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S. B. Detwiler.

Jack Pine Stand, Itasca Park, Minnesota.

FORESTRY QUARTERLY

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SOME NOTES ON JACK PINE *(Pinus divaricata)* IN WESTERN ONTARIO.*

BY L. M. ELLIS.

The Jack Pine —*Pinus banksiana or divaricata*—does not rank with White Pine, or Norway Pine, although it is a valuable species, and is becoming increasingly more so as the virgin supplies of the better kinds are becoming exhausted.

The wood makes excellent railroad ties, and by its cheapness, a large supply being available, it has become the tie tree par excellence of Western Ontario.

It grows chiefly on burnt-over areas—the extensive stands of it to be found in that part of the province are due, to a large extent, to past fires. This character of occupying brulé country it shares with aspen, with which it is frequently associated. These two trees are pioneers in that they are not components of the climax forest type of the region which is composed of a White Pine—hardwood—balsam association.

As a lumber tree it is inferior, as it never attains a very large size, barely over 18 to 20 inch diameter. It furnishes knotty lumber; the wood is soft and weak.

DISTRIBUTION AND ASSOCIATION.

Its botanical range covers the great Laurentian region. It is found from Nova Scotia to the valley of the Athabasca River, and down the Mackenzie to about latitude 65° North, ranging south-

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*The writer has mainly relied on his own investigation in the field. He has also consulted notes furnished by H. R. McMillan in Bulletin 6, Forestry Branch, and a report on tie timber to the Northern Pacific R. R. Co.

ward to the coast of Maine and through the Northern States to Minnesota, common and of large size in the region north of Lake Superior.

Along the southern limit of its range, for instance in Wisconsin, it remains a small tree, usually, less than 10″ in diameter and below 60′ in height.

It reaches its maximum development north and west of Lake Superior, west of Lake Winnipeg and north of the Saskatchewan River, where it frequently reaches a height of 85′ to 90′ with a straight trunk, sometimes free of branches for 30 feet, but rarely exceeding 20″ in diameter breast high.

North of Lake Winnipeg it rapidly deteriorates into an inferior tree, seldom exceeding 8″ in diameter and 50′ high. The trees of larger diameter are normally infected with heart rot.

In Western Ontario, and elsewhere, the Jack Pine occupies all the poorest sands where White Pine, Red Pine, or even aspen and birch no longer thrive. However, it can and does grow on the better soils, for instance on sandy loam. It never covers large areas in pure stand, but occurs in smaller stands of from five acres to several hundred acres in extent, wherever successive fires have swept over the country and have so reduced the humus contents of the soil that only the hardy Jack Pine can thrive.

It is normally associated with aspen and White Birch on the burned over areas, and while in the earlier stages of its development it appears in pure stands, later owing to the open crown conditions, birch, balsam, spruce slowly creep in. In fact the presence of birch is always a sure indication of merchantable Jack Pine. On the ridges and exposed situations where the soil is shallow and poor (causing low water content), Black Spruce enters the mixture to a large extent.

Typical Jack Pine forest has a characteristic vegetation of its own. *Alnus viridis* and several species of Vaccinium are more generally found here than elsewhere. The dry soil and maximum light conditions are inducements to the growth of these plants. Other shrubs common to the forests of this region are Mountain Ash, *Sorbus americana;* Mountain Maple, *Acer spicatum;* Hazel, *Corylus americana.*

Under young stands of Jack Pine the ground cover is extremely sparse, but it increases when the stand becomes somewhat open

or is mixed with birch. With density reduced to 60% to 80% a vigorous growth of herbaceous plants springs up, the most common being *Cornus canadensis, Lycopodium*—several species; *Aralia nudicaulis; Clintonia borealis; Pteris aquilina; Lonicera canadensis; Gaultheria procumbens; Unifolium canadense; Smilacina trifolia; Chiogenes hispidula; Coptis trifolia.*

The Forest.

Jack Pine has adapted itself to many different sites and conditions, but in general it is distingushed from the other pines by its ease of reproduction and growth on sandy barren soils. It grows, however, under varied conditions of moisture, from the pure absolute muskeg with 70% to 80% water content to the bald rock ridges where 5% water content is sometimes high in the heat of the summer.

However, it is only on the warm, granular, well drained, deep soils of the upland that the Jack Pine grows to the sizes necessary for tie-timber. "The optimum water content for its development varies from 10% to 20%." Relatively dry coarse sand with comparatively small amount of humus are typical sites.

Given certain natural conditions it is possible to foretell with fair accuracy the future forest cover of the region. Jack Pine and Aspen will inevitably reclothe the bald burn and make their appearance very soon after the fire has swept over the region, the Jack Pine seeking the higher and drier sandy soils, while the Aspen establishes itself on the richer loamy soils of the benches and bordering on lakes.

By the agency of fire the field of Jack Pine is being extended throughout districts, where at one time White Pine reigned supreme.

At least two principal types of Jack Pine forest may be distinguished:

Type 1:—Jack Pine in mixture with White Birch and Black Spruce on deep, well-drained soil, a mixture which produces the largest returns in sizes suitable for cross-ties.

TABLE No. 1.

Composition on Site I.

(Average of 11 Acres)

Number of Trees Per Acre

Diameter Breast high	*Jack Pine*	*White Birch*	*Aspen*	*Black Spruce*	*Balsam*
4 inches	1.0	26.2	.8	13.0	
5 "	1.2	24.7	1.7	21.5	.5
6 "	1.2	22.5	4.2	19.2	.25
7 "	6.0	25.0	2.7	15.2	.75
8 "	12.5	16.7	4.2	9.5	.75
9 "	17.5	7.0	4.5	6.5	.50
10 "	12.5	2.5	3.7	2.5	.50
11 "	12.2	1.7	3.0	2.2	.25
12 "	11.2	1.2	2.5	1.7	.25
13 "	11.0	.5	1.7	.02	.25
14 "	6.0		.7		.25
15 "	3.1		.02		
16 "	1.0				
Total	93.0	128	27	91	4
Per cent.	27%	37%	8%	27%	1%
Trees, 10 inches and over in diameter b. h.					
Total	57.0	59.0	11.6	6.4	1.50
Per cent.	42.0	44.0	8.4	4.6	1.0

The yield of Jack Pine in the diameters 10″ and over in the above average is perhaps 25% higher than the average yield for the entire district.

Type II: Jack Pine in mixture with Black Spruce, Balsam Fir and White Birch on scanty, impoverished, cold and poorly drained soils. All the higher hills, ridges, low lands bordering on muskegs are included in this site. In the Lac Seul country the largest part of the interior regions are occupied by this mixture.

The Jack Pine here rarely reaches merchantable sizes, and never in such bodies as to make exploitation profitable.

TABLE No. 2.

Composition on Site II.

(Average of 10 acres)

Diameter Breast high	Jack Pine	Black Spruce	Balsam, Fir	Larch	Birch	Aspen
	Number of Trees Per Acre					
4 in. & under	8.2	124.4	44.1	.8	20.8	.4
5 "	8.8	41.7	2.2	1.3	.4.3	.6
6 "	16.5	40.4	.4	1.6	8.8	1.8
7 "	27.4	16.4	.3	2.0	4.8	1.5
8 "	32.8	14.1	.2	1.4	1.5	1.3
9 "	16.8	12.3	.2	.6	.4	.5
10 "	9.6	9.0		.3		.2
11 "	3.2	3.0		.2		.1
12 in. & under	1.6			.1		
13 "	.5					
Total	125.4	235.3	47.4	8.3	40.6	6.4
Per cent. ..	27	50.4	11.2	1.5	8.6	1.3
Trees 10 inches and over in diameter breast high.						
Total	14.9	12.0	0	.6	0	.3
Per cent. ...	54.0	43.0	0	2.0	0	1.0

Characteristics of Jack Pine.

Form.—Jack Pine on well drained deep soils attains a height of 80 feet, and not uncommonly even 85 feet. In diameter breast high outside the bark 18 inches may be considered a maximum figure (12″—15″ is the average natural size). Isolated specimens have been measured 22″ d. b. h. and 90′ high. Under normal forest conditions the crown is narrow and rather open, covering only the upper portion of the tree.

Where it grows in the open the branching system is wide and spreading. The limbs pendulous and laden with cones, the whole resembling very closely a typical orchard apple tree. It is short and stunted and would be of use only for fuel when maturity is reached, between 85 and 100 years; but rot sets in at about 100 years, and the tree rapidly deteriorates to a useless condition. Peristency of branches is very characteristic, more so than in other pines. Even under dense crown cover the dead limbs remain on the tree. Knotty lumber results. However, the knots do not seriously affect the use of Jack Pine for ties.

Under average conditions, the clear height of the stem varies from 30% to 45% of the total length, depending on the age and situation.

Taper.—The taper of Jack Pine is not at all excessive. Excessive taper is always an indication of poor soil and difficult conditions of growth, while the full-boled tree is found only on deep loamy soil with optimum silvical surroundings. Other things being equal the taper is greater and more variable from the ground to diameter breast high, and in the top. For the merchantable portion of the tree for a length of 8 feet, the taper varies from .6 inches to 1.4 inches, with an average of 1 inch; (like most other Canadian species) while in the crown and butt it is much greater and ranges from 1 inch to 3 inches per unit length of 8 feet.

TABLE No. 3.

Taper of Logs.

Basis 79 trees

Diameter breast-high, Outside bark	*Diameter inside bark at given height above ground.*								
Inches	*9 ft.*	*17 ft.*	*25 ft.*	*33 ft.*	*41 ft.*	*49 ft.*	*57 ft.*	*66 ft.*	*73 ft.*
5	4.9	3.6	1.6	.3					
6	5.9	4.8	3.3	1.7	.2				
7	6.5	5.2	4.1	2.1	.2				
8	7.5	6.5	5.7	4.7	3.4	2.4	.7	.2	
9	8.6	7.8	6.9	6.1	5.1	3.0	1.5	.4	
10	9.5	8.2	7.5	6.6	5.8	4.1	2.5	.7	
11	10.2	9.5	8.7	7.8	6.8	4.8	3.0	1.1	
12	10.9	10.0	8.9	8.1	7.2	5.8	3.6	2.0	.4
13	11.7	11.0	10.1	9.1	8.	7.0	5.1	3.3	.8
14	12.2	11.3	10.6	9.5	8.4	7.4	5.7	3.7	1.3
15	13.0	11.8	11.2	10.2	8.8	8.0	6.0	3.5	2.0
16	13.7	12.8	11.2	10.7	9.4	8.4	6.4	4.0	2.2

Bark.—Jack Pine has a thin bark which is fissured into irregular confluent rounded edges, with close scales of reddish color. It increases in thickness from that of fifteen inches on the sapling to that of six inches on the mature tree standing in the open.

The percentage of bark as compared to that of the total volume of the tree varies but little. The average on 100 trees being found to be 11%. It might be expected that as the volume of the tree increases the bark percentage should decrease, but there is not more than 1% difference in the percentage amount on a 5″ tree as compared with a 15″ tree.

Silvicultural Requirements.

Soil and Moisture.—Although Jack Pine owing to its frugality, hardiness and fecundity, grows on a wide range or soils, it nevertheless demands for its best development fairly deep sandy glacial till, such as is found on plateaux upland,—gently rising ground where the drainage is good, and the moisture not far beneath the surface.

It grows still vigorously where hardwood, such as birch and aspen will no longer thrive, where successive fires burning off the loam and humus have created conditions unfavorable for their growth.

Over wide stretches of Laurentian country where these conditions are present the Jack Pine holds the field.

A mechanical analysis of typical pine soils made by the U. S. Forest Service shows how, under natural conditions, the Jack Pine seeks the coarser soils, although not necessarily confined to them.

The following table shows the percentage of the species found on the different grades of soil.

Species	*Fine gravel 2.0 to 1 m.m.*	*Coarse sand 1+00.5 m.m.*	*Medium sand .5 to .25 m.m.*	*Fine sand .25 to .1 m.m.*	*Silt .05 to .006 m.m.*	*Clay .006 m.m.*
White Pine	1.3%	6.8%	7.2%	22.%	29.1%	7.6%
Red Pine	.4%	3.7%	12.0%	62.4%	6.7%	2.8%
Jack Pine	2.5%	34.2%	39.9%	13.9%	4.1%	3.7%

It will be noted that coarse sand and medium sand comprise in a large degree the soils of the Laurentian country where Jack Pine reaches its best development.

Hundreds of square miles of just such sandy land exist between Fort William and Kenora, deposited by glacial action, land which is stocked with sapling growth of Jack Pine—potential wealth, which would become actual, if the fires were kept out for 75 years.

On the better soils Jack Pine in maturity averages 12 to 16 inches in diameter breast high outside the bark, and 75 to 82 feet high, producing 3 to 5.2 ties per tree; whereas in Type II, low flat, ridges, etc., Jack Pine is short, stunted, a low wide spreading

tree with excessive taper, and is very limby, never growing much more than 10 inches in diameter and 60 feet high.

Compared with its associates it will withstand considerable drought and frost and it is altogether peculiarly adapted to thriving under xerophytic conditions.

Jack Pine is a comparatively deep rooted tree; where spruce and balsam fir are blown down by the hundreds, Jack Pine easily holds its own. The tendency under average conditions is to develop strong laterals, rather than tap root, thus securing maximum food materials and optimum moisture. These laterals ramify in all directions 12″ to 24″ beneath the surface.

Up to ninety years of age wind has practically no effect on the tree, but as it becomes over-ripe and its vitality is reduced it is more susceptible to wind action, and much valuable timber blows down before it is noticeably deteriorated. Where there is excess of water content in the soil the roots of the Jack Pine are forced to grow closer to the surface, the windfall is more frequent, but as the species here never reaches an average size which would permit of harvesting for tie, or saw material, the increased damage due to windfall is of small import.

Tolerance.—Jack Pine is most intolerant of shade at all ages. This intolerance accounts in part for its presence in pine islands during the younger stages, where, by the exclusion of quick growing broad-leaved species, it secures the optimum amount of light necessary for its existence.

For reproduction the optimum seemingly is sunlight. Under mature forest the average density is such that the light admitted is below the minimum necessary for the young tree, so that seedling growth is very rarely found under mature stands.

During the seedling stage the Jack Pine can hold burned over land, provided it can secure complete possession of the ground from the beginning, but if the faster growing Aspen enters into competition with it, it quickly succumbs to the broad leaved tree. In later life the open symmetrical head of the Jack Pine admits the maximum amount of light to the growing crown.

Owing to the inability of Jack Pine to endure even its own shade, in the transitional change it gives way to other trees which are capable of growing under less favorable light conditions, e. g. spruce, balsam, White Pine.

Seed Production.—With the optimum amount of light, cones

Jack Pine Plain on Mattagami-Porcupine Portages, Ontario.

Jark Pine Plantation in the Treeless Sand Hills, Holt County, Nebraska, 20 years after planting (see F. Q., Vol. I, p. 140).

appear at the early age of ten years, but in close stands they do not appear until 5 to 10 years later. This early fruiting partly explains the persistent re-appearance of the tree on areas which have been burnt over repeatedly within the last 60 years.

Where the soil is deep and loamy, and other conditions are favorable, seed production is delayed, but the increased quality of the seed balances the later fruiting.

The period of maximum seed production lies between the ages of 40 and 90 years.

"At a rough approximation a normally developed tree, 15" diameter and 90 years old, would produce annually 300 to 500 cones, with 10 to 30 seeds per cone (the larger the cone the more the number of seeds per cone)." It will be seen that seed production from a mature Jack Pine forest would reach considerable proportions, but as there is practically no reproduction under the mature stand the seed produced counts for little unless the area is burnt over, when the viable seed is at once awakened into activity. Ten days after a fire had passed over the Clearwater country (Summer 1910) Jack Pine seedlings 1 to 2 inches high were growing (scores of thousands to the acre) over large portions of the district.

During growing seasons of excessive dryness the production of seed is more abundant than at other times, but no definite alternation of seed years has been observed.

Cones may persist on the branches from 10 to 25 years, or even longer and are serotinous. It has been said that fire is the only medium by which cones release their seed, but this is certainly not entirely true, for a fair percentage of the cones open when still on the tree, to be sure, after several years; the cones becomes dry, contract, open and the seed is released. During dry summers many cones are opened when in a wet season they would remain closed. Soon after opening on the tree, limbs bearing cones may be broken off by the wind, or trees are blown over and squirrels, etc., bring cones to the ground. Then the sun opens many cones, but a large percentage are never opened until expanded by sudden heat—by fire—when the seed falls on the fresh mineral soil to germinate and restock the area.

Germinating power of Jack Pine is high, namely, 60% to 75%, and it is retained for many years, provided the cone is sealed.

The facility of reproduction after fires, and the inability of

reproduction under mature stands, means that *Jack Pine forests can in nature only be secured by fire.* This fact will be borne out by further investigation.

Danger and Diseases.—Jack Pine is fairly resistant to fire. During early youth, however, up to 30 years of age, the thin, soft bark of the sapling offers no resistance to the forest fire, while the resinous foliage presents an ideal fuel for the flames. Sweeping fires receive a great impetus when pure Jack Pine stands are encountered, and it is here that the greatest damage is done.

The adult tree is not as susceptible to damage by fire, the bark being thicker and firmer. Yet in an ordinary ground fire as much as 60% of the stand may be so weakened that the stock will eventually die, death being caused by the killing of the root system or either by insects.

Jack Pine is one of our most hardy species, and rarely injured by frost even during the earliest stages of its development, and altogether it can adjust itself to extremes of temperature which are very common to its range of distribution.

The normal healthy tree is practically free from insect attack of every kind. Rare instances have been noted where the leaders of sapling trees have been wounded, resulting in a resinous excrescence interiorly on which a pupa was developing—"presumably *Retina comstockiana*"—beyond this case no insects have ever been observed attacking the healthy tree.

The weakened, or fire-killed tree, however, is the subject of attack immediately after the fire *i. e.* if during the summer by bark and wood destroying insects common to the region, e. g. genus Monohammus and *Pissodes strobi.*

In two seasons after the attack, the wood will be so riddled as to be useless for lumber, although not damaged so seriously as to prevent its use for tie purposes.

Porcupines seem to have a particular liking for the bark from trees 10 to 14 inches in diameter, and, although the damage is not widespread, individual cases have been seen where as many as 18 trees on a quarter acre have been girdled by a band one foot high around the stem, with all the enclosed bark eaten clean away.

Rate of Growth.

Comparing the following figures and tables derived from studies in Western Ontario with those obtained for Jack Pine for other regions, e. g. Minnesota, and northern Saskatchewan, it is found that relatively the pine of the district compares most favorably with them all, and indeed outstrips the growth in Minnesota, while the Pine of the Lac Seul region is a much inferior tree. It may be said that nowhere else does the Jack Pine reach better development than in the district studied.

Seedlings grow very little during the first five years of its existence while it is establishing a firm root system needed to compete with the ever thirsty aspen and birch. On well drained soils the sapling soon shows its quick response to favorable conditions of soil and light, so that by the first decade it is 8 feet high.

The annual growth after the establishment of the root system is from 1 to 1.5 feet. This rate holds fairly uniform for about 40 years, after which it steadily decreases, falling to an imperceptible amount at 100 years.

Height of growth is a very good indication of soil conditions, for while on fertile soils the mature tree reaches 80 feet to 86 feet, on poor, wet, cold soils a mature height growth of 60 feet is very good.

TABLE No. 4.

Height Growth on Average Soil Conditions.

Basis: 100 trees

Age	*Height*	*Age*	*Height*
5 years	1.5 feet	60 years	64 feet
10 "	8 "	65 "	61 "
15 "	17 "	70 "	70 "
20 "	28 "	75 "	72 "
25 "	36 "	80 "	74 "
30 "	42 "	85 "	76 "
35 "	46 "	90 "	77 "
40 "	50 "	95 "	79 "
45 "	54 "	100 "	80 "
50 "	58 "	105 "	81 "
55 "	61 "	110 "	81.5 "

The following tables of diameter growth are based on a complete stem analysis of one hundred trees taken under fairly average and normal conditions of growth.

The greatest growth seems between the ages of 10 and 20 years. During early youth, because of the density of the stand, the growth goes into height, but once the competiton for light is lessened, volume and diameter growth become more prominent. From the 40 to 70 years the progress is uniform at nearly 1.5 inch per decade. Then it slowly declines, and at about 90 years, the diameter accretion is practically at a standstill.

TABLE No. 5.

Diameter Growth.

(Basis: 100 trees)

Age	*Diameter breast high*	*Age*	*Diameter breast high*
5 years		60 years	11.7 inches
10 "	.8 inches	65 "	12.4 "
15 "	2.0 "	70 "	13.0 "
20 "	4.0 "	75 "	13.5 "
25 "	5.8 "	80 "	14.0 "
30 "	7.1 "	85 "	14.5 "
35 "	8.1 "	90 "	14.9 "
40 "	8.9 "	95 "	15.2 "
45 "	9.6 "	100 "	15.6 "
50 "	10.3 "	105 "	15.9 "
55 "	11.0 "	110 "	16.2 "

TABLE No. 6.

Time Required to Increase Diameter one inch, under Average Conditions.

Diameter breast high Inch	*Age Years*	*Time required to grow one inch Years*
1	11	11
2	15	4
3	18	3
4	20	2
5	22	2
6	25	3
7	29	4
8	34	5
9	41	7
10	48	7
11	55	7
12	62	7
13	70	8
14	80	10
15	91	11
16	107	16

TABLE No. 7.

Volume Growth (exclusive of bark) under Average Soil Conditions.

Basis: 100 trees.

Diameter Breast high	*Total volume of Stem.*	*Diameter Breast high*	*Total volume of Stem.*
2	.26	9	13.10
3	.70	10	16.90
4	1.50	11	21.25
5	2.54	12	25.75
6	4.15	13	30.40
7	6.30	14	35.20
8	9.30	15	39.80
		16	42.90
		17	44.50

TABLE No. 8.

Rate of Growth in Volume.

D. B. H. Inches	*Age Years*	*Vol. Cu. ft.*	*Increase in vol. per inch of D. B. H. Per cent.*	*Annual rate of increase in volume Per cent.*
7	29	6.3	48	9
8	34	9.3	41	6
9	41	13.1	29	4
10	48	16.9	25	3
11	55	21.25	18	2.5
12	62	25.75	18	2
13	70	30.40	13	1.3
14	80	35.20	13	1.1
15	91	39.80	8	.5
16	107	42.90	4	

TABLE No. 9.

Yield of Ties on average soil conditions. Based on Actual Measurement.

Diameter breast high	*Age*	*Yield of Ties*			
		No. 1 Tie 7"x7"x8'	*No. 2 Tie 6"x6"x8'*	*Cull Tie 5"x5"x8'*	*Total All kinds*
9	41			1.0	
10	48		.8	1.1	1.9
11	55	.3	2.0	1.0	3.3
12	62	1.2	1.8	.8	3.8
13	70	2.2	1.5	.8	4.5
14	80	3.2	1.5	.4	5.1
15	91	3.8	1.3	.3	5.4
16	107	4.0	1.2	.2	5.4

It will be seen that for a 15″ d. b. h. the yield is greatest and it suggests that a rotation based on value increment should not exceed 90 years, for after the age of 90 years the volume increment and in this case that means also value increment is practically at a standstill.

Cut to a diameter limit of 10 inches, measurements of 30 sample plots on poor rocky soil and open stand developed not more than 18 ties to the acre. But mature stands on good, well drained soils produced in an average of 50 sample areas, taken over several thousand acres, 150.5 ties, of which 17 per cent. No. 1; 43 per cent. No. 2, and 40 per cent. culls—a yield, which by proper silvicultural management could probably be increased by at least 25 per cent.

COMFORTABLE CAMPS AS A MEANS OF INCREASING THE EFFICIENCY OF WOODS LABOR.

By S. B. Detwiler.

Any reduction in the cost of lumber production tends to hasten the application of better methods of forest management. Improvement in machinery has progressed much more rapidly than increased efficiency in hand labor. Sixty to eighty per cent. of the cost of lumber is money paid for manual labor according to Captain J. B. White, of Missouri. At the mill there is a better opportunity to apply labor saving methods than in the woods and the larger mills, at least, are fairly well organized, yet much remains still to be done. One of the largest mills in Minnesota was recently rearranged, and as a result the cost was reduced from $3.80 to $1.90 per M. An Arkansas firm is said to save $1.50 per M. by an improved system of transportation and piling in the yard; five men do the work which formerly required thirteen.

In the woods the logging boss reigns supreme and resents any innovation as a reflection on his ability or as a useless fad. He depends on close supervision and the loyalty of his men to keep down costs. High wages, increased cost of supplies and a poorer class of men are causing lumbermen to turn their attention to a more systematic management of the woods work. One firm investigated the loss from poorly laid out ice roads and engaged an engineer to locate the roads at all their camps, with very satisfactory results. A Michigan operator is using an efficient cost-keeping system which shows the work performed by the various crews, and the total cost of each operation. In Wisconsin, a camp with accommodations for men and horses has been built on car trucks, in order that the men might save time in going to their work. Piece labor is advocated by some as a method of cheapening woods operations, and in many cases, undoubtedly, it will prove practical, especially where only one class of material is gotten out, such as ties, cordwood or pulpwood.

Any method which conserves the energy of the men and systematically organizes their work, is of value, but no system

will succeed unless the human factor in labor is recognized and the utmost advantage taken of it. Camp bosses recognize the value of good fellowship, strict discipline and bounteous feeding, and they are not slow to take advantage of benefit derived from competition between individuals and crews. Nearly every foreman has his own methods of holding his men, and frequently it is his personality and his ability to enforce his commands that are his greatest asset. The environment of a camp is seldom conducive to the greatest efficiency of labor, especially near towns. Alcoholic liquors, improper diet, poor ventilation, and lack of amusement are all factors which must be reckoned with in nearly every camp. Also, the lumberjack of the early days has been largely replaced by less intelligent foreigners, and it is becoming more and more difficult to hold men of the desirable class. As forestry practices are adopted by loggers it will become more necessary to have crews of trained and intelligent workmen, and this class of men must be attracted by something more than mere wages. Men of this class must either be furnished with homes, or with comforts in camp that will in some degree compensate for the lack of home life. A great army of men who are down and out through dissipation, drift from camp to camp. It is impossible to estimate the loss from this cause, but there is little doubt that much of it would be avoided if these men were placed under conditions where they could regain their self-respect and bodily vigor.

A lumber company operating on the Mississippi river in Minnesota and Wisconsin has a camp which was built with a view of supplying more than ordinary comforts. The fact that the timber is situated along a navigable stream made it possible to use a floating camp, and the necessity of frequently changing the base of operations made it economical to use a camp that was easily moved. A two-deck excursion barge, 24 by 120 feet, is fitted with a steam heating plant, incandescent gasoline lamps, and a pressure tank for water supply. The upper floor is equipped with double-decked spring bunks and mattresses. The forward portion of this floor is reserved for a reading room, and contains tables for writing. A wash-sink, bathtub and a stove to dry clothes in wet weather are also provided. The lower floor consists of a kitchen and dining room, with modern conveniences, and with ample storage room for supplies. A small room for the

1. Floating Lumber Camp, capable of accommodating 90 men.

2. Kitchen and Dining Room, Floating Camp.

3. Sleeping Quarters, Floating Camp.

4. Wash Room, Floating Camp.

accommodation of the cooks, and a store and office combined are also on this floor. Numerous windows and a half dozen ventilators give an abundance of air and light. Hardwood floors and painted wood work make it easy to keep the quarters clean, and the camp was inspected and fumigated by a physician at least once in two weeks, when a large crew was employed. The camp will accommodate 90 men.

The original cost of the barge was about thrice that of the ordinary tar paper camp, and the equipment about a thousand dollars more than the usual furnishings. Since the camp is good for twelve or fifteen years, or more, the outlay is not excessive, while the comfort and cleanliness of the "hotel" holds the men, and makes them more self respecting. The camp has been in use only one year, so that the ultimate results are unknown, but the experiment shows promise of great possibilities in the conservation of labor.

Most camps cannot be fitted up in the style of this camp because they are not permanent. If the problem were studied, however, much could be done to improve them. A small board and tar paper camp was built in sections, 10 and 12 feet long, and fastened with bolts so that it could be quickly taken down and transported. The cost was increased about 50% (mostly for labor), but made the building many times more valuable. Camps of this kind would not only save money, but could be made to add much to the comfort of the men.

HOW FASCINES ARE MADE.

By S. B. Detwiler.

The improvement of our rivers for navigation affords an excellent, though very limited opportunity for forest management. The dams and shore protections which confine the currents and keep the channel scoured, are constructed of bundles of brush (fascines) weighted with rock. Along rivers where improvements are being carried on, the forester can make the cleaning and thinning of young stands profitable. Since this is usually difficult to accomplish, a description of fascine making on the upper Mississippi river may be of interest.

The brush used on the upper river (St. Paul to mouth of Missouri river) from the beginning of improvement work in 1878, to June 30, 1910, totals slightly over 8,000,000 cubic yards, about one-fifth being used in shore protections, one-twentieth in repairs, and the remainder in constructing dams. About four and one-third cubic yards of brush are required per lineal foot of dam. Approximately 200 miles of shore protections and 225 miles of dams have been built on the upper river.

The specifications of the U. S. Engineer's office for brush are as follows: "Fascines shall be made of live brush, sufficiently trimmed and choked to form a compact mass, 20 feet long and 12 to 15 inches in diameter, and tied with bands of lath yarn or wire not more than 4 feet apart." Bundles down to 10 inches in diameter are usually accepted but they must hold out in length, although any length in excess of 20 feet is not paid for. Brush cut for fascines may be 4 inches in diameter at the butt, although 3 inches is usually the limit. The species are seldom named, although the willow is preferred because the bundles pack better. In constructing the dams the fascines are closely packed into mats, 12 feet or over in length, held together by three or more pairs of binding poles which are secured by ties of lath yarn or wire. Poles must be 20 feet long, 3 inches or over at the butt, and are piled and paid for the same as brush. The mats are loaded with rock according to specifications, and sunk, the butts of the bundles being down stream. The shore revetments ("rip-rap")

are more frequently built entirely of rock above low water line, but mats are used for a foundation under water. On the lower river the mats are elaborately constructed.

The prices paid for brush are usually from 17 to 19 cents per cubic yard, the range being 12 to 26 cents. In 1910, in the first division, the contract for 60,000 cubic yards, loaded on the barge, was let at 22 cents per yard. The successful bidder sublet contracts at 90 cents per cord (about 18 cents per cubic yard). This price was the highest paid in over 10 years, on account of the high price of labor, scarcity of brush and the extremely low water. Although summer cut brush is much preferred because it packs better, it was decided to get out winter brush in Division I, in 1911. The contract calls for 70,000 cubic yards at 17.9 cents per yard, 60 per cent. of which must be banked this winter. The contractor will get most of this brush from the tops of trees cut for logs and cordwood.

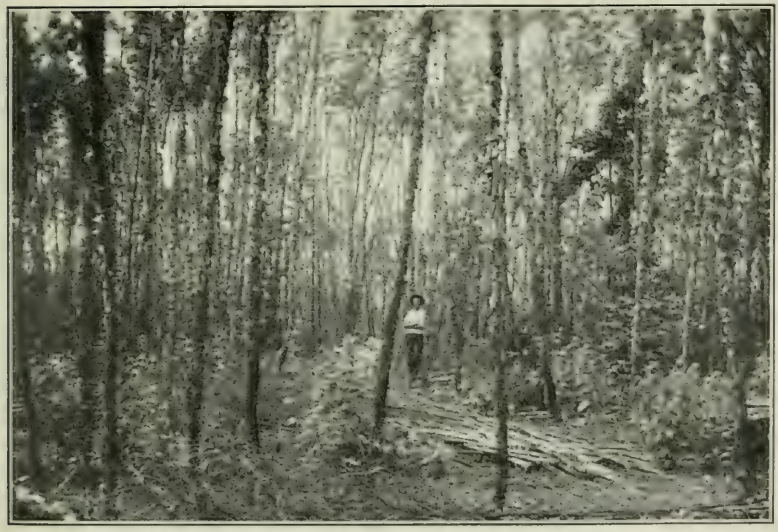
The government owns hundreds of acres of low islands in the Mississippi river, which are reserved for the production of brush for river improvement. Willows (*Salix nigra,* and sandbar willows of the *fluviatilis* type) are the principal species on these "towheads" and form dense stands. The contractor does not have to pay stumpage for this brush, but can cut it at his own discretion. The brush is cut clean and the stumps low, and in five or six years the sprouts can again be profitably cut. The maximum yield per acre from a fully stocked stand of willow where the trees run 2″ to 4″ in diameter at the butt, is about 1,500 cubic yards. The War Department tried some experimental willow plantations on over-flow lands near St. Louis, but without success. However, observations seem to show that the higher portions of the towheads may be completely seeded to willow if the proper measures are taken.

The brush cutter prefers to cut willow because it is lighter and more convenient to handle, and consequently more profit in it. Where, however, willow is scarce they go to the higher bottoms for other species. This land is usually owned by private individuals, who charge 1 or 2 cents per cubic yard for stumpage where cutting is unrestricted. The professional brush cutter often has a good idea of the principles of thinning, and stands which are excellent examples of such cutting, and which show greatly increased growth, are to be found in many places on the

river. This has led many owners to permit responsible contractors to thin young stands of maple, ash, elm, birch, etc., free of charge. The brush men trim the live side branches to pack in the top of the bundle to make it hold its diameter, hence the appearance of the stand after thinning is very pleasing. Trees in the open are frequently trimmed to the top; one such tree, a birch about 20 years old, furnished 19 bundles of brush from its side branches.

An experienced brush cutter covers the tract systematically, beginning near the banking ground and cutting successive strips. The brush is placed in wind-rows, in piles of sufficient size for a bundle. These piles are allowed to dry for three days to a week and are then tied. In tying, the brush is first lifted onto a rack about 16 feet long made after the fashion of a sawhorse. Sometimes three short racks are used instead of having them joined into a long one. The work is greatly facilitated if the ends of the cross sticks on which the bundle rests are long and slightly curved downward, since this prevents the brush from catching while it is being tied. Two men work together in tying. The brush is compressed by the use of two wooden arms about 3 feet long, which are connected by a rope 18 inches long, tied about 3 inches from the lower end of the sticks. One arm is passed beneath the bundle and then back over the top so that the rope forms a loop around the bundle. By pressing down on the arms, using the 3 inches at the lower end as a fulcrum, the bundle is choked tight. One arm is fastened under the cross piece of the rack, leaving a man free to tie the brush. Strings are usually cut 52 inches long, and double strings are frequently used on the first two ties to prevent the bundles from loosening during handling. Lath yarn is preferred to wire because, though more expensive, it saves time and does not hurt the fingers. After tying, the bundles are carried into convenient piles with the butts placed in one direction. They are then loaded on wagons with special racks which are made so that the brush may be tipped off without handling. Three men work together in loading (a driver and two loaders). The brush is dumped on the bank of the river or a slough and is then carried on the barges. A barge will hold about 400 cubic yards, and this quantity can be loaded by six men in half day, under average conditions. The bundles are piled

A. Interior of 18 year-old stand of River Birch prior to thinning. Mississippi River Bottoms, Wisconsin.



B. Thinning 18 year-old stand of River Birch for fascines and cordwood. Mississippi River Bottoms, Wisconsin.

evenly 5 to 6 feet high, and the brush is measured when it is delivered at the works.

A crew of 6 or 7 men work together to best advantage in cutting brush. Figures of average cost of making willow fascines were obtained in 1910 at several camps where the best work was being done. The cost will vary with the men and the wage, the character of the brush and its location, and the stage of water. In high water for instance, the ground is too soft for teams, and the brush must be carried directly to the barge, but the barge can then be placed to better advantage.

Average Cost of Fascines per Cubic Yard

Cutting, 1 man at $2.00 cuts and piles 80 cu. yd. per day,	$0.025
Tieing, 2 men at $2.00 ea. tie and pile 100 cu. yd. per day,	0.040
Hauling, 3 men and team at $2.00 ea., bank 400 cu. yd., per day,	0.020
Loading, 6 men at $2.00 ea. load 400 cu. yd., in ½ day,	0.015
Lath Yarn, per cubic yard,	0.010
Total cost per cubic yard, exclusive of stumpage,	$0.110

Eleven cents per cubic yard may be taken as the average cost where the wages are about $2.00 per day, and all the conditions are favorable. At this figure the average haul should not exceed three-eighths of a mile, or possibly a half-mile. Under exceptionally favorable conditions the cost may not exceed 7 or 8 cents. Under unfavorable conditions the cost may easily run 15 to 18 cents per yard. Accordingly, the returns per acre may be very low or may run as high as $150.00 to $200.00.

GRAIN AND TEXTURE IN WOOD.

By Samuel J. Record.

Much confusion exists not only in the popular conception but also in the minds of professional men and authors regarding the proper use and meaning of the terms 'grain' and 'texture' as applied to wood. Many writers use the terms interchangeably and without defining them. Others who attempt definitions fail consistently to agree, as will appear from the following excerpts.

Boulger[1] explains his use of the term 'grain' thus:

> "The elements of the wood are generally parallel in direction to the axis of the stem or limb in which they occur—*i. e.* the wood is *straight grained;* but they may be spirally twisted round the stem, or oblique, in which latter case if successive layers lie in the opposite directions the wood is *cross grained.* A slightly wavy longitudinal course in the elements of the wood produces the condition known as *curly grain,* frequent in maple; whilst slight projections or depressions repeated on the outer surface of successive annual layers produce the *bird's-eye* and *landscape* varieties in the same wood."

It appears from this statement that the *arrangement* of the wood elements determines grain.

Laslett[2] refers to grain as "the lines and planes of structure." Again he says:

> "Grain—a term it is not easy to define, but which refers to the kind of surface—rough, smooth, coarse or fine—left after the action of a tool."

This conception agrees fairly with that of Boulger, that grain is concerned with the *arrangement* of the wood elements.

Baterden[3] in his recent work defines a specific use of the term:

> "Wood is called 'coarse grained' or of 'bigger bait' if the annual rings are wide apart, and 'fine grained' if they are close."

[1] "Wood" by Boulger, second edition, pp. 32-33.

[2] "Timber and Timber Trees" by Laslett, page 4.

[3] "Timber" by J. R. Baterden, page 11.

The Century Dictionary is authority for this definition:

> "Grain is the substance of wood as modified by the quality, direction or arrangement of its fibers."

This embraces the conception of the writers quoted but introdues a new attribute, viz the *quality* of the wood elements.

In only one publication[4] so far issued from the Government Forest Service is a definition of grain attempted. From a page of discussion is quoted the following:

> "The terms 'fine-grained', 'coarse-grained', 'straight-grained' and 'cross-grained' are frequently applied in woodworking. In common usage, wood is 'coarse-grained' if the annual rings are wide, 'fine-grained' if they are narrow; in the finer wood industries a 'fine-grained' wood is capable of high polish while a 'coarse-grained' wood is not, so that in the latter case the distinction depends chiefly on hardness, and in the former on an accidental case of slow or rapid growth."

In order to ascertain the conception of the term 'grain' now held by members of the U. S. Forest Service, expert in wood, the writer obtained from them memoranda from which two excerpts follow:

> " 'Grain' is properly used to designate the structural composition of wood resulting from the character and the association of its component elements within the annual or other periodic layers of growth. It follows that differences in the thickness of the layers of growth do not affect grain and that characteristic differences of grain are due, solely, to the arrangement, direction, size, and form of the elements of the wood."
>
> "Grain designates the structural composition of wood, resulting from the form, size, arrangement, and direction of its component elements of fibers and vessels. According to this usage, grain takes account only of the assembling of the different elements within the layers of annual growth. * * * If the fibers and vessels which make up the wood are small, the wood is considered fine grained; if relatively large, it is coarse grained."

This amplifies the definition of the Century Dictionary but introduces a new phase, viz: That the width of rings or layers of

[4] "Timber," Bulletin 10, Division of Forestry, U. S. Dept. of Agr., pp. 21-23.

growth never have direct bearing upon 'grain.' This is so opposed to the popular conception that it can only serve to increase confusion without gain in exactness of expression.

Stone[5] considers 'grain' in reference only to the *size* of the wood elements without reference to their *arrangement* or *direction.*

> "A plank may be 'fine grained' in one part and 'coarse grained' in another, whereas if the plank is cut from the outside of the tree (tangentially), the grain or size of the pores and cells may be uniform throughout."

Although the term 'texture' is frequently used in describing woods, few writers attempt definitions of it, while many use it as a synonym in part for 'grain'. Gayer [6] says:

> "The texture of planed wood depends upon its anatomical structure, on the arrangement of its fibres and the direction in which it has been sawn. * * * Wood is said to be even-grained when it possesses fine medullary rays, and not only equal annual zones, but narrow summer zones, as in slow-growing sessile oak, spruce or silver fir. Wood is also even-grained in the case of many fruit trees, with evenly distributed pores (pear, apple, service tree, etc). * * *
>
> "Fine-textured woods are those which show freedom from knots, fine or even grain, fine waviness, or other marks. As a rule dense broad-leaved species are more finely textured than porous woods, and more easily polished. Coarse-textured woods are coarse-fibred, light, porous woods, those with considerable difference between the spring- and summer-wood, and knotty wood."

The lack of harmony in the above cited usages of the terms 'grain' and 'texture' is due for the most part to their attempt to embrace too wide a field. Wood is a complex structure composed of definite elements with infinitely variable arrangement. Almost without exception, authorities agree that arrangement or direction of these wood elements affects 'grain'. Disagreement and confusion results when size, form, and character of these elements are included.

It remained for Prof. J. W. Toumey, of the Yale Forest School, to suggest a practical way of overcoming these difficulties. He

[5] "The Timbers of Commerce" by Stone, Introduction page xiv.

[6] Schlich's Manual of Forestry, Vol. V, pp. 60-61.

considers 'grain' as referring wholly to the *arrangement* or *direction* of the wood elements, and employs the term 'texture' when referring to the *size, quality* or *fineness* of these elements as affecting the structural character of the wood. He further holds that neither term has specific meaning without the use of some qualifying adjective as 'fine,' 'coarse,' 'uniform,' etc. It appears to the writer that this use of terms brings order out of confusion, and best of all coincides in very large measure with the popular conception and usage of the terms.

Some of the adjectives used to give 'grain' specific meaning are: coarse, fine, even, uneven, rough, smooth, straight, cross, spiral, twisted, wavy, curly, mottled, landscape, bird's-eye, gnarly, and silver. All of these terms refer to certain arrangements of the wood elements and several of them are dependent on the layers of growth. For example, 'coarse grain' means wide growth rings; 'uneven grain,' irregular growth, etc.

'Straight grain' as applied to a tree occurs where the wood elements are parallel to the axis of growth: as respects a board, when the radial and tangential planes of structure are parallel to its length. Sawn boards are often cross-grained even when cut from straight-grained logs, while straight-grained sticks may be split from a spiral-grained tree.

The most common attributes of texture are coarseness and fineness, evenness and unevenness. Coarse-textured woods have many large elements or the average size is large as in Castanea (Chestnut). Even or uniform texture applies to woods exhibiting little variation in the size of the elements as in *Juniperus virginiana* (Red Cedar).

Following are instances of the use of both terms in describing woods: *Pinus strobus* (White Pine), medium texture and grain; *Pinus taeda* (Loblolly Pine), medium texture and coarse grain; *Sequoia sempervirens* (Redwood), coarse texture and fine grain; *Pinus edulis* (Nut Pine), fine texture and grain.

In summary, the writer contends that 'grain' should be employed in referring to the *arrangement* or *direction* of the elements of woody structure, while texture should refer to the relative *size, fineness* or *quality* of these elements.

THE EQUIPMENT AND OPERATION OF A GERMAN SEED-EXTRACTING ESTABLISHMENT.*

By Forstmeister Wiebecke.

Translation by Sydney L. Moore.

Among the problems that confront the practicing forester today, whether in private, state, or federal service, is the important one of securing a large annual supply of seed of the desirable coniferous species for his reforestation work. Extensive reforestation has been initiated within the last few years by several corporations and states. The federal Forest Service in particular has within the last two years increased very largely the amount of such work upon National Forests. The natural consequence of this activity has been a tremendous increase in the demand for forest tree seed.

In the case of coniferous species, large quantities of seed have been imported from Germany because of the lack of a sufficient supply of native seed. This lack of native seed is due to the fact that the forest tree seed business has not yet been developed in this country to the extent necessary to supply the demand. There is now a demand (which is going to increase constantly) for coniferous seed in bulk, at a low cost, with high germinative power and high purity. This means that establishments for the exclusive handling of coniferous seed, according to the most approved methods, have got to be constructed either by private individuals as a commercial enterprise, or by the large private and federal forest administrations to supply their own needs. At present, there are very few or none of these establishments in this country.

I believe, therefore, that a description of the equipment and operation of such a seed-extracting establishment, as given by the German forester Wiebecke, will be of great interest to many American foresters. The description which follows is a translation of the greater part of an article by Wiebecke, printed in the "*Zeitschrift für Forst und Jagdwesen*" of June, 1910. Wiebecke

*Although this article was briefed in F. Q. Vol. VIII, p. 515, we reproduce this complete translation because it covers the subject exhaustively.

gives in detail the plans and methods of operating a seed-extracting plant for Scotch pine, in short, his ideas of a model seed-extracting establishment for pine seed. For his purpose he cites the successes and failures that have attended the operation of the plant at Eberswalde where numerous experiments have been conducted to determine doubtful points.

Wiebecke's article is as follows:

I. Location of the Seed-extracting House.

1. If one is at liberty to determine the location of a seed-extracting house which is to be built, it is recommended to place it at a concentration point of the greatest possible accessibility, a point from which roads radiate connecting the forests and in the vicinity of railroad stations leading to it. The yard, etc., about the seed-extracting house is by all means to be paved (for easier approach in soft weather).

The location far from a railroad of the Eberswalde seed-extracting house, which also lies at a distance from the main road, causes excessive transportation costs, which I can show to be 4 cents (.15 marks) per 2.2 pounds of seed (1 kg.).

2. The seed-extracting house must be located upon an open flat, exposed to sun and wind,—so much the better to dry the cones in the shed; the smoke bothers no neighbors and neighboring fire danger is avoided.

3. The seed-house manager (in the case of larger seed-extracting houses the seed-house secretary) must invariably live nearby, as well as the seed-house foreman; the purchasing of cones must go on at every hour of the day, for the sake of an abundant supply at all times; the seed-house business itself requires constant supervision day and night from a reliable foreman.

II. The Cone-shed.

Large high sheds located within the forest wherever possible and in open places, with solid or close-jointed board walls are the suitable thing. Bins constructed contiguous to one another if possible, of a size 10 x 10 x 10 = 1000 cubic feet = 770 bushels of cones (270 hl.) to the bin, are the proper thing in this shed.

Cones gathered in December, or better still in January and the

following months, harvested in sunny weather, stored dry, and transported in dry weather and then placed in the shed, give little trouble as a rule in storage, so that they can even be kiln-dried safely during the following summer if they have been purchased so abundantly as to make this necessary.

But even if the drying-kiln should first begin to handle the cones in January, and wanted, if possible, to take only dry ones, it could get cones (at advanced prices) gathered in November when there was no snow (consequently harvested more easily) which were suitably stored somewhere until removed to the seed-extracting house; rainy weather and snow during their transportation and unloading from the railroad are more frequent than desirable. Often the cones mould in the large bins, sticking fast to one another, and must be continually worked over, and suffer even then. Cones collected in February open, according to experience, more easily than those gathered early; the constant changes of sunny warmth, of cold, and of dry wind ripen up the cones on the tree; cones properly handled in late winter can be opened with increasing ease in the summer.

Upon this basis, I recommend a cone-shed of light, open rafters, with flat roof and a central passage, the roof of which is raised at the sides about 20 inches ($\frac{1}{2}$ m), and provided with slat-shutters. The elevation of that part of the roof over the central passage, and having the sides formed of slat-shutters is necessary since experience in old roofed sheds with closed roofs shows that the topmost layers of cones in the bins are made moist by sweating on account of the lack of circulating air; the upper cones retain after several months storage 4.4 pounds (2 kg) of water to 220 pounds (100 kg) of weight more than those which are stored compactly pressed together, apparently more unfavorably, in the middle of the large bin.

The floor of the whole shed should be made of asphalt or cement; the former is better protection against ground moisture. It must be raised about 20 inches ($\frac{1}{2}$ m) above the outside ground, and as a safeguard against the entrance of rodents, etc., should be protected by a surrounding ditch about 20 inches (50 cm) deep plastered and cemented on the inner side, or in some other suitable manner. Also the doors of the central passage should be made tight against rodents, to a height of 20 inches (.50 m), but for the rest with movable slat-shutters to

allow free circulation of dry air (wire net doors with movable slat-shutters over them).

The outer walls are also made of movable slat-shutters such as one commonly finds used cheaply and easily in the better equipped brick kilns. They are shut tight in damp weather and opened when it is sunny and windy, in the same way as the door slat-shutters.

Standing on both sides of the central passage and arranged at a distance of about 12 inches (30 cm) apart so that it is possible to clean them are cone-silos, which are 10 feet (3 m) deep (from the central passage toward the outer wall), five feet (1.5 m.) wide, and for ease in filling them not over 10 feet (3 m) high. The floor of these is sloped strongly toward the central passage (a 1 to 2 slope) so that the cones will run out through a chute. It is made of oak slats placed on edge, close together, and cut 1 1/5 x 3 inches (30 x 75 mm(with 1/2 to 3/4 of an inch (15 to 20 mm) space between. The walls of these silos are made of galvanized wire net which is strong and of suitably small mesh supported on oak poles. Every such silo would hold about 340 bushels (120 hl) of cones after allowance for the space occupied by the poles, braces, and walls; therefore two or three silos take a carload or double carload of cones; one silo, about three farmers' wagons full of cones. Smaller quantities can be kept separate by laying old sacks between them. The number of these silos necessary for the contemplated extent of the seed-house business is placed behind on another on both sides of the central passage. The cones in them are continuously surrounded and reached everywhere by dry air; they continuously dry and ripen.

According to occasional observations of the extraction cost of cones dried in this manner as compared with fresh cones, one can reckon in Eberswalde a reduction in favor of the former of about 6.5 per cent. If one wants to mark off in the individual silos the quantity of each particular lot of cones by colored marks for the sake of keeping check on them, this can be easily arranged; it is practicable, but it can not serve as a basis for the measuring of cones and payment for them, because the higher filled the silos are, so much the more compressed are the cones, and consequently the diminished quantity removed from a silo seems unfair to the person who originally supplied the cones.

Tests of weight at the Eberswalde cone bins which are impractically equipped and 10 x 10 x 10 = 1000 cubic feet, with tight walls and cement floors, showed that from 220 pounds (100 kg) of weight 22 pounds (9.8 kg) of water was dried out in the seed-house shed; in the case of longer storage the drying out was raised to 33 pounds (15 kg) without shoveling the cones over.

III. Preliminary Drying-room.

Invariably in conjunction with the cone-shed a preliminary drying-room is constructed, equipped with similar silos (but perhaps 6½ feet (2 m) wide), with strong, heavy, outer walls, and heated from 77° to 95° F. (25° to 35° C.) through the surplus hot air of the seed-extracting house. This room if of such size that the seed-house workman can easily manage to store in it a supply sufficient for 10 to 15 kiln-days; requiring, therefore, about 4 to 6 silos. Ventilators remove the moist air.

More emphasis must be placed upon the continuous removal of the moist air. Only in this way can a more rapid and safer drying be accomplished at moderate degrees of heat. It must be effected in the cone-shed through an active circulation of air, in the preliminary drying-room with ventilators and in the real drying-kiln by means of exhausts.

Cones preliminarily dried at a moderate temperature in this manner open easily and with specially good germination energy in their seeds. Time, expense, and danger from heat in the drying-kiln are saved. How eminently important the establishment and operation of this sort of preliminary drying-room is for the careful, cheap, and more rapid extraction of seed, (with the application of the most careful possible temperatures) is shown from investigations in the Eberswalde drying-kiln: Cones dried out in the cone-shed from 112 to 101 pounds per 2.8 bushels (51 to 46 kg per hectolitre), lost during the 7 days in which they were preliminarily dried at 91° F. (33° C.) in small compartments through which air circulated, 13 pounds (6 kg) more of water. The ripest cones began to crack open on this seventh day. Accordingly, therefore, the original weight of freshly delivered cones which equals 112 pounds per 2.8 bushels (51 kg per hl) was reduced through drying in the air and in the preliminary drying-room to 88 pounds (40 kg). The favorable result thus

obtained lies in the fact that an unusually short time and moderate temperature will accomplish the complete final opening.

The application of 77° to 95° F. (25° to 33° C.) in this preliminary drying-room in which the cones remain 10 to 15 days according to their condition, before kiln-drying, corresponds to the noon-day temperature at which cones sown in plantations crack open voluntarily. The treatment in the drying-kiln, then, serves only to hasten the completion of the process, to effect the complete opening of the more resistant, hard-opening smaller cones, etc.

Arrangements for heating this room can be effected without cost for special heating material, through suitable management of the hot-air combined with the drawing-off of the resulting damp air.

Such heating arrangements are found operating with special economy in all veneer factories, chair factories, furniture works, etc., which must subject their wood to a special drying process. They are not new, nor especially costly, nor difficult for the industries which are concerned with them. Just as little so is the arrangement of the following.

IV. Drying-kiln.

It was formerly the opinion (and Borgmann and von Penz even about 1900 remodeled and managed the Eberswalde drying-kiln according to this principle) that the still-closed cone could be kiln-dried with higher degrees of heat because it protects the enclosed seed, but that care must be taken, therefore, to have the seed fall out of the opened cone as soon as possible into a cooler room. This idea has indeed, in a certain respect, been most influential for drum drying-kilns, etc. It is not to be doubted that every *superfluous* delay in a high temperature can do no good to the seed.

However, the application of higher degrees of heat to cones still closed and therefore containing moisture is (contrary to the opinion just expressed) especially dangerous, as in general living things (and the embryo in the seed is such a thing) can resist dry heat better than moist; in every case numerous experiments in the Eberswalde drying-kiln have shown (and Overforester Haack has given attention to this) that cones which are

taken fresh from the delivery wagon and at once exposed to a temperature of 131° F. (55° C.) until they crack open (that is for about 20 hours long) preserve on the average only 7 per cent. germination while the same cones preliminarily dried for several days in rooms warmed from 77° to 86° F. (25° to 30° C.) and then kiln-dried at about 104° to 122° F. (40° to 50° C.) for 6 to 8 hours and finally kiln-dried for a short time until they crack wide open, in the hottest part of the drying-kiln at 122° to 131° F. (50° to 55° C.), showed (in the average of over 1,000 tests in the year 1908-9) 87.6 per cent. germination (the maximum amounting to 98.7 per cent.). From this observation the practice has been developed for the Eberswalde drying-kiln of treating the cones first dried in the preliminary drying-room (which unfortunately is only a primitive one) for several hours in the coolest part of the drying-kiln and then exposing them gradually more and more, through constant transposition of the drying trays, to the in-flowing hot air. In this way it has been possible, without increasing the degrees of heat, to shorten the process in the drying-kiln with a great increase of the germination per cent. But it is especially dangerous that in the ordinary kiln-drying establishments of the Prussian Forest Administration cooler and warmer air must be let in by constant changes of the inlet valves and with continuous observation of the thermometer, whenever the temperature in the drying-chamber ascends over 131° F. (55° C.) or threatens to fall below 113° F. (45° C.), with the result that the air-valves must be handled every 8 to 12 minutes. Every brief neglect makes itself felt through the whole contents of the drying-chamber (about 45 bushels) (16 hl), resulting in a great decrease of the germination energy.

The often discouraging results of plantations (despite all labor and care) have for a long time been correctly traced back to careless and too severe kiln-drying of the seed with the consequent weakening of its vitality; the seeds will indeed germinate if kept long enough (especially in germination testing apparatus cleverly chosen and carefully attended to); but they can not withstand unfavorable weather in the plantation and endure exposure to the weather which stronger seeds (those, for instance, released naturally or resulting from cone-sowings) vigorously overcome.

It can not be left unmentioned that in the tenth edition of

Gayer's "Forest Utilization," 1909, the chapter upon the equipment of seed-extracting houses contains some dangerous observations. For example, "to extract seed at 140° F. (60° C)." The chapter has in general remained almost literally the same since 1878 and still earlier (4th and 5th editions); it proves how little kiln-drying science has progressed since then in the knowledge of foresters. The average Scotch pine seed germination is often given them as only 65 per cent.

My conclusion is, therefore, that cones should be slowly dried at first in the preliminary drying-room and exposed to continually increasing degrees of heat up to the highest temperature of 113° to 122° F. (45° to 50° C.), and this process shortened as much as possible by the removal of the resulting moist air. For this purpose the following arrangement of the drying-kiln should serve:

In the preliminary drying-room the cones are spread out flat upon wood drying-trays about 51 inches (1.3 m) long and 30 inches (75 cm) wide. The floors and sides of these consist of wooden slats nailed near each other with a space between; I recommend soft wood slats between which little cones possibly do not stick so fast as between oak sticks. The drying-trays are about four inches (10 cm) deep, but should be covered only with one copious layer of cones so that when the cones increase in size upon opening, there is still sufficient room. These drying-trays are then shoved into a carrying rack, above one another about 10 to 15 high, so that they stand over one another with two to four inches (5 to 10 cm) space between, and so that the workman can fill the highest tray from the ground.

The whole rack is mounted on a low truck moving upon rails, and after opening a sliding door is pushed into the drying-kiln in which a current of dry air circulates around every tray. The drying-kiln is a room about five feet (1½ m) wide, 6½ feet (2 m) high and 26 to 30 feet (8 to 9 m) long with tight walls which takes 10 such trucks (with tray racks) coupled to one another on the broad side.

Hot air is let into this drying-kiln through a series of separate openings on both sides. The hot air apertures are arranged on both sides in a series above one another from the bottom to the top and especially in the vicinity of the exit-door of this drying-kiln, while air holes are located near the entrance-door, through

which the moist air forming in the drying-kiln is constantly drawn out. Once more should the importance of the removal of the moist air be emphasized here; it must be drawn backward toward the entrance-door in order to prevent the cones which are getting more and more dry from becoming heated again with moisture present.

The exit-door of this drying-kiln consists of panes of glass .12 to .15 of an inch (3 to 4 mm) thick, properly framed; the kiln-master can, therefore, see whether the cones have opened properly. According to the time of year, the quality of the cones, etc., the opening of the cones occurs in periods of time of different length which practice and observation soon learn to recognize.

The order of operation is as follows:

The kiln-master opens the exit sliding door, draws out the truck nearest to him, at the same time pulling forward the others nearest the door, goes to the entrance door, opens it and shoves in a truck filled with fresh-drying-trays, which he couples to the next truck in order to close the entrance-door again.

The operation is a continuous one, going forward day and night so long as there are cones.

It is uneconomical, even harmful, to cool off the drying-rooms oftener than is necessary to clean the stove grates, draughts, flues, etc. Competent stove-factories design stoves requiring the least possible interruption in heating for continuous efficiency.

It is not at all difficult for present day science to control the hot air accurately and to maintain it constantly at a temperature of 104° to 122° F. (40° to 50° C.) with occasional attention to a reliable little regulating apparatus. One need only think of the central heating system employed in modern houses everywhere.

In order to guard against all contingencies thermographs and hygrographs, visible from the outside, are constructed in the drying-kilns (also as a check upon the kiln-workman).

The design of the drying-kiln, the introduction of warm air maintained uniformly at 113° to 122° F. (45° to 50° C), its regular distribution in the drying-kiln and the removal of the damp air as it cools, is not at all new to the technique concerned with such things; similar operations are carried on in many kinds of industries; I call to mind, for instance, the drying arrangements in modernly-equipped pasteboard factories. The

method of drying just described can easily be looked after by one man even if two such drying-kilns are set up beside each other at one working place from which the thermograph, etc., is observed and upon which the emptied drying-tray trucks are shoved back in order that they may be pushed into the entrance-door after being filled in the preliminary drying-room.

Each individual drying-kiln should hold 10 trucks coupled broadwise to one another because according to experience at the Eberswalde drying-kiln cones which opened with difficulty were dried out after 10 changes of the trucks, at 90-minute intervals at most; cones which open easily require 40 to 50 minutes in each position, when there are 10 changes from the coolest to the hottest parts of the drying-kiln.

If one should use fewer drying-tray trucks coupled behind each other, the cones would be brought to the greatest heat too quickly; if one should arrange more trucks in a series in a drying-kiln it would be necessary to force so much the more hot air into the excessively long space and to remove moist air from it, and the drying-kiln would be cooled down on account of the very frequent removal of the trucks which are finished. However, one can secure every possible service from a drying-establishment by arranging many drying-kilns near each other, as desired.

I want especially to lay stress upon the recommendation, for medium-sized and larger establishments, that a hot-air drum, or something similar be placed between the heating-stove and the drying-kiln. The heating-stove is fired with empty cones, occasionally supplemented with coal.

Besides this I will mention the fact that it is superfluous, with the latest science of heating, to provide for the drying-room in the loft above the heating equipment, as done hitherto in commercial seed-extracting houses. Such an arrangement serves merely to increase the cost, since all the thousands of bushels of cones must in such a case be lifted up to it.

V. The Churn-room.

The opened cones taken out of the drying-kiln are quickly emptied into the churn-room, which is about 20 feet (6 m) long and three to four feet (1 to 1.1 m) wide with neatly cleaned, solid walls.

The emptying out of the cones must be done quickly in order that the cones, which close again upon cooling, (especially at their base), may not hold fast the seeds. With this object the entrance to the churn-room is invariably located near the exit from the drying-kiln.

The churn-room likewise is warmed by hot-air to 77° to 86° F. (25° to 30° C.), in order to keep all moisture away from the cones and seed. In it a wooden box with a funnel-shapped bottom is set up, about 39 inches (1 m) above the floor, into which the workman empties the drying-trays taken fresh from the drying-kiln. By manipulating a slide door he lets the cones fall into a churn. The latter consists of a cylinder with its sides constructed of thin iron bars, of the same style as a sorter for cleaning grain. They are known to all older seed-extracting establishments. By the rotation of the churn the cones are shaken about, slowly downward, while they give out their winged seeds. The winged seeds fall through the bars upon the floor of the churn-room which is rounded in the shape of a gutter lined with tin, and drawn out into a funnel closed with a slide-door, which readily conducts the collected seeds into the wing-removing room.

The workmen must avoid entering the churn-room, even with felt slippers, to sweep up the seed, in the manner hitherto practiced. The Scotch pine seed is easily crushed or compressed and every such wound forms an infection point for fungi; or else, as in many other cases, the embryo instead of coming out normally (with root tip foremost), comes out of the seed coat with the cotyledons foremost,—a useless little plant.

Germination tests show that every injured seed, commencing a few hours after the injury, festers a mould distinctly visible to the unaided eye after three or four days. Uninjured seeds do not! Numerous tests at the Eberswalde seed-house with seeds artificially torn or nicked have shown (sometimes in every case) cotyledons breaking through first ("rump-born"). All these seed are useless for sowing in plantations.

The churn must have a diameter of about 31 inches (80 cm) and a length of 16 feet (5 m) and be set up with a fall of 39 inches (1 m) at the most (this can be regulated); it is revolved rapidly (from the outer room). The empty cones, shaken around in it, fall out of the end into a funnel-shaped trough which empties into a shed from which the cones can be easily removed

for fuel or for sale without the necessity of the cone-purchasers, etc., entering the true drying-rooms.

VI. Empty-cone Shed.

This can be built, as cheap as possible, with board walls and a floor made secure against the entrance of dampness. On account of the fire danger it is recommended that it be built with walls closed on all sides, and made air-tight possibly with roofing-paper or better, calked with oakum, and of such size that the whole drying process will not be interrupted and harmed by an inopportune overflow of cones.

VII. The Wing Removing Room.

The winged seed gathered in the churn-room is here, once a day, put into sacks.

If cones from different collectors or for different tests are kiln-dried on the same day, each kind is sacked separately. The winged seeds are in these sacks freed from the wings by carefully beating the sacks with soft leather flails and grinding them around frequently.

This method is the most careful one known to me. If well carried out, it removes the wings from Scotch pine seed with such completeness that, in the plantations, the seed runs smoothly out of the smallest aperture of the seeding machine. With seed from which the wings have been so removed, it has been possible to distribute evenly, with the Drewitz machine, 4.4 pounds (2 kg) in 6.2 miles (10 km) of seed furrows.

Other methods leave behind wing particles or injure the shells of the seed.

Each sack is given an enclosed label with the notations: Kiln-dried on.....; Cones delivered by.....; Derived
(Date.) (Name.)
from.....kiln-dried cones,.....winged seed. Thus
(bushels.) (pounds.)
one can easily prove, by germination tests of each sack, the quality of the supply and care exercised on each particular drying day.

The sacks are then finally hung up in this room for several

days. The temperature of the room is kept at 77° F. (25° C.) in order to keep out moisture.

On convenient days, but at least once a week, the contents of each sack separately is cleaned in one of the best, well-known grain cleaning machines. In this way particles of wings and dust are blown out; needles and cone scales are sifted out, sterile seeds are separated out by the machine.

The separation of large and small seed is also accomplished, but not in a useful manner. Ordinary grain cleaning machines work by means of an air-blast and manipulation of sieves. But by the air-blast larger seeds with bits of wing attached are blown together with wingless smaller seeds. Numerous germination tests have shown only unessential differences in germinative power between the two sizes. But since it has been shown that larger and smaller seeds have different "use-value" it is recommended that the seed be sorted according to size in a suitable sorting-machine.

The proper label is put back in each sack after it has been filled out with the weight of the winged seed and the wingless seed.

The cleaned seed is still kept in this moderately warm room. Once a week a small number of seeds are taken from the product of each day or of each assortment in order to carry on germination tests with them.

VIII. Germination Chamber.

A compartment about three feet square (1 m) is sufficient for this; fitted up as a miniature green-house, continuously heated by hot-air to about 86° F. (30° C.); under its glass panes stand the little "cellars," tin boxes, (Improved and described by Overforester Haack) and upon the bridges of these are laid about 100 seeds on a strip of flannel or blotting paper, the edges of which hang down into water. The practical application of this at the Eberswalde seed-house has resulted in the use of blotting-paper only, the seed being allowed to lie free upon it, and the individual tin boxes, which can comfortably hold 10 tests of 100 seeds each, being covered with very large plates of glass, lying loose upon them. The seed are then always visible, germinate quickly, and after 170 germination hours give a result which is accomplished in the quickest and most useful way to be of practical value. We

germinate three parallel tests of each day's seed assortment, so that any incorrect handling in the germination chamber can be definitely established. If all three tests are proportionate, the particular assortment of seed is traced back to the cone-collector and poor values are penalized or high values commended. If the three tests turn out unequally new seeds of the same assortment are on the seventh day at once put in, in order to determine definitely any mistakes in the drying process.

The practical working out of several thousand germination experiments at Eberswalde has confirmed the opinion of Haack that in the case of fresh seed from good cones all the really useful seeds have germinated in 7 days. For example, about 1,000 experiments in 1909 with seed from Pomerania showed, in the best instance, 98.7 per cent. of germinated seed after 170 germination hours; at the Eberswalde seed establishment this is called "germination energy," (contrary to those testing establishments which compute the germination energy after a very much longer time,—in a manner of little use for practical application). The total result, achieved after 21 germination days, is called, at the Eberswalde seed establishment, "germination capacity", (likewise contrary to the testing establishments which continue observations up to the 43rd day).

The average of all experiments with local seed from December 1908 to June 1909 gave a germination on the seventh day of 87.6 per cent., on the twenty-first day of 92.2 per cent. Therefore, in the later weeks only 4.6 per cent. germinated, which has no significance in practical plantation sowing.

If the quality of the seed has been authentically established in the germination chamber, it is thrown together according to its germination quality (though naturally the different assortments are kept separate) and also according to the principle that every forester who supplies cones can receive back the seed extracted from his own cones.

So much of the seed as is to be used early in the spring is stored in suitable dry rooms, in little sacks holding about 66 pounds (30 kg).

IX. The Granary.

The different lots of seed mentioned above, which are to be used soon, are placed in this room, in little individual sacks. Its

size depends upon the maximum amount of seed being extracted during the winter months, from December to April. It must be mouse-proof, dry and of a uniform temperature.

All the other seed, in particular that being cleaned from April to December, is stored in the wing-removing room until the completion of the germination tests, after which it is finally dried out for an hour just inside the exit door of the drying-kiln in order to remove any absorbed moisture. (This final drying out has the same object which the prudent farmer aims at when he spreads out his hay in the midday sun just before putting it in, in order to dry out the dew or other moisture before putting it in).

The seed is then at once poured into glass carboys; these are corked and sealed and taken into the seed-house cellar.

X. *The Seed-house Cellar.*

Older experiments by Cieslar and others as well as more recent, very exact, year-long experiments by Haack have shown that the storage of cones, be it ever so well done, in order to open them in subsequent poor seed years, does not prevent the germination capacity from falling off from year to year until it speedily becomes useless for practical sowing. The experiments have further shown that the germination capacity remains much more constant if the pure seed is shut up in the dark, uniformly dry and cold.

One is perhaps warranted in stating the proposition in the following way: The seed contains a living thing which is capable, on the one hand (1) of protecting itself to a certain degree against inopportune development, on the other hand (2) of taking advantage of favorable moments for development and growth.

Concerning (1): In the dry summer season the outer corky layer of the seed, the seed coat, becomes hard; it seems indeed as if the inner, thinner seed coat also becomes corky to protect itself, since the seed shrinks and no longer fills out the inside of the outer capsule. One can easily recognize, in the case of larger kinds of seed, as for example oaks, how when laid upon too dry ground they germinate with difficulty, after long delay, or not at all. While the same oak seeds, if one splits the outer hard shell

absorb water quickly and readily, the seed coats are distended and the seeds develop.

In a similar way many Scotch pine seed are delayed and, therefore, useless in dry planting seasons, or else do not develop at all, because their outer seed coat hardens too much in order to protect them against summer dryness, no longer lets in sufficient water and the embryo does not break through.

Concerning (2): In every case when in summer or autumn sufficient humidity accompanies the warmth always prevailing at these seasons, the seed tries to develop (also when on rainy days the air in the ordinary granaries is sufficiently moist); every such attempt soon ceases again, when dry weather ensues; but each time the vitality is weakened so that all seeds by weakening themselves are ruined. (Even potatoes stored in cold dark cellars can be prevented from germinating for a long time, whereas they germinate quickly when in the spring before planting they are spread out upon barn-floors for 8 to 14 clear, moist, warm days).

These observations perhaps explain why the above mentioned recent experiments lead to the conclusion that the germination energy can, by the exclusion of light, moisture, and heat, be preserved for several years.

Thereby is the opportunity afforded to preserve the surplus of abundant seed-years in a useful condition for poor seed-years, which seldom continue longer than one or two years.

For this a seed-house cellar is needed, high enough so that a man can enter it upright; large enough so that as many carboys can be placed in it upon shelves (in two tiers on both sides of a central passage 5 to 7 feet (1.5 to 2 m) wide as are needed to preserve the seed.

The Eberswalde seed establishment has connected with it a primitive experiment cellar built into the ground. It is dark; it is located upon and in a dry sand-hill; it is about 3.3 feet (1 m) high covered over with earth and straw; the thermograph in it shows that it maintains a constant even temperature of about 46° F. (8° C.); double doors with straw filling and a closed entrance vestibule protect it against the entrance of heat and cold.

In it stand hundreds of glass carboys such as can be bought comparatively cheaply from druggists who obtain sulphuric acid, etc., in them. Storage in this earth cellar at the Eberswalde seed-establishment showed an unimpaired germination vitality up to

the present time (middle of May, 1910) of the seed which had been extracted and stored since the beginning of April, 1909. It is recommended that carboys of this sort, but somewhat stronger, be specially blown, capable of holding exactly one quart (1 litre) or 66 pounds (30 kg) of seed. A number is placed upon each one with oil paint; corresponding numbers in a catalogue show the assortment, germination, etc., of the contents. In order to carry them into the cellar flat, strong osier baskets with strong handles are recommended. Besides each carboy stands a little medicine bottle, similarly filled with the same seed, painted with the same number, and out of these we take test samples so as continuously to watch over, in the germination chamber, the preservation of the seed.

The glass carboys are more convenient and easier to open and shut than soldered tin containers concerning the tight soldering of which there may be reasonable doubts, since we know how often canned vegetables spoil because the little cans are frequently not tightly soldered. The cans could of course be screwed air tight but there have recently been doubts as to whether the oxidation of the tin does not injure the enclosed seed which forms carbonic acid. The contents of the glass carboys are always visible and the division of the seed in the spring is easily managed by the use of these carboys which contain 66 pounds (30 kg) in each case.

In building seed establishments the cellar should be constructed near the extraction house, with double insolated walls and a protecting double vestibule, possibly under the cone-shed or under the living quarters of the kiln master or foreman.

Since, however, according to Haack's investigations the seed preserves its germinative energy better the nearer the temperatur is maintained constantly at 32° F. (0° c), one will have to build the cellar as the ice-cellars of large breweries are built. A sufficiently large and strong vault is constructed and insolated walls and roof are built about it. Ice is put between the vault and the outer walls, care is taken to constantly remove the water from melting and thus a suitable temperature is maintained.

The cost of building such a seed-extracting establishment can not be much higher than the cost of the usual conventional seed-house having the same annual capacity. The cost of constructing the cone-shed will be somewhat dearer; everything else is the

same as for an ordinary seed-house of similar size, even if built in accordance with the latest science and arrangements.

The construction of the drying-kiln and the heating system will perhaps cost more; but they can not cost excessively since many factories possess similar equipment for much less valuable products than Scotch pine seed. Every home has a central heating system, while we are concerned only with the heating of a few small rooms which can be effected cheaply by hot air. The fuel is chiefly empty cones and coal. This feature is especially economical.

By having practical equipment the operation of the plant is simplified for the workmen; continuous operation makes the most of the buildings and other arrangements, and increases the utility of the heating system, thereby making the cost of operation cheaper.

All in all, the current expenses of the seed-extracting house are cheaper than hitherto. The cost of the cellar is a new addition, but it must be figured in, if the results of the latest investigations and experience are to be made use of in our actual practice, which certainly requires them; this cost is not excessive, even if one prefers a regular ice-cellar, since the two-storied arrangement of the carboys does not require any great amount of space.

I want to touch upon one more point: Cones which are picked late, delivered dry, and collected from old stands have the following advantages:

1. They open quicker; all expense, wages, interest, and the final charging-off of the cost of the seed extracting establishment amount to less with such cones.

2. It seems that such cones afford greater germination energy and consequently greater real value.

3. The quantity of seed yielded varies frequently between one and one-quarter and one and three-quarters pounds per two and three-quarters bushels of cones (.55 to .80 kg. per 1 hl).

It is my idea (and it must be carried out in practice) to offer advanced prices to cone collectors for cones which afford the greatest yield of seed, the highest real value and the cheapest production of seed; perhaps at first in the form of a suitable bonus which would be paid after the results from the cones had been ascertained. Correct and honest calculation and payment of this bonus will teach the cone collectors to supply such seed-extract-

ing establishments with cones which are collected and handled in the best manner. Because of the eminent importance of the cone supply it is more than necessary to pay especially well for late picked, well handled cones that open quickly, contain abundant seed and show in their seed the highest germination,—in fact, to put a premium on them.

SOME FACTS ON FORESTRY CONDITIONS IN SWEDEN.*

By Max H. Foerster.

The Kingdom of Sweden comprises 172,876 square miles, 8 per cent. of which is water. As to size it is the sixth in rank of the European countries.

Longitudinally it extends about 900 miles south and north with a breadth of only 180-240 miles. Stockholm, the capital and center of the wood industry, is situated one-third of the longitudinal distance from the southern end, Sundsvall and Hernoesand not quite two-thirds of the distance. The distance of this point from Berlin in airline is 700 miles, which is as far north as Rome is south.

Ages ago the kingdom was divided into three large provinces, Goetarike, Svearike and Norrland. The first one comprises the southern part of Sweden about as far as Norrköping. Svearike comprises central Sweden and extends along the coast to the latitude of Gefle, but along the Norwegian boundary it continues much farther north. Norrland includes the northern and largest part of the country. At the present time it is the most important part of Sweden as far as the wood industry is concerned. This land division is, however, only of historical importance, but continues to exist in the minds of the people. For purposes of administration, Sweden is divided into 24 administrative districts.

The population of Sweden is recorded as 5,300,000 inhabitants. Of these 24,000 are Finns, residing in the northern part of Norrland, and about 7,000 are Lapps, living in Lappland, largely on the proceeds from their reindeer herds. The residence of these Mongolian people, especially the Finns, used to extend much farther south in the interior part of the county. Hence the name "Finnenwald" for the forest along the boundary between Swedish Wermland and Norway, which still contains many reminiscences of the Finnish inhabitants. The density of the population varies considerably. Disregarding the cities, of which only two have

*Translated from *Allgemeine Forst- und Jagdzeitung, April, 1910;* article by Dr. C. Metzger.

over 100,000 inhabitants, (Stockholm and Gotenburg) the people live scattered in the country, densest along the coast in the agricultural districts, and sparsest in the heavily timbered districts and the large plains of Lappland which lie above timber line. The most thickly settled regions are Malmö (225) and Gotenburg (198), while Norbotten, the most northern province, has an average of only three inhabitants per square mile. Large areas of the latter country which compare favorably in size with Bavaria, Saxony and Wurttemberg are totally deserted. Of the total area of the country 12 per cent. is used for agriculture, and 51 per cent. is timbered. In accordance with this, a large per cent. of the Swedish population obtains its subsistence from the industries which result from the use of these 70,000 square miles of timberland. About 47 per cent. of the population is said to practice agriculture; but at the same time, the forest and the work going on in it are an equally, if not more important source of income for the agricultural inhabitants of the forested districts, especially in the northern ones. The wood industry alone employs 67,000 workmen.

Of further importance as sources of income are the mining industry (iron, copper, zinc), the textile industry, and fishing. Hunting, especially for wild fowl, must also be regarded as such.

The topography of Sweden is largely hilly. Level stretches are only found in the south (Malmö) and along the coast where they are broken up by hills. The topography becomes more rugged as one advances towards the Norwegian boundary, which coincides for long distances with the crest of the Scandinavian watershed. Hence the streams, arising on the eastern slope of the mountain chain, traverse only Swedish ground. Only the Klarelf River, traversing Wermland, originates in Norway, where it rises from the Faemund Lake under the name of Trysil. The rivers are rarely over 300 miles in length, flowing in a southeasterly direction. Their gradient is steep and their courses frequently interrupted by natural dams, above which they form long narrow lakes and through which they break as cataracts and rapids; therefore they are only navigable for short distances. On the other hand, these streams are of the utmost importance for driving timber, their numerous falls and rapids are an almost inexhaustible source of power for industries and traffic.

Most of the streams flow into deeply incised fjords, the open-

ings of which are strewn with small rocky islands. Thus protected the fjords offer excellent harbors and are therefore the natural stations of commerce and industry, i. e. of the wood industry, the centers of which are found along the rugged coast of Sweden.

These streams bring the rough logs to the saw mills and pulp manufacturing plants, and from their yards the products are loaded directly on to the ships.

Geologically, Sweden differs widely from Denmark and the North German plain. The bedrock underlying the forest soils belongs almost exclusively to the fundamental formation of the Archean rocks, granites, gneisses, and quartzites. Only small areas inside the timbered belt contain paleozoic formations. The bedrock crops out quite frequently in the level and hilly areas, generally in the form of rounded knobs or ridges, but the crevices, ravines and troughs of the same are always filled with diluvium, which conceals the bedrock over long distances. Only on steep slopes is the soil a product of erosion of the bedrock, but even here it is frequently mixed with diluvial depositions. The forest soils must therefore be classed as diluvial. The soils of the glacial moraines have, however, gone through a series of displacements in postglacial times, due to upheaval and depression of the land-surface, and hence inundation by the waters of the sea and the action of streams.

The more or less dry, level stretches of sand, usually covered with scrubby pine growth, should be distinguished from the hilly gravel of the moraines on which grow mixed stands of pine and spruce, or spruce pure, and also from the gravelly ridges of coarse or fine but smooth material, which belongs to the poorer soils and as a rule can only grow pine. In contrast to these glacial soils those formed by disintegration of the fundamental rock formations, are found in the mountains and show a greater or smaller degree of fertility according to their origin.

Due to the large extension of the kingdom from north to south, the climate of Sweden shows great variations in the different provinces. Southern Sweden (Schönen) possesses a climate similar to the insular climate of Denmark. On the west coast the influence of the gulf stream and ocean is quite noticeable. The harbor of Gotenburg is free of ice. The farther one advances to the north, however, the more raw and continental

the climate grows, especially in winter, when the large lakes of Finnland and Sweden, as well as a large number of the harbors of the Baltic Sea, are frozen over and the moderating influence of these waters on the climate is eliminated. The warm season of the year, therefore, shows a mild sea climate, similar to the German climate.

The mountain group in the western part precipitates a large per cent. of the precipitation coming from the ocean. Only the west coast as far north as Gotenburg is open and receives a relatively high precipitation (70-75 cm) similar to the Norwegian coast. The greater part of Sweden, however, lies in the shadow of the Scandinavian Divide, so that most of the recorded precipitations in the interior and coast land fall below 50 cm. This is especially true of the timbered Norrland, which only gets 40-45 cm. annually. The mountain ridge also protects Sweden against western storms. Winds are quite limited, especially in summer; and the number of calm days is large. This is of great significance in the straight symmetrical development of the pine.

The sources of warmth during the summer months differ very little from those in Germany. As far as the amount of heat, which favors vegetation is concerned, the longer hours of the day equalize the lower degree of intensity of the sun's rays, so that our cereals and even species of turnips ripen in the central Norrland.

The greatest change in climatic respect is brought about by the cold season. In central and northern Sweden, the timbered sections, the lakes freeze over during November, beginning with those farthest north. In Wermland the lakes are usually frozen by November 20th, in Dalekarlien by November 10th to 15th. Actual thawing does not start in till the latter part of April.

The lakes of Dalekarlien are free from ice about May 10th but farther north the ice does not break up before June. In central Sweden snow covers the ground from 90 to 130 days, in northern Sweden for 200 days on an average of a number of years. The harbors of the Baltic Sea are closed several months during winter, unless they are artificially kept open as the harbor of Stockholm and several others south of it are. Navigation usually closes down in December, beginning again in May. For trade and traffic, therefore, the harbors of Norrland are handicapped.

Snow and ice play an important role in forestry in Sweden, first in connection with the growth of the forest, and second, with forest utilization.

The covering of snow, which for months protects the little plants, is doubless of the greatest importance. In late spring they emerge from the cover of snow almost immediately into the most vigorous vegetation. On the other hand damage by snow is a rare occurrence, as there is a low degree of atmospheric moisture in the winter and the snow falls dry.

The snow also offers cheap transportation of wood. By freezing over lakes and swamps the winter opens up the most inaccessible and distant forest regions. When a cutting is to take place, shacks are constructed for the crew and horses. Skidding trails are staked out, following the streams, swamps and lakes, avoiding the loss of timber. The snow on these roads is iced and steep grades covered with brush or grass. The logs are loaded on sleds and skidded to the nearest driveable stream by the small but strong woods horses. The ends of the logs are stamped with the mark of the owner and left on the ice or the bank of the stream until thawing sets in. The drive begins with the breaking up of the ice on the small streams and continues until midsummer, the streams and rivers being gradually cleared towards their mouths. At the sorting booms above the industrial districts they are caught and rafted from there on downstream. The numerous rapids and falls are avoided by improvements of all sorts.

At watersheds or divides raising apparatus and means of transportation are constructed at advantageous points in order to make possible the transfer of logs from small river systems into larger ones. The necessary dams, booms, etc., for rendering the streams of Norrland and Dalekarlien driveable represent a capital of 8,000,000 to 11,000,000 dollars. Driving and rafting are usually conducted by special boom companies, of which the timber owners, sawmill owners, pulp manufacturers, etc., are members. The cost of transportation is thus reduced to a minimum. On a well managed driveable stream the cost is hardly more than one-half a cent per mile per saw log, to which must be added the cost of sorting, which amounts to from ¼ to 1 cent according to the size and equipment of the sorting gap. As skidding on sleds in winter is also cheap, provided the distances

are not too great, the wood material is delivered to the industries at a very small expense, even though it often has to come a distance of 200 miles. Permanent logging roads or road systems are not known in the Swedish forests. On the other hand, there are over 15,000 miles of driveable streams and about 40,000,000 logs are transported by them annually.

The entire forested area of Sweden is estimated at around 70,000 square miles. Of this total 75 per cent. is in private and 25 per cent. in government ownership. To every farm-house belongs a greater or smaller forest area, depending upon the amount and productive capacity of the cleared land. The unit for this is up to the present day so-called "Mantal," i. e., the number of soldiers to be sent by each farmhouse, a remnant of the old military government. A part of these forests, mainly the so-called *Aussenwaelder* which were located farthest from the farms were later on sold to large concerns. Oftentimes these forests were aggregated to form community forests.

Considering the distribution of forests it must be remembered that the south is scarcely forested at all. As a result of its favorable climatic conditions and the fertility of the soil, it has become the grain center of the country. The first large bodies of forests are encountered on the mountainous boundary between Gota and Svealand, north of Norköping. Sixty-two per cent. of Oestergotland and Oerebro are forested. The real forests of Sweden, however, are found in Wermland, Dalekarlien, and Norrland. The most heavily forested parts of the latter country are Gefleberg with 82 per cent. and Westernorrland with 73 per cent. forest.

Higher up in the mountains, especially going north, the forest cover diminishes rapidly. The mountainous Jämtland represents the average of the entire country, Norrland the most northerly province showing only 30 per cent. forested. The most important export point for Wermland is Gotenburg with which it is connected by the Klara and Gota river systems. Some 18 million cubic feet of wood material is exported from this place.

For Dalekarlien and Norrland, which, combined, represent about 80 per cent. of the total Swedish export of planks and boards, the principal export points are in their order beginning at the south:—Gefle, Soderham, Hundiksvall, Sundsvall, Hernoesand, Umea, Skelleftea, Pitea, Lulea and Haparanda.

The most important of these are Sundsvall and Hernoesand, with about 30,000,000 cubic feet of lumber exports each in boards and planks alone. In addition to this a considerable amount of mining timbers and material manufactured from waste is exported. These towns are situated at the mouth of Ljungman, Indals and Angerman rivers.

The national forests are also chiefly located in Norrland in the northern parts. In the most northerly part, in Norbotten, 51 per cent. of the total area is in government possession, in Västerbotten, 36 per cent. Going south, these figures decrease rapidly. National control is doubtless of great value for the preservation of the forests in the northern regions. A considerable portion of the private forest land has changed hands in the course of time, the peasants selling out to large corporations which exploit these forests with their sawmills. Of course this exploitation often consisted in a shameless destruction of the forest, resulting in a strong sentiment against the purchase of forest land by corporations. On the other hand it must be acknowledged that many of them manage their forests in a praiseworthy manner. The corporation forests have thus become a typical feature of Sweden.

The total area of these forests in Dalekarlien and Norrland is over 6,500,000 acres. That means about 19 per cent. of the forested area of these districts, which is estimated at 34,000,000 acres, two-thirds of the total forest area of Sweden. The farmers here own about twice as much as the corporations, 43 per cent. being in possession of the government and communities.

Of these community forests the "Spar" (savings) forests existing for a long time in Dalekarlien must be mentioned separately. These were formed in the following way: After dividing up the common forest lands, the peasants agreed to give up a large part of their private share and unite them again into community forests. The returns from these forests are used for the payment of taxes, schools, hospitals and other public purposes.

Some of the communities possessing "Spar" forests have become famous for their prosperity, but not only that, they form examples for the present forest protection movement, which aside from other aims, advocates the formation of compact commuity forests.

The only species to be considered for the lumber export are

pine and spruce. The southern part of Sweden contains also beech forests which, however, are only of local importance. Still less important is the occurrence of oak, though it does not reach its northern extension before 61°, i. e. slightly north of Stockholm. In the coniferous forests, however, birch, bird-cherry and aspen occur quite frequently.

Even where they are being heavily exploited the forests still show the natural types from which they have been derived. Until lately it has been, and still continues to be in a large part of the country the forest policy of Sweden to utilize such natural grown forests, forest preservation and regeneration has been aimed at with more or less good faith and success.

As private forests in the greater part of Sweden were absolutely free from restriction up to a few wears ago, examples of the worst kind of devastation are to be found all over the country. One must consider, however, that the forests of this northern country, which seems to be specially created for forest growth, can stand an incredible amount of abuse and reckless cutting.

Only this can explain the fact that the prophecies by foreign foresters of a total denudation of the entire country in the near future, which has been spoken of in the past century, have not come true. On the contrary the export trade has increased steadily and by far not all of the forested regions have as yet been attacked.

The most important species for the lumber export trade is pine, which covers the sandy bottoms, the glacial soils, and the dry, extensive sandhills in pure stands or mixed with spruce. The less poor and dry the soil, the greater per cent. of spruce in the mixture. Dry pine barrens often contain only a few straggling spruce as an understory.

Otherwise the ground cover consists of the reindeer moss—especially in the north—Erica and *Empetrum nigrum.* Farther south and in the moister localities of the north, mosses and species of Vaccinium also appear. But there, too, the spruce begins to come in, forming an understory of increasing density and, on the richer soils, competing successfully with the main species of the stand. Thus all phases of mixture of these two species are found.

When the pine is cut out of these mixed stands—a method which was commonly practiced until recently—the spruce stand

left is often unable to continue its good growth. The soil dries up, parasites increase, growth in height decreases, diameter growth decreases rapidly and as a result of the diminished growth and activity of the stand the balance between the water supply of the soil and its absorption is destroyed. The deteriorating spruce stand is not capable of sufficiently draining the soil. The soil grows wet and swampy, which results not infrequently in the death of the forest vegetation and a formation of a high moor.

This process is of common occurrence in the Swedish forests, the more frequently the farther north one progresses. The reclamation of these "watersick" soils, especially for pine, is often very difficult and expensive.

In the life history of the northern forests forest fires have always played an important role. They have always successfully driven back the thrifty spruce from the pine soils, as the spruce and not the pine falls a victim to fires. The soil laid bare by the fire is easily seeded with pine, resulting in an independent new generation of pine, which after some time gradually becomes mixed with spruce. After especially severe fires which have robbed the soil of its entire humus and litter, the pine generation tends to come in under a preceding birch stand, which is the only species at first able to take root. Under this protective cover, first the pine and later the spruce stands develop.

The example of nature is imitated successfully in many of the northern districts by using fire to establish the natural reproduction of pine.

On the swampy stretches of forest land drainage is provided for by constructing ditches. Deteriorated and drowned forests are cut over, the soil burned over after draining and then sowed to pine.

On fresh moraine soils, spruce forms thrifty pure stands from which pine has been completely crowded out. Some of the soils formed by disintegration of the fundamental rock, i. e. the lime and Silurian soils, grow pure spruce stands of high quality.

Until very recently spruce timber had very little if any economic value at all, as the sawmills cut pine chiefly. But since the growth of the wood-working industry spruce timber has found quite a good market value. Since then it has also been possible to so utilize the mixed spruce and pine stands as to aid the pine in retaining its dominant position in the stand. As long as the

pine only was cut out this was impossible and the old method usually destroyed the balance between the two species, to the great disadvantage of the pine as well as to the productive capacity of these soils which were not rich enough to produce pure spruce stands.

Whenever possible, nowadays, in mixed stands the spruce is cut first and the stand reproduced for pine with the aid of pine seed trees.

More advantageous conditions for the maintenance of pine as the dominant species were in former times only present in those forests, which were at the disposal of the iron works for the production of charcoal. For the charcoal industry both species were of equal value, so that the utilization tended towards extensive clear cuttings, which were quite well reproduced by natural seeding.

In many of these forests mixed stands of a high degree of perfection were and can still be found, which can no longer be classed as the virgin forest covering the country, but are more or less the result of human activity. On the charcoal cuttings the resulting stands showed quite an even development over large areas, in contrast to the original irregular selection forest.

Considering forest utilization, all methods of cutting are represented from the one-sided and worthless selection cutting for merely the largest pine logs, down to a clear cutting, taking everything, even the smallest timber. According to the good will and knowledge of the owner the actual cutting conforms more or less to silvicultural needs, and it must be remarked that in most of the Swedish forests even a slight consideration of the silvicultural needs is rewarded in a surprising manner. In central and southern Sweden especially there are forests which are altogether managed according to the European examples of artificial forest production. And on the other hand there are still immense forests in the North which are just beginning to be exploited, and in which a silvicultural treatment is out of the question.

The first attacks on virgin timber, excepting the charcoal cuttings perhaps, have always been selection cuttings, taking at first only the largest and most valuable pine saw timber. These first cuttings were followed by others in which the demands for size and quality of the timber steadily decreased, especially since

the forests were more and more opened up by the improvement of rivers and streams for rafting and driving.

The demands of the sawmills were at first the determining factor for the system of cutting. Forestry ideas as a rule did not gain consideration until in later stages of exploitation, if it was then still possible to consider them.

This was not accomplished generally, until the spruce found a strong consumer in the wood-working industry, and since rational charcoal manufacturing methods and the decrease in the expense of rafting have made it possible to utilize inferior species. The latter find their consumers in the meilers as well as in retort charcoal plants, since the smelters of Sweden still consume enormous amounts of charcoal—furthermore in the rapidly developing export of mining timbers, in the manufacture of paper pulp, chiefly by the mechanical and sulphite process for spruce, and the sulphate process for pine. Sweden affords a conspicuous example of how the possibility of utilizing inferior species limits forest destruction and advances scientific forestry.

In considerable portions of south and central Sweden, the forests have already been through all the stages of forest utilization. The formerly high returns have decreased and, if some capital had not been used for care and management of the forests they would have deteriorated much more in their productive capacity.

The extensive form of forest destruction has thus gradually given way to the intensive form of forest management, as can be seen in many of the forests in central and south Sweden, where it almost approaches the German method of management. The farther north one proceeds the more extensive methods are employed, consisting largely in a mere harvest of the virgin forest. The degree of misuse of the forest has always varied as greatly as the character of utilization. The more the forests were opened up and the more accessible they were rendered for the places of consumption, the sooner the period was reached which might be termed that of misuse.

On the whole, the forest of southern and central Sweden have been so misused, though in varying degrees.

Norrland, however, which contains more than half of the forest area of Sweden, still contains large bodies of timberland

which have not yet attained the permissible maximum degree of utilization.

The development of Sweden has advanced from south to north and the wood-industry has simultaneously advanced north with the exhaustion of the supply in the south. But in spite of the sins and errors on the subject of silviculture and forest protection, and in spite of the enormous growth of the wood industries, growth and use still seem to balance, considering the forests of the entire country.

Statistics of this sort have been gathered time and again, of course with various results.

According to the statistics of a committee which reported on the forest conditions in Sweden 14 years ago, the total annual wood consumption amounted to around 1,000,000,000 cubic feet, thus distributed:

For domestic use of population, ...	560,000,000	cubic	feet
For wood export, ...	216,000,000	"	"
For wood-working industries, ...	54,000,000	"	"
For mining industry, ...	190,000,000	"	"
Total, ...	1,020,000,000	"	"

To this must be added the amount of timber left in the woods to rot, windfalls, tops, defective logs, etc., amounting, conservatively estimated, to 182,000,000 cubic feet. The total annual cut then amounts to 1,200,000,000 cubic feet, while the total annual growth is estimated at a little more, namely 1,218 million feet. These figures have since been contested and proven unsatisfactory. According to recent investigations the total amount of export material is estimated at almost 250,000,000 feet, that of the wood-working industry has increased to 168,000,000 and the mining industry uses over 14,000,000 feet more than originally. The most indefinite figure is the largest one, that for domestic use. Since the great value of the forest has been recognized and the population has become more economical in its use of wood, at least of wood of economic value, and much of the defective material which was formerly left to rot, is now being utilized for domestic purposes as well as by the industries, the

figure mentioned for 14 years previous has probably hardly changed.

Contested in the same measure as the amount of material for domestic use were the figures given on the annual yield of the Swedish forests. There are many pessimists who claim that 1,218 million cubic feet is much too high a figure for the annual growth and there is much to be said in favor of their opinion.

After thorough inspection and investigation, however, I should count myself with those Swedish foresters who claim that the annual yield should be estimated still higher. According to the figures mentioned the annual use per acre of forest land is on an average not more than 22.5 cubic feet.* It should be possible to produce this result by a moderate degree of cultivation without disregarding the unfavorable climatic conditions on the productive capacity of the northern regions. The bulk of the Swedish forest is situated in regions which can be conservatively estimated at 35 to 40 cubic feet average annual increment.

In a few years these questions, both important for the country itself as well as its consumers and rivals, will be definitely settled. Jaegmästare Wedholm has submitted to the Swedish Reichstag a bill, proposing an estimate of the total forest area of Sweden with reference to the amount of standing timber, increment, and total cut, the work to be completed in the next three or four years at a cost of about $50,000.

This large task, which is similar to taking a businesslike inventory, will be carried out, and the undertaking proves sufficiently the serious attitude and interest with which the forest preservation question is regarded in Sweden.

Taking part in forest utilization are, the sawmills; the woodworking plants; the charcoal industry; the mining timber and pulp export trade; the population itself for domestic uses, such as buildings and fuel.

As a side issue grazing, especially of cattle and sheep, and of a few horses, must be considered as a forest use.

The wood export figures up to about 200,000,000 cubic feet lumber and about 400,000 tons of wood products, with a value of about $42,000,000 and $12,000,000 respectively. Besides this about $14,000,000 must be considered as the value of wood

* From the preceding figures the cut seems to figure out 30 cubic feet.—Ed.

material used in export manufactures, such as cabinet making and other industries working for export trade.

About 1,400 sawmills and 150 wood working plants furnish the export material. The largest item is supplied by the sawmills in the form of pine and spruce lumber, boards, planks, and deals, altogether about 158,000,000 cubic feet annually. About 12 per cent. of this is planed, chiefly spruce.

The national forests of Sweden are divided into 10 inspection districts and 90 "Revir." The government officers in charge of the latter are called "Jaegmästare", the inspection officers "Overjaegmästare". The central office is the royal domain administration department with a general director, at present a forester, at its head; General Direktor Fredenberg. Four chiefs of bureau work on the forestry affair.

The private forests, especially the corporation forests are managed by technical men. Some of these have previously held offices in the Government Forest Service and still retain their title "Jägmästare," or else they have received their training in a special course in the Government Forestry Institute at Stockholm which does not make them eligible for government work but gives them the title of "Forstmeister". The institute at Stockholm turns out the higher forestry officials of Sweden. The students previously attend either the forestry school at Omberg or at Kloten. A considerable part of the training is given along practical lines in the forest under the supervision of an instructor, during the summer months usually on some suitable National Forest.

The Government Forest Experiment Station, located at Stockholm consists of a forestry branch and a botanical-biological branch. Jägmästare Schotte is in charge of the forestry branch, and Dr. Hesselman of the botanical branch.

The experimental areas are distributed all over the country and are located in government and non-government forests as well.*

*For further interesting details the reader is referred to an account of an excursion of German foresters to Sweden in 1909, published in Zeitschrift fur Forst- u. Jagdwesen, Sept., 1910, and ff.

THE SWEDISH FOREST CONSERVATION LAW.

By B. E. Fernow.

One of the most interesting institutions in Sweden in connection with the new policy of influencing private forest management is that of the organization of County Conservation Boards.

This institution is the result of a law enacted after an exhaustive investigation and report in the year 1903. It became operative only in 1905, but has already in the five years of its operation accomplished much in improving conditions.

Under this law, in each province or county of the Kingdom —with the exception of the two northern, mostly settled, ones of Västerbotten and Norrbotten—a board of three or more persons is constituted to supervise the work of *privately* owned forests, the State forests being under a separate, efficient administration.

This Board consists of one member appointed by the Government, one elected by the County Council, and one member elected by the County Agricultural Society. Upon demand of the people additional members may be elected by the people.

This Board chooses a technical advisor from the State forest service, whose salary is paid by the Government, and with whose assistance and a number of rangers or inspectors the Board applies the law.

The remarkable and eminently wise and democratic feature of the law is, that it does not undertake to prescribe in detail what is to be done, but leaves this to the discretion of the Boards, with the mere injunction that a conservative treatment of the woods must be enforced and that regeneration or reforestation must be attended to. How this is to be accomplished is left entirely to the Board to decide. The Board, however, working under the County Council, has the power to enforce its rulings in the courts by injunctions, money fines, confiscation of logs, etc.

Naturally, at first, different Boards construed the law differently and applied the funds in different ways, which was undoubtedly intended by the law to give scope according to varying conditions.

There are, however, three directions in which eventually all have come to work, namely, education, assistance, and police regulations.

I may cite more in detail conditions as they are developed in the province of Värmland through the efforts of the efficient expert, Lansjägmästare A. Nilsson. In this province, the State owns only 4% of the forest area, 30 per cent. is owned by large corporations, and 66 per cent. by small holders, who own at most tracts of 600 to 700 acres.

The forestry expert gives three separate technical courses of instruction to woodland owners, each lasting about two weeks, namely, two in the fall on silviculture and mensuration, and one in the spring on draining, the utilization of the many peat bogs being an important problem. Two lectures a day and 6 to 8 hours demonstration in the field is the time given to these courses, some four or five forest rangers assisting at the demonstrations. While attending these courses the Board pays the living expenses of those attending. The number admitted out of the 80 to 90 applications is 50; in five years some 200 or more men attended these courses. In addition, literature of a popularly written but technical character is distributed. Sometimes this instruction is given in combination with high schools or country schools.

To those who ask for it, special advice is given in the management of their properties by sending an expert on the ground. To those who desire to plant waste lands or old clearings seed is furnished up to 50 lbs., at one-tenth of its cost, and other plant material may under circumstances be supplied free of charge.

The owner has a right to cut as he pleases, but if natural regeneration fails to appear he is obliged to plant, the Board determining when the necessity for such planting has arrived.

If the owner objects to the decision of the Board a special inspection is ordered, the expense of which he must pay, and at the same time he loses all claim to assistance. Although the power of the Board is great, the policy is to secure coöperation rather than to use force. By this time, owners have learned to see the advantages of these arrangements, and only speculators make trouble.

Protection against forest fires may also be among the functions of the various Boards. In the better settled districts the fire trouble is almost passed, the population being largely owners

of woodlands have learned to use care, so that in Värmland no large fire has been experienced in five years. Brush burning is therefore here not practised, the tops being used for charcoal and fuel generally. In other parts, more endangered, brush is burned at an expense of about 28 cents per acre. The watch tower idea was introduced 15 or 20 years ago in Jämtland, such towers being distributed about 6 miles apart, and as a result since 1901 no large fires have occurred. Incidentally, to show how the forest fires have been reduced, it may be of interest to state that in 1888 the area burned over in the State forests was estimated at 30,000 acres, and of private forest in four provinces at over 130,000 acres. In 1908 less than 500 acres were burned over in the State forests of about 12 million acres extent.

Although fires have not entirely been stopped, they have become very much rarer and less extensive. Indeed, one is struck along the railways with the absence of recently burned areas.

The funds to carry out the policy of conservation boards come largely from a small duty on wood exports, namely 14 cents and 8 cents per ton respectively on dry chemical and mechanical pulp, and half these amounts on wet pulp; 7 cents per 100 cubic feet of sawed material and half that amount on saw lags and fuel wood. This is to be changed to a direct tax on all wood cut, except for home consumption. The export duty yields altogether from $160,000 to $190,000, or around 5 cents per 100 cubic feet of export material. In addition, the State pays the salaries of the experts, some $16,000, and contributions in proportion to what the county gives. This contribution by the counties now amounts to about $27,000, the State duplicating this, so that around $230,000 are devoted to this policy of maintaining or securing conservative management of privately owned forests which have an extent of around 35 million acres, i. e. about 2/3 of a cent per acre.

The funds at the disposal of the various Boards vary, of course. In Värmland and Jämtland, for example, the receipts aggregate about $30,000, but by careful financial management and by not using the whole appropriation the latter province reported for 1909 funds at its disposal of over $60,000.

FIXATION OF THE DUNES ON THE COAST OF JUTLAND.*

By W. J. Morrill.

Shifting sands are causing trouble along the Columbia River in Oregon, as well as in other parts of the United States. Hence information on the methods in Demark employed to stop the shifting of sands will be of some interest to American foresters.

Along the west coast of Jutland, there were formerly forests of pine and spruce†. These forests were eventually recklessly exploited and eventually, the coast became naked, and the interior forests became sadly depleted. The west winds now swept across the peninsula unobstructed, the soil was dried out and lost its humus, exposing the sandy mineral soil and immense areas which had successfully grown forests were impoverished. Heather gradually succeeded in occupying much ground which had been forest clad, and the heather produced an acid humus, which caused an impervious hardpan to form. The worst consequences, however, appeared near the coast; sand was carried by the wind far back from the beach, as far, oftentimes as three or four miles. In places where the sand could find lodgement in the shelter of such obstacles as large rocks or even pieces of wood, a small mound of sand would form, just as drifts of snow form in similar circumstances. Sand grasses grew on these small mounds and served to hold them in place; as the mounds slowly grew, the grass grew with them always keeping above the layers of sand which slowly form new coverings for the ambitious mound. The nearer the beach the more rapid is the growth of the mound. Eventually the small mounds grow into veritable banks and even into hills which do not even then cease growing. If the hills would arrange themselves in a single row to form a huge wall for the protection of the inner country, matters would not be so bad; but these hills are migratory. Like the true frontiersmen, they no sooner become well settled and prosperous when they break up

*Adapted from an article by John Givskov of Copenhagen, Denmark.
†This is questionable!—Ed.

and move on further into the interior. The grass roots which have served to hold the growing dune for a long time will not serve forever to keep the sand hill from breaking; the wind may tear a hole in the west side of the hill and over the crest to the eastward goes the dune, grain by grain. In this way the wind can keep the dunes moving eastward quite rapidly. The dunes are abrupt on the west side and slope gradually on the east side. Seen from the west side they appear to be rugged mountains in miniature. This invasion of the constantly encroaching sand dunes has covered large areas of fertile land and even churches and farm buildings have been buried.

In 1792 the first experiments to curb the evil were undertaken by the government. As will be seen, many mistakes were made before correct methods were adopted to control the situation.

At first, the government tried to fix the dunes by sowing and planting broom, black crowberry and other herbaceous plants. Seaweed was plowed under, or "pricked out" in the sand. Some proposed to cut down the steep west side of the dunes and others opposed this method. From 1838 to 1851 no sowing or planting was done; the lack of success of previous experiments having baffled those engaged in them. The first experiments at planting trees to fix the dunes were made from 1810 to 1815 but not until 1857 did the government enact a law requiring this method of procedure. In 1867 the tree planting of dunes was organized under the Dune Department with a dune inspector in charge. Previous to 1852 it was the duty of the population living in the vicinity of the dunes to contribute work intended to hold the dunes in check. The work was often badly done and, besides, was a burden to the people. Often the people planted grasses on the tops of the dunes and the result was a higher, larger dune, much to their disappointement. In 1852 the government took the work in hand, but not until 1867 was it governed by an inspector. By 1870 the Dune Department had gained enough experience to assure them of successful methods. It had by this time determined what species of trees were able to withstand the strong, salt winds, rigorous climate and the light soil. With experience has come a material saving in the cost of methods. For example in 1853 the cost per acre for formation of a plantation was 262 Krone Danish, ($70.21) in 1878 it was 112 Krone Danish ($30.01).

Although the species successful in Denmark in the fixation of dunes might not succeed in America, the methods successful in Denmark, after many and costly experiments, may prove of value to the American foresters when they shall be called upon to attack the problem.

Coast protection is closely connected with the fixation of sand but I shall confine myself to a description of Danish methods of fixation of sand dunes.

The methods are modified in detail according to surrounding vegetation which can be used to cover the sand to prevent shifting. If heather grows in the vicinity, it is cut and spread on the sand in the holes and low places. If there is an abrupt hill it becomes necessary to level it in order that planting can be accomplished and that sweeping winds around the corners may be avoided. The heather is used to hold the sand until beach grass can be sown and take root. Ordinarily the east slopes of the hillsides are sown to this grass from above and downward in parallel rows running at right angles to the prevailing west wind. The east hillside is covered in this way only as far up as the point where the slope does not exceed 30° to 35°. The wind gradually cuts off the summit of the hill or that portion of it with more than a 30° to 35° slope and sifts the sand over the grassy east aspect, where the grass, in response to its tendencies, grows sufficiently fast to keep above the accretions of sand.

After the steep summit has blown away there remains in its place a 30° to 35° slope which is sown to beach grass, as were the lower slopes previously. Cut heather can be used in place of beach grass but has to be renewed as it becomes covered. Smooth hills and plains are generally covered with cut heather and not sown to grass if there is plenty of heather at hand.

Heather not only serves to fix the sand but arrests seeds of many different plants which germinate and grow, forming a permanent cover. If this cover becomes dense enough, the sand is held in place; however, heather is preferred since it is strongest.

More often the beach grass is planted instead of its seed being sown. The plants are removed by a spade which cuts the rhizome at a depth sufficient to permit new growth to start from it. Three or four pieces are planted in holes 8 to 10 inches deep made with a special spade. The distance between the holes is 6 to 9 inches, and the rows are 12 inches apart.

Limbs of pine, spruce and fir could be used as cover but would not obviate the necessity of sowing seeds of grasses, mosses or other herbs. Before trees can be planted the sands must be fixed. The limbs of conifers would serve to fix the sand until the grasses can continue and supplement the work of sand fixation, and even the grasses are more precarious than a tree cover and serve to hold the sand until the tree plantation is established.

Hedges as used in coast protection might be used to advantage to control the shifting of sand along the Columbia River. A new method observed in 1908 at Blaavand, Jutland, although used for coast protection, might succeed in the Columbia River and is described as follows:

Pine limbs are put down in a row, like a hedge, on the sand beach at right angles to the coast line, the distance between rows being about 220 yards. For inserting the limbs in the sand a steam pump is used, a hose with an iron pipe 8 feet long on its end being attached to the pump. The iron pipe is pointed downward on the sand and when the water is pumped through it the sand is excavated by hydraulic force. In this way a trench is made about 8 feet deep in which the branches of conifers are placed upright in three rows protuding several feet above the surface.

When the sand blows up from the sea these hedges hold it and gradually there is formed a long embankment; later, on these embankments beach grass is planted and finally, after the sand is fixed, fir and pine will be planted. These hedges are made to extend as far as possible into the water in order to divert the currents from the shore. To further guard against the erosion of the banks of the shore, another system of hedges, similar in construction to that described above, is constructed to run parallel to the beach at right angles to the first described hedges. These hedges are placed about 7 yards apart and the depth is only 4½ feet and 1 foot wide. The limbs are placed very close in these trenches, which here were dug with spades because the distance from the forcing and lifting pump was too great. This system of hedges not only holds much sand from shifting inland but acts as a buffer to the action of the waves.

The cost of the hedges where the pump is used for excavation was $0.30 per running yard, which includes all items of expense, cutting limbs, freight, excavation of trench and placing the limbs in position. The excavation costs $0.088 per running yard. The

cost of the trenches excavated with spades is somewhat more, amounting to $0.40 per running yard, including all items of expense.

If some of these coast protection methods should be applied on the Columbia River, a series of hedges should be built at right angles to the prevailing wind, and these connected, perhaps, with hedges running in the direction of the wind because more shelter would result from this arrangement and thereby sand grasses can be planted or sown with more rapid results. In a short time the hedges would become walls of sand on which the beach grasses would be planted and these walls would grow for many years but would be able to hold the sand from shifting inland. Eventually these dunes should be planted with trees and when these have gained a foothold the forester's work would be finished and permanent protection from further inroads of the sand would be achieved.

In Denmark, the tree species best adapted for dune planting are *Pinus montana* and *Picea alba,* of which 3 or 4 year old transplants are used. *Picea alba* thrives well close to the beach where the salt cold air is harmful to most species. *Abies pectinata* thrives well on the north slopes of the dunes and in deep depressions. The greater part of the dune is planted with *Pinus montana* especially on the west slopes. Formerly the transplants were set about 3 feet apart and the rows about 3½ feet apart, but expense of thinning at a time when the products of the thinning had no value has caused the adoption of broader spacing, so that now the transplants are placed 6 feet apart, with 12 feet between rows.

The plains between the dunes are first sown to heather and only after the dunes are fixed are the plains planted to trees, because the heather grown on the plains may be required to be cut to furnish heather to be used on the dunes as described above. When the time arrives for planting the plains with trees, furrows are plowed and a year or two after, holes are dug in the furrows with a spade and the earth loosened for receiving the transplants. Usually a mixture of spruce and pine is planted, every second plant being a spruce. Occasionally other species are used such as *Picea excelsa, Abies balsamea, Picea sitchensis, Pinus banksiana* and, if well sheltered, *Pseudotsuga taxifolia.* It is doubtful if the last two mentioned here have a future. Japanese

larch has been used in some plantations and does better than European larch. Experiments with every evidence of success are being made with *Quercus pedunculata* and *sessiliflora, Fraxinus excelsior, Betula alba* and *Alnus glutinosa* upon moist ground. *Fagus silvatica* has been used on high places. In one case it was observed that in a mixed plantation formed in 1855 on fine sand the oak had accumulated four inches of rich soil under it while a neighboring pine had made but half that amount of soil.

The southwestern part of Jütland gradually will become forested once more after a belt of forest has been formed along its west coast. The evil caused by previous generations will be eventually corrected.

SUPERVISORS' MEETING AT SAN FRANCISCO.

From December 13 to 16, 1910, at San Francisco, was held a Supervisors' Meeting for the consideration of National Forest problems with particular reference to District 5. At this meeting were present the Supervisors, Deputy Supervisors, and Forest Assistants from the various National Forests in the District as well as members of the District Office.

In his opening address District Forester F. E. Olmsted emphasized the fact that the Forest Service is charged with the protection and management of property valued at many hundred of millions of dollars. Just now the guardianship is so feeble that occasionally it is quite impossible to prevent a considerable amount of the property from going up in smoke. That, of course, will be remedied. It should be considered too that utilization at the present time is very small in comparison to what it should be and what it will be in years to some. From the National Forests in California will be sold somewhat over a billion feet of timber every year and the Forest Service will be so organized and equipped as to make sure that future crops of even greater volume and better quality will follow the cutting. Every forest will be netted with roads, trails, and telephone lines and closely settled with ranger homes. Through study and scientific practice we shall increase the supporting capacity of range lands to double what they are at present and this no doubt in spite of the fact that many of the most valuable forest areas will be closed to grazing. The supervisor will be the forester and will run his forest without restriction except that necessary to keep his own policy uniform with that of his brother foresters throughout the west. Instead of supervising the work of a million or more acres he will find his hands more than full attending to the business of his forest of 200,000 acres. The size of the ranger districts and patrol districts will be very greatly reduced and barring hurricanes and cyclones, fires will only occur where there is an inefficient ranger. The income from the National Forests will then undoubtedly be more than double the cost of administration.

T. D. Woodbury, Assistant District Forester, in charge of the Office of Silviculture, discussed the subject of "Silviculture's

Future Work." In California there are about 28,000,000 acres of National Forest land containing a stand of timber estimated at approximately 90,000,000,000 ft. b. m. This is to be improved and its use regulated in such a way that the flow of streams may not be interefered with and that a continuous supply of timber may be available after private forest lands which are being cut without any thought of the future, have been exhausted. With the cutting over of the large private holdings the demand for National Forest timber will greatly increase, market prices will advance, and the Forest Service will be in a position to impose conditions upon purchasers which tend toward good forestry, the enforcement of which to-day is impracticable. This will include the removal of insect infested and diseased trees, the cutting of undesirable species to lower diameters in order to eliminate them from the stand, building of fire breaks where necessary, and the closer use or utilization of lumber now left in the tops, stumps and limbs. The intelligent management of the Forest implies the preparation long in advance of carefully worked out plans. Our so-called reconnaissance work, which is nothing more nor less than stock taking, is the first systematic step toward regulation. In the National Forests of California are about 2,000,000 acres of land once forested, which is not producting timber today. Of this it is estimated that only 400,000 acres will reforest itself naturally from seed trees, leaving 600,000 acres to be dealt with artificially. Great activity in the prosecution of this important work is essential. During the past year 6,000 pounds of seed have been collected for use on the National Forests in District 5, and next year the amount will be greatly increased. During the past season the seed-spot method of sowing was used entirely. The question of reforestation is still largely in an experimental stage. Areas where forests can not be started by seeding will be planted. No planting work to speak of has yet been done in northern California. However, steps have been taken to prepare for this work, and within a few years it is expected that large quantities of seedlings will be available for planting in the northern position of the State.

Swift Berry of the District Office introduced the subject "Planting." Planting for watershed purposes on land which is not capable of producing a commercial forest is desirable only in case the cover to be produced will be more valuable than the

existing brush cover. Planting problems in California, especially in the southern portion of the State, are exceedingly difficult owing to the long dry season, unfavorable locations, and enemies such as rabbits, squirrels, etc. The greater portion of the planting work in central and northern California will undoubtedly consist of direct seeding.

Dr. E. P. Meinecke discussed the matter of requiring purchasers to cut dead and diseased trees in timber sales in consideration of reduced stumpage rates. Disease and death of trees are caused not only by fungi or insects. Lightning, storm and fire are highly destructive, and man is entirely helpless as far as lightning and storm are concerned. Lightning does far more harm than it is commonly credited with, through injury to the trees, which permits the entrance of the germinating spores of injurious fungi. Aside from fire the most dangerous enemies of the forests are insects, mistletoes, and fungi. White fir suffers more from mistletoe than other species. Needle diseases are far more important in California than either in the east or in Europe. The diseases best known are caused by wood destroying fungi. Under present conditions the only means of getting rid of trees infected with these diseases are timber sales, administrative use, and free use. At the present time the only important help can come from timber sales. Effort is now for the first time being made to have every marked tree, whether merchantable or not, felled by the purchaser. The felling of unmerchantable timber requires that some form of compensation be made the purchaser. The most practical way under present conditions appears to be a reduction of the stumpage rate. Ordinarily the reduction will be very small in comparison to the great benefit that will result to the forest from the decrease in the danger from fire and from insect and fungus infestation, and the benefit to the composition of the forest. On a specified sale area would be marked about 500,000 feet out of a total of 7,000,000 feet more than would be marked under old regulations. Two million feet of sound timber would have to be left standing after cutting, or 10,000 feet to the acre. Out of the extra 500,000 feet cut, which includes snags and unmerchantable, doubtful, and undesirable trees, quite a number will contain some merchantable timber to be paid for which would otherwise go to waste. The great advantage will be that on the tract will be left

only thrifty and sound seed trees. The practice of leaving diseased or over-mature seed trees is strictly comparable with raising cattle and sheep from diseased stock.

The subject of insect infestation was discussed by John M. Miller, Forest Ranger. The amount of damage caused by insects on the National Forests of California has never been carefully estimated. However, on some of the National Forests the presence of dead and dying timber is presenting a problem so acute, as to force itself upon the attention of the forest officers and timber owners. The presence of insect damage is less striking on account of the mixed stands, since many of the insect enemies are peculiar to only one species of tree or are capable of doing their most serious damage on one host. The knowledge of a specialist is needed for the positive identification of species and the scientific supervision of remedial work. But for the primary location of insect damage we will undoubtedly have to depend upon that all around man, the Forest Ranger. To assist rangers in helping to carry out this work there is needed a publication which will contain the more elementary portions of information relating to fungus and insect enemies of the forest. Collections of forest insects are also needed in the district and supervisors offices. The work of combating damage by insects and fungus in the west is still largely in an experimental stage, since the methods now known are largely theoretical or are based on work that has been done in the middle west under conditions which are materially different from those existing on the coast. It will take at least another year of experimentation before it can be determined what are the best methods to pursue.

Mr. O. C. Merrill, Chief Engineer of the Forest Service, outlined briefly the development of water power in California and methods of encouraging its use. Within the National Forests are approximately 15,000,000 undeveloped horse power, of which practically one-third is within the forests of California. The capitalized value of this total undeveloped horse power is, on the basis of $100 per horse power, $1,500,000,000. In California the control of water power will eventually mean the control of all industries, especially after the present fuel supply becomes more nearly exhausted. Water is slowly displacing all other sources of power. This is evidenced by the fact that one hydro-electric company in central California is to-day practically furnishing all the power

used in 67 cities and towns. The situation in southern California is largely controlled by two companies, in central California by one company, and in northern and eastern California by several small concerns. This situation is, however, not considered as necessarily detrimental to the public interest, since through consolidation and the resulting economy in the cost of power production it is possible to furnish electric energy to the consumer at cheaper rates. Federal and State regulation, each in its own sphere, are, however, essential.

The subject of stream gauging was briefly discussed by W. L. Huber, District Engineer. In order to determine the availability of the stream as a source of water supply for municipal and industrial purposes, for the development of power, or for irrigation, definite information is necessary relating to the ordinary stream flow, range of flow, and the total yield of water in fixed time periods. A plan of coöperation has been adopted between the Forest Service and the Geological Survey for supplementing existing information regarding stream flow so far as it relates to a number of the more important streams in the National Forests. This information will be of great value in supplementing data independently collected by the State and by the Geological Survey.

Mr. Coert DuBois, Associate District Forester, discussed the question of forest fires. Unless fires can be kept out of the forests it is impossible to practice forestry on them. To actually protect against fire is thus the first duty of the forester. The careful working out of a complete fire protection plan is of prime importance in this work. The experience of the past season has demonstrated conclusively that while preparations for fire fighting work may be satisfactory under ordinary conditions they are by no means as complete as they must be in order to provide adequate protection.

The subject of "Grazing" was discussed by J. H. Hatton, Assistant District Forester. The annual forage yield of all the National Forests now supplies in round numbers 8,000,000 sheep and goats and 1,750,000 cattle, horses, and hogs, and is utilized by more than 27,000 individuals and concerns besides furnishing free grazing to settlers, prospectors, and travelers. The management of the grazing business in California extends to about 3,000 permittees and involves 175,000 cattle, horses, and hogs, and

400,000 sheep and goats under paid permit. The private land business within the National Forests in District 5 increases these numbers nearly 100 per cent. Our national Forests control from one-third to one-half of the public range and much of the summer sheep grazing. A conservative use of the range under Forest Service supervision had made better growth and better weights. It is the business of the Government's foresters to make the cattle and sheep silvicultural tools if possible, instead of crowding them out altogether or allowing them to become forest enemies. Grazing must, of course, be considered secondary to silviculture, but the two interests must be as fully safeguarded as possible. The rigid grazing policy of Europe can not be generally practiced in this country on account of the great economic importance of the stock business, which must be given full and fair consideration. Grazing contributes toward the protection against fire by keeping down grass and other combustible material, and the stockmen render valuable assistance in fighting such fires as occur. There are many different opinions as to the relation between grazing and forest reproduction. The conditions differ so greatly that no general statement can be made, at least not until after careful studies have been made on many of the National Forests.

Assistant District Forester C. Stowell Smith, discussed the subject of "Forest Products." Besides firewood and lumber, the principal classes of forest products may roughly be enumerated as follows: Export timber, pulp wood, cooperage stock, turpentine and rosin, shingles and lath, cross ties, mining timbers, posts, poles, and similar products. The total value of these products amounts to about $1,075,000,000 annually. To obtain them no less than 20,000,000 cubic feet of wood must be cut. Since 1880 over 70,000,000,000 board feet have been cut. In spite of the substitutes for wood in the shape of metal, stone, and other materials, the consumption of wood in civilized countries has never decreased. On the contrary, demands in new directions have rather increased the use beyond the saving brought about by the substitutes. One of the first steps toward bringing about a more conservative utilization of the forest products of the country must be an attempt to prevent waste in the woods and in the materials. Far more wood is wasted than is used. The Forest Products Laboratory at Madison, Wisconsin, established in coöperation with the State University, is unquestionably the best

equipped institution of the kind in the world. The lines of work conducted in the laboratory are indicated by the names of the sections into which the organization is divided, as follows: Timber Tests, Pulp and Paper, Chemistry, Timber Physics, Wood Preservation, Wood Distillation, and Pathology. The Office of Wood Utilization at Chicago carries on such investigations not of a scientific or experimental character as may be advisable to promote the greatest economy in the utilization of forest products. One of the important projects which is being worked out in California is with regard to eucalyptus and involves the study of the effect of season of cutting, season and method of girdling, soaking in fresh and salt water, and method of piling and climatic conditions upon subsequent seasoning. The effects of bark peeling, and "S" irons are also being investigated as affecting loss of moisture, checking, and shrinking. In connection with this project, and to further amplify it, arrangements have been made with the state for the erection of an experimental dry kiln near Los Angeles. This will be constructed within a year, and will be of such design that the factors affecting seasoning, such as humidity, temperature, flow of air, etc., can be accurately controlled. Studies are also being made with regard to the manufacture of paper from woods found in California. Very little has yet been done along this line, but the opportunities are very great. Redwood pulp can undoubtedly be advantageously utilized for the manufacture of wrapping paper and paper to pack fruit and lime boxes, since for these purposes the dark color of the paper will be no disadvantage. The possibility of this utilization will undoubtedly have a strong tendency favorable to the conservative handling of redwood tracts, since waste can be utilized at a profit instead of remaining on the ground to form a fire menace. Experiments are also in progress to determine the practicability of wood distillation for the production of gas for generating power, light, and heat, as well as to determine the commercial possibilities with regard to turpentining operations in western species, particularly white pine, lodgepole pine, sugar and digger pines.

CURRENT LITERATURE.

Final Report of the Royal Commission of Inquiry on Timber and Forestry, British Columbia, 1909-1910. Victoria, B. C. 1910. Pp. 116.

This most painstaking and comprehensive report is the finding of the three commissioners appointed in July, 1909, to make inquiry into the timber resources of the province, the preservation of forests, the utilization of timber areas, and all related matters.

The first half of the report deals in detail with historical and statistical facts having a direct bearing upon the problems of forest policy that were studied.

A brief history of the successive legislative enactments regarding grants, leases and licenses is first given. Prior to 1896 timber lands could be acquired by purchase and Crown grant in the same way and at the same rates as any other land, except that after 1888 a royalty of fifty cents per thousand feet was exacted on all timber cut. In 1896, however, lands carrying 8,000 feet to the acre, west of the Cascades, and 5,000 feet, east of the Cascades, were defined as timber lands and reserved from sale. The issuance of leases at a nominal rental per acre was begun early, in order to encourage sawmill erection. Various changes in the terms of lease and renewal were made from time to time, till in 1905 the provision for granting leases was abolished. The special license system was authorized in 1888. The first licenses were non-transferable and were limited, one to one person for a year and for 1,000 acres; the fee was $50 and fifty cents per thousand feet royalty. In 1901, the berth was reduced to 640 acres and the fee raised to $100. In 1903, the fees were increased to $140 and $115, respectively west and east of the Cascades, the license to be taken out for any period not exceeding five years upon payment of rental for the number of years desired as a lump sum in advance. In 1905, the license system was radically changed, in that thereafter licenses would be transferable and renewable yearly for twenty-one successive years; the existing licenses likewise for sixteen years. In 1910, as a result of the Commission's interim report, it was provided that licenses would

be renewed as long as there was merchantable timber on the land, at such rates and under such regulations as the government saw fit to impose. In 1907, the license system as far as unlicensed lands remained was withdrawn until further notice.

Dealing next with the question of resources the report says: "It is plain that we do not as yet possess the means of making a sound estimate of the resources of Canada, and this lack of reliable statistics has a serious bearing on forestry problems." As far as could be learned, there are in British Columbia some 9,000,000 acres under license, 1,000,000 acres under lease, and in private hands 1,245,000 acres together with the yet unsold portion of 5,300,000 acres granted to railways, the amount of which could not be learned. As regards the unalienated timber lands the commissoners say, to complete *any* estimate of our forest resources we are obliged to adopt arbitrary figures and act on the popular belief that about one-quarter of the timber land under provincial control, or 3,750,000 acres, still belong to the province —a pure conjecture" (!). The above figures, with the railway belt ceded to the federal government, would give British Columbia a total merchantable forest area of 26 million acres. "In the absence of statistics based upon cruise and survey we are obliged to depend very largely upon guesswork in estimating the amount of merchantable timber standing on this area." The guess is 240 billion feet, (slightly less than Dr. Fernow's estimate) less than half the probable stand of Canada.

The report next passes to a discussion of timber supply and demand, with its resultant bearing on British Columbia conditions. In the opinion of the commissioners "the value of standing timber in British Columbia is destined to rise to heights that general opinion would consider incredible to-day; and under careful management heavy taxation need never fall upon the population of the province—the profits from a permanent Crown timber business should make British Columbia a country of semi-independent means."

After some twenty pages of statistics concerning method of tenure, forest revenue, lumber cut, rise in prices, stumpage values, and cost of fire patrol and cruising, the commissioners proceed to deal with their recommendations. These are classified as concerning tenure, regulations and administration.

It is evident that the suggestions concerning tenure would aim

at the removal of existing anomalies. To this end they recommend a cruise of all Crown grant timber lands to arrive at a proper valuation for tax assessment purposes; an adjustment, on renewal, of rentals, royalties, and regulations, as between lessees and licensees to equalize payment; that rates of rental and royalty upon licenses should not be fixed more than one year in advance; and that holders of tanbark and pulp leases should be granted the right to cut mill timber. Between 1901 and 1903, pulp leases were granted to the extent of 554 square miles. These were for 21 years at a rental of two cents an acre and a royalty of 25 cents per cord of pulpwood, and carried an obligation to erect a pulp mill of specified capacity. This condition was seldom carried out, the operation becoming a sawmill business with timber procured at $12.80, instead of $140, a mile. To remove this unjust competition with licensees it is recommended that a cruise be made to determine the amount of pulpwood and of saw timber on the leasehold, and that the lessees be required to take out a special license to cover their lumbering rights, the rental for this to bear the same proportion to that paid by other licensees as the average stand of mill timber on the lease bears to the average stand under license in that district, less two cents an acre. The continuance of the present reservation of all Crown timberland is urged, with fire-damaged areas and fractional areas adjoining existing leaseholds or timber limits to be licensed first. In future sales, the berth should be surveyed and timber cruised, an upset price fixed, and license sold at auction, the timber to be removed in five years. The discontinuance of handloggers' licenses is recommended on the ground that the timber is cut under conditions difficult of control.

The recommendations concerning regulations and administration have to do with a forest policy, in which the future of the province is kept strongly in mind. In brief, these embrace cutting regulations requiring the taking of all trees down to 14 inches diameter breast high and tops to 10 inches, cutting of low stumps, and use of the saw. In addition, royalties should be collected upon all merchantable timber left in the woods and operators required to dispose of debris. The organization of fire patrol system is urged, the cost to be shared equally between the government and the licensees. Later, when survey has delimited the boundaries of unalienated timber lands in any district it is

proposed that the government bear the full expense of protecting its own land and half that of the licensed land. The survey of limits by licensees should be enforced in order to clear up the confusion in titles, maps, and unalienated fractional areas.

The administration machinery for all the above is recommended to take the form of a Department of Forests under the Commissioner of Lands, consisting of a forester with a field and office staff, the organization being discussed with some detail. It is hoped that the new university will make arrangements for the training of the technical men.

The financial aspect of the forest policy is met by the recommendation *that the royalty of the present year (some $265,000) be set apart as a sinking fund for the department, and that royalties of succeeding years be passed to the same account,* on the ground that such receipts should be regarded as differing from any other form of provincial revenue—in fact, as capital, not current revenue. This appears to us a most wise and correct attitude in recognizing that it is not increment but capital which in most cases is removed by logging operations. As time goes on and both cut and rate of royalty increases the contribution to the sinking fund could be graded.

The report closes with an appendix of some 40 pages containing, among other things, the interim report, regulations relating to forests, the Idaho fire law, and various data of the British Columbia Department of Lands. J. H. W.

Report of the Superintendent of Forestry and Irrigation for 1909-10. Being Part VII of the Annual Report of the Department of Interior. By R. H. Campbell. Ottawa, Canada. 1910. Pp. 77.

The account of the work of the year ending March 31, 1910 as reported by the various officers of the department is given in most satisfying fullness of detail, and shows that good, steady progress is being made.

Especially is this the case as regards the administration of the forest reserves. These, it may be stated, are situated entirely in the four western provinces. An additional three million acres have been reserved on the east slope of the Rockies, bringing the total there up to nine million acres. Work has been in progress

marking the eastern boundary. To other reserves, temporary reservations aggregating 486 square miles have been added. Forest nurseries have been established on three reserves, but with indifferent success owing to the work being delegated to untrained men. Two more reserves have been put in charge of permanent forest rangers. Some of the reserves have also been made game reserves and the running of dogs at large in federal parks has been prohibited—measures that have the hearty support of the people. Over 700 head of buffalo now graze within the parks.

All other work on the reserves has wisely been held subservient to that of fire protection. To this end 91 miles of boundary lines of prairie reserves were burned before the snow was out of the woods. In addition, guards were ploughed 8 feet wide (in some places a double guard 4 feet wide with a rod strip between) for a total of 37 miles; railway companies did likewise to the extent of 21 miles; the average cost was $7 per mile. Roads were made along 200 miles of boundary, these averaging 9 feet in width (ultimately to be 16 feet), at an average cost of $13. These serve for transportation to fires, for back firing and for the getting out of timber by settlers. Old roads within some of the reserves were also cleaned up and 11 miles of new road, 16 feet wide, were built at a cost of $21 per mile.

Besides this protective work the patrol system was extended, employing 96 men. Special attention was given to patrol along railways and construction lines, with good results.

There were taken off the reserves during the year some 27 million feet of lumber. Of this, 4 million feet, besides poles, rails, posts and cordwood, were cut under settlers' permits, giving returns of some $6,300. The balance was cut under old timber licenses. Timber seizures to the value of $3,000 attest to the activity of the forest rangers in stopping trespass. As a further preventive 408 miles of boundary were plainly marked with iron posts.

The removal of hay from the reserves is encouraged. There were issued 84 permits netting $197, under which 1,500 tons were cut. So far, grazing has in no way been regulated on the reserves, but already certain districts are calling for such regulation. Throughout, the forestry branch evidently believes that the reserves are for the judicious use of the people.

The work of the Division of Tree Planting on the prairies, now

ten years in existence, has steadily grown. In the spring of 1909, some 2,570,000 trees were distributed to 2,010 applicants, and the capacity of the nursery, some 85 acres, will soon be reached. The experiment with conifers during the last three years has been very satisfactory. Seedlings of maple and ash from seed collected from regions farther south with a corresponding longer growing season were a failure. A new departure was made in the demonstration plantations and exhibits of simple nursery methods for farmers at the Brandon and Calgary summer fairs. The division also carries on a general educational propaganda by preparing articles for agricultural and horticultural publications, distributing literature, and lecturing before Farmers' Institutes. The settler should soon reasonably be expected to grow his own nursery stock for his plantations and shelter belts.

Owing to the rapid development of irrigation the work of inspection and survey of all projects in Alberta and Saskatchewan has greatly increased. Especially urgent is the matter of stream measurements. Of the large projects, the Canadian Pacific Railway Company now have 1,300 miles of canal and ditches built irrigating 250,000 acres, the Alberta Railway and Irrigation Company 238 miles covering 70,000 acres, and the Southern Alberta Land Company 47 miles of main canal. In addition there are 364 minor projects with an irrigable area of some 117,000 acres.

The report closes with some twenty illustrations, new and interesting. J. H. W.

Forest Fires in Canada, 1909. By H. R. MacMillan and G. A. Gutches. Bulletin 9, Forestry Branch. Ottawa, Canada. 1910. Pp. 40.

This bulletin is a review of the present situation and is evidently issued to help in the movement, universal throughout North America, towards a realization by the nation of the urgent necessity of stopping forest fires.

A rough guess is made as to how much has been burned in the past 300 years. Allowing 600,000 square miles for tundra, 700,000 for the semi-treeless subarctic region, 200,000 for prairie, and 300,000 for inland lakes and area above timber line, leaves some 1,600,000 square miles originally forested. Deduct from

this 92,000 square miles of cultivated land and 100,000 square miles of cut-over lands and there remain 1,700,000 square miles of forest, which at an estimate of 3,000 feet per acre would mean over 3,000 billion feet. But the most optimistic guess yet given for Canada's present timber supply is the equivalent of 1,000 billion feet. Thus the conclusion is reached that two-thirds of the original forest has been burned—the equivalent of a solid forest twice the size of Ontario and Quebec combined; or, to express it otherwise, for every foot of lumber that has been produced in Canada's lifetime seven feet have been burned.

Still further to accentuate the destruction that has gone on, quotations are given from the reports of exploration and survey parties. These cover every province and show how widespread has been the damage.

The effects of fires on soil, future growth and waterflow, besides the timber destroyed, are discussed in detail.

As regards the causes of forest fires, there is universal agreement among the provinces that, in order of their importance they are (1) railway engines; (2) settlers clearing land; (3) campers and travellers. Patrol is the best means of preventing fires from railway construction. Legislation requiring the companies to pay half the expense of such patrol exists only with reference to federal lands. In Ontario, however, the Transcontinental Railway Commission have agreed to pay one-third. Patrol along lines operating through timbered land is also in existence in the case of a few railways. In Ontario these bear all the expense so incurred by the government. The system should be extended throughout Canada. Power to examine engines should be given to officials of the fire service, as the law regarding spark arresters and proper ash pans remains a dead letter. (We understand this power has lately been given to federal forest fire officials.) As regards the setting out of fires by settlers, there is legislation in the majority of the provinces requiring the procuring of a permit. Only in Nova Scotia and British Columbia is this rigidly enforced.

The causes of fires can be guarded against only by an increase of efficiency and extension of the patrol system covering the traveled routes into timberland. A substitution of oil for wood in the logging engines used in British Columbia would reduce the fires there. The disposal of slash is undoubtedly the greatest prob-

lem in forest protection to-day. That it can be solved is evidenced on the lands under management by the United States Forest Service.

For the prevention of forest fires, what is needed more than anything else is the whole-hearted support of the public. We are only just beginning to realize the value of fire protection from the standpoint of standing timber; from the standpoint of the future growth that realization is still farther off. The destruction will go on till lumber prices reach the cost of production.

The remainder of the bulletin is given up to a synopsis of the official information regarding the season's fires in the different provinces, and extracts from the provincial fire laws. A total of 1,134 fires was reported, burning over 435,000 acres, destroying timber nominally valued at $210,400. The returns are admittedly much below the reality, and in some provinces, notably Ontario and Quebec, no records are available. J. H. W.

Forest Products of Canada: 1909: Lumber, Lath, Square Timber and Shingles. By H. R. MacMillan. Bulletin 11, Forestry Branch. Ottawa, Canada. 1910. Pp. 30.

The statistics presented are based upon schedule reports made directly to the Forestry Branch by 2,085 mills as compared with 1,409 mills in 1908. They are the first highly accurate detailed statistics issued in Canada, and of the many interesting facts we give the following.

The total lumber cut reported was 3,814,942 M bd. ft. (one-tenth the annual cut in the United States) valued at about 63 million dollars. Ontario is easily the first province in lumber production, contributing 40 per cent. of the total. In British Columbia the cut of fir and cedar was greatly increased over that in 1908 so that now the province stands second, producing 21 per cent. of the whole. Quebec stands third with 17 per cent., a decrease of 7.5 per cent. from that of 1908, despite the fact that reports were received from 451 mills as compared with 277 mills the previous year. New Brunswick furnished 10 per cent. and Nova Scotia 7 per cent.

Of the species lumbered, spruce formed 29.5 per cent., white pine 27.4, Douglas fir 12.3, hemlock 7.9, cedar 5.0, and red pine 4.4 per cent.

Tables are given for twenty species, showing for each the quantity and value of the cut in each province.

In spruce lumber production Quebec lead with 31.7 per cent., New Brunswick next with 23.7 per cent. and Nova Scotia furnishing 15 per cent. While the average price in Canada was $14.55 per thousand, in United States it was $16.25 (partly the difference of the duty?), the average prices in adjacent Quebec and Maine being $14.28 and $16.56, respectively, at the mill.

The total cut of white pine in Canada was about one-third that of United States. Of this Ontario furnished 85 per cent., Quebec 6, and Nova Scotia 3.4 per cent. Only the State of Minnesota cuts more white pine than Ontario. While the average price for 1908 in Minnesota was $18.19, in Ontario it was $21.08. In 1909 the average price in Ontario rose to $22.33, and for all Canada from $20.08 in 1908 to $21.55.

Ontario produced 53.6 per cent. of the hemlock, Quebec 18.2 and Nova Scotia 15.7 per cent. Of the red pine cut Ontario furnished over nine-tenths.

Among the other species, balsam is noteworthy as being the only wood of which Canada cut a larger amount of lumber in 1909 than United States. The cut totalled some 91 million ft. B. M., worth an average price of $12.85. Quebec supplied three-quarters of the cut, and now balsam stands second in the list of important woods in that province. Evidently other woods are growing scarcer in the East.

The remaining softwoods are supplied mainly by British Columbia. The cut of Douglas fir showed an increase of 25 per cent. over that of 1908, the average price being $14.58. Cedar, next in importance, formed three-quarters of the total Canadian output of that species. The cut in British Columbia was exceptionally heavy in 1909—some 140 million feet as compared with 115 million feet in Washington State, the nearest approach. The price dropped to $13.43 from an average of $17.22 the year before. Tamarac stands fourth (after spruce) among the woods of this province, which supplied two-thirds of the total tamarac cut in Canada. The remainder was produced in Ontario (18 per cent.) and Quebec (11 per cent.).

Hardwoods made up only 5.7 per cent. of the total lumber cut. Of these, birch formed 24 per cent., maple 20, basswood 19, elm 16, ash 8, and beech 7 per cent. The birch is produced in On-

tario, New Bruswick and Quebec; maple and elm practically all in Ontario; basswood in Ontario (two-thirds) and Quebec; ash in Ontario and Quebec, equally; beech in Ontario (over one-half) and Nova Scotia (one-quarter). Thus, besides leading in the production of white pine, hemlock and red pine, Ontario supplied two-thirds of the total hardwood cut in Canada. Canada is dependent upon the United States for hardwood supplies, the value of such imports in 1909 exceeding by one million dollars the value of the home cut. The imports are mainly oak, cherry, chestnut, gum, hickory and tulip.

The average price for the different species at the mill ranged, for spruce, from $11.98 to $16.21; for white pine, from $14.42 to $22.33; for hemlock, $10.15 to $13.69; for cedar, $12.29 to $15.41; for red pine, $9.96 to $17.03; for balsam, $9.37 to $15.39; for larch, $11.50 to $15.50; for birch, $11.59 to $21.76; for maple, $10.27 to $18.38.

Statistics of the export of hewn square timber (which is practically equivalent to the production) show a total of only 41,442 tons (1 ton = 40 cubic feet). This was chiefly white pine and birch, valued at $31.92 and $10.63 per ton respectively. The square timber export reached its maximum in 1877, and has since steadily declined till now it is about one-tenth the amount. In the decade 1871-80 the average white pine export was 15 times and oak 200 times that of 1909. This reflects the increasing scarcity of large sizes of first quality logs, as does also the price increase, viz., from 12 to 38 cents for pine, from 30 to 54 cents for oak and from 15 to 22 cents for birch per cubic foot.

The lath production amounted to 822,124 thousand pieces of an average value of $2.46, chiefly from Ontario, New Brunswick and Quebec. The lath cut in Ontario are white pine, in British Columbia Douglas fir, and in the other provinces spruce.

The shingle cut was 1,499,396 thousand, averaging $1.86. The total value was greater than that of the lumber value of any species except spruce, white pine and Douglas fir. British Columbia produced two-fifths of the total cut. Cedar is the species mostly used, to the extent of 75 per cent., with spruce next. Most of the white pine shingles were of western white pine cut in British Columbia. J. H. W.

Forest Products of Canada, 1909: Pulp Wood. By H. R. MacMillan. Bulletin 12, Forestry Branch. Ottawa, Canada. 1910. Pp. 9.

From this compactly written bulletin we quote the following figures which refer to domestic wood manufactured into pulp in Canada.

Reports were received from 25 mills in Quebec, ten in Ontario, seven in New Brunswick, six in Nova Scotia and two in British Columbia. The latter are new mills not yet running on full time. Some ten other Canadian mills failed to report. These fifty mills used 622,129 cords of wood and produced approximately 445,408 tons of pulp. The average value of the wood per cord was $4.07 in Nova Scotia, $4.69 in New Brunswick, $5.72 in Ontario, and $5.83 in Quebec. In Ontario and Quebec, where most of the wood was consumed, the price varied very little from that of 1908.

Of this pulpwood, Quebec manufactured 51.4 per cent., Ontario 30.1 per cent., New Brunswick 14.2 per cent., and Nova Scotia 4.1 per cent. The consumption by species was: spruce 82.9 per cent., balsam 16.1 per cent. (a much higher percentage than in 1908), and negligible quantities of poplar and hemlock. The average prices per cord were: balsam $6.26, poplar $5.81, spruce $5.41, hemlock $4.51. These prices, however, do not represent the relative value of the different species for pulp manufacture, as they are not the purchase price in all cases; in cases where the manufacturing companies own timber limits they indicate only the cost of logging and transportation to the mill. Only one pulpmill in Canada manufactures sawmill waste.

Three reduction processes are used in Canada. Three-fifths (60.8 per cent.) of the pulpwood was reduced mechanically, over one-third (37.2 per cent.) by the sulphite process, and the remainder by the soda process. In Quebec and Nova Scotia the mechanical process is largely used; New Brunswick uses the sulphite process mostly, while Ontario manufactures about an equal amount of pulpwood by both processes. The soda process is little used in Canada on account of the cost, though it can be successfully used with a greater variety of woods than the other processes. Of the wood used for mechanical pulp, spruce formed nearly four-fifths (79.3 per cent.), the remainder being balsam;

of the wood used in the sulphite process spruce formed 90.6 per cent., balsam 8.1 per cent. and poplar 1.3 per cent.; and of the wood used in the soda process spruce formed 71.2 per cent., poplar 20.7 and hemlock 7 per cent. (In United States hemlock is manufactured by the sulphite process entirely.)

The average production of pulp per cord of wood used in the mechanical process was 1,651 pounds; by the sulphite process 914 pounds, and by the soda process 961 pounds.

The average yearly consumption of pulpwood per mill in Ontario was 18,735 cords, in Quebec 12,797 cords, in New Brunswick 12,636 cords and in Nova Scotia 4,179 cords.

Of the 445,408 tons of pulp manufactured in Canadian mills, 280,744 tons (63 per cent.) were exported, an increase of 41,000 tons over the preceding year's export. Of this export United States took 68.2 per cent. and the United Kingdom 28.3 per cent. The prices per ton paid to the Canadian exporters were: for chemical pulp, United Kingdom $40.04, United States $39.09; for mechanical pulp, United Kingdom $10.26, United States $16.09.

It is noticeable that more pulpwood is exported from Canada than is manufactured at home. Annually Canada supplies about 20 per cent. of the pulpwood manufactured in United States. Besides the wood domestically manufactured 915,633 cords were exported in the raw state in 1909. This export, representing three-fifths of the pulpwood cut in Canada, went to the United States. The consideration received for it averaged $6.28 per cord, an average value at the point of shipment of 71 cents per cord more than was paid by Canadian mills. Nearly all this export went from Quebec, the average price paid by Quebec mills being 45 cents per cord less than the export price.

As the United States imports much more pulp than it exports, it would necessarily have imported this pulp from Canada had it not imported the wood. Exporting the wood to the United States brought in $5,752,659. Exporting the pulp which that wood made would have brought, at the average prices paid by the United States importers in 1909, $16,719,418. If the manufacture were completed and the pulp made into paper in its final form before exporting the difference would be still greater.

The pulpwood shipped from Canada in 1909 furnished 46.4 per cent. of the raw material used by the 90 pulp mills of New

York State, 10.3 per cent. of the raw material manufactured in the 62 pulp mills of the New England States (Maine, Massachusetts, New Hampshire and Vermont) and 6.1 per cent. of the raw material used by the 16 pulp mills of Pennsylvania. A larger quantity of pulpwood was exported in 1909 than in 1908.

The manufacture of the 915,633 cords of wood exported in 1909 kept running at full capacity for the year 69 of the 251 pulp mills in the United States. If this pulpwood had been reduced to pulp in Canada, it would have supplied for the year 73 pulp mills of the average size of those already in Canada. The greater part of the pulpwood exported was cut in Quebec; if it had been manufactured in Quebec it would have kept running 71 mills of the same size as those now existing in Quebec.

J. H. W.

[All publications issued by the Forestry Branch are free on application.]

Report of the State Forester of Wisconsin for 1909 and 1910. By E. M. Griffith. Madison, Wisconsin. 1910. Pp. 136.

This report is a vigorous presentation of reasons why the state legislature should carry out the recommendations of the special Legislative Committee on Waterpowers, Forestry and Drainage. This committee, after studying conditions for two years, has joined with the State Conservation Commission and State Board of Forestry in recommending that a general state tax of 2-10 of a mill be levied and collected annually for twenty years; and that the proceeds be granted to the Board of Forestry to inaugurate a fire patrol system and to purchase lands to consolidate the present reserves.

The above tax will yield $600,000 yearly, and it is estimated that the cost of the patrol system will amount to $250,000 per year (13 million acres). The balance is to be used to purchase more reserve land till the present reserves of 340,000 acres are increased to two million acres, and also for their management.

That the present system of fire protection is useless is shown by the fact that in 1908 one million acres were burned over with a loss of $9,000,000, and in 1910 nearly 900,000 acres with a loss of $5,000,000. The season of 1909 was very wet and the damage was small. As the writer well says: "The American people as a whole are uncivilized in their apparently stoical in-

difference to the appalling annual losses from forest fires." At present Wisconsin has the old town fire warden system based upon the plan of putting out fires after they occur, whereas the patrol system is one intended to prevent fires starting. The system of patrol proposed is along the usual lines of organization, with speedy and adequate pay for fire fighting. Ultimately telephone lines and watch towers are to be built. In addition, the proposed legislation requires permits for setting out fires, and gives the State Board of Forestry power to order the burning of dangerous slash.

If anything more than the tremendous fire losses is needed to induce the legislature to take prompt action towards a definite future policy, it is supplied by the fact that in the last ten years Wisconsin has dropped from first place to eighth in lumber production. The production has decreased 40 per cent. The wood-using industries so valuable to the state can now obtain from Wisconsin only one-half the lumber they use.

The importance to the water power resource of the State of the maintenance of forest cover is fully shown. The theory of the relation of this cover to stream flow is given, with concrete examples.

The report urges a continuance of the soil surveys in order to have a land classification of the state as soon as possible. The establishment of a ranger school is also recommended.

Besides various other matters there is included a brief account of the work to be carried on in the new Forest Products Laboratory, and an outline of two special reports on "Wisconsin Wood-using Industries" and "Taxation of Forest Lands in Wisconsin." The complete reports can be secured from the State Board of Forestry. J. H. W.

Third Annual Report of the Oregon Conservation Commission to the Governor. Portland, Oregon. 1910. Pp. 55.

This report is submitted in accordance with the law which calls for "a full account of the year's work setting forth the condition of the natural resources of the State, together with such recommendations for legislation as may be deemed advisable." It recommends, as requiring immediate legislative action, (1) the passage of a bill to create an efficient State forestry service; (2)

liberal and hearty co-operation between the State and those federal agencies engaged in gathering physical data on the State's natural resources and in the dissemination of the information so gathered. The subjects dealt with are: forests, land and stream surveys, good roads, water transportation and water laws. We can touch only on the first of these.

Oregon is supposed to have one-fifth of the merchantable timber in the United States. Of this, one-third is in the National Forests, the other two-thirds mostly in private hands, the State owning little. But as the Commissioners point out: "The interest of the average citizen in forest protection and use is affected very little by the passage of title to forest land; the owner gets only the stumpage, which is a small part of the value; the people get everything else. Forest wealth is community wealth."

Yet, as a result of Oregon's apathy toward forest preservation, one and three-quarters billion feet of timber were burned in 1910. This, if saved for manufacture, would have brought 23 million dollars into the State. The reason for such tremendous destruction is that there is no machinery for actual protection. The only protection given, outside of the Federal protection of the National Forests, is the more or less co-operative patrol by private timber owners. There is a State Board of Forestry which works with an appropriation of $250 a year and which has no machinery for active work (!). The forest laws, in the opinion of the Commissioners, "amount to giving in legal language the State's gracious permission to its forests to take care of themselves."

Hence, the immediate appointment of a State Forester with wide powers is urged, and a liberal appropriation for patrol service. The building up of a large state fire organization is not favored, but rather the encouraging and aiding of local action by those whose own interest insures the maximum efficiency with the least state machinery, the State taking charge of the situation only where this form of relief cannot be obtained. Otherwise the State has no *forest* service and "the forester's entire time is occupied by fire work which he can do no better than others and he has no opportunity to do the things which he alone can do."

It is encouraging to come across a commission which so thoroughly lives up to the limit of its duties and presents the actual conditions so plainly and forcibly. J. H. W.

Protection of Forests from Fire. By Henry S. Graves. Bulletin 82, U. S. Forest Service. Washington, D. C. 1910. Pp. 48.

In view of the extensive damage from fires during the past summer, the appearance of this bulletin is most timely. The entire subject of forest fires and fire fighting is briefly reviewed and summarized. A discussion of the character of forest fires, as surface fires, crown fires, and ground fires and the influence of topography, soil, and vegetation on their behavior is followed by an exposition of the damages caused by fire. Emphasis is here placed on the injurious effects of repeated burning upon the reproduction and future condition of the forest, which is important in view of the recent popular advocacy in some quarters of the fallacious doctrine that the way to prevent fires is to burn annually. Under prevention of fires such measures as disposal of slash, lopping tops, and prevention of setting of accidental fires, receive attention, as well as the important subject of construction and use of fire lines, and the organization of a patrol, lookout stations, and telephone lines. The bulletin closes with a discussion of methods of fighting fire, laying stress on the importance of organization and equipment. No attempt has been made to exhaustively discuss the question of efficient fire protection for any one locality, but a complete survey of the general problem is given which cannot fail to be of great value educationally.

H. H. C.

Report of the Forester for 1910. By Henry S. Graves. (From Annual Reports of the Department of Agriculture.) Washington, D. C. 1910. Pp. 67.

The report shows a total area in the National Forests on July 1, 1910, of 192,931,197 acres, including Alaska and Porto Rico. The changes in area made during 1909 and 1910 consisted of additions of 453,517 acres and eliminations of 2,037,645 acres due to field investigations which had been in progress during the preceding year.

No new forests were created.

The cost of administration and protection was $0.01894 per acre and for permanent improvements $0.0031 per acre, a slight increase over the previous fiscal year. The total receipts were

$2,090,148.08. The yield from timber was $0.00541, grazing $0.00512 and special uses $0.00031 per acre, a total of $0.01084 per acre. That is to say, the expenditures are still about two and a quarter million dollars above receipts.

A new form of permit for the utilization of water power on National Forests has been prepared which will simplify the issuance of permits for this purpose and safeguard the interests of the Federal Government. The rate charged under the new form of permit "will be based primarily on the value of the land occupied for power purposes as measured by its capacity for the development of power, with a deduction for distance from market and for portions of the land to be occupied which do not belong to the Government. A fixed rate of $1.00 per net electrical horsepower per year is the full charge. This rate is equivalent to one sixty-sixth of a cent per kilowatt-hour." This does not represent more than one half of 1 per cent. of the investment in fixed charges. The charge is made from the time the permit is issued, but at a reduced rate until a ten-year period has passed, and amounts paid during the unproductive period are credited against the rentals which will be due during the period of partial production. The aim of this scheme of payment is to discourage the holding of power sites for purposes of speculation.

The executive force of the Forest Service during the year 1909-10 consisted of 2,536 persons, as follows:—

Supervisors,	140
Deputy supervisors,	106
Rangers,	1,293
Guards,	558
Forest assistants,	97
Field assistants, timber and mining experts, engineers, etc.,	156
Clerks,	186
Total,	2,536

The average area under the charge of each ranger and guard was 104,307 acres or 163 square miles.

The estimate of standing timber on the National Forests, exclusive of Alaska and Porto Rico, was revised during the year

and is now placed tentatively at 530 billion feet. Sixty-two per cent. of this amount is in the three Pacific Coast States; twenty-one per cent. in Idaho and Montana; and twelve per cent. in Arizona, Colorado, and New Mexico.

The report of losses by forest fires does not cover the autumn of 1910, when very destructive fires passed over some of the National Forests. The loss on National Forests during 1909-10 was 169,410,000 board feet with an estimated value of $297,275. Eighty-four per cent. of the forest fires were due to lack of preventive care on the part of the users of the forests and the railroads traversing them. The latter were especially delinquent. Efforts are being made to eliminate the latter source of danger by patrols, the use of spark arresters on coal and wood-burning locomotives, and the substitution of oil for other kinds of fuel. The use of oil has proved especially satisfactory because the fire danger from oil-burning locomotives has been proved to be absolutely nil.

The total cut of timber on National Forests was 484,412,000 feet, a slight increase over the preceding year. The heaviest cut was in the following states: Montana, Idaho, California, Colorado, and Arizona. The sales in each state were 40 million feet or over. The number of timber sales reached a total of 5,398, an increase of 418 over the previous year.

Timber trespass shows a gratifying decrease over previous years, due to the increased efficiency of the force, and improved methods of management.

Reforestation was pushed vigorously during the year. A total of 9,745 acres were planted or seeded. This work was conducted on 106 forests. It is planned to reforest 20,000 acres during 1911; 40,000 acres in 1912, and to enlarge the operations until 150,000 to 200,000 acres annually are covered.

The year marked the opening of the new forest products laboratory at Madison, Wisconsin. The increased facilities afforded by this laboratory has enabled the Forest Service to broaden its work along investigation lines.

The report closes with a statement of the plans for the year 1910-11 which include the inauguration of the new water power permit system, increased efficiency in fire protection, experimental reforestation, etc. R. C. B.

Utilization of California Eucalypts. By H. S. Betts and C. S. Smith. Circular 179, U. S. Forest Service. Washington, D. C. 1910. Pp. 30.

Much attention has recently been devoted to the exploitation of eucalyptus plantations in California. Many companies have been organized, some of whom in their over-zeal have exaggerated the profits of eucalypt culture, in many instances misquoting or misconstruing statements of the Forest Service. To supply definite information on the various elements of uncertainty in the business the Forest Service is conducting investigations, and this circular presents in brief form the results of mechanical tests of the wood which have been recently carried out in coöperation with the University of California.

The eucalyptus is native to Australia and was introduced into California in 1856. Of some 75 species now being grown, only five give indications of being well adapted to the conditions. Fully 90 per cent. of the eucalyptus in California at the present time is blue gum (*Eucalyptus globulus*).

The fibers of eucalyptus wood are much interlaced, making it tough, very difficult to split and refractory in seasoning. The number of mechanical tests made are too few to warrant final conclusions, but they indicate plainly that several species of eucalyptus are equal to the better grades of hickory in bending and crushing strength. The experiments have not yet been carried far enough to warrant a comparison of eucalyptus and hickory as to toughness and resilience.

Owing to the great tendency of the wood to warp, shrink and check in seasoning, the problem of ready utilization without undue waste is a difficult one. No satisfactory or commercially practicable method of seasoning lumber from the California grown eucalypts has been devised. The most satisfactory results so far were obtained from open piling under cover with uniform and close sticking, together with high piling to produce weight. Three years are required for the lumber to thoroughly air season. The greatest difficulties in seasoning are encountered in immature, rapid-grown timber, just the class of material which in all probability will be most widely utilized in California for lumber.

Although definite information is lacking, the indications are that "some species of eucalypts grown in California may prove

excellent substitutes for woods in use at present for cordwood, piling, posts, poles, cross-ties, mine timbers, paving blocks, insulator pins, furniture, finish, veneer, cooperage, vehicle stock, and tool handles." The sap-wood, which makes up a high percentage of an immature tree decays rapidly in contact with the soil. Reports received from Australia state that the trees must be at least sixty years old before their lumber is suitable for finer uses such as finish and furniture. Should this prove true for California grown eucalypts it will have a decided bearing upon the profits to be obtained from plantations. S. J. R.

Some Results of Dead Load Bending Tests of Timber by Means of a Recording Deflectometer. By Harry D. Tiemann. Reprint, Proceedings of the American Society for Testing Materials, Vol. IX, 1909.

This paper embodies some of the results obtained from four series of dead load tests made by the U. S. Forest Service with dry longleaf pine beams during three years beginning August 1, 1906. The deflections of the beams were recorded automatically upon a revolving drum, the whole apparatus having been designed by Mr. Tiemann who was in charge of the experiments.

Some of his deductions are briefly as follows:

1. The deflections and recoveries produced by immediate addition and removal, respectively, of live loads are the same, (up to the elastic limit, and probably to the point of first failure) as would have been produced had there been no dead load upon the beam.

2. When the beams were not ruptured by the time test, and, after resting a year without load, were tested in the usual power machine, it was found that neither the ultimate strength nor the elastic limit had been reduced. The stiffness (immediate modulus of elasticity) also was not changed by the dead load.

3. The greener the wood the more plastic under permanent load. Variations in the moisture content of the surrounding air decidedly influence the deflections under dead load. Beams deflect most during damp weather, and such increases are cumulative instead of being recovered by subsequent drying.

4. In an atmosphere of constant humidity dry longleaf pine beams may with safety be loaded permanently to within 75 per

cent. of their immediate elastic limit, and deflections under such load will gradually diminish to zero. Increase of dampness lowers the elastic limit so that what was at first a safe load may thereby become dangerous.

5. After removal of a dead load, a beam's recovery from the time effect is gradual and not always complete.

6. A beam may be considered safe under a permanent load when the deflections diminish during equal successive periods of time. A continual increase in deflection indicates an unsafe load which is almost certain to rupture the beam. S. J. R.

The Silva of California. By W. L. Jepson. Memoirs of the University of California, Volume II. Berkeley, California. 1910. Pp. 283, plates 85, maps 3.

The object of this memoir is "to bring together in one volume an account of the timber trees of the state which shall as nearly as possible represent our present knowledge of the taxonomy and geographical distribution." It is the result of nineteen years of field studies and collections on the part of the author, and the volume throughout reflects that basis.

The forests of California are characterized by the abundance of conifers, both in species and individuals. The broad-leaved trees, mainly evergreen, are rich in species but very poor in individuals. Of these, most typically Californian and most abundant, are Live Oak, Valley Oak, Blue Oak and Tan Oak, Laurel and Madrona (*Arbutus*). A census of species indicates 92 in all, representing 22 families. Of this number, 49 species are typical of California and 18 confined to that state.

The state is divided by the author into five natural forest provinces, according to the character of the forest, the composition and the species.

The first of these, the great valley of the Sacramento and San Joaquin rivers, is almost treeless, being characterized by scattered groves of Live Oak and Interior Great Oak on the east side, and in addition Willow, Cottonwood, Box Elder and Oregon Ash along river banks. The present forestless condition is due largely to the nature of the soil and climatic conditions, but also to the earlier annual burnings by the Indians. Only fourteen species in all are represented.

The region of the South Coast Ranges also contains much barren land, and as a whole is characterized by scattering groves of Live Oak and Blue Oak. In contrast with the inner ranges which show but four species, the seaward slopes show 13 species, of conifers. Those of widest range are Yellow Pine, Digger Pine, Douglas Fir and Redwood. This region has also six local littoral conifers—in all 49 species of trees.

The North Coast Ranges district has as its most marked feature the Redwood belt on the seaward slopes of the western range, where the climate is marked by the low daily and seasonal range of temperature and high rainfall. On the summit and east side of this range only 50 per cent. is wooded—mostly with Douglas Fir, Tan Oak, Madroña and Oregon Oak. The inner Coast Range above 4,000 feet supports a forest belt of Yellow Pine, Sugar Pine, Incense Cedar, White Fir, Red Fir, and southward, Digger Pine. This province is the richest of the five, containing 59 species.

The Sierra Nevada is the most extensive and most important forest region of the state. The western slope is especially heavily forested and the altitudinal zones are strikingly marked. The foot-hills are largely barren showing only scattering clumps of Digger Pine and Blue Oak. This is usually succeeded by a belt of chapparal, following which is the Yellow Pine belt up to 5,000 feet; associated with the Yellow Pine are Incense Cedar, White Fir, Sugar Pine and Big Tree. Following this is the Red Fir belt with Red Fir, Silver Pine and Lodgepole Pine. Above 7,000 feet occur White-bark Pine, Mountain Hemlock and Juniper. This region possesses 52 species.

The fifth region, Southern California, with 57 species, presents largely desert conditions. Only in the valleys and unprotected slopes above 4,000 feet are there forests, and these of the open stand type. The species are chiefly Yellow Pine, White Fir, Incense Cedar, Jeffrey Pine, Coulter Pine and Desert Fir, with Black and Maul Oaks on the lower edge of the conifer belt.

In the 30 pages devoted to the subject of distribution as outlined above, the author goes fully into the physical, biological and accidental factors involved.

An equal amount of space is devoted to a discussion of such biological characteristics as stump-sprouting, leaf variation, seed production, tree form, nanism, hybridization, and teratology.

The remaining 220 pages contain, of course, the more important portion of the text. Under each species is given the literature, followed by a description which is neither verbose nor a succession of technical terms. After this is given the distribution and various other supplementary data which never come to the student of mere herbarium material, but only to the field man. There are, of course, keys to the families, genera and species.

Besides the text figures there are 85 full page plates. About one-half of these are from photographs of tree types and forest types, usually a desideratum in dendrological works. The subjects of illustration are uniformly excellent, but in some cases the reproduction is not of the highest quality. The remaining plates are from line drawings illustrative of taxonomic characters.

For a book necessarily so largely descriptive the perusal of this volume affords much pleasure. The author has achieved the happy result of producing an absolutely scientifie work, written in simple interesting language. J. H. W.

Fungous Diseases of Plants. By B. M. Duggar. Boston, Mass. 1909. Pp. 508.

Diseases of Economic Plants. By F. L. Stevens and J. G. Hall. New York, N. Y. 1910. Pp. 513.

The substantial basis on which the science of Plant Pathology rests has been due in no small measure to the faithful and intelligent efforts of such botanists as Farlow, Burrill and Smith. It is now practicable to deal with it as an independent subject in the classroom, and a small army of younger enthusiasts are actively engaged on investigations in this field. The value of this phase of botany is also appreciated by the farmer, the horticulturist, the fruit-grower, the forester.

Strangely enough there has been a lack of American textbooks and manuals on this subject. Hitherto, it has been necessary to rely on European publications and on bulletins issued by the various agricultural stations. It is with pleasure, therefore, that we welcome two new books written by American pathologists. They are conceived from somewhat different standpoints and hence should reach a wider circle of readers.

Duggar's "Fungous Diseases of Plants" partakes more of the

nature of a textbook, and will be found an excellent aid to the student who is striving to make his first acquaintance with Phytopathology.

The subject matter is arranged under three general headings: I. Culture Methods and Technique, II. Physiological Relations, III. Fungous Diseases of Plants, and further subdivided into chapters. In this connection one of the most valuable features is the citation of literature. A list of the more important references precedes each chapter.

The first division is intended solely for the student and young investigator, and sufficient aid is given to enable any intelligent student to make his own way.

The second is possibly the most unsatisfactory part, as the matter treated is of such importance as to suffer from so brief an account. A chapter of practical value on the methods of preparing fungicides brings this section to a close.

The bulk of the work, as one would expect from the title, deals with the diseases themselves. The sequence adopted is based on the classification of fungi—the most logical for the student, and with the aid of an index arranged according to the hosts, easily usable by the layman. The illustrations are good, the descriptions are clear, and the number of diseases described fairly comprehensive. An approved method of treatment is given for each malady.

This book is in no sense a classic, not even a compendium, either of the whole or of any part of the field, nor does the author make any such claims for it. But it is a well-written elementary text, and should prove exceedingly useful.

Stevens and Hall's "Diseases of Economic Plants" strikes one as being eminently practical. Both authors have been associated for many years in joint experimental work on plant diseases and show a thorough acquaintance with their subject. After a very brief historical resumé of Plant Pathology in America they at once plunge into a discussion of such topics as the damage caused by disease, symptoms of disease, prevention and cure of plant diseases, fungicides, spraying machinery, cost of spraying, profits from spraying and so on. These are all treated succinctly, within the limits of sixty pages. The rest of the book deals with the individual diseases, the account being arranged according to an economic classification of plants under culture. Thus the dis-

cases of small fruits are described in one section, those of vegetable and field crops in another, cereals in another, trees and timber in another and so on.

Disorders due to physical or chemical agencies receive some attention—though quite inadequate. But a wide range of fungous diseases is dealt with. The illustrations are fair, and the text clear. Many references to the literature are given in the form of foot notes. On the whole, the book commends itself as a useful reference work for students and especially for plant producers. J. H. F.

The Isolation of Harmful Organic Substances from Soils. By Oswald Schreiner and Edmund C. Shorey. U. S. Department of Agriculture, Bureau of Soils. Bulletin No. 53.

The suggestion that the infertility of certain soils might be due to organic substances injurious to plants was put forward by the Bureau of Soils about five years ago. At that time experiments showed that poisonous substances undoubtedly were present in the soils, but just what they were was only a matter of conjecture. The next step in the investigation was to determine the effect of known decomposition products of plants, especially the decomposition products of proteids and related substances, upon plants grown in laboratory cultures. This was done on the assumption that such substances or similar substances might be found in exhausted soils. Of eighteen nitrogenous substances found in living or decaying plant structures, twelve were poisonous, two neutral and four beneficial to wheat cultures when applied in concentrations varying from one-ten-thousandth to one-tenth of one per cent. These and similar experiments were described in Bulletin 47.

During this time the investigators were continually trying actually to isolate the harmful substances from certain soils of known infertility, and they were finally successful as described in the Bulletin under review. They obtained four organic compounds, dihydroxystearic acid, picoline carboxylic acid, agroceric acid and agrosteral, all well defined crystalline bodies, one of which is quite injurious, one slightly harmful but closely related to much more harmful compounds and two that are not harmful, so far as the wheat seedlings used in the tests are concerned.

The first two mentioned are the poisonous substances and they have been isolated from at least six strikingly sterile soils from various parts of the United States. The first mentioned substance seems to be dependent upon the presence of fungi associated with the roots of oak trees, in one instance at least.

This Bulletin is very welcome, in that it apparently pushes aside a little the veil that hides the causes of soil sterility. While investigations like this are, for the present, applied to farm land, they could be undoubtedly applied with very interesting results to heaths, moors and other barren forest land. C. D. H.

Distribution and Movements of Desert Plants. By Volney M. Spalding. Carnegie Institution of Washington. Publication No. 113. Pp. 144.

The area studied by Professor Spalding occupies four square miles including and adjacent to the Desert Laboratory domain at Tucson, Arizona. The plant associations of the area are considered under nine principal groups as follows: The river (Santa Cruz) and irrigating ditches; the river banks; the flood plain; the salt spots; the wash (drywater course); the mesa-like slopes; the hill (including various associations on different aspects); the superficial soil layers associations and the associations of parasitic and symbiotic plants. The characteristic plants and the habitat factors of each association are described and discussed. Then the author passes to a detailed consideration of five characteristic species, showing by topographic maps the exact location of each individual or groups of individuals and discussing the factors of site which determine the location of each species. For example, the creosote bush, the most abundant plant, occupies as its principal habitat areas of course gravelly, whitish transported (eroding) soils. The mesquite on the other hand occupies areas of deposition (flood plains). In addition, the most exclusive creosote bush areas are those where the layer of caliche (lime-hard pan) comes most nearly to the surface, while mesquite, as a rule, is absent from such areas. After considerations like these, the author proceeds to discuss invasion, competition and succession on the area.

The discussions outlined above occupy the first two chapters of the volume. The third chapter contains articles on climatic

conditions by the senior author, on the geology by Tolman, and on the soils by Livingston. The latter is a continuation of the studies reported in Publication 50 (F. Q. VI, 4, P. 3 8), and it shows again the striking correspondence between the per cent. water content of the soil and the distribution of the species as well as that of the associations.

Thornber in Chapter 4 gives a list of the species found in the groups of habitats described above. There are 442 species of seed plants on the four square miles under discussion. It is interesting to note that only 3% of these attain the stature of trees, 53% being annual and 20% perennial herbs. In the most xerophytic habitats, however, namely the hill and the mesa-like slopes 30% of the plants are woody and 43% are short-lived winter annual and summer annual species.

The remaining three chapters are devoted to articles by McDougal of The Origin of Desert Floras, which is very general, to Review and Discussion and to A Summary of Results by the senior author. The volume is illustrated by most excellent photographic reproductions. C. D. H.

A Phytogeographic and Taxonomic Study of the Southern California Trees and Shrubs. By LeRoy Abrams. Bulletin of the New York Botanical Garden. Volume 6, No. 21. Pp. 300-485.

The area studied comprises one-fourth of California. Southern California is separated into three well defined floral divisions, the costal slope, the mountains and the deserts. The species of the costal slope are principally of Californian origin; the species confined to the mountains are boreal or of boreal ancestry and those of the deserts are endemic or have migrated from adjacent desert regions. In discussing the distribution of the trees and woody plants of the region, the author follows Merriam's classification of life zones. The Hudson and Canadian zones in Southern California intergrade, and they are characterized by *Pinus flexilis, P. Murrayana* and *Populus tremuloides.* Most of Southern California belongs to the Austral Region. To the Transition Zone of this region belong some fifty species of trees and shrubs of which *Pinus ponderosa, P. ponderosa, Jeffreyi* and *Pinus Lambertiana* are characteristic. Owing to the large

number of endemic species in this zone in Southern California, the author recommends that the Sierran sub-area be segregated from Merriam's Western Arid Area. It is characterized by the three pines mentioned above.

The Upper Austral Zone in Southern California is represented wholly by the Upper Sonoran Area. The author divides the area into two sections, the costal slope and the piñon and juniper belts of the desert mountains. The former is further divided into three sub-districts, the Littoral, Costal and Interior. The Littoral is composed of the various sea shore formations, while the Costal is characterized by various evergreen oaks and chaparral. The latter, however, reaches its highest development in the Interior sub-district.

The Lower Austral Zone is represented by the Lower Sonoran Area which includes all the desert regions below the juniper belt and protrudes into some of the hot valleys of the costal slope.

The remaining portion of the paper (160 pages) is devoted to an annotated catalogue of the Southern California trees and shrubs. C. D. H.

Second Annual Report of the State Forester on the Progress of Forestry in Vermont. By Austin F. Hawes. Montpelier, Vt. 1910. Pp. 52.

Vermont has had a state forester only since April, 1909, and the present report is an index of his activities. The beginnings of a state forest have been made in two areas, near the central part of the state, containing 800 acres which are used for demonstration purposes. In the spring of 1910 the State Nursery sold 376,000 seedlings to 81 customers. Of the purchasers, fifteen were lumbermen, thirty or more farmers, and the rest land owners in other business. Besides this, the state planted 67,000 seedlings on its own lands. About 122,000 seedlings from other sources were planted by private owners, so that nearly 566,000 trees were planted in the state in 1910. The State Nursery contains over two million seedlings, mostly white pines. The nursery is already practically self supporting.

The forester has published three bulletins and he conceived the unique idea of giving concise summaries of information on various subjects upon private mailing cards. Eight of these have

been issued and they present data in regard to the number of second growth hardwood trees required to make a cord; lumber and cordwood equivalents; compound interest made by a log; shipping weights in pounds per 1,000 B. M.; effect of moisture on strength of timbers; wholesale lumber prices, 1882-1908, New York market; approximate average rate of growth for northern forests; approximate current annual increase in per cent. of volume for trees of different diameters when the average number of rings in the last radial inch is known.

Data upon the lumber industries of the state are being gathered and those of three counties are included in the present report.

C. D. H.

The Physical Structure of Wood in Relation to its Penetrability by Preservative Fluids. By Harry D. Tiemann. Reprint from Bul. 120, American Railway Engineering and Maintenance of Way Association. 1910. Pp. 16. Illustrated.

This paper embodies the results of research to determine effect of condition of wood on its permeability to gases and liquids; more especially the physical changes in the wood elements during seasoning which affect their permeability.

Every cell in fresh green wood is completely separated from neighboring cells by the primary wall—middle lamella—which is continuous. Water may percolate through this membrane gradually but even under high pressure the rate is slow. The membrane is practically impermeable to gases, regardless of the pressure. This explains why green timber cannot be successfully impregnated with preservatives.

Seasoning of wood, whether naturally or artificially, effects changes other than loss of moisture. One of great importance is the opening up in the walls of the wood elements—tracheids, fibers and vessels—of long narrow slits, visible only under high magnification and appearing to run always spirally round the cell. It is impossible to dry wood by any known method without producing these slits, which increase in size as drying progresses, and when once produced cannot be eliminated. It follows that wood once dried cannot be restored to its original condition. A beam dried and then soaked is always more brittle than the green material.

One important effect of these slits is in rendering wood permeable. The greater the degree of dryness the greater the permeability of the wood. In green white oak it was found impossible to force any air through a two-inch block though a pressure of 150 pounds per square inch was brought to bear; after seasoning air was readily forced through a four inch block with a pressure of less than 5 pounds. In green black oak air passes readily through all of the vessels but not through the other wood elements. While possible to fill the vessels of certain green woods with preservatives such treatment would of itself be of little or no value, since the main portion of the wood structure is composed of wood fibres and tracheids which as shown are impermeable until seasoning splits their walls. S. J. R.

Maple-Sap Sirup: Its Manufacture, Composition and Effect of Environment Thereon. Bulletin 134, Bureau of Chemistry, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 110.

This bulletin is a report on the manufacture and analysis of maple-sap sirup, after an extensive investigation covering the maple producing states and Canada. Analyses were made of nearly 500 samples collected from representative camps and form a basis for the comparison and grading of maple sirups.

The report is replete with tables showing camp and manufacturing data, physical properties, chemical analysis, ash data, lead number and malic acid value, for the different samples arranged according to source.

The studies of the factors affecting the composition of maple sirup include effect of the run, of cleansing of seasonal variations, and of covered and uncovered sap buckets. It appears that sirup made from the last run of sap is usually darker in color, contains slightly more ash and malic acid than that from the earlier or middle runs. It is probable that the color of the sirup is dependent largely upon the presence of certain bacteria which contaminate the tap holes and affect the late run sap, giving the sirup the so-called "buddy" flavor. Boring new holes or reaming out the old ones will result in making the late run sap clean and clear, capable of producing light colored, fine flavored sirup.

The use of milk or white of egg in cleansing sirup affects no

material change in its composition and their use is a questionable benefit since the same result can be obtained by filtering.

Uncovered sap buckets allow rain, dirt and insects to enter, which increase the impurities of the sirup and darken its color.

The report concludes with a collection of references covering maple sap, its manufacture into sugar and sirup, and their analysis. S. J. R.

Damage to Chestnut Telephone and Telegraph Poles by Wood Boring Insects. By Thomas E. Snyder. Bulletin 94, Part 1. Bureau of Entomology. Washington, D. C. 1910. Pp. 11.

Recent investigations of the author show that serious damage is being done to the bases of chestnut telephone and telegraph poles in certain localities by the grub or larva of a wood boring beetle (*Parandra brunnea* Fab., Order Coleoptera, Family Spondylidae).

The attacks were first called to the attention of the Bureau of Entomology in December, 1906 from Baltimore, Maryland. The injury to the poles consists in large mines in the wood near the line of contact of the pole with the ground, necessitating a frequent re-setting or even the replacement of the damaged poles. On lines examined in North Carolina, Virginia, West Virginia, Maryland and the District of Columbia from 15 to 40% of chestnut poles set for 10 to 12 years were found to be seriously injured. The damage is greatest and the borers most abundant in high or level, dry ground.

The most effective method of prevention is open tank or cylinder impregnation with creosote. A thorough brush treatment of creosote, wood creosote, creolin, and some other preservatives have been found efficient for several years. R. C. B.

Yield from Eucalyptus Plantations in California. By Louis Margolin. Bulletin 1, State Board of Forestry, Sacramento, California. 1910. Pp. 38.

The report gives in tabular form the results of measurements of sample plots in all important eucalyptus groves in the state. This work was carried on by the Forest Service of the U. S. Department of Agriculture in co-öperation with the California

State Board of Forestry. A brief discussion of the factors influencing growth is followed by two volume tables, one of which is in cubic feet and the other in feet board measure, for Blue Gum (*Eucalyptus globulus*). Detailed data on each grove inspected occupies the greater part of the bulletin.

The Effect of the Speed of Testing upon the Strength of Wood and the Standardization of Tests for Speed. By Harry D. Tiemann. Reprint, Proceedings of the American Society for Testing Materials, Vol. VIII, 1908.*

It has long been a recognized fact that wood has a greater resisting power to immediate stresses than to more permanent loads. This paper embodies results of research to determine the fundamental laws underlying the relations of time and strength.

Following is an epitome of Mr. Tiemann's deductions:

1. Tests, in order to be intelligently compared, must take into account the speed at which the stress was applied.

2. In determining basis for a ratio between time and strength the rate of strain, which is controllable, and not the rate of stress, which is circumstantial, should be used.

3. This ratio or "speed strength modulus" may be expressed as a coefficient which, if multiplied into any proportional change in speed, will give the proportional change in strength, at any given speed. This ratio is derived from empirical curves.

4. Green and wet wood show greater change in strength than dry wood.

5. The following speeds expressed as rates of fiber strain (Z) in ten-thousandths of an inch per minute per inch of length of fiber, have been proposed as standards:

Bending	Z = .0015 in. per min. per in.
Compression	Z = .0015 " " " " "
Shearing	Z = .0100 " " " " "

6. At least 50 per cent. change in speed may ordinarily be permitted without correction since the same could not cause the load to vary more than 2 per cent. Care should be exercised, however, to secure uniform speed throughout the test. S. J. R.

* This article was reviewed in F. Q. vol. VII, p. 100, but we bring this addition for the information it contains.

The Cost of Growing Timber. By R. S. Kellogg and E. A. Ziegler. Reprint from American Lumberman, December 31, 1910. Pp. 18.

There are five elements of cost in growing timber; (1) The value of the land; (2) the stocking of it with young trees; (3) the administration of the operation and the protection of the growing timber; (4) the taxes; (5) the rate of interest. It is assumed that the value of forest land unfit for ordinary agriculture is worth $3 per acre and a charge of $7 per acre is allowed for fully planting or it is assumed that fully stocked land where natural reproduction occurs is worth $10 per acre. The cost of administration and protection will vary widely but are conservatively estimated at 5 cents per acre. Taxes are assumed to be equivalent to 10 cents per acre per year but emphasis is placed upon the desirability of a change in method of taxation. A 4 per cent. rate of interest is assumed in all calculations. Tables are then given for 6 important species comprising white pine, loblolly pine, longleaf pine, red oak, yellow poplar and Douglas fir for which there is a large amount of reliable growth data. The conclusions are that white pine will yield 4 to 6 per cent. compound interest for a 40 to 70 year investment; loblolly pine 4 per cent. for 30 to 50 years, and that red oak, yellow poplar and Douglas fir will soon bring remunerative prices. While the discussion is only an approach toward the ideas of proper forest management it is a very instructive one and the tables should be of considerable value to students in the forest schools. F. J. P.

The Conservation of Natural Resources in the United States. By C. R. Van Hise. New York. 1910. Pp. 413.

Van Hise has considered the subject of conservation of our natural resources under the headings of Mineral Resources, Water, Forests, The Land, and Mankind, together with a chapter of Appendices. He states that this modern movement is the direct result of the work of scientific men and gives especial prominence to the memorials of 1873 and 1890 to Congress from the American Association for the Advancement of Science, to Mr. Pinchot and the Conference of Governors. It is clearly recognized that the work in forestry has been the forerunner in this

great work, but to the student in forestry it appears that too much stress is given to the governors' conference as contrasted with the many years of patient work by the real pioneers of conservation in this country. The author does not pretend to be an authority on the various subjects he has discussed and so draws most of his material from the U. S. Geological Survey, Report of the National Conservation Commission, Report of the Inland Waterways Commission and other publications.

The chapter on forests is of greatest interest to the forester though it does not contain anything new. It is stated that the principal needs in forestry are reduced waste in cutting, less waste in milling and manufacture, improved methods in turpentining, preservative treatment, utilization of by-products, reduced fire losses, reforestration of burned areas, maintenance of forests over essential areas, stocking of forests so as to produce larger growth, combat of insect pests, substitution of other materials for timber, and reformed tax laws.

An interesting position is taken by the author in defending the foresters in the present agitation over the relation of forests on stream flow as against Chittenden representing a portion of the engineers and Moore as representing the Weather Bureau. Citations are made from Forest Service Circular No. 176 which was so unceremoniously withdrawn from circulation by the Secretary of Agriculture and from the Report on the Influence of Forests on Climate and on Floods by Moore which is recognized as being more faulty than the report it criticises.

It is stated that scientific forestry is practiced upon 70 per cent. of the publicly held forests and less than 3 per cent. of private holdings while the first duty of the nation and states is held to be the practice of forestry over their entire holdings, then pass laws requiring the same practice upon private holdings. The wastefulness in our forests is characterized as unmatched in the history of the world.

Naturally there are a few errors such as the statement regarding forest fires in the Rocky Mountains or Pacific ranges where it claimed that "as you stand on one peak you cannot see its neighbor. The whole region is under a pall of smoke; and this has gone on year by year, decade after decade," or again "in the pine forests in the north the winter stumps average not less than five feet." A few typographical errors also occur.

On the whole the work gives a remarkably clean cut statement of the question of conservation and succeeds much better in this than any or all of the publications from which material is drawn. In some cases the lecture form adds strength and interest but occasionally it causes weakness. The book is designed for general readers and for easy reference for those interested in some particular phase of the work. It fills a great purpose at the present time when there are so many ardent so-called conservationists who know almost nothing concerning it and so many opposed to conservation who are using false or limited arguments against it. F. J. P.

The Indian Forester. A monthly Journal of Forestry, Agriculture, Shikar and Travel. The Pioneer Press, Allahabad, India. Subscription, Rupees 12.6.

The October number of the "Indian Forester" contains a number of articles of interest. "Forestry Education in India" indicates that even with the schools already established, they feel the need for greater educational facilities. "The demand for education in scientific forestry is growing apace. In the United Provinces a small class for training foresters was started three years ago. It was intended for about 12 students annually * * it has been necessary to enlarge the class to 30 students, and at least as many again have been refused admission." This seems to me an admirable indication of the growing importance of forestry in India.

The scientific paper "Root Infection of Trametes Pini" is instructive. The more work of this kind the better.

Perhaps the most interesting article in this issue is "Conference of Forest Officers on Fire Protection, held at Poona, on July 15 and 16, 1909." It appears that the conference is to be annual, and that in the future other matters of importance will be discussed. Officers attending were required to submit memoranda on the subject under discussion. These memoranda are circulated beforehand, and consequently the subjects could be intelligently discussed. Briefly, they decided to spend more money on fire protection, to have severer punishments for setting fire, more liberal rewards for extinguishing fire, systematized fire protection plans, fire notices, more complete system of fire fines and fire

stations in order to secure the immediate detection of forest fires. This increased fire protection will be expensive, but they felt it was well worth the money.

"Notes on Works of Improvement in the F. M. S. forests" impresses one with the difficulty of forest administration in the mixed evergreen forests of the tropics. "The Determination of the Volume of Amorphous Pieces of Wood" might be used in this country. "Fire Conservancy in Indian Forests," contains a discussion in regard to the burning of fallen debris. In this connection Mr. Latham felt that the soil would not be enriched by burning, since the nutriment would be washed away.

The review of the "Annual Administrative Report of the Forestry Department of the Madras Presidency for 1908-9," indicates progress on working plans to be "lamentably slow." There was an increase in expenditure for permanent improvements and for special fire protection; but artificial reproduction seems to be far in arrears.

The establishment of a forestry college at Coimbatore will undoubtedly supply an adequately trained staff.

The reviews of the administration reports for the Nizam's Dominions for 1907-8 and the Sammu and Kashmir State, rather indicate the administration has been financially successful, at some sacrifice to intensive forestry.

On the whole, the issue is well worth careful study.

T. S. W., Jr.

Forest Conditions of the Ozark Region of Missouri. By Samuel J. Record. Bulletin 89. College of Agriculture, Agricultural Experiment Station, University of Missouri, in Co-operation with the U. S. Department of Agriculture.* Columbia, Mo. 1910. Pp. 195-280.

The bulletin opens with a brief description of the physiographic features of the region and a discussion of land ownership, the taxation problem, local industries and transportation facilities. A brief forest description by counties is given, followed by a silvical description of the more important forest trees. The latter part of the bulletin is devoted to a discussion of the various agencies that

*The field investigation was made in 1906.

damage the forest, statistics of the forest products in the leading counties for the year 1908 and a list of trees and shrubs common to the region.

The author recommended the establishment of a course in forestry in the State University in charge of a technical forester who should have the direction of the forest work in the State. A four-year course was established in the University in September, 1910. R. C. B.

The Woodman's Handbook. By H. S. Graves and E. A. Ziegler. Bulletin 36, U. S. Forest Service. (Revised and enlarged.) Washington, D. C. 1910. Pp. 208.

This new edition contains the Scribner, Doyle, Maine and Spaulding log rules complete and a table giving a comparison of 44 log rules for the contents of 16-foot logs. Standard and cubic measures are discussed and cord measure, with their equivalents. Thirty pages are devoted to timber estimating, and the better methods of estimating, with the principles underlying them, are thoroughly covered. Growth is briefly discussed. The more useful intsruments for cruising and estimating, as compass, height measures, calipers, are described. The most important addition to the Handbook is the appendix, which contains 57 volume tables of important commercial species, Eastern and Western, conifers and hardwoods, each of which is classified on bases of both diameter and height. Still more important are 8 tables giving yield per acre of paper birch, loblolly and scrub pine, white pine, and yellow poplar. The small number of these yield tables available for publication shows the need for investigations along this line. H. H. C.

The Forest Resources of the World. By R. Zon. Bulletin 83, U. S. Forest Service. Washington, D. C. 1910. Pp. 91.

Mr. Zon has presented in concrete form a summary of the forest resources of the world. Now that conservation is of paramount interest, Zon's bulletin is particularly opportune. Many of those opposed to a rational forest management in the United States have pointed to the vast untouched timber resources of

other countries, which at a time of shortage the United States would be able to draw upon as a source of supply. Zon shows conclusively that we must not look to other countries for timber imports, since there are but three important European countries, Russia, Finland and Sweden, which can export to a great extent without decreasing their natural forest resources. It is true that by more intensive management the forest productivity in Europe has largely increased, yet this will result in a small increase as compared with the increasing needs for wood products. Even the substitution of cement and iron in construction purposes cannot alter the ever-increasing demand for wood products. According to Zion, in European countries, the total forested area is estimated at 750,112,821 acres, and in countries outside of Europe the total forested area aggregates 3,050,298,009 acres. The total forested area of the world is thus almost 4,000,000,000 acres, or a quarter of the total land area. This does not include the forests of China, Korea, South America, nor Africa, for which there is no available data, but we should bear in mind that most of the species in those countries not enumerated are hardwoods, which could never be used for general building purposes, or are species totally unsuited on account of their composition. For each country on which reliable data is available is given the forest area, distribution, composition of forests, character of forests, present stand and annual growth, annual cut, home consumption, and wood prices. Since the data is based on the best available sources, "The Forest Resources of the World" will prove an exceedingly valuable reference book for public speakers and conservationists who wish to consider forestry from a very broad standpoint. The data is conveniently arranged, and is exceedingly valuable for reference purposes. T. S. W., Jr.

Schlich's Manual of Forestry. Volume II: Silviculture. By Sir Wm. Schlich. Fourth Edition, Revised. London. 1910. Pp. 424.

The fourth edition of this volume, almost the only one on silviculture in the English language, follows closely the make-up of the third edition, which itself was constructed after the pattern of the first edition, with a section on the foundations of silvicul-

ture added. Like its predecessors, it deals mainly with European conditions and species, except for the addition of notes on some American species.

In the systematic manner of presentation it reminds us of Heyer and Hess. It lacks the philosophic flavor of Gayer, and the freedom of discussion which characterizes the newer German works of Wagner and Mayr. But, for this very reason, as a manual for class use, it is superior, for it is brief and succinct and gives sufficient latitude for a teacher to expand.

It is of interest to note that Douglas Fir is found in England not to be windfirm, the wet weather occurring with heavy winds being assigned as cause. The statement that the species requires a moist climate and deep fertile fresh or moist soil, is due to lack of distinction between localities of derivation, for we know its thriftiness in the dry regions of its field of distribution. As regards difference in behavior of the green and blue form as regards resistance to frost, it is said, that experience so far obtained is somewhat contradictory. It should not be, if careful tab is had as regards locality of derivation!

Although in one place the author states that this tree, as far as experience goes at present, outgrows all European timber trees, and reports on a special plantation of 48 years' standing, which produced at the rate of 134 cubic feet per acre, he later doubts whether in the long run it would do better than the European Silver Fir. We have doubts on this, although the author is correct in assuming that the early rate of growth does not continue. Indeed, in British Columbia, which may be compared with western England as to climate, after 75 to 100 years the rate becomes ordinary rather suddenly, say 7 years to the inch, when it was 3 to 4 years to the inch before. *Thuya plicata, Tsuga albertiana* (our *heterophylla*) *and Chamaecyparis lawsoniana,* besides *Pinus strobus,* and *P. divaricata,* come in for notes. The superior value of our White Pine—its remarkable staying powers and low shrinkage per cent.—is evidently not yet discovered in England, since its wood is compared to that of spruce.

A number of additional illustrations and diagrams to illustrate silvicultural methods (one, the well-known "Hacker's" transplanting machine, being twice labeled "Hackel") add to the value of the book.

Until the first book, on silviculture based on American data and conditions is written, Dr. Schlich's volume will remain the American forester's handbook. B. E. F.

Die Forsteinrichtung. Von Dr. H. Martin. Third Edition. Berlin. 1910. Pp. 281.

Judeich's successor in Tharandt has been able in this volume not to furnish any more complete or comprehensive volume than Judeich's own classic work, nor has he improved on Judeich as a text book—the absence of mathematical apparatus in that respect being a detriment, but he has brought the discipline of forest organization into a modern garb and up to time, with a wide knowledge, which he has acquired not only from literature but extensive travel. He has especially brought this discipline more closely into relation with silviculture and other parts of forest practice, which is an advantage although strictly not part of a text book on forest regulation. In this respect the author has perhaps followed French precedent.

An interesting feature is the fact that the author abandons, at least in part, Judeich's strict adherence to the soil rent theory as a basis for forest regulation and for the determination of the finanical rotation in an annual management, admitting that here matters are different from those in an intermittent management upon which the soil rent theory is built.

This third edition is a considerable improvement over the first and second which, as it were, might be considered preparatory to this complete volume—it is the most modern not only as to time but as to contents.

It is divided into five chapters. The first discusses the preliminaries for making a working plan. A new beginning lies in first ascertaining by soil expectancy calculations or other means to determine the propriety of continuing forest growing or farming on parcels which are not under forest; not forgetting the protective function of forest cover.

The districting of a forest property in plain and mountain is carefully gone into. The usual chapters on forest description and methods of ascertaining yield data are very briefly dealt with in 20 pages; but their bearing on regulation requires 50 pages of discussion. The chapter on the formulation of working plans

introduces, what is usually only cavalierly treated, consideration of silvicultural matters, some 13 pages out of the 60 referring to regeneration, planting, thinnings, soil protection, etc., as influencing yield regulation.

The chapter on the methods of forest regulation which is left to the end of the book, brings a short historical review of methods —which in Judeich are treated broadly—and then describes the methods in actual practice in the various German states, Austria and France, giving a particular value to the volume.

Altogether this volume of 281 pages—as against Judeich's 575 pages—covers in a comprehensive yet compact manner the whole subject, and for its brief, direct, yet interesting style deserves attention of American foresters. B. E. F.

OTHER CURRENT LITERATURE.

Pulpwood Consumption, 1909. Forest Products, No. 1, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 15.

Cross Ties Purchased, 1909. Forest Products, No. 8, Bureau of the Census. Compiled in co-öperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 11.

Wholesale Prices of Lumber Based on Actual Sales Made F. O. B. Mill for each Quarter of the Calendar Year 1910. U. S. Forest Service. Washington, D. C. Pp. 24.

Insects Which Kill Forest Trees; Character and Extent of Their Depredations and Methods of Control. By A. D. Hopkins. Circular 125, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 9.

A brief discussion of noteworthy bark beetle insect depredations in the United States is given. This is followed by a few general rules for the control of dark beetles and specific instances where control has been affected.

Insect Injuries to the Wood of Living Trees. By A. D. Hopkins. Circular 126, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C., 1910. Pp. 4.

Insect Injuries to the Wood of Dying and Dead Trees. By A. D. Hopkins. Circular 127, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 3.

A brief description of the insects attacking dead and dying conifers and hardwoods, with brief directions for the prevention of attacks.

Insect Injuries to Forest Products. By A. D. Hopkins. Circular 128, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 9.

A discussion of the different species attacking round timber with the bark on; freshly sawed lumber; seasoned lumber; finished lumber, such as handles, wagon, carriage and machinery stock, woodwork in building, tanbark, etc. Preventive measures are discussed at some length.

Insects in their Relation to the Reduction of Future Supplies of Timber, and General Principles of Control. By A. D. Hopkins. Circular No. 129, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 10.

Contributions toward a Monograph of the Bark-Weevils of the Genus Pissodes. By A. D. Hopkins. Technical Series No. 20, Part 1, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 68.

The Oak Pruner. By F. H. Chittenden. Circular No. 30, Bureau of Entomology. Washington, D. C. 1910. Pp. 7.

A brief review of the life history, distribution and damage wrought.

Forest Nurseries for Schools. By Walter M. Moore and Edwin R. Jackson. Farmers' Bulletin, No. 423, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 24.

Prepared as a guide for rural school teachers.

Distribution and Migration of North American Shorebirds. By W. W. Cooke. Bulletin 35, Biological Survey, U. S. Department of Agriculture. Washington, D. C. 1910. Pp. 100.

Raising Deer and Other Large Game Animals in the United States. By David E. Lantz. Bulletin 36, Biological Survey. Washington, D. C. 1910. Pp. 62.

Bitumens and their Essential Constituents for Road Construction and Maintenance. By Prévost Hubbard. Circular No. 9, Office of Public Roads. Washington, D. C. Pp. 16.

A brief description and discussion of various bituminous materials in use in road construction and maintenance.

A Preliminary Treatment of the Genus Castilla. By Henry Pittier. Contributions from the United States National Herbarium, Volume 13, Part 7. Washington, D. C. 1910. Pp. 247-279.

This bulletin contains the results of a study of this genus of rubber producing trees indigenous to Central and South America. A few pages are devoted to a discussion of the general characters of the genus. This is followed by a key to, and a detailed description of the various species now recognized.

History of the Cocoanut Palm in America. By O. F. Cook. Contributions from the United States National Herbarium, Volume 14, Part 2. Washington, D. C. 1910. Pp. 271-342.

Annual Report of the Smithsonian Institution, 1909. Washington, D. C. 1910. Pp. 751.

Among the miscellaneous memoirs contains: The Conservation of Natural Resources, by J. Douglas; Problems of Local Distribution of Plants in Arid Regions, by V. M. Spalding.

Investigation of the Department of the Interior, and of the Bureau of Forestry. (In thirteen volumes.) Vol I: Report of Committee. Washington, D. C. 1911. Pp. 192.

Contracts in Forest Reserve Timber Lands. (Letter from the Secretary of the Interior transmitting information as to contracts in force at the time of the approval of the Act prohibiting the selection of timber lands in lieu of lands in forest reserves (33 Stat., 1264) and requesting further information with respect to such contracts in answer to Senate resolution of January 27, 1910.) Senate Document No. 112, 61 Congress, 2nd Session. Washington, D. C. 1910. Pp. 485.

Ceded Chippewa Pine Lands, Minnesota. Sale of timber on lands both inside and outside of the Minnesota National Forest, at Cass Lake, Minnesota on September 15, 1910. Instructions, descriptions of land, estimates and rules and regulations for the selling, scaling, cutting and removal of the timber, approved June 23, 1910. Washington, D. C. 1910. Pp. 84.

The greater part of the volume is occupied with a brief description by forties of the timber to be sold.

Engineers' Field Manual, Parts I-VI. Professional Papers No. 29. Corps of Engineers, U. S. Army. (Third revised edition.) Washington, D. C. 1909. Pp. 452.

Parts I-VI include Reconnaissance, Bridges, Roads, Railroads, Field Fortifications, Animal Transportation. This is an excellent pocket size field manual printed on thin paper and bound in leather. The chapters on Bridges, Roads, Railroads, and Field Transportation, are of special interest to foresters. The latter chapter treats of the selection, maintenance, and care of horses and mules, including veterinary work, tractive force of animals, detailed instructions on the use of the pack saddle, wagons, etc.

Eighth Report of the Forest Commission of the State of Maine. Augusta, Maine. 1910. Pp. 110.

Approximate Current Annual Increase in Per cent. of Volume for Trees of Different Diameters when the Average Number of Rings in the last Radial Inch is Known. Vermont Forestry Card No. 7, State Forest Service. Burlington, Vt. 1911.

Approximate Average Rate of Growth for Northern Forests. Vermont Forestry Card No. 8, State Forest Service. Burlington, Vt. 1911.

Leaf Key to the Trees of the Northern States and Canada. By R. B. Hough. Lowville, N. Y. 1910. Pp. 63.

Reforesting. By C. R. Pettis. Bulletin No. 2, Forest, Fish and Game Commission. Albany, N. Y. Pp. 25.

A bulletin designed to furnish definite, detailed information on how to start a forest, how to secure planting stock, the most desirable kinds to use, when and how to plant, and results that may be expected.

Forestry. By L. W. Goodrich, Forester of Hartford, (Conn.) Water Department. (Reprint from Journal of New England Water Works Association, Volume XXIV, No. 3, September, 1910.) Pp. 345-364.

A paper setting forth the forest work that has been done by water companies in Connecticut, with several discussions. A volume table for White Pine to a diameter of 26 inches is appended.

Report of the Connecticut Agricultural Experiment Station 1909-10. Part V: Commercial Fertilizers. Connecticut. 1910. Pp. 375-454.

Wood-Using Industries of North Carolina. By R. E. Simmons. Economic Paper No. 20, North Carolina Geological and Economic Survey. Raleigh, N. Carolina. 1910. Pp. 74.

Text Book of Botany for Colleges and Universities. By J. M. Coulter, C. R. Barnes, and H. C. Cowles. Volume I: Morphology and Physiology. Chicago, Ill. 1910. Pp. 484.

Morphology of Gymnosperms. By John M. Coulter and Charles J. Chamberlain. Chicago, Ill. 1910. Pp. 470.

The Commercial Woods of the United States and Their Uses. By G. T. Surface. (Reprinted from the Bulletin of the Geo-

graphical Society of Philadelphia, Vol. VIII, No. 3, 1910.) Pp. 34.

Proceedings of the American Association for the Advancement of Science: Meetings 59, 60, 61. Boston, Mass. 1910. Pp. 686.

The Farmers' Handbook of Explosives. By E. I. DuPont. Wilmington, Delaware. Pp. 115.

A catalogue giving valuable data regarding the care and use of dynamite for stump and rock removal, hardpan blasting and other purposes.

How to Know Some Ohio Trees. By W. R. Lazenby. Agricultural College Extension Bulletin, VI, 3. Columbus, Ohio. 1910. Pp. 16.

Our Conebearers and Evergreens. By C. H. Goetz. Agricultural College Extension Bulletin, VII, 4. Columbus, Ohio. 1910. Pp. 16.

Fourth Annual Report of Forest Conditions in Ohio. Bulletin 223, Ohio Agricultural Experiment Station. Wooster, Ohio. 1910. Pp. 116.

State and Local Taxation: Address and Proceedings of Third International Conference, 1909. Columbus, Ohio. 1910. Pp. 387.

Contains, of interest to foresters, an address on Forest Taxation Under the Direct State Tax in Maine.

Second Biennial Report of the Minnesota Tax Commission, 1910. Minneapolis, Minn. 1910. Pp. 490.

The Determination of Humus. By F. J. Alway, E. K. Files, and R. M. Pinckney. Bulletin 115, Agricultural Experiment Station. Lincoln, Neb. 1910. Pp. 25.

The Woodlot for Central Indiana. By E. C. Pegg and M. B.

Thomas. (Reprint from the Proceedings of the Indiana Academy of Science, Twenty-fifth Anniversary Meeting, 1909.) Pp. 21.

A discussion of the condition of Indiana woodlots and suggestions for their improvement and perpetuation.

Twenty-first Annual Report of the Missouri Botanical Garden. St. Louis, Mo. 1910. Pp. 195. Contains of interest: The Fungous Root Tubercles of Ceanothus, Elaeagnus and Myrica, by E. G. Arzberger; Fungi of Clay Mines, by P. Spaulding.

Annual Report of the Minister of Lands and Forests for the Province of Quebec, 1909-10. Quebec, Canada. 1911. Pp. 277.

Report of Progress of Stream Measurements for 1909. Department of the Interior, Ottawa, Canada. 1910. Pp. 207.

Progress Report of Forest Administration in the Andamans for 1909-10. Calcutta, India. 1910. Pp. 30.

A Note on the Lac Insect (Tachardia lacca); its Life History, Propagation and Collection. By E. P. Stebbing. Indian Forest Memoirs, Volume I, Part 3, Forest Zoology Series. (Second edition.) Calcutta, India. 1910. Pp. 82.

The Sylviculture of Hardwickia Binata. By D. O. Witt; *Notes on Sandal, (Germination and Growth of Seedlings),* by M. Rama Rao. The Indian Forest Records, Volume II, Part 3. Calcutta, India. 1910. Pp. 157.

Annual Progress Report upon State Forest Administration in South Australia for year 1909-10. By W. Gill. Adelaide, South Australia. 1910. Pp. 12.

A Critical Revision of the Genus Eucalyptus: Volume II, Part 2. By J. H. Maiden. Sydney, New South Wales. 1910. Pp. 61-100, plates 53-56.

Annual Report of the Director of Forestry of the Philippine

Islands for 1909-10. By Major G. P. Ahern. Manila, P. I. 1910. Pp. 25.

Our Waste Lands: A Preliminary Study of Erosion in Mississippi. By E. N. Lowe, with an appended address on *Mississippi's Agricultural Potentialities,* by Dr. W. J. McGee. Geological Survey. Jackson, Mississippi. 1910.

Preliminary Examination of the Forest Conditions of Mississippi. By C. E. Dunston. Bulletin 7, Geological Survey. Jackson, Mississippi. 1910. Pp. 76.

A discussion of the forests and forest problems of the State, with suggestions for forest management. Under title of Legislation, the author gives a summary of the past legislation, and outlines the legislation needed. This includes the establishment of a State Forest Commission, the appointment of a State Forester, the creation of State Forests, and the passage of a forest fire law. An appendix contains a proposed fire law for the State.

Official Proceedings of the Eighteenth National Irrigation Congress, held at Pueblo, Colorado, U. S. A., September 26 to 30, 1910. Pueblo, Colorado. Pp. 412.

Short Keys to the More Important Trees and Shrubs of Oregon and Washington. By Hugo Winkenwerder, University of Washington. Seattle, Wash. 1910. Pp. 8.

Third Biennial Report of the State Forester of the State of California. By G. M. Homans. Sacramento, California. 1910. Pp. 160.

Facts About True and Spurious Mahogany. By C. D. Mell. Reprint from Hardwood Record, October 25, 1910.

Shade Trees in Towns and Cities. By W. Solotaroff. New York. 1911. Pp. 284.

The Principles of Handling Woodlands. By H. S. Graves. New York. 1911. Pp. 335.

Biennial Report of the Forestry Commission of New Hampshire for 1909 and 1910. Pp. 105.

Soils of the Ozark Region. By C. F. Marbut. Research Bulletin 3, University of Missouri. Agricultural Experiment Station. Columbia, Missouri. 1910. Pp. 273.

Twenty-third Annual Report of Experimental Farms, Canada. Ottawa, Canada. 1910. Pp. 528.

The Farmer's Plantation. Bulletin 10, Forestry Branch, Department of the Interior. Ottawa, Canada. 1910. Pp. 23.

Report of the Pennsylvania Department of Forestry for the Years 1908-09. Harrisburg, Pa. 1910. Pp. 373.

Forest Resources of Arkansas. Little Rock, Arkansas. 1910. Pp. 34.

PERIODICAL LITERATURE.

BOTANY AND ZOOLOGY.

Natural History of Moles.

In an interesting account Dr. Knauer demolishes various misconceptions which are current, regarding the life history of moles. He declares the mole a decidedly useful animal in the forest (without bringing reasons, but probably because of its capacity for destroying larvae). Their voraciousness for earthworms, insects, snails, frogs and small reptiles is well known.

A detailed account of the life history, as usually described, is given, the fanciful descriptions, full of error, originating in France. A German, Dahl, and an Englishman, L. E. Adams (Memoirs and Proceedings of the Manchester Literary and Philosophical Society 1902-3), are given the credit for dissipating the fancies.

They find no regularity, but great individual variety in the structure of the mole's dwelling. They deny that the remarkable accumulations of worms are due to providential instinct, but result from the wandering of worms to greater depth as the ground freezes. The maiming of worms to keep them as live food is a myth, the maiming being an incident of immuring them in the ground.

These stores of worms are hunted after by fishermen, especially in December and January. It is ascertained that the claimed disparity in numbers of males and females does not exist, and that there is only one brood.

Neues aus der Naturgeschichte des Maulwurfs. Centralblatt f. d. g. Forstwesen. November, 1910. Pp. 485-492.

SILVICULTURE, PROTECTION AND EXTENSION.

Density and Variation in Spreading Capacity.

Forstinspektor Hauch of Denmark, whose important discussion on the influence of the spreading habit of different species on spacing in plantations we briefed in Vol. III, p. 181, discusses further the spreading capacity of species under repeated reference to Johannsen's work on "Heredity."

He believes to have discovered a correlation between this capacity and the tendency of tree species to form straight slender stems and regular growth. The relation between spreading habit and root system has been suggested in the former article.

With maple, ash, alder which are characterized by small spreading capacity, an upright growth is much more the rule, than with oak and beech which have great spreading capacity, similarly spruce and pine are distinguished.

Even in stands of the same species, but of different derivation, the same phenomenon is exhibited: as the oak stands grown from Danish and German acorns at the Danish Experiment Station show, the Danish oaks showing a crooked and irregular form, which the foreigners never develop. Several illustrations exhibit the difference. The stands of foreign derivation also show a larger number of dominant stems, a result of smaller spreading habit and this habit, the author thinks, is a heritage.

Nevertheless, he contends that not too much value must be placed upon the selection of seed material with reference to the variation of spreading habit of the same species in different localities. For, after all, this difference is only relative, the specific habit great. Hence, dense sowings or plantings for species with spreading habit cannot be avoided; and thereby the advantage of securing a wide variation of forms is also secured. Most of the quantities quoted by authors for seed and plant quantities touch the extreme limits of the needful; what is really necessary we do not know, and hence, to be sure, larger quantities than are usually employed with these species are required.

In the cited oakstands, in which very large quantities were used, (12 to 15,000 per acre) the advantage of this becomes

more evident as they grow older. Contrary to the fears of many, at the age of 20 years, the great density has not produced stands with thin weak stems, but not only high but thick stems with strong crowns have been differentiated.

The spreading habit should not only be considered in spacing plantations, but also in the practice of thinnings, in which the advantages of the density must be considered and its disadvantages avoided.

He inveighs against both too early (10 year) and late thinnings (30 to 40 year), the latter delaying too long the decision of what is to be dominant. In a vigorously growing stand he proposes to thin at an age of 15 years and the thinnings cannot be repeated too often, if possible annually during the years 15 to 20. In that manner a dominant stand of well distributed trees and a lower story of soil cover can be developed, taking out only what is of damage to neighbors and leaving the oppressed harmless part.

A rather unconvincing experiment with such a thinning method closes the otherwise suggestive article.

Zur Variation des Wachstums bei unseren Waldbäumen, etc. Forstwissenschaftliches Centralblatt. November, 1910. Pp. 565-578.

Moss Cover and Increment.

Böhmerle whose observations on the influence of moss cover on natural regeneration we briefed in Vol. VII, p. 200, now brings data from the Austrian forest experiment station showing the influence of moss cover on increment of pine in the same forest near Vienna which is characterized by a dry climate, especially during the period of vegetation.

The forest is described in the previous brief.

The inimical influence had been remarked in the previous publication but additional experiments were instituted in two plats, in which on one-half the area the moss cover was carefully lifted and turned over, so that without scarifying the soil the living moss cover was changed into a dead one, and the vegetative activity of the moss and its use of water for the same was destroyed.

This was done in 1907. In 1908 a decided drouthy year occurred, but 1909 and 1910 were rainy years.

The cross section area per cent., based on the area in 1907 in the two experimental areas as a whole, was found as follows:

		1908	1909	1910
I,	65 year	.429	4.085	3.379
II,	85 year	.177	2.782	2.830

showing a most decided influence of the dry and rainy seasons.

Differentiating now the two parts in the two areas, the one with the moss cover turned (a), the other with the living moss cover (b), the following difference in the cross section area per cent. appeared; the basis being again the total area in 1907:

		1908	1909	1910
I	a	.343	2.018	1.778
	b	.086	2.067	1.611
II	a	.105	1.346	1.365
	b	.072	1.436	1.465

The stands with the living moss cover remain in the drouth year behind those with the dead cover, the younger stand more than the older. In the two wet years the opposite relation appears, the fully saturated living moss bolsters acting favorably in hot days of the wet season.

This showing accentuates the desirability of destroying the living moss cover. A removal or breaking up every five years, which in those parts may be done by the poor farm population gathering the litter for bedding, is the proposed method.

Moosdecke und Holzzuwachs. Centralblatt f. d. g. Forstwesen. December, 1910. Pp. 523-526.

Planting with Borer.

Setting out young trees of those species which develop a pronounced taproot is always attended by liability of injury to this root and consequent set back in the growth of the plant. A conical, auger-like borer with a blade $7\frac{1}{2}$ inches long and 5 inches across at the top has proven very satisfactory for this work and very cheap in use.

One workman with the auger is able to prepare planting spots for two setters.

Der Spiralbohrer. Silva, October 7, 1910. Pp. 312-13.

Bought vs. Homegrown Plant Material.

For many years past Prussia has been planting trees on waste land owned by the State and at the same time trying to influence private owners to do the same. Provincial agricultural societies have also encouraged private planting, and a considerable increase in the forest area has resulted.

In many cases plant material has been grown locally when better stock could have been more cheaply secured from large nurseries. Where favorable conditions of soil and labor are together present homegrown plants from carefully selected seeds are preferable. But nurseries require a rich soil and this means the continual use of fertilizers to replace the nutrients removed in the young trees. And unless the necessary supply of cheap and efficient labor is at hand the cost of home nursery may be three or four fold the value of plant material secured from large nurseries.

Ein Beitrag zum Kapitel der Pflanzenerziehung. Silva. July 8, 1910. Pp. 209-11.

Combating May Beetle.

In a very readable article with full detail Puster describes a successful campaign against Melolonta (relative of our June-bug) which had for years defied all attempts at reforestation over a large territory. Not less than 7,000 acres were involved, on which not only younger and older cultures were regularly destroyed, but even old timber was gradually killed by the larvae and beetles, there being from 100 to 300 larvae per square yard. Much money had been wasted in replanting and in attempts to get rid of the pest, until it was finally decided that the only salvation was in a thoroughly organized beetle-catching campaign. The beetles fly every four years, the larvae living four years underground. By preparing bait trees, which consist of single trees in the open, low and branched low, of kinds preferred, oak, birch, blue beech and larch, the beetles are attracted. In the early morning and in the evening before the flight begins, they can be shaken from the trees into

large sheets, then killed with carbon bisulphide and used in the compost heaps. The main point lies in the organization of the crews to do efficient work, seven boys and girls being found the best number under a competent leader. In two flight years a portion of the territory has been cleaned, 22.5 million beetles were caught at an expense of about $5,000. The results have been gratifying, and it is expected that in the flight year 1911 a supreme effort will be made to get the whole area cleaned.

Interesting is the calculation of the result effected in the additional increment secured, and in the decrease of the planting expenditure for fail places. In 1899-1902, the planting cost was $53 per acre, in 1903-6 $12, in 1907-10, after the campaign of 1907, $3.30.

In increment an annual increase to the value of $10,000 is figured, showing that the expense is worth while.

Ein Jahrzehnt im Kampf mit dem Maikäfer. Forstwissenschaftliches Centralblatt. December, 1910. Pp. 633-644.

MENSURATION, FINANCE AND MANAGEMENT.

Growth Rate in Selection Forest.

Dr. Matthes discusses at length conditions and management of a mixed beech-ash-maple-oak selection forest in Thuringia, a rare object in Germany. The private selection forests are usually the result of an attempt to convert composite forest into high forest. There are several types, namely that with a close stand, in which the young age classes are lacking; that showing a two-storied character; and that in which the different age classes are present in groups—the normal selection forest, which is rare. We are mainly interested in the growth conditions which appear in several tables.

The number of trees of different diameter on sample areas were distributed as follows, for type I before and after a cut intended to produce a young regeneration, for type II as it stood. For type III no data are given.

Type I.

Diam. inch:	3-6	6-8	10	12	14	17	19	22	Total
1892	28	42	46	38	22	21	6	4	207
1905	17	20	27	23	20	13	6	1	127
Type II.	31	20	26	24	14	10	7	3	135

On sample areas of over 12 acres extent the following average data of growth were obtained, giving actual heights and the years per inch of diameter needed in each diameter class.

Diameter Class:	4-8		9-13		14-18		19-23 inches	
	Years	*Height*	*Years*	*Height*	*Years*	*Height*	*Years*	*Height*
Beech	11	48	10	71	7	82	7	87
Maple	12	64	11	71	10	76		
Ash	13	67	8	75	8	80		
Oak			15	66	12	70	19	76

Of most interest is the comparison of height for beech compared with timber forest conditions:

	Selection II site		*Timber*		*Selection III site*	*Timber*
Age	*Diam.*	*Height*	*Height*	*Diam.*	*Height*	*Height*
	cm	*m*	*m*	*cm*	*m*	*m*
20	3.86	6.64	4.3	2.5	2.25	3.
30	6.06	8.30	8.2	4.1	4.81	6.
40	10.0	9.6	12.4	6.3	6.25	10.
50	14.	12.3	16.4	9.5	9.25	14.
60	19.06	16.3	19.	15.7	11.75	16.9
70	27.	20.8	21.	22.1	15.30	18.9
80	33.2	23.44	23.	27.3	19.3	20.9
90	40.	25.3	25.	34.3	21.51	22.
100				43.5	23.25	23.

These figures would show that while in early life the height growth remains behind, finally it is evened up.

An elaborate stem analysis of beech trees from close timber forest and from selection forest, to determine difference in form, and the changes in it in consequence of setting free trees which have stood in close cover, shows that, while the width of the decennial increment in diameter in the younger years of dense selection forest trees decreases from base to top (rapid taper), in the middle polewood stage and beginning timber-wood stage it increases, just as in timber forest trees (becoming full-bodied). In the tree grown in dense position of timber forest, from a "turning point," six to ten feet above ground, the ring width of the decennial increment increases both down and upward, in the upper portions to 1.5 to 4 times the width at the turning point.

In the selection forest, trees which have been set free show during the period of freedom a gradual decrease from the turning point upward to the crown, in the given case by one-third of

the ring width at the turning point, and then it sinks from crown base to top more rapidly, in the given case to one-fifth of ring width at the turning point.

The completely free grown tree behaves like the trees set free.

These findings of the difference of form development according to position of trees suggests that the usual form factors are of no avail in the selection forest and that, to secure volume growth data, differentiation must be made in calipering into stems quite free, half free, closed and crowded tree classes, and to ascertain special form factors from sample trees of these. By the use of diagrams the six different forms that may be found are elucidated and for the increment per cent. calculation the constants for the formula $\frac{400}{nd}$ are found to vary from 350 to 940.

Before these constants had been developed the increment had been ascertained by Schneider's formula as 59 cubic feet per acre on a volume of 2,000 cubic feet per acre or 3 per cent. nearly.

A revision of this finding after 23 years seemed, however, to make the increment only 26 cubic feet, the correctness of which the author doubts and dismisses without explanation, expecting to make new measurements with his new method.

Several pages are filled with detail prescriptions as regards felling practice and regeneration, which cannot be briefed.

Der gemischte Buchenplenterwald auf Muschelkalk in Thüringen. Allgemeine Forst- u. Jagdzeitung, May, 1910. Pp. 149-164.

MENSURATION, FINANCE AND MANAGEMENT.

Forest Management of Hesse.

The financial difficulties of various German states have lately led to propositions to increase their cut or curtail the expenditures of forest administration. An increase in the number of districts and district managers, which had been installed in 1900 in Hesse has led to an inquiry of this sort and as a result a very interesting comparison of the results of the decade 1889-99 with those of the period 1900-09, attained in the management of the crown forests of Hesse has been published, which shows remarkable advances.

The area involved is only 177,000 acres, of which only 31%

is coniferous. The annual cut has increased from 75 cubic feet to 84 cubic feet per acre (not counting in 12,000 acres of new purchases). The increase is due, in part, to the thinnings, attainable with the increase in district managers, these thinnings, representing 62% of the total harvest, and in part to new methods of regulating the yield.

This regulation includes a comparison of actual and normal increment, of actual and normal stock, of the two or three oldest age classes as to area with the normal area for these age classes and a ten-year felling area. The rotation is determined upon the basis of typical "index-stands" which are carefully booked in various districts. It is believed that the cut can still be increased and quality improved.

In the first decade the workwood per cent was 18, in 1908 it had risen to 30%. The gross money yield had risen from $3.93 per acre and 5.28 cents per cubic foot in the first decade to $6.43 and 7.42 cents in 1908; a total increase in income of over 2.5 million dollars for the last 10 years. This is, in part, due to rise of prices, but also to more careful sorting.

Expenditures also increased, but the net income increased from $5.07 to $7.73. The total expense for personnel has since 1898 risen steadily from 69 cents to 84 cents per acre.

A comparison of yields in various states for 1907 is also given, which credits Saxony with 95, Württemberg with 96, Baden with 92, Hesse with 87 cubic feet per acre. It is pointed out that for proper comparison these yields must be compared with stock on hand to get the use per cent. Data for such comparison exist only for Baden and Hesse. In Baden the stock is given as 4140 cubic feet, that of Hesse at 4,000 round: the use per cent. is therefore 2.2%.

Die Entwicklung der hessischen Staatswirtschaft. Allgemeine Forst- u. Jagdzeitung. May, 1910. Pp. 180-185.

Stave Timber Estimating.

Estimating stave timber refers especially to oak that is to be made into tight cooperage for oil, whiskey and beer barrels. The trained estimator must have a good knowledge of the soundness of standing timber, the relation of sizes to number of staves and the various grades of staves that may be cut from various portions of the tree.

Where railroad ties are to be cut in conjunction with the stave material an estimate is also demanded for them. Occasionally some estimators give the estimate of saw timber.

In the slack barrel business the timber is estimated usually by the cord and reduced to the number of staves or, less frequently, by the thousand board feet. This is done because the timber for slack cooperage is so frequently cut from small timber or scrubby timber where the reduction factor is large and the loss great. Where lumbering is combined with slack cooperage the estimate is usually by the board foot.

The St. Louis Lumberman, Oct. 15, 1910.

Cumberland River Log Rule.

This rule originated at Nashville more than 50 years ago and gives less board measure than any other rule in general use. Logs received at Nashville are rafted 200 to 400 miles on floods which naturally dirty the log and obscure defects. Loggers usually cut the trees so as to take advantage of all swells or even crotches and occasionally logs have been plugged or cleated so as to keep the bulges beneath the water.

Since only one-third of the log is above water there are generally more concealed defects below water than above. The Cumberland rule was devised to meet these conditions, but owing to smaller sized logs and the constant increase of price of logs with a fluctuating price on lumber, Nashville operators found it necessary to change the application of the rule from measuring middle diameter to the diameter at the small end of the log. This is acknowledged to be little better than a guess and a more scientific scale is greatly desired.

The Southern Lumberman, October 29, 1910.

Diameter and Price.

A study of the change in prices of trees with increasing stem diameter for the various German species shows that larger sizes do not always mean higher prices per unit volume. Beyond a certain limiting diameter prices cease to rise, or even fall off. This fact clearly sets a mark for economical management. Each species should be cut at least as soon as it reaches the diameter commanding the highest

price. Other factors, of course, enter, but their effect is generally to lower the rotation.

Statistical data are given in the form of plotted diagrams, having for arguments price and middle diameter of stems. The prices are the averages obtained at public auctions during the past three years.

Stammholz-Mittelpreise im Grossherzogtum Hessen. Silva, August 19, 1910. Pp. 257-261.

Forest Finance Problems.

Sooner or later our rough and ready method of determining forest values will give way to more refined ones, but it is needful to escape the finesse which the soil rent theory has introduced.

In a discussion on a literary war between two authorities on forest taxation, Dr. Schiffel in his usual sane manner points out that the first need is to come to an agreement as to "what in the forestry business is fixed capital and what current capital?"

He shows that there is a difference in this respect between an intermittent and an annual management. In the intermittent business the soil alone is fixed capital, while the value of the growing stand is at every age the interest accumulating production fund, the current or working capital which is returned every r years. For this condition the well-known soil rent formula is theoretically correct. Practically it is useless, because the difficulty in estimating future yields and costs, and long-time interest rates is too problematical.

In the annual management, however, the annual income is not a return of the current capital and soil interest, but it includes the interest on the wood capital, which in this case, essentially different from the intermittent management, is like the soil fixed capital, at work in producing income. It is a forest rent, including the soil rent and the rent on the growing stock.

From this consideration it follows that the intermittent management is not a forest management but a soil management in which a forest rent does not result.

Only in the annual sustained yield management is there a forest rent developed—a real *forest* management. The annual returns pay the interest of the forest capital, which includes soil capital

and wood capital, and also repay the annual expense—the current capital—*without* interest.

Only by the erroneous conception of dissolving the annual sustained yield management into a series of *r* separate intermittent managements, *i. e.* into soil management, does the wood stock become interest paying production fund—current working capital, —an unjustifiable proceeding.

This intermittent management idea is an invention of the soil rent theory.

The application of these conceptions to forest taxation is made. The article also contains a criticism of Speidel's *Forsteinrichtung und Reservebildung.*

Ueber das Wesen des Waldkapitals, etc. Centralblatt f. d. g. Forstwesen. November, 1910. Pp. 475-485.

Taxation of Timber Lands.

Tables have been prepared showing the difference in cost of holding timber according to the present method of taxation and what it would be if the tax were made yearly for soil values but made on the timber when it was cut. Under the present method of taxation the consumer must help to bear the taxation in the increased cost of lumber but it would prevent a great deal of cutting and aid reforestation if the revised taxation were adopted.

TIMBER TAX TABLES FOR WESTERN WASHINGTON.

TABLE I.

Period	*Amount of Tax Per Acre on Present Basis, Interest Compounded Annually at 5%*					
	On Standing Timber at 40c per Annum		*On Land at 10c per Annum*		*Total Tax on Timber and Land*	
Years	*Average per Annum*	*For Period*	*Average per Annum*	*For Period*	*Average per Annum*	*For Period*
1-5	$0.44	$2.21	$0.11	$0.55	$0.55	$2.76
1-10	.50	5.03	.13	1.26	.63	6.29
1-15	.57	8.63	.14	2.16	.71	10.79
1-20	.66	13.23	.16	3.31	.82	16.54
1-25	.76	19.09	.19	4.77	.95	23.86
1-30	.88	26.58	.22	6.64	1.10	33.22
1-35	1.03	36.13	.26	9.03	1.29	45.16
1-40	1.21	48.32	.30	12.08	1.51	60.40
1-45	1.42	63.88	.35	15.97	1.77	79.85
1-50	1.67	83.74	.42	20.93	2.09	104.67

TABLE II.

Amount of Tax Per Acre, Timber to be Taxed When Cut, at a Percentage of the Stumpage Value, Land Taxed Annually.

Value Per M	*On Standing Timber, Yield 50 M BF* Rate Per M	Tax per Acre		*On Land per Acre at 10c per Annum*		*Total Tax on Timber and Land*	
For Period	*For Period %*	*Average per Annum*	*For Period*	*Average per Annum*	*For Period*	*Average per Annum*	*For Period*
$2.00	2.2	$0.44	$2.20	$0.11	$0.55	$0.55	$2.75
3.00	3.3	.49	4.95	.13	1.26	.62	6.21
4.00	4.3	.57	8.60	.14	2.16	.71	10.76
5.00	5.3	.66	13.25	.16	3.31	.82	16.56
6.00	6.4	.77	19.20	.19	4.77	.96	23.97
7.00	7.6	.89	26.60	.22	6.64	1.11	33.24
8.00	9.0	1.03	36.00	.26	9.03	1.29	45.03
9.00	*10.0	1.12	45.00	.30	12.08	1.50	57.08
10.00	10.0	1.11	50.00	.35	15.97	1.77	65.97
10.00	10.0	1.00	50.00	.42	20.93	2.08	70.93

*Actual percentage, 10.7%.

The Timberman, October, 1910.

UTILIZATION, MARKET AND TECHNOLOGY.

New Knowledge on Charcoal Manufacture.

An important and comprehensive contribution on charcoal manufacture, based on experiments under practical conditions is furnished by Denz, who for 20 years has had charge of charcoal works in Hungary and elsewhere. We can here give only the results without going into the details of the seventeen series of experiments. The author gives also a full reference list to works on the subject in German.

The first experiment was to decide whether Violette's dictum from laboratory experience was correct, that the output of charcoal made with the same temperature is proportional to the duration of the process: slow coaling producing double the amount of rapid coaling; also that the meiler must not go blue. The conclusion from the two series of experiments are as follows:

1. The relation, which prevails in the dry distillation of wood, of the duration of the process to quantity does not apply to meilers.

2. The usual opinion that the quality of the charcoal is the better and the quantity the larger the slower the process is erroneous. Not a slow but a progress adapted to conditions—sometimes even moderately accelerated—gives best results.

3. The smoke holes of a coaling zone must be kept open until the smoke becomes light blue. During this stage of blue smoke the gases escape which otherwise may cause collapse of the meiler, and the coal then gets its proper density.

4. For a continuous progress of the coaling process a certain amount of air is needful, otherwise quality suffers and even progress is not possible.

The results of a series of experiments on the behavior of the different sizes of wood showed:

1. With the same amount of air coaling progresses the faster the smaller the wood.

2. To secure the same quality of coal the progress must be faster with small wood than with stout wood.

3. To char stout wood requires more air.

4. Quantity production is larger from young wood or from the younger parts of stems, than from old wood.

5. The weight of beech charcoal is highest from young stem wood, then from branch and split wood, while overmature wood makes the lightest charcoal.

Regarding the size of meilers, it was found that:

1. The size of the meiler must be adapted to size of wood: the stouter the wood the larger the meiler.

2. When the wood is too large the process of coaling progresses with difficulty, and the labor cost is greatest. Split wood and small billets coal the cheapest.

Regarding the length of billets, experiments with sizes varying from 3 to 6 feet:

1. Both larger volume and greater weight is secured from short wood. The difference between shortest and longest was 3.3% in weight, and 6 to 9% in volume.

2. The coaling proceeds too quickly with long wood for good results.

3. Long wood requires more after filling than short wood, and this accounts for the poorer result.

4. With long wood the consolidation of the coal in the meiler is impeded.

5. In long wood the gases circulate more easily between the charred parts and deteriorate them.

6. The danger of explosives is greater with long wood.

7. The labor cost increases with the length of the wood.

An extensive series of experiments concerned itself with a comparison of the output of standing and lying meilers. The latter are the easiest to manage, but the quality as well as quantity of coal are inferior. The cause was found in the access of the gases to the already charred wood, which deteriorate the coal.

The meilers had been so arranged that they permitted access to the interior during the process.

The observations regarding the progress of the process were:

1. The progress of the charring follows the incoming air rather than the outgoing air whenever the source of air lies under or in front of the coaling zone. It is impossible in the lying meiler to lead the coaling upward.

2. The charring has a tendency to progress more rapidly at the base and towards the base. The position of the base whether rising, falling or horizontal, influences the progress in the lying meiler, just in the same manner as in the standing meilers.

In the lying meiler only straight wood of even length can be advantageously used; otherwise, labor cost becomes excessive, hence it is altogether uneconomical where the better class wood has another use.

As to the progress of coaling in standing meilers it was found:

1. In standing meilers the process can never be guided otherwise than from the top downwards.

2. It requires a centre around which the whole process moves, from which it progresses in all directions evenly.

3. Best results are obtained when the wood is seasoned or if a "forewarming" of the meiler is made, *i. e.* a light glowing is maintained in the middle of the meiler until the wood is of proper dryness.

A further investigation into the heat development and temperatures in meilers leads to the following conclusions:

1. In meilers the coaling process progresses in this manner: As soon as by the direct firing the degree of heat is reached at which the charring of the wood takes place, the charring progresses without a further outside source of heat.

To start the charring a somewhat high initial temperature is necessary, varying with species and size of billets from 315° to 420° *C*. As soon as the self charring process is begun the temperature needs to be no more than 240° to 280° *C* in the coaling zone; hence

2. Charring in meilers is a burning subdued by limited access of air, which causes shrinking of the wood to the volume of coal without any loss of substance usual with burning—an oxidation without light effects, the German "schwelen" (smoulder).

3. Small wood requires less heat than stout wood of the same kind.

4. The degree of heat which the wood under access of the proper amount of air generates itself is the most advantageous for the coaling process.

5. Real burning, fire or glowing does not take place. Only to initiate the process of charring is this required, and must not be allowed to continue beyond the initiation.

6. The descriptions in charcoal literature which refer to fire, burning, glowing, and the statement that a glowing mass is to be found in the meiler when burned out, are to be changed as not describing actualities.

A long and difficult series of experiments was made to determine the behavior of different qualities of wood, green, air-dry, soaked, sour and partly rotten, etc., of beech, fir and spruce.

1. The highest smouldering heat and the most rapid coaling is developed in the rotten or doty wood. This also develops the largest amount of gas and causes explosions readily.

2. In green wood coaling proceeds slowly at first. But when once begun it proceeds rapidly and shows a very high degree of heat at the coaling zone due to the continued development of steam.

3. Wood which has been dry and then soaked (floated) at first

chars with high heat very irregularly. Only when the water is driven off do progress and heat become normal.

The hygroscopic water is much more easily driven off than the sap.

4. In sour wood, in spite of a very high degree of heat, charring progresses slowly.

5. The lowest heat and the slowest coaling is shown by well-dried wood.

If green, wet, sour or rotten wood is mixed with dry wood in a meiler so that one of these qualities is placed on one side of the meiler, the dry wood on the other side, the progress of coaling is more rapid in the dry wood, because the steam developed on the other part works on it.

7. Rotten or doty wood, even when mixed with sound wood, chars more quickly than the latter.

8. Carburetted hydrogen is developed in any charring process, the more the higher the smouldering heat; the more steam is developed, the poorer the quality of the wood. It does not produce any injury if it can escape through the smoke holes unhindered. If it is impeded here, then it attacks first the ready charcoal; finally it may explode.

9. If under presence of steam and glowing carbon there is a formation of carbon oxyd gas, this damages the process and the result. In a fully finished meiler the coal is deteriorated, the coal crumbles into small pieces, becomes soft and light.

10. In these respects the different species show little difference.

11. Hard woods produce more severe explosions than conifers and light woods. Frequency of explosion, however, is a characteristic of conifers, especially fir.

The notion that split wood should be set with the split side to the interior was found of not the slightest value.

Placing the wood in lying position in a standing meiler was found only to be more expensive, otherwise without objection.

The ease of charring—which, with the exception of the conifers, denotes also high yield and good quality—the following qualification of species was found:

Very good coalers: oaks, beech, ash, maple, elm, birch; difficult, but large yield: spruce, fir, pine; slow coaling and small yield: willow, poplar, basswood.

The volume per cent. varies between basswood with 44.8 and oak 69.7; the weight per cent. between elm with 21.6 and oak 27.5.

1. The higher the absolute fuel value of a species, the higher lies its coaling temperature. These species cannot produce the needed smouldering heat as those with a higher specific heat co-efficient, hence they count among the difficult species.

2. If species of different heat co-efficients are to be coaled together those with the lower co-efficient should be placed in that part of the meiler which during the whole process exhibits the highest heat, i. e. in the quandel zone (center).

Finally, an account is given of the development of a method to secure by-products of wood vinegar and tar from meilers.

It was found that this could not be done from standing meilers, but a lying meiler constructed in special manner with a partially moveable cover, produced 24 per cent. excellent coal, 38 per cent. pure, strong acetic acid with small quantities of tar; and since the method permits a perfect regulation of the coaling process better results may eventually be expected. An impregnation cylinder being attached produced perfectly treated ties at the smallest expense.

Vorgänge bei der Holzverkohlung in Meilern, etc. Centralblatt f. d. g. Forstwesen. December, 1910. Pp. 526-548.

Charcoal Burning in Germany.

Charcoal burning is persistently carried on in the mountains of Westphalia, Germany, despite diminishing returns from the industry—returns which each year threaten to vanish—and despite efforts of forest managers to introduce culture of the spruce. The production of charcoal began some five hundred years ago with the smelting of the rich iron ores of the region. Until the introduction of coal and coke, the forests of these mountains were wholly devoted to charcoal production to supply the needs of blast furnaces. For there was a time when this region produced a steel highly prized throughout Europe, and ore was carried from as far away as Sweden. What charcoal is now produced finds but a local and uncertain market.

Charcoal is produced in pits and the charcoal burner of to-day follows exactly the same method of preparing and piling up his

wood and setting and burning his fires as his forefathers. The pits are carefully located to secure wind protection. The wood is placed on end layers, the lowest nearly erect, the upper each lying flatter than the one below so that the vertical section of a finished pile is roughtly a parabola. The whole is then covered with sods and brush and finally with earth and the fire started at the bottom of a narrow chimney left in the centre. Burning requires from one to two weeks. Five excellent illustrations increase the value of the paper.

Haubergswirtschaft und Waldköhlerei im Sauerlande. Silva, July, 22, 1910. Pp. 225-7.

Improved Lumber Camps.

Lumberjacks in British Columbia have started a movement for more sanitary camps, contending that some camps are splendidly equipped but in general the camp arrangements are far behind the time. Enforcement of "The Health Act" is requested and the following amendments are desired: (1) bedding owned by the company be made subject to sanitary inspection, dealt out to each man on joining the camp and charged to him, with rebatement of cost of same on his departure; (2) bath houses and wash houses to be at least 50 feet from the house, and to be of modern construction; (3) modern and sanitary bunks with springs and mattresses, and comfortable, well ventilated quarters for the men; (4) a fully equipped medicine chest with bandages and splints; (5) launches or boats in every camp to take the injured or sick to the nearest hospital or doctor, instead of waiting the call of the regular boats, which are in many cases once a week; (6) that it shall be unlawful to pay the men otherwise than in cash, or, if this be inconvenient or impossible, by ordinary bank cheque or time cheque, payable at par and on demand at some bank or reputable place of business in the nearest town or city, and that the men shall, in any event, receive on departure from camp full cash transportation to the said town or city.

Canada Lumberman and Woodworker, October 15, 1910.

Use of Cableways.

Overhead cableways are particularly useful for moving logs and sawn lumber from inaccessible forest regions to drivable streams or to railroads. Their maintenance is economical and the cost of operation is low, depending on the fall from the woods to the delivering station. Where the fall is great no power is required and in extreme cases the system may itself become a source of power. A few facts and half-a-dozen illustrations of the use of these cableways in the mountainous countries along the lower Danube are given in a recent number of "Silva."

A later number of the same periodical gives similar data for the cableway connecting the wooded upper slopes of the Usambara mountains in German East Africa with the plains below. With a slope of 87% in places this is the steepest of its kind in the world. The cableway is used to carry cedar wood and farm products from the higher slopes to the plains below, and manufactured goods in smaller amounts form the up-going load. No power is required; on the contrary the system runs a dynamo for furnishing light to the plantations below.

Zur Frage der Holzgewinnung im transsylvanischen Alpengebiet. Silva, July 1, 1910. Pp. 201-2.
Die steilste Bahn in der Welt, eine Holztransportbahn. Silva, November 4, 1910. Pp. 345-6.

Tree Felling Machine.

A novel device to replace axe and saw in felling trees and cross-cutting logs has been patented in Germany, and it has been widely described in lumber trade journals of that country and this. The cut is made by burning with the heat developed from the friction of a one-millimeter steel wire drawn back and forth across the stem at the rate of 1,500 times a minute. Power is furnished by an electric or gasoline motor set up a hundred feet or more from the tree to be felled. A pair of steel cables runs to the stem to be cut. The ends of these cables have suitable clips for attaching the wire which makes the cut. The length of this wire is about twice the diameter of the stem. A new wire is used for each cut. The cost of these wires is less than one cent apiece. The operation of the felling machine requires one man attending the motor. It is difficult to compare the time required for making

similar cuts by hand-sawing and by machine, but such data as are available indicate that machine-cutting is a little faster on small trees and may be as much as six times as fast on larger sizes.

Die Gantke'sche Baumfällmaschine. Silva, August 26, 1910. Pp. 267-72.

Logging Costs in Oregon and Washington.

In Washington and Oregon, a good crew of fellers should average seven to ten trees, or 50,000 feet of timber a day in timber that averages from 5,000 to 7,000 feet to the tree; eight to thirteen trees, or 40,000 feet in timber that averages 3,000 to 5,000 to the tree; and fifteen to thirty trees, or 30,000 feet in timber averaging 1,000 to 2,000 feet per tree. Two buckers should follow each set of fellers unless there are several windfalls or rough slope land when there should be a third bucker. Two adjoining operators are known to have varied 10,000 to 15,000 board feet in loss due to breakage because of carelessness on the part of fellers in one camp. This can be easily prevented by checking each crew's work. Three sets of fellers are needed for each two yarders, and where one set of fellers does the work for a single yarder the yarder is working slowly. Felling and bucking timber averaging 5,000 to 7,000 feet per tree should cost 45 cents a thousand; 3,000 to 5,000 feet per tree, 55 cents; 1,000 to 2,000 feet per tree, 65 cents. This includes the cost of filing, new saws, axes, and sledges.

In donkey yarding many operators lose money by using machines that were never large enough for the work or are too old. On machines large enough so that it is not necessary to block any logs out of the woods, the main line for a 10 by 12 yarder should be 1 1-8 inches in diameter, and for the trip or haulback line nine-sixteenths of an inch; on a 11 by 13, or 12 by 12, compound the trip line should be 1 1-4 inches and the haulback five-eighths. These lines should log 5,000,000 feet before breaking. All cable breaking on yarders should be prevented by transferring the cable to a road machine as soon as it shows signs of wear. Nine hundred feet is considered a good average working distance. The following table shows average results that may be expected from a yarder:

Board feet per log	*Am't yarded per day*	*Cost per thousand*	*Board feet per log*	*Am't yarded per day*	*Cost per thousand*
2,000	90,000	$0.40	1,000	55,000	$0.65
1,750	78,750	.45	750	41,250	.87
1,500	67,500	.53	500	32,500	1.12
1,250	62,500	.59	250	22,500	1.60

This table makes allowances for time lost in moving yarders from one location to another and the cost is based on a crew containing one driver, one fireman, one-half wood bucker, one chaser, one hook tender, two rigging slingers, one swamper and sniper which costs $26 per day to which should be added $10 for upkeep of machinery, blocks, rigging, lines, etc. In this table it is assumed that the trip or haulback line is run 425 feet a minute, the main line 225 feet a minute, but, if the machine is working at 450 feet, the actual length of time that the machine is really hauling logs is about two and one-half hours, which with the necessary short starts to straighten logs in the woods makes five hours. Four hours is allowed for placing chokers, unfastening logs by chaser, pulling windfalls and changing the head block on the trip line. One hour per day is allowed for an accumulation of time in which to move the donkey engine which usually averages about 800 feet in seven hours.

Two-and three-log pole roads should not cost more than 27½ cents per foot and need no care after construction if properly built. Running chutes are estimated to cost 55 cents per foot for large fir timber. A road engine has an average length of haul of 3,000 feet and it is advisable to have the machine large enough to care for the output of two yarders. If the distance exceeds this a swing donkey is recommended. The crew usually consists of an engineer, fireman, wood bucker, chaser and a grab man. The average cost of labor and deterioration is about $32.50 per day.

Size of log in bd. ft.	*Cost of road donkey work at $32.50 per day*	*Yarding timber directly to railroad*	*Yarding to a 3,000 ft. pole road with two yarders*	*Yarding to a 3,000 ft. pole road with one yarder*
250	$0.70	$3.95	$4.70	$5.40
500	.50	3.47	4.02	4.52
750	.40	3.07	3.52	3.92
1,000	.30	2.90	3.25	3.55
1,250	.26	2.79	3.10	3.36
1,500	.25	2.68	2.98	3.25
1,750	.21	2.60	2.86	3.07
2,000	.18	2.55	2.78	2.96

In compiling the figures for the last three columns railroad expense is computed at one dollar per thousand with an additional 10 cents allowed for surveys, buildings, etc.

The Timberman, October, 1910.

Pacific Coast Log Roads.

The logging railroads of the Pacific Coast from San Francisco north to near the Arctic circle represent 2,000 miles, requiring $1,500,000 for repairs and replacements and $1,000,000 for new lines and equipment. In 1909, Washington had 630.75 miles, divided among 154 sawmills or an average of 4.09 miles per mill. The longest line of 32 miles is owned by the Polson Logging Company while three companies own 20 miles or more. These figures do not include several short lines which carry on general business but are dependent upon the sawmill for 90 per cent of their revenue.

The average cost of a main line logging road in Washington or British Columbia is $7,655 and the cost of equipping a road which operates one yard or a standard crew of men in the woods is $29,200. On this basis a ten mile road and the equipment would cost $110,000. A few years ago, 15 per cent. grades were not unusual but 4 per cent. grades are now the upper limit; 25 degree curves have been replaced by a maximum of 12 degrees and the standard rail is 56 pounds, although 36 to 65 pound rails are in use.

American Lumberman, November 19, 1910.

Good Roads and Forest Use.

In the sixteen counties of North Carolina that are west of the Blue Ridge Mountains about three-fourths of the area is in forest and most of this land is better suited for forest production than for any other use. In 1909, the state forester estimated that 15 million cubic feet of timber was hauled to market over the public roads of these counties. The estimated cost of hauling this timber was $750,000 which is twice as much as its stumpage value. This cost of hauling necessitates the leaving of lower grades and inferior species in the woods as well as tops and small logs that might otherwise be used for cordwood. Good roads would mean a closer utilization that would decrease fire danger in the smaller

amount of debris left as is shown in Buncombe county where cordwood can be hauled for six to ten miles at a profit on good roads but on three-quarters to one mile where the roads are unimproved. Good roads also increase the value of cut-over lands after the lumbermen have finished cutting the merchantable timber. Inter-county roads of good construction are recommended as an important undertaking and are being rapidly constructed in this state.

"Good Roads and Lumbering," The Southern Lumberman, December 24, 1910.

Change in Use of Species.

Up to 1880, White Pine was most extensively used for interior finish for all buildings except those of highest class for which hardwoods, including mahogany, prevailed. About 30 years ago southern pine began to encroach on White Pine for this use, and this has been followed by cypress and many hardwoods. Redwood, Douglas Fir, spruce and cedar from the Pacific Coast have gained considerably in the last ten to fifteen years but have been slow because of high freight rates. Hemlock had been used for dimension materials for several years in New England but did not begin to have a value in the middle West until 1885.

Hardwoods have shown the greatest diversity. Up to 1880 White Oak was used almost to the exclusion of other hardwoods. Then the value of Red Oak was recognized and gradually became an important species. In the late 80's Hard Maple became important as a flooring material and now several other hardwoods are of great importance. It was not until 1886 to 1890 that cottonwood and gum first were considered but are now standard box materials competing strongly with northern pines.

American Lumberman, December 17, 1910.

Square Timber Trade

In the early part of the last century the entire export of Quebec pine was squared timber, hewn with the axe. This timber was floated down to Quebec, where it was butted and dressed. Culls were used locally for wharf timber and other similar uses. The square logs were converted into planks and boards at sawmills in the large

towns in England, but in county yards, pit sawing prevailed. In 1861, waney pine was first allowed; the timbers were left with 3 to 6 inches on the corners to avoid waste in hewing the timber exactly square. The first raft of square timber on the Ottawa River left the mouth of Gatineau River June 11, 1806, and took 28 days to reach Montreal. In the early days the rafts were very crude. Cables were made from twisted birch saplings, anchors of wood and the wooden oars, which were 24 feet long, were hewed from small trees. The industry has largely disappeared with the introduction of the modern sawmill. A detailed table of the output of square and waney timber from 1845 to 1909 is appended.

Canada Lumberman and Woodworker, January 1, 1911.

Glut in Low Grades.

The greatest difficulty confronting hardwood millmen to-day is how to realize a profit or even cover the cost of production in low grade lumber. The demand for box material has been less since the introduction of fiber and paper boxes which are rapidly replacing lumber. Low grades are consquently piling up in various parts of the country, especially at points remote from consumption.

This decline may cause development in use superior to that of boxes. It is said that no other problem before the hardwood millmen is so important and that, despite other statements to the contrary, hardwood lumbermen have made little progress toward effective forest conservation or economic utilization of their product. Dry kilns at points of production would aid materially but other solutions must also be made.

Hardwood Record, October 10, 1910.

Quebracho.

This tree is the most valuable of all the species growing in Argentine Republic. It has been used extensively for railroad ties and fence posts, and is said to have lasted 40 years. The bark was formerly exported in large quantities for tannin but now the extract is shipped. The center of the quebracho trade is Santa Fe, a city about 350 miles north of Buenos Aires on the Parana River. During the year 1909 Argentina exported 55,493

tons of quebracho extract valued at $4,226,333 in Argentina gold (one dollar Argentina gold equals $0.965 United States money). The principal market was the United States which received 25,693 tons; Germany received 6,265 tons.

The Lumber Review, November 15, 1910.

Use of White Cedar and Enemies.

The species *Chamaecyparis thyoides,* is native to the Atlantic coastal plain from Maine to Florida growing mostly in springy swamps. Its best stand development is reported to be in Ocean County, New Jersey. The largest stand is located at Double Trouble on Cedar Creek which flows into Barnegat Bay, and covers 1,800 acres. The species has a remarkable density which often prevents a man from walking through its stands. Forest fires are practically unknown because of swamp conditions.

The species is used almost exclusively by boat builders who now pay $65 per M at the mill. Siding and one-half inch stuff demand $25 per M at the mill. It makes the highest class 4.18 and 4.24 inch shingles and is second only to tamarack for ship knees being used for bilge timber, braces and breast hooks while the tamarack is used for sternposts and post wells. The most extensive use is for telegraph poles. A minor industry of great importance in this forest type is the collection of spagnum moss which yields $10 per ton when dry.

Many fungi affect the white cedar. The hair root fungus, *Agaricus melleus,* which is coarse and bushy like an Indian's hair, bores through the roots or knees of the cedar and cuts them off below ground. High winds then blow the trees over if there is enough space or against other trees. Often as soon as the tree is felled it is attacked by *Coriolus prolificans* which is distinguished by its large number of small brackets. Later on its decay, *Elfvingia megaloma* and *Fomes annosus* are common. A new species which is badly destructive is *Steccherinum ballouii.* This species forms buff-colored fruiting bodies which occur in the crowns of the trees but may work down on the top portion of the trunk.

American Lumberman, November 12, 1910.

Utilization of Tupelo Gum.

This species, *Nyssa aquatica,* is also known as Tupelo Gum, Cotton Gum, Sour Gum, Large Tupelo, Swamp Tupelo, and Wild Olive tree. The tupelo has an extended commercial range in eleven states, and produced twice as much lumber in 1907 as in 1905. The tree attains a diameter of 3 to 4 feet and a height of 65 to 90 feet. It is chiefly associated with cypress.

The wood is close grained, compact, with thin, numerous medullary rays, of a light brown or often nearly a white color.

Early settlers generally let tupelo alone. In a list of the uses of this wood published a century ago was large wooden bowls, wagon beds, hubs for heavy wagons and one-piece cart wheels. The wood was one of the first substitutes for Yellow Poplar. For 200 years Yellow Poplar was the principal stock for tobacco hogsheads but increased prices have caused a large use of Tulip Poplar. Plug tobacco boxes which were once made almost exclusively from sycamore are now largely made from Tulip Poplar. A comparatively large amount is exported to Europe as square timber where it is resawed and used for interior finish.

The amount of veneer cut from this species in 1907 was about 15 million feet or about 4 times as much as black walnut. Veneer trunk makers prefer it to all other woods because it may be had in sizes large enough for the largest trunks. It is especially desired as backs for mirrors when 3 or more sheets are glued together. Occasionally it is used for outside finish.

Tupelo floors in warehouses and factories are claimed to wear smoother and longer than oak or maple. It is also used for pump logs, conduits, tramways, sills for lumber trucks, piano cases, piano tops, carriage bodies, many kinds of furniture, crates, baskets, boxes, packing cases of grills, coffins, sounding boards for musical instruments, slack cooperage, turned table legs, spindles, balustrades, posts, columns, plasterers' laths, picture frames and its cord-like roots are occasionally substituted for cork on fish nets and bicycle handles.

The Tupelo Gum has few insect enemies but often decays quickly from fungus attacks. It takes preservative treatment readily and a large part of its future use may be for cross ties, cross arms, posts, poles, mine timbers, shingles, pump logs and

paving blocks. Tests have shown that it is satisfactory for pulp which is good enough for print paper and possibly for book paper.

American Lumberman, Nov. 26, 1910.

Value of Lodgepole Pine.

The use of Lodgepole Pine has increased largely in the last two years because of the high prices for other species and a recognition of the merit of this species. It has principally a local use for rough lumber, mine props, railroad ties, and fence posts in regions where it grows naturally. Its distribution is said to have increased greatly during the past 300 years as a result of fire. The seed of this species, protected by serotinous cones, gives it an excellent opportunity to establish itself after burns.

Before 1905, Lodgepole Pine stumpage sold uniformly on National Forests at about $1.00 per thousand board feet. In 1905, a maximum price of $2.50 was received in one large sale, while in other cases $1.50 to $2.00 was received. In 1906, prices ranged from $2.00 to $5.00 per thousand according to local conditions. The yield rarely exceeds 7,000 board feet per acre, but occasionally goes as high as 20,000 board feet.

Over 2,000,000 ties of this species are used annually, of which 1,800,000 are cut from National Forests. The Union Pacific and Burlington railways prefer Lodgepole Pine ties over any other species of western timber on account of ease of preservative treatment. The Northern Pacific Railway is beginning to use them. The average price for standard ties is about 50 cents each, and for second-class ties is about 30 cents each.

Mines in Wyoming and southern Montana annually demand 300,000 to 500,000 pieces, or 3,000,000 to 5,000,000 linear feet. Of this amount Lodgepole Pine forests furnish about 3,000,000 linear feet. Lumber in the rough sells at $14 to $16 per M, surfaced, at $17 to $19. Flooring sells at $18 to $22 per thousand and lath at $5 to $6 per thousand. These prices prevail where the timber is easily accessible. Flooring has sold as high as $30 where long hauls are necessary.

It is believed that Lodgepole Pine will find a broader future

market by being used for fence posts, box board pulp, telegraph poles and telephone poles.

American Lumberman, November 12, 1910.

Walnut Burls.

True burls are quite rare and few dealers have enough knowledge to form an accurate estimate of their value from exterior appearances. Root burls covered by soil are usually valuable while those growing higher up are exposed to the elements, bark grown, and often insect infested. Burl may take any form, but the most desired form is that of a turnip. Burls at the surface of the ground send out roots and the fewer roots the greater the value of the burl since the roots are straight grained. They are sold by the pound at 10 to 15 cents and higher.

Black walnut is a very common burl tree and is more productive of the malformation where the timber is somewhat dwarfed and stunted. Burl veneers are cut by sawing, slicing or the rotary process and great skill is required in opening and cutting in order to get the finest figure on the same block.

The Wood-Worker, October, 1910.

Mahogany.

True mahogany, *Swietenia mahogani,* stands in a class by itself and most of the woods sold under the trade name of mahogany are inferior. This unexcelled cabinet timber has been exploited for about 200 years and large, accessible trees are now scarce. It was first imported into England, unmanufactured, in 1724 and since that time the demand has been much larger than the supply causing the use of more than twenty substitutes under the trade name. The so-called African or Gambia mahogany which is largely used is *Khaya senegalensis.* The principal American species used as a substitute is *Cedrela.* Other prominent genera used are *Soymida, Chukrassia, Trichilia, Guarea, Pterocarpus, Calophyllum, Cariniana, Persea, Swartzia, Caesalpinia, Eucalyptus* and *Tristana.*

Hardwood Record, October 25, 1910.

New Method of Turpentine Gathering.

The Gilmer system of turpentining has been inspected by a large number of lumbermen and turpentine manufacturers. This system distills crude turpentine directly from the tree by an air-tight cup. The tree is tapped without hacking and it is claimed that it does not injure the tree in the least and is as rapid as the old method. A Union Naval Inspector made an analysis of the ground showing that 748 pounds of crude turpentine gave 530 pounds of resin and 148 pounds of spirits, equal to 13½ gallons to the barrel. This gave 19.78 per cent. turpentine, 70.85 per cent. resin and 9.37 per cent. waste which is a gain of 18.54 per cent. over the old method.

Southwest, October, 1910.

Value of Turpentine Limits.

A few years ago the turpentine privilege sold for $3 per acre for a 3 year period but at present the price averages about $4.50. This is for stands of 10,000 to 12,000 feet. Privileges are usually based on a "crop" of 10,500 boxes at a price of $700 to $800. Many quarter sections average this number of boxes but if more than 160 acres are required the cost varies from $2.50 up depending upon the cost of operation. Other factors such as swampy or high ground, condition and size of timber, number of trees to the acre and general accessibility greatly affect prices.

American Lumberman, Nov. 12, 1910.

Apple Barrels.

Apple barrels are generally made of ash, gum, or other hardwoods with elm hoops as a standard. The stave is 28½ inches long with an average width of 5½ inches. Six hoops are generally used but occasionally eight hoops are used for special purposes. Coopers are careful to maintain the uniform capacity of three bushels. Number 2 stock is generally used for apple barrels; white No. 1 stock is used for flour. In the South where the heat is intense many plants use negro labor exclusively.

Barrel and Box, October, 1910.

Beer Kegs.

The average beer keg of eight gallons capacity sells for $2.25 to $2.35 and has a life varying from 3 to 10 years. It is sometimes refilled as often as twice a week but if it is assumed that the cost is $2.25, refilling 50 times a year, average life 4 years and $1.75 for repairs on the basis of 25 cents for each replaced stave and 28 cents for each new hoop, the cost of the package would amount to one-fourth of a cent for each gallon as against approximately four cents a gallon for glass bottles.

Barrel and Box, October, 1910.

Wooden and Fiber Boxes.

One- fifth to one-sixth of all the sawmill output of the United States is made into boxes and most of this is low grade material that remains after sorting. In 1910, the Forest Service carried out an investigation in Massachusetts, Maryland, North Carolina, Kentucky, Illinois and Wisconsin and found a total use of 1,137,137,000 feet or 63 feet per capita. At this rate there was a falling off of 1,000,000,000 feet from the year 1907. The material for fiber boxes is largely produced by pulp mills and usually completed by box mills that glue and cut the boxes. The size of fiber boxes, thickness of board, and minimum strength of board are governed by the regulations of railroads and are strictly enforced. The three sizes specified are 60, 80 and 100 points—that is 60, 80, and 100 one-thousandths of an inch respectively. The 60 point box must not have its three dimensions exceed 65 inches with a filled weight of 40 pounds; the 80 point box must not have its three dimensions exceed 70 inches and the 100 pound box must not exceed 75 inches and a filled weight of 90 pounds. Express companies will accept weaker boxes than railroads.

In this investigation 57 per cent of the fiber boxes were found to be made from chip, 22 per cent. from straw, 16 per cent. from wood pulp and 5 per cent. from jute.

In a general way the fiber boxes cost 10 per cent. less than wooden boxes. 90.6 per cent. of all boxes are wood against 9.4 of fiber if based on surface measure. Competition between the two kinds of boxes is active for comparatively small

sizes only where extra strength is not required. Fiber does not stand water well but never imparts taste while some wooden boxes impart taste. Rats gnaw fiber boxes more than wood but theft is more common from wooden boxes. Both boxes are largely made from different kinds of low grade material and may be used over and over, by re-pulping the fiber box and using the wooden box as it is and finally converting it into fuel.

American Lumberman, Dec. 10, 1910.

Wood Paving Specifications.

The most important specifications adopted for wood block paving by 43 representatives of large cities from all over the United States are as follows:

The wood to be treated shall consist of Long Leaf Pine, Norway Pine, Black Gum or Tamarack, but only one species shall be used in one contract. Longleaf Pine blocks shall be cut from sound timber, well manufactured, full size, saw-butted, square-edged and shall be free from hollow knots, worm holes, knot holes, through-shakes and round shakes that show on the surface, and not have an average of less than six annual rings to the inch measured radically. The other species shall be of a first grade similar to that demanded for Longleaf Pine.

The blocks may be from 5 to 10 inches long but shall average 8 inches, three and one-half to four inches in depth according to traffic, and 3 to 4 inches in breadth. All blocks in one street or improvement shall be of equal size. A variation of one-sixteenth of an inch shall be allowed in depth and one-eighth of an inch in width. The blocks shall be treated with a specified grade of oil, and contain not less than 20 pounds per cubic foot for pines and tamarack, and 22 pounds for gum.

The oil must be a coal tar product free from adulteration, specific gravity of at least 1.10 at 38 degrees C., and not more than 3 per cent. of the oil shall be insoluble by hot, continnous extraction with benzol or chloroform.

Blocks are to be laid on a sand cushion one inch in thickness laid upon concrete foundation. Pitch or fine sand is to be used as a filler. All expansion joints are to be laid along the curb and traverse joints one-half inch in width every fifty feet along

the street; these joints are to be filled with a bituminous composition.

American Lumberman, Dec. 17, 1910.

Thickness of Veneers.

Thickness of veneers is causing considerable discussion among the manufacturers and the users. According to reports from the U. S. Forest Service the greatest quantity is cut 3-16 of an inch thick, with $\frac{1}{8}$ inch thickness second, and $\frac{1}{4}$ inch third. These figures show the average thickness but are misleading as they do not show the relative thickness of veneers used for different purposes.

At present, face veneering proper is mostly cut in thicknesses of 1/16, 1/20 and 1/28 of an inch in both the rotary-cut and the sawed or sliced stock. Formerly most of the sawed or sliced stock was cut 1/16 to 1/20 of an inch thick while rotary stock aften ran up to 1/16 or 1/8 inch for face veneering. The present tendency, however, is toward the thinner veneers running between 1/16 and 1/20 of an inch while it is expected that another year or two will bring the average close to 1/20 of an inch except in mahogany and some other valuable imported woods which are commonly cut to 1/30 of an inch.

There is already springing up a difference in practice since door and millwork users generally demand 1/8 inch material and some of this is used in furniture panels. Naturally the greatest bulk of thick veneer is used as thin lumber in box shooks and other package making.

Woodcraft, November, 1910.

Cost of Veneer Cutting.

With a total factory and miscellaneous expense of $73 per day per machine, a log cost of $20 per thousand and an average per cent. of waste that the author has found from experience in Northern Wisconsin, the following costs are given for single-ply, rotary cut stock:

1-28",	$3.12
1-24",	3.52
1-20",	3.87
1-4 ",	13.31
1-16",	4.71
1-8 ",	8.00
3-16",	10.25

Hardwood Record, Dec. 25, 1910.

Cottonwood Boxes.

Cottonwood was for a long time considered almost worthless. The demand for box material brought it into extensive use and at present there is frequently a demand for cheaper substitutes. Cottonwood varies considerably in color from pure white to nearly the color of red gum. It takes printing excellently and rivals the basswood in this respect. It is almost exclusively used in the middle west for high-grade whiskey boxes which often demands one of the highest type of boxes constructed. Its special value is increased because of the large sizes, tough fiber in proportion to weight and a spongy quality that enables it to stand shocks.

The St. Louis Lumberman, Dec. 1, 1910.

STATISTICS AND HISTORY.

Swiss Wood Trade.

A valuable contribution to the statistics of the Swiss republic is furnished by Prof. DeCoppet's report on the wood trade with foreign countries during 1885 to 1907, a sequel to Dr. Bühler's statistics for 1851 to 1885.

For former years the custom house reports have served, but since 1907 a regular forest statistical office has been provided.

Since 1885, the importation of cordwood and charcoal, as well as of logs, has increased, the latter five fold. For sawed material there is also a rise, but export has decreased much less than in the raw product.

In 1885 pulpwood was being exported in excess of import, in 1907 the opposite is the case. The total wood import, which in 1885 was nearly balanced by export, has more than doubled,

from 10,600,000 to 24,600,000 cubic feet, and from $2.6 to 9 million in value, while the export has fallen from $2.2 to 1.6 million. Austria furnishes about one-half of the total import while about two-fifths of the workwood import comes from there; another two-fifths from Germany, while in 1885 the import from Germany amounted to four-fifths.

Especially sawed material is for the most part furnished by Austria, displacing Germany.

In 1907 the total consumption in the country was: workwood, import 14,100,000, home production 35,300,000; fuelwood, import 10,600,000, home production 36,400,000; or altogether over 94 million cubic feet of wood, or about 30 cubic foot per capita, half of which workwood.

The author uses this showing to point out the necessity of better management of the 2.5 million acres of home forest.

Statistik des Holzverkehrs der Schweiz mit dem Auslande. Schweizerische Zeitschrift. June, July, 1910. P. 220; also Centralblatt f. d. g. Forstwesen. November, 1910, p. 492.

Lumber Prices.

The lumber trade of Michigan, Wisconsin and Minnesota was slight from the early 40's to 1862 or 1863, but the Civil War caused a boom in the late 60's which was followed by a collapse in the panic of 1873. After the restoration of specie payments in 1879 the white pine business improved rapidly until the boom of 1881, but declined in 1882 and 1883. From 1883 there was a steady increase in prices due to the rapid settlement farther west until the panic of 1893. At this time stumpage values had increased to $3 or more a thousand, lumber began to be based on stumpage values, and there was an effort to standardize stumpage values; but this failed. Many operators made a profit owing to the ease of handling logs and lumber on the water even though they would have lost if stumpage values had been considered.

The southern pineries are at present in the position of the northern pineries during the years of 1850 to 1875, with worse effects due to the necessity of moving the southern pine almost as soon as manufactured.

American Lumberman, Nov. 19, 1910.

Canadian Pulpwood and Pulp.

In 1890, the raw pulpwood material exported from Canada amounted to $80,005 of which $22,808 went to Great Britain and $57,197 to the United States. By 1900, this export amounted to $902,772 of which $38,370 went to Great Britain and $864,077 came to the United States. In 1909, the total had reached 794,986 cords, valued at $4,356,391, practically all of which went to the United States.

The wood pulp record is even more striking. In 1890 Canada exported $168,180 worth of pulp of which $460 went to Great Britain and $147,098 to the United States. By 1890, this export reached $1,806,016 of which $562,178 went to Great Britain and $1,193,753 to the United States. In 1909, the total pulpwood export was $4,306,929. Great Britain received $1,084,720 and the United States $3,064,879 while the remainder went to France, Belgium, Mexico, Japan, Argentine Republic, Cuba and miscellaneous countries in the order named.

Pulp and Paper, October, 1910.

Timber Trade in Spain.

Spain is very sparsely timbered and depends largely upon importations from Norway, Sweden, France, Russia, Portugal and the United States. The latest year for which statistics are available, 1908, shows the value of imported lumber and staves as $7,382,000 of which $1,515,000 worth came from the United States. The value of staves, shooks, etc., from this country amounted to $644,122 which is charged tariff at the low rate of 2 cents per 100 lbs. Ordinary species in logs or pieces more than 40 millimeters thick are charged tariff at the rate of 5 pesetas (96½ cents) per cubic meter which amounts to $2.29 per thousand board feet, while smaller material is charged 6 pesetas ($1.16) per cubic meter or $2.75 per thousand. All American woods with the exception of walnut are classed as ordinary. High rates are charged on all manufactured material with the result that most of it is manufactured at home.

Most of the lumber is imported by Madrid dealers, while Barcelona is the center for stave material. "American style" furniture, especially for offices is becoming popular, but is mostly

home made. White and Yellow Pine is the chief lumber imported in the Valencia district; beech from Austria-Hungary and the Balkans is preferred for furniture, coach building and cabinet making.

Lumber Trade Journal, November 1, 1910.

Silvicultural History.

A comparison of present conditions in a forest with the forest description and working plan of a hundred and twenty years ago is one of the interesting possibilities in Germany. This stock taking and planning were made like many since, as a preventive measure against an impending wood-famine. On making such a comparison, the present forester finds the soil has improved with the change from coppice and mixed forest to high forest; that conifers have been introduced by way of experiment on soils which produce higher returns under hardwoods; that in that day some minor species, notably birch, were given consideration, where now they are disregarded as timber trees.

Highly satisfactory results have come from natural regeneration of spruce, and natural seeding has maintained an admixture of cherry in oak stands. The wonder is how in the face of such excellent results natural regeneration was in the last half of the nineteenth century so entirely neglected and planting practiced instead. The hope thereby to gain the four or five years represented by the age of the plants when set out seems to have been the controlling factor.

Fichtenverjüngung einst und jetzt. Silva. June, 1910, pp. 193-5.

Austria Reform of Forest Administration.

In these days of budding forest administrations on the American continent the extended discussion by Kubelka of the needs of reform in an old established organization are, or ought to be, of interest, even though only the principles underlying the organization are of value to us.

The article follows a monographic discussion of the same subject by Charbulas, and goes into minute details, describing existing organization and criticizing it. It discusses the division of labor among the forest officials, and here criticizes the lack of

freedom of the man in charge of the local administration. The method of woodsales especially he wants to see improved in commercial directions, so as to enable the district managers to take advantage of market fluctuations.

Account keeping and budget formulation is treated in detail. Reduction of office work and of reporting work is urged so that the manager may devote more time to the woods; a short monthly report, from which the annual can be compiled, takes less time than an elaborate annual report.

The wider use of telephones is pointed out as a labor saving device within the forest and from and to head offices.

Inspection comes in for considerable discussion, as well as the character of personnel and advancement, the change from bureaucratic to collegiate form of direction. The details would lead us too far to elaborate.

Zur Frage der Reform der Staatsforstverwaltung. Centralblatt f. d. g. Forstwesen. October, 1910. Pp. 427-448.

Commercial Courses.

The Austrian forest administration has for the last five years instituted a commercial course for its officials, in which a dozen or more of the forest officials are ordered to attend lectures for eight weeks, and at the end of the course to an excursion to wood consuming factories under competent guidance (Prof. Marchet).

This excursion of 12 days duration is reported upon. It included visits to lumberyards, sawmills, planing mills, furniture and barrel manufacturers, impregnation works, shipping yards and harbors in leading wood markets, the excursion extending to Brussels and Antwerp.

This is certainly a unique institution for widening the horizon of the men who are called upon to direct eventually the forest policy of the country.

In another place a similar course for private forest officials to be held in Vienna is announced by one of the instructors at the government course.

Studienreise des Kommerziellen Kurses für Staatsforstbeamte im Jahre 1910. Centralblatt f. d. g. Forstwesen, October, 1910. Pp. 457-466.

Private Forest School in Prussia.

As interesting in showing the progress of private forest management in Germany, the institution of a new private forest school in the neighborhood of Berlin (Neubrandenbury) by two Oberförster may be referred to. The purpose is to educate on practical lines both lower and higher grade foresters for private employment and also sons of forest owners, somewhat like Dr. Schenck's school. It is to be a boarding school.

Centralblatt f. d. g. Forstwesen. October, 1910. P. 469.

Vicissitudes of a Forest School.

The oldest German forest high school, at Aschaffenburg, Bavaria, closed its doors on July 30, 1910. It had been founded in 1807, and with an interruption of a short period (1832-1844) for over ninety years prepared the foresters, wholly or in part, for the Bavarian forest service. Since 1878 when a forestry faculty was organized at Munich, it laid in a two years' course the foundation for the two years at the University which now has also been transferred to the University.

Dr. v. Fürst, well known even to American foresters by his volume on forest nursery work, its director for the last 32 years, retiring at the age of seventy-three, writes interestingly of the history of this institution.

When the school started the city and its surroundings belonged to the electorate of Mainz, but in 1814 it came into Bavaria. Originally it was a conception of some professors of the gymnasium, a municipal institution with a one-year course, but in 1819 was made a State institution, when a course for the lower and another two-year course for the higher education were organized.

This hotch-potch did not work well, and the quarrels among the staff broke up the institution in 1832, and transfer of the education to the University, giving up the idea of an academic education for the lowest forest officials to the rank of supervisors. In consequence the poor quality of these officials led to the re-establishment of the school in 1844 with a 2-year course, an organization of a secondary school character, the University con-

tinuing its work for the higher grades, until in 1848 this part was discontinued.

A reorganization in 1858 brought improvement, but did not bring the institution to a satisfactory position. In 1878, the new order of things, was inaugurated by a division of functions between the school and the University, and the troublesome times for the school seemed past. But it became apparent that the duplication of apparatus at the two institutions for the few students—by 1906 the number had fallen to 15—was an uneconomical arrangement and the abandonment became a natural sequel in the evolution of the forestry education of Bavaria.

The interest in the history of the school will remain as long as the names of the eminent men who taught there are quoted as authorities; several of them, known even in America, like Fürst himself, Gayer, Ebermayer, Weber, Schwappach, the botanist Prantl, while Behlen, the founder of the Allgemeine Forst-und Jagdzeitung, Mantel and Stumpf, once acknowledged authorities, are already nearly forgotten.

Die forstliche Hochschule Aschaffenburg. Forstwissenschaftliches Centralblatt. December, 1910. Pp. 621-633.

MISCELLANEOUS.

Lumbering in India.

Sawmills are run by Europeans and by natives. Usually the European mills are superintended by an Englishman assisted by natives but in large Calcutta and Bombay mills the engineer and one or two of his assistants are also white men. Native mills are of very poor class but some of the European mills have the finest equipment. There is a strong demand for lumber, particularly in Calcutta, Bombay and Madras. The railroads, contractors and government cause a good demand "up country." Railroad rates are cheap but wages vary greatly according to the district. In Calcutta the native may receive $5.00 per month, but in the north and south, two-thirds of this sum is an average wage.

Sawmill Operations in India, American Lumberman, Dec. 17, 1910.

Siberian Wood to United States.

According to a newspaper correspondent Americans "have found it necessary, on account of the expense and difficulty of securing wood supplies from Canadian forests, to go to Siberia and Manchuria." While during the building of the Chinese railroad the United States furnished large quantities of wood material, now a company of Russians, Americans and Chinese has been formed at Charbin which has a commission from the Chinese government and has begun to exploit the large cedar forests of the province Girin. The company works energetically with large means, and "find great support on the part of the government of the United States." Last year over 30,000 cedar logs were ready for shipment.

Centralblatt f. d. g. Forstwesen. October, 1910. Pp. 471.

OTHER PERIODICAL LITERATURE.

American Forestry, XVI, 1910,—

The Protection of Forests from Fire. Pp. 659-667; 710-717.

The Forests of Alaska. Pp. 704-709.
Abstract from Bulletin 81, U. S. Forest Service.

The Cabinet Woods of the Future. Pp. 723-729.
Description of suitable species, mostly Brazilian.

Where Forestry Can Be Studied. Pp. 730-733.
A list of institutions in United States where forestry is taught, with brief statement of scope of work done in each case.

(XVII, 1911),

Forestry Progress in New Hampshire. Pp. 19-29.
Historical.

The Protection of Forests from Fire. Pp. 41-47.
Conclusion of Bulletin 82, U. S. Forest Service.

Shall States Regulate the Management of Private Forests? Pp. 82-88.

The Minnesota Forester, III, 1910,—

The Forests of Costa Rica. Pp. 128-131.

Descriptive.

Bulletin of the American Geographical Society, XLII, 1910,—

Alaska Agricultural Possibilities. Pp. 888-903.

The Botanical Gazette, L, 1910,—

Reversionary Characters of Traumatic Oak Woods. Pp. 374-380.

The reversion of pith rays of severely wounded areas to the uniseriate condition is further evidence that the large "primary" ray is an aggregation of numerous small rays.

The Ecology of Conifers. Pp. 394.

(LI, 1911),

The Phloem of the Juglandaceae. Pp. 131-135.

Science, XXXIII, 1911,—

Pecan Scab. Pp. 77-78.

An account of the work of *Fusicladium effusum,* Wint. Varieties transferred from dry Texan conditions to the humid conditions of the gulf coast seem more susceptible.

The Formation of Carbohydrates in the Vegetable Kingdom. Pp. 131-142.

A résumé of the researches in this field.

Relation of Certain Fungi to Nitrogen Fixation. P. 191.

In culture experiments with five species no fixation was indicated.

Spruce Burls. P. 193.

Notice of description of appearance and anatomy of burls on white spruce in Maine and Minnesota.

Rust of Tsuga canadensis. P. 194.
Notice of a new species of Caeoma on the cones.

Canadian Forestry Journal, VI, 1910,—
Forestry for Municipalities. Pp. 99-104.

Ontario's Forest Fires. Pp. 107-109.

The Pulp and Paper Magazine of Canada, VIII, 1910,—
Canada's Trade in Pulp, Paper and Printed Matter. Pp. 255-258.
Detailed statistics, 1886-1910.

Statistical History of Canadian Trade in Pulp, Paper and Manufactures of Paper. Pp. 285-289.
Figures for 1886, 1900 and 1910 with those of United States for 1905-1910.

(IX, 1911),
Pulpwood Supply from Private Lands, Quebec. Pp. 32-34.
Estimates five million acres with twenty-five million cords.

Queen's Quarterly, XVIII, No. 3,—
Soil Fertility. Pp. 211-220.
A general exposition of the modern view of what constitutes fertility.

Quarterly Bulletin of the Canadian Mining Institute, No. 12, 1910,—
On Methods of Making Large Scale Contour Surface Plans of Claims or Mining Properties. Pp. 93-103.

Quarterly Journal of Forestry, V, 1911,—
Forests of the Far West. Pp. 9-17.
Interesting descriptive memoranda of a trip through Vancouver Island and California.

The Oak Forests of Slavonia, Austria-Hungary. Pp. 27-34.
Descriptive.

The Conference in Belgium. Pp. 45-48.
Silvicultural notes.

Arboricultural Society's Excursion to Ireland. Pp. 49-68.
Contains a short description of the climatic and physical features and forestry conditions of Ireland.

Japanese Forests. Pp. 84-90.

The Journal of the Board of Agriculture, XVII, 1910,—
International Forestry Congress at Brussels. Pp. 636-643.
Brief account of types of forest visited.

Transactions of the Royal Scottish Arboricultural Society, XXIV, 1911,—
The Vegetation of British Woodlands. Pp. 6-23.
Ecological and silvicultural.

Forestry Education, its Importance and Requirements. Pp. 24-42.
Contains a description of the facilities in European forestry schools.

Continental Notes—France. Pp. 56-66.

The Agricultural Gazette of New South Wales, XXI, 1910,—
How the Soil Acquires Nitrogenous Plant Food. Pp. 965-969.

The Philippine Journal of Science, Botany, V, 1910,—
The Bamboos of the Philippine Islands. Pp. 267-281.

NEWS AND NOTES.

The death of Frank J. Phillips on February 12 at his home in Lincoln, Nebraska, removed from the ranks of professional foresters a man of unusual brilliancy and attainments; one who gave promise of rising speedily to the very top of the profession.

Everybody with whom he came in contact grew to admire him for his ability and to love him for his personality.

Frank J. Phillips was born 29 years ago in Michigan where his father was and is a lumberman. Thus Frank early became acquainted with forest work and naturally availed himself of the opportunity to specialize in forestry at the Michigan Agricultural College. He thereupon "served his time" as a Student Assistant in the then Bureau of Forestry, followed by a post graduate course in the State University of Michigan.

In 1906, he entered the Forest Service as a Forest Assistant and did splendid work in the office of Forest Extension. In the fall of 1907, he resigned to become instructor in forestry at the University of Nebraska, where at his death he was held in the very highest esteem not only in the Department of Forestry but throughout the entire University.

Always a tireless worker, he was also a prolific writer sending frequent contributions to professional periodicals.

His acute power of observation, thorough scientific training, based on a soild foundation of common sense and knowledge of the woods, peculiarly fitted him for his life work. But great as is the loss to his profession the universal loss of such a virile, sympathetic, lovable nature is infinitely greater.

A. B. Recknagel.

In the death of Mr. Phillips the Forestry Quarterly loses one of its most valued collaborators. He was in charge of excerpting the Lumber Trade journals. The present issue attests to the assiduity with which he attended to this labor of love to the very end.—Editor.

The Week's bill initiating the purchase of forest reservations in the Appalachian range and the White Mountains by the Federal Government has been enacted into law—a new stage in the development of forest policies in the United States. The first one million dollars provided for the purchase in 1910 has of course lapsed, but $2,000,000 are available before July 1, of the present year; the purchase to involve in all about $10,000,000.

We consider this radical change of attitude between federal and state authority so important, that we print the act in full.

H. R. 11798. Appalachian and White Mountain National Forest Bill passed Senate February 15, 1911.

SECTION 1. *Be it enacted, etc.,* That the consent of the Congress of the United States is hereby given to each of the several States of the Union to enter into any agreement or compact, not in conflict with any law of the United States, with any other State or States for the purpose of conserving the forests and the water supply of the States entering into such agreement or compact.

SEC. 2. That the sum of $200,000 is hereby appropriated and made available until expended, out of any moneys in the National Treasury not otherwise appropriated, to enable the Secretary of Agriculture to coöperate with any State or group of States, when requested to do so, in the protection from fire of the forested watersheds of navigable streams; and the Secretary of Agriculture is hereby authorized, and on such conditions as he deems wise, to stipulate and agree with any State or group of States to coöperate in the organization and maintenance of a system of fire protection on any private or State forest lands within such State or States and situated upon the watershed of a navigable river: *Provided,* That no such stipulation or agreement shall be made with any State which has not provided by law for a system of forest fire protection: *Provided further,* That in no case shall the amount expended in any State exceed in any fiscal year the amount appropriated by that State for the same purpose during the same fiscal year.

SEC 3. That there is hereby appropriated, for the fiscal year ending June 30, 1910, the sum of $1,000,000, and for each fiscal year thereafter a sum not to exceed $2,000,000 for use in the examination, survey, and acquirement of lands located on the headwaters of navigable streams or those which are being or which may be developed for navigable purposes: *Provided,* That the provisions of this section shall expire by limitation on the 30th day of June, 1915.

SEC 4. That a commission, to be known as the National Forest Reservation Commission, consisting of the Secretary of

War, the Secretary of the Interior, the Secretary of Agriculture, and two members of the Senate, to be selected by the President of the Senate, and two members of the House of Representatives, to be selected by the Speaker, is hereby created and authorized to consider and pass upon such lands as may be recommended for purchase as provided in Section 6 of this act, and to fix the price or prices at which such lands may be purchased, and no purchases shall be made of any lands until such lands have been duly approved for purchase by said commission: *Provided,* That the members of the commission herein created shall serve as such only during their incumbency in their respective official positions, and any vacancy on the commission shall be filled in the manner as the original appointment.

SEC. 5. That the commission hereby appointed shall, through its president, annually report to Congress, not later than the first Monday of December, the operations and expenditures of the commission, in detail, during the preceding fiscal year.

SEC 6. That the Secretary of Agriculture is hereby authorized and directed to examine, locate, and recommend for purchase such lands as in his judgment may be necessary to the regulation of the flow of navigable streams, and to report to the National Forest Reservation Commission the results of such examinations: *Provided,* That before any lands are purchased by the National Forest Reservation Commission said lands shall be examined by the Geological Survey and a report made to the Secretary of Agriculture, showing that the control of such lands will promote or protect the navigation of streams on whose watersheds they lie.

SEC. 7. That the Secretary of Agriculture is hereby authorized to purchase, in the name of the United States, such lands as have been approved for purchase by the National Forest Reservation Commission at the price or prices fixed by said commission: *Provided,* That no deed or other instrument of conveyance shall be accepted or approved by the Secretary of Agriculture under this act until the legislature of the State in which the land lies shall have consented to the acquisition of such land by the United States for the purpose of preserving the navigability of navigable streams.

SEC. 8. That the Secretary of Agriculture may do all things necessary to secure the safe title in the United States to the lands to be acquired under this act, but no payment shall be made for any such lands until the title shall be satisfactory to the Attorney General and shall be vested in the United States.

SEC. 9. That such acquisition may in any case be conditioned upon the exception and reservation to the owner from whom title passes to the United States of the minerals and of the merchantable timber, or either or any part of them, within or upon such lands at the date of the conveyance, but in every case such exception and reservation and the time within which such

timber shall be removed and the rules and regulations under which the cutting and removal of such timber and the mining and removal of such minerals shall be done shall be expressed in the written instrument of conveyance, and thereafter the mining, cutting, and removal of the minerals and timber so excepted and reserved shall be done only under and in obedience to the rules and regulations so expressed.

SEC. 10. That inasmuch as small areas of land chiefly valuable for agriculture may of necessity or by inadvertence be included in tracts acquired under this act, the Secretary of Agriculture may, in his discretion, and he is hereby authorized, upon application or otherwise, to examine and ascertain the location and extent of such areas as in his opinion may be occupied for agricultural purposes without injury to the forests or to stream flow and which are not needed for public purposes, and may list and describe the same by metes and bounds, or otherwise, and offer them for sale as homesteads at their true value to be fixed by him, to actual settlers, in tracts not exceeding 80 acres in area, under such joint rules and regulations as the Secretary of Agriculture and the Secretary of the Interior may prescribe; and in case of such sale the jurisdiction over the lands sold shall, ipso factor, revert to the State in which the lands sold lie. And no right, title, interest, or claim in or to any lands acquired under this act, or the waters thereon, or the products, resources, or use thereof after such lands shall have been so acquired, shall be initiated or perfected, except as in this section provided.

SEC. 11. That, subject to the provisions of the last preceding section, the lands acquired under this act shall be permanently reserved, held, and administered as national forest lands under the provisions of Section 24 of the act approved March 3, 1891, (Vol. 26 Stat. L., p. 1103), and acts supplemental to and amendatory thereof. And the Secretary of Agriculture may from time to time divide the land acquired under this act into such specific National Forests and so designate the same as he may deem best for administrative purposes.

SEC. 12. That the jurisdiction, both civil and criminal, over persons upon the lands acquired under this act shall not be affected or changed by their permanent reservation and administration as National Forest lands, except so far as the punishment of offenses against the United States is concerned, the intent and meaning of this section being that the State wherein such land is situated shall not, by reason of such reservation and administration, lose its jurisdiction nor the inhabitants thereof their rights and privileges as citizens or be absolved from their duties as citizens of the State.

SEC. 13. That 5 per cent. of all moneys received during any fiscal year from each National Forest into which the lands acquired under this act may from time to time be divided shall be

paid, at the end of such year, by the Secretary of the Treasury to the State in which such National Forest is situated, to be expended as the State legislature may prescribe for the benefit of the public schools and public roads of the county or counties in which such National Forest is situated: *Provided,* That when any National Forest is in more than one State or county the distributive share to each from the proceeds of such forest shall be proportional to its area therein: *Provided further,* That there shall not be paid to any State for any county an amount equal to more than 40 per cent. of the total income of such county from all other sources.

SEC. 14. That a sum sufficient to pay the necessary expenses of the commission and its members, not to exceed an annual expenditure of $25,000, is hereby appropriated out of any money in the Treasury not otherwise appropriated. Said appropriation shall be immediately available, and shall be paid out on the audit and order of the president of the said commission, which audit and order shall be conclusive and binding upon all departments as to the correctness of the accounts of said commission.

The following data on White Pine cones were collected in September, 1907, as a preliminary to seed-bed tests. The cones were gathered in northern Minnesota. Shortly after being picked, they were graded into three sizes and a rounded heaped-bushel measure of each size was then dried in a green-house at sun temperature. The seed was extracted in the ordinary manner by shaking in a box with a screened bottom, and the yield compared with the yield from a bushel of cones as picked from the trees.

From two and one-half to three bushels of dry cones were involved in these determinations.

YIELD OF WHITE PINE SEED FROM CONES OF VARIOUS SIZES.

Size of Cones		Weight green cones per bu. Lbs.	Number green cones per bu.	Weight clean seed per bu. Oz.	Seed* per oz.	Number Seed per lb.	Number Seed per bu.	Number Seed per cone
Large	(over 4½ in. long)	30.5	558	15.75	1925	30,800	30,318	54
Medium	(3¼ to 4½ in ")	30.0	870	14.50	2450	39,200	35,525	41
Small	(under 3¼ in. ")	31.0	1639	15.75	2704	43,264	42,588	26
Unselected, as picked		27.0	1027	14.50	2272	36,352	32,943	32

*Average of two ounces of seed, of each bushel.

S. B. DETWILER.

Your recent letter of inquiry of October 31, as regards the care of the *seed of Red Cedar* came to me to-day. May I say, without boasting, that ever since 1903, I have succeeded well in growing red cedar from seed. The germination of the seed, and the growth of the seedlings for the spring of 1910 was especially good. A perfect stand on about 500 square feet of bed was secured.

The seed—which ripen in one year contrary to what I was taught by a certain teacher of forestry—were gathered in October and November, December or even January. They were immediately stratified without any previous treatment, such as rubbing, soaking, etc. I used boxes six inches deep—placing a layer of sand one inch deep,—then one-half inch of seed berries,—then sand, and repeating this till the box is filled. Moist sand is used. The boxes were then sunk into the ground so that the top of the boxes were just a little above the surface of the ground. Then over the boxes was placed about eight inches of leaves, straw or grass, and weighted down to keep the wind from blowing this covering away. These boxes are then left there without being disturbed, from say October, 1910 until late February or March, 1912. They germinate very early that spring (1912), even before winter is over. Sow the seed in nursery with the sand or separated. Cover the seed ¼ inch deep with rather fine field sand. Cover the sand with about two inches clean straw or leaves. This protection is necessary. As soon as the seedlings are pushing up through the sand cover at a good rate, remove all of it except what naturally settles about the seedlings covering the soil. This light cover, especially if of clean chaff is a great help for the little trees. It keeps down the weeds, conserves the moisture, and makes everything fine. I used lath-screened and enclosed beds. I have found it absolutely necessary to use every reasonable precaution to conserve moisture in the beds while germination is going on. Wind is the worst enemy. A layer of sand over soil in bed makes a better seed bed and works better—is easily leveled down with a leveling board. This layer of sand is leveled to within ½ inch of top of bottom framing boards.

I have not experienced any trouble with the "damping-off" fungus. As far as light is concerned, the Red Cedar can be grown without shade screens from the earliest stages of growth on. Cut-worms are serious pests. I have used poisoned bran

mash. Its efficiency seems doubtful. I believe that certain colored lights placed in the beds at night will help, not the "worms" but the trees. The Red Cedar transplants well after a month old, but this may not pay. In the ordinary seed bed without transplanting, one year seedlings will average six inches high. Best success has been had by transplanting to nursery row or to the field at that age, rather than allow them to remain in the bed another year. Of many hundreds, possibly several thousands of seedlings, one year old, transplanted to nursery row, as high as 90 to 98 per cent. lived. The spade used like a dibble aided by your feet makes a good transplanting tool.

I have obtained a fair germination of the seed of *Juniperus pachyphloea,* Alligator Juniper, by simply soaking seed in ordinary water and using no other treatment.

ROBERT E. EASTMAN,
Lynchburg, Va.

A recent news item from Canada records the insurance by Lloyds, of London, of six thousand square miles of timber lands against loss by forest fires. This, the first insurance of the kind ever effected on this continent, so far as we know, has been taken out by one of the largest timber land owners in the Province of Quebec, Price Bros. & Co., Ltd., of the city of Quebec. This new form of insurance was brought to the attention of financial circles in Montreal and Toronto recently when Price Bros. announced the issue of $5,000,000 of five per cent. bonds on their properties. The issue is to cover the expansion of their lumber business into a paper making company, with a 150 ton newspaper mill now being built by Jonquieres, Que., in the Lake St. John region, where they are developing 15,000 horse-power. The insurance of their enormous holdings of timber lands against fire is intended as additional security to the bondholders. It covers a term of thirty years. Insurance of timber lands against loss by fire has been regarded as impossible except at prohibitive rates. It has remained for the redoubtable and unterrified Lloyds to prove the contrary.

We learn that this is not, however, a *bona fide* insurance, but rather an insurance gamble, such as are generally done in England, like the insuring of the life of the King up to a certain date

to sustain a bet. In this case the insurance is said to cover only the first $50,000 damage, beyond this the risk ceases.

The following description applying to much of the Eastern slope of the Rocky Mountains in Canada comes to us in a letter.

"East of the Rocky Mountains west of the railway from Calgary to Edmonton, or more accurately between the 115th meridian and the mountains, north of the old main line of the C. P. Ry, and south of the G. T. P. Ry., lies a vast stretch of rough land, well watered, well drained, sloping northeastward between altitudes of 6,000 and 3,500 feet. The soil, varied by glaciation, is, in general, unfit for agriculture.

"From any of the bare rocky summits of the foothills and outlying ridges, colors of the landscape appear gray and brown with small patches of green. Through a strong glass the gray is barred by vertical lines, the same that is seen near by—old fire-killed spruce and lodgepole pine still standing. The brown is mingled with black. The brown part is dead leaves still on the trees, the black is charred trunks.

"The few green patches are V shaped in hillside coves or parallelograms scattered along valley sides.

"About 1 to 70 seems the proportion of green. Shame, shame, shame! Instead of 15 billion feet of saw logs not over 200 million, and that scattered so it is hardly worth picking up.

"Far too large a portion of this area has been recently burned.

"A period of increased burning, beginning with the settlement of the plains, is marked and recorded in the charred remains, the scars of the survivors and the succeeding volunteers.

"The fading out of the forest toward the plains is generally free from sharp lines of fire.

"The burning there has been customary for a long time and the growth is aspen and willow in clumps.

"But in toward the mountains where the mineral prospectors have been going and where greenhorn hunters have been swarming since the settlement of the plains there are vast amounts of dead timber still standing—monuments of ignorance and carelessness.

"White, Black and Engelmann Spruce and Lodgepole Pine grow together along the foothills. Before burning, the spruces are largely predominant, but the pine follows the fire and in time

the spruces start under the pines. Toward the plains larch, aspen and balsam with willow brush add meager variety to the few species of the region." A.

The following commissary figures were secured in a cord wood camp at Gleed, Ariz. The labor is principally supplied by Mexicans but there are usually a few Americans in camp. During the month of June, 1910, the total payroll amounted to $1,039, out of which $207.80 was paid in cash while the remainder was traded out in the commissary. Eighty per cent. is considered to be a fair average figure of the amount traded out at the commissary. Since the price paid for chopping four-foot wood is rarely over $1.00 per cord and the average cut per man is 1¼ to 1½ cords per day, the Mexican chopper rarely makes more than a living.

LIST OF COMMISSARY PRICES.

	Cost Price.	*Sale Price.*	
Flour,	$3.95	$5.40	per cwt.
Beans,	.07½	.12½	" lb.
Bacon,	.22	.35	" "
Ham,	.20	.30	" "
Candy,	.12½	.40	" "
Baking Powder,	.27	.50	" "
" "	.08	.20	" "
Milk,	.09	.20	" can
Chili,	.07	.15	" "
Japanese Chili,	.25	1.60	" lb.
Potatoes,	.01	.05	" "
Table Fruit	.17	.25	" can
Salmon,	.13	.25	" "
Sardines,	.04	.10	" box can
Corn Beef,	.13	.25	" " "
Crackers,	.10	.15	" lb.
Syrup,	.35	.85	" half gal.
Lard,	.16	.20	" lb.
Matches,	.04	.10	" package
Candles,	.02	.05	each
Soap,	.04	.10	per bar
Salt,	.01½	.05	" lb.
Tea (English Breakfast),	.30	.70	" "
Coffee (Arbuckle's),	.16	.25	" "
Quaker Oats,	.18	.35	" package
Canned corn and peas,	.09	.20	" can
Rice,	.06	.12½	" lb.
Tobacco,	At standard prices		
Overalls,	.80	1.25	" pair
Cotton undershirts and drawers,	.40	1.00	" suit
Cotton Socks,	.05	.15	or 2 pr. for .25
Handkerchiefs,	.04	.15	each
Overshirts,	.40	1.00	"
Towels,	.10	.25	"

Dried Fruits,	.15	.25	per lb.
Oil,	.33	.60	" gallon
Fresh Beef,	.07	.15	" lb.
Axe handles,	.27½	.50	each
Axes,	.90	1.75	each
Saws,	4.00	6.50	"
Files,	.12	.20	"
Shoes,	2.15	4.50	per pair
Gloves,	.90	1.75	" "
Starch,	.08	.15	" lb.
Olive Oil,	.07	.15	" bottle
Vinegar,	.05	.25	" "
Wagon Grease,	.07½	.15	" can
Spices,	.07	.15	" ¼ lb. can
Tents, 10x12,	19.00	25.00	each
Bedquilts,	1.50	2.50	"
Oranges,	2.00 a box	.60	per doz. (200 in a box)
Galvanized Pails (12 qt.),	.55	1.00	each
Sugar,	.06½	12½	per lb.
Fry pans,	.20	.35	each
Canteens,	.70	1.25	per gallon
Half Soles,	.22	.40	each
Watermelons,	1.85	5.00	per cwt.
Cigarette papers,	.02	.05	" book
Vermicelli,	.07	.20	" lb.
Onions (dry),	.03	.10	each
Onions (green),	.40	.60	a dozen bunches
Radishes,	.40	.60	" " "
Eggs,	.25	.50	" doz.
Dried Beef,	.25	.50	" lb.
Few simple medicines,	At standard prices		
Garlic,	.50	1.60	per lb.

Specifications for ties filed by fifty-one of the largest railroads in the United States and four in Canada show 78 species that will be accepted for ties. Twenty-one of these species are soft woods and fifty-seven are hardwoods. This list includes most of the important woods of the country in which those marked with an asterisk are listed for preservative treatment by most of the larger railroad systems:

Softwoods.

Cypress*, Douglas fir*, Hemlock*, Jack pine*, Loblolly pine*, Redwood, Shortleaf pine*, Red pine*, Sitka spruce*, Lodgepole pine*, Longleaf pine*, Pinon pine, Southern white cedar, Spruce pine*, Western hemlock*, Red Cedar, Tamarack, Red Spruce (Douglas fir), Red fir (Douglas fir), Northern white cedar, Western yellow pine, Yellow cedar.

Hardwoods.

Beech*, Black gum*, Black oak*, Bur oak, Butternut*, Black jack oak*, Black Walnut*, Catalpa*, Cherry*, Chestnut, Chestnut oak, Chinquapin, Cork elm*, Cottonwood*, Cow oak, Coffee tree, Hackberry*, Honey locust*, Laurel oak*, Live oak, Locust, Mockernut hickory*, Osage orange, Overcup oak, Pignut hickory*, Pin oak*, Post oak, Red elm*, Red gum*, Red maple*, Red mulberry, Red oak*, River birch*, Rock elm*, Sassafras, Scarlet oak*, Shellbark hickory*, Shingle oak*, Soft maple*, Spanish oak*, Sugar maple*, Sweet birch*, Sycamore*, Sugar berry*, Slippery elm*, Swamp maple*, Swamp white oak, Tupelo*, Turkey oak*, Water oak*, Water hickory*, Western red cedar, White ash*, White elm*, White oak, White pine*, Willow oak*, Yellow birch*.

It is assumed that a tie contains 42 board feet and has an average value of 50 cents.

Wages for Woods Labor. The Secretary of the Western Pine Manufacturers' Association recently sent out a letter to the members of the association asking what wages they were paying in the woods this winter. Replies were received from 16 of the members and below are given the lowest, the highest and the average of wages being paid:

Yarding hook tenders, $2.75, $5.00, $4.00; Rigging slingers, $2.75, $3.50, $3.00; Yarding firemen, $2.25, $3.00, $2.60; Woodbuckers, $2.00, $2.75, $2.50; Chasers, $2.25, $3.00, $2.60; Oilers, $2.00; Headloaders, $2.75, $3.25, $3.00; Second loaders, $2.50, $3.00, $2.66; Spooltenders, $2.50; Choker men, $2.25, $2.50, $2.37; Signal men, $2.00, $2.75, $2.37; Knotters, $2.25, $2.50, $2.37; Snipers, $2.50; Swampers, $2,00, $2.75, $2.40; Buckers, $2.75; Headfallers, $2.50, $3.00, $2.75; Second fallers, $2.50, $2.75, $2.56; Undercutters, $2.50; Road engineers, $2.75, $100 per month; Brakemen, $2.00, $3.00, $2.75; Locomotive engineers, $100 to $125 per month; Locomotive firemen, $2.75 per day to $65 and board per month; Boom men, $2.50, $2.75, $2.62; Skidroad men, $2.75; Railroad graders, $2.00, $2.75, $2.35; Section men, $2.00, $2.40, $2.20; Landing builders, $2.60; Flunkies, $2.50, $40 and board per month; Pump men, $2.50; Cooks (18 to 40 men), $50.00, $75.00, $66.66; Cooks (40 to 75 men), $60.00, $100.00, $77.00; Cooks (100 to 125 men), $120.00; Bull cooks,

$2.00, $2.50, $2.25; Blacksmiths, $65.00, $100.00, $82.00; Blacksmith's helpers, $2.20, $3.00, $2.40; Night watchmen, $2.00, $2.50, $2.16.

West Coast Lumberman, November, 1910.

A very remarkable development in the wood alcohol manufacture has taken place during the years from 1907 to 1909. In 1907 the so-called de-natured alcohol law took effect, and as was to be expected the price of wood alcohol dropped in 1907 to 15 cents from 34 cents in 1906. Indeed, it was supposed that wood alcohol would be entirely crowded out of the market. Instead, the industry of wood distillation, according to official figures of the Bureau of the Census, has, if not increased, yet held its own, and prices for wood alcohol at the same time have improved to 17 cents in 1908, and 24 cents in 1909. The total value of products in 1909 was still $8,330,000 representing a consumption of 1,265,000 cords. The average cost per cord, $3.21, represents a rise over the price of 1908 by 8 per cent. and by 2 per cent. over that of 1907.

A new method of clearing logged-off lands is by the charpit. This was worked out on the clay lands of the Pacific coast but has also proved a success on sandy lands. The new process was devised by Prof. H. W. Sparks and will clear the western lands of stumps in 2 to 3 weeks at a cost of $20 per acre. An excavation is made around the stump which is filled with cinders, covered with gravel or cracked rock on which was smeared fuel oil or coal tar. This is covered with kindling and lighted after which it is covered with clay in order to retain the fire and heat.

It is estimated that the forest fires of 1910 in Montana and Idaho damaged 1,871,000,000 feet of timber, most of which was privately owned timber in Idaho. In Oregon there was less organized co-operative fire fighting with a loss of 1,250,000,000 feet. It is also estimated that the timber owners in these three states spent $667,000 and saved resources easily worth $4,000,000,000. Adequate fire protection can be given at two to ten cents per acre if the proper co-operation is secured.

An important announcement has been made by the Ontario

Crownlands department that a series of experiments will be conducted during the winter of 1910-11 in burning brush in the Rainy River district. The result of this work will be watched with interest in the United States where the northern pine forests are so badly in need of adequate protection.

A $4,000,000 paper mill has just been established at Tomakamai, Japan, in which all the heavy machinery was manufactured in the United States. The daily output of this mill is about 70 tons each 24 hours which is over one-half of the amount consumed for news and book paper in the entire empire. The available supply of native timber is estimated to last 50 to 100 years. It is believed that Japan will now become an exporter of wood paper.

A shipment of 70,000 railway ties of "stringy bark" (*Eucalyptus obliqua*) left Hobart, Australia, in October for the United States and two shipments of the same size will be made in March and June, 1911. The species lasts 15 years or more as a tie where the precipitation is 20 to 60 inches; the wood is not easily inflammable, holds spikes well and is comparatively immune from the attack of white ants and other land insects.

Formerly shuttlewood was secured from Turkish boxwood which was imported from countries near the Black Sea. About 25 years ago the makers of roller skates commenced using this wood and increased the prices so that native dogwood and persimmon were substituted, the former being preferred. The limited supply of these species has led to present experiments with Pacific dogwood, California valley mahogany, cascara buckthorn, madrona, goldenleaf chinquapin, Pacific yew, and red gum.

Cork oak is being experimented with at Brownsville, Texas. It is said that a barrel of acorns is planted each year and that wherever live oaks are found growing on the shifting sands in this vicinity that cork oak will also thrive. The trees of cork oak already planted are making a good growth.

Japanese oak is being used to a considerable extent along the Pacific coast owing to the high freight rates on the better grades

of our own eastern oaks. This foreign oak can be supplied at $8 to $10 per thousand cheaper than our eastern oak.

Wagon hubs made from cemented sections are being manufactured at Batavia, Illinois, and are said to be greatly superior in strength to solid wood. It is proposed to use inch material which shall be built up on edge 5 inches wide on a standard 3¼ axle. In place of using solid hickory at $65 to $70 per M, cheaper inch stock is used which may have greater defects but still be stronger than the solid hickory. It is claimed that the compound axle will be sold for about the same as the price for the green one-piece stock of solid hickory.

A pronounced development of recent years is the use of fibre material in building operations. This has already caused a higher use for jack pine in the form of sulphite fiber. A single order for ten million feet has recently been made by the Great Northern Railroad company for one of these patented fiber materials to use in lining refrigerator cars.

It is reported that a new concrete railroad tie has been patented by a resident of Stockton, California. The tie is made in two sections, being disjointed in the middle to give elasticity. A cross section extends out on each side, slightly leveled from center bearing to each end of the section to allow the rail the necessary spring. A steel bar, countersunk, is placed on top of the tie section, which joins the rail, extending under and clamping on the outside of the rail, while a steel clamp on the inside of the rail resting against a boss on the steel bar and inside of the rail, is secured to the tie by a bolt. This arrangement it is claimed, makes it impossible for the rails to spread or turn over.

The U. S. Government has recently issued new grading rules for all southern yellow pine sold to any department. These rules are published in Southwest for October, 1910.

A remarkably well written, illustrated article on the "Early Progress Made in the Manufacture of Woodworking Machinery" is published in Wood Craft for January, 1911. The article com-

prises 26 pages and includes the most noteworthy advances that have been made since 1776.

The fifth annual convention of the Michigan Forestry Association was held at Kalamazoo, November 16. The following officers were elected: President, Charles W. Garfield, Grand Rapids; vice-president, John H. Bissell, Detroit; Secretary, Filibert Roth, Ann Arbor; treasurer, W. B. Mershon, Saginaw.

A new department of woods and forestry has been established at the American Museum of Natural History in New York City with Miss Mary C. Dickerson in charge.

A bill to create a Bureau of National Parks is before Congress, for the purpose of concentrating the "supervision, management and control of the several national parks and national monuments, etc."

Middlebury College, Middlebury, Vermont, has been offered ten thousand acres of wild land for forestry demonstration purposes by Joseph Battell.

Last autumn the Province of Quebec opened its new School of Forestry which is affiliated with Laval University. Students are admitted only after one year of training in the woods under the direction of the Department of Lands and Forests.

At a meeting in Washington on January 13 an Association of Eastern Foresters was formed for the furtherance of forest work in that section. Alfred Gaskill, State Forester of New Jersey, was chosen Secretary, the only officer, and a constitution was adopted, limiting the membership to forest officials and forest (?) instructors attached to universities or State schools of forestry in the New England and North Atlantic States, including Maryland. Other professional foresters may also be elected.

A conservation association has been organized in Georgia with Judge John C. Hart as president. The policy will be to protect forests at the headwaters of streams and useless destruction of

reproduction. There will be a strong effort to reclaim swamp lands.

The semi-annual session of the Western Forestry and Conservation Association was held December 5 and 6 in Spokane, Washington. The papers and addresses presented at the meeting are given in the American Lumberman for December 17, 1910.

The forestry world of Canada was once more stirred up by the Prime Minister, Sir Wilfred Laurier, who called a forestry convention at Quebec in January of this year, the arrangements to be made through the Canadian Forestry Association. The meeting was well attended by many prominent men from all parts of the Dominion, and a number of men, mostly professional foresters, from the States, the Forest Service being represented by Mr. Peters. The Canadian Commission of Conservation was holding its annual meeting at the same place and week, lending additional prestige to the occasion. The educative value of the convention—and that is all that can be expected of such gatherings—was undoubtedly considerable, not the least on the many lumbermen present. The fire question naturally came in for the lion's share in the discussion, and it appeared that the downing of tops at least, if not the burning of brush, was admitted to be not an altogether impractical proposition.

The Commission of Conservation of Canada held its annual meeting in Quebec on January 17. It was a short business session, at which the chairman, Hon. Clifford Sifton, reported on the work done by the permanent force at Ottawa, which will form the subject matter of a forthcoming report. Amendments to be recommended for legislation in the law defining the responsibility of railroads with regard to forest fires were discussed and adopted. A bill to regulate the use of water powers was endorsed.

Silva for July 1, 1910, gives Dr. Fernow's "History of Forestry" a highly appreciative review, lamenting only its publication in the English instead of the German laguage. The reviewer, Dr. Jentsch, of Münden points out that this is the first attempt to give a careful survey of the rise of practical forestry in the various parts of the world.

The forty-fifth edition of Gurley's Manual of surveying and engineering instruments is an enlargement and improvement in make-up of this excellent publication by the well-known, leading firm of W. & L. E. Gurley, at Troy, N. Y. The illustrations of transits in colors add much to the ease with which the details of the instruments can be seen.

Mr. C. S. Chapman has resigned his position as District Forester in the Forest Service in charge of District 6 with headquarters at Portland, in order to accept the position of Secretary of the Oregon Forest Fire Association. The position of District Forester has been filled by the appointment of Mr. George H. Cecil, who formerly held the position of Associate District Forester, in the Portland office. Mr. Chapman entered the forest service as a student in March, 1900, and as a forest assistant on July 1, 1902. He secured his technical training in forestry at the Yale Forest School. Mr. Cecil entered the forest service as a student assistant in the summer of 1903 and as a forest assistant on July 1, 1905. His technical training was secured at the Biltmore Forest School.

Mr. W. R. Fisher, Assistant Professor of Forestry at Oxford, known to American foresters by the volumes on Forest Protection and on Forest Utilization of Schlech's Manual of Forestry, died on November 13, 1910. Mr. Fisher was in the Indian Forest Service from 1872 to 1889, during that period becoming Director of the School of Forestry at Dehra Dun and Conservator of Forests of the School Circle. In 1890, on account of ill-health, he left India and joined the School of Forestry at Casper's Hall, coming, in 1905, with that school, to Oxford. In connection with his teaching every year he conducted educational tours through the European forests. He was closely identified with the progress of the Royal English Arboricultural Society and the place of the Society's *Quarterly Journal of Forestry* in forest literature is due entirely to Mr. Fisher's labors.

COMMENT.

After a long and persistent struggle through several years the measure to establish forest reservations in the eastern states under federal authority and at federal expense has become a fact. What a change of heart and of principles in government policy has been wrought in the last two decades! In 1890, we were still struggling to convert the land policy of the United States to a saner attitude with reference to the timberlands. We were then told that it was entirely contrary to the spirit of American institutions for the federal government to own lands, except for disposal, that it would be entirely incompetent and improper for it to manage any of its own lands for continuity. At that time any one who would have suggested that the government might buy lands for the purpose of management would surely have been designated as fit for the lunatic asylum. At that time—it was during President Cleveland's first administration—even co-operation on experimental lines with a state institution was frowned upon as undemocratic. These were, indeed, "road breaking" times! Those of a later generation who have reaped the results of these early struggles have little idea of the discouragements which beset the forest reformer of those days.

It should never be forgotten that to John W. Noble, Secretary of Interior, under President Harrison, (and to those who educated him up to it), belongs the credit of having first recognized the need and having taken the first practical step towards a change of the land policy of the United States, when he insisted in conference committee at the last hour of Congress upon the insertion into the law of the clause empowering the president to set aside forest reservations.

That these reservations must be specially managed was then still a matter, which needed years of educational effort to make clear. Meanwhile, through the inconsiderate action of President Cleveland upon the representations of the Academy of Science, in doubling with one stroke the area of the reservations without any provision for their use, the whole reservation policy was very nearly abolished and the hard-earned beginnings lost. President

Cleveland came near impeachment through his action, and only the ending of Congress saved the situation.

Undoubtedly, the propriety of the purchase of these lands may be questioned in principle, but expediency, which in American government counts often for more than principle, justified the action as long as the individual States are remiss or financially incapable of doing their duty.

It is to be hoped that both the purchase and the final management of the Appalachian and White Mountain reservations will be wisely done and recommend themselves to the people at large, so as to invite an extension of this policy.

If the object of Canada is what it once avowedly was, namely "to get rid of her timber," the proposed reciprocity arrangements with the United States will undoubtedly help it along. The opening of a wider market cannot help but induce increased effort to supply it. That is, of course, what the United States—some of her people—want. As long as the individual Provinces who control the commercial timber area of Canada keep the restriction, which makes the manufacture of the raw materials in Canada a condition of their timber licenses, only the private lands will be more rapidly stripped. Of such there are hardly more than ten million acres in existence. But the pressure which will be brought upon the governments to open the door may be too strong for them to resist long.

If, before that time, the organization of strong forestry bureaus could be brought about and the cutting be done under reasonable forestry regulations, the reciprocity arrangements might be a blessing for Canada—otherwise not. Whether the United States will be the gainers is open to question.

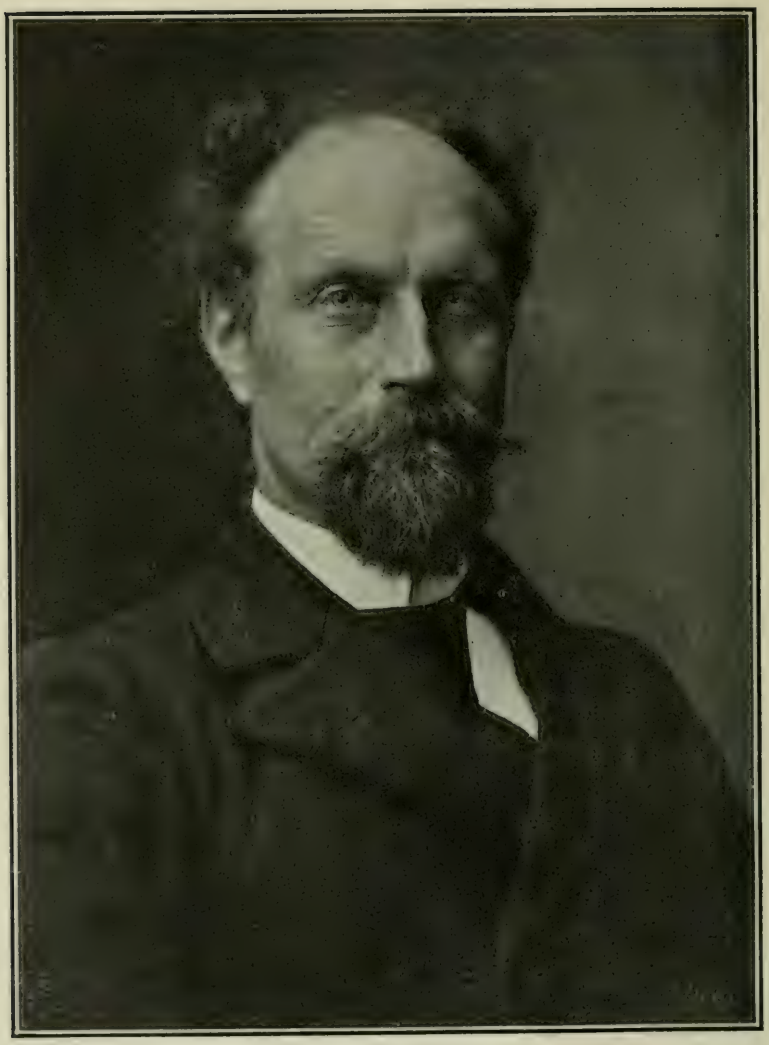
Here is one point that is not generally recognized in the discussions and which makes the timber trade a business to be considered by itself: In the exploitation of virgin forest the percentage of high grades that can be secured is small, rarely more than 20 per cent. The low grades which inevitably fall at the same time from the saw are a drag if not a drug in the market. These will also be increased from Canadian sources as far as cost of transportation does not prevent; wasteful use must be the result.

Another point that has truck us, as strange, is that these questions are always discussed merely with reference to the

present and with little or no consideration of the future. Here again exhaustible natural resources are on a different plane from manufactures, and conservative policy much more required.

More attention has been paid to the forest fires of the past year than ever before and this is especially true of lumber journals, general magazines and newspapers. The total damage during the past year was greater than at any time in our history notwithstanding the fact that the efforts to prevent and control forest fires by lumbermen, states and the national government are much greater than was true when the previous disastrous fires occurred.

The year's experience again emphasizes the fact that our foremost forestry problem is adequate fire protection. The efficient work done by the private Forest Fire Protective Association in the northwest has greatly impressed all private owners of large holdings and will have a salutary effect in the formation of new associations as well as a better appreciation of state and national work. Some of the most authentic lumber journals state that these private organizations did better work than the ranger force on National Forests but this may perhaps be largely accounted for by a difference in natural conditions. Nearly every journal unites in the demand for better appropriations for the National Forest Service while some authors justly condemn the congressmen and senators from the northwest who have done all they could to limit Forest Service appropriations. The House of Representatives having on February 11 passed a bill making a contingent appropriation of $1,000,000 for fire fighting, the possibility of more effective protection is probably given.



Prof. Dr. H. Mayr, München

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FORESTRY AND THE LUMBER BUSINESS.

By J. E. Rhodes.*

Forestry in its larger sense means the preservation of the forests for use. Using the forests involves lumbering; therefore forestry and lumbering must eventually become one consideration. Forestry which does not contemplate the use of the forest is not practical forestry and will not appeal to practical men. It is, therefore, necessary that the forester should know something of the conditions and necessities of the lumber business.

Up to the present time the United States Forest Service has taken the majority of the graduates of the forestry schools, but the time is not far distant when the Government will have a staff sufficient to handle its own work, when trained foresters must look to other fields for the exercise of their professional abilities. Consequently, the attitude of the lumbermen and timber owners toward your chosen profession must be of direct interest to you.

While I do not speak with authority, I am more or less familiar with the views which are held by many of the progressive men of the lumber industry upon the subject of forestry. It is not strange that the generation of lumbermen now passing had but little patience with the theoretical forester. The evolution of economic conditions is only just now beginning to make possible the consideration of the application of scientific forestry principles to lumbering operations with any hope of financial gain. While it is true that forestry methods are adaptable to lumbering in a small way in certain localities and in certain species of timber, it is impossible to apply them to the large lumbering opera-

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tions in the Lake States, in the Southern States and in the States of the Pacific Coast.

The lumber business has gone through several stages of development. Like everything else, it has proceeded along the easiest and most natural lines. Up to 1897 it was not considered more profitable than the majority of manufacturing industries; indeed, not as profitable as the average. Up to that time the views of our fathers still prevailed to the effect that the forests should be cut as rapidly as possible in order that the land might be opened for settlement. With the prosperity and expansion of the nation, which began in 1898, the consumption of lumber increased beyond all precedent, and continued in a large way up to the close of 1907, when it was checked by the panic. During the ten years from 1898 to 1907 the abnormal demand for lumber was at times beyond the ability of the mills to supply. This resulted in the development of new fields of timber in the South and West, gave a value to many kinds of timber which had been previously considered almost worthless, and stimulated the building of many new mills. This exploitation and development of the lumber industry did not cease until the producing capacity far exceeded all reasonably possible demands for lumber. With the increased wealth of the people the demand for lumber increased per capita. From 1900 to 1908 the increase in population was estimated at 22 per cent., while the increase in the consumption of lumber was 65 per cent. The consumption of lumber per capita has been figured as 360 feet in 1890; in 1900 it was 460 feet, and on the basis of the census of 1910, it was practically 500 feet. Answering to the laws of supply and demand, the price of lumber advanced considerably during the period between 1898 and 1907. It was during these years that the public generally first came to realize that the timber resources of this nation are not inexhaustible. This realization marked the second stage in the development of the lumber industry in this country. It, together with the extraordinary demand for lumber, caused the value of standing timber to advance sharply. In 1890, Northern pine stumpage, the estimates of which included only the very best white pine, was sold for from 75 cents to $4.00 per thousand feet, depending upon its location and character. To-day it sells from $6.00 to $14.00 per thousand feet, and the estimates cover everything on the land, including white and Norway pine, tama-

rack, spruce, balsam, jack-pine and anything that will make a saw-log. Yellow pine timber in the Southern States was considered of very little value and twenty-five years ago sold for 50 cents to $1.00 per thousand feet. To-day the production of yellow pine constitutes nearly one-half the total lumber output of the United States, including the hardwoods. Yellow pine stumpage has risen from practically nothing to from $3.00 to $5.00 per thousand feet.

In 1890, the total production of lumber in the Lake States was over nine billion feet, while in 1910 it was only about two billion. More than five hundred mills which were at one time or another sawing Northern pine in Minnesota, Wisconsin and Michigan, are no longer operated, because there are no more logs to saw. While the output has declined in the Lake States, it has rapidly increased, because of the building of new mills, in the South and West, so that the aggregate production of the country has been growing. The census reports show the following lumber production of the United States in recent years:

1904, ...	34,135,139,000	feet.
1906, ...	37,550,736,000	"
1907, ...	40,256,154,000	"
1908, ...	33,224,369,000	"
1909, ...	44,585,000,000	"

The decline in the production during 1908 was due to the financial depression following the money stringency of the last quarter of 1907. The entire lumber industry has been marking time since that panic. It is one of the very few businesses which has not fully recovered from the effects of the decline in prices suffered at that time. But it is significant that while the prices of lumber declined, the prices of standing timber did not. Due in part to the completion of new mills under way, the total production of lumber in 1909 was the largest in the history of the nation. There is every reason to believe that the lumber production of the country has about reached its maximum. If generally favorable business conditions are to continue for a few years, it is evident that with the decline in the output, the lumber business will soon enter upon the third stage of its development; namely, the adoption of conservative methods of handling timber. It is therefore

easy to see why lumbermen are coming to realize that something must be done if their business is to be prolonged indefinitely. As long as the prices of lumber have barely covered cost of production, as has been the case with the great majority of manufacturers since 1907, no thought, whatever, can be given to forestry methods. Lumbermen know that timber products are indispensable to our civilization and that they can continue to be manufactured and consumed in the present volume but a few years at best. When in the course of natural events prices of stumpage have risen to the proper basis, other conditions being favorable, scientific forestry will surely be adopted by lumbermen. They are too intelligent business men not to undertake those methods which will perpetuate their supplies of raw material and prolong their business. If forestry cannot be undertaken with profitable results it cannot be considered at all by private individuals, as they cannot be expected to conduct a work of this kind at a loss to themselves, no matter how much they may be prompted by sentiment or regard for future generations. The price of lumber must reach a point where it will pay to grow trees or forestry cannot be thought of. The time when forestry can be seriously considered as a business proposition, therefore, depends entirely upon the development of economic conditions. It is to help them hasten these conditions that lumbermen will appeal to the foresters. Hence, the interests of the lumbermen and the foresters in working to this end are mutual.

Aside from the present inadequate value of stumpage, the two great obstacles to forestry are, as you know, fire and taxation. When these problems are solved, the field for forestry will be open in America. If the professional forester is looking toward a vocation in economic forestry, outside of the Government service, he must first address himself to the task of subduing forest fires.

A field which promises some opportunities for trained foresters in the immediate future is in the service of the States. A number of the State Legislatures are at this time considering the establishment of State forestry work which will require the services of technically trained men. This work will be confined very largely at first to fire prevention, particularly in the Lake and far Western States. These States themselves own vast areas of timber, for which improved protection from fires will be de-

manded as it increases in value. The first concern of the State foresters will be the organization of efficient patrol systems, with all that that involves; namely, securing the co-operation of private timber owners; educating the public by word and pen of its interest in the forest, the fact that forest wealth is community wealth; impressing every citizen with the fact that every tree which burns is a direct loss to him. The work of creating a healthy public sentiment in favor of larger State legislative appropriations for the protection and management of forests will devolve upon the foresters. The enormous losses by forest fires the past year have put the public mind in a more favorable attitude for advanced work along this line than it has ever been before. It has become recognized that the State should not only insure its own property from loss, but that it owes its citizens the protection of their lives and property as well. No one can do more to impress this fact upon people than the foresters, because when the timber owner announces any such propaganda his motives are immediately questioned. The people will recognize the forester as a man qualified to speak and speak unselfishly.

After they have reduced forest fire losses to the minimum, the next stage of the State foresters will be the inauguration of conservative methods in the handling of State timber, just as the Federal Forest Service has done. This will also include reforestation, which the State and Nation alone can afford to undertake. State foresters will also be called upon to assist in the classification of lands suitable for the growing of trees as distinguished from agricultural lands. People are beginning to realize that it is a crime to put deluded settlers upon lands from which they reap misery and starvation instead of wealth and happiness. Hence, there will be a field for the professional forester in State work before there is an opening for him in private undertakings.

Some timber owners are beginning to ask if it is not possible to put the forest upon a permanently paying basis by utilizing its productive power. In endeavoring to figure out what must be done in order that timber may be handled upon scientific forestry principles, lumbermen are confronted with the fact that the present system of taxation is an absolute barrier against the adoption of any forestry methods, whatever. And here I will make a distinction between reforestation and conservative lumbering. Lumbermen believe that cut-over lands and lands not

suitable for agriculture must be planted, if at all, by the State and National Governments. It is a work which cannot be considered by the present generation of business men as a profitable enterprise or investment, simply because in most species of timber the returns to be expected are inadequate and wholly problematical. The length of time required to plant and mature a crop of trees is too great to interest Americans. The State lives on while individuals perish. The State can borrow money at 2 per cent., while the individual must pay 5 or 6 per cent., and while the individual must pay taxes in some form or other, the State is exempt. The actual planting of trees, therefore, is for the benefit of future generations, and must be done by the State.

Conservative logging, as lumbermen understand it, means the cutting of virgin timber so that the forest may perpetuate itself. This may involve the cutting of trees of certain species by diameter limit, the leaving of seed trees, leaving stands of young trees where under certain conditions their increase in size will be an element worth reckoning; also the protection of watersheds, the cutting of timber for the creation of fire lines, ascertaining the rate of growth of different species in different localities, knowledge of the exact relation between the forest growth and timber consumption, etc., all of which will have to be worked out by the technical forester. These conditions vary in every locality and with every kind of timber and with the changing conditions of the lumber market.

In consulting the forester about conservation methods of logging, lumbermen find that the cost will be very greatly enhanced over present costs, and they are confronted with the question of what kind of a tax they can pay and still leave a reasonable margin for the investment and risk. Scientific forestry must present some inducement as a business investment or it never will be undertaken. It is useless to expect men to look at it in any other light. It is evident that there will have to be a radical change in the present methods of taxation, and here again the public must be educated by the forester. He alone can show the people that there can be no real progress toward conservation so long as the present system of taxation remains in vogue. It is the most important question before the lumbermen to-day and will some day be one of the most important before the nation. While many thinking people recognize the truth of this

statement, it is to be regretted that up to this time the public generally has opposed any change in present methods of taxing timber lands. If the enthusiastic conservationists expect lumbermen to preserve their trees they must meet them on their own ground and show more of a spirit of harmonious co-operation than has so far been manifested. It is plainly to the interest of the foresters to show the people that so long as the forests continue to be taxed on the basis of an annual crop, holding young trees until they reach maturity means financial loss to anyone who attempts it. Such methods of taxation are in the end ruinous to the community also, for they encourage devastation and abandonment to the State of lands that thereafter yield no revenue either in the form of products or taxes.

At the present time the important matter of the taxes to be levied against timber lands rests entirely in the hands of the local assessors, whose only ambition seems to be to get the largest amount of money they can collect from the owners of timber in their counties. They hold that the more taxes lumbermen are required to pay the faster they will cut their timber, hence, the larger operations they will conduct, the more men they will employ, and the more quickly will the country be opened for settlement. Timber is now taxed under the general property tax system, the same as most other forms of wealth. Assessments are usually made by men having no special qualification for the work. In some localities efforts are made to cruise or estimate the timber, but knowledge as to the amount and value of timber on certain pieces of land is generally gained from second-hand evidence or by very superficial examination of the property. The increase in the values of forest lands for the purpose of taxation has been from four to five hundred per cent. in many sections within the past few years. The rate of taxation varies according to the township or county in which the timber is situated, and widely different assessments are made by different tax assessors residing in the same towns so that there is no uniformity in either the rate or valuation. There is nowhere in the United States any uniformity for levying assessments on timber or cut-over lands. The results of such haphazard methods are frequently surprising. It is utterly impossible to make anything like a definite statement in regard to these matters because of the great variation in assessments and rates upon the timber in the same locali-

ties and of apparently the same value. The system of taxing timber as other property is taxed was long ago abandoned by every other progresive nation. To ascertain what the actual burden of taxation on timber lands in this country is to-day, will require an exhaustive study covering a long period of time.

I do not know that excessive taxation has as yet prevented the adoption of forestry methods by lumbermen for the reason that other conditions have not been propitious. The price of stumpage has not yet reached that point where such methods can be applied even if there were no taxes. It is significant that in the localities and species where timber prices are the highest taxes have correspondingly risen. This is true in the white pine of the Northern States where the taxes are much higher than upon timber in other sections. Conservative methods might be undertaken in logging white pine if there was no annual taxes were it not for the fact that physical and climatic conditions are far more favorable for securing natural reproduction in yellow pine of the Southern States, and in the fir of the Pacific Coast States. This is, of course, due to the more rapid growth of the two latter species. I believe that the pine forests of the North will have to be sacrificed before Southern and Western timber has reached a value which will make it possible to log it in a way to secure successive crops. All but a remnant of the Northern forests will be gone under present conditions inside of fifteen years. I do not believe that the Northern States will present a field for the activities of the forester, except in State and Federal service, to be compared with the opportunities in the Southern and Western States. Private forestry will offer very little inducement to the owners of Southern and Western timber inside of ten to fifteen years, and it never will be much of an inducement until the tax is made to follow the saw.

A tax upon the timber crop when it is cut would make it unnecessary for the owner to put up additional capital to sustain his property as is necessary under the increasing annual tax. A tax on the yield would make it an object for the timber owner to hold his property for future speculative values as it would entirely eliminate the principal element now entering into the carrying charge when considering what the final cost may be of holding a tract of timber. The problem of how best to tax timber wealth in such a way as to encourage forestry while at the same time

making it bear its just burden of the expense of government, is one in which the foresters can very properly interest themselves.

The question now arises in your minds as to what there is for the forester to do until that time when conditions are favorable for the adoption of private forestry upon a large scale. The foresters who are looking to the immediate future need not despair, although I am free to confess that the opportunities outside of State and National work are not as promising as many have doubtless been led to believe. The foresters will find a limited field with the operators who take contracts to cut timber off Government land which require more or less forestry regulations. In a short time, the States will demand the same requirements of those who log timber upon State lands.

If the young foresters desire to spend a few years in living in the woods, a limited number of men can even now find employment as timber cruisers. As stumpage increases in value, the old-fashioned haphazard methods of estimating timber are found to be unsatisfactory. Lumbermen, especially those operating in white pine, have found that trained foresters can estimate the amount of timber on a given tract of land much more closely than can the old-fashioned cruiser. A trained forester consumes considerably more time in estimating timber than does the old time woodsman because he calipers trees, but his increased accuracy is worth far more than the difference in cost. The forester who seeks employment with lumber companies must be skilled in work of this kind, and the time is not far away when those dealing in timber lands will require that the estimates of standing timber be made in a careful and scientific manner, to include accurate map work and detailed reports of topography, species, and the general physical conditions of the country covered. This work requires men of good physique who are willing to live in the woods for months at a time. It is about the only branch of the lumber industry, as it is at present conducted, in which the scientific knowledge of the forester can be especially serviceable. There are other departments of the business in which the forester can engage, but they will only make a partial demand for his knowledge of forestry. There are but a very few lumbering operations of any size in this country to-day, outside of New England, where trees are logged with an idea of obtaining a second crop. In some regions a greater precaution

is taken to prevent fires than in others, which, of course, gives natural reproduction a chance.

The history of European forestry is repeating itself in the United States. We are progressing along exactly similar lines. The price of standing timber abroad averages about as much as the price of manufactured lumber in this country at the point of production, and long before stumpage here has reached a valuation equal to that in Europe, our forests will be protected, conserved and most carefully managed. As soon as there is a sane system of taxation of timber lands, and adequate protection from fire, we shall begin to practice forestry more extensively. It will accompany and be in proportion to the increase in the value of timber. For this reason there will be no timber famine in America.

In seeking to solve the question of fire risks and taxation, the foresters will not only hasten the day when their own services will be in demand but they will be at the same time performing a service of benefit to mankind.

NEW VIEW POINTS IN SILVICULTURE.

By Raphael Zon.

In a sense Professor Mayr's last book on Silviculture*, which has drawn considerable attention from the forester world abroad, does not contain anything new to those who are familiar with his earlier writings, such as *"Waldungen von Nord America," "Fremdlàndische Wald and Parkbäume für Europa,"* and his articles in the periodical literature. In this new book, however, are brought together all the facts and his conclusions, and, therefore, a better opportunity is afforded to grasp fully the point of view of the author.

The greatest service rendered by Prof. Mayr to silviculture lies not in facts and conclusions advanced by him, but in the entirely new point of view, and in the new method of dealing with silvicultural problems. Silviculture, until a comparatively recent time, consisted chiefly of pure empiricism, of rules and regulations based on the experience of practitioners. There was very little attempt to study silvicultural results in the light of the physical factors which produced them. While one finds in the old handbooks on silviculture hints as to the influence of climate upon forest vegetation, they do not go very far and the books deal as a rule chiefly with statements of silvicultural facts which take place in the forest, without taking into account at all the medium, the soil, and the atmosphere which condition the biological peculiarities of the forest.

Silviculture based only on experience, no matter how valuable the experience, could not become a science in the true sense. Prof. Mayr was one of the few foresters who helped to establish silviculture on a scientific foundation. All his works are marked with an attempt to understand and interpret silvicultural problems as a result of the *climatic factor.* Climate is at the bottom of all his explanations of biological differences in stands which grow in different places, as well as of the application of different silvicultural methods. One must be careful not to ac-

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Waldbau auf naturgesetzlicher Grundlage. Ein Lehr-und Handbuch, bearbeitet von Heinrich Mayr. Berlin, Paul Parey, 1909.

cept without critical revision all of Prof. Mayr's statements and conclusions as undisputed laws. They are not laws yet, but merely presentiments of such laws, merely the first outlines of the future structure of scientific silviculture, which is bound to grow up on the basis of a scientific study of the forest. Some of his statements may not be based on a sufficiently solid foundation, future work may and doubtless will bring in many corrections and show the faultiness of some of his conclusions, yet the idea itself which points such a fruitful path to silviculture will never die. His investigations are those of a geographer, with all the good and bad sides of the geographic method of investigation.

He studied the forests in Europe, in Asia, and in America. In his travels he compared the climates and forests of different countries and his conclusions are the result of these comparative geographical studies. Such geographical studies, while they are extremely valuable, yet are not devoid of some subjective element. These defects of personal observations over large fields can be corrected only by means of intensive experimental methods of investigation over small areas.

The book consists of three large parts, each subdivided into a number of chapters: (1) Fundamental, Natural Laws of Silviculture; (2) The Reproduction of the Forest; (3) The Growing and Care of the Forest. Of these three parts the first one if of the greatest importance to us, since the conclusions drawn there are based on many facts observed by him in North America, and for this reason is helpful in understanding our own forest conditions as well as those of the entire world; the other two parts are more specific and their application is narrowed down chiefly to European conditions.

Mayr established both for the old and the new world a series of forest regions. The basis for this division into forest regions is the climate, which determines, not only the distribution of the forest but its very existence. Of the climatic factors temperature and humidity of the air play the most important part. The author considers the average temperature for the four vegetative months as the one which determines the distribution of the different species and the limit of forest extension. For the northern hemisphere, the vegetative period occurs during the "tetrahore," the months of May, June, July and August. For the

southern hemisphere, it includes the months of November, December, January and February. Wherever the average temperature during the vegetative period is below 50 degrees Fahrenheit no forest can exist. The line connecting the points which have during the four vegetative months an average temperature of 50° is the limit of forest extension or the "isohyle."

Another climatic factor which determines the existence of the forest is the humidity of the air. The basis of his repeated studies in the prairies of North America and Eastern Asia during the years 1885-87 led him to consider the following figures as the minimum amount of moisture in the air and in the ground (precipitation) which are necessary for the existence of the forest:

If less than 1.95 inches of rain falls in one region during the months of May, June, July and August on the northern hemisphere, and on the southern hemisphere during the months of November, December, January and February, the natural establishment of a forest is impossible, even though the moisture of the air may be ever so great. Such an unforested coast line upon which the precipitation is not sufficient—even though the moisture in the air is sufficient and, in fact, in some places quite high—extends in North America from the fortieth degree north latitude southward through Central and South America to Patagonia. Such a coast line lies also on the west side of Africa south of the equator. It lacks forest because the necessary water is lacking in the soil; if this water is supplied artificially, these prairies can be transformed into luxuriant grain fields, orchards, and forests.

Regions which during the four months receive more than 1.95 and less than 3.9 inches of rain, also do not support a forest when the humidity in the air during the same time sinks lower than 50 per cent. The great prairies between the Rocky Mountains and the immense stretch of forest near the Atlantic Ocean in North America receive less than 3.9 inches of precipitation with an average relative humidity of less than 50 per cent. To this may be added the extensive steppe region of southern Russia and western Asia; the steppes of the interior Mongolia of eastern Asia; the steppes of Uraguay, Paraguay, southeastern Africa, and Australia. At any time such tracts of country in which the

forest is not able to penetrate by the help of nature can be transformed into forests by artificial means.

If the precipitation exceeds 3.9 inches, dryness of the air can not prevent the existence of the forest. If the land is watered by artificial means or otherwise supplied with water by natural means (irrigation, ground water) a forest will spring up even though the air may be ever so dry during the period of growth.

On the basis of the average temperature, air humidity, and precipitation during the vegetative period as well as on the basis of the annual temperature, the dates of occurrence of the first and last frosts, and the absolute minimum temperature, Mayr established several forest regions or zones for Europe, America, and Asia. Each zone is characterized by tree species, which have about the same climatic requirements. The different zones are arranged below in tabular form for ready comparison.

ZONES OF SIMILAR CLIMATE, ELEVATION AND WOODY SPECIES OF THE FORESTS OF NORTH AMERICA, EUROPE AND ASIA

[NOTE: The climatic data are given in the following sequence, a? denoting absence of information: average temperature during growing season, May 1 to Aug. 31; Humidity; Precipitation during growing season; Mean annual temperature; First, fall frost; Last, spring frost; Lowest recorded temperature.]

I. Cool Region of the Stunted and Dwarfed Trees, Limits of the Forest,—The Alpine Region,—The Polar Region

NORTH AMERICA.

Atlantic Region (Northern Canada)	Central Region (Rocky Mountains)	Pacific Region (Sierra Nevada, Alaska)
45°-48°; 80+; ?; 32°;	11,500 feet	
?; ?; —49° *Betula, Alnus, Salix, Juniperus, Abies balsamea, Pinus banksiana, Larix laricina.*	?; ?; ?; ?; ?; ?; ?; *Pinus flexilis, Pinus albicaulis, Pinus aristata, Picea pungens and engelmanni Larix lyalii.*	9,900 feet—1,650-3,960. 46°; 90%; 6 in.; 28°; ?;?;—4° *Salix, Populus, Alnus, Pinus balfourinana, Larix lyalii, Tsuga mertensiana.*

ASIA

Himalaya Mountains	Japan (From Urupp north-east, and from sea up.)	
Up to 13,200 feet.	Middle, at 8,250 ft.—over 3,300.—Kwilen, over 990.	
?; ?; ?; ?; ?; ?; 14°	?; ?; ?; ?; ?; ?;—22°	?; ?; ?; ?; ?; ?;—49°
Sorbus, Abies pindrau, Larix griffithii.	*Sorbus, Alnus, Salix, Populus, Betula, Pinus pumila, Picea hondöensis, Picea ajanensis, Larix kurilensis, Larix leptolepis.*	Scrubby specimens of the preceding zone, especially the birches (*Taiga*), *Picea obovata, Larix sibirica, L. dahurica, cajanderi.*

EUROPE

Southern	Middle	Northern
(Appenines, 8,250 ft.; Balkans, 6,600 ft.)	(Northern Alps) 6,600 ft.	Above 1,980 ft.

46°—50°; 80%; 16 in.; 34°—37°; June; Aug.; 31° to 49°.

In the north, birch shrubs, alders, willows, *Picea excelsa, Pinus septentrionalis;* in middle Europe, *Pinus pumila, Picea excelsa, Pinus cembrà, Larix europaea.*

II. Moderately Cool Region of the Spruces, Firs and Larches.—The Spruce, Fir or Larch Region.

NORTH AMERICA

Atlantic Region	*Central Region*	Pacific Region
(Middle States, from 5,940 ft.; Northern States from 3,300 ft.; Canada, from 1,650 ft., northward to sea coast.)	(Rocky Mountains, over 3,300 ft. in north; over 1,650 ft. in South.)	(Sierra Nevada, 6,600 ft. to 9,240 ft.; Cascade Mts., 4,950 ft. to 8,910 ft.; Alaska, to 1,650 ft., up to 550.)
59°; 75%—80%; 16-23 in.; 43°; May; Sept.; —40° (5° in South).	?; ?; ?; ?; ?; ?; ?.	50°; 80%; 20 in.; 43°; ?; ?; 3°
Pyrus, Betula, Populus, Salix, Abies balsamea, fraseri, Tsuga canandensis, Picea alba, nigra, rubra, Thuja, occidentalis, Pinus strobus, resinosa, banksiana, Larix laricina.	*Pyrus, Betula, Picea pungens, engelmanni, Pinus contorta, aristata scopulorum, Pseudo-tsuga, taxifalia var. glauca, Abies lasiocarpa, concolor, Juniperus pachyphloea, Larix lyalli, occidentalis.*	*Pyrus, Betula, Alnus, Abies grandis, concolor, nobilis, amabilis, magnifica, Pinus contorta, monticola, balfouriana, flexilis, albicaulis, ponderosa, Picea sitkaensis, breweriana, Pseudo-tsuga taxifolia, Tsuga heterophylla, mertensiana, Larix occidentalis.*

ASIA

Himalaya Mountains	Japan	China
Eastern, 9,570 to 14,190 ft.	South, 4,950 to 8,910 ft.; north, 3,300 to 4,950 ft.; Eso, 1,650 to 3,300 ft.; Kurilen, over 300 ft.	
Western, 8,250 to 13,200 ft.	54° to 59°; 80 to 90%; 12 to 39 in.; 39° to	
?; ?; ?; ?; ?; ?; ?.	45°; ?; ?; —22°	?; ?; ?; ?; ?; ?.
Sorbus, Betula, Alnus, Salix, Abies webbiana, pindrau, Tsuga dumosa, Picea morinda, Larix griffithii, Abies cilicica.	*Sorbus, Betula, Alnus, Salix, Abies, veitchii, mariesii, sachalinensis, Pinus koraensis parviflora, densiflora, Picea bicolor hondöensis, ajanensis, glehnii, Larix leptolepis, kurilensis.*	*Sorbus, Alnus, Petula, Salix, Populus, Picea schrenkiana, wilsoni, neoveitchii, mastersii, brachityla, likiangensis bicolor, ajanensis, Abies delavayi, Fargesii, veitchii, Pinus bungeana, henryi, sinensis, Larix principis, rupprechtii and dahurica, sibirica, (?) thibetica, griffithii, chinensis.*

EUROPE

Southern	Middle	Northern
4,290 to 7,590 ft.	South, 2,970 to 6,930 ft. North, 1,980 to 3,300 ft.	Over 1,650 ft.

50° to 57°; 75%; 23 to 31 in.; 37° to 45°; May; Sept.; —31°

Sorbus, Alnus, Betula, Salix, Populus, Abies pectinata, pinsapo, cephalonica, Picea excelsa; omorica, Pinus silvestris, uncinnata, cembra, peuke, Larix europea.

Ural: *Abies sibirica, Pinus sibirica, Picea obvata, Larix sibirica.* Caucasus: *Abies nordmanniana, Picea orientalis.*

III. Temperate Forest Zone of the Deciduous Trees, the Cooler Half, —The Beech Zone.

NORTH AMERICA

Atlantic Region	Central Region	Pacific Region
(Southern States, 660 ft. to 2,640 ft.; Middle States, 1,320 ft. to 2,970 ft.; North & South Canada, 1,320 ft. to 2,970 ft.)	(Arizona, New Mexico, 3,960 ft. to 6,600 ft.; Rocky Mountains, up to 3,300 ft.)	(Sierra Nevada, Cascade Mts., Coast Ranges)
66°; 65%; 8 in.; 45° to 54°; May; Sept.; —13° to —31°.	?; ?; ?; ?; ?; ?; ?.	4,950 ft. to 6,600 ft. 59°; 80%; 5 in.; 45° to 50°; March; Nov.; 3°.

Fagus ferruginea, Quercus alba, macrocarpa, coccinea, palustris, tinctoria, Carya alba, porcina, amara, tomentosa, Acer rubrum, saccharum, Fraxinus, Salix, Betula, Juglans, Liriodendron, Prunus, Ulmus, Populus, Tilia, Sorbus, Pinus strobus, resinosa, rigida, banksiana, Thuja occidentalis, Chamaecyparis spharoidea, Abies balsamea, Picea, alba, nigra, Larix larcina.	*Fraxinus, Populus, Prosopis, Salix, Pinus chihuahua, ponderosa, scopulorum, murrayana, strobiformis, Abies arizonica, mayriana, Pseutodsuga taxifolia var. glauca, Picea engelmannii, pungens.*	*Quercus garryana, californica, Acer macroph., Fraxinus oregona, Populus trichocarp, Alnus, Salix, Pseudotsuga taxifolia, Abies grandis, venusta, concolor, Thuja plicata, Tsuga heterophylla, Chamaecyparis lawsoniana, nootkatensis, Libocedrus, decurrens, Sequoia washingtoniana, Pinus monticola, lambertiana, ponderosa, jeffreyi, contorta, Picea sitkaensis, Larix occidentalis.*

ASIA

Himalaya Mountains,	Japan	China
Eastern, 8,250 to 9,570 ft.; Western, 6,600 ft to 8,250 ft.	Middle, 2,640 ft. to 4,950 ft.; north, 1,320 ft. to 3,300 ft.; Eso, 660 ft. to 1,650 ft.	
?; ?; ?; ?; ?; ?; not under 50°.	63°; 80%; 16 in.; 45°—48°; May; Oct.; —13°.	?; ?; ?; ?; ?; ?.
Acer, Pyrus, Tsuga dumosa, Abies pindrau, webbiana, Pinus excelsa, khasiana, gerardiana, Picea morinda, Larix griffithii.	*Fagus japonica, sieboldii, Quercus dentata, crispula, Fraxinus mandshurica, longicuspis, Phelleodendron, Magnolia hypoleuca, Cladrastis, amureuse, Acer, Cercidiphyllum Acanthropanax, Ostrya, Betula, Salix, Carpinus, Prunus, Populus, Tilia, Ulmus, Chamaecyparis, Thuja, Cryptomeria Thujopsis, Sciadopitys, species of pine, Pseudotsuga japonica, Tsuga diversiflora, Taxus, Abies homolepis, sachalinensis, Picea polita, bicolor, ajanensis, L. leptolepis.*	*Fagus sinensis, engleriana, Quercus dentata, mongolica and others, Tilia, Acer, Prunus, Fraxinus, Ulmus, Betula, Carpinus, Populus, Salix, Biota orientalis, Taxus baccata (?), Pinus sinensis, armandi, bungeana, henryi, mandshurica, Pinus koraensis, Abies, Tsuga, Pseudolarix fortunei, Larix.*

EUROPE

Southern	Middle	Northern
(Appenines, 2,970 ft. to 4,620 ft.; Balkans, 2,640 ft. to 3,960 ft.; Pyrenees, 2,640 ft. to 4,290 ft.. Ural, 3,300 ft. to 4,620 ft.	South, up to 2,970 ft. North, up to 1,980 ft.	Southermost regions of Scotland, Denmark, Kurland, Livonia, Estland.

61° to 64°; 70%; 10 in.; 45° to 54°; May; Sept.; —13° to —22°.

Fagus silvatica, Quercus pedunculata, sessiliflora, pubescens, hungrarica, Acer, ulmus, Betula, Carpinus, Prunus, Alnus, Populus, Fraxinus, Salix, Tilia, Pinus peuke, silvestris, austriaca, leukodermis, Picea elcelsa, Abies pectinata, pinsapo, cephalonica.

Ural: *Pinus sibirica, Abies sibirica, Picea Obovata, Larix sibirica* (first appearance).

Caucasus: First appearance of *Abies Nordmanniana, Picea orientalis.*

IV. Temperate Forest Zone of the Deciduous Trees, the Warmer Half,—the Chestnut Zone.

NORTH AMERICA

Atlantic Region	Central Region	Pacific Region
(Southern States, up to 3,300 ft; Middle States, up to 1,320 ft.; Northern States, up to 660 ft.)	(Arizona, New Mexico, 2,640 ft. to 3,960 ft.; Middle States.)	(California, 1650 ft. to 4,950 ft.; Oregon, Washington, British Columbia, up to 990 ft.)
73° to 75°; 70%; 16 in.; 54° to 59°; April; Oct.; 7° to 4°.	?; ?; ?; ?; ?; ?.	59°; 85%; 4 in.; 50°; Feb.; Nov.; 21°.
Castena dentata, Quercus lyrata, imbricaria, alba macrocarpa, falcata, etc., Carya alba, porcina, amara, sulcata, olivaeformis, Nyssa silvatica, Fraxinus quadrangulata, Ulmus alata, Robinia pseudacacia, Gleditsia, Acer, Carpinus, Cetlis, Aesculus, Ostrya, Juglans, Liriodendron, Gymnocladus, Sassafras, Prunus serotina, Catalpa, Deciduous magnolia, *Platanus occidentalis, Liquidambar, Pinus glabra, haeda, palustris, clause, inops, pungens, mitis, rigida, Tsuga caroliniana, Taxodium distichum, Juniperus virgiana, Thuja occidentalis, Chamaecyparis, sphaeroirea.*	*Quercus? Platanus wightii, Juglans, Fraxinus Populus, Pinus chihuahuaana arizonica, mayriana, ponderosa, scopulorum.*	*Quercus garryana, californica, densiflora, Platanus racemosa, Arbutus menziesii, Aesculus, Cercis, Acer, Libocedrus decurrens, Pinus ponderosa, sabiniana, jeffreyi, coulteri, attenuata, radiata,* Chamaecyparis *nootkatensis, lawsoniana, Pseudotsuga taxifoila, macrocarpa.*

ASIA

Himalaya Mountains	*Japan*	China
7,260 ft. to ?	(S. Japan, 1,650 ft. to 4,950 ft.; Middle Hondo, up to 2,640 ft.; N. Hondo, S. W. Eso, up to 660 ft.	
?; ?; ?; ?; ?; ?; ?.	68°; 80%; 20 in.; 54° —59°; ?; ?; —4°	?; ?; ?; ?; ?; ?; ?.
Cedrus deodara, Deciduous magnolia, *Prunus, Pinus excelsa.* Asia Minor (Lebanon): 3,300 ft. to 8,580 ft. ?; ?; ?; ?; ?; ?; ?. *Cedrus libani, Juglans regia*	*Castanea crenata, Zelkowa keaki, Magnolia hypoleuca, kobushi, Juglans, Quercus serrata, variabilis, glandulifera, etc., Paulownia, Aesculus, Rhus, Hovenia, Albizzia, Phellodendron, Celtis, Gleditsia, Cercidiphyllum, Fraxinus, Carpinus, Sophora, Acanthopanax, Acer, Ulmus, Prunus, Pinus, thunbergii, densiflora, Cryptomeria japonica, Chamaecyparis, Thuja, Thujopsis, Sciadopitys, Torreya, Abies firma Tsuga sieboldii, Juniperus rigida, chinensis, Cephalotaxus.*	*Castenea crenata, Zelkowa keaki, Quercus serrata, Bungeana, glandulifera, Pauliownia, Phellodendron, Catalpa, Liriodendron, Rhus, Gleditsia, Gymnocladus, Hovenia, Aesculus, Sterculia, Albizzia, Juglans, Celtis, Fraxinus, Carpinus, Acer, Ulmus, Ailanthus, Prunus, Cercidiphyllum, Sophora, Liquidambar, Cunninghamia, Libodedrus macrolepis, Biota orientalis, juniperus, chinensis, rigida, recurva, Cupressus funebris, Cephalotaxus, Torreya, Pinus sinensis, henryi, Tsuga sieboldii, chinensis, yunnanensis, Pseudolarix fortunei.*

EUROPE

Southern	*Middle*
(Italy, 1,650 to 3,300 ft.; North Italy, up to 1,320 ft.; Greece. S. France, Spain, Portugal, up to 1,980 ft.; S. Tyrol, up to 990 ft.)	(S. England, S. Ireland, N. W. France.)
	?
68° to 73°; 50 to 60%; 4 to 8 in.; 55° to 63°; March; Nov.; 12°	59°; 80%; 8 in.; 50°; April; Nov.; 3°.
Castanea vesca, Quercus pedunculata, sessiliflora, pubescens, cerris, hungarica, Ostrya, Celtis, Platanus, Aesculus, Fraxinus, Ulmus, Carpinus, Cupressus fastigiata, Pinus maritima, aleppensis, pinea, austriaca, corsicana, silvestris.	*Castanea vesca,* cultivated, *Quercus pedunculata, sessiliflora, Carpinus, etc.*

NORTH AFRICA (Atlas)	*CAUCASUS*
3,300 ft. to 6,600 ft.	660 ft. to 3,300 ft.
?; ?; ?; ?; ?; ?; ?.	?; ?; ?; ?; ?; ?; ?.
Cedrus atlantica, Juglans regia, Quercus, pubescens.	Large proportion of the European species, *Pterocarya, Zelkowa.*

V. Sub-Tropical Forest Zone of the Evergreen Oaks and Laurels,—The Laurel Zone.

NORTH AMERICA

Atlantic Region	Central Region	Pacific Region
(Florida, coast region of the Southern States.)	(Lowest parts of Arizona, New Mexico, and northern Mexico.)	(California, up to 1,650 ft.) 23° —14°.
77° to 82°; 75%; 23 in.; 59° to 70°; Jan.; Feb.; 19°.	75°; 40%; 5 to 11 in.; 63°; ?; ?; 23° to 14°.	61°; 75%; 1 in.; 57°; ?; ?; 28°.
Quercus virens, Persea, Sabal palms, *Pinus cubensis, palustris, Taxiodium distichum, Juniperus virginiana, Chamaecyparis ,thyoides Magnolia grandiflora.*	*Quercus grisea, Arbutus zalapensis, Prosopis juliflora, Cereus giganteus, Cupressus arizonica, Agave, Yucca.*	*Quercus agrifolia, Castanopsis, Umbellularia californica, Arbutus menziesii, Washingtonia* (Palm), *Cupressus macrocarpa, Sequoia sempervirens, Pinus insignis, muricata, attenuata, sabiana, Pseudotsuga macrocarpa, Tumion californicum.*

ASIA

Himalaya Mountains	Japan	China
4,300 ft. to 7,250 ft. (Climate of the cooler situations.)	(Formosa, Riukiu Is., Shikoku, S. Hondo, up to about 1,650 ft.) 1,650 ft to 6,600 ft.	So. China up to Kuenlun.
59° — 66°; 72 — 93%; 21—47 in.; 52°—55°; ?; ?; 25°.	73°; 80%; 39 in.; 63°; March; Nov., 19°.	?; ?; ?; ?; ?; ?; ?.
Quercus incana, fenestrata, etc., Cupressus torulosa, Buxus, Cedrus deodar, Pinus excelsa, Rhododendron Evergreen Magnolia.	*Quercus acuta, glabra,* etc., *Machilus, Litzaea, Cinnamonum camphora, Buxus, Ilex, Olea, Pasania, Trachycarpus-Palms, Camellia, Podocarpus, Cryptomeria japonica, Luchuensis, thunbergii, Juniperus rigida, chinensis, Torreya,* Evergreen magnolia.	*Quercus gualca, semecarpifolia,* etc., *Machilus, Litzaea, Cinnamonum camphora, Buxus, Ilex, Olea, Pasania,* Dwarf palm, *Camellia, Podocarpus, Cryptomeria japonica, Pinus sinensis, Cunninghamia sinensis, Keteleeria, Glyptostrobus heterophylla Juniperus rigida, chinensis, recurvea, Biota orientalis,* Evergreen magnolia.

EUROPE

(South coast, islands of west coast of middle Europe)

68°—72°; 50—60%; 2—4 in.; 61°—66°; Dec.; Feb.; 23°.

Quercus suber, etc., Q. Ilex, Larus nobilis, Arbutus Unedo, Buxus, Ceratonia, Olea, Cupressus fastigiata, Pinus canariensis, pinea, maritima, aleppensis, Chamaerops-palms.

That distribution of the forest depends in a most remarkable degree upon humidity is clearly seen from the fact that all large forest regions of the old and new world are confined to the oceans and seas. Thus the European forest region owes its existence to the Atlantic ocean; the eastern Asiatic forest region to the Pacific ocean; the Indian to the Indian ocean; and the Eastern and Pacific forests of North America to the Atlantic and to the Pacific oceans.

There is no doubt that temperature and especially air humidity play a most important part in distribution of these forests, yet it is not always possible with the aid of the climatic factor alone to explain in every case the natural treeless condition of certain regions. *The soil conditions must also be taken into account.* As an example may be cited our prairies or the Russian steppes. Thus a large part of our prairies and of the Russian steppes as far as the climate is concerned could support forest growth, yet no forest grows there or if it does it is only on definite situations. Under identical climatic conditions in one place the forest artificially established perishes in spite of all human care, while in another place it thrives. That the presence of large quantities of soluble salts in the soil may be the cause of the treeless condition of a large portion of our prairies, may be inferred from Hilgard's studies. In California, according to Hilgard, at a precipitation of 500 millimeters, salts of sodium are washed out by the ground waters, while at a precipitation of less than 500 millimeters these sodium salts accumulate to a different depth of the soil and become injurious to tree growth.

Mayr himself admits that the area of prairies goes outside of the region of deficient precipitation (1.95 inches) and low air humidity (below 50 per cent). He, however, ascribes this to the prairie fires, which pushed the forest backward. This very often repeated argument for the treeless condition of our prairies and the Russian steppes was really never based on accurate observations, while the presence of soluble salts in the soil as the

cause of the treeless condition has been proven in many instances in a most convincing manner.

Furthermore, the minimum amount of precipitation which is necessary for the existence of the forest must vary with the conditions of the soil, especially its moisture holding capacity. It makes a great difference whether the moisture holding capacity of the soil is 2 to 3 per cent. or 12 per cent. In case of sandy soil with a very low moisture holding capacity (2 to 3 per cent.), precipitation will penetrate deep into the ground and will become available for forest growth, while in case of heavy, clayey soil whose moisture holding capacity may be 12 per cent., with the same amount of precipitation, water will remain in the upper layer of the soil, from which it will rapidly evaporate without becoming useful to vegetation.

Unfortunately, Mayr did not state all the facts which lead him to decide on his minimum amount of moisture necessary for the existence of the forest. It seems doubtful that the amount of precipitation during the four vegetative months is really the only deciding factor in limiting forest growth. Tree distribution often depends not so much on the amount of precipitation that falls during the vegetative season as upon the amount of water accumulated in the soil during the winter and fall.

Mayr's views on the mooted and complicated question of acclimatization, which is of such importance to the practitioner, as well as to the theoretical man, are of interest.

Mayr radically differs from the majority of foresters on the question of acclimatization, on the ability of transmitting certain characteristics acquired by trees grown under new climatic soil conditions, and on the importance of the source of seed for forestation purposes.

Mayr denies the possibility of acclimatizing or adapting a species to new climatic conditions. He claims that each species can exist only under certain climatic conditions. If it is introduced into new environment in which it meets conditions to which it was not accustomed in its native land it perishes. He further claims that acclimatization of forest trees—if such exist at all—requires such a long time that it has no practical value for man. He also denies the possibility of hereditary transmission of various deviations from the mother type. He thinks that only the typical characteristics are transmitted, but not the various de-

viations from the type caused by changes in environment. The deviations from the type are of accidental nature and therefore are not permanent. For this reason, the question of the source of seed, in his opinion, has no significance whatever for the forester. No matter where or from what trees the seed is collected the progeny resulting from the seed, irrespective of its origin, will possess only the characteristics which are typical for the species as a whole.

Mayr is doubtless right when he denies the possibility of transmitting qualities which are the result of soil conditions or silvicultural treatment, but this is about as far as one can go with him. There are characteristics which are the result of climatic conditions and yet are retained and transmitted through inheritance. For instance, the Scotch Pine in the Baltic provinces invariably has straighter trunks and yields wood of higher quality than the Scotch Pine of central Germany.

Vilmorin in the twenties and thirties of the last century experimented with growing Scotch Pine from German, French and Russian seed. The pine of the Baltic provinces differed from the rest in that it had a straight, cylindrical, well developed trunk; and the seed from the plantations of the Riga variety produced a progeny possessing the same good qualities as the first generation.

Von Sievers in the fifties of the last century made similar experiments in some of the Baltic provinces. The pines grown from seed collected in Darmstadt did not possess such straight trunks as the pines from the native seed. The same experiments were repeated by several investigators and with the same results.

Cieslar in Austria and Engler in Switzerland have both demonstrated the importance of the source of seed upon the character of the plantation. Seed was collected from trees of different species grown in the valleys and in the mountains and were sown under identical climatic and soil conditions, in order to determine whether the characteristics of the mother trees will be retained in the plantations made under exactly the same conditions. It was found that the spruce of the mountains, which grows slower than the spruce of the valleys, retains this characteristic when planted in the valleys and vice versa; other characteristics such as the length of the vegetative activity were found to be also retained. Engler, on the basis of his experiments, came to the

conclusion diametrically different from that made by Mayr, namely, that for planting native or naturalized species the seed must be collected in the region in which they are to be planted or at least from localities which climatically are very similar to those in which they are to be planted. Mayr, on the other hand, without really disproving Vilmorin's, Engler's, and Cieslar's experiments, cites his own experiments which tend to show that only typical characteristics are transmitted and not deviations from the type due to changed climatic conditions. This divergence of opinion as to what characteristics are transmitted through inheritance shows that the question does not allow of general sweeping conclusions.

Engler further points out that the acquisition by forest trees of new characteristics and their transmission to future generations does not require such an infinitely long time as is claimed by Mayr. He mentions interesting facts with regard to the spruce. After the retreat of the glacier into the mountains, spruce was one of the first species which reappeared in the Swiss valley, the climate of which at that time resembled closely the climate of the higher altitudes. Later, when the climate of the valley became warmer and the conditions became favorable for the growth of hardwoods, the latter crowded out the spruce into the mountains. In the historic epoch, when the forests in the valleys were badly cut and abused, spruce descended again from the mountains into the valley. With the aid of material which was found in excavations, it was possible to determine that spruce was not present in the valley in the neolithic time, and that it appeared only in the helvetic period, that is, early in the middle ages. This, according to Engler shows that it did not take such a long time for the spruce to acquire biological characteristics which enabled it to grow in the valley.

The climatic factor is laid also at the foundation of all cultural operations in the forest—thinnings, planting, etc. This, however, would take us into the other parts of Dr. Mayr's most interesting book, the review of which must be left for some other

THE WHITE PINES OF MONTANA AND IDAHO—THEIR DISTRIBUTION, QUALITY AND USES.

By F. I. Rockwell.

Limber Pine—*Pinus flexilis* James.

Range: Eastern slope of Rocky Mountains from Alberta and Montana to western Texas, and westward on high divides and mountain ranges through Utah, Nevada, New Mexico and Arizona into southeastern California on the western slopes of Sierra Nevada Mountains. Altitudinal range from 4,000 to 11,000 feet.

Occurrence: "On dry, rocky, east slopes, summits, tops of ridges and foothills, and sometimes on sides of moister canyons and banks of mountain streams. Adapted to a great variety of soils and not exacting as regards depth or moisture, but grows best in moist, well-drained soils. Usually in dry, rocky, very shallow soil, appearing to prefer dry, loose, gravelly loam, with little or no humus. Reaches higher elevation on clay soils than on sandy ones.

Usually occurs singly or in small groves among other conifers, where it is of largest size; occasionally in pure, open stands, commonly stunted, on exposed slopes and ridges. Apparently less frequent in Pacific than in Rocky Mountain range. In Pacific region associated mainly with Lodgepole Pine and Black Hemlock at higher elevations, and sparingly with White Fir and stunted Sugar Pine at lower altitudes." (Sudworth.)

In the Rockies, at the lowest range of tree growth and from 4,000 to 6,000 feet elevation, it forms open scattered stands of round topped, stunted trees of no commercial value, usually in company with Rocky Mountain red cedar or Western yellow pine. At timber line, from 8,500 to 10,000 feet, it assumes similar or even more stunted form, associating with Lyall Larch or other alpine species. At intermediate elevations, it occasionally produces merchantable timber in company with Douglas Fir, and possibly also with Whitebark Pine, Lodgpole Pine, Engelmann Spruce and Alpine Fir. This is a point which should be the subject of further investigation.

Commercial Distribution in District I: Probably only on the eastern side of the Continental Divide in Montana does this species occur, and then only occasionally is it found of merchantable size. When merchantable it usually forms but a small per cent in mixture with other species. The trees are apt to be best developed when occurring in fairly dense stands of Douglas Fir, Lodgepole Pine, or White-bark Pine, with which latter species it is often confused. In a few places, Limber Pine has been noted to form a considerable proportion of the merchantable timber. On the west side of the Bridger Mountains, Gallatin National Forest, Forest Assistant A. A. Saunders reports a mixed forest which yields 8,000 feet to the acre, the Limber Pine forming 10 to 15 per cent. of the stand,—the remaining species being Douglas Fir. Supervisor Bunker reports considerable bodies of Limber Pine on the Lewis & Clark National Forest, particularly on the North Fork of the Teton River and on Dupuyer and Birch Creeks, extending eastward over the foothills and plains as much as 10 or 20 miles from the mountains. One body on Birch Creek about 10 miles from the mountains comprises about 1,000 acres Of the merchantable timber in the foothills and canyons of that region, the Limber Pine forms 1 per cent. Farther from the mountains in the vicinity of the same streams and their tributaries it forms the major portion of the tree growth, and often exists in pure stands. It is not certain whether this species exists in commercial amounts in places other than those mentioned.

In most localities, however, the trees are commonly scattered or in small groups among other species, as stated above, and it is comparatively seldom that the trees will yield merchantable logs. Whether or not Limber Pine grows west of the Continental Divide in Montana or Idaho is not yet definitely known, but it is probable that the trees which have there been called Limber Pine are in reality White-bark Pine (*Pinus albicaulist*) These two white pines are very similar in occurrence, habits, and in qualities and uses of the wood, and consequently there is a great deal of confusion among Forest officers concerning them. This is especially true in the Rocky Mountain Forests of Montana, where the two species are apt to mingle between the elevations of 5,000 and 8,000 feet. Generally speaking, however, White-bark Pine appears to be the tree of the higher altitudes.

Considerable stands of merchantable Limber Pine, so called,

exist on the Madison Forest also, but whether the species is *Pinus flexilis* or *Pinus albicaulis*, the Forest officers are uncertain. Probably both species are represented. When grouped together as one species they are estimated to form about 5 per cent. of the total tree growth of the Forest. Below 6,000 feet and above 10,000 feet, as well as on exposed situations, the species are very scrubby and of no value. Between those limits, and attaining their best development at about 8,000 feet, the trees usually produce one, sometimes two, and occasionally three logs.

Manner of Growth: Commonly a low, stout, much-branched tree, usually between 25 and 50 feet high, with a trunk from 5 inches to three feet in diameter. In its usual habitat the tree is so stunted and the trunk so short as to yield no merchantable logs. In better locations, however, it is possible to cut 10 foot or even longer logs. When found growing mixed with other species in sheltered canyons, it often forms a tall straight tree, in shape somewhat similar to that of the Lodgepole Pine. As compared with White-bark Pine, when grown in the same situations, the Limber Pine has the longer straighter trunk of the two. The bark of large trees is comparatively thick, being distinctly furrowed and ridged. The branches are large and thick, developing apparently at the expense of the trunk.

The characteristics which easily distinguish Limber Pine from White-bark Pine are confined chiefly to the cones. The cones of *Pinus flexilis* are commonly considered larger and thicker than those of *Pinus albicaulis*. The tips of the cone-scales of both species are very thick, but those of the Limber Pine are rounded, while those of the White-bark are markedly pointed. Furthermore, the Limber Pine cones liberate their seeds and fall to the ground soon after they are ripe, so that it is most always possible to find entire cones beneath the tree, old and weathered perhaps, but still intact. This is in contrast to the cones of *Pinus albicaulis,* which are very persistent on the trees, and remain closed for some time, so that by the time they reach the ground they are apt to be torn to pieces by birds and squirrels, or else fall to pieces from decay.

Characteristics of Wood: The wood of Limber Pine is pale lemon-yellow in color, soft, and close-grained on account of its exceedingly slow growth. When green the wood is extremely heavy, and if left in water any length of time will sink. After

being seasoned, however, it becomes extremely light. At a sawmill which formerly operated on Dupuyer Creek on the Lewis & Clark National Forest, it was found that Limber Pine could be manufactured into a good grade of lumber and shingles. The stem of the tree was generally free from defects and knots, and could be used for the better grades of finishing lumber. This Limber Pine had grown mixed with a heavy stand of Douglas Fir in a sheltered canyon, and the trees had grown tall and straight. It is seldom, of course, that the quality of the wood can be found as good as that on Dupuyer Creek. In its most common habitat its scrubby growth makes it useful only for fence posts and for fuel. Only occasionally is it fit for sawtimber, and then a good proportion of the lumber produced would be apt to be very knotty.

A very unique method of securing a preservative treatment of Limber and White-bark Pine timber for fence posts as practiced by ranchers in the vicinity of the Madison Forest is related by Supervisor Bunker. A sapling growth the size of the posts desired is selected, and in the spring as soon as the sap runs freely so that the bark will slip easily, the rancher peels the bark from the standing trees for the length to be used, and then leaves the tree to Nature. The tree immediately oozes out a sufficient quantity of pitch to cover the wound and dies. Six or eight months later the rancher cuts the tree, now thoroughly seasoned, smears the cut ends with tar, and has a post impervious to water, insects or fungus. Posts so treated are said to last indefinitely. Mr. Bunker personally examined one lot which the rancher said had been set for 20 years, and the posts seemed as sound as ever. The Limber and White-bark pines are apparently the only species which are treated in this way, the ranchers going to considerable trouble and expense to secure these particular kinds. Presumably the original reason for this was because the bark of the young white pines peels so easily, although possibly in the case of these species the outside layers of wood become more thoroughly impregnated with pitch than other species would. It is quite probable, however, that the treatment would succeed with Lodgepole Pine and other species as well. Probably this method of treatment might prove quite economical and practicable to bring into common use where it is desired to thin young stands and utilize the thinnings for posts.

Below are given the uses to which the wood of Limber Pine is now being put, according to the observations of the Forest officers without, however, distinguishing it from White-bark Pine.

Past and Present Uses.

Result—good.	*Result—fair.*	*Result—poor.*
1. Common lumber.	8. Mine props.	11. Shakes.
2. Finishing lumber.	9. Fence posts.	12. Carroll fences.
3. Building timbers.	10. Bridges on roads and trails.	13. Water wheels.
4. Shingles.		14. Telephone poles.
5. Flumes.		15. Cross arms, Parts of.
6. Sluice-boxes.		16. Ranch vehicles.
7. Fuel.		17. Ranch implements.

Authority—Page S. Bunker, Supervisor Flathead Forest.

Others add its use for posts, railroad ties, telephone poles.

Silviculturally, Limber Pine is valuable as a protective cover at high elevations where the snowfall in winter is very heavy and where the ground dries very thoroughly in summer. Forest Assistant Saunders mentions the fact that Limber Pine has proved to be the most resistant of any species to the sulphurous fumes from copper smelters, since on the Deerlodge Forest it has continued to make a healthy growth in localities where all other species have died from the fumes.

White-bark Pine—*Pinus albicaulis* Engelmann.

Range.—Highest altitudes at which timber grows, from the Rocky Mountain and Pacific ranges in Alberta and British Columbia at latitude 53 degrees, southward through Montana and Idaho along the Rockies at Northwest Wyoming and the Targee National Forest, Idaho; also along the Cascade through Washington and Oregon and through the Sierras of California to Kaweah Peaks. At elevations of 5,000 to 10,000 feet in Idaho and Montana, and from 4,500 to 8,000 in Washington, increasing to limits of 7,000 to 11,000 feet in California.

Occurrence.—Confined to narrow altitudinal limits on alpine slopes and exposed ridges to timber line throughout its range. Grows among broken, bare rocks, in disintegrated granite, and in shallow rocky soils with little superficial moisture; best in deep, well-drained, moist soil.

"At north, sometimes in pure, open stands on grassy areas, but

usually in open, park-like stands, preferably on north slopes with Alpine Fir, Engelmann Spruce, Lyall Larch, Limber Pine and Lodgepole Pine. On summits of Cascades, commonly pure at timber line, and often in clusters of from 3 to 7 trees, as if growing from same root. In southern Washington, with Alpine Fir, Black Hemlock, and Yellow Cedar; in Oregon with Black Hemlock, Alpine, Lowland, and Noble Firs, Lodgepole and Western White Pine, and Engelmann Spruce. In the Sierras, forming pure groups at timberline, on east, south, and west slopes, with patches of Black Hemlock and Western White Pine, and at lower altitudes with Lodgepole Pine." (Sudworth.)

In Montana and Idaho, the species occurs sometimes in pure, open stands on grassy areas, but usually in open park-like stands, preferably on north slopes, in mixture with Alpine Fir, Engelmann Spruce, Lyall Larch, Lodgepole Pine, and in the Rocky Mountains proper, with Limber Pine. In moist localities, it is also found on southern and western exposures. In the dense forests of northern Idaho and western Montana, competition is so strong that the intolerant White-bark Pine is usually crowded onto the highest pinnacles and most unfavorable situations, and even there its occurrence may be limited to occasional specimens. In the somewhat drier forests of central Idaho and central and southern Montana, the struggle is not so severe, and the species is apt to occur in considerable stands in favorable situations.

White-bark Pine is always found in situations which undergo great seasonal and daily ranges of temperature, and which are subject to fierce winds, very heavy snows, and a short growing season.

Commercial Distribution in District I.—This species does not approach a size and quality which would suit it for commercial purposes, except when growing in the most favorable situations, such as on deep rich fairly moist soils in protected spots. Supervisor J. E. Barton mentions only one locality on the Pend Oreille Forest where it exists of merchantable size over considerable areas. In the vicinity of Lake Darling, at an elevation of 5,000 feet, it occurs in rather dense groves of considerable extent, forming a fringe on the alpine meadows surrounding the lake. This basin is protected by ridges running up to 1800 feet above the lake. No groves of importance are recorded on the Kaniksu or the Coeur d'Alene, but on the Clearwater and Nezperce

Forests Mr. Barton found the species in merchantable size covering rather large areas, at altitudes varying from 5,000 to 6,800 feet. This district appears to be about the middle range of the species for Idaho, the trees being about 40 feet high, from 6 inches to 20 inches in diameter, and with an average merchantable length of about 24 feet.

Such stands also occur on the Forests of Western Montana, but they are almost wholly on elevations which will be inaccessible for a long time to come. Mr. Woodward mentions an excellent mixed stand of White-bark Pine and Lodge-pole Pine in the Missoula Forest, on the divide between the east fork of Rattlesnake Creek and the west fork of Gold Creek. The species here had a long clear bole with a short and narrow crown, a form quite similar to that of the Lodgepole Pine with which it grows. Along the main Continental Divide in Montana, from Glacier Park southward, merchantable stands are quite common on the broad ridge tops, gentle slopes, and in the basins at the heads of streams, where the soil is deep and fairly moist and the winds not too severe. Here, as elsewhere, the very moist soils along the creeks are occupied by Engelmann Spruce and Alpine Fir. The drier soils farther up the slopes are given over to mixed stands of White-bark Pine and Lodgepole Pine, or above the range of Lodgepole, to White-bark in pure stands. It is quite possible that in many localities of this region, White-bark and Limber Pine are associated, particularly between 5,000 and 8,000 feet, the merchantable groves of White-bark Pine being found between 6,500 and 8,000 feet elevation. This point should be determined by further investigation. Certain it is that much of the timber which is called Limber Pine is in reality *Pinus albicaulis*. It is only in this region east of the Continental Divide that White-bark Pine is sufficiently accessible to be of present commercial value. It is now, however, being cut for commercial purposes on the Deerlodge Forest and on others further south, and probably on the Lewis and Clark also along with Limber Pine.

Manner of Growth.—White-bark Pine usually has a low, long-branched, twisted or crooked trunk, ranging from 15 to 50 feet high and from 10 to 24 inches in diameter. In the high wind-swept home of this tree it is often merely a sprawling shrub with enormous branches spreading over the ground. As an example of the other extreme, an exceptionally perfect specimen of *Pinus*

albicaulis was noticed growing with spruce in a creek bottom on the Lewis & Clark National Forest that measured 18 inches d. b. h. and had a tall straight trunk that would yield four good 16 foot saw-logs. The average merchantable stand of this species, however, usually runs quite uniform, with a merchantable length varying from 10 to 30 feet, depending upon the situation.

White-bark Pine is usually not very straight, even at its best. It has considerable taper and crook which is usually markedly contrasted with the straightness of the Lodgepole Pine and spruce growing with it. Very characteristic also is the tendency it has to fork a foot or so above the ground. In general, this species is very similar to Limber Pine and the two species are commonly confused. However, the trunk of *Pinus albicaulis* is generally much shorter and more crooked than that of *Pinus flexilis,* and the bark of the former is usually much thinner, and more or less scaly-smooth, rather than ridged and furrowed. The purple cones of White-bark Pine are shorter and stubbier, and the cone-scales very pointed. Moreover, the cones are longer persistent on the trees than are those of the Limber Pine, and open very slowly after they are ripe. Since the seeds are a favorite food of the jays, magpies and squirrels which inhabit the high altitudes, the cones are usually cut or torn to pieces before they are ready to fall, and for months afterwards one may see the bare central shaft and a few of the basal scales still remaining in place on the tree, but no entire cones anywhere. Should the birds or rodents not get the seeds, the cones may remain closed after falling until the scales, rotted at the bases, break away in bunches, liberating the seeds. The fact, therefore, that under the Limber Pine the old cones may be found entire, while under the White-bark they are rarely or never so, affords one of the simplest and safest ways of distinguishing between the two species.

Characteristics of Wood.—The wood of White-bark Pine is light-brown in color, soft, close-grained, light in weight when seasoned, and in other ways quite similar to ordinary White Pine. It may prove to be more brittle, however. In contrast to the brittleness of the wood of the trunk, that of the branches is extremely tough. The grain is nearly always twisted, which makes the wood unsuitable for matches and for some other uses to which ordinary White Pine is put. For the commoner uses

of contruction, however, requiring ease of working rather than strength, this species should answer fairly well.

The wood of White-bark is so similar to Limber Pine as to be scarcely distinguishable, except under the microscope, and the statements made concerning Limber Pine can be applied to White-bark as well.

Uses of the Wood.—Common construction; Building timbers; Flumes; Sluice-boxes; Shingles; Building logs; Mine props; Mining stulls; Bridge timbers; Fence posts, Cordwood (for fuel).

Western White Pine—*Pinus monticola* Douglas.

The Idaho White Pine of the lumberman, and occasionally called Silver Pine by foresters and botanists.

Range.—The type tree of the North Idaho forests. Scattered through mountain forests from the west slopes of the Rockies in Montana and southern British Columbia westward through nortern Idaho and Washington to the Pacific coast, at elevations up to 6,000 feet. From the Columbia-Kootenai Valley of British Columbia, and from the mountains and southwest coast of Vancouver Island its range extends southward along the Cascade and Coast Ranges from sea level to 6,000 feet in Washington, at 1,500 to 8,500 feet in Oregon in the cross ranges of northern California at 4,500 to 7,200 feet, and in the Sierras at numerous points between 5,500 and 11,000 feet elevation.

Occurrence.—In general not confined to any definite type of locality. At the north it is most abundant and largest in the deep porous soils of most valleys, but is also occasionally found growing in dry exposed subalpine regions.

"Greater development in northern Idaho, on gentle north slopes and flats. Less frequent west of Continental Divides in Montana and of Cascades in Oregon. In northern California, on north slopes, and on south and west slopes in protected coves, broad valleys, and mountain benches; in southern California rather abundant on high, west slope of Sierras." In regions other than Idaho occurs commonly as scattered trees or small groups with other species; very rarely in pure stands and only on exposed high slopes. In Cascades and Sierras occasionally forming 50 to 70% of stand on small areas, but through-out its range not exceeding 3 or 4 per cent. In western Washington associated with

Western Hemlock, Amabilis Fir, Lowland Fir, and Douglas Fir; in Oregon, with Douglas Fir, Lowland Fir, and Amabilis Fir; in California, with Douglas Fir, Lodgepole Pine, Red Fir, and Shasta Fir." (Sudworth.)

In the humid climate of northern Idaho, Western White Pine forms the determining feature of the forest type as a whole, although the percentage of the species varies very widely in different localities. It is the predominant tree in the white pine flats between 2,200 feet and 4,500 feet elevation, and to a considerable extent at somewhat higher corresponding elevation on the moist southerly slopes. It frequently exists in almost pure stands, but more often other species form 10 to 50% of the merchantable volume. On northerly exposures its codominant associates are Western Larch and, to a less extent, Douglas Fir, Engelmann Spruce, and White Fir, (*Abies grandis*); while under the main stand, Western Red Cedar, Western Hemlock, and White Fir usually form a lower story, or an undergrowth. On southerly exposures, including those sloping to the southeast and southwest, Douglas Fir is the usual associate, while in some localities White Fir, Lodgepole Pine, Western Larch, and occasionally Yellow Pine, are found. Here as a rule there is no understory of cedar and hemlock.

The detailed range of Western White Pine in Idaho and Montana is given below.

Commercial Distribution in District I.—Western White Pine is of the highest commercial value of any species wherever found. Throughout the entire panhandle of Idaho, from the Middle Fork of the Clearwater River to beyond the Canadian boundary, it makes the best growth of any species and produces the bulk of the merchantable timber. The per acreage yield is far greater than that of any other species grown in the region. In the Priest River Valley on the Kaniksu Forest, where the species reaches its maximum development, the white pine type occupies about 80% of the entire area. Approximately 42% of the merchantable timber of this type, or 34% of the entire stand of the region, is Western White Pine, according to J. E. Lieberg's estimate. In places the stand is found to be 90% pure, although in the majority of typical well developed stands the White Pine forms only 60 to 70% of the merchantable volume. Western Red Cedar frequently forms 5 to 10%, while the remainder is principally

Western Larch. In investigating the yield of White Pine in this region during the summer of 1910, entire sections were examined which were covered with a mixed stand such as described, and which would yield no less than 70,000 feet B. M. per acre. Fully stocked acres of nearly pure White Pine were found which contained over 130,000 feet B. M. merchantable volume per acre. This timber was all 140 years old, with an average height of about 130 feet, yielding 6 merchantable logs to the tree; and with an average diameter breast high varying from 14 to 24 inches, depending on situation and density of stand. Larger trees, which have diameters ranging up to 36 inches, height up to 175 feet, and yielding as high as 9 logs to the tree were quite common, however, in the same age classes. This is practically the age at which the yield is the greatest. The trees continue to grow rapidly for 60 or 70 years more, increasing in height and diameter, but this growth is usually more than offset by a thinning of the dominant stand, the subdominant cedar and hemlock finally filling up the interspaces.

Upon the Coeur d'Alene the development is practically as good. The Percentage of White Pine here is greater than that on the Kaniksu, since the species forms a greater proportion of the type. Supervisor Weigle estimates that 40% of the merchantable stand is White Pine. Upon the Pend Oreille the winter type appears to dominate at a somewhat less degree while the species usually forms only from 25 to 50% of the type, the larch again becoming more plentiful. South of the Coeur d'Alene, upon the North Fork of the Clearwater River in the Clearwater National Forest, the species grows in immense bodies, but as one proceeds south it becomes more and more restricted to moist protected basins and stream bottoms of about its middle range in altitude, until on the Nez Perce it becomes reduced to single scattered specimens or patches and finally disappears altogether.

On the eastern side of the Bitterroot Range in Montana the same condition prevails. Although scattered over a considerable part of the Kootenai River, the white pine type is said by Deputy Supervisor Parker to cover scarcely more than 5% of the total area, while the species only occasionally makes up 25% of the forest type. On the Blackfeet and Flathead National Forests extensive stands of this type are found in Swan River Valley, and the various forks of the Flathead River (particularly the

South Fork) but here the species does not appear to form over 10% of the merchantable timber. Reproduction is abundant however, and seems to indicate that in these localities the species is to become predominant.

On the Cabinet Forest, White Pine is found in small groups or as isolated specimens, in the small basins at the heads of tributary streams, on gentle northerly slopes. On the Lolo, where topographic conditions perhaps cause greater humidity, the species occurs in heavy stand, in mixture with Engelmann Spruce, Larch, and other species. The type is confined, however, to the western end of the Forest—the upper drainage of the St. Regis River, the head of Trout Creek and the West Fork of Fish Creek, which territory corresponds in general with that of the heaviest snowfall in the Forest.

Upon the Missoula Forest, Western White Pine is found only as isolated specimens in the Clearwater Valley, probably the Southeastern limit of the range.

Manner of Growth.—"In dense forests, in which its most characteristic form is found, this pine has a tall, slender shaft, with a peculiarly short-branches, narrow, symmetrical crown; the branches are usually slender and drooping and in early life extend over one-half or two-thirds the length of the trunk." In Idaho, the regions of its best development, on its best site, its height ranges from 90 to 170 for 140 year old trees and when fully mature, usually from 150 to 200 feet or over. It then is usually from 2½ to 3½ feet in diameter. A white pine somewhat exceptionally large was cut in the Priest River Valley in 1910. This tree was 60 inches in diameter breast-high, was cut into twelve 16-foot logs, and scaled 7,000 feet B. M.

Outside of this region of best development, and also within the region on poor situations, such as south slopes, ridges, and thinner soils, "its height ranges from 90 to 100 feet. In open forests, where the conditions are less favorable to its better development, it is a short-bodied tree, 50 or 60 feet in height, with one or several very long, stout horizontal branches extending from 10 to 15 feet or more beyond the other slender branches. This striking character distinguishes the tree as far as it can be seen. The bark of trees a foot or more in diameter is distinctly broken into peculiar small, square blocks. No other tree associated with it has this

bark character. The bark of mature trees is rarely over 1¼ inches thick." (Quotations from Sudworth.)

In general, the appearance of this species is very similar to that of the eastern *Pinus strobus*, which it also closely resembles in other characteristics. The chief difference in appearance are the very narrow crown and thin bark of the Western White Pine as contrasted with the broader head and the comparatively thick deeply rifted bark of its eastern relative.

Characteristics of Wood.—Practically the equal of the eastern White Pine commercially, and largely taking its place in markets east of the Rocky Mountains. The wood is of a light brown color, very soft and light, straight and close grained, easily worked, but very strong. Heartwood fairly durable in contact with the soil. Some lumbermen claim that this species yields somewhat less clear lumber than does the eastern species. Others contend that the quality is fully as good. Match manufacturers assert "that for their purposes the eastern species is preferable, since the Western White Pine contains more hard streaks and more bird's eyes," defects for match manufacturers but not for general purposes.

The uses of the wood are the same as those of its eastern congeuer.

SEASONAL VARIATION IN THE FOOD RESERVES OF TREES.*

By John F. Preston and Frank J. Phillips.

INTRODUCTION.

One of the earliest records of the reduction of starch in the cortex and phloem of the stems of woody plants in winter is contained in a report by Mer[1] in 1879. This author examined but few trees at this time, but noted in them the winter decrease of starch and the increase of oil globules.

A much greater contribution to the knowledge of the seasonal condition of the stored food of woody plants was made by Russow[2] who published his results in 1882. He examined at various seasons the cell-contents of phloem and xylem of stem and root of 92 species, of which 51 species grew in the open at Dorpat in western Russia. The xylem of these trees was not examined in all cases, but, as far as examined, showed starch present in both stem and root in both summer and winter. In the phloem, the variation of starch content was marked, this substance being at a maximum in late autumn, and disappearing from the most of the trees in winter. Examinations were made in two consecutive years, one with a mild winter and one with a severely cold winter. In the mild winter, 10 trees kept considerable starch in the phloem of the stem, but this was reduced to none, or but a trace, in the cold winter. Also, of the 42 species of trees and shrubs kept in a plant house over winter, about a half showed more or less starch remaining in the phloem of the stem. But since nearly a half of

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*(Contribution 126 from the Botanical Department of the University of Michigan.

This paper is the result of the work of two of my former students under whose names it is published. These two students left me good reports of their work, and these reports I have edited and prepared for publication. I should add that a third student, Mr. Nelson F. Macduff, also furnished some of the data.—F. C. Newcombe.)

[1]De la Repartition de l' Amidon dans les Rameaux des Plantes ligneuses. Bull. Soc. de France. *XXVI*, 1879, p. XLIV.

[2]Ueber den Inhalt der parenchym. Elemente der Rinde. Sitzber. Naturforsch. Gesellsch. Universität Dorpat. VI, 1882, 369. Abstract in Bot. Centralblatt. XIV, 1883, 271.

them lost all, or nearly all, their starch, notwithstanding the warmer temperature of the house, Russow concluded that the solution of the starch is independent of immediate climatic conditions. Russow's view was that the starch was transformed into fat.

In a report to the Versammlung russicher Naturforscher und Aerzte, Odessa, Grebnitzky and Baranetzky[1] stated that their examination showed that the autumn starch disappeared wholly from the phloem of the stems of trees in winter, and disappeared wholly from the xylem of the stems of soft-wood trees, while the xylem of hard woods showed merely a reduction in the amount of starch. They, too, supposed that the starch was transformed into fatty oil.

In the year 1891, following a shorter paper on the same subject, Fischer[1] published a very extensive and detailed account of his studies of the reserves of trees. He confirmed the reports of former observers as to the disappearance or reduction of starch in the stems of trees as the season advanced from autumn to winter, and summed up the whole annual transformation of the non-nitrogenous stored material as follows: At the time of the fall of the leaves in autumn, the stems of trees show a starch maximum; in winter there is a starch minimum, and in early spring a regeneration of starch, producing a second starch maximum, followed later in spring by a second starch minimum. The soft-wood trees in general dissolve all their starch in winter, replacing it in whole or in part with fat, while the hard-wood trees in general retain a large amount of starch especially in the xylem in winter, and show but little fat. This high percentage in winter of starch on the one hand, or of fat on the other, allows trees to be divided into two groups, starch-trees(composed mostly of the hard-woods), and fat-trees (composed mostly of the soft-wood and conifers). The starch minimum of spring is followed by a glucose maximum at the time of the unfolding of buds; but this maximum soon diminishes as the sugar is consumed in the formation of new tissue. Glucose may appear in some trees as a product of starch solution in winter, but not to the extent that fat

[1]Bot. Centrblt. XVIII, 1884, 157.

[1]Beiträge zur Physiologie der Holzgewächse. Jahrb. wiss. Botan. XXII, 1891, 73.

does. Yet the total of sugar and fat is not enough to account for all the starch dissolved.

Mer,[1] writing in the same year as Fischer and in a subsequent paper in 1898, differed from Fischer by denying that glucose was one of the transformed products of starch.

D'Arbaumont[2] examined the stems of nearly 100 species of trees and shrubs, and came to the conclusion that the disappearance of starch in winter, though influenced by the temperature environment, is a fixed habit in woody plants, inasmuch as several trees, kept in a warm plant house over winter, nevertheless lost all their starch from the stem. D'Arbaumont's observations do not seem to coincide with Fischer's as to the greater diminution of starch in soft-wood trees compared with hard-woods, inasmuch as both hard-woods and soft-woods are found in his list the members of which lost all their stem starch in winter, and both hard-woods and soft-woods are found in his list the members of which retain some starch in the stem in winter.

To the questions under discussion, Sablon[3] made the next important contribution. His methods are mostly microscopical, by chemical analysis. Fischer had suggested that the starch, on dissolving in early winter, passed in part into an unknown substance. This substance Sablon claimed to have discovered in reserve cellulose. Moreover, according to his analyses, reserve cellulose constitutes by far the largest part of the non-nitrogenous reserves, starch, sugar and fat being wholly subordinate. In the stem of the chestnut, for instance, in proportion to the dry weight of the stem, the maximum content of starch was, according to Sablon, 4.6%, minimum 2.4%; the maximum of sugar was 4.3%, minimum 2.1%; the maximum of fat 1.1%, minimum 0.6%; while the maximum of reserve cellulose was 20.2%, minimum 14.4%. The presence of reserve cellulose was determined not only by extracting the finely ground powder with boiling 10% hydrochloric acid, and subsequent chemical analysis, but by the use of the microscope, the xylem cells showing in winter a layer of cellulose which disappeared in spring. Some

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[1]Des Variations qu' éprouve la Réserve amylacée des Arbres aux diverses Epoques de l' Année. Bull. Soc. Bot. France, XLV, 1898, 299.

[2]Sur l' Evolution de la Chlorophylle et de l' Amidon dans le Tige. Ann. Sci. Nat. 8 ser. T. 13, 1901, 319; T. 14, 125.

[3]Recherches physiologiques sur les Matières de Réserves des Arbres. Rev. gen. Bot. XVI, 1904, 401.

species, Sablon believed, deposit their reserve cellulose within rather than upon the wall of permanent cellulose.

In 1895, Schellenberg[1] strengthened the position of Sablon regarding the annual formation of reserve cellulose in trees. In the xylem parenchyma of *Aesculus hippocastanum, Betula verrucosa,* the Beech Oak, Ash and Alder, though there was an unlignified inner lamella, this was never dissolved, because the cells died at the end of the season of their formation. But in *Vitis vinifera* and *Robinia pseud-acacia,* these xylem parenchyma cells do not die so early, and their inner lamellae are partially dissolved the following spring. The primary cortex of young twigs may be used for deposit of reserve cellulose, as in the case of the Birch, Alder, Hazel and Horsechestnut, and most probably in *Salix capraea, Quercus penduculata, Populus* and *Fagus silvatica*

The parenchyma of the phloem was seen to dissolve partially its cellulose in Alnus, *Aesculus hippocastanum,* Betula, *Pinus montana, Larix europaea,* and *Picea excelsa.*

The deposit of the reserve cellulose takes place from August till October, or even to the end of November in some species, the walls being seen to thicken. In the spring, the solution of the cellulose is determined by an actual thinning of wall in some cases, and by a partial solution without much thinning in others, the loss of density in the wall being shown by polarizing apparatus.

Niklewski's[1] study concerned chiefly the fat content of Tilia, Betula, Prunus and Syringa. Unlike Vandevelde,[2] who found fat not changed in amount when the starch of autumn is dissolved, Niklewski found fat increasing from summer into January, and, after that, a decrease till summer. But Vandevelde and Niklewski agree that the amount of fat present is not directly related to the transformations of starch. Starch can be changed to sugar and sugar to starch by varying the temperature; but the formation of fat is a seasonal function, largely independent of temperature.

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[1]Ueber Hemicellulosen als Reservestoffe bei unseren Walbäumen. Ber. d. d. bot. Gesellsch. XXIII, 1905, 36.

[1]Untersuchungen über die Umwandlung einiger stickstofffreier Reservestoffe während der Winterperiode der Bäume. Beih. Bot. Centrblt. XIX, 1906, 68.

[2]Bijdrage tot de scheikundige physiologie van den stam der Boomen. Ghent, 1905. (This paper was inaccessible to the present authors.)

Fabricius[1] investigated the varying starch and fat contents of all parts of the Norway Spruce. The numerous transformations as told by Fisher, Fabricius claims,, hold good for young stems only. In older stems, he finds starch remaining in large quantities in winter in both phloem and xylem. Only once in the year is starch wholly transformed into fat, and that is in summer, after the buds begin to unfold. Fat remains in the wood through summer, and is converted back to sugar from September to November. A solution of starch in April takes place only in young twigs; and a new deposit of starch in summer takes place only in the phloem. In the xylem, the starch in summer is converted over into fat, which persists all summer. Roots elongate in June, July and again in October, and while they are elongating, fat is always present in the cortex of the root.

More recently Sablon[2] has published a second paper on the reserves of trees, in which he maintains his position that sugar and fat are of but minor importance as reserve material, reserve cellulose being far greater in quantity than both combined. The maximum of carbohydrate reserves falls at different times for trees with deciduous leaves and those with persistent leaves; for the former, the maximum is at the fall of the leaf in autumn; for the latter, at the beginning of activity in spring. For both kinds of trees, the minimum is later in spring.

In all of the foregoing work there was little attention paid to the condition of the carbohydrates in roots, except that Russow and Sablon extended their observations to these members. Petersen[1], however, in two papers gave the results of his exami-

Nogle Undersogelser over Traeernes Rodliv (with French Resume) Ibid. 1898, 1.

nation of the roots of eight species of trees, according to which the starch in general was not dissolved in the roots in winter, though it did disappear from both phloem and xylem of the root of *Betula verrucoca* and from the phloem of the root of *Acer pseudoplatanus* in December. Petersen's studies extended to the stem of a larger number of trees, but, as his results generally agree with Fischer's, we need not dwell longer on the details.

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[1]Untersuchungen über den Stärke—und Fettgehalt der Fichte auf der oberbayerischen Hochebene, 1905. Abstract Bot. Centrblt. 102, 1906, 29.

[2]Recherches physiologiques sur les Matères des Réserves des Arbres II. Rev. gen. Bot. XVIII, 1906, 5.

[1]Stivelsen hos vore Lovtraeer under Vinterhvilen. Oversight kong. Danske Vidensk. Selskab Forh. 1896, 50.

The conclusions of the foregoing contributions may be summarized briefly in the following sentences:

STARCH.—(1) There is common agreement that in the cortex and phloem of young branches reserve starch accumulates from early summer till autumn, then gradually diminishes in amount to a minimum, or to nothing through the winter; then in early spring reappears in large quantity, to diminish to a second minimum as the buds are unfolding.

(2)) In the xylem of young branches and trunks, it is agreed that there is, in winter, a reduction in some trees, in some, a total disappearance of starch.

(3) In the relatively few statements regarding the presence of starch in roots, there is agreement that there is much less seasonal variation than in stems. Starch remains in both phloem and xylem of the root through the winter, and reaches a minimum there in early summer.

(4) In the older trunks and older branches of the Norway Spruce, according to Fabricius, there is not so great a seasonal variation as in the younger stems. In the older stems, the starch in both phloem and xylem remains the year through, though with some reduction in late autumn.

SUGAR.—According to the extensive work of Fischer, sugar shows a maximum in December, and a lesser maximum in early spring, its maximum coinciding with the minimum of starch. Most authors agree with Fischer, and believe that these substances have a reciprocal action in changing the one into the other. Mer, however, as the result of several analyses, concluded that there is no more sugar present in winter than in summer. Sablon also found only a small increase of sugar in winter.

FAT.—Although Fischer and one or two other authors believed, on rather insufficient evidence, that starch was transformed into fat in early winter, the most of the writers agree that the amount of fat present has no relation to the transformations of starch. The most that can be said is that fat is at a minimum in early summer, and that it increases from this time till January, and then begins a decline lasting till May or June.

CELLULOSE.—Only two authors have written on cellulose as a food reserve—Sablon and Schellenberg. If Sablon's conclusions are correct, then the amount of reserve cellulose is considerably greater than the combined amounts of starch, sugar and fat.

This reserve cellulose is claimed to be deposited in different tissues in different species—in the primary cortex and phloem of twigs, in the phloem and xylem of older stems and roots. The increase in thickness and density of membranes is said to take place in the latter part of summer and in autumn, and the thinning to take place when growth starts in the spring.

OBSERVATIONS.

An examination of nine of our representative forest trees was made at intervals of one to two weeks from the first of October, 1905, to the middle of June, 1906. This study was undertaken with a view to gaining further information on two questions: (1) How closely do our trees conform to the behavior of their near relatives in Europe? (2) There having been heretofore relatively but few trees examined for the determination of the seasonal variation of the carbohydrates in the roots, what is the condition of these reserves through the seasons?

The methods employed were simple, being merely a microscopical examination of sections treated with iodine, Fehling's solution, osmic acid, alkannin, or cyanin. These reagents, of course, identified only the starch, reducing sugar, and fats. Unfortunately time did not allow the determination of the reserve cellulose, nor any more accurate measurements of the starch, sugar, and fat than could be judged by simple observation of sections.

In making the observations here recorded, 9 trees were examined: *Populus deltoides* Marsh., *Tilia americana* L., *Salix alba* L., *Juniperus virginiana* L., *Ulmus americana* L., *Acer saccharum* Marsh., *Quercus rubra* L., *Juglans nigra* L. and *Carya glabra* Mill. All of these trees grow wild in this region, and all except Salix are native.

A glance suffices to show that of the 9 trees, the first 3 in the list are soft-woods, and the 4th a gymnosperm, and hence the four belong to the group whose relatives in Europe are said to dissolve all or the most of their starch above ground in winter, while the last 5 belong to the group whose European relatives have been found by most observers to dissolve the starch above ground in the cortex and phloem but to retain more or less starch in the xylem throughout the winter.

STARCH IN TWIGS AND STEMS.

Populus deltoides.—In cortex, phloem and xylem of the parts above grounds; the starch passes through the phases observed in Denmark by Petersen for *Populus tremula* and in northeastern France by Mer for Populus sp. That is, in both cortex and stele the starch is at a maximum in autumn, disappears wholly in winter, is regenerated in the early spring, and again disappears in May. Russow, however, found starch abundant in winter in the phliem of *P. tremula.*

Tilia americana.—The behavior of starch in the stem of this tree is nearly like that of *Populus deltoides,* except that in Tilia a small amount of starch may be found in the outer part of the phloem, in the medullary rays of the xylem zone, in the xylem, and in the pith probably at all times in winter. It was not seen in the cortex or phloem in the first half of January, and not in the xylem in the last half of January, but examination each week before and after showed its presence in the respective tissues, and its reported absence was probably due to hasty examination. This result agrees more nearly with the observations of Mer on *Tilia* sp., and of Russow on *Tilia europaea,* but differs from those of Fischer, who found no starch in winter in any part of the stem of *Tilia parvifolia.*

Salix alba.—The twigs and 10-year old trunk of this tree lost all their starch in January in this region (Ann Arbor, Mich.). Fischer reports *Salix babylonica,* and Mer and D'Arbaumont report *Salix capraea* as retaining some starch all winter.

Juniperus virginiana.—By the middle of November the twigs and trunk of this tree up to 12 years of age had lost the most of their starch. By the middle of January the last traces had disappeared, the medullary rays retaining theirs the latest.

Compared with this, the behavior of *Juniperus communis* is described by Fischer as showing no starch in any part of the stem in winter, except for a trace retained in the xylem.

Ulmus americana.—In the twigs of this tree, the starch disappeared from the cortex at the middle of December, but did not wholly vanish at any time from either phloem or xylem of twigs or older trunks, though it was much reduced in both phloem and xylem of these members.

This same species presents a similar behavior when grown in eastern France, as recorded by d'Arbaumont.

Ulmus campestris is reported by Fischer as retaining starch in the xylem only, while both Mer and d'Arbaumont found the same species retaining starch in both phloem and xylem.

Acer saccharum.—This tree retains considerable starch throughout the winter in xylem and medullary rays of both twigs and older stems. This behavior exactly coincides with that of *A. dasycarpum* as mentioned by Fischer, and with that of *A. pseudoplatanus* and *A. saccharinum* as mentioned by d'Arbaumont.

Juglans nigra.—In both twigs and trunk of this tree, the starch wholly disappears from the cortex and phloem, but is retained in the wood parenchyma and medullary rays to the extent of about 25% to 33% of the maximum content of September.

Juglans regia, in northeastern France, according to Mer, behaves exactly as does J. nigra, as concerns the starch in winter.

Carya glabra Mill.—This hickory loses all its starch in cortex, phloem and xylem in smaller stems, but retains about one-fourth the maximum amount in winter in the medullary rays of the xylem zone, and in the wood parenchyma of larger stems.

To the best of our knowledge, this is the first report as to the winter content of starch of any of the hickories. The species here treated ranges itself with its relatives, the walnuts, in America and Europe.

Quercus rubra.—Both twigs and the older trunk show starch present throughout the winter in cortex, phloem, xylem, pith and medullary rays. In cortex and phloem, there is in winter but a small quantity compared with the maximum of autumn; but the amount in the xylem and pith does not appear to diminish greatly.

It is worth noting that none of the oaks reported by the various investigators of Europe show starch in the phloem of the stem in winter, though all show more or less winter starch in pith, xylem and medullary rays of the xylem ring. Such reports are made for *Quercus robur* at Leipzig by Fischer; for *Quercus pedunculata, Q. pubescens, Q. alba* and *Q. tinctoria* in eastern France (Côte d'Or) by d'Arbaumont.

Starch in Roots.

It has already been stated in this paper that the roots of trees as far as examined have generally shown but little diminution of

starch in the winter. However, Petersen found the roots of *Betula verrucosa* losing the starch in all their tissues in December, while the roots of *Acer pseudoplatanus* lost at the same time the starch from the phloem.

The nine trees reported in this paper were examined at weekly intervals from October to June for the amount of starch in the roots. The phloem of the root of *Carya glabra* showed some reduction of starch in December, but the roots of the 8 other trees retained their starch in both phloem and xylem undiminished throughout the winter as far as the microscopical method could determine. All of the species showed a reduction, but not a complete loss of starch in their roots in April or May.

The material taken for examination in winter was not allowed in warm temperature before examination.

Conceiving the possibility that the retention of starch by the roots in winter might be, at least in part, due to the protection afforded by their buried condition, roots of the 3 species, *Tilia americana, Ulmus americana,* and *Quercus rubra,* were uncovered in midwinter, and exposed to the air, while still connected with the trees. Although these roots were frequently exposed to temperatures of —10° to —20°, and for 6 weeks almost continuously to a temperature below 0°, there was no perceptible effect on the content of starch. The exposed roots and the unexposed roots presented the same appearance under the microscope.

Sugar Reserves.

Since the analytical chemical work of Sablon, sugar can hardly be given the place of importance assigned to it by Fischer, namely, as a large reserve in trees. The examination of the 9 species of trees included in this report demonstrated the presence of a large amount of sugar in the spring only, at the time of the unfolding of the buds. There was an increase of sugar in the late autumn in all species; but only *Juniperus virginiana* and *Salix alba* showed much sugar in any part of the tree at any time except in April and May. The roots of all 9 species showed only traces of sugar at any of the examinations except in April and May.

Fat Reserves.

The variations in the amount of fat reported by most of the investigators have been found to hold true for 8 of the 9

trees here reported. (*Acer saccharum* was not examined for fat.) That is to say, fat was at a minimum at the time of unfolding of buds, increased slowly through the summer to attain a maximum in late autumn or early winter, to decline again to the minimum of spring. The trees showing considerable quantities of fat were *Populus deltoides, Juglans nigra, Tilia americana,* and *Ulmus americana;* while those showing but little fat were *Salix alba* and *Carya glabra.* The fat was in largest amounts in the phloem and rays of the twigs; the roots of none of the trees showed more than traces of fat in any of the tissues.

SUMMARY.

The work reported in the present paper, and that of the European investigators, may be summarized in the following statements:

1. There is in the stems of all trees in temperate climates a reduction in November and December of the amount of starch present in autumn, the reduction being so great in some trees as to lead to the complete disappearance of the starch throughout the stem, while in most trees the xylem retains more or less starch, and in still others both xylem and phloem retain some starch through the winter.

2. A few trees have shown a considerable increase of fat in the phloem and xylem in late autumn or early winter; but there is insufficient evidence for the belief that starch is transformed into fat. In most trees the increase of fat is not marked.

3. The trees that contain considerable fat in winter are some of them hard-woods and some of them soft-woods, as *Populus deltoides, Tilia americana,* and *Juglans nigra* in the present paper, the first two being soft-woods and the last a hard-wood. The soft-wooded *Salix alba* contains but little fat, but considerable starch in its stem in winter. From these results and those of European authors, it would hardly seem justified to name broad-leaf hard-woods generally as *starch trees,* and the soft-woods and gymnosperms generally at *fat trees,* as proposed by Fischer.

4. As claimed by Sablon, so the work reported in this paper seems to indicate no great increase in the content of sugar in stems and roots, except in the spring as the buds unfold.

5. In the root, the transformations do not keep pace with those in the stem, and starch remains the year round, the greatest reduc-

tion occurring in spring. The roots of all nine trees studied in the present work showed much starch in both phloem and xylem all through the winter.

6. The transformations of the carbohydrates are largely dependent on the season, though the immediate conditions of temperature have some effect. Thus, Russow and d'Arbaumont found that several species kept in a warm glass-house over winter lost their starch at the usual time; and in the work reported in this paper, roots of trees exposed to the severity of winter by removing their covering of earth did not appreciably reduce their starch. On the other hand, it is known that a stem, without starch in winter, will form starch in a few days after placing in a warm temperature; and Russow reports several species of trees that retained considerable starch in the stem through a mild winter, but lost much or all of their starch in the next winter, which was severe.

7. Fabricius reports that the older stem of *Picea excelsa* does not transform its starch to so great an extent as the younger stems. Several of the trees examined in the present work have shown the same thing; and hence it is quite likely that it is a general phenomenon.

8. Sablon has pointed out that the maximum for total carbohydrate reserves for deciduous leaved trees is at the fall of the leaf in autumn, whereas the maximum is at the opening of buds in the spring for persistent leaved trees.

9. Finally, the work of Sablon and Schellenberg indicates that the principal carbohydrate reserve of trees in winter is cellulose. One might wish that the methods employed by these two investigators were a little more convincing. Sablon obtained favorable results by chemical analyses, and both he and Schellenberg report seeing the walls thinned down in spring; in other cases the walls showed a loss of refractive properties in cases in which reduction in thickness could not be seen. There need be nothing suspicious in the claim of a loss of substance where loss of thickness could not be seen; for enzyme action produces exactly this effect at the first solution of walls in some seeds[1].

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[1]Newcombe. Cellulose Enzymes. Ann. Bot. XIII, 1899, 49.

PITH FLECKS OR MEDULLARY SPOTS IN WOOD.

By Samuel J. Record.

Pith flecks or medullary spots are small, brown, half-moon shaped patches appearing so commonly on the cross sections of many of our woods, especially those of the four families Salicaceae, Betulaceae, Rosaceae and Aceraceae. All close observers of wood are familiar with their appearance and several writers, notably R. Hartig[1], Kienitz[2], Nördlinger[3], Stone[4], and Boulger[5], have made use of them as one of the specific characters in wood identification. The purpose of this article is to summarize investigations of the origin and nature of pith flecks, with special reference to the taxonomic value of such occurrences.

It appears that attention was first called to these spots by Th. Hartig[6] in 1840, terming them "cellular channels" (Zellgänge). He noted and described their occurrence in birch, red alder and hazel. He made no attempt, however, to explain their cause.

Rossmässler[7] proposed the name "medullary recurrences" (Markwiederholungen), believing the flecks to be of the same formation as the rays.

Nördlinger[8], in preparing his wood sections, remarked the occurrence of the spots in several species of wood and gave them the name "pith flecks" (Markflecke), which has been generally accepted.

Cordes[9] and Mohl[10] confirmed the statements of Th. Hartig and Rossmässler regarding the species of woods in which the flecks occurred. Ratzeburg[11] made some investigations of the flecks which he termed "brown chains" (Braunketten) on account of their color and horizontal distribution. He considered it possible but scarcely probable that they were due to the mining of the cambium by the larvae of an insect which he provisionally called *Tipula suspecta.*

Kraus[12] made a more detailed study of the pith flecks with the intention of using them diagnostically as a means of identifying different kinds of woods but came to the conclusion that at least in the case of the conifers they were inconstant and could not safely be used in diagnosis.

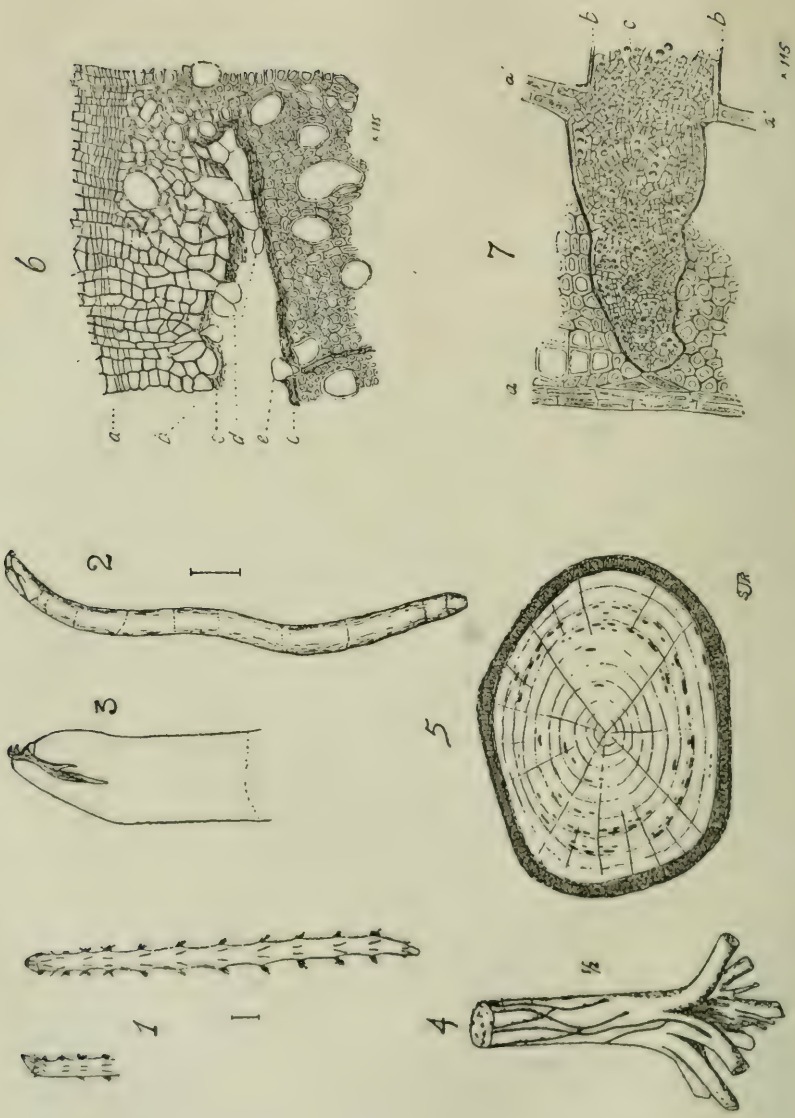
Later, R. Hartig[1] made use of the pith flecks in describing woods, and Kienitz[2] utilized them in a wood key which he made up for lecture purposes. Kienitz early came to the conclusion that the spots were not normal developments and during the years 1881-1882 made some investigations of the cause of the formations. The results were published[13] in 1883.

He discovered that the pith flecks in species of Salix, Sorbus and Betula were tunnels—filled by new cells—of an insect larva which obtained its nourishment from the cells of the cambium and new growth at the time of the formation of the growth rings. This verified the hypothesis advanced at an earlier date and referred to above.

Kienitz observed the development of the larvae in small stems of mountain ash and willow (*Salix rubra* Huds., *S. viminalis* L., and *S. caprea* L.) Unfortunately, he was unable to grow the insect to maturity or obtain the imago. He submitted some of the larvae to Dr. Gerstäcker, who identified them as dipterous insects.

Kienitz concluded that the insect winters in the pupal state in the ground and that the mature insect lays its eggs singly on or in the young sprouts or any tender stem of the woody plant. In May or June the eggs hatch and young larva (Fig. 2) eats a path or tunnel into the cambial zone. In the beginning the tunnel is very narrow corresponding to the relative size of the larval body. The larva grows little in thickness but considerably in length, finally becoming 2-3 cm. long. The tunnel which remains very narrow radially widens in a peripheral direction, since the larva eats to its right and left. Only the cells of the cambium and of the very latest formed wood are eaten, even by the full grown larvae.

In all cases observed, the tunnels were directed downward at first. When the larva has penetrated to a certain depth, it turns about without building a loop, making the tunnel only a little wider at this turning point. The location of this turning point varies, often being at the root collar or perchance, in a lateral root. After turning back it follows the old tunnel for a short distance, usually about the length of its body, and then starts off in an oblique direction so that the two tunnels make an acute angle with each other. (Fig. 4.) The larva, as a rule, does not go very far upwards but reverses itself and eats with its head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Explanation of Figures

Fig. 1. Lateral and dorsal views of a larva of *Opostega nonstrigella* Ch., taken from a twig of *Ribes vulgare.* (After GROSSENBACHER).

Fig. 2. Young scarcely half-grown dipterous (?) larva taken from a shoot of *Salix rubra* Huds. (After KIENITZ).

Fig. 3. Much enlarged lateral view of the head of a larva similar to that in Fig. 2. (After KIENITZ).

Fig. 4. Lower portion of a peeled mountain ash stem (*Sorbus aucuparia L.*) showing the lower ends and turning points of three tunnels of which one reaches down into a root. On the cross-section a few pith flecks are visible. (After KIENITZ).

Fig. 5. Cross section of a stem of birch (*Betula pubescens* Ehrh.) showing numerous pith flecks. Natural size. (After KIENITZ.)

Fig. 6. Cross section of a willow shoot (*Salix rubra* Huds.) showing a portion of a tunnel deserted by the larva for a long time. (a) New cambium which has been formed to replace that destroyed. (b) Cells which originally belonged to the bark but later became wood cells. (c) Margin or border of the wound formed by the walls of the destroyed cells and excrement of the larva. (d) The layer (c) has been broken through in several places 'by the outgrowth of the bark cells and the division of the bubble-like 'filling cells' (tyloses?) has begun. From the woody portion only one 'filling cell' (e) has emerged; it is from a ray. (After KIENITZ.)

Fig. 7. Cross section of one-half a pith fleck from a stem of *Betula papyrifera* Marsh. (a), (a'), (a''), rays. (b) Margin or border almost obliterated. (c) The 'filling cells' are thick walled, densely pitted, and filled with starch. (Original.)

downward again, occasionally turns once more, and finally after it has taken on a shorter and stouter form, bores through the bark, forces itself slowly out through the narrow opening and falls to the ground.

The length of the tunnels varies considerably and seems to be determined by the amount of available food which the larva finds. In slow-growing mountain ash stems the greatest observed distance up and down was 1 meter, while in a succulent willow sprout the distance was from 20-30cm. In the latter space, however, were found three turning points.

Frequently, several larvae were found in the same slender shoot. For example, in a small stem of mountain ash less than 1 cm. in diameter were found four larvae at the same time. Their paths frequently crossed.

Kienitz observed that in a cross section of a stem, the large pith flecks were always found near the outer edge of the growth ring, the smaller ones in the early wood. (Fig. 5.) From this he concluded that there is only one generation a season, since if there were two generations of the insects, more than one layer or region of broad spots would be found in the same growth ring. He also concluded that the larvae in mountain ash, various species of willows, and *Betula verrucosa* were of the same species.

In the tunneling process the larva does not completely devour the cells but seems only to tear them open, presumably using for the purposes the hooks on the end of its mouth (Fig. 3), after which it appears to suck up the cell contents. The torn cell walls, which are still soft, are compressed by the advancing larva and in this way a narrow passage is formed. These tunnels, as well as the larva which is of the same color as the cambium cells, are at first hard to see since the decomposition of the destroyed cells has not begun and the radial diameter of the passages is very small.

Since cambial activity continues undisturbed on both sides of a mine, while at the same time cell formation in the mine itself ceases, the radial diameter of the tunnel increases after the larva has passed. Consequently, pith flecks are larger in rapid-growing sprouts than in slow-growing shoots. In time, the cambium layer (Fig. 6, a) bridges over the mine and afterward produces normal xylem and phloem.

In the meantime, some of the uninjured cells on the cortical side of the channel become rounded and increase in size in cross-

section, until finally they break through the layer of cell fragments (Fig. 6, c) and press like bubbles into the hollow space (Fig. 6, d) where they grow very rapidly, divide in all directions and soon fill the cavity. The ray cells of the bark were found to be the most important and almost the exclusive regeneration centers, though rarely other parenchymatous cells of the cortex and very seldom ray cells of the xylem (Fig. 6, e) were observed also to take part in the process.

The dissolved cell fragments and larvae excrement are compressed into a narrow border (Fig. 7, b) by the rapid growth and division of the "filling cells." The pressure tends to keep back other cells which otherwise would soon have proliferated into the cavity. The "filling cells" assume very irregular shapes, the walls thicken and grow darker (probably from tannin) and are densely pitted with simple pits. Starch gradually makes its way into these cells and often all the cells are found filled with starch grains which contribute toward making the pith flecks resemble the rays. (Fig. 7, c.)

The cells which lie between the newly formed cambium and the channel (Fig. 6, b), originally belonging to the bark but now surrounded by the newly formed ring of wood, do not remain unchanged, either; they thicken their walls appreciably, become wood-like and in cross-section appear as wood cells though usually more rounded. In longitudinal section they can be readily recognized by their very short length in contrast with the normal structure of the wood cells formed by the new cambium.

Kienitz found pith flecks in the following woods: *Alnus glutinosa* Gärtn., *A. incana* D. C., *Betula pubescens* Ehrh., *B. verrucosa* Ehrb., *Corylus avellana* L., almost all species of Salix, several species of Sorbus, *Crataegus oxycantha* L., *C. monogyna* L., a few species of Prunus, probably also in some species of Pyrus. He believed the somewhat similar spots in conifers, of which Kraus[12] speaks, to be of different origin than those in broadleaf species.

A recent contribution to this subject has been made by Grossenbacher [14]. He made a careful study of the insect causing pith flecks in current stems, and found that the mining was done by the larvae of a tineid moth, *Opostega nonstrigella* Ch. (Fig 1). The larva is in many ways different from that described by Kienitz, as may be seen by comparing Figs. 1 and 3, while the

turning points of the tunnels are semi-circular instead of pointed. The histological modifications which result from the mining of the Opostega larva are fundamentally the same as those described above.

Grossenbacher reports the presence of cambium miners in the following trees: *Prunus mahaleb,* seedlings of *P. avium, P. serotina, P. virginiana, Crataegus oxyacantha,* and other species of Crataegus when among infested *P. avium* or *P. mahaleb.* They were also found in *P. cerasus* and *P. domestica* of some nurseries. The mines and larvae were present in various sized stems, branches and shoots of the above hosts from the surface of the ground (even underground) up to nearly 3 meters above.

Various writers have referred to pith flecks in describing wood. Laslett[15] notes their occurrence in "many Birches, Alders, Hawthorns, Poplars, etc." and considers them "points of structure that help the expert to determine the nature of a piece of wood." Boulger[5] (page 33): "Another character of some value in discrimination is the occurrence of pith flecks, or medullary spots, dark rust-like patches, which occur in Alder, Hazel, Hawthorn and some species of Willow, Poplar, and Pyrus. They are supposed by some authorities to originate in passages bored by the larvae of a species of Tipula (wire worm) which live in the cambium, these passages becoming filled up immediately with cellular tissue; but their origin requires further investigation."

In his classification of woods Boulger makes the presence or absence of pith-flecks the basis for separating certain species of Acer, of Populus and of Pyrus. *Acer barbatum* Mich. (*A. saccharum* March), for example, is said to be without pith-flecks, thereby distinguishing it from *A. campestre* L. and *A. pennsylvanicum* L. The present writer, however, has observed pith-flecks in the wood of *A. saccharum* Marsh, and it is probable that their use in the other instances referred to is equally unreliable.

Stone[4] recognizes the pathological origin of pith flecks but states (pages XVI-XVII) that they "are as characteristic of the species as any other feature because the grub is faithful to its special tree and prefers it to all others, therefore as a series of years can hardly pass without the presence of the grub, no log of wood of a susceptible species of tree will be found without these traces."

Opposed to this statement are the observations of Kienitz[13]

He found, for example, that some mountain ash and willow stems have many pith flecks while other individuals of the same species in the vicinity, often from the same root stock, did not show them. Furthermore, he looked in vain for pith flecks in a large number of birch and alder stems in a certain locality, though ordinarily the wood of the *Betulaceae* contains them in abundance. Again, in stems with pith flecks certain growth rings may be free of them while others are thickly dotted.

The present writer has observed pith flecks in the following woods: *Salix laevigata* Bebb., *S. fluviatilis* Nutt., *Betula populifolia* Marsh., *B. papyrifera* Marsh., *B. nigra* L., *Ostrya virginiana* (Mill.) Koch., *Pyrus rivularis* Dougl., *P. sambucifolia* C. & S., *Amelanchier canadensis* (L.) Medic., *Crataegus crus-galli* L., *C. punctata* Jacq., *Prunus americana* Marsh., *P. pennsylvanicum* L. F., *P. ilicifolia* (Nutt.) Walp., *P. Mollis* Walp., *Acer pennsylvanicum* L., *A. saccharum* Marsh., *A. saccharinum* L., *A. rubrum* L., *Ceanothus velutinus arboreus* Sarg., and *Adelia acuminata* Michx.

It is interesting to note that while pith flecks have been reported in the woods of some fifty species and fifteen genera, no large pored or ring porous woods are in the list. The oaks, ashes, hickories, elms and similar woods are absent. The writer can assign no adequate reason why this should be true, though the character of the bark may possibly account for it.

In view of all of the foregoing, the writer has come to the same conclusion as Gayer,[16] viz: that as pith flecks "have a pathological origin, and may be absent they should not be used in the identification of woods."

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SILVICULTURAL TREATMENT OF ABANDONED PASTURES IN SOUTHERN NEW ENGLAND.

By Philip T. Coolidge.

The lands used by early generations in New England for field crops, orchards, hay, and especially for pasture, began to be abandoned fully eighty years ago. Abandonment of lands so used became common fifty or sixty years ago when the emigration westward reached large proportions. The settlement of the fertile lands from Western New York to Illinois put both agriculture and grazing on the worn New England soils at an economic disadvantage. The necessity for winter feeding imposed by the heavy snows, also, has made New England less suitable than the West for the live-stock industry. As the herds and flocks were withdrawn, the forest slowly reclaimed the land long before won from it. Where grass land is used for pasturage without cultivation, only severe grazing can prevent slow reforestation in a region like New England, naturally forest clad—a condition to which the scattered Cedar and Juniper in most pastures still in use bear testimony.

The natural regeneration of the forest was considered a deterioration of the land until the growing scarcity of timber reversed this sentiment. It may be now assumed that land on which forest growth has been allowed to return is more valuable for the production of timber than for any other purpose. There is at present in New England a rapidly growing demand for the practice of intensive methods of forestry on lands not suited for other uses. Unfortunately, where land has been abandoned for agriculture or grazing, the returning forest consists for many years of Red Cedar, Juniper, Gray Birch, Alder and other species of little or no value. These species not only produce little timber of value themselves, but choke better species, whether of natural or of artificial origin.

On all open lands—except swamps and soilless rocks—the investigations of the State Foresters of several New England States—notably Connecticut and Massachusetts—prove beyond doubt that plantations of White Pine, Chestnut and certain other

rapidly growing species will yield profits as well as ordinary interest. Questions as to the practicability of artificial plantations on open lands are answered by the publication of these State Foresters. The question which the present article discusses is whether—granting the feasibility of planting on open lands— is it feasible to make plantations where species of little value now growing would choke the planted trees? Does the added expense of clearing away reproduction of inferior species make the plantation impractical? On the other hand, this article does not discuss the treatment of pastures very long abandoned on which valuable species, like Oak, Hickory, Chestnut, White Pine, are well represented and have supplanted the earlier growth. Such pastures have passed into the category of the established forest, although extreme need of improvement and reproduction thinnings may veil the fact that simply the usual silvicultural methods of treatment of wood-lots in Southern New England should be followed.

White Pine is most commonly used for plantations in New England. However, in the northern portion of the region especially, Norway Spruce is more suited by its requirements to certain situations—as loamy soils, on which White Pine, with its predilection for sand, is sometimes not vigorous; and Norway Spruce is probably of as rapid growth as White Pine. In Connecticut, Chestnut is a thrifty, rapid growing species. It is easily reproduced by coppice, and a fire, which would cause total loss in a plantation of White Pine, would leave chestnut stools capable of reproduction. Its stumpage value is, however, not yet as high as that of White Pine, and the occurrence of the Chestnut disease also makes its use temporarily undesirable.

A study of the publications of the State Foresters leads to the following general conclusions: That at the end of a forty or fifty year rotation, a plantation of White Pine in Southern New England, should yield from 25 to 50 M. feet, B. M., per acre; worth from $6.00 to $12.00 per thousand at present stumpage prices, and that such a plantation should yield, after the cost of planting, protection and taxes is subtracted, compound interest at 4%, and also net profits up to about $300.00, and averaging about $150.00, depending upon the quality of the locality and the nearness to market. The estimated amount of the net profits on the better situations should be noted. It will be referred to later,

since it indicates that on such situations there is abundant leeway for expenses necessitated for removal of inferior species.

It should also be noted that the estimates of financial yields are based on present stumpage prices; the stumpage value of New England timber will undoubtedly continue to rise, especially with the exhaustion of the Southern timber, now a question of perhaps a score of years only. The estimates of financial yields also allow liberally enough for protection from fire to eliminate the danger of loss to investments from that source. The profits so figured are therefore most conservative.

Furthermore, on all abandoned pastures, valuable species such as Chestnut, Oak, Ash, Hickory and White Pine are slowly reseeding the ground under the species of temporary type, such as Cedar and Birch, and forcing their way through the crowns of these earlier trees, ultimately to suppress them. Each of the ruling species of forest trees in time regains its former type of locality. The presence of reproduction of these valuable species may reduce considerably the cost of planting. The conditions on various pastures differ extremely, but from fifty to a hundred years may be given as a rough average of the length of time required for a fairly complete re-stocking with valuable species—a period long enough for one or two rotations of White Pine.

The species which restock cleared lands promptly and abundantly (in numbers) are Red Cedar, Juniper, Gray and Black Birch, Poplar, Cherry, Scrub Oak, and Pitch Pine. Cedar and Juniper have a stiff, prickly foliage on which stock will not browse, and these species are the first to gain possession of the land. Birch and Poplar, with delicate shoots, are much more liable to injury by stock, and appear after a pasture has been partly or completely abandoned. Where seed trees of these species occur, Birch and its allies may rapidly suppress any Cedar and occupy the land almost exclusively, and where seed trees of the species mentioned above are absent nearly pure Cedar may result. All gradations from pure Cedar to pure Birch occur, however, in the less recently abandoned pastures. Black Birch also, is an important species in early reforestation, and although it may be considered an inferior species in Chestnut and Oak woods, its wood is of fair value for both fuel and lumber. It grows rapidly to considerable size, and is long lived, and, therefore, cannot be classed as undesirable on old pastures.

The types of brush on old pastures characteristically vary on very small areas. Frequently several kinds of brush grow together on the same quarter acre, or perhaps one quarter acre is covered with Juniper, the next with Cedar and Birch, and the next is mainly open. An average per acre of the cost of removal of inferior species would, therefore, be of little value in making a practical estimate of the cost of the work on a given pasture. A general discussion of the conditions would be of more value. Hence the field work on which this article is based consists mainly of ocular observations and the conclusions have been guided by measurements on a small number only, of sample plots.

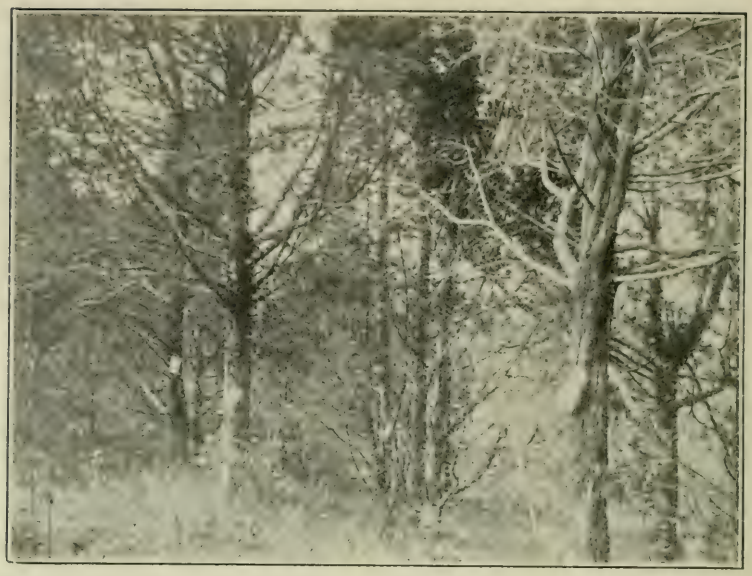
To simplify discussion, the various sorts of brush are treated as if they occurred separately:

Ground Juniper.—This shrub occurs abundantly on every abandoned pasture. It reaches a height of three or four feet and its beds are sometimes thirty-five feet across. The cost of clearing away, piling and burning this material—the chopping is best done with a bush hook—so that plants can be set out 6x6 feet apart—is at the maximum $4.00 per acre. This expense was determined by chopping out "wells" 6x6 feet apart in Juniper patches, in which to insert the planted stock, until one-sixteenth acre was prepared. Fortunately it would never, in practice, be necessary to spend $4.00 an acre on Juniper, because it never covers a pasture in full density and even where comparatively dense, plants may be inserted largely between its clumps. Planted White Pine is ordinarily spaced 6x6 feet to insure rapid height growth and early pruning. A large number of the trees are removed in thinnings. Where small clumps of Juniper, not more than ten feet wide, occur it will not pay to chop out holes in them for planting. Ten foot spacing should, however, be the exception, not the rule, since it would cause a growth of crooked limby trees.

Wholesale cutting away of Juniper is unnecessary, but the chopping out of "wells" before inserting the plant facilitates planting and eliminates danger of the Juniper choking out the planted trees. The occurrence of Juniper on a pasture should never discourage putting the land on a paying basis by planting. Juniper is seldom dense enough to cause an extra expense of more than $1.00 or $1.50. This amount would compound at 4 per cent. to only $8.00 or $10.00 in fifty years—an insignificant expense, compared to the profits estimated for plantations.

Birch, five years old, 1,400 sprouts to the acre. Cost of clearing, about $4.00.

White Pine plantation, 22 years old, in Connecticut.



Red Cedar, .6 Density.
Cutting trees large enough for posts (marked) will open stand sufficiently for planting.

Typical Pasture, with Cedar, Juniper, Birch and scattering Oak and Chestnut. 1,400 sprouts to the acre.

Red Cedar.—This species, on account of its abundance, is the most important of those occurring on old pastures. Its density, depending largely on the former treatment of the pasture, varies very widely. A lightly grazed pasture may have an excellent stand of Cedar and yet be on the poorest soil, and an over-grazed pasture may have only a scattering of worthless bushy trees. Cedar posts, 6 feet long and 4 inches in diameter at the small end, are worth about 20 cents apiece; they cost from 5 cents to 7 cents to cut and haul, and the stumpage value is therefore about 14 cents. Owing to the use of Chestnut tops for posts, the use and value of Cedar for posts is decreasing.

A fully stocked stand (the exception on old pastures) about forty years old will yield a maximum of 400 or 500 posts and 10 cords of firewood. The rate of growth of Red Cedar was estimated from Prof. Graves' figures in an article in FORESTRY QUARTERLY, Volume 3, page 350. Four hundred and fifty posts, worth about 14 cents stumpage each, and 10 cords of wood, worth $2.00 a cord stumpage, give a gross return of about $70.00. If taxes and interest for forty years on the value of the land are subtracted from this amount, the net profits compare most unfavorably with those of White Pine plantations. Further, it should be carefully noted that Cedar occurs generally in irregular open stands, and that the fully stocked stand, which will produce 400 or 500 posts in forty years, is very exceptional. Plainly, Cedar does not commend itself as an investment.

Cedar will not interfere with the growth of the trees of a plantation, except where it occurs in stands of more than .5 density. The rapidly growing trees of the plantation soon push past the Cedars in the more open stands. Stands less than fifteen years old on recently abandoned pastures are seldom of more than .5 density, and stands forty years old generally contain a large enough proportion of post trees to permit profitable thinning to that density. The only problem, therefore, offered by Red Cedar, is the treatment of stands of more than .5 density, between the ages of about fifteen and forty years—or from the time the trees are from one to two inches in diameter until they are of post size. Dense Cedar, one or two inches in diameter, can be cut, piled and burned with about 2½ days of labor per acre—or at a cost of about $4.50 per acre. The trees can be cut with a brush hook or axe by a single blow. The expense was determined by clearing one-six-

teenth acre sample plat. Reduction of density below .5 is sufficient, but in dense stands it is generally easier to cut nearly all the trees and let them fall in windrows. They can then be burned readily.

Chopping away Red Cedar, one or two inches in diameter, will therefore pay on all, except, perhaps, those poor soils, like sandy and rocky hills, where it occurs naturally and not because the land has been cleared. On such lands, it might be questionable whether the growth of the plantation would be rapid enough to pay the added expense of clearing away the Cedar. If, however, the Cedar on such lands is of less than .5 density, so that no clearing is necessary, it is probably safe to make the expenditure necessary for ordinary planting in the open.

After Cedar becomes two or three inches in diameter, the expense of clearing increases considerably. The trees are very bushy and are difficult to chop. Even although a small amount of saleable cordwood can be produced, the net cost of clearing trees averaging three inches in diameter, will be from $8.00 to $11.00 per acre, a sum that will compound at 4 per cent. interest in fifty years to $60.00 or $80.00. This figure was determined by a one-sixteenth acre sample plot.

Where there is a combination of good soil and good market, it may sometimes pay to clear large Cedar, but as a rule, it will probably not pay to chop any Cedar after it is about two inches in diameter. Furthermore, Cedar two or three inches in diameter will probably yield posts in twenty years and it would be poor business policy to undergo considerable expense to sacrifice a half-matured although inferior crop. A practical rule is that it does not pay to chop away Cedar after it is so large that the cutting of a tree requires more than one stroke of the axe.

It should be noted that it is only the dense Cedar—the "Cedar Woods" that makes clearing necessary. Such stands are not common and the unusual, half open pastures can very easily be converted into profitable plantations.

Gray Birch.—Gray Birch covers not only large areas of abandoned pastures, but also burns and other clearings. It occupies open land quickly, and for this reason has an undeserved reputation for rapid growth. It tends to form more regular, dense stands than Red Cedar. The age of three Birch sprouts, cut on a large area of abandoned pasture at Mt. Carmel, Connecticut,

was thirty-eight. Measurements of six of these sprouts showed an average height of 28 feet and an average diameter of 4 inches. The average crown space was 40 square feet, so that 1,100 sprouts per acre would be possible. The yield was estimated to be nine cords per acre for full density. This was in a dense stand and on good soil. These few measurements are, of course, scarcely conclusive evidence of the average rate of growth of Gray Birch, but they corroborate the ocular estimates that the short, quickly tapering, early maturing trees do not make rapid volume growth.

Birch cord-wood is worth $5.00 a cord, and an allowance of $2.00 a cord for cutting and hauling leaves $3.00 a cord, or say $30.00 for ten cords per acre as the net yield of forty years. Interest at 4 per cent. and taxes on land worth $4.00 (fairly cheap for the region) per acre would compound in forty years to about $27.00. In other words, natural reforestation by Birch is financially a flat failure.

Nearly the same treatment is suggested for Birch as for Red Cedar. Birch one or two inches in diameter can be cut and piled for $4.00 an acre, or by two days' labor. As with Red Cedar, after Birch becomes about two inches in diameter, it is better not to cut it until it is large enough for cordwood, not only on account of the expense of chopping these larger trees, but also because the crop of Birch cordwood, small as it is, is only twenty years distant and its sacrifice would not be counterbalanced by the profits from a plantation.

An advantage of planting on land stocked with inferior species, like Birch and Cedar, is that these forest weeds serve as nurse trees. Planting of forest trees in the open necessitates use of well developed transplants at least three years old, if the plantation is to survive the climatic adversities of the first few seasons. The cost of such planting is generally estimated to be about $7.00 per acre. The shelter afforded by nurse trees permits the use of one year old seedling stock. This can be raised in seed beds at a cost of from 35 cents to 50 cents per thousand. As allowance should be made for the death of one-third of these delicate plants, the plantation should be spaced 5x5 feet (or 1,700 plants per acre), instead of 6x6 (or 1,200 plants per acre) as usual. A man can plant out two or three thousand seedlings per day with a dibble, so that at $2.00 a day the cost of planting, the total cost per acre—1,700 plants—for stock and planting, should not be more

than $2.50. This stock is not ordinarily furnished by commercial nurserymen, but the seed-beds require so little room—for White Pine, a square yard sown with two ounces of seed will furnish enough seedlings to plant an acre—and so little care that it should be a simple matter to raise it, especially for farm wood lots.

This type of stock should, however, be used only where there is a density of stand of .7 or .8. The old stand should be removed two years after planting, as the seedlings require protection only during the first two years, and after that time will not make straight or rapid growth without open sunshine. The old stand can be removed without much danger of injury to the plantation so long as the planted trees are small. With Birch, if two or three years are allowed to elapse before cutting, the planted trees will be given opportunity to keep ahead of the sprouts which will come from the Birch stumps. Cutting the Birch in July or August would of course prevent its sprouting. Two dollars and fifty cents per acre is $4.50 less than $7.00, the usual cost of planting per acre. Four dollars and fifty cents compounds at 4 per cent. interest to $31.98 in fifty years, and would, therefore, add appreciably to profits.

The tables in Forest Service Bulletin 22, "The White Pine," show that suppression retards trees about ten or twelve years. In other words, if a stand of Birch or Cedar were large enough to cut in ten or twelve years, the most practicable method would be to postpone the plantation until two or three years before cutting.

Scrub Oak.—In many parts of Northern New England there are large areas covered with entirely worthless Scrub Oak (*Quercus nana.*) These barrens are the result of repeated fires on dry, sandy lands. Little forestry can be practiced where the fire question has not been solved. Where it has been solved, however, there is no reason why these lands should not produce their share of timber. Probably the best species for such areas are Norway Pine, Scotch Pine, White Pine, or Pitch Pine. Yields probably as good as on the poorest White Pine lands should be obtained. In many cases fire protection alone would produce a good crop of Oak, for a large proportion of what apparently are Scrub Oaks are Black Oaks and other valuable species of Oaks dwarfed by the fires. Where planting is desired—and Pine should yield a better revenue than Oak—no thinning is necessary. The fires generally have so reduced the Scrub Oak stools that sufficient

openings occur throughout them to make room for a complete plantation. Immediately after a fire is, of course, a very desirable time to plant, because the available room is almost unlimited and the new sprouts grow slowly.

Other Deciduous Brush.—Dogwood, Poplar and Alder are, also, common species of brush. Dogwood and Poplar grow very much like Birch and may be treated similarly that is, either cut when young or reserved until of cordwood size. Alder may be cut like young Birch. Sumac and Briers cast so slight a shade that their removal is unnecessary. Where unusually dense, the planter can hack them away with his mattock with little trouble from the immediate neighborhood of each plant.

Use of Fire.—The favorable condition for planting, both on Scrub Oak and Birch lands immediately after fire, suggests that carefully conducted burning might be the simplest way to rid brush from land to be planted. For several reasons, however, fire would probably not be the cheapest way to accomplish this purpose. In the first place—almost every brush stand has a scattering of valuable species in it. The use of fire prevents the alternative of expense to protect this valuable reproduction, or sacrifice of it. Secondly—the use of fire requires planting after, rather than before, the removal of the objectionable cover. If the fire does not kill the stools, the new sprouts will easily overtop the planted stock, which would have much better chance if planted before the clearing; and thirdly—on account of the lack of shelter, large stock—three-year old transplants—must be used in place of the cheap one-year old seedlings.

MULTIPLE VOLUME TABLE.

By Lincoln Crowell.

In cruising, where the trees on a block or strip are tallied by diameters and height classes, and the volume of the trees obtained later from a table, a Multiple Volume Table, compiled in the manner of the accompanying form, is very convenient as an aid in computing the total volume of the area in question.

The total volume of the number of trees of a certain diameter and height class may be read directly from such a table without having to figure it out.

The Multiple Table is compiled from a volume table of the species estimated. After it has been compiled it may be traced and blue printed and be of service indefinitely.

DIAMETER CLASS	HEIGHT CLASS OR LOG LENGTH	MULTIPLE VOLUME TABLE								
		NUMBER OF TREES								
NCHES	LOGS	1	2	3	4	5	6	7	8	Etc.
18	1									
	2									
	3									
20	1									
	2									
	3									
22	2									
	3									
	4									
ETC.										

SUPERVISORS' MEETINGS AT BOISE, IDAHO, AND OGDEN, UTAH.

At Boise, Idaho, January 2 to 4, 1911, was held a meeting of the Supervisors of the National Forests in District 4, situated in Idaho and Wyoming. The object of the meeting was the discussion of National Forest problems.

The discussion of grazing questions bearing upon National Forest administration occupied the first part of the meeting. The National Forests in District 4 in Idaho and Wyoming are for the most part heavily stocked, particularly with sheep, and the question of so administering the grazing business as to interfere as little as possible with the principal objects for which the National Forests were created is exceedingly difficult and complicated in view of the large amounts of money invested in the stock business and the general importance of the industry to the country as a whole. The general tendency is toward a reduction in the number of stock allowed to graze on the National Forests and toward closer restrictions with regard to the grazing of stock, particularly sheep, on areas which are in process of reproduction. Great assistance in the settlement of range controversies has been rendered by co-operation between the Forest Service officials, on the one hand and advisory boards representing associations of stock owners using the National Forests, on the other.

A discussion of the points to be considered in marking different commercial species for cutting brought out the fact that the system of cutting theoretically preferable can not always be followed in practice on account of market conditions which make it impossible for dealers to dispose of all classes of material which would result from such operations. In pure lodgepole pine stands which are sufficiently even aged and where markets are sufficiently intensive, clean cutting in strips is recommended. The strips cut and those left intact should be of equal width, generally 100 feet. Where the danger from windfall is not great the over-mature and defective trees may be removed from the uncut strips. The strips should run in the direction of the prevailing winds where danger from windfall is great. On steep slopes where there is danger of erosion and snow slides the strips should run across the slopes rather than up and down. In pure lodgepole stands

where it is impossible to use the strip system the selection system must be adopted. The aim should be either to thin the stand very lightly with the object of making the remaining trees more wind firm and allow a second cutting at an early date or to remove all the mature and undesirable trees and thus leave only enough trees to form the basis of a future cut. Between these two extremes there are many graduations and the method to be used depends upon local conditions entirely. The main point to be considered is wind-firmness, seed production being a secondary consideration.

On the Targhee Forest Douglas fir is the best timber tree and should be favored against other species on sites favorable to its growth. Where lodgepole and Douglas fir grow in mixture it is recommended that all merchantable lodgepole be marked for cutting and only such fir trees as are defective and over-mature. In marking fir on its own sites we should approach as near improvement cutting as local conditions will permit.

Engleman spruce should be encouraged wherever it grows better than other species in mixture. The aim should be to remove over-mature, suppressed and defective trees with a view to improving the stand. The soil should be protected from drying out and the trees left so spaced as to reduce windfall to a minimum.

In marking yellow pine, forest conditions should not be disturbed more than is necessary, and only the mature and defective trees should be removed. Openings should be avoided and sufficient seed trees should be left to insure reproduction.

On account of fire danger the method to be followed in disposing of brush resulting from logging operations is of great importance. There are three different methods of brush disposal:

(1) Piling and burning.
(2) Piling and not burning.
(3) Lopping and scattering.

The first method seems advisable where fire danger is great. However, to burn brush means that about four or five per cent. of the area will be burned over with the possibility that some of the stand will be injured, besides the certainty of destroying all the seedlings on the burned spot. The second method obviates these disadvantages, while the third is particularly applicable where the fire danger is small. Brush cover is of decided value in preserving soil moisture and in lessening damage from early frosts. Reproduction is generally good around the edges of brush piles.

Lopping and scattering is generally considered to favor reproduction in open stands, particularly of yellow pine.

A discussion of direct seeding and planting brought out the fact that on the Cache Forest direct seeding thus far has not been successful, owing principally to drouth and destruction of the seed by rodents and birds. This applies directly to broadcasting of seed on the ground and on the snow as well as to seeding in prepared seed spots under cover. Planting operations have been more successful and plants set out in the spring have made better progress than those planted in the fall.

In connection with the discussion on methods of fighting forest fires, the plan in use on the Clearwater Forest in Idaho during the summer of 1910 is of particular interest. This Forest is very heavily timbered and has an area of about 3½ million acres. There is one telephone line into the Forest to a Ranger Station about 20 miles from the Supervisor's office. There it branches, one line going east 65 miles, and one north 50 miles. There are no roads and only a few trails. Probably 15 to 20 per cent. of the Forest was burned over and one-third of the timber on the burned area was destroyed. In handling the fire fighting crews the first thing sent out was supplies and equipment. The Supervisor had carefully prepared a standard list of supplies designed to last a 10-man crew for two weeks, and another list designed to last a 20-man crew for the same length of time. This list of supplies was left with the local storekeeper who forwarded the necessary articles upon request from the Supervisor, thus avoiding delay and making sure that all necessary articles should be included. The supplies were forwarded by a pack train which was owned and operated by the Forest Service, thus insuring prompt and certain delivery. On the Forest were employed 90 Forest officers and the existence of the pack train rendered it practicable for them to remain continuously on duty in their districts, the most of them not needing to come to town for any purpose. The packer who was with the fire fighting crew acted as messenger and every day made a trip to the telephone to report to the Supervisor regarding the progress of the work in the field. This procedure kept the Supervisor in touch with the situation and enabled him to issue promptly whatever orders were necessary. The construction of trails and telephones is of primary importance in connection with fire fighting work on most of the National Forests at the present time.

At Ogden, Utah, from January 23 to 25, 1911, was held a meeting of the Supervisors of the National Forests in the States of Utah and Nevada.

The discussion on "working plans" brought out the fact that wherever practicable the purchaser should be required to distribute his cutting so as to remove a portion of the less desirable timber in connection with the removal of that more favorably situated, in order that the possibility of a future sale might not be destroyed in case the purchaser should become bankrupt or the sale be discontinued for any reason. In connection with timber sale work a progress map is very desirable showing the location of cutting areas, amount of timber marked, progress of brush burning, and all other silvicultural operations on the forest.

Under "Points to be considered in marking different commercial species of marketable timber for cutting," it was emphasized that the character of marking of a given body of timber depends on many conditions, some of the more important of which will probably be made upon the forest. It is no longer the policy of the Forest Service to adhere rigidly to certain diameter limits or even to any given rules, the intention being to adapt the requirements in each particular sale to the local conditions. The most desirable species should be favored, and the other species marked down to the lowest merchantable size. If possible, cut the more desirable species directly after a seed year and the inferior species just before seeding takes place. The more accessible the timber and the better the market conditions the more conservative should be the marking. In marking for cutting it is of the first importance to insure sufficient reproduction and if possible to plan for a stand better than the original. If possible, openings in the forest cover should be made gradually in order to facilitate reproduction. In marking for cutting in stands of juniper it has been found advantageous, in cases where there are several boles or large branches from the same root, to cut out some of the larger for posts or other material, leaving the balance to continue growth. With this system of cutting sprouting will also occur and make good posts. This system has been found to work satisfactorily in young trees, but in old trees the vitality is lower and the removal of any considerable portion of a tree is likely to kill the balance.

In the discussion of "Conduct of timber sales," it was made

clear that from an administrative point of view it is best to discourage the making of very small sales, or of sales to ranchers or others who are not familiar with the best methods of conducting such work. In Utah and Nevada, in the heavier stands, brush should be lopped close and piled in moderate sized piles as near the center of the openings as possible. The heavy limbs and tops of trees should not be placed in the brush piles, but should be trimmed up and left to one side. In more open stands the question as to whether brush will be lopped and piled in small piles or scattered is to some extent one of expense, since scattering costs more than piling in small piles. Both systems favor reproduction, particularly piling in small piles. Unless necessary as a fire protective measure, the burning of brush should be discouraged.

The amount of forest planting done has increased very greatly within the last one or two years. On the Wasatch Forest the planting of a nursery stock has been a success, while direct seeding has not. However, on account of the great expense of the former it is imperative that a successful method of handling direct seeding work be discovered. To this end a great deal of experimental work is being done. On account of the immense areas of burnt-over land, reforestation should be undertaken in every case rather than the afforestation of areas which have not previously produced timber crops. In general, planting should be done where the trees will have the best chance to succeed. Planting under aspen has been quite successful, but sagebrush has proven very unfavorable as a planting site.

Forest fires cannot be eliminated entirely, because of the vast amount of highly inflammable material at present in the National Forests. However, much can be done by patrol, co-operation with the settlers, and the construction of telephones, roads, trails and bridges, fire lines, lookout stations, etc. In mountainous regions telephones and trails are of prime importance. Roads and trails frequently serve also as fire lines. In initial construction as well as in maintenance, fire lines as such are very expensive. Emergency tool boxes should be available at convenient points. Carefully prepared maps showing the location of roads, trails and fire lines, as well as streams and other points from which a fire can be attacked, aid materially in planning an attack on the fire.

AN APPRECIATION OF DR. HEINRICH MAYR, ORDINARY PROFESSOR OF SILVICULTURE, UNIVERSITY OF MUNICH.

On the twenty-fifth day of January last, as Dr. Mayr was closing a lecture in Silviculture in the University at Munich, he fell from an attack of acute heart trouble and never spoke again. It was indeed in keeping with Dr. Mayr's tremendous energy and constant application to his work as a forester that he should die in harness.

Dr. Mayr was born near Munich on October 29th, 1854, his father being a Forstmeister under the Bavarian Government. He received his Doctor's degree in Economics in 1884 and after a short period of practice became Privatdozent in the Faculty of Economics in the University. In July, 1885, he came to America under Commission from the Bavarian Government to study our forests and report upon the trees that might be adapted for use in Bavaria. From that time on he was a constant traveler, having circled the globe a number of times and only a few months before his death spent some little time in Scotland. From his first American trip he returned through Japan, China, Java and India, paying special attention to forest distribution and to studying the important trees to determine if possible their value for planting in Europe. In 1887 he returned to Japan as Professor of Forestry in the University of Tokio. There he brought together the results of his trip to America in a book entitled "Die Waldungen von Nordamerika." This book was published in 1890 and up to that time was one of the best studies of American forests written either in English or German. After about four years in Japan Dr. Mayr returned to Germany, studying en route forest distribution in China and Ceylon. For nearly twenty-five years Dr. Mayr assisted Professor Dr. Robert Hartig in Botany and Investigative work and during this period experimented constantly with foreign tree species in Bavaria. From this long series of experiments and from results of work in the Forest Experiment Station at Grafrath, established by Dr. Mayr in 1894, and after a second

trip around the world with Prince Ruprecht of Bavaria, he produced a master work in the book entitled "Fremdländische Wald und Parkbäume für Europa." Nothing so extensive in either describing distribution of species or discussing their adaptability for European conditions had ever been prepared before. The book is illustrated with an unusual number of photographs and drawings, many of them by Dr. Mayr himself, and many loaned by the United States Forest Service.

In connection with the teaching of Silviculture proper in the University of Munich, Dr. Mayr taught Forest Utilization and Forest Protection also. The classic work on Forest Utilization by Dr. Karl Gayer was revised several times by Dr. Mayr, the last edition being entitled "Die Forstbenutzung," Tenth Edition, by Gayer and Mayr. At time of his death Dr. Mayr was at work upon a book describing at length the results of his years of work at the Bavarian Forest Experiment Station at Grafrath. It is a great loss to forestry that he was not able to complete this work. The books mentioned above were not the only products of Dr. Mayr's great energy. He assisted in editorship of several forestry publications and produced many pamphlets upon various questions which have and are agitating the forestry world in Germany, such for instance as the influence of source of seed upon future crop.

Few men have had and used as effectively the wonderful gift of teaching in the way in which Dr. Mayr did. His great earnestness and power to present matters in a clear, logical way coupled with his ever pleasing personality, gave him always a full class room and attracted men to him from all over the world. During the last year of Dr. Mayr's life he was ailing constantly and yet was ever cordial and sympathetic and ever ready to help the student and especially the stranger.

In being a silviculturist Dr. Mayr was also an ecologist and a botanist, if the first two lines of work can be separated at all. His memory was wonderful and he carried apparently clearly outlined in his mind the nomenclature of the entire forest flora of the world. His extensive travels, while making possible the excellent books he produced, in a way caused him to over-generalize, especially in lectures, more than a man of less wide experience would have done. He was also at times rather empirical and radical, and impatient with the opinions of other

scientific men, and yet he will go down in forestry history as the greatest master of silviculture of this country, because for the first time he brought together in one book and in a definite way the foundation principles of silviculture and that upon the only true basis, that of natural relationships. It is safe to predict that his book upon silviculture will continue to be an authority wherever the foundation principles of the subject are studied or taught.

Dr. Mayr's death is an irreparable loss to silviculture, not only in Germany, but throughout the world and the many foreign students who have been enthused with the man's tremendous energy and ability, feel his loss almost as personally as the wife, sons and daughters who formed with him an unusually attractive and sympathetic home. May the son who is following him in forestry carry on the work continued so ably over so long a period, and perfect and apply the results of the splendid Forest Experiment Station at Grafrath, which should be given Dr. Mayr's name.

HUGH POTTER BAKER.

CONSUMPTION OF BASKET WILLOWS IN THE UNITED STATES FOR 1908.

By C. D. Mell.

The data was gathered almost entirely by correspondence with 203 willow-ware makers, and although no claim is made that the figures are absolutely correct they are very close approximations. They show the gradual increase or decrease in the production and consumption as compared with former years. There are few basket makers who have failed to reply to the inquiries, and there are also a small number of minor establishments throughout the country which were not reached, but the influence of their combined consumption upon the total is relatively small. Making a fair allowance for incomplete figures it is safe to state that the amount of basket willow consumed during 1908 in the United States was approximately 3,650,000 pounds, and that the total value of the material ready for the basket makers' use was not less than $225,000.

Centers of the Industry.

Basket willows are grown chiefly around cities having a large percentage of German population to whom the advancement of the industry in this country must be principally credited. The chief centers in the Eastern States are New York, Philadelphia, Pittsburg, Baltimore, Syracuse, Liverpool, Rochester, Buffalo, Holland, Michigan, Milwaukee, Chicago, Burlington (Iowa), St. Louis and Cincinnati. This industry has not been so well established in the States west of the Mississippi River.

Basket makers, as a rule, are Germans who learned the trade in Germany, locating here in the large cities. They began business a number of years ago when there was a splendid market for custom-made baskets. A strong demand for rods soon induced a number of farmers near these cities to grow basket willows. It gradually spread, however, to regions farther away from the manufacturing centers, and at present basket willows are grown from Maine to Nebraska and from North Dakota to Tennessee

and Georgia. The growing industry is also being developed on the Pacific coast. Basket Willow is now most extensively cultivated in New York, Pennsylvania, Maryland, Ohio, Indiana and Kentucky.

Varieties of Willows Used.

Only a few varieties of willows are distinguished by willow-ware makers. The purple willow (*Salix purpurea* Linn.), called French osier in New York State, is the one most extensively cultivated in this country. In Michigan and Wisconsin it is called Welsh willow and is almost the only variety grown. It yields very satisfactory crops, especially in moist, fertile upland, where it is comparatively free from injurious insects. In Ohio, Indiana and Illinois this variety was the principal one planted about ten years ago, but large patches have been completely destroyed by insects, and has since been largely replaced by the American Green (*Salix amygdalina* Linn.) and Lemley willows (*Salix pruinosa* var.).

American Green willow is the principal one grown in the Ohio River valley, and it is also extensively cultivated in Pennsylvania and Maryland, where it is highly esteemed. Fully 75% of the basket willows grown in these two States are American Green, while in Ohio, Indiana and Illinois fully 50% is of this variety. Outside of western New York it is used almost entirely for making willow furniture.

Lemley willow, known among growers in the eastern central States as Gold Skin, produces excellent crops of rods that are regarded among the best by basket makers. The wood is hard though light in weight, and the rods peel very easily, remaining almost snowy white when peeled and thoroughly dried. This willow is also extensively grown in Maryland, but unless it receives proper attention in the holt the butts of the rods become thick and curved, which are objectionable features.

Black German willow (*Salix dasyclados* Wimmer) is raised locally in western New York and in Michigan. It possesses some of the characteristics of the American Green willow, though it may be readily distinguished from it by its pronounced bloom which covers the upper half of the shoot; also by its large thick leaves and leaf-like appendages at the base of the leaf stalk. The rods grow eight to ten feet high in a single season, but they have

a large pith and the wood is rather soft. It is better suited for making large hampers and willow furniture than it is for making small basket-ware.

The following table shows the amount of basket willow rods of each variety above named grown and consumed in 1908:

American Green willow, ...	674,000	pounds.
Purple willow, ...	1,942,000	"
Lemley, ...	160,000	"
Black German, ...	63,000	"
Total, ...	2,839,000	"

Quality of Rods in Demand.

There is a constantly increasing demand for basket willow rods of the best quality. Basket makers prefer to buy their willows from growers who know how to peel and sort the rods properly. Slender, pliable and branchless rods are in great demand and bring good prices, while the crooked, branched or otherwise defective rods are frequently sold below the actual cost of production. The fact that growers offer for sale a poor grade of rods not only lowers the price for home-grown material as a whole, but it encourages the use of imported willow rods. The quality of rods is dependent upon the soil, the variety of willow, and the method of cultivation. The fact that a number of growers do not know the requirements of basket willow rods from the basket maker's point of view has led a great many basket makers, and particularly owners of large establishments, either to grow the willows required in their factories or to import them from Europe. The statistical reports from basket makers show that 13 per cent. of the consumers grow all the stock required in their factory; approximately 21 per cent. grow a small portion of the stock, while the remainder, or 66 per cent., obtain their stock either from the grower direct or from importers. Although imported rods are higher in price they are of a better quality and basket makers consider them cheaper in the end than home-grown rods which seldom meet the requirements.

Rods should be sorted into four height and quality classes if they vary from two to six feet in length, but when rods are from two to eight feet long they should be sorted into five height classes.

Care should be taken to have the rods of one grade as nearly uniform as possible. The smaller the rods are the higher will be the price. Farmers frequently discard the smaller rods because such stock requires considerable time to peel, which renders the margin of profit small. They fail to realize that basket makers not only appreciate the value of small rods, but require them in making certain ware. Manufacturers are obliged, therefore, to order imported rods of small sizes.

A serious objection to home-grown willows is that a good many rods are split during the process of peeling. The purple willow splits very easily, especially if the operator is not trained in the proper method of peeling. Proper handling of the rods must not end with peeling, but care should be exercised after peeling. They should be bleached quickly in the sun and thoroughly dried in the open air, after which they may be stored in a dry, dark place. When thoroughly dry, they are tied in bundles about a foot in diameter at the base, three bands to each bundle, one near each end and the third near the middle. The rods in the bundle must be as nearly parallel as possible.

There is constant demand, especially among willow furniture makers, for white, sap-peeled rods in large quantities. Unfortunately it is difficult to convince growers that the demand for willow rods of highest quality is increasing. It is a phenomenal fact that in a country where all lines of work have taken such immense strides during the past two decades, that the willow industry has not been more fully developed, and that every year large quantities of the best grades of willow rods and manufactured willow-ware are imported from Europe.

Price of Home-Grown Rods.

The prices of willow rods are determined by a number of factors. At present imported rods cost from 7 to 10 cents per pound, while the same quality of home-grown rods fluctuates between 5 and 7 cents. The price depends upon the following factors: Grade and quality of the rods, the proximity to market, scarcity of rods, owners' knowledge of the market, the cost of growing the willows, and the price of imported manufactured ware.

A number of basket makers buy their willows green. This is especially the case in western New York. In the fall basket

makers buy the stock they desire, and during the winter the rods are cut, weighed and shipped. The price of green rods varies from $16 to $28 per ton. Large buyers usually make a contract with growers to sell them all the willows they can grow during a period of three years. This arrangement is generally made to insure a steady supply of stock.

The bulk of basket willows grown in western New York are sold to basket makers in Syracuse and Liverpool, where they are steamed and peeled for making clothes baskets and hampers. The cost of steaming the green rods is about $2 per ton, while the cost of peeling varies somewhat with the kind of labor employed. At present practically all the steamed willows consumed near Syracuse are peeled under contract in the State Penal Institution, and the cost per pound is somewhat lower than if peeled by laborers who receive from $1 to $1.50 per day. The cost of peeling the rods by hand after they are steamed varies from 2 to 3½ cents per pound. Steam-peeled rods when thoroughly dried sell for about 5 cents per pound but they are not used extensively outside of the State of New York.

The price of the best grade of sap-peeled willows has been steadily rising during the last three or four years. The best grades sell for 8 and 9 cents per pound, and a few basket makers have paid as high as 16 cents per pound for selected stock. Sap-peeled willows that are straight and cylindrical will bring from 7 to 8 cents per pound with high grade willow-ware makers in the large cities. Good grades of imported willows sell for still more, and there is no reason why American growers should not realize as much or more than importers do for their stock. This is only possible, however, by employing the intensive methods of growing them and by careful sorting and bundling the rods.

Consumption of Home-Grown Basket Willow in 1908.

Table 2 gives the consumption of both steam and sap-peeled basket willow rods in 1908 by States. It shows that approximately 66 per cent. of all the rods consumed were steam-peeled, of which fully 90 per cent. were consumed in New York State. Pennsylvania leads in the use of sap-peeled rods, which is closely followed by New York, Maryland and Massachusetts. The above figures are not the real amounts of production for each State.

Massachusetts, which stands fourth among the basket-willow consuming States, produces probably less than any other of the willow growing States. Nor is the annual production the same from year to year, since a great deal depends upon the climatic conditions, the care bestowed upon their cultivation, and the planting of new holts.

Peeled Home-grown Basket-willow Rods Consumed in 1908.

State.	*Steam peeled.*	*Average price per lb.*	*Sap peeled.*	*Average price per lb.*	*Total.*
	M pounds.	*Cents.*	*M pounds.*	*Cents.*	*M pounds.*
Illinois,	5	6.5	24	6.6	29
Kentucky,	....	....	62	6.4	62
Maryland,	4	6.0	137	6.2	141
Massachusetts,	4	6.6	131	8.5	155
New Jersey,	5	6.0	28	7.3	33
New York,	1,658	4.9	172	6.4	1,830
Ohio,	57	5.2	30	6.4	87
Pennsylvania,	53	6.4	183	7.1	236
Wisconsin,	18	6.0	39	6.7	57
Other States[1],	95	5.6	134	6.0	239
Total	1,899	5.0	940	6.8	2,839

[1]States included in "Other States" are California, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Oregon, Virginia, and the District of Columbia.

Importation of Basket Willow Rods Since 1905.

The value of imported basket willow rods has been steadily increasing since 1905, as is shown by the figures obtained from the Department of Commerce and Labor. These figures do not show that there has been a proportionate increase in amount of stock imported. The value of rods varies with the quality as well as with the demand and quantity of stock available. The price of imported raw material has advanced during the last four years same as it has of home-grown stock. The increased valuation of imported willow shows, however, that there is a shortage in home-grown material and also that basket makers are willing to pay a higher price for rods of the desired quality.

The table given below shows the valuation of imported basket willows prepared for basket makers' use during the last four years:

Value of Rods Imported Since 1905.

Year.	*Value.*
1905,	$25,109
1906,	29,374
1907,	39,036
1908,	54,711
Total,	$148,230
Average,	37,575

The appraiser at the Port of New York has kindly furnished estimates of the average number of pounds of willow of the different grades for every $100 of import value. From these figures it was possible to calculate that the three quality classes of the finer grade cost 7.5, 6.5 and 6.0 cents per pound respectively, and the coarser grade costs about 3.3 cents per pound. The average price per pound for all grades imported is about 6 cents. By dividing this into $54,711 the result will be 911,850, or the number of pounds imported during 1908. The actual appraised value of the average grade of willow is probably less than 6 cents, and, therefore, it is safe to say that the total amount imported during 1908 was about 1,000,000 pounds.

The average yield in this country is about 1,300 pounds per acre. One million pounds, therefore, represents about what can be grown on 800 acres. There is, however, a large quantity of manufactured willow-ware imported which represents approximately 1,500,000 pounds in addition to the one million pounds above referred to.

The following table shows conditions in 1907 and 1908, the total value for 1908 of consumption being around $225,000, which is approximately $75,000 more than the preceding year:

State.	Home grown. Firms Reported.	Rods Concumed M pounds.	Total Value Dollars.	Average Price per lb. Cents.		Rods Consumed. M pounds.	Value. Total.	Homegrown and Imported Average price per lb. Cents.	Total Value. Dollars.	Firms Reported.
	1907	1908	1908	1908	1907	1908	1908	1908	1908	1908
Illinois,	32	29	1,905.00	6.6	35	37	3,452.00	9.3	5,357.00	5
Kentucky,	47	62	3,962.50	6.4	3	....	.....	....	3,962.50	6
Maryland,	225	141	8,665.50	6.1	4	....	.....	....	8,665.50	12
Massachusetts,	74	135	11,360.96	8.4	185	258	23,462.38	9.1	34,823.34	8
New Jersey,	40	33	2,353.00	7.1	22	19	1,535.00	8.1	3,888.00	4
New York,	708	1,830	92,873.48	5.1	226	288	23,842.18	8.3	116,715.66	104
Ohio,	31	87	4,864.50	5.6	8	4	435.00	10.9	5,299.50	11
Pennsylvania,	111	236	16,372.87	6.9	70	60	4,847.00	8.1	21,219.87	35
Wisconsin,	59	57	3,681.25	6.5	54	59	4,664.50	7.9	8,345.75	6
Other States	113	229[3]	13,353.00	5.8	55[1]	48[2]	3,079.25	6.4	16,432.25	12
Total,	1,640	2,839	159,392.06	5.6	662	773	65,317.31	8.4	224,709.37	203
Percentic increase,		57.7				16.8				

[1]Minnesota, Michigan, Missouri, California.
[2]Iowa, Missouri, Virginia.
[3]Indiana, Michigan, Minnesota, Nebraska, Oregon, Virginia, District of Columbia.

CURRENT LITERATURE.

Ecology of Plants. By Eug. Warming. Assisted by Martin Vahl. Prepared for publication in English by Percy Groom and Isaac Bayley Balfour. Oxford, Clarendon Press. 1909.

The scope of ecological inquiry is so well defined by Warming that it seems worth while to quote it here: "To find out which species are commonly associated together upon similar habitats; to sketch the physiognomy of vegetation and the landscape; to answer the questions: why each species has its special habit and habitat, why the species congregate to form definite communities, why these have a characteristic physiognomy." The last questions are the really difficult tasks of ecology and their solution leads to the investigation of the problems concerning the economy of plants, the demands they make upon their environment, and the means that they employ to utilize the surrounding conditions and to adapt their external and internal structure and general form for that purpose.

The result of such activities on the part of the plant is the growth form, or in other words, the growth form is the expression of the degree of the external and internal adaptation of a plant to the natural conditions in which it lives. On this basis the author makes six classes of growth forms, as follows: Heterotrophic, parasites and saprophytes evidently derived from self-sustaining plants; aquatic; muscoid; lichenoid (mosses and lichens being separated by their method of nutrition), and, sixth, all other self-sustaining plants. The latter class is divided into annuals and perennials. The subdivision of the perennials is based upon such points as the duration of the vegetative shoot, the length and direction of the internodes, the position and structure of the renewal buds, the duration of the leaves, the adaptation of the nutritive shoot to the conditions of transpiration and the capacity for social life. Following these lines, the author groups the perennials into four sub-classes, renascent herbs, rosette plants, creeping plants and plants with erect long-lived shoots (subdivided into cushion plants, undershrubs, soft stemmed plants,

succulent stemmed plants and woody plants with long-lived lignified stems).

Having set forth as outlined above, the ground to be covered by the volume, Warming proceeds to discuss in twenty-two chapters, the factors of site, followed by seven chapters of remarkably clear discussions of the adaptations to those factors. The larger portion of the remaining chapters (100 in all) describes the plant formations of the earth. Warming's classification is based upon both climate and soil as the following outline shows:

A. Soil very wet; abundant water available. (1) Formations in water; (2) formations in marsh.

B. Soil physiologically dry; water available only to a slight extent. (3) Formations on sour soil; sub-divided into low moors, grass heaths, high moors, moss and lichen heaths (or tundra), dwarf shrub heaths, and bushland or forest on acid soil. (4) Formations on cold soil, including chiefly the sub-glacial fell fields. (5) Formations on saline soil, including salt swamps and deserts and littoral swamp forest (Mangrove).

C. Soil physically dry and its slight power of holding water determines the vegetation. (6) Formations on rocks; only herbaceous forms are given. (7) Formations on sand and gravel, including dune heath, bushland and forest. (8) Formations on waste land.

D. Climate very dry and determines the character of the vegetation, the soil being of secondary import. (9) Formations of deserts and steppes, including prairies. (10) Formations on savannas, sub-divided into thorny savanna, true savanna and savanna forest. (11) Sclerophyllous formations, sub-divided into garique, maqui and sclerophyllous forest.

E. Soil physically or physiologically dry. (12) Coniferous forests.

F. Soil and climate favorable to mesophyllous formations. (13) Mesophytic formations, subdivided into arctic and alpine mat grassland, meadow, pasture, masophytic bushland, deciduous dicotylous forest and evergreen dicotylous forests.

The four classes of plant formations of the previous Danish and German editions of Warming's Oecology of Plants have been extended to thirteen, resulting, as it seems to the reviewer, in a greater clearness in conception and consequently in a more logical grouping of plant habitats. A classification based upon both

climatic and soil conditions seems much closer to the actual determinations than one based upon climate alone as that of Mayr outlined above in this number of the Quarterly.

C. D. H.

Experiments in Blueberry Culture. By Frederick V. Coville. U. S. Department of Agriculture. Bureau of Plant Industry. Bulletin 193. Washington, D. C. 1910.

Coville's paper throws many interesting side lights upon the characteristics of peaty soils. He distinguishes "upland peat" from bog peat, the former being "a non-paludose deposit of organic matter, chiefly leaves, in a condition of suspended and imperfect decomposition and still showing its original leaf structure, the suspension of decomposition being due to the development and maintenance of an acid condition which is inimical to the micro-organisms of decay." Leaf mold is separated from the above by the facts that decomposition has proceeded so far that leaf structure has disappeared and that it is neutral or alkaline in reaction, at least so far as tested. The upland peat of the character defined above is found beneath laurel (Kalmia) thickets, beneath scrub pine (*P. virginiana*), and doubtless other pines as well, being the leaves of these species imperfectly decayed owing to their acidity. Freshly fallen oak leaves also were found to be acid (0.4 normal). Oak leaves one year old and two years old were 0.006 and 0.002 normal respectively, in acidity, that is, in such proportions of the "normal solution" of chemists. Oak leaves several years old beneath those of acid reaction were alkaline and contained 3.5 per cent. of lime. It is suggested that the lime in the leaves, remaining constant in amount and probably having been changed to a more soluble state, had neutralized the remaining acidity. The material then becoming alkaline, the bacteria of decay found congenial conditions and so decomposition proceeded with greater rapidity until real leaf mold had been formed. The author suggests that a similar sequence of events takes place in drained bogs and muck lands which, when first plowed, will grow only acid resisting crops, but later as their acidity disappears, they attain a high degree of fertility.

Coville punctures a theory of ecologists in relation to the diverse habitats of certain heath plants, namely, the one a peat bog, the

other a sandy, well drained and often dry upland. The usual explanation is that such plants are naturally adapted to the drier site, that they can grow in a bog because of the retarded absorption owing to the acidity of the soil water, that the two habitats are essentially alike so far as nutrition is concerned, both being dry in terms of avilable water. The author found by experiment in the case of the swamp blueberry (*Vaccinium corymbosum*) that no amount of dryness in an upland soil will make it flourish if that soil is not acid. It occupies both situations because the soil of both is acid and only in such soil does it produce vigorous growth.

C. D. H.

Surface Conditions and Stream Flow. By Wm. L. Hall and Hu Maxwell. U. S. Department of Agriculture, Forest Service Circular 176.

Although this very important contribution to the subject which its title indicates, is dated as issued January 11, 1910, it apparently has been allowed to reach the public only long after its date of issue. This curious time discrepancy reminds us that we had seen the title once before, and we recall the contents as having figured as Senate Document No. 676 about a year ago, and this again reminds us that it was quoted and at least to the satisfaction of the author controverted in its conclusions in the noted, if not notorious, contribution to the literature on the influence of forests on climate and on floods, perpetrated by Willis L. Moore (see F. Q. Vol. VIII, p. 74). The latter publication was perhaps mainly inspired by the former, and was to serve as an argument against the Appalachian Forest Reserve proposition. We expressed ourselves at the time sufficiently strongly on Mr. Moore's untenable attitude, and a number of other champions have demolished his argument in general, whatever there may be left of it in particular.

Again we come to the conclusion that there is, as yet, nothing definitely or conclusively proved as to the final effect of forest cover on floods, but that nevertheless our natural philosophy cannot escape the conviction that such influence exists and what it must be.

As the authors point out, if neither increased precipitation nor

change in evaporation, nor changes in topography or soil itself can be adduced for changes in water flow—we avoid the word "floods" which may be variously defined according to Moore—no other factor but the change in surface cover is left as an explanation of the change in high and low water stages.

At any rate the practical issue in the present case, which we take it was the policy of the federal government in securing a forest reservation in the Alleghannies, has been fortunately decided in favor of those holding that such influences exists—a moral and a practical victory for the Forest Service over the position taken by the Weather Bureau.

B. E. F.

Eucalypts in Florida. By R. Zon and J. M. Briscoe. Bulletin 87, U. S. Forest Service. Washington, D. C. 1911. Pp. 47.

This bulletin contains the result of an investigation to learn what species might be successfully grown in the State. The study took the form of an investigation of the species already planted and a comparison of conditions with those of regions in which eucalypts have been successfully introduced.

The eucalypts are natives of Australia and Tasmania, whence they have been introduced into the Mediterranean countries and certain parts of America, particularly Cuba, Hawaii, Brazil and California. As a general rule, the commercial species of eucalypts may be introduced into any region in which citrus fruits and the olive will grow in the open. They do best in a climate which permits of a distinct period of vegetative rest during the year, and are capable of withstanding temperature below freezing, if the period of low temperature is not long sustained and if it is coincident with the period of vegetative rest. The decisive factor is the absolute maximum and minimum temperatures. Precipitation is of less importance, the tree thriving in regions of 18 to 70 inches rainfall.

A comparison of the climatic conditions in Australia and in regions in which eucalyptus have been introduced with those in Florida shows that the climate of southern Florida, below the twenty-ninth parallel of latitude, is well adapted to the growing of eucalypts. The climate of southern Brazil comes closest to that of Florida. In Florida, however, the period of vegetative

rest is less pronounced and the atmosphere more humid, and hence freezing temperatures are likely to do greater damage.

As regards soil, most of the eucalypts can thrive on light, sandy soils, provided they are deep and the water table not too low. Where rock or hardpan is close to the surface they fail. The only species which can be safely tried in Florida are either those which can adapt themselves to light, sandy soils, or those which can stand superabundant moisture. Since most of the eucalypts need protection from wind, Florida, possessing no mountain ranges, is not favorably situated.

After a short account of the early introduction of eucalypts into Florida the species now growing are discussed, mainly from the standpoints of frost hardiness and rate of growth. Of the sixteen species, the five, *E. resinifera, rostrata, viminalis, robusta,* and *tereticornis,* seem best adapted to the climate of Florida. But since these eucalypts have been planted as shade trees or windbreaks their rate of growth affords an unsafe basis for commercial plans.

The bulletin throughout discourages the present tendency to indiscriminate planting of eucalypts with the hope of large and speedy returns. Species must be chosen suited to the particular soil and climatic conditions. The writers explicitly point out that the facts thus far obtained prove only that portions of Florida are climatically suitable for growing certain species and that the feasibility of commercial planting is wholly undetermined. The best methods of culture, the cost of planting, and the returns to be expected can only be settled by trial.

The bulletin closes with a summary of methods of planting, based mostly on Californian experience.

J. H. W.

The Forest Club Annual, Volume III, 1911. The University of Nebraska. Lincoln, Nebraska. 1911. Pp. 118.

This annual publishes articles contributed largely by students and alumni with the primary purposes of the development of the student. The present issue contains thirteen articles in various fields of forestry.

In the first article on "Logging and Lumbering Costs in Colorado National Forests" the factors influencing the cost of each

step of the process are discussed in detail, figures given, and comparisons made with the different species logged.

In the article on the "Forest Types of the Gila National Forest" five types are described, with an interesting consideration of the relation of these to the causes and extent of forest fires and methods of fighting them. The method of restocking of burned areas in each type is given.

Two articles deal with contour mapping, one describing the use of the Roth board for quick results, and the other the use of the aneroid barometer for very rugged country.

Under the heading "Forestry in Eastern Canada" is given a description of the operations of the Laurentide Paper Company of Quebec, as an example of forestry practice.

There is an article giving the results of experiments on seasoning and preservative treatment of Western Red Cedar poles, and Western Yellow Pine as a substitute for the former.

The account of the Nebraska forest fungi is continued, the present section dealing with the commoner leaf-inhabiting forms. The list of native and exotic trees of Nebraska in the preceding volume is followed up by a list of forest trees on the Pollard estate, comprising forty-nine species, seven of them exotic.

The Rodman tree-planting machine used by the Union Pacific Railway Company is described in another article. This is practically the Stratton machine used over twenty years ago in the same state. It is interesting to note the tendency towards machinery as labor grows scarcer.

There are various other articles, including a bud and twig key; a description of a form of Aspen with obovate leaves; the collecting of Lodgepole Pine cones by robbing squirrel hoards, with the method of seed extraction in the field; and a description of the spring frost damage to some twenty broad-leaved tree species.

The publication is a creditable production and splendidly illustrated.

J. H. W.

Forest Products of Canada, 1909. Cross Ties. By H. R. MacMillan. Bulletin 14, Forestry Branch. Ottawa, Canada. 1911. Pp. 8.

In 1909 the steam and electric railways of Canada purchased 14,178,241 cross ties costing $5,210,490 at the point of purchase.

Cedar, jack pine, tamarack and hemlock are the species mostly used. Cedar furnishes 30 per cent., jack pine 24 per cent., tamarack 20 per cent, and hemlock 13 per cent., of the ties used. Nearly all the remainder is made up of spruce and Douglas fir.

The average price was 37 cents per tie as compared with 38 cents in 1908. Cedar ties averaged 45 cents, tamarack 39 cents, hemlock 33 cents, jack pine 30 cents and spruce 25 cents, each.

It is pointed out that preservative treatment of ties is being largely adopted by United States railway companies, although using a high perecentage of durable species, and the adoption of this policy in Canada is urged. This would mean economy to the railways and would lead to the use of species which have little or no market at present, inferior as well as much fire-killed timber.

Adding 20 cents for the freight and cost of placing the tie in place to the purchase prices quoted above, and assuming the life of cedar ties to average 9 years, tamarack 8 years, hemlock 7 years, jack pine and spruce 6 years, the writer shows the annual charges per tie to be 8.74 cents for cedar, 8.76 cents for tamarack, 8.83 cents for hemlock, 9.54 cents for jack pine, and 8.59 cents for spruce (money 4 per cent.). If 30 cents be allowed as the cost of creosoting ties and equipping them with tie-plates, on a basis of a life of 15 years the annual charges would fall to 8.54, 8.00, 7.47, 7.19 and 6.74 cents, for the same species. The use of treated ties would thus result in an annual saving of from $6.00 to $70.50 per mile of track, according to the species used.

Wood-Using Industries of North Carolina. By Roger E. Simmons. Economic Paper No. 20, N. C. Geological and Economic Survey. Compiled in co-operation with the U. S. Forest Service. Raleigh, N. C. 1910. Pp. 74.

The value of the timber crop of North Carolina is exceeded only by that of the cotton and corn crops. In 1908 the State produced 1,137 million feet B. M. of lumber worth $15,598,000. Over half of this material was manufactured into finished products.

North Carolina supplies 96 per cent. of the 676 million feet B. M. of rough lumber required by its 21 wood-using industries. In all 33 different woods were manufactured, of which 18 are

entirely home-grown, and in the case of 8 others 90 per cent is local.

The wood most extensively used is yellow-pine—422 million feet B. M. or 62 per cent. of the total quantity of all kinds of wood manufactured. It is followed by oak with 21 per cent., poplar 5.3 per cent., gum 3.2 per cent., and white pine 2 per cent.

The average cost at the factory of all home-grown material was $14.13 per M. feet B. M. The average price of yellow pine varied from $11.94 in the Coastal Plain region to $12.40 in the Piedmont region, and $15.66 in the Mountain region. For the same regions the average prices of oak were $19.80, $18.31 and $10.26, respectively. The least costly wood of all was sycamore in the Coastal Plain region—$7 per M.

S. J. R.

A Study of the Massachusetts Wood-Using Industries. By Hu Maxwell of U. S. Forest Service under the direction of F. W. Rane, State Forester of Massachusetts. Boston, Mass. 1910. Pp. 38.

Manufacturers in Massachusetts convert approximately 550 million feet B. M. of rough lumber into finished products annually. This respresents less than half of the wood used in the State for all purposes, including construction, poles, ties, shingles, etc. Twenty different wood-using industries are represented, using 54 different woods.

Of the total amount of timber used only 30 per cent. was grown in the State. The most important species is white pine which furnishes nearly 300 million feet, of which 88 per cent goes into boxes and crates. Though Massachusetts is a white pine State yet 56 per cent. of the pine demanded by its factories comes from other States. In fact the State grows only two woods in sufficient amounts to supply its manufacturers, and these are little-used species,—yellow oak and applewood.

The total cost of the raw material at the factory was $11,692,-130 an average of $21.29 per M feet for all the wood reported. The cheapest wood was locally-cut cottonwood, worth $9 per M in the log at the factory. The most costly woods were mahogany at $251 per M and rosewood at $750 per M.

The most important wood-using industry is the manufacture of

boxes and crates which requires seven times as much wood as any of the other industries and almost twice as much as all the others combined. The average cost per M. for the 23 woods used in this industry was $16.02; of white pine, native-grown, $15.60; imported, $17.66.

S. J. R.

A Study of the Wood-Using Industries of Kentucky. By Roger E. Simmons. Compiled in co-operation with the U. S. Forest Service. 1910. Pp. 74.

"No report could better open the eyes of the people at large, and especially the business men of the State of Kentucky, to the importance of the State's adopting a forest policy, than a work of this character. When one notes that Kentucky each year consumes 220,000,000 feet of her own forests in the further manufacture of wood into final form, and brings in from other States 191,000,000 feet additional, and that nearly $10,000,000 annually is spent in payment for this raw material, he will realize the magnitude and importance of the wood-using industries of the State. Add to this the great army of men who are employed by these industries, the enormous wealth which each year is brought into Kentucky from the sale of the products turned out by them, as well as the industrial prosperity which ensues from so great a commercial activity, and the economic importance of perpetuating these industries in Kentucky will be self-evident."

"The lessons learned from the experiences of Indiana and Ohio should, more than any other fact, convince Kentucky of the immediate necessity of improving her forests. In 1900, Ohio, Indiana and Illinois produced 25 per cent. of the hardwood of the country. In 1908 their production of hardwood was only 12 per cent. compelling their wood-using industries each year to seek, more and more, new fields for their supply.

"That the drain on the forests of Kentucky is being felt materially is shown by the fact that in 1907 the lumber cut was 912,980,000 feet while in 1908 the production was 658,539,000, a decrease of about 28 per cent. Again, in 1907 Kentucky ranked first among the States as a producer of yellow poplar lumber, but in 1908 she was reduced in rank to third place. With the disappearance of the virgin forests, which each year in this State are

nearing depletion, two things must happen, either the wood-using industries will have to secure their supplies from other States, or shut down and move to other localities."

S. J. R.

A Study of Wisconsin's Wood-Using Industries. By Franklin H. Smith. Madison, Wisconsin. 1910. Pp. 68.

This report, prepared co-operatively by the U. S. Forest Service and the State Board of Forestry, covers the use of lumber which by machinery or some other process has undergone some change in form from the rough material. The products of the planing mill, such as siding, flooring and ceiling, were not included in the totals of material used.

As a lumber producer Wisconsin now ranks fifth, having fallen from first place in 1900 and 1904. The total annual production of lumber is over 1,600 million board feet. The wood-using industries of the state use 930 million feet of lumber valued at $20,000,000. Very nearly half (49 per cent.) of this material was imported. A large proportion was supplied by the Rocky Mountain and Pacific Coast states, though freight rates permit the manufacturers to draw their supplies from all parts of the country and ship the finished products into the same sections from which the material was obtained.

Twenty-two different wood-using industries are represented in the state. Forty different woods are used, of which nineteen are local. Basswood is employed in twenty of the twenty-two industries. Seventeen use white pine; sixteen, ash and elm; fifteen, maple; and fourteen birch and oak. It is interesting to note that 100 M. feet of willow lumber worth $9.70 per M. was used in the manufacture of woodenware.

Inspections made in the various factories show a waste of from 5 to 35 per cent—average at least 20 per cent—of the total volume of lumber consumed. The introduction of box factories as adjuncts to sawmills has materially decreased the waste of lumber at many mills. One prominent concern operates profitably a chemical plant in connection with its sawmill. The small and defective hardwoods, together with the tops of felled trees on the logged-off lands are utilized. The removal of the slash tends

to prevent fires and leaves conditions favorable for reforestation or for settlement as desired.

S. J. R.

Wood-Using Industries of Oregon. By Howard B. Oakleaf. Oregon Conservation Association. Portland, Oregon. 1911. Pp. 46.

This study of the wood-using industries of Oregon was made, co-operatively by the U. S. Forest Service and the Oregon Conservation Association. The report shows the amounts of material consumed annually by the various industries (except those manufacturing lumber and shingles) in the state, the kinds of woods used, and the technical properties of the native woods. Statistics were compiled from returns from all the wood-using industries in the state.

"The state of Oregon is reported to have nearly four hundred billion feet of standing timber, an amount equal to approximately one-sixth that now remaining in the United States. It would seem that Oregon should be among the foremost lumber producing states, but owing to the present inaccessibility of much of the timber, its operation is greatly retarded. Oregon ranked ninth in 1909 in the production of lumber, having cut nearly two billion feet, and it is very probable that the 1910 cut will equal and possibly exceed the above amount. Of the two billion feet of lumber annually sawed in this state, four hundred million is shipped out by water and eight hundred million by rail. Of the remaining eight hundred million board feet consumed in the state, approximately 25 per cent. is further manufactured into the various products considered in this report. The balance goes into general building and construction work.

"Oregon has seventeen commercial species, representing fourteen genera, with woods of diverse color and texture, ranging from the very hard deciduous trees, such as the oaks, ashes and maples, to the soft evergreen pines, firs and spruces.

"Nineteen distinct wood-using industries are operating in the state, and the plants comprising the various industries represent investments of from a few thousand dollars in the small woodworking shops to several million dollars in the pulp mills.

"The annual consumption of all of the wood-using industries

of the state is 296,791,900 board feet, nearly two hundred million feet of which is actually purchased in the form of lumber, the balance being obtained in the form of logs and cordwood. The purchase of this raw material represents an expenditure of about four and three-fourths million dollars. Of the 296 million feet annually consumed less than one per cent. is obtained outside of the state."

"This clearly shows how well Oregon is equipped to meet her wood demands, and that although her hardwoods are somewhat inferior and scattering, they are highly usable, and will increase in value as the Eastern supply is exhausted. It might be well to mention here that the state of Maryland is forced to bring in 80 per cent of the lumber used by her wood-using industries; Massachusetts, 70 per cent. and Wisconsin, 50 per cent."

S. J. R.

The Relative Durability of Post Timbers. By J. J. Crumley, Ohio Agricultural Experiment Station, Wooster, Ohio. 1910. Pp. 36.

This report is based upon investigations of 292 fences containing 30,160 posts. These fences were situated in Ohio for the most part; also Indiana, Illinois, Kansas and Texas. The species of timber studied were (arranged in order of durability as found) Osage orange, black locust, red cedar, mulberry, white cedar, catalpa, chestnut and oak (sp?). The investigator found that durability apparently was not affected by seasoning, i. e. posts set green seem to have lasted fully as long as those partially or thoroughly seasoned. It made no difference whether the upper or lower end of the post as it grew in the tree is put in the ground, except that the sounder end should be put down. If both ends are equally sound the larger should go down, since a large post usually lasts longer than a small one of the same wood. Timber grown rapidly did not appear as durable as slowly grown timber of the same kind. This was observed especially in red cedar, catalpa, and locust. It has usually been considered that rate of growth does not offset durability. The wood near the center of the tree did not prove as durable as that just beneath the sapwood. The investigator believes this to be due to the greater age of the center wood, to the presence of numerous small knots, and to in-

cipient decay. "On the other hand, the posts split from the outside of the tree have not been standing in the tree so long, have been formed after the tree was a foot or more in diameter and had a smooth trunk, and the wood therefore is clear of knots and not subject to infection by being exposed to the air through knot holes."

The bulletin is interesting and instructive but further investigations and careful experiments are needed before all of the findings can be accepted as conclusive.

S. J. R.

OTHER CURRENT LITERATURE.

Purchase of Land Under the Weeks Law in the Southern Appalachian and White Mountains. Unnumbered Circular, U. S. Forest Service. Washington, D. C. 1911. Pp. 9.

The Use Book: Water Power. U. S. Forest Service, Washington, D. C. 1911. Pp. 86.

Record of Wholesale Price of Lumber for January, February and March, 1911. U. S. Forest Service. Washington, D. C.

Contributions toward a Monograph of the Bark Weevils of the Genus Pissodes. By A. D. Hopkins. Technical Series No. 20, Part 1. U. S. Bureau of Entomology. Washington, D. C. 1911. Pp. 68.

The Genotypes of the Sawflies and Wood Wasps, or the Super-Family Tenthredinoidea. By S. A. Rothwer. Technical Series No. 20, Part 2. Bureau of Entomology. Washington, D. C. 1911. Pp. 31.

Damage to Telephone and Telegraph Poles by Wood-boring Insects. By T. E. Snyder. Circular No. 134, Bureau of Entomology, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 6.

Summary of Report of the Commissioner of Corporations on

the Lumber Industry. Part 1, Standing Timber. Department of Commerce and Labor. Washington, D. C. 1911. Pp. 38.

Natural Vegetation as an Indicator of the Capabilities of Land for Crop Production in the Great Plains Area. By H. L. Shantz. Bulletin 201, U. S. Bureau of Plant Industry. Washington, D. C. 1911. Pp. 100.

Danger of General Spread of the Gipsy and Brown-tail Moths through Imported Nursery Stock. By C. L. Marlatt. Farmers' Bulletin 453, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 22.

Paper and Wood Pulp Statistics, 1909. Preliminary Report, Bureau of the Census. Washington, D. C. 1911. Pp. 6.

Lumber, Lath and Shingles, 1909. Forest Products, No. 1, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 63.

Slack Cooperage Stock, 1909. Forest Products, No. 3, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

Tanbark and Tanning Extract, 1909. Forest Products, No. 4, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

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Tight Cooperage Stock, 1909. Forest Products No. 6, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

Wood Distillation, 1909. Forest Products, No. 7, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 11.

Poles, Cross Arms, Brackets, and Insulator Pins Purchased, 1909. Forest Products, No. 9, Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

Surface Water Supply of the United States: Part X, The Great Basin. By E. C. La Rue, and F. F. Henshaw. Water Supply Paper 270, U. S. Geological Survey. Washington, D. C. 1911. Pp. 192.

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Reconnaissance Soil Survey of the Eastern Part of the Puget Sound Basin, Washington. By A. W. Mangum. U. S. Bureau of Soils. Washington, D. C. 1911. Pp. 90.

Reconnaissance Soil Survey of Western South Dakota. By C. N. Coffey. U. S. Bureau of Soils. Washington, D. C. 1911. Pp. 80.

Soil Survey of the Woodland Area, California. By C. W. Mann, J. F. Warner, H. L. Westover and J. E. Ferguson. U. S. Bureau of Soils. Washington, D. C. 1911. Pp. 57.

Water Power of the Cascade Ranges: Part I, Southern Washington. By J. C. Stevens. Water Supply Paper 253, U. S. Geological Survey. Prepared in coöperation with the State of Washington. Washington, D. C. 1910. Pp. 94.

The Water Balance of Succulent Plants. By D. T. MacDougal and E. S. Spalding. Publication 141, Carnegie Institute of Washington. 1910. Pp. 77.

This report embodies two papers, viz: *Form-Alterations and Growth of Cacti* by E. S. Spalding and *Variations of the Water Balance* by D. T. MacDougal. The investigations were made near the Desert Laboratory in the Sonoran desert, attention being chiefly directed to the great tree cactus (*Carnegiea gigantea*), the

bisuaga (*Echinocactus wislizeni*) and some of the common pricklypears (*Opuntia blakeana and O. discata*).

The Management of Vermont Forests with Special Reference to White Pine. Bulletin 156, Vermont Agricultural Experiment Station. Burlington, Vt. 1911. Pp. 41.

Handbook of Conservation. By Mrs. F. H. Tucker. Massachusetts State Federation of Women's Clubs. Boston, Mass. 1911.

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Fifth Annual Report of the Commissioner of Forestry, 1910. Providence, Rhode Island. 1911. Pp. 35.

Biennial Report of the Connecticut Agricultural Experiment Station, 1909-10. Part IX: Report of the Entomologist. New Haven, Connecticut. 1911. Pp. 657-712.
Containing notes on various insect pests of trees.

State Conference on Taxation, January, 1911. Utica, New York. 1911. Pp. 23.
List of resolutions, officers, committees, etc.

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Contains the various annual reports for 1910.

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What Trees to Plant and How. By J. H. Levison. American Association for the Planting and Preservation of City Trees. Brooklyn, New York. Pp. 4.

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Contains *Arbor Day and Forestry; The Forests of the State; The Development of European Forestry,* and miscellaneous.

Laws of New Jersey Relating to Forestry. Circular by Forest Park Reservation Commission. Trenton, N. J. 1911. Pp. 27.

The Forests and Their Products. By F. W. Besley. Maryland Weather Service. 3:305-359. 1910.

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Forestry and Wood Industries. By A. B. Brooks. Morgantown, W. Va. 1911. Pp. 481.

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Biennial Report of the State Geologist, 1909-1910. By J. H. Pratt. North Carolina Geological and Economic Survey. Raleigh, N. C. 1911. Pp. 152.
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Forest Fire Protection and Revenue, and Among Timberland Owners in North Carolina. By T. P. Ivy. Raleigh, N. C. 1911. Pp. 11.

Town Planting; and the Trees, Shrubs and Other Herbaceous Plants that are Best Adapted for Resisting Smoke. By A. D. Webster. Press of E. P. Dutton & Co. Pp. 220.

A Study of the Wood-Using Industries of Kentucky. By E. Simmons. State Board of Agriculture, Forestry and Immigration. 1911. Pp. 74.

Tenth Annual Report of the State Board of Forestry, Indiana, 1910. Indianapolis, Indiana. 1911. Pp. 154.

The Nature of Parasitic Fungi and Their Influences on Their Host. By Mason B. Thomas. Crawfordsville, Indiana. 1911. Pp. 15.

Report of the Pro-Arbor and Bird Day Convention, Indianapolis, April 1, 1911. Reprint.

Contains addresses by Governor Marshall; *Arbor Day in the Schools*, by Stanley Coulter; *Women's Clubs and Forestry*, by Mrs. Grace J. Clark; *Municipal Forests*, by Charles W. Fairbanks. 1911. Pp. 2.

Official Report of the Lake States Forest Fire Conference, St. Paul, December 6-7, 1911. Chicago, Illinois. 1911. Pp. 181.

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Forest Conditions in Illinois. By R. Clifford Hall and O. D. Ingall. Bulletin 3, State Laboratory of Natural History. Prepared in co-operation with the U. S. Forest Service. Urbana, Ill. 1911. Pp. 175-253.

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The Conservation of Iowa Lakes, Streams and Woodlands. By T. H. MacBride and Bonhumie Shimek. Reprint from Report of the Iowa State Drainage, Waterways and Conservation Commission. 1910.

The Taxation of Forest Lands in Wisconsin. By A. K. Chittenden and H. Irion. State Board of Forestry, in co-operation with the U. S. Forest Service. Madison, Wisconsin. 1911. Pp. 80.

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Ninth Annual Report of the Director of the Bureau of Science, 1910. Manila, Philippine Islands. 1911. Pp. 70.

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Contains an article on Shrubs and Vines for Ornamental Planting.

Thirty-sixth Annual Report of the Ontario Agricultural College and Experimental Farm, 1910. The Legislative Assembly, Toronto, Canada. 1911. Pp. 304.

Contains the report of the Forestry Department.

Agricultural Work in Ontario, by C. C. James; *Unsanitary Housing,* by C. A. Hodgetts. Reprinted from the Second Annual Report of the Commission of Conservation. Ottawa, Canada. 1911. Pp. 59.

Fourth Annual Report of the Game and Fisheries Department, 1910. The Legislative Assembly, Toronto, Ontario. 1911. Pp. 191.

Forest Fires and Railways. By R. H. Campbell. Bulletin 16, Forestry Branch, Department of the Interior. Ottawa, Canada. 1911. Pp. 8.

Forest Products of Canada, 1909: Poles Purchased. By H. R. MacMillan. Bulletin 13, Forestry Branch, Department of the Interior. Ottawa, Canada. 1911. Pp. 7.

Report of the Proceedings of the Fourth Annual Convention of the Western Canada Irrigation Association, Held at Kamploops, B. C., August 3, 4 and 5, 1910. Government Printing Bureau, Ottawa, Canada. 1911. Pp. 155

Some West African Timbers. Bulletin Imperial Institute, 8, No. 3. South Kensington. 1910. Pp. 231-245.

Samples of wood of a number of different timbers from the Gold Coast Colony, Northern Nigeria, are reported on, relative to their distinguishing characteristics, working qualities and purposes to which they can be applied.

Note on Calorimetric Tests of Some Indian Woods. By Puran Singh. Government Forest Bulletin No. 1. Calcutta, India. 1911. Pp. 10.

Tree Growth at Centocow, Natal. By F. C. Fernando. Bulletin No. 3, Forestry Department. Cape Town, South Africa. 1911. Pp. 11.

A Research on the Pines of Australia. By R. T. Baker and H. G. Smith. Sydney, Australia. 1911.

Trees of the Tasmanian Forests of the Order Myrtaceae; the Genus Eucalyptus. By L. Rodway. Bulletin 17, Agriculture and Stock Department of Tasmania. 1910. Pp. 15.

Biennial Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii, 1909-1910. Honolulu, Hawaii. 1911. Pp. 231.

Contribucional Conocimiento de los Arboles de la Argentina. By S. Venturi and M. Lillo. Buenos Ayres, Argentina. Pp. 127.

This consists of determinations by M. Lillo of some 371 timber species of Argentina, based upon collections and observations made by S. Venturi in behalf of the Argentina Centennial Exposition of 1910.

Rapport sur l'Introduction des Essences Exotiques en Belgique. By A. Visart and C. Bommer. Brussels. 1909. Pp. 381.

This report embraces the salient features of an investigation commenced in 1900 to determine the results which have been secured during the past in acclimating exotic species of trees in Belgium and to secure information relative to additional species of possible value in developing forestry in various parts of that country. The exotic species having greatest importance are Populus canadensis, Quercus rubra, Robinia pseudacacia, Juglans nigra, Picea excelsa, Larix europea, Pinus laricio, P. laricio austriaca, P. strobus, Pseudotsuga, douglasii and Abies pectinata.

Beitrage zur Kenntnis der Chemischen Zusammensezung des Fichtenholzes. By P. Klason. Berlin, Germany. 1911.

Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen. Band X, Heft 2: Untersuchungen uber den Blattausbruch und das sonstige Verhalten von Schatten—und Lichtpflanzen der Buche und einiger anderer Laubholzer. Von A. Engler. Zurich, Switzerland. 1911. Pp. 107-188.

Forest Policy. Second edition revised and enlarged. By C. A. Schenck. Darmstadt, Germany. 1911. Pp. 168.

PERIODICAL LITERATURE.

BOTANY AND ZOOLOGY.

Damping off Disease Hereditary.

Professor Mayr, whose attitude towards the recent theories regarding the hereditary influences which may be propagated by seeds from certain localities has been rather heterodox, reported to the meeting of the International Association of Forest Experiment Stations the results of his experiments to show the hereditariness of the damping off disease, or "Schütte," produced by *Lophodermium pinastri.*

In his article he discusses first the general question of hereditariness. With considerable inconsistency he ridicules the assumption that straight form or spiral growth, early or late leafing, are hereditary and not merely results of climatic influences, but that the damping off disease is hereditary, and that plants derived from seeds from certain localities are liable to it more than those from other localities.

Experiments with Norwegian and Finnish seed of Scotch Pine, in comparison with such from middle Germany, induced the author to consider the northern pine "not as mere climatic variety or local race, but as a species by itself."

A further series of experiments with seeds from some eight localities, not all quite sure of its derivation, lead him to declare, that

(1) "the northern (Norwegian and Finnish) pine is free from the disease. To be sure, the young plants sicken, the needles becoming red, but the basis of the needles remains healthy. They bud the next year and only a small percentage succumbs, even under most unfavorable conditions. The 12-year-old sowings are still healthy and vigorous in the seedbed. They grow straight as an arrow (hereditary?!) with shorter needles with reddish buds, but they grow slower than those of the next groups;

(2) "pines from middle Europe, including those from Scotland, Holland, Belgium, Germany to the base of the Alps, Kurland, Livland, middle Russia, are sensitive to the disease, which under some unknown conditions fails entirely to appear or under other conditions leads to the loss of all plants;

(3) "pines from Auvergne (France), Tirol and northern Hungary are surely lost on clearings sowed in Germany. On these the disease exhibits itself in its most fateful manner, namely by death or crippling. There is, however, no reason to assume that in Germany if the plants escape the disease they could not furnish stands of good growth, straight and normal." (It is claimed by others that at least the French stock grows crooked.)

He concludes that to avoid the disease, only the northern seed is serviceable; and that in the second group no locality difference exists, but that sowings will or will not suffer from the disease according to weather, soil, treatment of the seed, manner of sowing or planting.

Finally, after a thrust at those who would collect seed only from the best grown "élite" trees, without any good reasoning, he advocates return to natural regeneration of pine with underplanting of beech, and, with still less reason, recommends the use of his mixed forest in small areas.

[The Editor is unable to conceive how a disease caused by an outside agent, a fungus, can be hereditary; but the disposition to suffer more or less might be. Certainly there is less reason to believe a disease hereditary than the form of the plant itself.]

Schüttekrankheit und Provenienz der Föhre. Forstwissenschaftliches Centralblatt. January, 1911. Pp. 1-14.

Transpiration and Sap Flow.

Confirmation of the results of Dixon and Roshardt is given by Overton in experiments on *Cyperus.*

The diminished water supply in the leaves of plants, a portion of whose stem has been killed by steam, may be due to the blocking of the vessels with gum and resinous substances. The withering of the leaves in these experiments is probably caused more by the deleterious action of substances produced in the steamed portion than by the lack of water. In plants whose living cells have been killed by hot wax or poisonous substances there is less apparent disorganization of the cells, and the leaves wither less rapidly. The inference to be drawn from these experiments is that the withering of the leaves is due chiefly to the action of poisonous substances which destroy the osmotic action of the cells and their lifting power. The living cells of the stem apparently are not essential to transpiration and sap flow.

Although it may be true that plants are able to lift water to the leaves through comparatively short lengths of deadened stem (considerably less than 30 feet), it has never been shown conclusively that the living cells of the stem of tall plants are not essential to transpiration. Root pressure, capillarity, and the sucking action of the parenchyma of the leaves undoubtedly play important roles in the ascent of water in plants. But a careful study of the anatomy and morphology of plants indicates that the living cells of the stem also perform an important function in tall plants.

"Relation of the Living Cells in Plants to Transpiration and Sap Flow." Bot. Gazette, Vol. LI, No. 2, February, pp. 102-120.

I. W. B.

Causes of Vegetative Cycles.

Cowles gives an interesting account of the development of the study of dynamic plant geology, and defines in a general way the more important vegetative cycles and the factors which control them. Vegetative cycles are shown to vary greatly in their duration. Thus climatic variations produce vegetative cycles whose duration must be computed geologically. Within this climatic circle are cycles of erosion, each with its vegetative cycle. The general trend of such a cycle can be seen by studying the erosive process of to-day, by comparing the stages of one district with those exhibited in another. Within the cycle of erosion are many vegetative cycles, some so short that their stages may be studied from year to year in a given district.

"The Causes of Vegetative Cycles," by H. C. Cowles, Bot. Gazette, Vol. LI, No. 3, March, pp. 61-183.

I. W. B.

SOIL, WATER AND CLIMATE.

Soil and Yield.

A study on the relation of soil and yield was made by Schoenberg in the pineries of the forest school at Eberswalde, which contain, in sequence from one terrace to another, the five site classes usually recognized for pine—diluvial sand soil of varying character. It is interesting to note that proceeding in one direction from the plateau to the River

Oder, the site classes change from I to V as lower and lower levels are reached; again proceeding in another direction the opposite series is found, *i. e.*, from higher to lower levels the site improves, except that small heads above the highest plateau belong to site V. The explanation is found in the fact that in the first area the groundwater lies so deep that it has no effect on the surface cover, while in the second area the groundwater is the determining factor and the levels to which it is most accessible are the better sites.

The chemical analysis of the soil in the first series shows an unmistakable relation between the mineral constituents and the yield or site class. At the same time in mechanical composition the variation is still more marked and establishes closest connection between yield and soil contents of clay or silt particles. It should be stated that this area is located in a rain-poor district, and, as it depends on the rainfall, the groundwater not being available, the water capacity of the soil due to larger or smaller amounts of silt particles becomes most important. In the second area, which according to both chemical and mechanical analysis should be ranged into the lowest site classes, the access to groundwater compensates for these unfavorable conditions and produces stands of class I and II. Under such conditions almost pure quartz soils can still be good forest soils.

Reference is also made to the influence of humus and it is pointed out that the greater humus content of the better sites is due to greater foliage and litter production. On the sites of class V an increase of humus through the stand or natural flora can hardly be expected. Yet, by underplanting of species producing more litter than the pine, even such soils could be stimulated to greater production, for in this way as by addition to silt particles the physical condition of the soil would be improved, notwithstanding deficiency in minerals. (See following article.)

As regards the use of mineral fertilizer the author explains that many a failure in results may be explained by lack of water. It is therefore more important to increase the water capacity of the soil by careful preservation and increase of humus content, avoiding severe opening, removing weed growth and by superficial soil culture.

Ertragsleistung und Bodenbeschaffenheit bei der Kiefer. Zeitschrift für Forst- und Jagdzeitung. Nov., 1910. Pp. 649-656.

Soil Moisture on Different Aspects.

A series of investigations, executed at the Austrian Experiment Station by Wallenbôck, concerns itself with determining the soil moisture on north and south exposures, forested and unforested. Mere philosophy sustains the following propositons:

1. The soil of a clearing receives more precipitation than the same under the old stand (17 to 32% being intercepted).

2. In the forest, the drying by moving air plays a greater role than on the clearing (due to transpiration of the forest).

3. On the clearing the drying out is primarily due to insolation.

4. In wet years the drying out by insolation on clearings is paralyzed by the frequent precipitation much more than in old timber (the soil in the clearing has no time to dry out deep enough).

5. Precipitation on south slope does not measurably differ from that on the south slope (in hill country).

6. The evaporative power of moving air is not much greater on south than on north slopes.

7. Insolation and the dependent soil temperature are very much greater on south than on north slopes.

Corresponding to these conditions are the results of the investigations in soil moisture.

1. Water contents of the soil on north and south slopes are in rainy and rainpoor years greater on clearings than under beech cover.

2. In rainy years the clearing increases in moisture on south slopes more, on north slopes less, than the soil under a beech stand on the same slope.

3. The difference in water contents of clearing and forested soil is in rainy years greater on the sunny exposure, in rainpoor years on the shady exposure.

4. The difference in water contents of differently exposed clearings is in dry years greater, in wet years smaller, than that of differently exposed forest stands.

Die Klimatischen Unterschiede auf Nord- und Südlehnen in ihrer Beziehung zum Wassergehalte des mit Altholz bestandenen und abgestockten Waldbodens. Centralblatt f. d. g. Forstwesen. February, 1911. Pp. 51-63.

Moor Cultivation in Germany.

Prussia still possesses some two and a half million acres of uncultivated moorland and its means of reclamation is being carefully studied. The moors have been formed under various conditions, and consequently there is a great difference in the soil to be dealt with, both in regard to its constitution and its quality. Where the vegetation is poorly nourished and there is a large quantity of water, the moors are formed for the most part by peat moss, heather and reed grasses. On the other hand, in a soil rich in plant food, the plants contributing to the formation of moors are rushes, reeds and a number of sour grasses. As the former are ordinarily formed above the water level, they are called upland moors, and the latter low moors, mostly grassland moors. The latter, as shown by the following data, are much richer in plant food material than the former. Upland moor: Nitrogen 1.2, phosphoric acid, 0.18, potash 0.05, lime 0.2 per cent., while the low land moor contains 2.3, 0.02, 0.15, 3.4 per cent. of the materials in the order named. The upland moors, after being put in good condition physically, are stimulated chemically by the addition of lime which accelerates decomposition and the neutralization of acids. Potash salts and phosphates are added to both types of moors. Both types are best adapted finally to meadows and pastures and as such, under improved conditions, compare favorably in yield to the best grasslands.

Consular Report from Hamburg. The Journal of the Board of Agriculture. March, 1911.

ROADS AND SURVEY.

Roadbuilding in Mountains.

Forstrat Eberts discusses at great length, and citing many authorities, the question whether roads along slopes should be either horizontal and rounded off to both sides, or inclined to the outside, or to the inside. The conclusion he arrives at is that generalization is a mistake, and that local conditions, especially soil conditions and water conditions, make any one of the three forms more or less desirable.

The weight of opinion, however, leans to a location of roads

with the inclination to the inside, *i. e.*, to the mountain. On light sandy soils (red sandstone) which are easily washed by rains and on humid slopes especially this inclination is necessary, while on firm stony soil the horizontal location or even a valleyward inclination may be practicable.

Wie hat der Ausbau der Holzabfuhrwege an Hängen zu erfolgen? Forstwissenschaftliches Centralblatt. February, 1911. Pp. 78-91.

A Canadian Survey.

Reconnaissance and valuation work over an area of between one thousand and two thousand square miles of private holdings in Canada, north of Montreal, has been in progress for about three years. There were no reliable maps of the area, so a preliminary survey was made by following the main water courses and a skeleton may made from the data thus obtained. Later, parallel base lines were run with staff compass and chain and numbered stakes set at intervals of 25 chains. Sometimes the range lines one mile apart were used as base lines. The cruiser and his assistant ran their lines between stakes with corresponding numbers. The ordinary data concerning types, topography and general land-marks, were taken by all parties in the field and checked up with one another as often as convenient. In cruising the circular half-acre sample plot was used. The limits of the plot were marked along the compass line with an 83¼ foot cord. The cruisers also reported on the apparent status of the occupants of settled lots where ownership conditions were liable to be cause of contention between owner and limit holder. The maps were made on a scale of 4 inches to the mile. An index map of the whole area on a scale of ½ inch to the mile was also made. (Many interesting and valuable points were omitted in the report, which would be appreciated if made available.)

Canada Lumberman and Woodworker, Feb. 1, 1911.

In making contour maps for logging operations a rod to be used with a hand-level may be made with the zero mark near the center and with an adjustable shoe at the bottom, so that the zero mark may be made the same height as the topographer's eye. The change in elevation is then read directly from the rod and no computation is necessary.

The Timberman, February, 1911.

SILVICULTURE, PROTECTION, AND EXTENSION.

Influencing Root System of Spruce.

Dr. Matthes furnishes a very interesting and important contribution to our knowledge of symbiotic processes which may be utilized in silviculture. It has reference to the possibility of influencing the root system and therewith the growth energy of spruce on poor soils. Such influences should be to increase the number of roots without too much root competition, an increase of "anchor" roots which penetrate more deeply into fertile soil, nourish the tree better and make it windfirm, thereby avoid tearing of roots and the consequent root rot. A series of experiments lasting through 10 years are at the basis of his conclusions.

A 12-year-old plantation of 4-year-old spruce transplants set out on a heath in plats had hardly grown at all, making hardly 16-inch height, one-half inch diameter at base, and three or four primary roots of 8 to 40-inch length with little branching. A part of the plantation was after 4 years from planting fertilized with ammonia-superphosphate, and the fertilizing continued for six years. The plants grew to over 3 feet in height and 2-inch diameter with a much larger root system. This fertilizing was, however, expensive, $2 per acre per year, or for the six years $12.00.

In another series the influence of green manuring and of mixing in Black Locust and Alder was tested.

The following observation was suggestive: An 18-year-old Spruce of 5-inch diameter and 12 feet height was surrounded by 8 alder stocks; which altogether having still live sprouts had a number of dead roots. Four roots of the spruce had reached one of these dead roots. These roots were unusually stout, 1 to 2 inches in diameter and 32 inches to 8 feet long, while 8 other primary roots which had not reached the alder stocks were less than 1 inch and quite long, 4 to 10 feet. The former had bored into the rotten alder roots and formed an immense number of fibrils. There were also three "anchor" roots formed which, with a diameter of nearly 2 inches, sunk to a depth of 8 to 14 inches.

In the experiment proposed and started, the author planted about 2,000 spruce to the acre; after 10 to 15 years he takes out 1,200 as Christmas trees which he can sell at a net return of

about $100. In their place he sets 2 to 3-year-old alder cuttings, which after having performed the service of increasing the root system of the spruce may be cut out in 15 years. In such a plantation after six years the result was astounding. While the portions left without alder showed up miserably (yellow color, low, hardly larger than when planted 8 years before), the plants among the alders showed a black green color, a height of 4½ feet, a diameter of nearly 2 inches, a crown diameter of 2½ feet, with stout, 3 to 5-foot long, fibrous root system among the alder roots. The whole surface of the soil was permeated with very fine alder roots bearing nodules many of which dead and in connection with fibrils of the spruce—showing that the influence is directly traceable to this feature of the combination. Especially on abandoned fields it has been observed that height growth soon ceases, caused by the early competition of the too little extended, although much-branched root system, as an investigation seemed to show.

Green manuring with lupine on farmland proved of excellent influence on the root system, as several experiments showed. A 2-year-old plantation in four foot spacing had strips of 12-inch width sowed with lupine. While the 6-year-old untreated plantation was about 3 feet high with 1¼-inch diameter, the part planted with lupine showed 7 to 8 feet in height and over 2-inch diameters; the roots in the soil not covered with lupine exhibiting few, within the lupine area thousands of fibrils. Occasionally roots would lengthen beyond the lupine strips and then show the same scarcity of fibrils. Unquestionably the nitrogen of the tubercles of dead lupine roots becomes available to the spruce. Very characteristic for the root system within the lupine area is the deep "anchor" rooting, which even after 6 years went down 16 inches, otherwise absent; when the tap roots of the lupine, now descending to 27 inches, shall have died, *i. e.*, when the stand closes up, the root system of the spruce is expected to deepen correspondingly. Characteristic also is the absence of side root development, which does not exceed 30 to 50 inches, so that little root competition is experienced.

A similar experiment made on raw humus or heath soil proved the same beneficial influence of the lupine.

In this experiment the cost of $12 per acre is also too high, but it is obvious that it can be much reduced by different procedure.

One way was to sow the lupine pods without soil preparation

on the farm soil at a cost of $2 per acre, with very satisfactory result. Even in the heather this simple, rough method promises to work.

All these experiments were made on waste lands. On forest soil, after clearing, the humus accumulations seem inimical to the success of the lupine, but it is perfect after burning over the clearing or removing surface cover otherwise.

Finally an account is given of the remarkable influence of Black Locust on the root and growth development of spruce. The influence is similar to the lupine, the spruce roots seeking and following the locust roots into the depth and forming whole nests of fibrils alongside on their bark.

An entirely different root development was observed in a 6-year plantation in clover, *i. e.*, of esparsette, luzerne, etc., in mixture. after oats. The development of the 3-year-old transplants was very good, a height of nearly 3 feet, a diameter of nearly 2 inches at base and a crown diameter of 2½ feet. The root system, however, was short (15-30 inches) with stout roots (¾-inch) going down to 12 to 14 inches, the depth being rather unusual, removing the root competition.

The author then refers to the relation of root development to disease and insect damage especially June beetle, to which old farm (waste) lands are so often exposed and against which the deep rooting is the best preventive.

In conclusion the author expresses his opinion that the alder combination is best and cheapest, with 2-year-old, once transplanted (6 to 8 inches in the row) stock, planted 6 feet by 4 feet; after 2 or 3 years spruce is planted, leaving the alder as nurses.

Mitteilungen über Bau und Leben der Fichtewurzeln und Untersuchung über die Beeinflussung des Wurzelwachstums durch wirtschaftliche Einwirkungen. Allgemeine Forst- u. Jagdzeitung. January, 1911.

Planting on Intractable Soils.

Hoffman relates experiences in planting wet clay soils of the Keuper formation, made still more intractable by Carex and Equisetum. Expense and lack of labor led to the substitution of a special plow for hand labor, with great success for the last three years.

None of the usual forest plows were found strong enough, bu

a steel road plow intended for opening streets answered the purpose. This plow, specially described, capable of cutting through 3-inch roots and throwing out 16-inch rocks, makes a balk of 10-inch width, as deep as desired to 16 inches, and worked even on 30° slopes with four oxen or two horses.

With the ox team, including the driver, at $4 per day, and the man at the plow at 62 cents, nearly one day was required to throw up the thirty furrows 4 feet apart on one acre, say $3.60 per acre (which for us would have to be doubled). The planting was done in the following spring on the disintegrated soil easily with cheap labor with 3-year-old spruce at the rate of about 3,000 to the acre on the balks formed by the sod from the plow furrows at a cost of less that $3 per M, so that the total cost of the plantation per M came to a little over $4, or between $12 and $13 per acre, 28% less than formerly.

In 2 to 3 years the depression between the balks vanishes.

The most important result, however, the writer finds in the superior growth of the plants so that in two years they had outgrown the 5-year-old ones set out without the plow furrows, not to mention their more vigorous looks, growing like transplants in the nursery, shoots in the second year of 12 to 16 inches being no rarity.

Fail places were found of hardly 1% as against 10% in former plantings.

The author then enlarges at great length on the changes in the soil which result from fall plowing.

Die Behandlung feuchter Lettenböden im Walde. Forstwissenschaftliches Centralblatt, February, 1911. Pp. 91-100.

Machine Sowing.

It is curious reading to us that scarcity of labor in Germany is forcing the employment of machines in silviculture operations.

Forstmeister v. Schmittburg working in Hesse found it impossible to secure the necessary labor for planting, not to speak of the high price demanded. He found himself forced to substitute machinery, partly self-invented, and devise a process which would work cheaply and efficiently.

Planting hitherto had not cost less than $50 per acre!

He had to return to sowing for the hitherto practiced planting of yearling pines, using specially constructed machines and fer-

tilizer. Two forest plows, manufactured by Eckert, but with a disk coulter added—which proved an absolute necessity—are used, one to peel off the surface cover, the other, a subsoil plow, to loosen the soil in strips or furrows.

A one-horse harrow, consisting of an iron frame with teeth bent backward (to avoid hanging on roots), and a guiding handle, found necessary in order to keep the harrow properly at work, smoothes the soil in the 16-inch furrow; a specially constructed sowing machine (to be had for $80 from A. I. Tröster-Butzbach) follows immediately, sowing seed as well as fertilizer in three rills (preferable to broadcast) and covering it at the same time.

The special features of the sowing machine are that it runs on wheels, with an extension axle, the one in the furrow to be sowed, the other in the adjoining furrow; it has in front of each seed tube a double disk coulter which not only prevents hanging but brings the seed into the soil. Of course, seed quantities and depth can be gauged. Behind each seed tube follows an independent roller, a single broad roller proving less efficient. The fertilizer, which is to assist in a good start for the little seedlings, must be carefully gauged and may consist of various combinations. The author promises a further discussion on this phase, but states now that Guano or Thomas slag, or potash-ammonia-superphosphate, may be used. Thomas slag, 6 lbs. per acre, has proved very satisfactory.

While hand sowing would have cost $4 to $4.50 per acre, the machine does it for $1 to $2. While, to allow for losses, about 10 lbs. of seed had formerly been used, 5 to 6 lbs. are sufficient for machine sowing, a considerable saving. The machine being good for 20 years and requiring occasional repairs there are still $3.50 per acre saved by machine work. With acorns the saving has been even $5 and $6. One horse and one man, when accustomed to the work, can harrow, sow and fertilize $3\frac{1}{2}$ to $3\frac{1}{4}$ acres per day.

Weeding between the furrows on the balk is also done by machine, a specially designed small plow, in the fall and spring, not between these times. This cultivation, not done until the second and third year, helps the plants greatly.

Weeding in the rows is, however, troublesome, as it must be done by hand, if necessary.

In the conditions where these methods are employed, this weeding cost $1.50 per acre per year, the plow weeding $2.

Altogether it appears that a plantation of this kind with all the repair planting, etc., that may be needed, can be accomplished for not to exceed $32, a saving of $18.

Die Kiefernkultur auf maschinellem Wege, etc. Allgemeine Forst- u. Jagdzeitung. February, March, 1911. Pp. 58-63; 77-84.

Douglas Fir in Germany.

Walther points out the difficulty of securing seeds from definite localities and hence the very variable appearance and behavior, especially later or earlier budding, of Douglas Fir, which can be specially noticed in nursery beds. The original importations which began in 1827 were undoubtedly of the green variety from Oregon and Washington with horizontal to pendulous branch habit and rapid growth. The gray to blue variety of slower growth from the Rockies came in after the eighties.

For favorable localities, like Hesse, the green variety is adapted according to 30 years' experience; for frost situations only the blue or gray variety suits.

This was specially observed in October, 1908, after a wet, cool summer, with extraordinarily small rainfall in October, followed by early frosts. In the midst of groups of the Douglas Fir single plants, even well protected ones, froze back for one to three annual shoots, especially on east exposures, the explanation being that these were of the coast variety. The older, 20-40-year trees, and protected ones did not suffer, even in exposed situations and even though they were of the green variety. This is explained by the probably more northern derivation of the plant material. Especially on dry soils is frost danger frequent.

The variety *caesia* (the name given to the gray-green variety) seems to combine the rapid growth of the green and the frost resistance of the blue variety. The Douglas Fir seems to resemble the German Fir as regards its gratefulness for shade when young, the light shade of Scotch Pine being especially favorable. Several illustrations accompany the article, showing excellent stands of this Fir.

Die Douglasie im Winter 1908-9. Allgemeine Forst- u. Jagdzeitung. January, 1911. Pp. 11-13.

Resistance of Douglas Fir to Insects.

An observation is reported in the German Dendrological Society of the resistance to attack of the Nun (*Lymantria monacha*, L.) by the Douglas Fir. Almost wholly denuded shoots bud out in most cases and only few entirely denuded individuals have succumbed. Even two and three-year-old plants did not suffer much from the ravages of the insect. In view of the large quantity of foliage which the Douglas Fir produces, in order to destroy extensive Douglas Fir plantations, the plague would have to develop in much greater numbers, than the worst known.

Sitka Spruce, Tsuga mertensiana and *canadensis, Pinus strobus* and *koraensis* have been entirely free from attacks, accentuating the value of the introduction of exotics.

Fortswissenschaftliches Centralblatt. January, 1911. P. 61.

Homegrown or Nursery Stock?

Small forest owners can most profitably purchase such plants as their planting operations require and purchase is best made from some reliable firm making a business of growing forest trees for sale. The management of a nursery is too exacting an undertaking for one whose demands for plants are not large and permanent enough to call for the employment of a skilled gardener. In some cases the larger users of plant material produce a surplus over and above their own needs and offer this for sale. This class of material frequently consists of the poorest stock, the owner keeping the better for his own use. There have been many objections raised against the purchase of plants from nurserymen, some of which are entirely unfounded and the rest valid against none but a few untrustworthy producers of which it is strikingly true that the evil they do lives after them.

Plants produced by reliable nurserymen are grown under the best possible conditions to develope into vigorous individuals, are sorted, packed and shipped with elaborate precautions against damage and reach the small planter in better condition and cheaper than he himself can grow them.

Zur Beschaffung von Waldpflanzen für den kleinen Grundbesitz. Silva. January 6 and 13, 1911. Pp. 1-2; 9-10.

Preventing Fraud in Seeds.

Swedish foresters attribute the numerous failures of stands planted in the sixties and seventies of the last century to the use of imported seed produced in a milder climate. Measures to restrict the importation of forest seeds were inaugurated in 1888 when a small duty was imposed. Ten years later the duty was made much heavier. Now the demand for seeds was very strong, and unscrupulous dealers found it profitable to import seeds and sell them as the native product. This deception has been effectually prevented, so far as coniferous seeds are concerned, by dyeing a portion of the seeds in each package as it passes through the custom house. The dye used is an alcoholic solution of eosin.

Schotte, Gunnar: Uber die Färbung des Forstsamens zur Unterscheidung ausländischer Ware. Silva. February 3, 1911. Pp. 33-34.

Seed Supply Question.

The question of the importance of the seed supply was also one which occupied the German Forstwirtschaftsrat at its session last fall. A resolution being the result, which curiously is designed to restrict the use of pine seed exclusively to that of German origin. Dr. Fürst in answer to strictures by Sievers explains that while seeds from some other localities outside of Germany would be just as good as German seed, the danger of importation through these of undesirable seed, as from South France and Hungary, led to the adoption of this resolution.

Die Behandlung der Kiefernprovenienzfrage in Deutschland. Forstwissenschaftliches Centralblatt. March, 1911. Pp. 148-152.

Spruce vs. Broadleaf Forest.

At the time when early in the last century the demand for fuel wood fell on the introduction of coal in the industries, the study of the natural history of forests had not been developed to the same extent as mathematical theories of forest management. The consideration of financial returns indicated a change from beech to spruce forests and such change was made, the spruce being managed in pure stands and under a system of clear cutting with artificial reproduction. The accepted theories justified such a

course and the facts at hand were interpreted as favorable. Practical experience in handling such stands on poor, shallow soils has shown that they do not behave as simply as anticipated and silvical studies have revealed some reasons for such behavior.

Spruce stands have proven to be windfirm only on exceptional soils and are always particularly susceptible to snowbreak. Root rot attacks many trees and at times all the trees on a large area are more or less rotten at the stump. The nun is by far the most serious enemy attacking spruce stands. Losses from this moth have been enormous and the most recent attacks (in 1909) have been only a little less disastrous than those of fifty years ago. But the most serious indictments against spruce stands is that they do not conserve and improve the soil but, by permitting the formation of a dense, dry duff, prevent water and air from reaching the soil so that it dries out and is compacted. The weathering of the rocks stops and the soil does not become richer in plant food as it should.

This undesirable soil condition has been remedied by hoeing up the duff every eight or ten years and by digging trenches to admit water and air to the mineral soil. A better course is to prevent the formation of duff by mixing beech in the spruce stands. Beech roots deeper and makes the stand windfirm, while its roots do not compete with those of the spruce; it carries more rain water into the soil and carries it deeper. Its chief function, however, is to furnish a coarser straw to the litter on the ground and, by holding it open to the percolation of rain water, to prevent the formation of duff. The mixture of the species in the stand must be designed to affect this end.

After studying the opinions held and the practices recommended by other authors, viz: Gayer, Weinkauff, Wagner, Salle and some Bavarian working plans, a method of procedure is formulated which for mature beech stands that can be naturally regenerated is as follows:

Fir is planted under the mature stand in favorable spots, four-year transplants being used. With the first seed year the litter is worked up and the ground put in condition to insure proper setting of the new stand. The parent stand is lightly thinned in the following winter. Thinnings are made at intervals during the next fifteen years until the whole mature stand is removed and a young growth of beech with a mixture of fir covers the ground.

The spruce is now introduced using transplants and setting four feet apart. The beech must have a start by some fifteen years in order that some individuals may persist until maturity. In planting the spruce, groups of beech are left to grow up free from competition with the spruce. The location of these groups will be somewhat irregular since they will be selected to include the most promising parts of the young beech stand. Their size will vary from two to twenty-five square rods with an interval between of four to six rods.

Polewood forests of beech can best be changed to the spruce-beech mixture by waiting until they are capable of natural regeneration. When oak occurs in mixture with beech it is removed in the first thinning of the mature stand. In pure stands of oak which are to be changed to spruce-beech mixture beech mast or beech seedlings must be supplied.

Hoffman, E. E. Erscheint es rätlich...schlechte Laubholzbestände auf flachgründigen...Böden in reine Fichtenbestände umzuwandeln? Silva. Dec., 1911. Pp. 391-2; 399-400; 407-409.

Forestry Combined with Farming.

The rich iron ores of the Westphalian mountains, lying in a wooded country from which the charcoal for their reduction was readily drawn, were responsible for the early industrial development of the region. The population was soon greater than the agricultural lands could furnish with bread and so it came about that between each rotation of sixteen to eighteen years in the coppice stands the land was planted tc rye. The demand for charcoal has now greatly fallen off (F. Q. Vol. IX, p. 141), and the population too has decreased. But it is still large enough to tax the fertility of the sterile soil under the unpropitious climate so that coppice management still persists, not because justified in itself—which it is not—but because the short rotation permits the use of the land for grain every sixteen to eighteen years. The effect of this is to increase the area of agricultural land by 12½%.

The coppice, excepting the oak, is cut in winter. In May and June when the cambium is active the bark is loosed from the oak and left hanging, attached by the upper end. When dry the bark is gathered, tied in bundles and carried to market. The standing wood is then removed before the first of August. The soil is then

broken, frequently with hoes because too steep for plowing and the litter raked into windrows and burned. The grain is put in with hoes or with a light plow which may be drawn by women and children. The harvest is usually cut with a sickle. These areas are parcelled out to their individual owners at cutting time in a way that is curiously primitive. The sub-divisions may be carried so far that one man's share is but a few square feet.

Attempts to induce these communal owners to the change to coniferous high forests meets the stubborn oposition always met in changing long established customs, here doubly effective because of the poverty of the owners. Purchase by the State seems the best solution and a start in this direction has been made.

Die Landwirtschaftlichen Zwischennutzungen der Haubergswirtschaft. Silva. November, 11 & 18, 1910. Pp. 351-52; 359-60.

Silvicultural Experiments.

Forstmeister Tiemann advocates inexpensive experiments which every forester may profitably make without much extra expense. He suggests a long list of such experiments, of which we cite a few.

1. Comparative trials with untransplanted root-pruned and with transplanted spruce on various sites; also transplanting with ball to see whether the extra cost pays. Also see, whether thinning out seed rills produces plant material which could be utilized a year earlier, than if left undisturbed .

2. Trial with different planting tools under different conditions as to rapidity and efficiency.

[Such trials were lately made by the students from Toronto University on a loose sand soil with more or less compact sod. A 7lb., 6 inch, common hoe was found the best universal planting tool in such ground both for rapidity and efficiency and for shallow planting (spruce), as well as for deep planting (pine), and for setting into deep holes in loose dry soil.]

3. Manteuffels top planting and planting on sod with or without balls of earth, in comparison with above.

4. Comparison in handling plants from water pails and from baskets with fresh soil; also water-soaked plants, soaked for various time periods, to see whether they do not withstand drouth better.

5. In sod, is it desirable to replace the sod, turned, around the plant to prevent evaporation or does the sod prevent penetration of rain water.

6. On poor soil influence of various fertilizers may be studied.
7. Time of planting, fall or spring, late or early, may be tested.
8. Comparative trials with seeds of different derivation.
9. Seeds from trees with spiral growth or other malformations and seed of different weight.

Über die wünschenswerte selbständige Anstellung kleiner waldbaulicher Versuche, etc. Allgemeine Forst- u. Jagdzeitung. March, 1911. Pp. 86-93.

MENSURATION, FINANCE, AND MANAGEMENT.

A Cubic Log Measuring Rule.

A commission was appointed by the Governor of Maine to recommend a standard cubic foot rule for measuring logs. Its report advises the use of a rule based on the length of the log to the nearest foot and the diameter at the center outside of bark. The total volume is read directly from the beam of a caliper graduated to show the cubic feet for various log lengths of different diameters. The amount of defect is left to the judgment of the scaler. For deduction of volume of bark, a general table is recommended, which is based on diameter at center of log and gives discount in per cent. This table was prepared from measurements of many trees of different kinds in different parts of the state, and is to be applied alike to spruce, pine, fir, hemlock, cedar and hardwoods.

Per Cent. of Volume of Bark to Volume of Log.

Diam. at center Inches.	*Per cent. of Bark.*	*Diameter at center Inches.*	*Per cent. of Bark.*
6	14.8	16	11.4
7	14.1	17	11.3
8	13.5	18	11.2
9	13.0	19	11.1
10	12.6	20	11.0
11	12.3	21	10.9
12	12.1	22	10.8
13	11.9	23	10.8
14	11.7	24	10.7
15	11.5		

American Lumberman. March 11, 1911.

Mathematics of Tree Growth.

Ever since Weber's efforts to express the experience figures of yield tables in mathematical formulae, this subject has from time to time been investigated, the object being eventually to reduce the work on yield tables.

Dr. Wimmenauer proved that the progress of height growth, as well as of acre-production, as a function of age x can be expressed in the general formula $y=ax^3+bx^2+cx=f(x)$.

By introducing three empirically determined heights with their corresponding ages the constants a, b, c, can then be calculated. Comparing this theoretical height curve with empirically determined ones, while culmination of both current and average increment in the former coincided approximately well with the latter, other discrepancies made the usefulness of the formula still doubtful.

Glaser attempts the solution of the constants by the method of least squares, which is based on determining the unknown constants in such a manner that the sum of the squares of the differences between calculated and empirically determined values be a minimum. He comes to a closer approximation to the empiric curve, the theoretical heights up to about the 40 year being somewhat larger, from 40 to 80 years somewhat smaller than the empiric ones.

In a second article, Glaser applied this formula of third degree to a number of empiric curves and found that the same relation as above prevailed, but with decreasing site quality the differences became less; also that Wimmenauer's procedure was sufficiently accurate to substitute for the more circumstantial method of least squares. Yet, altogether the results are not accurate enough to be used for yield table construction, hence the author investigated first whether any equation of the third degree could express, and finally whether an equation of the fourth degree would more closely approximate the actual growth conditions.

The first inquiry gave negative results.

A closer practically sufficient approximation up to about the 150 year was secured by the use of a fourth degree equation, but the practical use of the formula on account of the necessary extended calculations is doubtful.

It remains questionable whether by any analytical method it would be possible accurately to describe the progress of growth.

Zur mathematischen Interpretation der Zuwachskurven. Allgemeine Forst- u. Jagdzeitung. January, February, 1911. Pp. 6-11; 48-59.

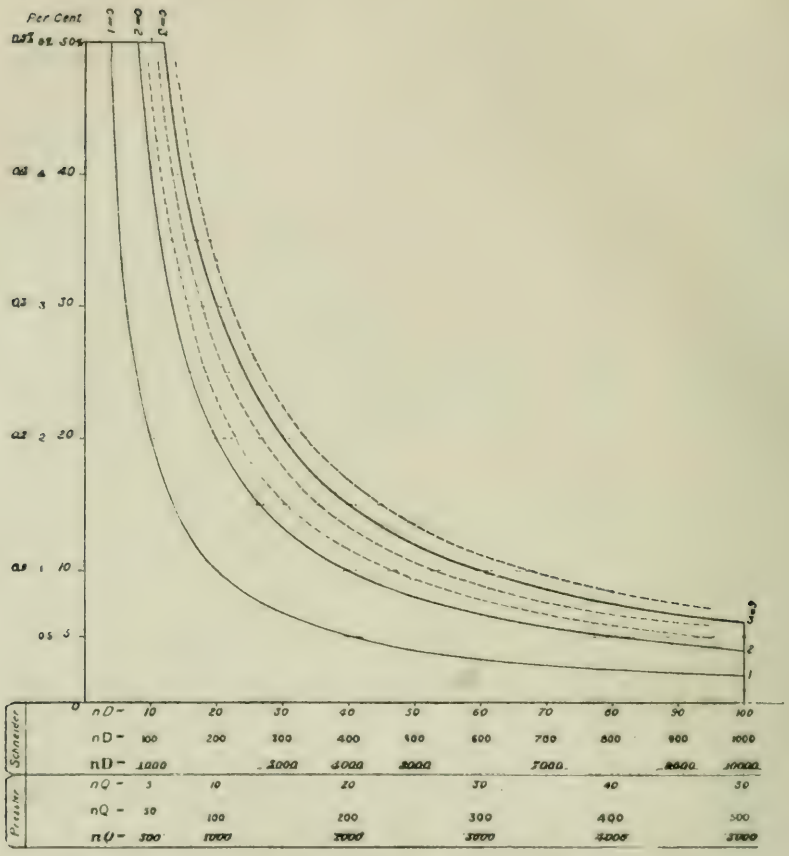
Increment per cent. Table.

The following curves constructed by Künkele offer a convenient means for reading off the rate of growth in diameter, area or volume, according to either Schneider's or Pressler's formula. Schneider's increment per cent. formula is $p=\frac{200c}{nD}$, in which n, represents the number of rings per inch or other unit; D, the diameter; and c, a coefficient which for diameter increment is $=1$, for area increment $=2$; for volume increment varies from 2 to 3 1/3, namely as follows:

when *crown*		*height growth* finished	moderate	vigorous
deep, to $\frac{h}{2}$,	$c=2\frac{1}{2}$	2 2/3		3
high, $\frac{h}{3}$,	$c=2\ 2/3$	3		3 1/3

The ordinates give the increment per cent. with these various values of c, the abscissae are based on the values of nD. According to their value they are read from the different style of numbers. Hence, only nD needs to be ascertained and the increment per cent. may be immediately read off.

The same curves correspond to Pressler's formula, $p=\frac{100c}{nq}$, in which n represents any number of rings, and q is the relation $\frac{D}{D-d}$, D being the present diameter without bark, and d the earlier diameter n years before.



This is a convenient substitution for Pressler's table of numbers, and as accurate as the formulae themselves.

Hilfstafel zur Zuwachserhebung. Forstwissenschaftliches Centralblatt. April, 1911. Pp. 200-1.

Value of Selection Forest.

An extensive study of the selection forest by Wernick brings much of interest, new and old. In the first section the question is raised whether improvement in the results of private forest management can, as Mayr claims, be secured by the use of the selection system. It appears that the private forests, not in entail, which

represent 36% of the total German forest area, produce almost half the yield per acre of the State forests. The yield per acre in timberwood of the different classes of forest property was in 1900 as follows:

Crown forests	33.7%	47 cubic feet
State forests		49 " "
Private forest, entailed	(10.4%)	43 " "
Other private forest	(36.1%)	28 " "

Of the private forest (and communal) in Prussia 87%, in Bavaria 91%, in Saxony 93% is in woodlots of less than 25 acres, a size which does not lend itself readily to management. Hence the endeavor has been to associate the small holders, but this movement has found indifferent success.

The second section brings judgments of authorities on the selection forest in general, which is mainly unfavorable.

Even Gayer comes to the conclusion "that it does not satisfy modern requirements." Judeich calls the enthusiasm created by Gayer in natural regeneration a fashion and a fancy to be inveighed against. "In general the sober practice will not be misled by the romance of the selection forest."

Wagner in his late work, although admitting the naturalness of this forest, calls it, considered from the economic point of view, "a phantom, a purely silvicultural ideal, which few may not and do not want to realize." Mayr says: "It has in full measure the advantages of the virgin forest but renounces entirely the advantages in volume and quality of the stand and area management."

Altogether while recognizing its silvicultural advantages, it is not considered commendable as an economic proposition.

As regards the yield, the author cites some dozen definite cases from Fankhauser's articles (briefed in F. Q. Vol. VI, p. 423) which showed yields of from 118 to 246 cubic feet.

The next section describes a dozen different methods of budget regulation in selection forest which is recognized as one of the most difficult problems. There are Heyer's, Karl's and Hundeshagen's normal stock formulae and a number of others, all of which are built upon theories applicable to a compartment system. The author singles out four as preferable, namely those of Gretsch, Tichy and Stötzer, who ascertain actual growth condi-

tions, the latter by groups or in circle method, noting at same time the exploitable trees, ascertaining actual increment and also attempting comparison with normal groups, and a French method which he considers the most serviceable and describes in detail.

This method, *méthode du contrôle,* was invented by Gurnard and worked out by Biolley, a Swiss forester, at Couvet, Canton Neuenburg, on about 6,000 acres of communal and in part on 15,000 acres of private forest, mostly fir and spruce. In the communal forest of Couvet, the introduction of a real cultural selection forest dates only from 1890, hence it is not yet all in proper condition.

Before describing the method the author brings a lengthy panegyric of the properly conducted selection forest as exhibited or aimed at in Couvet and explains the divergence of opinions by pointing out that such a great variety of conditions may exist in the selection forest. He brings a table comparing production in compartment timber forest and in the Couvet stands, which would make it appear that the increment is larger in the selection forest and the use per cent. with 3.5 against 3.3 not less.

According to Gurnaud's method the forest is to be divided into compartments, a thing which for selection forest is supposed not to be necessary; only in this way can good statistical data for the control be secured. The compartments are made with reference to site and stand difference of not more than 25 acres extent, and the areas carefully computed.

Dimension and not age is used for classification, and rotation is not a term applicable, since age and dimension do not go parallel here. An inventory is, however, necessary, and a repeated stock taking at that, besides an accurate accounting of felled material, and the stock taking is done over the whole forest in the same year. All trees of over 7 inches diameter are calipered in 2 inch classes, the place of measurement being marked so that they may be measured in the same place again. This is the *matérial principal,* the smaller growth or *matériel accesoir* being left out of consideration or being added with 10 per cent. of the principal volume. The diameter classes are grouped into three size classes—small, middle, and stout.

The volumes are computed from special volume tables which take into account the great variation in taper and give the approximate contents. This designated *sv* is different from the

volumes determined for felled trees to be sold (*fm*). The participation of the three size classes in the total volume is figured percentically. The volume of the average tree is calculated. A description of the character of the stand helps to bring out a picture of the same.

The increment is determined by comparing two inventories taken at different times, keeping count also of the material cut and removed, and also of the addition of trees to the lowest size class (*passage à la futaie*). The increment is figured separately for each size class and from the same volume table (*sv*) in order to make it comparable to the stock volume. We may find, e. g. first inventory (*v*) stout trees: 85 trees with 317 *sv*; second inventory after 5 years (*v*2), 115 trees with 452 *sv*; removal (*n*), 8 trees with 30 *sv*; *total* (*v*2+*n*), 123 trees with volume 482 *vs*; *the trees* of *v*1 increased in *v*2+*n* to 85 trees with 368 *sv*; 38 trees were added with 113 *sv*, increment for the 5 years 51 for the whole compartment, 13.8 per acre; annual increment 2.8; increment per cent. 3.23.

The same calculation is to be made for each size class.

The inventory shows to the judgment of the manager the size class in which the fellings are desirable, but the cut is made with reference to growth conditions, the vigorously growing trees are favored, the poor and those that suppress good growth are removed. Silvicultural considerations prevail, the whole area to be cut through evenly. Every 5 to 10 years return to the same compartment; especially when the stand is too uniform, work for differentation of sizes by initiating early regeneration and favoring the vigorously growing stock. In old uniform stands, where no pains will produce a proper selection stand, clear and plant. All material felled is, of course, carefully booked, measured by the same volume tables which are used for the inventory. At same time the logs, etc., are also actually measured and this measure booked in the "felling control book," and these measurements are used as a correcting factor of the *sv*.

The inventory, felling control and increment calculations for each compartment are placed in a periodic table, whereby a view of the forest conditions, a comparison of the production is facilitated and a statistical material is compactly brought together as in no other method, from which the felling budget is to be determined.

Now to determine the felling budget by which the forest is to be brought to normal condition of which we know nothing positive —the normal idea of the regular timber forest is of no avail—it is necessary to assume that with a certain amount and certain size class proportion the ideal condition is attained. This conception may be derived from portions of the stand which appear to the judgment of the regulator as normal. The authors assumed 5,000 to 5,700 feet as normal volume and a composition of 20% small, 30% middle and 50% stout trees, the aim being to keep as much as possible stout material on which to deposit increment. This is only an assumption, but by the control gardually it will be modified to correspond to the actual increment per cent. The method requires much judgment and calculation.

An example of the procedure in a concrete case further elucidates the method.

The author's conclusion then, as to the value and application of the selection forest for the improvement of farmer's woodlots is, that while it would be dangerous to be dogmatic, a possibility in that direction exists. The wind firmness secured, especially for such small isolated lots recommends it, as well as the independence of each parcel in its management, hence no need of the associated effort. In this sense the Bavarian instruction also expresses itself.

Plenterwald. Allgemeine Forst- u. Jagdzeitung. July, Aug., Sept., Oct., 1911. Pp. 229-235; 269-273; 313-321; 353;360.

Higher vs. Lower Rotations.

In antagonism to the tendency to reduce rotations and to form forest reserve funds, from which to eke out eventual deficiencies in the year's budget, as has been done lately in Wurttemberg, Oberforstrat Frey makes interesting arguments and calculations, using concrete figures.

According to Schwappachs money yield tables a management class of pine on site 1 in 70 year rotation, that is to say a property of 7 hectar, one hectar each of 10, 20, 30 to 70 years of age, would have a stock value of 2748 mark per hectar (around $264 per acre) and furnish an annual return of 621 mark of 88.8 per hectar (say $855 per acre). If the same 7 hectar were stocked with stands corresponding to double the rotation, that is to say one-half acre

each of 10, 20, 30 to 140 years of age the stock value would be 49418 Mark (say $680 per acre) and furnish 107.6 Mark annually per hectar (say $10.35 per acre). This is to say, the higher rotation produces about $1.80 more per acre.

Now the question is whether it is more profitable if the stock corresponding to 140 year rotation worth $680 and bringing in $10.35 per acre is in existence to reduce it to that of the 70 year rotation worth $264 and bringing in $8.55 per acre, when the difference of $416 may bring a better interest rate, namely $12 to $16 in addition to the $8.55, say $24.

The author points out that in this calculation the sure increase in wood value of the older stands is overlooked. For the 10- to 70-year-old stands such an increase is hardly to be expected, but experience has shown that the 80 to 140 year old stands may even in the next 20 years double and treble in wood value, so that although the capital value may thereby become $2,000 per acre, the income would be $30, or more than in the other way can be obtained.

The idea of forest reserve funds, the author says, has become fashionable and is considered modern, and he considers its application undesirable from a national point of view.

Jährliche Erzeugung wertvollsten Holzzuwachses auf kleinster Fläche. Forstwissenschaftliches Centralblatt. February, 1911. Pp. 71-78.

Working Plans in Bavaria.

After nearly one hundred years of adhering to the budget regulation for the Bavarian Forest Department, which was based upon the instruction of 1819, new working plans are to be formulated with considerable changes. In an extended article Dr. Vansekow gives a historic statement of the developments and a description of the present proposed procedure. The "normativ" of 1819 followed closely the teachings of Hartig in the volume allotment method with the stand as the unit. The instructions for ascertaining stock and increment on which the method is based, should with little modification even to-day be found most satisfactory.

As regards the rotation, the old instruction requires that it be "based upon careful investigations of the age at which the highest volume and money yield or else the required dimensions of those sortiments can be secured which are most desired, or else at which

the most vigorous reproduction may be secured." For a more complete assurance of a sustained yield the rotation was as a rule to be increased for a few years longer, and for each section of different growth condition a special felling age was to be determined, that is to say besides the general rotation for the entire range, special rotations for different parts were ascertained. The rotation was then divided into periods, three of four, or with long rotations five, and the stands ranged into periodic or yield class tables. "In this project the considerations of the most advantageous use of the forests are carefully weighed against the most rapid re-establishment of their spoiled condition and of the interests of the future with those of the present,"—the actual felling age being varied from the average rotation according to these considerations. At the same time in the ranging of the felling areas a proper location of age classes was also to be provided, as well as equality of budgets within certain limits.

A special working plan then was made for the first decade when the yearly material and money budget could be determined. Thinnings or "secondary fellings" were curiously enough to reduce the prescribed main fellings by so much.

Recognizing the difficulty of controling the sustained yield by volume alone a first attempt of bringing the area into use as regulator by prescribing that "all main fellings were not to be marked out by volume but by area corresponding to the determined volume."

Altogether this early regulation was in many directions sound and serviceable. It lacked, however, proper prescription for the detail of execution. These were furnished by later ordinances, which are set forth in the article, but which have no special interest for us. We will, therefore, confine ourselves to a statement of the new instruction which was issued in June, 1910, just exactly 80 years after the first order for regulating the Bavarian State forests.

This is radically different in principles of management, in method of yield regulation and in the technique, as well as in its form.

A strict adherence to the *sustained yield principle* within each unit of management, which formerly had been required as main aim of forest regulation, is abandoned, although an equalization of budgets of the whole Kingdom or certain aggregates of districts

might be attempted. The economic utilization of stands at the proper moment overrules the narrow sustained yield principle. A broader view is to prevail.

Since only rarely normal forest is in question, the yearly felling areas are to be so adjusted as to avoid overmature stands to be left or unripe ones to be cut.

The sustained yield principle of volume and value production is to find expression in regeneration at proper time and in more intensive care for increment by thinnings.

The aim to secure a normal forest condition by proper distribution of age classes is to be fostered only as far as it can be done without great economic sacrifices. The maturity of the stand carefully ascertained is to decide primarily whether it is to be cut or not. The budget allotment for the future if age classes are very abnormal, is to give merely an approximate idea of the progress of felling without being binding for the future. Graphic methods of giving insight into the actual status and changes are to be used.

Freedom is left to determine even the annual budgets from year on the basis but independently of the periodic felling plan, leaving it in the discretion of the administration to anticipate or delay fellings according to market conditions.

The economic principle finds clearest expression in the motives by which the *rotation* and the maturity of the single stand are determined.

While formerly the maximum volume production alone was the basis of the rotation, now, without giving up the desire to produce most desired wood quality, the maximum forest rent with reasonable interest on the invested capital, soil and stock, is to be also in part determining, as far as other interests or protective functions do not interfere.

Extensive investigations into growth relations and value production of younger as well as old stands are to be the basis, and various rotations are to be figured and chosen from.

The time of the minimum forest rent is to be the upper limit of the rotation while saleability of the produced grades or sizes is the lowest limit; an investigation into the production of various assortments or sizes at different ages must therefore precede. The progress of the quality increment is another criterion, making a difference between such species as spruce and fir where the

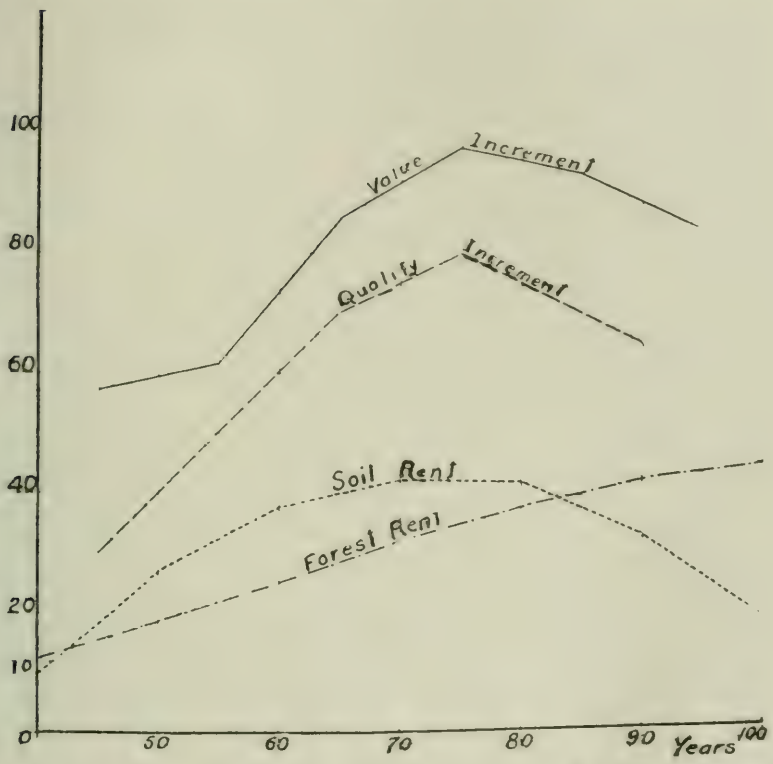
value increment from the most desired to stouter sizes suddenly falls off and those which like pine, oak, etc., continue into old age to appreciate. If then the rotation based on the most desired size for any reason does not satisfy, the relation of value increment to cost of production ascertained by use of the index per cent. may serve. If the interest rate secured in sinking gradually, the preference is to be given to the forest rent because for State forest the larger income within limits is preferable to the higher interest rate. When, however, an increase in the net forest rent can be secured only with a considerable reduction in interest rate, and an increase in volume and value production cannot be secured by managerial measures (thinnings) then the lengthening of the rotation would not be desirable. Besides these calculatory bases, other considerations are to aid in determining the rotation, such as influence of the length of rotation on soil conditions, capacity for natural regeneration, winddanger, decrease of health with growing age, influence of intensive thinning practice, and other managerial considerations.

The financial question—the fundamental requirement of the soil rent theory—as to the interest rate on the production capital enters then only in the third place, and only when the other two considerations, size and value production, do not suffice. But, after all, the rotation of the highest soil rent cannot vary very much from that rotation which produces in the shortest time the largest quantity of the most desired sizes and hence best paid material; the value increment forms the best index for the financial felling age. The author reproduces the following curves to show in what relation these rotations may stand, the curves are derived from a definite spruce stand on site II in Austria. They show that value increment, quality (size) increment, and soil rent coincides in their maximum closely.

For selection forest and coppice or coppice with standards size alone, d. b. h. is serviceable to determine the felling age, although quality and value increment determinations are not excluded.

As regards the *method of budget regulation* the new instruction strikes out in a new direction. While in both the allotment and the normal forest methods the budget is derived from a general working plan with a period table—a tabular exhibit of the fellings in area and volume from period to period bringing to view the progress toward the ideal of the future—now the felling plan is

not to emanate from a general plan, but is directly derived on the basis of the given stand conditions, the existing stands and parts of stands are placed in series according to managerial and economic considerations and the area and volume of the ripe or in the



next 20 years ripening stands are calculated. The maturity of the single stands then assumes the first place in determining the budget, in other words Judeich's stand management or age class method is the method in view,—an age class comparison forming the basis for the felling area determination.

To permit this free movement, the economic possibility of small felling areas and the partial giving up of strict sustained yield management are premises.

In ranging the stands in the felling plan, it is only necessary to make the felling area for the next decade approximate its proportions for a 20 year period.

In selecting the stands for felling, the necessity of utilizing over-ripe and deteriorating stands, sequence of a proper felling series and finally maturity decide.

The final budget in amount is found by dividing total area into total yield, when the average felling yield per acre is established, which is then multiplied by the periodic felling area. In addition thinning results are estimated, but no need of equalization of annual budgets exists.

The rest of the article is concerned with the routine of the work of regulation and of control.

Anweisung fur die Forsteinrichtung in den Königl. Bayrischen Staatswaldungen.. Forstwissenschaftliches Centralblatt. February and March, 1911. Pp. 177-199.

Value of Woodlot Book-keeping.

The need of book-keeping on the farm as far as field crops are concerned has been long acknowledged as proper. An anonymous article tries to make propaganda for control of private forests, or woodlots. The incentive is given by the account of a Swiss forest owner who for 14 years has kept a budget control of his 125 acres of woodlot, 3300 feet above sea level, managed for the last 20 years in a rational selection forest form.

It is composed of .7 spruce, .2 fir and .1 beech. The area was divided into compartments and the stock ascertained by counting and figuring cubic contents of all diameter classes of 9 inch and over. The cut was made from compartment to compartment and measured. After 10 years the stock was again ascertained. The result is interesting. Stock at beginning of period 2860 cubic feet per acre; at end of period 3290 cubic feet. There had been cut per acre and year 90.5 cubic feet; the increase in stock was 40 cubic feet; hence the total increment 130.5 cubic feet, or nearly 5 per cent. on the original stock.

The owner, therefore, found out that he could increase the cut without decrease of capital.

The ease with which this control, by no means perfect, but sufficient for the purpose, can be handled even by the inexperienced man recommends it. The owner begins to realize the value of his property and will manage it with more care.

Schweizerische Zeitschrift för Fortswesen. March, 1911. Pp. 73.77.

UTILIZATION, MARKET AND TECHNOLOGY.

Use of Thinning Material.

The thrift of a growing stand is always increased by proper thinning, but in many localities in Germany the material so removed can not be sold at a price sufficient to cover the cost of handling. There is urgent need for some method of utilizing this small material. The production of charcoal appears to offer a solution of the problem in some localities and such use is being actively promoted by the "Forstbüro Silva" in Darmstadt. The present paper gives some of the general features of charcoal production in meiler kilns in the Thürgingerwald and outlines the author's efforts to introduce a similar practice in the Vogelsberg. Other possible uses for small material from thinning are indicated.

Eulefeld: Einiges von der Köhlerei und der Zuwachspflege. Silva. January 27, 1911. Pp. 25-27.

Cost of Producing Yellow Pine Lumber.

Ten large manufacturers of southern yellow pine timber contributed detailed cost figures which include costs from the woods thru the saw mill and planing mill, to the buyer. The total costs, omitting stumpage, are peculiarly uniform when the fact is taken into consideration that the methods of cost-keeping are different, and that the logging and milling operations are carried on under widely varying conditions. Stumpage varies from $1.90 to $5.00 and is not included in the following table of costs.

Total cost per M., actual averages from large manufacturers: $12.83; $11.57; $10.68; $10.67; $10.37; $10.03; $9.84; $9.49; $9.06; $8.49.

The analyses of most of these costs are very detailed but the items vary so much that a general comparative summary would be impossible. In a few tables contracts and company work is compared. The table following was compiled by "The Lumberman" and seems to give reliable costs, providing all of the timber cut was put through the planing mill.

Cost of Yellow Pine Lumber.

Cutting,	.49	Drying,	.51
Skidding,	1.21	Planing,	.68
Loading,	.61	Selling,	.23
R. R. Building,	.90	Shipping,	.18
Hauling,	.75	Miscellaneous,	.29
Repairing Equipment,	.31	Superintending,	.49
Railroad upkeep,	.15	Interest on plant,	.49
Sawing,	1.46	Insurance,	.18
Sorting,	.20	Depreciation,	.59
Dipping,	.02	Taxes,	.14
Yarding,	.79		
		Total,	10.67
		Stumpage,	5.00
			$15.67

American Lumberman. March 4, 1911. Pp. 42 & 43.

Logging Cable in the Northwest.

A steam skidder with an overhead cable has been used in the Northwest about a year, and has seemed to give satisfaction. Two main cables were used so that while a crew was logging with one of them, another crew could be changing the other. Changing the carriage from one cable to the other required about 45 minutes. A strip 100 feet wide was worked from each cable and an area of about 800 feet radius was cleared at each setting. A daily average of 40,000 feet of logs was taken out by a full crew of 15 men at a cost of about $48.00 per day. A detail list of the cable used shows about 10,000 feet in use, most of which lasts about a year. The chief disadvantage was the aversion the men feel to working around a new type of machine.

American Lumberman. February 18, 1911. P. 581.

Feeding Men in Logging Camps.

Many lumbermen do not have a very adequate idea of just what it costs to feed men in their camps. A lower peninsula Michigan operator says it costs him 34½ cents per day per man; while a West Virginia company shows in detail as follows that it costs him 65.62 cents. (See also Vol. VII, p. 267.)

Flour,	5.50	Molasses,	.10
Potatoes,	4.07	Catsup,	.40
Cabbage,	7.00	Evaporated Apples,	.20
Milk,	1.08	Brown Sugar,	1.75
Cream,	.70	Granulated Sugar,	2.00
Peas,	.60	Pumpkin,	.40
Corn,	.90	Prunes,	.40
Coffee,	1.75	Lard,	2.75
Dry salt side,	1.33	Pickles,	.40
Tomatoes,	.90	S. beans,	.90
Jelly,	.37	L. beans,	.30
Mince Meat,	.85	Crackers,	.10
Cheese,	1.14	Ginger snaps,	.20
Oatmeal,	.60	Salt,	.15
Baking Powder,	1.60	Eggs,	.50
Blackberries,	1.33	Tea,	.90
Syrup,	.30	Butterine,	3.50
Macaroni,	.25	Meat,	20.00
Onions,	.40		
			65.62

American Lumberman. February 25, 1911. P. 27.

Yellow Birch Wagon Hubs.

Hub timber is usually bought by the lineal foot, ranging, for Yellow birch, from 4½ to 6 cents. Logs down to 8 inches can be used thus giving the operator $16.00 to $18.00 per M for his small timbers. Little or no deduction is made for crook for the stock is cut into short blocks, 9 to 15 inches long. The birch should be cut in winter, and where the mills run the year round, the stock is kept in water. Most of the operations in the manufacture of the hubs are automatic. It it quite essential that the blocks are bored so that the pith of the block is the center line of the hole. With one set of machines four men and one boy can bore, turn and mortise 100 sets of heavy birch hubs in 10 hours. When the machine work is finished the hubs are steamed for 18 to 20 hours and then painted, oiled or creosoted.

The Woodworker, February, 1911.

Spool Wood.

In the Northeast about 43,000 cords of Paper Birch is manufactured into spools annually. Only the best grades can be used for spools, the consequent large waste is used for fuel. The green logs in 4 foot lengths are brought to the mill in fall or winter, where they are squared to suit the sizes of the spools into which they are to be manufactured. These green bars are piled and allowed to air dry under cover for several months, and are then kiln-dried just before using. They are cut

to exact length of spool and turned to shape on a lathe. In most cases the process is entirely automatic. After turning the spools are smoothed by rolling with several balls of paraffine in a hollow cylinder. The largest spools are made in three pieces—the flanges fitting on the threaded end of a central cylinder.

Hardwood Record. February, 1911.

Toothpicks. Toothpicks are made principally from white birch. Maine produces the greatest quantities, altho New York, Vermont and Massachusetts have a few mills. Logs are picked by the logging boss and cut into veneer sheets which are as wide as toothpicks are long, then the veneers are cut into toothpicks by rotary knives.—

Hardwood Record. February, 1911.

Paving Blocks. In Minneapolis, Minn., about 40% of all the paving since 1902 has been creosoted wood blocks. The blocks are 4 inches deep by 4 inches wide and from 5 to 10 inches long; they were laid on a 5-inch concrete foundation with a sand cushion 1 inch thick. Pitch was used for filler. Most of the blocks were of Norway Pine and Tamarack, a little of Yellow Pine and Hemlock. There has been no difficulty with the swelling of the blocks and no repairs and no "bleeding" or oozing of oil from the blocks. Cost varied from $2.40 to $2.90 per square yard. Results: Yellow Pine blocks laid in 1902 show wear of ⅛ inch or 3.17%. Norway Pine laid in 1903 shows ¼ inch wear or 6.35%. Seven species laid in 1906 for experimental purposes on a road showing a record of travel averaging nearly 4,000 teams per day and 140 tons per foot of roadway, give the following percentages of wear:

Yellow Pine,	3.17 per cent.
Hemlock,	4.76
Tamarack,	4.76
Norway Pine,	4.76
Birch,	4.97
Western Larch,	9.36
Douglas Fir,	6.98

The Douglas fir was of poor quality, 2 or 3 rings per inch, and should not be considered.

Mississippi Valley Lumberman. March, 1911.

Utilization of Sound Wormy Chestnut.

On account of its lightness in weight, the width of board which can be obtained and its cheapness, it is rapidly gaining favor as a center for veneer stock. Casket manufacturers are the largest consumers. Piano and furniture manufacturers use a great deal .

Hardwood Record. April, 1911.

Effect of the size of the pile of lumber on the rapidity with which it dries is shown by the following figures: A pile of 12-inch oak 12 feet wide weighed at the end of 120 days, 4,240 pounds, while a pile 6 feet wide of same stock at the end of 120 days weighed 4,020 pounds.

Hardwood Record. April 10, 1911.

A cargo of Austrian turpentine piles is to be shipped to Vancouver, B. C., for use in dock building. Cargo will comprise 1,600 piles ranging in length from 60 to 75 feet.

Canada Lumberman and Woodworker. April 1, 1911.

Tasmanian Oak, *Eucalyptus obliqua,* is being shipped to U. S. in large quantities for harbor building, breakwaters, etc. The wood possesses the valuable property of repelling the white ant and the toredo; it contains an oil which prevents its decay; and added to this its extreme weight makes it ideal for piling in salt water.

Woodcraft. April, 1911.

STATISTICS AND HISTORY.

Prussian Budget.

The net income of the Prussian Forest Department continues to increase. While in the budget for 1911 an increase of expenditure of $450,000 is provided, namely altogether $15,000,000, the income has grown by $2,500,000 to $34,000,000, leaving in round numbers $2,000,000 more surplus, namely, 18.5 million dollars from less than 7 million acres.

Besides this ordinary budget there is an extraordinary one, which derives its income from sale of forest property figured at a little over $2,000,000 to meet extraordinary expenditures for

buying out rights of user, purchase of properties and certain other improvements, the latter reducing the total net income to 17.7 million dollars.

It is interesting to note that in the decade 1900-9 the income for wood alone rose at the annual rate of 3 per cent. compound, fuel wood, which represents about one-third of the whole in value, maintaining almost the same rate as the workwood.

At the same time the expenditures in the last decade increased at the rate of over 4 per cent., improvement of salaries probably accounting for most of this increase.

The personnel of the local administration consists of 33 Oberforstmeister, 97 Forsträte, 840 Oberförster, 5,157 Förster and some 18 other officials.

The cut on the 6.643 million acres of forestland is placed at 357 million cubic feet, or less than 54 cubic feet per acre, of which 30 per cent. "not controlled."

Allgemeine Forst- u. Jagdzeitung. March, 1911. Pp. 103-106.

Austrian Statistics.

The State forests of Austria are not very extensive; including some pastures and fields the State property comprises around 2.8 million acres, of which nearly one-third is unproductive. The annual cut at present is 45 cubic feet per acre of forest land, 53% workwood, which under the unfavorable site conditions is considered very good. The net income for 1911 is estimated at $950,000 in addition to free wood and other rights of user which are valued at over $300,000. The income per acre, including this value of the rights of user, is hardly 80 cents, and without counting those rights less than 63 cents.

There are 197 officials of the higher grade and 1,082 of the lower grade in the administrative service.

In addition there are 388 technical attachés to the political administration of the provinces to supervise the forest policy of the country and to participate in the administration of the melioration fund of 1.6 million dollars and in the reboisement work.

Centralblatt f. d. g. Forstwesen. January, 1911. Pp. 43-47.

Belgian Statistics. Belgium's total area is only 7.27 million acres and its forest area 1.32 million acres, of which less than half State forest. These 511,000 acres bring a net yield of $4.16 per acre. Oak wood brings 30 to 35 cents per cubic foot, and beech even more.

The official reports for 1906 place the wood import at around $36,000,000, a rise over the previous year of over $3,000,000, and further rise is anticipated.

The home product of coniferous wood is mostly utilized when fit for mine props, hence this large import of workwood. Against the import an export of 6.6 million dollars is set. Russia and Sweden are the largest contributors (over 50%), Russian imports increasing, Swedish decreasing.

Commerce d'importation et d'exportation des bois en 1906. Allgemeine Forst- und Jagdzeitung. December, 1910. P. 439.

United States Exports. The movement outward of timber for years of 1909 and 1910 may be summarized comparatively as follows:

	1909		*1910*	
Lumber,	1,509,836,000	board feet	1,876,763,000	board feet
Sawed timber,	434,985,000	" "	442,071,000	" "
Smaller dimensions,	25,472,000	" "	23,514,000	" "
Total,	1,970,293,000	" "	2,342,338,000	" "
Net increase,	372,045,000			
Average prices,	$21.41		$22.10	
Increase,	.69			
All wood and wood products,	$72,313,280		$85,789,033	
Increase,	13,475,753	or 18.6%		

American Lumberman. March 25, 1911. P. 28.

POLITICS AND LEGISLATION.

Waste Land Policy in Prussia. In a long, painstaking article, Semper discusses the policy of the Prussian government in buying up waste lands and mismanaged forests in the Polish provinces of West Prussia and Posen.

A historical review recites the causes of the devastation and also refers to the colonization commission which is instituted to supplant the restless and often shiftless Polish land ownership by German colonists.

In this connection, the rapid change of prices for the land is of interest as exhibited by the average prices paid for farms by the commission, namely, in 1886-1896, $55-65 per acre; in 1904, $98; in 1906, $137; in 1909, $122.

An example refers to a change of hands of certain forest property, which almost reminds us of our own experiences. Around 7,000 acres, the property of the Prince of Saxe-Meiningen, was sold in 1898 to a bank for $300,000, because the forest supervisor considered it improper to make an extraordinary felling in order to secure $12,000. The bank immediately cut this amount from 275 acres, and in 1899 sold the property for $500,000. In 1904, upon the death of the new owner, the colonization commission bought it for $800,000.

A table shows the changes which have taken place in the ownership of forest in the four districts involved from 1864 to 1900, namely percentic increases in State forest, and decreases in private forest, as follows: Danzig, +13, —13.5; Marienwerder, +13.6, —14.9; Posen, +9.3, —7; Bromberg, +8.6, —4.8. At the same time poor pastures and waste lands had been decreased by 250,000 acres, or about 25 per cent.

This statement shows, of course, that the private owners even lately have continued to decrease their forest area, for the increases in State forest were largely secured by planting up waste lands. The two provinces show a lower forest per cent. 19.8 and 22.9) than the average for the monarchy (23.7); in spite of their extensive poor sand areas and in spite of the activity of the forest administration, there are still over 800,000 acres of poor pasture and waste land left, besides poor farm land, that ought to be under forest.

The resumé of conditions states that the forest area of the two provinces has decreased at a threatening rate, especially on absolute forest soil; the waste land resulting from forest destruction exhibits an increasingly dangerous form and extent; in spite of improved agriculture, reduction in sheep, and successful reforestation, the devastation is increasing, blowing sands threatening the farm lands.

Finally the activity of the State forest administration is discussed. Private efforts in the sixties to reforest waste lands remained without result. The forest protection law of 1875 also failed to be effective, as well as the law of 1881, which was to

encourage the joint management of small farm woodlots. The provincial information bureaux, in existence since 1903 and 1904 (see F. Q. Vol. 7, p. 438), have done some good work, but not adequate to the need.

Several reforestation associations have been formed, comprising ownership of some 7,000 acres, who are assisted with plant material, etc. But really adequate, permanent results could only be expected from direct government activity.

In the sixties and seventies, small amounts were set out in the forestry budget for the entire monarchy for purchase of waste lands varying in the sixties from $35,000 to $90,000, and in the seventies $250,000 annually; from 1882 to 1892, the annual budget for this purpose was increased to $500,000 in the average, and since 1893, all the receipts from sales of public domains were set aside to secure waste land and forest properties; in addition, exchanges were made.

From 1887 special attention was given to the reforesting schemes in the province of West Prussia, where the need was greatest. Since the holdings were mostly small and scattered much difficulty was experienced in amalgamating large enough properties. Some 120,000 acres were bought in the first decade at prices ranging from $4 to $12 per acre, about $10 in the average.

Some large properties with well preserved forest were also acquired.

Altogether by 1900, some 170,000 acres had been purchased, all but 25,000 of which, absolute forest soil.

After 1900, when the war debts of the Napoleonic wars had been paid up, and thus the income from disposal of public lands which had served this purpose became available, purchases progressed more rapidly. But even this did not satisfy the situation, and in 1902 the vote of $25,000,000 for colonization purposes was also designated to increase the State forest property in these provinces.

This measure, to be sure, had a political as well as economic aspect, namely, to assist the germanization of the province in cooperation with the colonization commission.

This fund of 25 million was nearly exhausted by 1908, and was replenished by a further $6,000,000. By 1910, from these two funds, about 140,000 acres of waste and poor forest prop-

erty had been purchased, at an average cost of $42.60, while from the annual general forest purchase fund and by exchanges additions were made, so that the table, showing the entire transaction in detail, totals the forest territory acquired since 1900 as 258,000 acres, of which 218,000 acres pure forest land, and 64 % of this under woods. The whole purchase money was $7,000,000, or about $27 per acre. Around $400,000 was spent in making working plans for these new areas, which also increased the forest ranges by 116. Lately, owing to rise of prices and other reasons, the activity in this waste land policy has somewhat slackened.

Together with these purchases over 300 forest laborers' families and other immigrants were colonized on the farm lands, or about 25,000 acres, and altogether a new civilization has been brought in.

In the reforestation, the Scotch Pine, is the only species available. Where on the devastated areas still some woodgrowth remains, this is preserved, even if not of good form, as protection against sun and wind and to some extent as seed trees. If only cattle is kept out natural seeding succeeds readily, often beyond expectation better than artificial planting. Where needful the soil is scarified with a harrow; improvement cuttings are made when the young crop needs it—a policy of waiting seems to be encouraged by the tendency of straight slender growth which this pine exhibits in this locality—a northern type.

If artificial planting becomes necessary, sowing is preferred wherever poverty of soil does not prevent it. This is done without scarifying the soil more than with the harrow. It is done broadcast in strips, after burning or removing any dense soil cover. Sometimes the old method of sowing the cones is resorted to, if cheaper. In a cited case a sowing of cones, about 3.5 bushels to the acre, cost for broadcast sowing from $1.00 to $1.50 for sowing in hoed strips $3.30; and in the crop, instead of repair planting, shears were more necessary.

Often, resort must be had to planting. In that case the treatment of the soil is most important: no movement or loosening of the soil must be allowed, which would make it only more powdery. The planting must be done in earliest spring, as long as there is still winter moisture in the soil. Only the best plant material should be used, grown in nurseries located in the best soils. Lately Splettstoesser's borer (see F. Q. Vol. VIII, p. 467) is largely used.

On actual blowing sands, first a quieting of the soil by the customary mechanical means is necessary.

To improve soil conditions, sometimes mineral fertilizer, sometimes a leguminous crop is plowed under, or a frugal soil improving species, like Pinus *rigida* or *divaricata,* is used..

The writer cautions against the use of pure stands of Jack Pine, which is too valueless a crop and liable to attack of root fungi.

Altogether the question of future success of plantations on these exhausted soils is still open.

Some of the plantations made in the early nineties show already a retardation of growth, while natural seedings seem to thrive better. As a consequence of these observations the spacing has been increased to 4.5x3 feet.

To prevent fires from spreading, firelanes of 250-300 feet (!) width separate the plantations, and every other known precaution is employed.

The profitableness of the undertaking is only touched and, of course, is left uncertain, as the movement of wood prices is uncertain. A table shows the interesting remarkable rise of wood prices during the last half century. In the State forests of the four counties the yield for wood per acre has increased as follows:

	1850		*1892*		*1907*	
	Cents.	*Per cent.*	*Cents.*	*Per cent.*	*cents.*	*Per cent.*
Danzig,	20.	100	127.6	651	300.3	1534
Marienwerder,	23.6	100	176.4	747	398.1	1686
Posen,	52.8	100	181.1	346	333.1	631
Bromberg,	29.5	100	177.5	602	310.	1052

These figures look hopeful for financial success. It is also shown that the consumption of log material has grown ahead of the population; the import during 1866-71, averaging 80 million cubic feet, had risen in 1897-1901 to around 320 million cubic feet, and in 1908, a year of economic stagnation, to 450 million feet.

The increase of State forests then, which since 1887 has amounted to 435,000 acres, promises at least in part to satisfy a need, besides making useful these waste acres.

Die Ankaufspolitik in West Preussen und Posen. Zeitschrift Forst- und Jagdwesen. February, 1911. Pp. 65-96.

MISCELLANEOUS.

Forest Interests and Water Supply.

Hill forests are frequently drawn upon to furnish a water supply for towns and factories. Permission to enter a forest and construct ditches to secure a water supply should be given only after a careful investigation shows that the water can be spared and after the conditions under which it is to be taken are fully agreed upon between the forest owner and the water user. Drainage may remove too much water and seriously injure the stand; even the drainage which is a part of road building may have deleterious results. The following are usually the most essential points to be covered: (a) *Courses:* The head ditches should be planned to remove the water from the damper sites and should be led across the dryer to give them the benefit of seepage water. Ditches should not pass through localities liable to windfall. (b) *Construction:* Floodproof construction is in the interest of both the forest owner and the water user. Breaks are usually of greater permanent damage to the forest, however, and the owner will do well to see that ditches are properly constructed, Lattices where feeders enter the ditch serve to catch rubbish and prevent clogging. Trow lattices are best. (c) *Bridges:* Bridges are necessary to permit proper access to the forest. Their location and construction should be definitely agreed upon beforehand. The ditches are to be properly fenced where they run beside the road and at other necessary places. (d) *Weirs:* The streams emptying into the ditches should be provided with weirs and the water in the natural courses never allowed to dry up completely. Weirs should be firmly anchored to prevent displacement. (e) *Maintenance:* Constant care is necessary to remedy small damages before they become serious. Some care can be given by the forest personnel, but the employment by the water user of a competent person to care for the ditches is absolutely indispensable. (f) *Contingent Damages:* The right to construct ditches and take water from a forest will usually be given at a fixed annual rental rather than sold outright. The value of the land occupied will be calculated and a rental set, which represents interest on this value; consideration must not only be given the stand of trees which occupies the ground but to all other

items of value such as hunting and fishing privileges which may be rendered less valuable.

Einiges über Wasserabgabe aus Gebirgswaldungen. Silva. November 18, 1910. Pp. 361-62.

Modern Forestry Education.

Last fall with the abandonment of the forest school at Aschaffenburg (see F. Q. Vol. IX, p. 162), the whole method of educating foresters for the service in the State forest administration of Bavaria was changed and rearranged by royal decree. As we are at present concerned in standardizing forestry education on this continent, it may be of interest to brief this decree for comparison with our own ways. It is especially of interest as the education in Bavaria is carried on at a University, corresponding to what we would call a post-graduate course. Entrance requires graduation from a gymnasium, which corresponds to a good arts course into the junior year.

The time of study is four years with professional work, with two examinations, a so-called intermediary and a final theoretical examination. The latter which concerns all forestry subjects (9 mentioned), besides law, politic economy and surveying, is oral and public; the former, both oral and written, which may be taken after two years of study, comprises the natural history and mathematical, physical, fundamental and accessory subjects, which are recited in six groups, as follows:

Group A—Experimental Chemistry (inorganic and organic), Forestal Chemistry, especially the chemical parts of forest technology.

Group B—Mineralogy, Geology, Petrography, Forestal soil knowledge, with the fundamentals of Agricultural Chemistry.

Group C—Botany (Morphology, Taxonomy), Plant Anatomy—Physiology—Pathology and Plant Protection.

Group D—Zoology (Biology and Systematic), Natural History of forestally important animals, especially forest entomology.

Group E—Elements of Higher Mathematics, Descriptive Geometry, Geodesy with special reference to forestal needs.

Group F—General Meteorology and Climatology, principles of weather prediction.

Curiously enough, Physics is omitted—a somewhat serious, inexplainable omission.

In addition, a synoptical course of lectures, on which no examination is given, "Introduction to Forestry," with excursions to the woods, is to supplant the former requirement of eight months' sojourn on one of the ranges.

The examinations are held not by the teaching staff but by special commissions appointed by the Minister of the Interior.

Although part of the studies may be accomplished at other institutions, practical considerations will probably rarely admit of any other choice but Munich alone.

Apparently our best schools are not far behind this supposedly most advanced curriculum.

After 1914, only ten aspirants will be admitted to study for the State Service.

Die Reorganisation des forstlichen Unterrichts in Bayern. Forstwissenschaftlishes Centralblatt. February, 1911. Pp. 100-108.

OTHER PERIODICAL LITERATURE.

American Forestry, XVII, 1911,—

State Ownership of Forests, Pp. 191-196.

Advocates gradual acquirement of state forests in New England for educational purposes and the raising of timber.

Some New Ideas in Controlling Forest Fires. Pp. 197-203.

Describes some new fighting apparatus which was used on the Arkansas National Forest last year.

Microscopic Work on the Structure of Wood. Pp. 206-214.

An outline of the work planned by the section of timber physics at the Madison laboratory.

State Forests in Vermont. Pp. 253-256.

Descriptive.

Forest Fires in North America: A German View. Pp. 273-279.

Purple Basket Willow. Pp. 280-287.

Describes this willow with its varieties and hybrids, and the treatment for commercial purposes.

Forest Leaves, XIII, 1911,—

Convention of Pennsylvania Foresters. Pp. 19-20.

Need of Farm Woodlots in the Central States. Pp. 21-23.

National Forest Reserves for the East. P. 26.

Gives the provisions of the Weeks Bill.

Sierra Club Bulletin, VIII, 1911,—

Fire and the Forest—the Theory of "Light Burning." Pp. 43-47.

The Ohio Naturalist, XI, 1911,—

The Classification of Plants, VI. Pp. 289-298.

The Ancient Vegetation of Ohio and its Ecological Conditions for Growth. Pp. 312-329.

Pulp and Paper Magazine of Canada, IX, 1911,—

Relation of Logs to Pulp and Paper. Pp. 71-72.

The Forestry Convention at Quebec. Pp. 83-87.

Wood Pulp Trade in Scandanavia. Pp. 88-89.

The Journal of the Board of Agriculture, XVII, 1911,—

Moor Cultivation in Germany.. Pp. 999-1002.

[XIII],—

Osier and Willow Cultivation. Pp. 12-18.

Quarterly Journal of Forestry, V, 1911,—

Forestry in Russia. Pp. 101-119.

An account of a valuation of some three hundred thousand acres in the province of Perm.

Melampsoridium betulinum. Pp. 137-139.

Form Factors of Various Conifers. Pp. 140-145.

The Gardeners' Chronicle, XLIX, 1911,—

American Hawthorns: Some New Arborescent Species. Pp. 17; 36-37.

Descriptions of nineteen new species of the Tomentosa Group.

Sandalwood. Pp. 20-21.
An account of the South India tree and its disease known as "spike."

Street Trees and Gas. P. 44; 139.

A New Genus of Coniferae. Pp. 66-68; 84; 253.
A description of the genus Fokienia of the Cupressineae, from China.

Willow Trees Killed by Armillaria mellea. Pp. 100-101.

List of the Bamboos in Cultivation at Kew. P. 115.

The Indian Forester, XXXVI, 1910,—

The State Pine Forests of the Landes and Gironde Departments. Pp. 633-651.
A short description with special reference to the resin industry.

The Big Game Resources of the Empire. Pp. 715-725.

Forestry in Korea. Pp. 745-746.

[XXXVII, 1911],—

Wood Pulp Testing at the Forestry Court Cellulose Laboratory. Pp. 30-34.

Forest Railways for the Extraction of Timber in Burma, Double Rail and Monorail. Pp. 34-54.

Forest Problems in America. Pp. 109-115.

The Agricultural Gazette of New South Wales, XXII, 1911,—

Killing Green Timber. P. 25.
Description of method of exterminating scrub growth by chemicals.

Budding and Grafting. Pp. 59-66; 101-108.
Complete description of methods, with illustrations.

NEWS AND NOTES.

In two opinions rendered May first the Supreme Court of the United States not only upheld the constitutionality of the establishment of the National Forests, but it settled, once for all, that the Federal Government, and not the States, may say how reserved public land shall be used.

The entire course concurred with Justice Lamar, who announced the opinions when settling the cases of Fred Light, who will remain enjoined from allowing his cattle to graze in Holy Cross National Forest, and of Pierre Grimaud, K. P. Carajous and of Antonio Inda, who are under indictment for grazing sheep in Sierre National Forest, in violation of Regulation 45 of the Secretary of Agriculture.

"The United States can prohibit absolutely and fix the terms on which its property may be used," said the Justice in the Colorado case. "As it can withhold or reserve the land, it can do so indefinitely. It is true that the United States does not and cannot hold property as a monarch may for private and personal purposes, but that does not lead to the conclusion that it is without the rights incident to ownership, for the Constitution declares that 'Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or property belonging to the United States.'

"All the public lands of the nation are held in trust for the people of the whole country. And it is not for the courts to say how that trust shall be administered; that is for Congress to determine.

"The courts cannot compel it to set aside the lands for settlement, nor to suffer them to be used for agricultural or grazing purposes; nor interfere when in the exercise of its discretion, Congress establishes the forest reserves for what it decides to be national and public purposes. In the same way and in the exercise of the same trust, it may disestablish a reserve and devote the property to some other national and public purpose.

"Those are rights incident to proprietorship, to say nothing of the power of the United States as a sovereign over the property belonging to it.

"Even a private owner should be entitled to protection against willful trespasses, and statutes, providing that damages done by animals cannot be recovered unless the land had been enclosed with a fence of the size and material required, do not give per-

mission to the owner of cattle to use his neighbors' land as a pas-
they have no application to cases where they are driven upon un-
ture. They are intended to condone trespasses by straying cattle;
fenced land in order that they may feed there.

"Hence laws do not authorize wanton and willful trespass, nor do they afford immunity to those who, in disregard of property rights, turn loose their cattle under circumstances showing that they were intended to graze upon the land of another. This the defendant did under circumstances equivalent to driving his cattle upon the forest reserve."

In the California case, Justice Lamar upheld the rules which the Secretary of Agriculture had promulgated for the control of the reserves. He said that the "violation of reasonable rules regulating the use and occupancy of the property is made a crime not by the Secretary of Agriculture, but by Congress."

It was difficult, he said, to separate the legislative power to make laws and the administrative power to promulgate rules and regulations to put the laws into force.

"The offense is not against the Secretary, but, as the indictment properly concludes, 'contrary to the laws of the United States and the peace and dignity thereof.' "

The reforestation of treeless areas on the National forests is to be carried out on a rather large scale by the Forest Service, as is evidenced by the fact that broadcast seeding is to be undertaken on about 13,000 acres and about 800 acres are to be planted with seedlings this spring. District 6 leads in the extent of the areas to be sown, the estimated acreage being 5,616, as against the next highest of 3,445 acres in District 2. District 1 comes next with 2,456 acres; District 3 has 1,237 acres; and in Districts 4 and 5, 177 and 306 acres, respectively, will be sown. In the planting of seedlings, District 1 leads with 400 acres, and the work on Districts 2 and 3 involves 200 and 128 acres, respectively; while the combined acreage in the other three districts will be less than 100 acres. In Florida the Forest Service has recently planted several acres of Eucalyptus in the Everglades, in co-operation with the State; and another plantation has been established near Tampa, in co-operation with the Tampa Board of Trade. The planting of Eucalyptus on the Ocala National Forest will probably be postponed until the rainy season begins. Several hundred pounds of maritime pine seed are also to be sown this spring on the Florida Forests.

Several matters of interest regarding the forest work in Connecticut are reported. Legislation has not advanced far enough for a summary of the results to be given, but one bill has passed which creates a commission composed of the State Forester and Tax Commissioner and three others appointed by the Governor, who shall investigate the subject of the taxation of woodland and report with recommendations to the Assembly in 1913. The establishment of forest plantations throughout the State has progressed favorably during the spring, although no effort has been made to push this work because of the lack of suitable plant material at both the experiment station nursery and from commercial nurserymen. The State nursery has sold to private owners for planting this year, approximately 300,000 trees, and the total work the experiment station nursery will be able to supply approximately a million trees, and two private nurseries will have several million additional. It is intended that as soon as the commercial companies can supply the demand of private owners, the station nursery will be maintained only for the production of stock for experimental purposes and for planting on State land. Owing to the late spring, forest fires in the East have not been as serious as usual, and Connecticut, in common with other regions, has had few serious fires, the largest area thus far burned over being about 1,000 acres. By way of comparison, the number of fires in Connecticut in 1910 is reported at 834, with a total area of 47,443 acres burned over. The estimated damage to standing timber was $148,600, the damage to forest products and buildings $28,000, and the cost of fire fighting approximately $10,000. The cost of the fire warden service per acre of woodland in Connecticut is estimated at .7 cent for the year 1910, while in previous years it has been as low as .2 cent. The cost in 1910 probably represents the maximum, since the season was abnormal.

Charles P. Wilbur, who has been Assistant State Forester of New Jersey, will be State Fire Warden and organize the new service which the amendments to the law provide for.

In addition to the amendments to existing laws, the New Jersey forest legislation has provided for a new office of State Plant Pathologist. The service such an official can do is evidenced by the fact that late in April a plantation of 10,000 white pine trees was found infected with the blister rust. The attitude of the

people toward the forest service is shown by the fact that the owners of this plantation promptly agreed to its destruction.

As a result of the widespread forest fire damage last year, or as a reflection of more enlightened public sentiment, or perhaps of both, various State Legislatures have passed, or have under consideration, new forest laws or amendments to the old statutes which are bound to be helpful, particularly in relation to forest fires. In the West, California has added to its forest law of 1905 an educational office and the authorization of volunteer fire wardens under a comprehensive fire code; Washington has raised its annual appropriation from $23,000 to $38,000; while Oregon provided $30,000 a year for a State Forester and a working protective organization. Idaho made no change in the forest laws, but maintained the Fallon law, which is considered effective in its provisions for co-operation between the State and individual owners on an equal cost basis. In Minnesota a new forestry law has been passed which embodies many new features and is acknowledged to be the best law of the kind in any of the States. In the East, Pennsylvania has before the Legislature a bill providing a better protection for the State Reserves; and in New Jersey, the Forest Commission is prepared to extend and reorganize the forest fire service by the appointment of four division fire wardens and by various other changes in the laws and organization.

It is announced that Mr. F. A. Elliott has been appointed State Forester of Oregon, with headquarters at Salem. Mr. Elliott, prior to his appointment, was assistant superintendent of the logging department of the Charles K. Spaulding Logging Company. His thorough knowledge of the forest conditions in Oregon and his wide acquaintance with the manufacturing and timber-owning individuals and organizations should insure close co-operation and effective action in forest protection. Technical forestry and conservative lumbering, beyond mere fundamentals, cannot be expected in Oregon at the present time, but if reasonable control of forest fires can be achieved, the way will be paved for the future reforestation of burns and the cutting of second crops.

The annual meeting of the Western Forestry and Conservation Association was held in Spokane, April 3. This association is the

parent body and acts as a clearing house for the other organizations whose aim is the protection of the western forests. The Spokane meeting was largely attended by representatives of other fire protective organizations, and by railroad, State and Forest Service officials. Mr. E. T. Allen, Forester for the Association, presented his annual report and outlined the program of work for the coming year. He called particular attention to the favorable legislative action of several Western States during the year, and to the function the association can perform in directing and obtaining beneficial forest fire legislation. The educational work is being carried into the schools and taken up with the railroads, and the scope of the fire protective associations' work broadened in many ways. Mr. C. S. Chapman, manager of the Oregon Fire Protective Association, reported that the organization of his association was perfected on January 1, and is now on a good working basis. The Washington Fire Association has as a new chief fire warden, succeeding Mr. D. P. Simons, Mr. J. L. Bridge, a prominent Seattle timberman.

Owing to the alarm created by the spread of the chestnut blight westward through Pennsylvania, the State Legislature has under consideration a bill providing for the appointment of a commission to study the disease and determine methods of control, and giving authority to order the removal of infected trees when considered necessary. The commission, which is to serve without pay, can work through the State Department of Forestry or independently, at its option. The bill carries an appropriation of $35,000 for the expenses of the commission and $250,000 for the establishment of quarantine lines or other methods of control, in case a definite remedy is found, this latter sum being available only upon the recommendation of the commission and under authority from the Governor.

Rather unexpected success has followed the initial efforts of the Pennsylvania Railroad Company to improve the forest conditions on typical second-growth hardwood lands in Pennsylvania. The fundamental aim in this work was to utilize the mature and fire-damaged timber, remove the inferior species, and leave the land potentially more productive than before. It was not expected that the returns would much more than meet ex-

penses, particularly since each individual tree was marked for cutting and conservative methods followed throughout. In utilizing the timber cut, a market was developed for the low-grade material and for miscellaneous products, such as cordwood, pinwood, posts, bark, etc., while the tops, small trees, etc., were converted into charcoal. On the 1,200 acres cut over during the three-year period ending January 1, 1911, material of a gross sale value of $88,000, or $73 per acre, was produced. The expenses amounted to about $60,000, or $50 per acre, making the average net return about $23 per acre. It is impossible to say what the profits would have been if the usual lumbering methods had been followed, nor can the cost be put on an accurate board-feet basis, owing to the miscellaneous character of the products.

Dr. Shitaro Kawai, Professor of Forestry Engineering in the University of Tokio, Japan, arrived in Seattle on January 6, and since that time has been on an extended tour of investigation with Mr. Yeiichi Shigematsu, of the Japanese Forest Service, who has been in this country since last June. Dr. Kawai is at present in charge of the forest work in Formosa for the Japanese Government, and in this connection visited this country to learn at first hand our methods of carrying on lumbering operations. The investigations of these two Japanese foresters have covered visits to saw mills, logging camps, wood-preserving plants, saw works, wire-rope works, and in short, to representative points of interest in connection with the manufacture and utilization of timber in any form. Dr. Kawai is a thoroughly-trained forester, having spent six years in Germany, during which time he took the full course at Tübingen and special work at other forest schools. His first trip to this country was in 1903, when he visited the New York State School at Cornell University.

In the forest planting operations of the Pennsylvania Railroad Company this spring, between 400,000 and 500,000 trees, mostly red oak and Scotch pine, will be used in establishing permanent plantations. The work this year has been somewhat curtailed owing to the retrenchment policy in effect on nearly all Eastern railroads. In the Company Forest Nursery about 1,500,000 forest trees and 137,000 ornamental trees and shrubs were in stock when spring opened. This stock will be reduced at least

by 500,000 by the shipments for spring planting, and increased by 45,000 ornamental plants imported from France and Holland and by 200,000 privet cuttings. The nursery area has been increased by additions of about 5 acres to a total of 38 acres, and in the old nursery and additions the planting this spring comprises approximately 250 bushels of red oak acorns and 50 pounds of coniferous seed; while about 300,000 one-year-old conifers will be transferred to transplant beds. The extensive experiments in fall planting made last year indicate that in the climate of Pennsylvania both nursery and field planting can be carried on most successfully in the spring.

President Taft's appointment of Hon. Curtis Guild, ex-governor of Massachusetts and President of the American Forestry Association, as Ambassador to Russia, is well received and is a deserved tribute to Mr. Guild's work and ability. The members of the American Forestry Association, however, and particularly the Board of Directors, will keenly regret losing the head of their Association, for under Mr. Guild's leadership new life and spirit have been injected into the Association and its magazine, and several plans for increasing the scope and value of the work are being carried out. Not only is the Board more active than for years past, but an Executive Committee is at work, headed by Dr. Woodward, President of the Carnegie Institute, and an advisory board of editors has been appointed to direct the policy and broaden the field of the magazine. The Association and magazine under the new regime deserves the support of the technical foresters because it is really for the furtherance of their work and powers that this voluntary public service organization is maintained.

Under the New Jersey Act of 1909, the railroads of the State have constructed approximately 300 miles of fire lines, this work having been done entirely at the cost of the railroads. The work during the past year has been practically voluntary on the part of the railroads, owing to the question as to the constitutionality of the law, but railroad officials seem agreed that in the pine section of the State at least, these fire lines are of great practical value, and their construction will no doubt be continued even if the law is not upheld in the courts. Almost no fires have been started

where the lines are made, and the results have been very beneficial to both the State and the railroads.

Other items of interest from New Jersey are that forest plantings in the State will this spring aggregate not less than 300,000 trees, most of them being made on private property. The Forest Commission is also authorized to take up actively the extension of shade-tree work, and it will do this by furnishing an assistant forester to any community which has an organized shade-tree commission. A campaign for the improvement of woodlots is also planned. This will be carried out by having a man drive from farm to farm, giving practical demonstrations to the owners of the property. As in other States, however, fire protection is deemed the first essential, and if fires can be suppressed, the natural forests will yield results very quickly and at low cost.

The department of forestry of the New York State Forest, Fish and Game Commission has sold to private parties during the past spring 1,774,000 trees, the total number requested on orders amounting to over two million. White pine transplants were in greatest demand, with white pine seedlings second, while Norway spruce transplants and Scotch pine transplants occupied third and fourth places, respectively. The Salamanca nursery has been nearly doubled in size, and a nursery of five acres has been established at Saratoga, making a total of six nurseries which are being operated by the State. In connection with the nursery and planting work, the white pine blister rust has been found on three importations, one of them from France and the other two from the well-known Heins nurseries, near Hamburg. The prompt discovery of this disease will prevent its spread from the importations this year. The 700,000 two-year-old white pine seedlings which were imported from the Heins nursery in 1908 and transplanted to the Salamanca nursery have from time to time shown the existence of the rust, and the remaining 500,000 seedlings were this spring condemned by the State Department of Agriculture and burned. In the matter of fire protection, five new fire stations have been added, making a total of 27, in the Adirondacks and Catskills. The paid force during the coming summer will consist of 5 Superintendents of Fires, about 65 fire patrolmen and 27 observers on mountain stations.

Mr. F. W. Besley, State Forester of Maryland, has established two demonstration forests this spring, one near Bowie and the other near Princess Anne, Md. The one at Bowie contains twenty acres of which about fifteen acres, comprising a young stand of mixed hardwoods, will be managed as a woodlot to demonstrate methods of thinnings and improvement cuttings. The other five acres is an old field on which planting experiments will be conducted and probably a small nursery started. A three-acre plantation of loblolly pine (*Pinus taeda*) has been started, using three-year old transplants. The object is to introduce this valuable timber tree into a part of the State where it is not indigenous and where it may supplant the less valuable pitch and scrub pine. The demonstration forest near Princess Anne is a portion of an 800 acre tract, and contains a variety of forest types. The demonstration area covers about 30 acres, including the field type now coming up in pine thicket, a pure loblolly pine stand 40 years old, a mixed pine-hardwood stand 30 to 40 years old, and a virgin swamp hardwood type. These different blocks will be given scientific treatment. The old field portion which was only partially seeded, has been fully stocked by transplanting small trees from the heavily seeded to the open places and the other work will be taken up this coming fall. These with the two that were established last year make four demonstration forests under State supervision and control. The ownership of the land does not pass to the State, but by agreement the State Forester makes the plans and superintends the work, while the owner furnishes all labor that may be necessary. These demonstration forests, together with the four State Reserves, will serve to show what practical forest management will do in the different types of woodland in the state. The growing interest in forest management throughout the State is shown by the increased number of applications for advice in handling forest lands. Since October 1st, twenty-eight woodlots and timber tracts, aggregating over 8,000 acres, have been examined by the State Forester and plans of management proposed. A number of other applications are yet to be acted upon.

The forest fire loss in Maryland for 1910 because of peculiar conditions was greater than during the previous year. Sixty-five fires were reported by the Forest Wardens as burning over 18,000 acres of woodland and causing a damage of $97,000, in-

cluding a few buildings. It is noteworthy that nearly half of the acreage burned over and half of the damage was caused by one fire in a section where forest fires rarely occur and where there were no forest wardens. What made this fire so destructive was an extremely dry spring, and large areas of fallen pine timber broken and blown down by a severe storm the year previous. In the mountain counties, where there is the most danger from fires and where most of the wardens are located, the loss in 1910 was comparatively small.

The Announcement of the Colorado School of Forestry of Colorado College, issued in May, offers a four-year undergraduate course, leading to the degree of Forest Engineer, and a two-year graduate course, leading to the degree of Master of Forestry.

The enrollment in the undergraduate course during the past year has been thirty-six. The School is in charge of Prof. P. T. Coolidge, as Director. Mr. E. I. Terry, a graduate of the Harvard School of Forestry, was appointed as an Instructor in Forestry in January. Since his graduation, Mr. Terry has been in the Forest Service on the National Forest. The Ranger course which was given last year in co-öperation with the Forest Service, until the decision of the Attorney General made its discontinuance necessary, will probably be given in the fall by the Faculty of the School alone.

The Forestry Department of the University of Montana contemplates organizing a summer cruise for foresters. The course as planned would include visits to the best stands of western timber, viewing the operations of the Forest Service on the National Forests, such as nurseries and plantings, timber sales, patrols, fire-fighting, reconnaissance, grazing, etc. It would also include visits to some of the large private milling and logging operations. At the various points visited appropriate lectures on dendrology, silviculture and lumbering are to be given. As most of the time will be spent in the woods, the cruise will serve to give men experience in camping, packing, riding, etc., and at the same time be largely recreation. The number of persons admitted to the party must necessarily be limited, probably to 25 or 30. It would be organized largely for the accommodation of men in eastern forestry schools who may desire to become acquainted with

western forest conditions, and to see as much as possible of the practical operations in forestry during a period of from six to eight weeks.

The Biltmore Forest School has recently returned from its winter quarters in Germany for its summer sojourn in America. Following the well-known precepts of the Director, the students have participated in silvicultural and utilizational operations in the forest in the neighborhood of Darmstadt, estimated timber in the Black Forest and have studied conditions and operations in Saxony and in Bavaria, (in the latter in the Gramschatz Forest), and in the Spessart mountains. In certain of the Bavarian forests single white oak logs sometimes sell for $400 per M for veneering purposes, and 400-year old trees have an average stumpage value of $178 per *M*. Many saw-mills and wood-working establishments were visited, giving an opportunity to compare German with American methods, and observations were made on the behavior of numerous American species planted in Germany.

Nursery inspectors in the employ of the State Department of Agriculture of New York, report to have found German blister rust in three year old white pine transplants imported from J. Heins' nurseries. These trees were imported this spring and arrived in New York in March. Six trees with orange spores were found in a single thousand. It would appear from this that the danger from importing German white pine is not passed.

Quebracho lands in Paraguay are sold for $6,000 to $7,000 per square league (4,644 1/8 acres). Most of the capital invested is from Argentine. The quebracho trees are so irregularly scattered that it is deemed necessary to acquire 50 to 100 square leagues in order to get a fair average amount per league. The stands are so scattered that the investor usually engages in the cattle business also. No basis so far has been determined for valuation of Quebracho lands. The number of trees per league is a mere guess. The handling of labor seems to govern the returns from investment.

Water transportation is essential, for freight rates are very high. Quebracho logs are quoted in Hamburg at $22.50 per 1,000

kilos (2,204.6 pounds). Extract of Quebracho $7.40 per 100 kilos.

From an extract of a paper read by Dr. Allen F. Odell, Professor of Chemistry, Louisiana State University, on A Chemical Study of Cypress, it is learned that among the many products obtained from various chemical and distillation processes, a compound called cypressene has been isolated with the creosote oils. It is this compound which gives cypress its great durability. The chemist thinks that if this were used as a preservative, for instance in Oak, the wood would have an indefinite life.

The report on prices issued by the Forest Service shows slight improvement for the first quarter of 1911 for the western market, while yellow pine advanced considerably over the preceding quarter, other species less so. In hardwoods only the common woods show a tendency to increase, while the standard woods remain unchanged or declined slightly.

A patent has been granted on another cement cross tie. In the cement a block of wood is so dovetailed that it can be easily removed and replaced. This block rests on a cushion of cypress shavings which is supposed to overcome the non-elasticity of the concrete.

Per cu. ft.	1st class	38 to 40c.
"	2d "	33
"	3d "	23 to 25c.

From a report of U. S. Consul at Vladivostok, Siberia, it is learned that in Eastern Siberia the Russian Government has been cruising and surveying the Amur River system which comprises about 400,000 square miles, available for logging. The stand averages 45 trees per acre which mature in 100 years, thus 115,-200,000 trees could be cut annually without diminishing the forest. There are no privately owned forests. Timber can be taken out by water. British and German firms are asking for square logs, planks and lumber. Prices export f. o. b. steamer at Vladivostok for cedar lumber:

The British Columbia Government has rescinded its order enforcing the use of the B. C. log scale. Pending further investigation, the interior operators will be permitted to use the Doyle scale for the payment of royalty.

Shipments of Aspen are made to Japan for use in manufacture of matches.

COMMENT.

It is only fitting that Dr. Hugh P. Baker, one of Professor Mayr's most recent students, should have extolled his master and great teacher as he has in the appreciation which we have gladly placed in the front of this issue.

No one will deny that Prof. Mayr has been most fertile and suggestive in his literary work, but the sober critic who did not come under his personal sway and who did not know anything of his personality except what was revealed in his writings will probably be inclined to discount some of the praise. The one thing that must impress an unbiased reader of Prof. Mayr's writings is, on the personal side, the self assertiveness warring against all others, and, on the material side, the sometimes reckless assertion of facts, the argument of *ipse dixit,* frequent inconsistencies and unjustifiable generalizations, all of which make one hesitate to accept at full value his conclusions. While he sought the truth, his personal fame seemed dearer to him. Many unpleasant literary scraps, which the American dislikes, but the German seems unfortunately too often to court, stand to his credit, or rather debit, and of his new doctrines many will not survive him long.

Mayr's last silvicultural proposition, for instance,—the mixed forest in smallest stands—is one of them which we may designate as stillborn, for even in the most intensively managed larger forest administrations it would become entirely impractical. This is at once apparent, if we contemplate that a 6,000 acre proposition in 80 year rotation, if it were divided according to Mayr into small stands of say 5 acres, there would be 1,200 such stands, each of which requiring, also according to Mayr's conception, thinnings and final harvest cuts, altogether some 180 fellings annually, besides underplantings and repair plantings of not less than 80 to 100 acres annually—a physically impracticable operation, not to mention its cost.

Nevertheless we do not mean to detract from Prof. Mayr's unquestionable merit in having advanced silvicultural thought in a more modern direction, in which he has, however, a number of notable competitors.

The intensive management of the National Forests involves one of the largest forest planting projects ever undertaken in this or any other country, and at the same time it is one of the most difficult ones, owing to the fire danger and to the unfavorable soil and climatic conditions in many parts of the West. For several years planting was looked upon as one of the least important functions of the Forest Service, and, of course, during the formative period of the National Forest organization, other things were more urgent. Secretary Wilson, however, has always been an ardent advocate of reforestation, particularly by means of broadcast sowing, and the amount of work undertaken by the Service in both direct seeding and the planting of seedlings is being greatly increased each year. It is understood that definite plans have been made for some years ahead, and that eventually the annual reforestation program will involve a total area of 200,000 acres. While this work is commendable from nearly every standpoint the question naturally arises whether the practical difficulties incident to drought, fires, and poor soil will not lead to failure in many cases unless the way is paved by extensive experimental work. The failure of many of the earlier planting projects can be clearly traced to lack of definite knowledge as to what could be successfully accomplished under the varying conditions on the National Forests, and the reduction in size and the abandonment of several of the earlier nurseries shows the necessity for a well-grounded plan before going ahead on a large scale. For some time after the transfer of the reserves to the Department of Agriculture the people of the West were more or less antagonistic, and since water is one of their most important assets, its conservation by the reforestation of watersheds was undertaken at several points. Particular attention was given to the reestablishment of the forest cover on city watersheds, in the National Forests, and as it has later developed, this work was started in some cases where success was practically out of the question, owing to the unfavorable local conditions prevailing. A notable example is that of the work in the semi-arid mountains of southern California, where a combination of drought, chaparral, and damage by rodents made extensive reforestation a physical impossibility. While much of this work was started experimentally, it soon went far beyond this point, and the ultimate failure of several of the projects was all the more apparent because of their size. These

earlier experiences have served to put the nursery work and the planting of seedlings on a more restricted, yet more successful basis, and it is to be hoped that the lessons learned will be applied to the broadcast sowing. It would be extremely unfortunate if this work should have to be curtailed and a large part of it doomed to failure because sufficient experimental sowing had not been done to demonstrate by what methods and to what extent it can be successfully carried out.

The trade situation in Southern Yellow Pine presents a rather peculiar feature, a growing strength in prices having developed at the beginning of the year with a rather sharp increase during the latter part of the winter, particularly in the lower grades. This would call for no comment if business conditions were normal and the demand sufficient to justify a price increase; but it has come in the face of very moderate buying and with little prospect of a revival of brisk trade conditions in the near future. The comparatively small stock of material in the hands of retail dealers and of wood-consuming plants at the beginning of the year, and the fact that the railroads and other large consumers did not buy heavily in 1910, led to the forecast that trade conditions would improve during the early part of 1911 and the demand for lumber increase. This assumption has not been borne out, and the lumber-consuming industries have continued to buy only in sufficient quantities to meet necessary current needs; so that the advance in price of $2.00 to $2.50 per M. has not been justified by the demand nor by the consequent reduction of the stock at the mills which would result from active buying. The only feasible explanation seems to be that the manufacturers, following the past two years of poor business and the consequent difficulty of meeting obligations, have been forced to put prices on a higher basis, and having done so, are holding them up regardless of general trade conditions. Railroad cross-tie prices have not been advanced, but on the contrary ties have been selling during the past winter at considerably less than during the preceding summer. The situation as regards yellow pine stumpage is also worthy of comment in the above connection, stumpage prices having held firm during the past several years of depression, regardless of the rather wide fluctuations, mostly downward, which have taken place in the lumber market.

The extended tour of this country now being made by Dr. Shitaro Kawai, Professor of Forest Engineering in the Imperial University at Tokio, Japan, mentioned under "News and Notes" in this issue which has been widely commented upon in the lumber trade journals, calls attention to the rather remarkable progress which Japan is making in the line of timber utilization and forest management. The American forester naturally has little detailed or authentic knowledge regarding forest conditions in the Japanese Empire, and the common conception of the lumber industry in that country is of two coolies sawing out boards by hand from logs supported on an elevated platform, or of saw mills where only the crudest kind of machinery is used and practically everything done by hand labor. This picture is probably true of general conditions in Japan proper, but in the face of this it is rather startling to learn from Dr. Kawai of the distinctly progressive and extensive sawmill operations which are being inaugurated in the Arisan Forest, in Formosa. This forest, formerly the property of an individual, was turned over to the Japanese Government in 1908, and in the development and exploitation of this 25,000-acre tract, expenditures aggregating over a million dollars are being made, and modern methods of conservative lumbering are to be followed. Forty-one miles of logging railway have been constructed into this forest from Kagi station, on the Government railway in Formosa, at a cost of $50,000 a mile. A large saw and planing-mill of American manufacture is to be constructed, and American logging machinery will be used in getting out the timber. It is expected that a creosoting plant will be built in connection with the sawmill, and close utilization will be the rule both in the logging operations and at the mill. The estimated stand in the Arisan Forest is six hundred million cubic feet of softwoods, of which about 40 per cent. is *Chamaecyparis obtusa* (Hinoki in Japanese), and 60 per cent. largely *Chamaecyparis formosana* (Benibi in Japanese). The Hinoki is said to be one of the most valuable softwoods in the world, and somewhat resembles our Douglas fir. The Hinoki will average 4 to 6 feet in diameter and 150 feet in height, while occasional trees considerably exceed these dimensions. The Arisan Forest is located in a wild, mountainous region inhabited by savages. Although the best timber is found at about 6,000 feet above sea level, the climatic and soil conditions are believed to be

very favorable for carrying out a plan of long-time management. At the present time Formosa imports about two million dollars worth of lumber annually, a large part of it from the United States; but the work which the Japanese Government is now undertaking is expected to greatly reduce the lumber importations and at the same time develop a region which, during the seven centuries the island was under Chinese control, was entirely uncivilized and isolated. We have good reason to be proud of the progress made in the practical management of our National Forests during the past ten years; yet it is something of a blow to our pride to find that the Japanese, in a forest which they have owned only since 1908, are applying methods which are perhaps more intensive than any we have yet inaugurated, and this in territory which has been in their possession only since the Chinese-Japanese war. To give all due credit, we must conclude that the work in the Arisan forest is the most ambitious forest project yet attempted in the Orient.

While the past year has been one of perhaps unprecedented advance in matters of State forest legislation, the new laws have thus far failed to provide any solution of the vexed question of forest taxation. Probably the unvarnished truth is that none of the volunteer associations is ready with definite recommendations; while the individuals who hold decided views on the subject are not in a position to get their ideas enacted into laws, or are too much at variance between themselves to procure definite results. Many believe that the tax question is second in importance to that of fires, and in certain States at least its solution would remove one of the lumbermen's stock reasons for not cutting for a second crop. If forest taxation were on a more rational basis, it is still a surmise whether there would be any appreciable increase in the amount of non-agricultural land kept under forest. Our whole tax system is crude and in many ways faulty; yet industry has not allowed itself to be materially hampered; and while better forest taxation is needed and should be sought, there is no real reason why forest management should not go merrily on its way pending the solution of the taxation problem. The States are showing more liberality in their forest appropriations, and are not only making laws, but providing machinery to operate them; so we may hope that some day they will feel liberal enough to curtail

present tax revenues slightly for the sake of providing a perpetual rather than a temporary source of income from their forest lands.

The development of the forest fire association idea in the Northwest and the spirit and effectiveness with which the work is being conducted, leads to a renewed hope that we may yet see forestry practiced on private land. The best of it is that foresters are back of it, and that trained men are at the head of at least two of the big associations. Yet they are the kind of men who not many years ago were tolerated by the lumbermen as harmless fanatics. What would the timberland owners of Washington and Oregon have said ten years ago if a forester had told them he could reduce their fire losses to a minimum and apply methods of prevention and control which were really effective? Capital to the extent of millions was invested in timber then as now, and the fire danger was quite as real. It took a full decade of propaganda, backed by tangible results on the National Forests, to carry conviction that the new methods—which are not new, but merely systematized—were better than the old, which were really no method at all. The elaborate forest working plan idea failed to convert the lumberman, the talk of an immediate timber famine failed to impress him, because he knew better, and all the well-laid schemes failed to make the timberland owner a forester—because it wouldn't pay. Then came the forester with ideas on fire protection, and these have been accepted because they are practical, necessary, and create a credit balance. In fire protection the American forester has found himself, and incidentally been discovered by the lumbermen. Following effective fire protection will come forestry.

In regard to the article on Equipment and Operation of a German Seed Extracting Establishment, translated by Mr. S. L. Moore and printed in our last issue, pp. 26-44, we are advised by a high authority from Germany, that the article contains a number of statements which do not correspond to the practice, nor are accepted for future plans.

Especially the gradual movement of the cones into a continuously rising temperature is said to be a practical impossibility. A plan for a new, large seed extracting establishment in Marienwerder is being worked out by Oberförster Haak, an authority on this subject (See F. Q. vol. VIII, p. 338), which includes the best modern idea, and we hope eventually to be able to describe it.

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THE NEED OF A VIGOROUS POLICY OF ENCOURAGING CUTTING ON THE NATIONAL FORESTS OF THE PACIFIC COAST.

BY BURT P. KIRKLAND, *Forest Supervisor.*

Much has been written concerning cutting policy, regulation of annual cut, etc., on the National Forests. While most of the writers assume to speak for the National Forests as a whole, as a matter of fact the methods of reconnaissance, cutting regulation, etc., advocated are as a rule not at all adapted to the National Forests west of the summit of the Cascades, in Washington and Oregon. These forests are, however, destined to furnish a far greater portion of the cut from the National Forests than their area indicates. There is little doubt that of several National Forests in this region, each will furnish a greater sustained annual yield than the entire National Forest area in some of the six districts among which the National Forests are distributed. It seems evident, therefore, both that discussion of the needs of this particular region by persons familiar with the true conditions is needed, and that the too frequent practice of persons familiar with only a limited part of the National Forest area speaking for the whole is one to be discouraged as not conducive to a proper public understanding of National Forest conditions. Before entering into the subject matter proper of this article, a brief discussion of some of the special conditions present in the region will aid in understanding the conclusions aimed at.

CONDITIONS WHICH NECESSITATE DISTINCT METHODS OF CUTTING AND REGENERATION IN THIS REGION.

In most of the National Forest regions what is practically a selection system is now in vogue. As the species involved are

often light demanding and unadapted to a true selection system, it is probable that this will, as time goes on, more nearly approach a system of reproduction under shelterwood except where a strip or group system is used. However this may be, the fact remains that in those regions the smaller trees cannot now be utilized in most places, and that they are of sufficient value in themselves and for furnishing seed to warrant saving even at considerable cost. The small trees are at least as apt to be of the most valuable local species for the situation as not. Moreover, horse logging, the prevailing method, makes it entirely possible to save them.

In Western Washington and Oregon all these conditions are different so far as the old mature stands, covering most of the National Forests, are concerned. In the first place, the young and immature trees consist almost entirely of inferior species, principally hemlock and the true firs of insignificant value for present or future purposes as compared with the old stands. In the second place, the logging methods necessary to remove the enormously heavy old trees do not permit of saving young growth. The largest percentage of this young growth must inevitably be crushed by felling the old timber, and by dragging out the heavy logs. It is, therefore, evident that the application of the selection method to the present stands (which will not be duplicated under forest management) is impossible unless the forester be satisfied with a stand containing only a partial stocking of very inferior species.

Since clear cutting methods must be used, regeneration of the forest by natural methods can be accomplished only through the use of seed trees in groups, or singly, or by cutting in strips. Foresters who have had the most experience on the ground, have come to believe that artificial regeneration is the cheapest method of renewing forests in this region, following cutting, whether it gives the best stands or not. The following facts are the basis for this belief. Douglas fir, which is the most important species to encourage in this region, contains in the stands where cutting is now taking place on the National Forests, from 2,000 to 5,000 bd. ft. to the tree even in the smallest trees in the stand. Since, in view of the fact that a large proportion of the trees left for seed are sure to be blown down soon after the surrounding stand is removed, it will surely be necessary in order to ensure even ap-

proximately full stands of reproduction, to leave not less than two or three trees to the acre, or the equivalent of 4,000 to 15,000 board feet worth $10 to $25 at present stumpage prices, and this value is constantly increasing. It is safe to assume that all of this will be lost before another cutting can take place, since, even if a few trees should survive they will be so heavy to handle in comparison with the relative small timber obtained at the next cutting, that machinery which will be adapted to removing small timber will not suffice to remove these heavy old trees.

It is, therefore, a logical conclusion that artificial regeneration will be cheaper and probably better than natural regeneration from scattered seed trees, even leaving out of consideration the cost of protecting the seed trees from fir when the area is slash burned. In some few cases, defective trees containing little merchantable material can be utilized for seed trees; but on many areas no such trees are found. If such trees are left they will soon die and constitute a serious fire danger, since dead stubs are the worst agency for scattering sparks when fires occur. In the case of groups of seed trees, the loss by windfall will also be extremely heavy, and the objection to having old heavy trees to remove at the time the next stand is ready for cutting is also present. I have seen broad belts of windfall in Douglas fir, even in the edges of solid sections left next to cuttings.

No sale area in this region has yet been found where it was thought possible to require cutting in strips. The steep ground on the National Forests makes this practically impossible in connection with railroad logging, which alone is entirely satisfactory for the removal of heavy timber from steep slopes. Requiring purchasers to remove timber in strips would almost exactly double the investment in railroad construction, which is already heavy, and render logging prohibitive, unless stumpage prices were greatly reduced. Furthermore, in the case of the seed trees in groups or singly, the logger loses an amount on his road construction proportionate to the number of thousand feet left. Since road construction in the mountains will probably create a charge of 50 cents to $1.00 for every thousand feet of timber on the ground, the loss to the logger will be $2.00 to $8.00 or more per acre in the case of leaving seed trees, and still heavier where groups of seed trees are left, even leaving out of consideration the cost of protecting them when the slash

burn is made. To cover this loss the Forest Service will, in the long run, unquestionably have to deduct the amount from its stumpage prices. This amount added to the loss of stumpage through trees uncut makes the cost of natural regeneration far too heavy in most cases, and renders artificial regeneration the inevitable method to be followed in the case of decadent old stands. This is true even without consideration of the fact that the trees in these stands in many cases do not produce vigorous seed. At first thought it appears that all this cost of artificial regeneration must be borne by Forest Service appropriations; but such is not the case. It is just as legitimate to require the timber purchaser to bear the bulk of this cost as it is to require him to pile brush, which also is a measure on behalf of the future stand, just as is artificial regeneration. It will, in fact, often, if not usually be cheaper for the logger to perform the work of artificial regeneration under the direction of Forest officers than it will for him to lose the profit of cutting trees that would otherwise have to be saved for seed trees.

CUTTING POLICY.

On account of some of the foregoing and other considerations, it has sometimes been assumed that sale of timber from the National Forests of this region is undesirable. The chief grounds for this opinion are, or have been, (1) Because of the lack of local industries such as agriculture, mining and other industries using wood in their development, local cutting has been assumed to be unnecessary. (2) It has been assumed that timber stored up now could be utilized later. (3) Because increased stumpage prices may be expected later, it has been believed that it would be good financial management to hold all the timber. Other minor arguments have been advanced.

Timber has never been withheld from the market except when in a limited number of cases a sale has been discouraged through high stumpage prices, but the idea that withholding cutting for a few years would not be opposed to good conservation has persisted in some quarters. It is worth while, therefore, to show the fallacious ground on which this idea is based. In order to do this the grounds mentioned may be taken up in order as follows:

(1) *Is cutting needed for local industries?* Instead of the absence of other industries being a reason for not cutting timber on the Forests in this region, it is on the contrary, a strong reason for encouraging cutting to take place. The local population is chiefly dependent on the lumber industry. In some cases towns have been established within or near the National Forests on account of hoped for mining development; in others, on account of the lumber industry itself. In many of these cases the mining industry has failed to develop satisfactorily, and the population must fall back on the lumber industry. It is evident, therefore, that these towns are dependent entirely on the lumber industry, and that its failure will necessitate the removal of the local residents, with a consequent abandonment of the homes which have been created, and the destruction of much capital. Hence, where a population dependent on agriculture could remain and secure such lumber as is needed from outside sources, if necessary, in the case of the population dependent on the lumber industry the homes of the people are dependent on a timber supply and hence on cutting from the National Forests if other timber has been exhausted. No further argument should be necessary to show that cutting is often even more essential in this region than in other National Forest regions. Where no development has taken place as yet none can take place until cutting of timber begins. The only important bearing aside from this, that the lack of sufficient local consumption to utilize the local timber supply has, is its bearing on the size of sales. Since it is wholly unnecessary to restrict the use of the National Forests here to local consumption, as is the case in some poorly timbered regions, sales of such size as will economically supply timber for export to other parts of the United States should, on the contrary, be encouraged. Horse logging and small mills wasteful in operation cannot do this.

(2) *Effect of Withholding Cutting from the National Forests on the Future Timber Supply.* Since governments should provide equally for the present, the immediate future, and the distant future, no system of forest management other than an approximately sustained annual yield management can, for a moment, be considered. It can easily be shown that if the National Forests are to be handled on a substantial annual yield basis, neither the immediate nor the distant future can be bene-

fited by any system of storing up old, decadent, virgin stands of timber. It is a well known fact that from 75% to 90% of the area of the forests of the Pacific Slope bear stands of this nature.

If we assume that whenever cutting does begin on a National Forest bearing a stand of this nature, it will be on a sustained annual yield basis, it seems self evident that if we are to use a rotation of, for example, 100 years, and are going to have an approximately sustained annual yield through the first rotation under management, only approximately one one-hundredth of the area may be cut over each year, whether cutting to the limit of the Forest begins now or twenty or thirty years hence. Moreover, if cutting to the limit of the Forest does begin now, it is entirely evident that we will be cutting over about one one-hundredth of the area each year after 20 or 30 years just the same as if no cutting had taken place in the meantime, and consequently, that the yield from the Forest will be just as large then if we cut to the limit of the Forest in the meantime as it will if no cutting takes place. It is, therefore, almost an axiom that if we proceed on the assumption that the Forest will always be worked on a sustained annual yield basis, that we cannot cut any more timber from the Forest 30 years hence if cutting is withheld in the meantime than we can if we have been cutting to the limit of the Forest, and consequently that all the volume production which may be secured in the next 30 years by cutting on a sustained annual yield basis will be irrevocably lost if cutting is withheld. This is true, because in the recadent stands now existing no growth is taking place, and in many cases a decrease in the volume of the stand is occurring on account of the dropping out of the Douglas fir in stands which have reached the maximum age for Douglas fir, and its replacement by hemlock stands, which never contain as large a volume per acre as do thirty stands of Douglas fir. The conclusion is inescapable, that if we are to have regulation of the cut on a sustained annual yield basis when cutting does begin on any National Forest in this region, the immediate future cannot benefit in any degree from withholding present cutting from the Forest.

For example, on the Snoqualmie Forest it is calculated that one hundred million feet a year can be removed annually forever. We can begin removing this one hundred million feet a

year at once, or we can wait 20 or 30 years. If we waited 20 or 30 years, as has been advocated by some, we could not remove over one hundred million feet a year without depleting the supplies of the more distant future, and creating an improper distribution of age classes in the first rotation under management, which could not be corrected until the second rotation under management. I take it that the foresters who will be in control 30 years hence will not contemplate over-cutting then any more than we would now, and that therefore, we might just as well take from the Forest the three billion feet that can be cut in the next 30 years without injury to the future, as to leave it there to decay, which is exactly what must happen if it is not cut.

Let us now examine the effect on the distant future. While it is evident that the immediate future will be neither harmed nor benefited by cutting now to the limit of the Forest, it can also be shown that the distant future (say 100 years hence) will be benefited by present cutting, providing cut over areas are immediately regenerated, which follows as a matter of course, on a National Forest. This benefit will come through increased wood supplies due to the fact that large areas of decadent stands now contain only from 20 to 30 thousand board feet of poor hemlock to the acre, due to Douglas fir having dropped out through long absence of fire, although these stands are often times on the best quality of forest producing soil. If these stands are removed and the area is immediately reforested with Douglas fir, the Douglas fir stands 100 years old will contain fifty thousand feet or more to the acre as against the 20 or 30 thousand of hemlock, if the present decadent stands are stored up till that time, as will have to be done with some of them for 100 years and more if a sustained annual yield be followed through the first rotation and cutting does not begin until 30 years hence.

The net results, therefore, of failure to cut to the limit of the Forest at the present time will be that while it makes no difference in the amount of produce yielded by the Forests in the immediate future, (20 to 30 years hence) there will be irrevocably lost all timber which we fail to cut less than the sustained annual yield, which will be a heavy present loss without any benefit to any future generation. There will also be a loss in volume production, which will be felt in the distant future, (100 years hence) due to old decadent stands not having been replaced by

thrifty young stands which would have reached maturity at that time if cutting had taken place at the present time. These losses are directly proportionate to the amount which we cut less than the sustained annual yield. It is for the benefit, rather than to the detriment of the Forest that cutting take place to the limit of the Forest at once.

(3) *Financial Considerations.* It follows that if the above deductions are true concerning volume production, the financial returns from the Forest in the immediate future will not be decreased in any sense by cutting on a sustained annual yield basis now. Since just as much volume can be removed in the immediate future if we cut now as can be if we do not, just as much timber will be available for sale at such increased prices as we may obtain then, as will be available if no cutting or only a little cutting takes place in the meantime. Likewise the distant future would be benefited financially by cutting at the present time.

When, therefore, we hear the policy of withholding greatly over mature stands from cutting advocated by foresters, when the National Forests of the Pacific Slope bear this class of stands almost exclusively, it proves only that these men lack faith in their own profession, and look upon these mature stands as one would look upon a mine whose resources would be exhausted whenever they are utilized, and would therefore naturally be utilized immediately, or withheld for utilization for several years. according to the owner's idea of which would yield the greatest returns. This is exactly the standpoint of the lumberman, but it is surprising that it should also be the standpoint of any technical forester. Forestry is practical and businesslike, and American foresters will make an irretrievable error, which will meet certain condemnation in the future, if they disregard absolutely the principles of forestry, which have been proven by a century or more of European experience. I believe it would be very difficult to find authority in any European forest practice which would indicate holding the cut below a sustained annual yield basis in any area under forest management where nearly all the stands of timber on the area are so decadent as those on the Pacific Slope, many of which have decreased by thousands of feet to the acre below the volume which thrifty Douglas fir stands in the region contain.

It is hardly necessary to state that as long as cutting is evidently beneficial to the Forests, every effort should be made to dispose of timber from each Forest to the amount of its possible annual sustained yield. Both the Federal Government and the States need the money which will be yielded by cutting. The Federal Government is hampered in undertaking progressive conservation measures by lack of funds, and the States need all revenues available for road and school purposes. In fact, this need of revenue is almost a sufficient reason in itself for vigorous encouragement of cutting on Forests, and it is fortunate indeed that the National Forests are in such a condition as to make cutting possible within a few years which will yield a heavy revenue, not only without damage to the present or future of the Forests, but with positive benefit, especially to the more distant future.

There has been and is a great deal of criticism of the Forest Service because more cutting has not taken place on the National Forest. While, I believe, it is not a fact that any effort has been made to retard development of the Forests, and while timber sales have been made as fast as the demand for the timber at reasonable prices has arisen, it is nevertheless true that the best results cannot be obtained by this passive method of handling timber sales. Active effort is needed to increase the number of sales on nearly every Forest of the Pacific Slope. On the Snoqualmie Forest about one hundred million feet of timber is now under sale contract, and it is expected that enough more can be sold within the next year to bring the cut of the Forest up to its safe limit. None should, or will be sold beyond this limit.

The timber on the National Forests is so inaccessible as compared with large areas of timber in private ownership, that there is very little demand for it, and lack of cutting has been due to this fact, although this has not been taken into consideration in the criticisms of the Forest Service which have been made. It is nevertheless true, that no one thing would have so favorable an effect on local public opinion in this region as increasing the cut of the Forests to their safe cutting limit. This is true, because it is of the greatest importance to the region that the income to roads and schools should be increased, and that the enormous revenue which would accrue to labor and capital through the timber cutting should be made available. The National Forests

of Washington and Oregon are capable of yielding an annual revenue of $3,000,000 to $4,000,000 as soon as they can be brought to their cutting limit. This revenue will of course rapidly increase as stumpage prices increase. If this revenue had to be obtained at the expense of the future, as would be the case if the cutting had to take place in immature stands, or if the storage of mature stands could be taken advantage of without over-cutting in the future, there might be some reason for withholding cutting, or failing to encourage it. Since this is not the case, every effort should be made to increase cutting to its proper limit.

It is a fact that this increase in the amount of cutting will increase the cost of administration, which the Forest Service can ill afford with its present appropriations. However, there is no doubt that as the revenue increases, Congress will recognize the need of larger appropriations. As the cost of administering timber sales in this region need not exceed 10 cents per thousand feet, while timber will sell at the rate of $1.50 to $3.50 per thousand feet, it is evident that the cost of administration of the sales constitute not more than 5% to 10% of the revenue received from them.

The problem of whether over mature Forests should be stored up on acres to be devoted permanently to forest management is entirely separate and distinct from that of whether stumpage on lands not to be used permanently for forest production, or to be sold land and all sooner or later, should be held a long or short time. In the former case, the young stand to follow cutting has to be considered. In the latter case, no such consideration appears. The problem of when to cut a single small tract, even if it is to be used permanently for forest production, is also distinct from that of tracts large enough to make a sustained annual yield management most profitable. With a small tract to be handled as a permanent forest producer, storage is proper as long as increase in stumpage prices is rapid enough. In the large tract the storage cannot be taken advantage of except by over-cutting later. Persons who maintain that lack of cutting on the National Forests is not undesirable are, it seems, looking at their management from the small tract standpoint.

National Forests as Examples of Management.

Although the area of National Forests is large, they contain such a large proportion of barren land that they constitute a smaller factor in furnishing a supply of timber than may be supposed by some. Hence, one of the most beneficial uses to which they may be put is to furnish the best examples in forest management. The storing up of old, declining stands which are decreasing in intrinsic value, while the annual cut of the Forest is less than one-tenth of its producing ability, is wholly at variance with any principles of forest management which have been found wise in other countries.

The policy of some holders of large blocks of timber in private ownership in Western Washington is nearly in accordance with the principles of forestry, involving as it does the disposal of old timber and holding young. On account of existing tax laws, these owners are not, however, in a position to manage their holdings according to the best silvicultural principles, although they might be glad to do so. The State and National Governments are the only ones who can do this at present. The State of Washington now has no technical foresters in its employ, and with the example of an enormous area of National Forests bearing heavy stands of timber not even paying expenses, it can scarcely be expected to be attracted to forest management. Its revenues are insufficient for its other needs, and while it is the general opinion of State officers that forestry does not pay, and is only of use to future generations, no very active forest management may be expected by the State.

It devolves, therefore, upon the National Government if any real forest management is to be undertaken in this region.

The experience of cutting large areas with the view of following the cutting by regeneration of the Forest is needed in order to ascertain proper methods. The forester of 20 years hence, will, I am sure, much prefer that timber sales on a large scale had been made for the past 20 years, in order that the cumulative experience would be available for his use than to have a heritage of old over-mature timber to handle, which as has already been shown, can yield no greater revenue at that time on account of cutting having been withheld.

It is fully realized that fine technicalities in management can-

not be introduced now, but I do believe that not all the well tried principles of forest management need be forsaken. The National Foresters will be better fitted to meet the demands of the distant future, and at least as well fitted for meeting the demands of the immediate future, if cutting to the limit of the Forest begins as soon as possible.

Effect of Present Cutting Policy on Future Timber Supplies.

The only reasonable argument for withholding cutting from Forest now, is that the timber stored up can be utilized later. It has been shown that this stored up timber cannot be utilized later without at that time abandoning in whole, or in part, a sustained annual yield management. Even if we assume that such management will be abandoned, what will be the effect in this particular region of storing up timber? It is a well known fact that the sawmill capacity of this region is far above the market demands. Every sawmill is able to secure all the logs it wants whenever it can sell its lumber product. In other words, as much timber as can be marketed is being cut annually in any case. It is quite clear, therefore, that cutting on the National Forests west of the Cascades will simply take the place of so much cutting on private lands. The total amount of timber stored in the western part of the State will not be increased at this time by storage on the National Forests. Of course, this will not be true sometime perhaps 20 to 40 years hence, when stumpage on private lands comes to be partially exhausted. Now, which is the most desirable from a public standpoint: storage of stumpage on private lands, or on National Forests? I believe the former is far the most desirable from the standpoint of the State and public for the following reasons. (a) Stumpage stored on private lands bears large revenues to the State through taxation: on the National Forests it yields no State revenues until cut. As soon as it is cut on private lands it ceases entirely to yield State revenue. This is true under the present system of taxation, which, whether just or unjust, will without the slightest doubt continue for virgin timber. (b) Cutting of timber on National Forests will be followed by reforestation. On private lands, cutting is in most cases followed by the land lying abso-

lutely waste. Such land brings no revenue to the State, and *produces no future wood supply.*

Every timber sale which has been made on the Snoqualmie Forest furnishes a concrete instance of the fact that cutting of National Forest timber displaces just so much cutting elsewhere. Nearly every applicant is a logger or millman, who, if he does not operate on the National Forest, will do so elsewhere. They are usually not owners of stumpage, but can buy it when needed. Whether or not cutting takes place on the National Forest at the present time has no effect on the amount of stumpage stored up in Washington and Oregon as a whole. These are facts easily demonstrable on the ground. Hence, whether we are to have forest management on an annual sustained yield basis beginning now or later, or only on a periodic sustained yield basis, nothing can be more certain than the fact that no future generation is benefited in the slightest degree by withholding cutting from the National Forests of this region now, providing it does not exceed a safe cutting limit. It should be unnecessary to state that it is of vast benefit to the present generation to have cutting take place, and that this constitutes an unaswerable argument for encouraging cutting in every legitimate way.

Effect of Cutting of Soils of Different Qualities.

Having concluded that cutting is essential, it is worth while to examine briefly the question of where it can best take place. Since one of the chief advantages of cutting over-mature stands is that they may be replaced by growing young stands, it will be advantageous to displace poorly stocked stands on the best forest soils first. If a stand on poor soil is replaced, little growth is secured in the stand which follows, while the reverse is the result on good soils. This principle should be applied locally in confining cutting, except of dead timber, to lower slope and bottom land types, as a rule. Broadly it indicates that it is more advantageous to encourage cutting in stands on the Pacific Coast, because they are on the best forest producing soils, than it is in stands in the Rocky Mountains. This argument is partly neutralized, however, by the fact that poor soils usually have smaller stands, and hence the removal of an equal volume from them leaves a larger area available for forest growth.

It is certainly advantageous to have cutting take place when possible, on areas where good growth will result in the stand to follow. This usually means on the Pacific Slope at not over 3,000 feet altitude, as well as on favorable soils.

Effect of Prices on Forest Policy.

The highest market prices should of course be secured for National Forest timber. There is no reason, however, for pushing prices beyond the true value of the timber. The correct policy is the Use Book policy of making prices according to accessibility. Disregard of this leads to the prevention of sales of timber greatly in need of sale, but inaccessible. No standard prices should be so fixed as to defeat this result. Timber most in need of sale silvculturally should, when possible, be sold first regardless of its accessibility. This cannot be done unless prices are flexible. Accessible timber will be worth just as much more than inaccessible timber ten years hence as now. It is therefore just as profitable to hold as the latter. The most defective stands should always be cut first.

The Question of Comparative Prices Received Here and in the Rocky Mountain States.

The Rocky Mountain states cannot produce sufficient forest products for home use. If they export them, it will only be for a short time, and to a short distance, to the prairie States. On the other hand, if the United States is to produce its own lumber supply, the Pacific Coast must always be a timber exporter. This means that there will always be a difference in stumpage value between timber there and in the Rockies, approximately equal to the cost of transporting lumber from here to the Rockies, modified by differences in the intrinsic value of timber in the two places. Hence, timber that brings $5 stumpage there is probably just as desirable to hold as $2 stumpage here. When stumpage prices become $5 here, they will undoubtedly be $8 there.

Question of Waste.

In some quarters, objection to cutting now is made on the ground that there is too much waste. All should, on the con-

trary, be thankful that in America we have not yet reached the point where it is necessary to utilize decayed, excessively knotty or other similar material for lumber, although its use as a by-product deserves all possible encouragement. The fact that if timber is not cut on the National Forests it will be cut elsewhere also comes in here. The waste is greater elsewhere than on National Forest cutting. Economic waste should be carefully distinguished from uneconomic. The waste by decay in over-mature forests left standing will be as great a waste by cutting if they are cut.

Summary.

(1) Though timber on the Pacific Slope is seldom needed for actual consumption locally, it is nevertheless urgently needed in the development of local industry, and for shipment to other parts of the United States.

(2) Since the Forests are covered for the most part with over-mature stands, loss by decay is rapid, and at least offsets all growth. The attempt to store up all of these stands cannot therefore result in any benefit to the future. Incidentally, it should be noted that no cuttings should be permitted in thrifty stands less than 150 to 200 years old. If the sustained annual yield management is to be the method used in managing National Forests, the immediate future can in no wise be benefited by keeping the present cut of the Forests below a sustained annual yield basis.

(3) From (2), it follows that withholding cutting from the Forests now merely results in the loss of the present revenue without adding anything to future revenue. All possible present revenue within a sustained annual yield basis, which is not taken, will be irrevocably lost. This loss will amount to from $3,000,000 to $4,000,000 annually for Washington and Oregon.

(4) Present cutting can, without any damage to the future, yield liberal revenues to Federal and State Governments with consequent favorable effect on public opinion, and on appropriations available for Forestry work.

(5) National Forests should be made the best possible examples of forest management. Allowing over-mature timber to go to waste is inconsistent with such policy.

(6) Cutting should take place on best forest soils first, where they bear over-mature and decadent stands.

(7) Storing timber on National Forests will tend to encourage more cutting on private lands, with the result of further decreasing State revenues through taxation.

EXAMPLE OF A GERMAN WORKING PLAN.

(Extracts from Working Plan for Tegernsee Forest, Bavaria.)

TRANSLATED BY A. B. RECKNAGEL.

Introductory Note.—The following summary of the methods of management form a part of the Working Plan for the Tegernsee Forest in Bavaria, the manuscript of which is in possession of the Yale Forest School. Since this plan, which is a revision for the period from 1891 to 1902 inclusive, deals with a practically virgin forest of spruce with fir and beech in mixture, it would seem to be particularly applicable to similar conditions in America. The Tegernsee Forest contains 13,757 acres, of which in 1891 the division by age classes was as follows:

1st age class—merchantable	—33.3%	of the stand
2nd age class—nearly merchantable	— 6.1%	of the stand
3rd age class—intermediate	—17.1%	of the stand
4th age class—young growth	—43.5%	of the stand

The object of management is the rejuvenation of the stands now over-mature and the bringing into productive condition of areas now unproductive by means of cultural methods described below. The Plan is by the area method; rotation 144 years. The Forest was placed under administration in 1875 when the division of the age classes was as follows:

1st age class—merchantable	—51%	of the stand
2nd age class—nearly merchantable	— 1%	of the stand
3rd age class—intermediate	—13%	of the stand
4th age class—young growth	—35%	of the stand

This shows the progress made towards the theoretical ideal or having 25% of the area in each age class.

1. SITE.

The Government Forest of Tegernsee and Kreuth lies on the slopes of the northern Alps. The absolute elevation is from 876-

1,700 metres (2,875 to 5,577 feet)—the area is in general very steep with many cliffs and canyons. The area is part of the Communities of Tegernsee, Rottach, Wiesse and Kreuth.

2. Climate.

In general the climate is mild. The differences in elevation cause marked local variations in climate and vegetation—early and late frost are not common, but heavy winds, snow, thunderstorms, hail, fog, are common and are injurious to the forest. The prevailing wind direction is from southwest, west, or south —snow usually falls in great masses, causes bending and breaking and shortens the vegetative season, especially at high elevations. Snowslides are not uncommon causing great destruction to forest and ground cover, leaving steep, bare slopes.

The young stands experience many difficulties through snow, stamping and grazing of cattle and grazing of game.

The average rainfall is great—greater than almost any place in Europe. Hence, the atmospheric moisture is very high and particularly favorable to the growth of spruce.

3. Soil.

The rock is a dolomite, a granite and in places a limestone formation. The soil is a rich sandy loam of good depth.

4. Species.

The predominant species is the spruce with an almost universal admixture of fir and beech, especially in the oldest stands; in younger stands fir and beech are less noticeable and sometimes entirely absent, probably because of clear cuttings and injury through game. Only in a few overmature stands does the fir dominate. Old larches are scarce, young ones frequent. The spread of larch has been prevented through injury by game and cattle, and the poor choice of sites where it was planted.

As subordinate species come maple, elm, ash, alder. Still more rare are birch, choke cherry, etc.

5. Former Management.

On account of greater accessibility and in part because of not spreading the cuttings over a sufficient area, large areas were cut

over with temporary reserve of the usually worthless inferior material as a protection. Each year's cutting usually joined on to the previous year's. The cut-over areas were usually sown broadcast with spruce and in part with larch seed without scattering of the brush—in part right after the logging was completed, in part several years later.

Plantations were rare, often only with natural (wild) stock.

As a result of cuttings in stands already too light, these stands were thinned out still further and the area because of insufficient seeding, given over to grass and weeds.

Thinnings were generally confined to the down timber—especially girdling of the trees reserved for protection, often without reference to the need of further protection on the part of the young growth. This neglect will mean careful planning on large areas now without adequate young growth.

Improvement cutting should be confined to the less steep slopes, where the getting out of the timber will not destroy the natural or artificial reseeding, or to the steeper mountains where the cutting and logging can be done on snow in winter, provided adequate precautions be taken to prevent windfall.

6. Future Management.

The object of management is the growing of spruce stands with greatest possible admixture of beech, fir, maple, and larch.

Ideally the spruce should occupy 70%, the other species 30% of the total area and volume.

Fir, beech, and maple would easily reproduce naturally if various conditions did not prevent. Even the artificial regeneration of these species is very difficult and should not be attempted but every effort made to secure its natural spread up to the allotted 30% of the area.

Spruce and larch could usually be reproduced naturally were it not for the great age of the stands, and other conditions, which make it seem undesirable to await natural re-seeding and indicate that spruce and larch must usually be reproduced artificially.

Larch should only be planted in suitable sites—i. e., on fresh, deep soils, on open areas and not under cover or in damp, foggy, ravines, or canyons, nor on north, northeast and northwest slopes. Furthermore it should be mixed with other species so that in case the larch fails no gaps will occur in the stand.

Balsam can well be used in mixture with spruce for planting on southern exposures and on rocky sites; but its area is greatly restricted because of damage through snow and game.

In the future management the areas at high elevations should be distinguished from the timbered area proper.

The high elevations contain in part entirely untimbered, unproductive (barren) areas, in part Alpine forests which are composed of stunted, irregularly scattered, limby, decadent spruce, crippled, old firs, beech, maple, and mountain alder.

The marketing of this material is very expensive and in part impossible without damage to the lower lying stands.

The reforesting of such areas is uncertain, and very expensive. Therefore only a very careful selection system can be used here whereby only the oldest, most merchantable and decadent individuals with reference to liberating young growth are removed with due precautions to retain the cover unbroken and only where the material can be removed at an actual profit without, of course, removing trees needed to prevent rock slides, avalanches and the like.

Many such parts of the forest are segregated as Alpine reserves —these must be strictly conserved.

The true forest area ranges down to 2,600 feet in elevation. (The lower lying areas are privately owned.) Even her cliffs and precipices occur. Just below the unproductive (barren) areas a corresponding belt of woods must be kept intact in order to prevent an increase in the unproductive (barren) areas.

Method of Cutting.

Since these forests, as stated, are chiefly on very steep mountain slopes, where they are not only very exposed to windstorms, but where also the advance growth is practically all destroyed in logging or at least rendered valueless for the basis of the new stand, and since, furthermore, the existing methods of lumbering as a rule require a concentration of the cuttings (coupes) the method of selection cutting does not seem appropriate. But even a strip method is not advisable here, despite its usual advantages, since the stands, as a rule, have passed the seed producing stage and the logging of the remaining strips would cause the destruction of the young growth on the cut-over areas. Furthermore,

the openings are very prone to come up to grass and weeds. Therefore, this method would only delay ultimate restocking. Again it would not be possible to scatter the brush on the cut-over strips, since it would prevent the logging of the remaining strips.

The strip stand (shelterwood—strip) method of cutting, as heretofore, should therefore be adopted. The progress of cutting should, as a rule, be from the highest part of the slope to the base thereof.

Where conditions prohibit the cutting of an entire strip in one year, it should begin at the top of the slope and be extended to the base in subsequent years.

The logging of the lower slopes ahead of the middle or upper slopes and vice versa is as a rule not permissible. Only where the material of the upper portion of the slopes can be logged without touching the lower portion and without interfering with reproduction already present on the lower slopes may the logging of the lower slopes take precedence over the logging of the upper slopes, providing no injury through wind is caused thereby. The usual small skidding and hauling roads from which the felled material on steep slopes is often logged can not as a rule furnish an excuse for this partial logging on each strip. The strip cuttings must progress in the direction against the prevailing wind currents, i. e. as a rule, towards the southwest. On sunny slopes the remaining stand must furnish protection to the cut-over area against drying out. In such cases, therefore, the longest dimension of the cut-over strip apart from narrow canyon-like valleys should stretch either horizontally or diagonally across the slope.

The cut-over strips should have a width of not to exceed 45 metres (150 feet), but a rule cannot be formulated since the local conditions may necessitate a greater or lesser width.

The cutting strips must be narrower the steeper and sunnier the slope is, and the more the soil is given to growing up to grass and weeds, and the less protection there is; whereas on the contrary on shady slopes the cuttings can be wider.

In order to prevent a too early cutting of the adjacent strips a cutting cycle of at least six years is indicated. In order to achieve this end a sufficient number of stands should be indicated for the near future where operations can be begun. Also within the stands the preparatory cuttings must be carefully regulated ac-

cording to local conditions. Thus the preparatory cuttings can be advantageously begun near the ditches, small ravines and the like, although the clear cutting of strips (coulissenhiebe) must be carefully avoided.

A new cutting should, as a rule, never be made adjacent to the older one until the reproduction on the former is *assured*. For the rest in the choice of cutting areas, besides the securing of reproduction and the productivity of the soil, the most economic method of logging should be borne in mind. Therefore, the cuttings should be concentrated as much as possible. Along very steep and high mountain ridges the forest cover should be retained intact, therefore, no utilization of these areas will, as a rule, be attempted in order to prevent the injurious windfalls and snow slides.

On the cutting areas all the weaker material, the small sizes, especially beech and fir of advance growth and weak growth should be left as protection material whose logging in later operations can well be waived. Where it is possible, however, to remove these protection trees in the next cutting this should be done. On the shady slopes the amount left for protection can be greatly lessened. The protection material, of course, must not be removed in early cuttings, thinnings, preparatory cuttings, and in the execution of the first removal cuttings. Advance growth of all kinds must be carefully protected. On the steeper slopes where protection material is lacking, beech and fir must be left for protection where it can later be logged either by itself or in connection with an adjacent cutting. The leaving of a denser stand is often permissible in certain places where the subsequent logging can be done in winter or spring on snow. In certain stands containing a large percentage of beech on moderate slopes, reproduction of beech can be secured from the mature trees remaining in the uncut portion. When the area has seeded naturally and the young seedlings have developed sufficiently to ensure a stand of beech, the adjacent mature stand should be cut under the strip stand method until an area suitable for spruce is reached. Occasionally, the adjacent area can be cut clean and the area, as far as spruce reproduction is not already present in sufficient quantity among the beech naturally, sown with spruce seed so long as the beech is still small and will not choke out the spruce.

If the beech stand is heavier it will have to be interplanted with thrifty spruce and larch. The larch should only be planted where the young stand of beech and spruce is not appreciably larger than the larch seedlings and where the soil and the site is suitable (see supra).

At the end of the cutting and the logging of the wood the remaining brush must be scattered in order to hinder the grazing by cattle during the first period of the young growth. This matter must be given special attention where there is much grazing and where the soil is loamy and wet, and also where the reproduced stand is very young. Barricades can be built of brush across cattle trails to good advantage, where these trails lead across the cutting area.

Reproduction of the Cut-Over Areas.

As already stated, since the spruce in general is overmature, sufficient natural seeding cannot be expected of it, and therefore, the spruce must, as a rule be reproduced artificially. This can be done through the seeding of the cutting areas with approximately 15 kilogrammes (33 lbs.) of spruce seed per hectare (13 2/5 lbs. per acre), and that as soon as possible after the cutting which here, as is well known, takes place in summer and after the hauling out of the material in the fall. Therefore, the seeding should be done in the spring succeeding the cutting.

The seed should be scattered as uniformly as possible over the cutting area in favorable places on mineral soil; undecomposed humus should be removed. The individual sowing areas should not be too close together and must be covered with brush for protection. On very steep slopes where, in consequence of the logging, the bare mineral soil has been exposed, success from seeding can be expected only after the appearance of a light grass cover.

Where the soil cover has not decomposed sufficiently and bodies of raw humus are found, a superficial working of the ground must be done in order to remove the humus. Where certain areas of the cutting, or whole cut-over areas even before the cutting, are covered with weeds no good results can be expected of the seeding. Here the restocking should be done through planting of spruce. For planting the areas should be carefully

chosen as in seeding. The spacing should not be too far apart since cattle and game will destroy many plants. The use of poor stock should be most carefully avoided. As a rule, only plants grown in seed beds should be used. Where weeds have not taken possession of the ground, 2 to 3 year old, not too slim, seedlings can be used; on a very weedy place stronger plants, preferably 3 to 5 year old transplants should be used. Where on middle slopes seed beds can be placed, plants grown there would be preferable to those grown at lower elevations in regular nurseries.

As rapidly as possible newly cut-over areas should be restocked. After these, the fail places in those stands which will soon form a canopy, and last the larger areas which have grown up to weeds.

The reproduction of cut-over areas by means of seeding should only be attempted where good results can be expected under conditions of grass and weeds, and as a rule seeding should only be attempted once and then planting resorted to. On the upper slopes which cattle frequent and on wet areas it will frequently be necessary to fence in the cut-over areas, if reproduction is to be secured. Where wood is lacking for this purpose wire fence should be used. The patchy character of young growth on many of the cut-over areas, the large areas at present without young growth, the failure of reforestation on large unprotected areas, the necessity of cleaning up the old over-mature trees, all make it necessary to do a lot of intensive artificial reproduction during the immediate future, and with the high wages prevalent in this region and the high elevation of the areas to be restocked, requiring great effort to get the plant material there, make a large expenditure during the immediate future imperative. It is inadvisable to attempt reproduction, either by seeding or planting, of beech or fir, since adequate results are not to be expected. The introduction of larch can be secured through seeding in mixture with spruce seed. On places where grazing is heavy and there is much game no attempt should be made to introduce larch.

Later Removal Cutting and the Final Cutting.

The trees left for protection as mentioned above—provided they cannot and should not be logged in the next succeding cutting, should not be felled (or where this is impossible the limbs taken off, or the tree girdled) until they have become suppressed

or are no longer needed. The girdling can naturally only be used in hardwoods and where it is better and cheaper than felling. Where artificial reproduction has been satisfactorily achieved the protection of trees may be removed all at one time. However, as a rule, especially on sunny slopes they should only be removed gradually in accordance with the needs of the young growth.

Thinnings.

If there is an opportunity to make thinnings at a profit light thinnings up to moderately heavy ones should be made but should be confined to the entirely or partially suppressed trees, to be intensified later but not so as to jeopardize the future shelterwood cutting.

As far as possible diseased and non-thrifty material should be removed. In all cases, care should be taken to preserve secondary stands of beech and fir in order to have trees needed for protection in the future cuttings.

Final removal cuttings and selection cuttings, since the resulting material, as a rule, cannot be logged without injury to the remaining trees, should not be attempted except on a very moderate scale and on suitable areas where they can be executed without danger to the remaining stands.

Signed,

Tegernsee, July 10, 1889.
Per Haag, *Royal Forstrat.*
Per Wild, *Royal Forstmeister.*
Per Kiechbe, *Royal Forstassessor.*

A CANADIAN FOREST SURVEY.

By James W. Sewall.

During the last winter it fell within the province of the firm of which the writer is a member to map and estimate some two hundred and thirty square miles of timber land in the Province of Quebec on the rivers à Mars, du Moulin, Cyriac and Moncouche, which enter the river Saguenay near the town of Chicoutimi, below Lake St. John. This would have been a simple piece of work were it not that the limit of time allowed for the completion thereof was between the first of February and the first of May, namely three months, which in fact coming spring shortened to about two and one-half months.

As soon as the work was definitely decided upon, an office was established at Chicoutimi, a town of some six thousand people; this office served as a draughting room, and as the headquarters for hiring and paying men as well as for a central bureau where the field crews obtained information and ordered supplies. By telephone this office was connected with the depot camps of the Chicoutimi Pulp Co. (for whom the mapping was done), these depots being by chance stragetically located for the purposes of the survey; from them the pulp company furnished supplies, thus doing away with considerable cartage. They are located on the river du Moulin and on Lac des Ilets, on the northerly end of the mapped territory.

Our field force of some forty-five men was divided into three parties, at one time augmented by a fourth party for sledding. The magnetic needle was used in all surveying, and the calipered strip system in obtaining estimates. The duties of the parties were immediately laid out, and very few variations from the first plan of campaign occurred.

Party No. 1 was a surveying crew only, on it fell the reconnaissance and boundary work of a large part of the job. Starting from the Chicoutimi Pulp Co. depot at Lac des Ilets it was hauled by team nine miles, hand sledded some eight more up the river Cyriac valley, and began its survey by running a boundary line eastward toward the river du Moulin; on reaching the du Moulin it used the stream as a base on which to haul supplies,

and continued running a watershed line about this latter river; after reaching its head it hauled across the divide into the river à Mars valley, and ran a watershed line around the head of that river. At its final point it was some forty-five miles from the depot, about thirty-five miles of which were covered by hand-sled.

Party No. 2, a surveying and estimating crew, started at the mouth of the river Moncouche, ran a stadia traverse from there to the starting point of Party No. 1 on the Cyriac, returning to the Lac des Ilets depot, shifted itself, and ran a base line twelve miles southerly from a point near said depot, thereby intersecting Party No. 1's first line; by the line it had begun its course south, certain work had already been done by Party No. 3, so that Party No. 2 could also, using its line, as fast as run, as a base, send out caliper crews east and west, and cover an allotted territory, exploring and surveying at same time. Incidentally, hauling on hand-sled was the big problem of the work, where supplies had to be kept in to rapidly moving crews far from their base. After reaching the line of Party No. 1, Party No. 2 followed up the river du Moulin, resolving itself into a calipering party entirely, covered the territory already bounded by Party No. 1, followed that part onto the à Mars shed, and covered that territory. Party No. 2 kept in connection with the base of supplies, continually pushing sled loads inland toward No. 1, so that No. 1 could send men back and draw from the caches so established; by this means a good sled beat from the Lac des Ilets depot to the farthest point surveyed, with hauling in separate average lengths, was wide and held open.

Party No. 3, also a combination line and estimating party, ran an arbitrary base line from the Lac des Ilets eastward to the river du Moulin, re-stocked at that river's depot, turned, and ran southerly to a line already established by Party No. 1, thus bounding a part of the tract it was to estimate; on the Party No. 1 line it set itself over and ran back to the first base line, estimating at the same time it made line.

After each of these parties had completed the above mentioned work they reported to the Chicoutimi office, and were turned onto the final tract, a small area nearer the village. So well did all plans work out that there was not a week's difference in the ending of the surveys of the three parties, and by massing the

men on this last area the contract was easily completed just before soft snow made traveling almost impossible.

As may be inferred the men in charge of the different parties were depended on to push ahead their respective works, without any immediate supervision of detail. The firm was enabled to do this by reason of having experienced men who were familiar with woods conditions in the State of Maine—conditions which resemble those of Quebec to a great extent. Without these efficient men in charge the speedy carrying out of the contract with any degree of exactitude would have been impossible. They enabled the writer, in general charge, to devote himself to travel among the parties, and to office work.

As before stated, hauling, that is the question of supplies, was the most difficult problem, increasing as each party got farther from its base. Five sled-men to each party were kept busy, and at times this number had to be considerably increased. The sleds used were made with spruce board sides, runners of iron, and hardwood rounds, securely bolted from side to side and from runner to top, this being the construction of the ordinary Maine moose-sled. It behooves the purchaser to look over his sleds carefully; they are subjected to hard usage, and unless well and properly built will be a source of continual vexation and delay. The dimensions of the best sleds we had were: length six feet, width sixteen inches, height six inches, width of iron runner three inches, thickness of board sides one and one-eighth inches, and rounds six inches apart. The sides must be solid, not built with standards, as bushes will catch in the open spaces, if such are left, and retard progress. A sledman, in ordinary going on a snow-shoe trail well beaten down, can haul from 150 to 200 pounds a fair day's travel. The snow-shoe trails should be well marked by bushes stuck in the snow, wherever open places subject to winds are encountered.

We adopted the short round highland snow-shoe, using lamp wick fod thongs. We found the local shoes of this type satisfactory in model but not strongly enough made for survey work. The dimensions of the average shoes are: length two feet and seven inches, and width one foot and eight inches, with close mesh. If one would have some reliable maker follow this model he would obtain an almost ideal shoe for surveying work, especially in hilly country. The trouble with the Canadian shoes was in the inferior quality of the bows.

Ordinary wall tents (without flys) of ten ounce duck were used, one for the men and one for the chief of party with his American help. As a rule the cook also stayed in this latter tent. At first a third tent for wangan was carried, but these were soon given up on account of bulk and weight. Everything possible was sacrificed to lightness and compactness, as so much moving over step long hauls had to be made.

We used the regulation box stoves, those made with a small oven for cooking purposes. So far as these latter with ovens are concerned a better arrangement is the one found in Maine, where box stoves are made with a rod across the top, on which are hung the ordinary open baker for ovens. The ovened stove has of necessity a small fire box, which is, to say the least, a nuisance on cold wet nights. With the simple box stove, pitched on six feet of snow, after the tent was well boughed down, we were warm and comfortable. Cold was not a hardship to be reckoned with, outside of a nipped nose or ear now and then.

Sleeping bags are not so satisfactory as the ordinary lumberman's spread, and are much more expensive. Mr. Lyford, of the Riordan Paper Co., informs me that he uses down robes with gratifying results. These latter are expensive, but would be recommended for the heads of party and their chief assistants. The native help in our district furnished their own blankets.

Our provision list has been reduced to the following statement, per man, per week. It is based on about 6,000 meals, and we think is fairly reliable for winter work, when meat can be taken and kept indefinitely by freezing.

Dried Apples	.45	pounds	Onions	.27	pounds
Allspice	.001	"	Oatmeal	.10	"
Baking powder	.18	"	Pepper	.02	"
Beef (fresh)	5.32	"	Prunes	.48	"
Beans	1.82	"	Potatoes	3.64	"
Corn meal	.14	"	Peas	.59	"
Cheese	.95	"	Pork (salt)	1.30	"
Cream o' Tartar	.06	"	Pork (fresh)	2.75	"
Cassia	.003	"	Pickles	.02	gallons
Candles	.76	"	Rice	.12	pounds
Flour	4.85	"	Raisins	.24	"
Ginger	.007	"	Soda	.07	"
Hardbread	1.78	"	Salt	.36	"
Kerosene oil	.01	gallons	Sugar	2.13	"
Lard	.65	pounds	Soap	.19	bars
Mustard	.015	"	Tea	.17	pounds
Molasses	.10	gallons	Bread (frozen)	1.25	"
Matches	.03	gross			

All payments were made from the Chicoutimi office, no time or supply bill being honored unless countersigned by a chief of party. For time slips a printed, non-negotiable form, showing the payee's name, time, and amount due less credits was used; this at the same time constituted a receipt to be signed by the payee. Inventory and requisition sheets were furnished the men in charge, on which they listed all supplies and outfit taken, received or returned. By this method a fairly accurate check was obtained on purchases. Moreover a ledger account of articles against each crew was possible, whereby the Chicoutimi office was enabled to locate and tell the number of all articles in the field; credit was given on this account as articles were returned, and if not returned the articles were charged against the loser.

The magnetic needle answered our purpose well (barring scattered local attraction) for the surveys. We found the most expeditious method of making traverses to be with transit and stadia, employing two rodmen.

While the strip system of estimating gave satisfactory results, we should recommend hereafter the evenly distributed sample plat, as being less cumbersome, allowing more time for looking up bunches of timber and topographical details, and permitting less opportunity for errors in acreage measured. In our strips we used the ordinary four men crew, taking topography at the same time as estimates. The aneroid barometer, checked by level lines, gave the contours, a fifty foot interval being employed.

Naturally with a new country, a comparatively large crew, and necessary haste in the completion of the work, a certain amount of waste, both in effort and expenditure was made. The survey, as a whole, confirmed and taught several things, namely:

(1) Experienced men to take charge of all field parties, on a survey covering large areas, where immediate supervision cannot be had, are an absolute necessity.

(2) The smaller the crew and the longer the time taken, the better and cheaper will be the work.

(3). Country far from the base of supplies, especially where canoeable streams are few, will best be attacked in winter.

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*The men who had charge of the three parties of this survey were K. McR. Clark, of Boston, Mass., James A. Conners, of Old Town, Me., and O. A. Wakefield, of Andover, Me. L. J. Freedman, of Houlton, Me., handled the office.

(4) Transportation of supplies is the great problem; a native boss sledman can obtain the best results from the haulers, but he must be trustworthy and interested in the work.

(5) The sample plot is preferable to the strip system in mapping and estimating large uncontrolled areas.

(6) A definite head of affairs with final authority must be within easy reach, to decide changes in plans, and direct the general course of the work.

THE BILTMORE STICK AND ITS USE ON NATIONAL FORESTS.

By A. G. Jackson.

Every forester has felt the need of a simple and portable diameter measure. Calipers, which are widely used and give good results, are awkward instruments to carry in the timber. They become coated with pitch, or swelled when used in the wet, so their manipulation is difficult and unsatisfactory. The use of calipers large enough to measure the trees of the Pacific coast forest of Douglas fir, western red cedar and sugar pine, not to mention the big sequoias, is impractical, to say the least. However, for use on trees in sample plots and wherever close accuracy for individual trees is more important than speed or convenience, calipers will always be in demand. For cruising and reconnaissance work their use will be limited to forests where the trees are of a diameter permitting the use of small sized calipers. Even in such forests a lighter and handier instrument will eventually displace them.

The diameter tape comes in for some use in measuring occasional trees, especially those too large for the ordinary calipers, but it is too slow ever to be generally used in cruising, Its results are usually too large due to its passing over local irregularities of bark and the tendency to depart from a true horizontal in passing around the tree trunk.

After trying both calipers and diameter tape, the forester realizes that something better is necessary for general practical use. In the summer of 1908, the writer's attention was called to the Biltmore stick by Supervisor Kirkland of the Snoqualmie National Forest, who furnished him the tracing of a scale to be used on a stick for measuring diameters. How this scale was constructed, whether from diagrams or by use of mathematical formula, was not known. Neither was the proper arm length noted on the scale. An arm length of twenty-six inches was tried and a stick bearing this scale used in reconnaissance work on the Snoqualmie National Forest during the field seasons of 1908 and 1909, giving fairly satisfactory results and proving the advantages

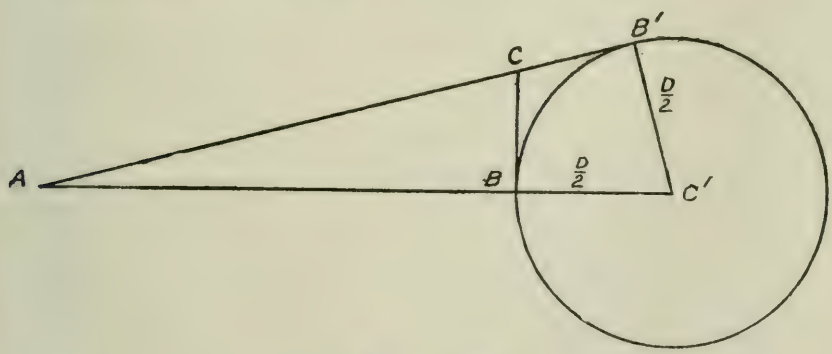
of such an instrument over calipers and diameter tape in this kind of work.

As the name indicates, the Biltmore stick idea undoubtedly had its origin at the Biltmore School of Forestry. Dr. Schenck mentions it in his "Forest Mensuration" but gives no description or explanation of its construction.

Knowing of no published explanation of how the above mentioned scale was constructed and used, and believing that such an explanation would be of interest to the profession, the writer determined: (1) To derive a formula which might be used to construct an accurate scale, (2) to use this formula in the construction of such a scale, (3) to check up this scale for various diameters by comparing its readings in actual field work with caliper readings, and (4) to write an account of this investigation.

The problem resolved itself to this proposition: To derive a formula for a scale which applied tangentially to a circle at a fixed distance from the observer will give the diameter of the circle.

Assuming 25 inches as the fixed distance from the observer and applying the geometrical principle of similar triangles having proportional sides, we have



$$\frac{AB}{BC} = \frac{AB^1}{B^1C^1}$$

$$AB = 25 \text{ inches, and } B^1C^1 = \frac{\text{Diameter, or D}}{2}$$

Substituting these values

$$\frac{25}{BC} = \frac{AB^1}{\frac{D}{2}}, \frac{25D}{2} = AB^1 \times BC, \text{ and}$$

$$(1) \quad BC = \frac{\frac{25D}{2}}{AB^1}$$

$$(AB^1)^2 = (AC^1)^2 - (B^1C^1)^2$$

By substitution,

$$(AB^1)^2 = (25 + \frac{D}{2})^2 - (\frac{D}{2})^2 = (25)^2 + 25D = 25\ (25+D),$$

$$(11) \quad AB^1 = \sqrt{25\ (25+D)}$$

Substituting this value for AB^1 in equation (1)

$$BC = \frac{\frac{25D}{2}}{\sqrt{25\ (25+D)}}$$

Since BC is the scale for $\frac{1}{2}$ of the diameter of the circle, the formula for the scale for the whole circle is

$$\text{Scale} = \frac{25D}{\sqrt{25\ (25 \times D)}}$$

If it is more convenient to use a different arm length than 25 inches, this formula may be adapted by substituting the length desired for the 25 wherever that number occurs in the formula.

Using this formula for diameters of 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 inches, scale lengths for these respective diameters were obtained. Points representing these lengths were plotted on cross section paper where the abscissae represented inches in diameter and the ordinates represented inches on the scale. Through these points a smooth curve was drawn. From this curve the scale was read for each even diameter from ten inches to one hundred inches. This scale was then laid off and carefully drawn on tracing linen. Strips an inch wide were cut lengthwise of this tracing thus producing the scale in a convenient form for carrying or mailing.

If it is desirable to indicate diameters smaller than ten inches or larger than one hundred inches they may be derived directly from the formula and marked on the scale.

A check was made on the accuracy of the formula by construct-

ing diagrams for several diameters and applying the scale for these diameters.

For actual use a straight stick four and one-half feet long, an inch wide and three-fourths of an inch thick with a slight bevel on one side should be selected and the scale marked or burned upon it so that the graduations occur on the bevel edge. The stick should be capped or shod at each end with a light metal ferule to prevent wear. The stick length, four and a half feet, may be used to check the breast height point on the trees measured. The twenty-five inch point should be marked on the back of the stick so the user may check up his arm length occasionally.

To use this stick the observer holds it horizontally against the tree four and a half feet from the ground and twenty-five inches from his eye which should be at the same level as the stick itself. The zero end of the stick should lie in the line from his eye to one outer edge of the tree. Then, turning his eye, the observer should note where the line of sight between his eye and the other edge of the tree crosses the scale. The reading on the scale at this point gives the diameter of the tree.

When the diameters of only a few trees are to be taken, the tracing scale may be attached to a suitable stick with thumb tacks and the readings made without taking the trouble to mark the scale on the stick itself.

The writer made a Biltmore stick out of white oak according to these specifications except that the ends were not shod and the stick itself was only four feet long. The gradations and figures were burned on the stick with a pyrographic needle after which the instrument was coated with shellac.

To test the accuracy of this stick the writer with two assistants, one equipped with the Biltmore stick and the other with sixty inch calipers, examined 975 trees of four different species in the cedar-fir-hemlock forest near Berlin, Wash. The diameter of each tree was taken at the same point with the stick and with the calipers, the stick man calling his reading first. These diameters ranged from ten to sixty inches. The average diameter for the 975 trees was 28.56 inches measured with the calipers, and 28.66 inches measured with the Biltmore stick thus giving an average difference of only one-tenth of an inch.

Both regular and irregular trees were measured just as they occurred in the stand. Fifty-nine of these measurements were

taken on windfalls and other down timber. On these the stick readings checked as closely with the caliper reading as on the standing trees.

The following table gives the number of trees and total diameter inches of each species, and shows the very slight discrepancy between the two instruments by species and for all four species.

TABLE SHOWING COMPARATIVE MEASUREMENTS OF 975 TREES WITH BILTMORE STICK AND CALIPERS.

Species	Number of Trees Down.	Standing. Reg.	Standing. Irreg.	Total.	Total Diam. In. Bilt. Stick	Total Diam. In. Calipers	Total Difference	Average Difference
Douglas Fir *(Pseudotsuga taxifolia)*	26	210	24	260	9481	9520	—39	—.15
Western Red Cedar *(Thuja plicata)* ...	22	112	21	155	2474	2510	—36	—.23
Western Hemlock *(Tsuga heterophylla)*	11	298	49	358	10555	10452	+103	+.28
Amabilis Fir *(Abies amabilis)*		194	8	202	5443	5369	+74	+.31
Total four species ..	59	814	102	975	27953	27851	+102	+.1

In 1910 the Forest Service had a small quantity of Biltmore sticks made bearing this scale. During the field season of that year these sticks were used on the Crater, Olympic, Snoqualmie and Umpqua National Forests in intensive reconnaissance work and met with great favor as convenient and practical instruments.

Tests of the Biltmore stick made on the Crater, Olympic and Umpqua Forests gave the following results:

Crater National Forest; data furnished by Mr. H. D. Foster. One hundred trees ranging from ten to sixty-four inches in diameter were measured with Biltmore stick, calipers and diameter tape.

Olympic National Forest; data furnished by Mr. W. H. Gibbons. One hundred and eighty trees ranging from ten to fifty inches in diameter were measured with Biltmore stick and calipers.

The following table shows the results of these tests, which, to be sure, are not very conclusive owing to the small number of trees measured in each case, but at least indicate the Biltmore stick's practical value as a field instrument. The data secured on the Snoqualmie National Forest is repeated for the purpose of comparison.

TABLE OF COMPARATIVE MEASUREMENTS WITH BILTMORE STICK, CALIPERS AND DIAMETER TAPE.

Forest	*No. of Trees*	*Total Stick*	*Diam. Cal.*	*Inches Tape*	*Total Dif. Stick & Cal.*	*Ave. Dif. Stick & Cal.*	*Total Dif. Stick & Tape*	*Ave. Dif. Stick & Tape*
Crater	100	2915	2820	2881	95	.95	34	.34
Olympic	180	5300	5276		24	.13		
Snoqualmie ..	975	27953	27851		102	.1		

On the Umpqua Forest no test was made in which a large number of trees were measured with both the calipers and Biltmore stick. However, a number of tests made to check the accuracy of the work showed that measurements made with the Biltmore stick of diameters up to about 42 inches fall within the same inch class as those made with calipers. Above this diameter, measurements would fall within the same two-inch class. This data was furnished by Mr. E. H. MacDaniels who also says, speaking of the Biltmore stick: "This instrument is thoroughly practicable. An average man can work with a degree of precision in keeping with the object of an ordinary timber estimate, and its convenience makes it a very desirable substitute for calipers."

Errors in using the Biltmore stick are due to irregularly shaped trees. The more nearly the bole in cross section approaches a circle the more accurate will be the Biltmore stick readings. This is also true when calipers are used. A varying arm length causes erroneous readings. Errors may be caused by the stick not being straight or by the observer holding it against the tree in some position other than horizontal. Turning the head instead of the eye while making the reading, or having the eye too high or too low are other sources of error. However with care these errors may be practically eliminated and the stick will prove an extremely convenient instrument which will give very satisfactory results. Its convenience and accuracy should bring it into general use wherever careful cruising is being done.

A METHOD OF ASSESSING FIRE DAMAGES IN THE SOUTHWEST.

By Robert Rogers and Barrington Moore.

The methods of assessing forest fire damage which have so far been employed in the West have, from a technical standpoint, been far from satisfactory. It is not the intention here to go into a discussion of past methods or the principles of this important subject, but rather to present a detailed statement of a suggested method for finding the value of forest products destroyed by fire in the Southwest. This method has been devised by the writers in connection with their work in District III of the U. S. Forest Service, and is published here purely as a personal article, not with the claim that it is an entirely satisfactory method, but rather in the hope that it may constitute a progressive step which will not only serve in practical application, but also in securing recognition in the courts of the inherent forestry principles involved, in the valuation of the forest as a growing crop. It will have served a purpose if it starts at least discussion of this important subject.

We are badly hampered to-day, of course, on account of the lack of silvical data, and this fact has influenced the shaping of the plan herewith presented. The aim has been to take the data available, and secure a method embodying forest principles capable of application. The interest rate used, it is felt, should conform as nearly as possible to the interest rate of the locality. However, if the principles are accepted the adjustment of the interest rate is a minor consideration.

It will be noted that an estimate of an increase of 100% in the stumpage rates at the end of a twenty year period has been used. It will be agreed, we believe, that in valuations of this character it is only right that a certain increase should be considered. Just what this increase should be in each case should be determined by a careful study of the particular region concerned. The whole subject of estimated future increase in stumpage cannot be properly considered in the space at command here. Suffice it to say that considering an average valuation of $3.00 per M. ft.

B. M. for the timber of the region for which this method of valuation has been devised an estimated increase of 100% at the end of 20 years is considered thoroughly conservative.* That this increase will occur uniformly throughout the period is not to be expected. Granted, however, that the increase of 100% does occur at the end of 20 years it can be reasonably assumed for the purpose of valuation that the increase will amount to 25% for each 5-year division of the period. The following figures have accordingly been used.

ESTIMATED INCREASE IN STUMPAGE.

Period.	*Per cent. increase in stumpage of rate charged in 1911.*
1912-17	25
1917-22	50
1922-27	75
1927-32	100

The Classification of Products Destroyed by the fire will fall naturally under four headings:

1. Merchantable timber (all trees above 12″ D. B. H.).

2. Pole stand (all trees between 6″ and 12″ D. B. H.). These will form the basis of future cuts for the next 10 years.

3. Reproduction (both seedlings and saplings, i. e. everything up to 6″ D. B. H.).

4. Forage; the actual amount of grass on the area.

The *Method of Estimating* must, to a certain extent, vary with the topographic conditions; but the following points should be strictly adhered to:

1. All four classes of damage can be estimated at once, but a separate tally must be kept for each.

2. Estimating should be done by strips rather than by sample acres, either circular or square. Single acres may be taken if in strip form not more than two chains wide; one chain wide is preferable.

3. The strips should be run through the burn in such a way that their result will give as near the average conditions of the burn as possible.

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*The value of stumpage at the end of 20 years in District III, U. S. F. S. has been estimated at $6 per M. ft. B. M. by T. S. Woolsey, Jr.

4. Obtain the area of the burn as accurately as possible. A suggestion would be to find the average length and average width by means of strips run at right angles through the length and breadth, respectively, of the burn.

Find the proportion of the total area represented by the strips and multiply this proportion by the total area: e. g. with an area of 120 acres, strips aggregating 15 acres represent 1/8 or 12.5% of the total; therefore, multiply the totals obtained from the strips by 8.

The estimate of damage to the merchantable timber, poles, and reproduction, should not be made until at least four months after the fire, since then the trees which will live or die can be distinguished with a greater degree of accuracy.

The area for estimating the amount of damage to the forage should be determined at the time the fire is extinguished.

In cases which may be brought into court, great care should be taken in making the estimate so that the amount of damage will be the actual loss suffered.

For the sake of clearness and simplicity, a single, specific case of 500 acres, yellow pine forest on which everything, mature timber, poles, reproduction, and forage, have been destroyed by fire, will be taken as an example.

The are contained before the fire: 1,500,000 feet of merchantable timber, 10,000 poles, 250 acres of good reproduction, and 250 acres of scattered reproduction, or a total of 300 acres* fully stocked with reproduction; and sufficient forage for 50 head of cattle for one year.

1. *Value of Merchantable Timber:* The area contained before the fire 3 M. ft. B. M. of merchantable timber per acre, or 1,500,000 feet. All this has been destroyed. The practice in this country has heretofore been to consider the present stumpage value of the timber destroyed as the loss incurred. This ignores two factors: First, that the timber is generally inaccessible at present; and, second, when it does become accessible stumpage rates will have risen. Ignoring these two factors generally results in giving too high a value to the timber lost. Taking these two facts into consideration, a more correct present value will be found, as follows:

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*See page 416.

(a) Determine as near as possible the length of time within which the timber upon the burned area could have been sold. In deciding upon this figure it will be necessary to depend upon the reconnaissance maps of the Forest and upon the judgment of the Supervisor. A minimum figure within the nearest five years should be used. For example: If the timber is at present inaccessible but there is some possibility that the country will open up in the future, it would be justifiable to say that the timber will not be sold for 15 years at least, perhaps not that soon, and use 15 years as the basis.

(b) Find the rise in stumpage value, from the accompanying table,* for the period above decided upon, and add this to the present stumpage value. Then multiply the volume destroyed by the increased stumpage price to find the value of the timber at the time when it would have been sold. The present stumpage price will vary on each part of each Forest, according to quality of timber and logging conditions. This basis can generally be determined from reconnaissance maps.

(c) Discount the value thus obtained for the period decided upon under (b) to the present by multiplying by the proper factor from a discount table. This will give the true future value, discounted to the present at 5%, compound interest, a conservative rate of interest. Since this result takes into consideration a minimum rate of stumpage, and a reasonable time within which it could be sold, it represents more nearly the actual present value of the timber.

Example: 1,500 M. of merchantable timber destroyed; 15 years is minimum time before a sale is possible; 75% is rise of stumpage in 15 years; $2.00 per M. is present value of stumpage on that part of Forest burned over; hence $2.00×1,500 M.= $3,000, present stumpage value of timber destroyed; $3.50 per M. =value of stumpage in 15 years; to discount $5,250, 15 years to the present at 5% we multiply by .481; $5,250×.481=$2,525.25 is the present (or expectation) value of the timber destroyed.

From the above it will be seen that, even though we allow for a rise in stumpage of 75%, the present value of timber which cannot be cut for 15 years, found by the above method, is considerably below the present stumpage value.

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*See page 413.

2. *Value of Poles Destroyed:* The value of the poles is the value of the merchantable timber which they will make discounted for a period equal to the difference between 75 years (the average age of a 12″ tree)* and the average age of the poles at the time of the fire. This does not allow for the death of suppressed poles because the openness of a yellow pine stand is such that but few poles die of suppression. Where the stand is dense the suppressed pole can be counted out in the estimate. The average of these poles can be found by getting an average diameter and looking up this diameter in the growth table.

The stumpage value should be the stumpage value of that part of the forest on which the burn is located, increased by the per cent. given for the number of years between the average age of the stand and 75. (See page 413.)

These poles form the basis of future cuts for the next 100 years, and, if the data were available we should figure the expectancy value of the pole stand for each felling period e. g., 30, 60, 90, 120, years, etc.†

But since such data are not available, the above method, of which the following example is given, is used for simplicity:

Example: 10,000 poles destroyed; volume of a 12″ tree equals 70 board feet (Woolsey's tables); volume of 10,000 poles equals 700 M. Board feet; average diameter of poles equals 9″; average age of poles equals 55; 20 years is time required for poles to become merchantable; $2.00 increased 100% equals $4.00 the stumpage price in 20 years; 700×$4.00 equals $2,800, the value of the poles in 20 years; to discount $2,800 for 20 years to the present at 5% multiply by .377; $2,800×.377 equals $1,055.60 the present value of the poles destroyed.

3. *Value of Reproduction Destroyed:* Determine the actual area of forest fully stocked with reproduction which has been burned over. Add to this the area of scattered reproduction reduced to acres fully stocked. The result will be the actual number of acres fully stocked with reproduction which have been burned over.

Multiply the number of acres of fully stocked reproduction by 4,300 feet, the average volume on a fully stocked acre 75 years

*From an average of growth tables collected by Mr. T. S. Woolsey, Jr.

†This presupposes the group selection system, the one adapted to Western Yellow Pine.

old, the age at which the stand becomes merchantable.* The fully stocked instead of the average acre must be taken because the reproduction destroyed has been reduced to terms of fully stocked acres. The result will be the volume which the reproduction destroyed would have produced at 75 years.

Increase the present stumpage price for the region of the burn by the per cent. given for 20 years;** multiply this price by the total value found above; find the average age of the reproduction destroyed, and deduct from 75; discount the total value of the stumpage found above for the difference between 75 and the age of the reproduction at the time of the fire, to get the expectation value of the reproduction when burned.

Example: 250 acres of forest fully stocked with reproduction burned; 250 acres of forest with scattering reproduction equivalent to 50 acres of fully stocked reproduction burned; 300 acres is actual number of acres fully stocked with reproduction that have been burned; 4,300 feet per acre is the average merchantable volume on a fully stocked acre 75 years old.

4,300×300=1,290,000=total volume which the reproduction destroyed would have produced at 75 years; $2.00=the present stumpage of the region; $4.00=the present stumpage price increased by 100%, the per cent. given for 20 years.

$4.00×1,290 M.=$5,160.00 total value of reproduction at 75 years; 15 years=average age of reproduction; 75—15=60 is the period for which to discount the value of the reproduction; .0535=the factor for 60 years at 5% compound interest; $5,160.00×.0535=$276.06, the present value of the reproduction destroyed.

4. *Value of Forage Destroyed:* (1) Determine as nearly as practicable the total number of acres of range burned over and the number of months during which time forage on this area is lost. Ordinarily in the Southwest grass may be considered to replace itself within one month after the start of the summer rains.

(2). Determine from standards which are based upon adopted

*From Mr. T. S. Woolsey, Jr.'s tables on fully stocked Black Jack stand based on two 5-acre plots on the Datil National Forest on soils of moderate fertility.

**Though the period will be greater than 20 years it is considered unsafe to predict even a minimum rise of stumpage for periods longer than 20 years.

standards of the locality the average carrying capacity before the fire of the range burned over. Express this in terms of the number of acres which it will take to support one animal for one year.

(3). Divide the total number of acres of range burned by the carrying capacity factor determined under (2). This gives the total number of head which the range area previous to the burn would have carried for one year or its fully carrying capacity. If the period for which the forage is lost is less than one year determine the carrying capacity of the area for the period for which the forage is lost. This is obtained by multiplying the total number of head which the area would ordinarily carry for one year by $\frac{12}{x}$ where x equals the number of months for which the forage is lost.

(4). Based upon the prices paid by stockmen for the use of private lands and for permits on the Indian Reservations, $1.50 per head per annum for cattle and horses, and 30 cents per head per annum for sheep and goats, is a fair estimate of the actual value of the forage. Where the forage is lost for a period of less than a year, as will generally be the case, it is suggested that the monthly rate be determined under the general rule for fixing the rate for short grazing periods, adopted by the U. S. Forest Service, which means that where the forage is lost for a period of more than four months and less than one year, the charge will be at the rate of 15 cents per month on cattle and horses or 3 cents per month on sheep and goats, with an addition of 20 per cent. for periods of from one to four months. All periods of less than a year should be expressed in terms of whole months.

(5). Multiply the total number of head which could have grazed on the area during the period for which the forage was lost by the monthly rate per head as determined in accordance with the provision of (4). This gives the total value of the forage destroyed.

Example of Valuation of Damage to Cattle Ranges: Area of range burned equals 500 acres; carrying capacity of area at the rate of 10 acres to 1 head equals 50 head; forage is lost for a period of 3 months; carrying capacity of range for period for which forage is lost is equivalent to $50 \times \frac{12}{3}$ equals 200 head, i. e., feed for 200 head 3 months has been destroyed.

The rate charged for periods of 3 months for cattle is 3×15c. equals 45c. which is further increased 20% since the period is less than 4 months to 54 cents.

The valuation of the forage lost is then 200×$.54 equals $108.

The total valuation of the damage to the forest products on the 500 acre burn is thus:

1. Damage to merchantable stand,	$2,525 25
2. Damage to pole stand,	1,055 60
3. Damage to reproduction,	276 06
4. Damage to forage,	108 00
	$3,964 91

RESULTS OF "LIGHT BURNING" NEAR NEVADA CITY, CALIFORNIA.

By M. B. Pratt.

It is a common practice for ranchers living in the vicinity of Nevada City to burn over their wood lands in the spring, generally in early April. They contend that the burning does not damage the timber to any extent and affords protection against fires in the dry season. The land burned over is stocked with second growth yellow pine of very rapid growth, with here and there a large tree of the original virgin stand.

On the afternoon of April 4, 1911, a rancher living about two miles from Nevada City was burning brush along the creek in front of his house. There was a brisk wind blowing and the fire spread in the dry needles of the wooded slope bordering the creek. According to the rancher's statement, it would have been a very easy matter to put out the fire, but as long as it was started, he thought he might as well let it run and burn off the litter and underbrush. With the assistance of the man helping him burn brush he spread the fire along the lower edge of the slope. The wind carried it at a rapid rate through the ground cover and litter which was drier than usual at this time of the year on account of the unusual warm weather of the preceding two weeks.

The fire burned up the slope to the top, where it burned fiercely in manzanita brush and a thick clump of yellow pine.

Since there was some wood cut a short distance beyond, the rancher and his man stopped the fire at night-fall when it had died down considerably, by scraping away the needles from a narrow trail along the upper part of the slope. He stated that it probably would have gone out of its own accord.

This burn came to my attention as I was passing along the road on account of the number of burned young trees. The condition of the stand seemed to denote that the fire was accidental rather than by design since it hardly seemed possible that the owner would deliberately let fire burn up so much young growth. Upon being questioned, however, this gentleman stated that he con-

sidered conditions after the fire very satisfactory and that the young timber killed did not amount to much as it was too thick anyway. His contention was that the timber left will now grow better and that he will have more in the long run than before the fire. He stated that the area had not been burned over for 20 years at least.

To show the results of this so-called beneficent light-burning, a sample ¼ acre plot was taken in a clump of young trees averaging 50 feet in height and 40 years of age which fairly represents conditions on the 15 acres burned over.

Results of burning on ¼ acre plot of yellow pine: (a) The ground litter of pine needles was partially consumed. (b) There was no chapparal on the ground. (c) Effect on tree reproduction by age classes:

	Alive	*Dead*
Class I—1 to 5 years	..	..
Class II—5 to 10 years	1	23
Class III—10 to 20 years	28	46
Class IV—20 to 40 years	59	24
Class V—over 40 years	..	..

This count on this plot shows that all of the growth up to 10 years of age, three-fifths of the growth from 10 to 20 years of age, and two-sevenths of the growth from 20 to 40 years of age was killed. Seedlings younger than five years of age were absent on this plot owing to the density of the stand. Observations on other parts of the burned area, however, showed that all of this age class had been killed.

The average diameter of the class from 20 to 40 years of age was about 10 inches. Many of the poles killed in Class III were over-topped and would eventually have died out.

The fire burned the hardest where there was manzanita brush. In one place a yellow pine tree 40 inches in diameter and 115 feet high, which was surrounded by this brush, was killed. The flames had run up the bark which was pitchy to the very top of the tree.

The stand of poles and old trees before the burning averaged about 8,000 board feet per acre. Practically one-third of this amount was killed as well as the majority of the young growth

up to 20 years of age. A few sugar pines 30 to 40 feet in height were killed, the trees burning like torches.

If the young growth had not been killed, it would have developed into a merchantable pole and cordwood stand in about 20 years. Cordwood is being cut from timber up to 20 inches in diameter on an adjoining tract. After the second crop had been removed, it would have taken fifty years for the third crop to develop since the nucleus for that crop was badly lacking. The second crop would yield about 10 cords or 5,000 board feet to the acre in 20 years and the third crop that amount after fifty years.

This burn has affected the second crop of timber by destroying trees that would have been ready for the ax in a few years after the largest trees had been cut out. The third crop is about totally ruined, and it will take at least five years to get any kind of a beginning of the fourth crop.

The burning has not furnished the older trees a protection against fire since the brush will soon sprout again and come in denser than ever as a result of the fire. The dead needles resulting from this fire will fall and the foundation laid for a hotter fire than ever.

Last year a piece of light burning near this tract came to my attention. It was an ideal fire from the light burner's standpoint, burning slowly along in the pine needles and tar-weed. Of course it burned up the tender seedlings since the tar-weed makes a hot, pitchy fire, but it did very little damage to the clumps of young growth from 10 to 12 feet high or the older trees. This spring I looked over this piece and found it covered with a thick layer of pine needles. The tar-weed was all coming back and the conditions for figures were just as dangerous, if not worse, than last year. This piece will doubtless be burned over again and again and the condition reached such as is found in the vicinity of Camptonville where there are stands of large yellow pine trees under which there is very little reproduction on account of the dense carpet of tar-weed which has developed as a result of repeated burnings.

This light burning was done in the vicinity of the Rock Creek fire last summer which burned about 250 acres of second growth timber and brush land. The land it burned over had been repeatedly light-burned but the results attained interposed no barrier to the progress of the crown fire of last summer.

NOMENCLATURE OF DIVISIONS OF AREA IN WORKING PLANS.

By Barrington Moore.

There has been little time for the consideration of working plans in America. Not only educating men for the profession, so new in this country, and bringing the public to an appreciation of the aims of the profession, but also the gathering of fundamental data on which to build the practice of the profession have absorbed the efforts of foresters. Progress has, however, been astonishingly rapid, and we are now in a position to begin to apply this education and accumulated data to the management of our forests.

An article dealing very generally with working plans was contributed by the author to the last number of the Proceedings of the Society of American Foresters (Vol. VI, No. 2). Much space was spent discussing the necessity of dividing the area into working circles and of making separate working plans for separate forests and parts of forests; it was therefore impossible, in necessarily narrowed limits, to give as much space as desired to a clear cut definition of the basis of each division of the area required in working plans.

The first point to settle is the scientific designation of the divisions to be made; the second and most important, to determine the fundamental principles on which the divisions shall be based.

In the following definitions the term "working circle" will be used to designate any area from which it is possible to obtain a sustained yield. Although there has been some discussion as to the advisability of the term, it has been commonly accepted and is generally used by the English, the only people speaking our language and practising forestry; for it conveys the proper meaning clearly and concisely, the word "working" implying a utilization and development of the forest, and the word "circle" conveying the idea that the working is done according to a "rotation" or "cycle of years" which will bring you back to the same starting point and thereby insure an indefinite use of the forest

resources. Some foresters have, however, expressed a dislike for the term and have attempted to substitute the term "working unit." Some of these, however, admit that they do not know a reason for their dislike: "perhaps it is because of the foreign origin of the term," one suggested, but this is manifestly not an argument at all. Others fear that the word "circle" may give the idea of a circular area. But certainly those who advocate the term "working unit" can not claim that it conveys the idea any better if as well as does "working circle." The word unit expresses so many divisions both of land and material inside and outside of the profession that its use here must be carefully defined and restricted: and also it must be universally accepted before we dare hope to escape confusion. Are we then going to beat about the proverbial bush merely to avoid a really excellent term used by people whose language is ours, and who for many years have practised a very effective and highly developed kind of forestry?

The word "block" for the subdivisions of the working circle, and "compartment" for the subdivisions of the "block" are so clear and expressive that there should be but little question of their general acceptance.

The principles on which divisions of the area in working plans should be based are the following:

Division into working circles. The basis for this division is: geographic situation, markets, and ability to produce sustained yield; the boundaries will generally, but not always (e. g. not in flat country), be topographic. That is, two distinct parts of a forest, capable of producing a sustained yield, tributary to different markets, and possibly separated by distinct topographic boundaries, will form different working circles. A working circle thus formed should be called a "Division" and given a suitable local name, e. g. "the Bear River Division of the Olympic National Forest" or "the Crystal Lake Division of the New York Forest."

As the management become sufficiently intensive, forest types, silvicultural systems and product may also form a basis for working circles; thus in a coniferous working circle managed under the shelterwood compartment system for a sustained yield of saw-timber, there may be certain areas of hardwoods or of inferior coniferous species which, under a different silvicultural

system, would give a sustained yield of cordwood or mining timbers. In this case, as soon as the management prescribes a separate silvicultural system and separate regulation of the cut for part of the already existing working circle, a new working circle is formed. The new working circle should, however, not be called a Division, but be named after its product, e. g. "the mining timber working circle of the Bear River Division" or the cordwood working circle of the Crystal Lake Division.

Where two distinct working circles are tributary to markets which do not require sustained yield—as, for example, export markets,—the working plan may be simplified by combining the two Divisions, at least in so far as the regulation of the cut is concerned. When, however, one or both begin to need sustained yield, a separate regulation must be made for each.

Division of the Working Circles into Blocks. This division is made to assist in regulating the cut, and should be on the basis of logging units or groups of logging units, the boundaries depending entirely upon topography. The Block should receive a suitable local name, generally taken from the watershed of the stream which it covers.

Division into Compartments. The basis will be a single logging unit or year's cut. The designation should generally be by means of numbers. This division need be made only in the more intensive working plans.

There can not be too much emphasis laid on the importance of deciding upon these divisions of the area, both during the progress of the field work and in drawing up the working plan. There should be a complete knowledge of such matters as present market conditions, lines of transportation, outlets for the timber and the probable changes and developments in all three. Changes of divisions once decided upon, except in the inacessible parts of a forest may involve a complete overhauling of the working plan and cause much confusion. Because of this, if changes in market conditions, transportation systems, or outlets are liable to occur and can be foreseen, it is well to provide for them in the working plan. This may sometimes require a separate regulation of the cut with a different annual yield for two possible contingencies. For example, given an area at present tributary to a certain market; this area now forms a working circle. But there is a possibility of a railroad being

built in such a way as to pass by this area on the side furthest from its present market. Manifestly, certain logging units of this present working circle will then become tributary to the railroad. In this supposed case it should be possible *now* to foresee with greater or less exactitude those larger logging units which will become tributary to the future railroad. Hence the regulations of cut should be drawn up *now* for the entire working circle tributary to the present market, and also for the working circle minus the logging units which will be cut off by the possible railroad.

Inaccessible areas will frequently cause difficulty in making working plans. For it will be possible on many forests to cover only the accessible portions with a reconnaissance sufficiently thorough to obtain detailed data; while the only information with regard to the inaccessible areas will be very rough estimates and crude, often inaccurate maps. But in drawing up the working plan resulting from this reconnaissance the inaccessible areas should also be included. Each inaccessible part of the forest should be placed in its proper working circle according to its geographical situation and the market to which it is tributary; inaccessible areas should not be allotted haphazard to various working circles. The plan can, therefore, provide for the accessible part of the working circle in detail, and outline a rough policy from the best available estimates, maps and silvicultural information, for the inaccessible part. For example, if the inaccessible portion of the working circle is 80 per cent. of the total working circle i. e. (contains 80 per cent. of the timber), and the rotation is one hundred years, and further if it is probable that the inaccessible timber will commence to be opened up within at most twenty years, the present working plan could provide in detail for the cut during the next twenty years and give a rough outline of policy for the remaining eighty years. Within ten or twenty years it will undoubtedly be necessary to revise the plan (revisions are generally made every ten years in Germany), and it will then be possible to secure detailed data on at least a part of what is now inaccessible.

In making his divisions of the forest for purposes of regulating the cut the working plans officer should always consider administrative divisions (ranger districts), fire protective units, and grazing units, and should make a very strong effort to co-

ordinate as far as conditions will allow these divisions with his working circles, blocks and compartments. But he should by no means sacrifice working circles and blocks too much for the sake of administrative units because, as forests are developed, and as more men become available, these uits are liable to undergo changes.

The ideas herein expressed are more or less in the nature of suggestions and are open to crticism. Criticism in fact is earnestly desired, for it is obvious that only through an interchange of mature thought and the most free discussion can progress be made.

We are glad to see discussion on these formal and yet technically important matters of nomenclature taken up anew which have been left untouched since the appearance of the Forestry Bureau Bulletin No. 61, six years ago, and the review of it in the FORESTRY QUARTERLY, Volume III, which we think will bear re-reading by would-be terminologists.

We hope Mr. Moore's call for criticism may be heeded for it is useful early to establish an acceptable terminology as it is difficult to eradicate poor terms once in the world. To contribute towards this end we would refer to what we said in that review regarding terms in general and accentuate especially the desirability of term quality in the words selected. While the existence and use of a term in the literature of another nation, especially of the same language, is strong argument for its retention, it is still open to question whether a change is not desirable. In the end, we must admit also the use of synonyms, for, after all, language is partly a matter of taste and only partly of rule. As stated in the review referred to, the English of the Britons appears to us often unfortunate and cumbersome from the standpoint of term quality.

We side with those who object to the use of 'working circle,' not, of course, because it is English, but because it is not very expressive. The explanation of the word circle as referring to rotation seems to us fanciful, probably a mere area managed from one center suggesting the term. We do not know, but suspect, that it is a translation by the first Indian adminstrators from the German "Kreis," which is a subdivision of Bezirke. Mr.

Moore, on p. 43, vol. VIII, of the QUARTERLY has given the definitions of area division in India, and on the following page suggested the substitution of "block" for circle. A "working block" i. e. an aggregation of stands to be managed under one system, that is a managerial unit or management class, seems to us neat and more explanatory and we have used it for a long time.

It is unfortunate, however, that Mr. Moore, in his definition as it appears to us, somewhat mixes up two classes of area division, which should be for obvious practical reasons, kept separate, namely, the administrative divisions, which are geographical locations, and the managerial divisions, which are based primarily on ideas of management.

If this is done, the problem of ranging hitherto unused parts into working plans, will solve itself more easily, although it will always remain a problem requiring revision of original plans.—THE EDITOR.

REPORT ON SUPERVISORS' MEETING AT DENVER, COLORADO.

The meeting of the Supervisors of District 2 was called to order at 9 a. m. on January 23, 1911, by District Forester Riley, acting as Chairman.

The first day's proceedings consisted of a brief discussion of the important work which had been carried on on each Forest since the last meeting with special reference to special problems and improved methods.

Mr. Riley opened the meeting with an address, quoted in part as follows:

"We have made great progress since our last meeting and still greater progress must be made to get the forestry work of this region to the proper standard in the near future. You are guardians and business managers for 20,000,000 acres of public lands upon which are natural resources with an actual cash value of over $200,000,000. The value of property directly and indirectly dependent upon a wise conservation of these resources is several hundred millions of dollars more. All of this wealth is under your immediate charge and you are responsible for its protection and development.

The timber, range and waters of the West should be developed. They are all meant for use, profit and enjoyment. It is possible to use them in two ways: We may turn them over to private or corporate owners without restriction, or we may keep them in Government ownership with provision for their restricted or conservative use. In the first case, development would proceed with the object of financial gain to their owners. This would result in a kind of development making little or no provision for sustained productiveness. It would tend toward a monopolization by a few powerful hands to the probable detriment of the ordinary citizen. It would bring about the use of a resource without regard to its effect upon the others, or upon the closely related interests. In the second case, permanent ownership being with the people, development could proceed with provision for both financial gain to private enterprise and sustained productive-

ness. The Government could well afford to sacrifice a part of its immediate revenue for the sake of getting continous future returns. That sort of monopoly which hurts the ordinary citizen could be prevented. We can not use the timber and range in a thoughtless or prodigal manner without working a serious injury to the water supply. If the water supply suffers, loss will come to the interests dependent upon irrigation and navigation. Regardless as to whether the present profits of lumbering are large or small, the essential point is that we should keep the land producing timber without cessation.

The future man of weight in the Forest Service will be the Supervisor. Within twenty years the Supervisor will be the Forester with an administrative unit of from 50,000 to 350,000 acres yielding from $3 to $12 per acre per year. The Ranger will have his hands full with a district of from 5,000 to 10,000 acres. Through study and scientific practice, we shall increase the supporting capacity of the Forests to double what they are at present. The land troubles will be over, because forest, agricultural and mineral lands will have permanently settled themselves into their proper classes and uses. The Supervisor will make 100,000,000-foot sales with no more concern than he now makes a $50 sale of fence posts. This will be made possible by the complete working scheme that will be in effect for all timber tracts.

It is the object of this meeting to count big in a step forward. Here are a few of the questions before us:

Why has so much lumber been destroyed by fire?

Can we get and hold an even more effective Ranger force?

Why are we not selling more timber?

Why are we still in doubt whether we shall get a satisfactory crop of trees on the cut-over land?

Are we permitting sheep and cattle to graze on forest land to the detriment of forest growth?

Do we practice what we preach in regard to preservatives? Why not?

Do we use and distribute our annual appropriation to the best advantage from an ordinary business standpoint, considering the actual value of conservation of each particular Forest? How can we determine this question?

This meeting is your meeting. If you return to your Forests

with a broader, clearer, happier view of the work before you, its object will be accomplished.

SILVICULTURE

January 24, 1911. Chairman, Mr. Moore.

Supervisor W. J. Morrill, of the Rio Grande, read a paper on Silvicultural Systems on the National Forests, which is summarized as follows:

As a general rule, protective forests call for the selection system of silvicultural treatment. The first requirement of our Forests is that they shall serve for protective forests, and only secondarily, as a source of supply for lumber, hence the selection system promises always to be the system most commonly used on our forests.

The Selection System Under Shelterwoods.

The disadvantages of this system are:

1. The cost of logging is high, because a large area must be covered for the crop.

2. It is claimed that growth is 10 per cent. slower than in other systems of silviculture.

The advantages are:

1. Less skill is required to carry out the system, and therefore, less liability to make silvicultural mistakes.

2. The timber is usually of large size, and, therefore, is marketable in places where small timber is not.

Shelterwood Group System.

Advantages:

1. This method can be used to best advantage only where a market exists for small lumber and cordwood.

2. It is claimed that it protects young growth satisfactorily from frost and snow and against drought.

3. No data is available to show how it compares with other systems in the relative production of wood.

Disadvantages:

1. It opens up the soil to drying influences more or less accord-

ing to the size of the clearing, whereas the selection system by single trees disturbs the forest conditions the least of any system; hence for protection, the group method is not as desirable as the single tree method.

2. Since the group method aims at disposing of the old stand within a comparatively limited time, many years must elapse after the young crop is formed before a supply of saw timber is again available. This would be a disadvantage if the stand is expected to supply a steady demand always present, or is not of an area large enough to be divided into compartments which are treated successively, and enough compartments to round out the cycle of rotation.

Under present economic conditions, it seems that the selection system by single trees is generally preferable to the group system.

Since it is not profitable to cut over a selection forest annually, a period of years must elapse between cuttings. This should be obtained by the Van Mantel formula expressed as follows:

$b = \frac{S}{\frac{1}{2}a}$ in which "b" represents the amount of timber in board feet or cord which should be cut annually; "S" represents the actual amount of timber per acre in board feet or cords in the stand; "a" represents the most profitable age at which the timber is ready for the ax. To illustrate: Suppose an Engelmann spruce stand averages 10,000 feet per acre, the total stand per acre. Suppose that we assume the trees average 200 years when it appears most profitable to cut them.

$$\text{then } b = \frac{10{,}000}{\frac{1}{2} \text{ of } 200} = 100 \text{ ft. B. M.}$$

Since no purchaser would be willing to cut over the area annually for only 100 ft. B. M., we must determine the smallest amount which would justify a cutting. Suppose this amount is 2,500 feet B. M. Then 2,500 divided by 100 equals 25, the number of years which should intervene between cuttings. These figures only hold good for a normal forest, but in the above illustration, if 1,000 feet is a greater wood capital than is normal, 100 feet is more than grows annually, and we would reduce the wood capital or if less, we would add to the wood capital. The advantage of

this formula is that in the course of time normal conditions are at least approximated in regard to wood capital.

The seed tree system of cutting is a poor system on account of the windfall. Clear cutting by the compartment plan is not feasible on our Western National Forests on account of cost of artificial regeneration. The true compartment system under shelterwood may be preferable. Several preliminary thinnings and one seeding thinning should take place.

The advantages are:

1. The production of wood and quality are unsurpassed.

2. The shelter trees may be grown into larger timber than the bulk of the crop and the annual increment laid on the shelter trees is large.

3. The soil, humus and moisture conditions are not as much affected as in clear cuttings.

Disadvantages:

1. Danger to the seedlings from frost, insect, weeds and grass is larger than in the selection system.

2. The shelter trees may be windthrown.

3. Great care is required to successfully manage this plan.

4. Moisture and soil conditions are more disturbed than in the selection system.

Clear cutting in lodgepole may be advisable.

In conclusion the value of the selection sytem should be emphasized and to urge that our shelter forests be regulated to a sustained yield basis and that we aim toward attaining normal forests.

A general discussion of this paper followed.

Mr. Shaw and Mr. Morrill were of the opinion that under good management the rotation of Engelmann spruce could be reduced at least 20 per cent.

Marking Sample Areas

During the past year, the trees on a sample area on a proposed green timber sale have been carefully marked for cutting prior to the singing of the sale contract. Supervisor John McLaren, of the Sopris National Forest read a paper which endorsed this procedure and mentioned the following advantages of it:

"The first good that results from this plan is that the pur-

chaser must visit the area, and since he certifies that the marking is done satisfactorily, he goes into the matter more thoroughly and gets a definite knowledge of the restrictions which will govern the sale by a full discussion. It has been hard to get the purchaser, in many cases, to take sufficient interest in a timber sale transaction, and he is inclined, in general, to sign up a contract without giving it material thought and noting its contents.

The second important factor in connection with this requirement is that it developes more care on the part of the examining officer as he is inclined to give a proposed sale more thought and time, and will arrive at a better understanding of the existing conditions on the sale area than when working under pressure and covering the field work hurriedly with the feeling that the timber to be cut may more closely be considered after the sale is made and when the final marking is done."

Supervisor Bushnell feared that he would not be willing to abide by his sample marking, after he had occasion to see how some of the area looked after being thinned.

Supervisor McLaren replied: "We must get away from the idea of going back and changing our marking. We should go into it more carefully in the first place, study timber that has already been marked, and then the probabilities are very small that we will have to make any change after a sale has started."

Supervisor Cook said: "We have tried out sample marking on two sales on the Arapaho of about 20 acres. The chief value we found was to ourselves. It helped the marking board to get together and discuss things when the purchaser was not present, and we wrangled it out among ourselves."

Deputy Supervisor Miller said that it was difficult to get the purchaser to look over the sample area; that they were always satisfied with the marking and that little good resulted from it.

Supervisor Bushnell objected to marking the whole sale prior to cutting for fear of mistakes, but, on the whole, the sentiment of the meeting was strongly in favor of the practice.

Marking Boards

This subject was introduced by Supervisor Philips, who said: "A marking board was organized on the Montezuma Forest soon after the instructions came out last spring. The board is com-

posed of the Supervisor, Deputy Supervisor and Forest Assistant. These three members always go out together to do the marking. If possible, rangers from adjoining districts where conditions are practically the same are called in to go out with the marking board. The scheme has worked well and we feel that a great deal of good has come from it. A more uniform policy is established on the forest, and mistakes are avoided."

Assistant District Forester Moore closed the lengthy discussion with a summary of the points brought out, as follows:

"Mr. Lovejoy has laid stress upon the fact that the purchaser wants to know how much timber he is going to be allowed to cut rather than the kind and number of trees. I think that these two points are very closely related and that by means of marking sample areas under the direction of the forest marking board, we are going to be able to tell the purchaser more accurately how much timber he will get. We have had some pretty wild estimates on sales made in the past, which is evidence that sufficient attention was not given in advance to the manner in which these timber sales were to be marked. It is very clear that we should give more consideration to the marking at the beginning of a sale and determine as accurately as we can the number of trees that will be marked and the kind; then we are going to be closer in our estimates. There are a great many reasons why we should get the purchaser on a timber sale in advance of operations and it seems to me absolutely essential that this be done. The purchaser should certainly know the boundaries of his sale area on the ground. All the points likely to come into controversy should be settled before the sale, particularly with a new purchaser."

Brush Disposal

Supervisor Lovejoy opened the discussion and the following is a condensation of his paper:

"The principal benefit of any form of brush disposal is the fire protection which it is presumed to give. In addition to the fire protection, there may be a secondary benefit in the increase of reproduction. The undesirable factors are principally the loss to the soil of the material which should go into it, the danger to standing trees left after the cutting from the injury by fire and the cost. Any brush disposal or brush piling is good disposal or

piling if it allows of the complete destruction of the brush without injury to the standing trees, and cheaply. With reference to the camparative advantages of scattering or piling brush, this would probably depend on local conditions; that is, the preference of scattering over piling would depend principally upon the fire risk involved, the silvicultural condtion of the stand, the species, and the locality, particularly with reference to slope and possible erosion. In brush piling, all sorts and shapes of methods have been tried, and the kind of brush piling which will prove best for any given stand must finally be worked out for each locality or stand. For instance, in clean cutting where cordwood is utilized and nothing but the top branches go into brush, or where the stand is nearly clean cut and cordwood taken, I believe that the wind-row method is much preferable to brush piles. One thing I think is necessary to be considered in deciding on the type of brush disposal, and that is, the period intervening between the piling and the time when the brush will be burned. If there is any chance of the brush having to go through a snow before it is burned, you can not pile it low nor spread it out. You must protect it by the heavy pieces around the outside. If this is done properly, and the pile is symmetrical, such a pile will go through two or three heavy snows without losing its shape. It may settle a little, and the brush fall away from it, but it stands up, and can be burned under almost any conditions. If deemed desirable, care may be taken to make the pile symmetrical, or to place sticks around the outside in such a way that the pile will shed snow. Where properly built, such a pile can be burned in snow four or five feet deep with good results. The injury to trees left depends on a lot of factors, primarily, of course, on the number of trees left to the acre and the number of brush piles to the acre, the size of the piles, the condtion of the brush at the time it is burned and the depth of the snow. With fairly deep piles, and the brush in prime condition, cutting from a stand of lodgepole of about 12,000 to 15,000 to the acre from which is removed from 2,000 to 5,000 feet to the acre, you will run perhaps 25 piles to the acre. Under other conditions you may get as high as 100 of these piles. The number of piles lighted and the number of piles not burned will, of course, vary. Mr. Gregg conceived the scheme of plastering the trees nearest the piles with snow at the time of burning. By adopting this plan we found it

possible to burn piles which were within a few feet of good seed trees without any injury to the trees except a little scorching of the lower branches. The action of the heat melts the snow, the water runs off, and the tree is not scorched. When your large piles get going you can not get close enough to the trees to throw enough snow to hold it back, whereas, on a small fire a few shovelfuls of snow will do the work. Where such burning is going on, a man can not attend to more than 20 piles at once, and he can not set off a lot and leave them. Of course, all the time he spends on a given brush fire increases the cost per acre; but it is pretty easy to determine for any given job of burning how many trees you can afford to lose and whether it is cheaper to burn the trees up than to save them from fire. I do not think it pays, as a rule, to burn trees to save them from fire. In the past, the time of burning brush on large sales appears to have been determined by the time you found most convenient to burn. I think that any of us who have had to fight fire during the summer on a timber sale where the brush had been left unpiled or piled and not burned would never lose another chance of burning brush which was in a pile, or of having brush piled rather than scattered. I do not know of any area where it has seemed to me safe to leave brush on the ground. I might state that lodgepole brush does not go to pieces so as to reduce the fire danger absolutely inside of fifteen years. Our fire risks are so tremendous, and our preparation for the suppression of fires so inadequate, that taking into account the damage to the soil and all the other resulting disadvantages, I am afraid that we have not yet reached a point where we dare leave brush on the ground. While the cost of burning is a factor, I do not think that it is a very important one, as we can not afford the fire risk which comes from leaving unburned brush on the ground, and the additional protection resulting from the burning of the brush fully offsets the additional cost of burning. In wind-row burning, practically clean cutting, the cost is approximately 10 cents per 1,000 feet or $1 per acre under the worst conditions. Where approximately one-tenth of a stand of trees had been cut, and the brush on that stand piled, the piles averaged from 15 to 25 to the acre, and the cost runs up approximately to $2.50 per acre. I do not believe that I could permanently insure the area from destruction by fire any cheaper than that. The display of brush burning torches on

the table brings up a considerable number of questions. A good torch is one which does its work as cheaply as possible; it should also be light, durable and convenient to handle, and should not leak. It should burn as little oil as possible, and still throw a flame of the size desired. Further, it should be able to reach to a greater or less degree to the inside of the pile, and the cost of the torch itself should be taken into consideration. I have found that temporary laborers are sometimes inclined to put the torch in the pile and leave it."

Mr. Moore: We heard from the Forester some time ago that there was a standard torch on requisition at Ogden, but the Property Clerk informs me that this was not a standard torch and that it had been decided to purchase torches locally. (Committee appointed to report on the selection of a proper torch at the end of meeting.) There is one point in connection with the brush burning business that we have not gone into very much; that is the question as to whether the brush burning on the forest should be handled by the regular ranger force or whether we must consider the employment of temporary men.

Mr. Lovejoy replied: I believe that matter is entirely dependent on local conditions, and that in many cases it is impossible for the local force to make any showing with the amount of brush there is on the ground, and it is evidently necessary in such cases to hire outside help. In cases where the sales are small, and the local rangers can handle the work, they should do it.

Mr. Imes said: I think it would cost but little more to have the Forest officers burn the brush. I can get guards at $75 a month who will do better work than the average laborer, and who also have a certain interest in their work. The only objection that I find to this plan is that I do not have sufficient salary allotment for brush burning.

Supervisor Morrill said that he believed in lopping and scattering the brush in the majority of sales on the Rio Grande Forest. The danger from fires was remote there, judging from the record in the past five years, and it is thought that the benefit to be derived from soil improvement due to decaying leaves and twigs outweighed, locally, the danger from fire incurred by leaving the slash on the ground. Engelmann spruce is the principal timber cut on the Rio Grande Forest, and the moisture conditions mitigate against forest fires. However, as a precautionary measure,

a zone two or three hundred feet wide, on which the brush is piled and later burned surrounds a considerable area of cutting where the slash is scattered.

It was determined by expression of all the Supervisors that brush scattering was practiced to some extent on all of the Forests in the District.

Free Use.

It appears that free use for green timber was not granted on a majority of the Forests in the district, and that the policy is to restrict the free use of green timber as rapidly and as far as possible. Free use must be handled on each Forest according to its local conditions.

The question was asked whether any fire lines had been built through granting free use of timber, either living or dead, along roads.

Supervisor Imes of the Black Hills (S) Forest said: "We had a fire in the Black Hills last summer that jumped a plowed field 300 yards wide. I decided that if we are going to have fire lines that will be any advantage, they must be pretty wide. We have numerous roads through the Forest, but think it will be necessary to widen them, if they are to be of any great advantage in case of fire. So I have told the ranger that when an applicant was entitled to a free use permit, he should confine the cutting to within 100 feet of the road, and I have endeavored to confine all free use permits to such places."

Reconnaissance.

The practice of employing forest school students for reconnaissance, as has been the practice for the past five years, was favored by a large majority of the Supervisors. Some were of the opinion that the rangers could do the work better, but they could not be spared from other work during the summer; others believed that the inexperience of the forest school men was outweighed by the interest they took in forest work.

Method of Collecting Cones.

Supervisor Wheeler of the Colorado Forest said that Western Yellow Pine cones were gathered on that Forest by picking by

hand, since squirrels did not gather and hoard the cones. Some of the pickers became very expert, averaging two bushels an hour each; however, the average individual would gather only three or four bushels a day. Hooks and pruners were used to some extent, but the majority preferred to pick by hand. Picking by hand was encouraged because less injury was done to the trees.

Wherever the squirrels hoard cones, robbing the hoards was the most satisfactory method of getting the cones. Supervisor Sweitzer said that without the assistance of the squirrels, gathering Douglas fir cones would be impracticable. The same may be said of Engelmann spruce.

It was the consensus of opinion that purchasing cones by measure was preferable to buying by weight. Mr. Sweitzer paid 75 cents per bushel for Douglas Fir cones purchased from ranchmen and delivered at his headquarters. He thought the price was fair, since cones gathered by laborers working for him by the day cost him 80 cents per bushel. It appears that Engelmann spruce cones cost about the same, and Western Yellow Pine cones should be obtained for about 50 cents per bushel.

On the San Juan (E) Forest about ¾ pound of clean seed per bushel was obtained. The same amount of Engelmann spruce seed per bushel of cones should be obtained. The clean Douglas Fir seed cost Mr. Sweitzer about $1.10 per pound. Mr. Wheeler said he expected to reduce the cost of clean Western Yellow Pine seed to 60 cents per pound or less, in the future. Seventy-five cents per bushel of cones was paid for 2400 bushels in the Black Hills (N).

Supervisor French said, by using ranger labor, the cost of lodgepole pine cones was reduced to 60 cents per bushel.

Supervisor Langworthy was fortunate in having a large crop of Western Yellow Pine cones and paid 50 cents per sack. He failed to state the size of the sacks but presumably they were the bushel sacks. Conditions being different on the San Isabel Forest than on Forests where the cones were delivered at central points, he maintained field camps, five or six in number, to which the cones were brought and the seed extracted. He says: "A great many of the cones opened in the sacks. The last cones we picked opened up within four days after they were placed on the sheets. Cones picked before that took about eight days. We began at that camp gathering cones on September 15. We waited

until we thought the cones were ripe. We finished our extraction of seed on October 12, being less than a month at that camp. There were three of us, and we cleaned up 1,272 pounds of seed. This seed was floated for a few minutes in cold spring water. The amount of chaff and refuse we skimmed off after floating the seed was 22 per cent. in weight. We float the seed twice; after floating them the first time, we skimmed off the chaff and then floated it over again. After that we had 22 per cent. chaff; this includes the siftings which fell on the sheet when we screened the cones to get rid of the dirt.

In all of the cases I have mentioned the seed was gathered from thrifty young trees about eight or ten inches in diameter, and 25 or 30 feet high. We also gathered seed from old matured trees, such as spike tops, etc. The cones from these trees were found to be a little different in shape, being longer and more pointed. These trees are termed by the lumbermen yellow pine, while the others are called jack pine. The cones gathered from the old trees yielded four pounds of clean seed per bushel.

When we had the seed extracted we put a bushel of the winged seed in a seamless sack, laid them on a wagon sheet on the ground and tramped the sack under foot for about ten minutes with a sort of rotary motion. We then winnowed the seed in the wind, and allowed them to drop into a box with a wire screen bottom. We would then shake the box, and get rid of the little particles of chaff attached to the seed. The seed was fairly clean after that operation, except for the shoulders or clips. The floating operations were done in cold spring water, and the seed were not allowed to remain in the water over eight minutes. When we put them in the water, and stirred them up briskly, it removed all the wings and clips, and it was absolutely clean. Our cleaned seed cost us 58.9 cents per pound which includes everything."

While discussing seed extraction, Mr. Imes said: "I am still endeavoring to find out just what is the best method of extracting seed by artificial heat. We have worked at it since September, and I think I have found out a few things that should not be done, and a few things that should be done. I can best explain by describing our operations from the time they started. I had never seen a pine cone treated by artificial heat, and knew nothing about it. I thought it was simply a matter of applying the heat, but soon found it was quite a different proposition.

We rented a two-story building at Custer with a good basement. This building was 50x25 feet. My original plan was to store the cones upstairs, making a drying room on the ground floor, and have the furnace in the basement. The drying room which was on one side of the ground floor was very tight, and after I got it arranged, I filled it with green cones. I expected to take them out in 36 hours. I had them in there seven days, and they were closed as tight when I took them out as when I put them in. The reason was there was too much moisture by evaporation from the cones which filled the room with steam, and I found the cones never would open in that way. By that time I saw I was going to get such a quantity of cones, I would have to enlarge my drying room. I tore down the first drying room and made a new one 30 feet long by 20 feet wide. The arrangement of this drying room was about as follows: I first made what I called a false floor, constructed of 2-inch slats laid on joists. The spaces between the slats were about ¾ of an inch. The trays first constructed were seven feet long and four feet wide. They were constructed by simply taking wire meshing and nailing on each side two strips 1x2 inches. There were no shelves made to place them on, but to strengthen the trays we nailed cross pieces across the corners. That gave us a 4-inch space between each tray, and the trays were stacked one on top of the other. These trays held about two bushels of cones. After I had constructed this new drying room, and got it finished, it worked in pretty good shape. I found by leaving the cones in three nights and two days, they were ready to come out, that is, they were sufficiently opened on these trays that practically all of the seed would rattle out. After the cones had opened, I built what we called a "flying machine." It was nothing more than a cylindrical box which was rotated by a gasoline engine. It was constructed by using a piece of gas pipe 16 feet long with four cross pieces set on the pipe, and covered with wire meshing. This was rotated at just the right speed to allow the cones to work out at the lower end, and the seed to fall on the floor. It was set on a slope so that the cones were put in at one end and rolled out at the other end of their own accord.

After the seeds shaken out of the cones are gathered up we run the winged seed out through a fanning mill. The fanning mill sits in the basement of the building. The seeds pass over the

screen, and the very fine dirt, dust, etc., passes through the screen, and the winged seeds remain in the fanning mill. They are, you might say, cleaned winged seed, that is, seed with the wings on. In running a fanning mill, I find the light seeds are blown out of the mill. The heavy seeds stay in it, which to a certain extent reduces the necessity of water floating to get the light seed out. The light seeds are not fertile. They are small seeds with a wing, and a very small kernel of no value at all. After the seeds are first fanned that way, they are put in what is called the wet box. Water is poured over them, then the seeds are stirred up until thoroughly moist; after that they are placed on a second screen, which is sufficiently large to allow all seed to go through by rubbing. The second screen is horizontal. A quantity of moist seed is placed on there and rubbed; that loosens all the wings from the seed. I might state here that we are experimenting with the view of possibly doing away with the rubbing or second handling. I found from one of our experiments that it is not necessary to rub these seeds over the screen. I think it is sufficient to moisten them and dry them. You might not get as clean seed, but it will be clean enough for all practical purposes. By wetting them and getting them dry, you can get the wings from the seed by simply running them through the fanning mill. After the seeds have been wet, they are dried by placing them on sheets in the sun, which requires from two to four hours. Now we dry them in our cylinder, which is covered with window screen set before the furnace. We put about 100 pounds in the cylinder and set it up before the furnace, and rotate it a few minutes. We dry in one night 400 pounds of seed. This makes four different dryings, but they are not wet any great length of time and not very wet at all.

The first furnace we used was simply a big boxwood stove that had a cement floor underneath it, and outside of the stove we built a wall of fire-brick, put a lot of cement over this, and allowed an opening in the top to go through into the bottom of the drying room on the same principle as any hot air furnace. From the bottom of the floor, we had cold air pipes which lead into this air chamber around the boxwood stove. I found the boxwood stove would not stand the heat for the length of time required, and I have since built a furnace of fire-brick on exactly the same principle as I used in the boxwood stove. We have a great many

problems to work out yet, and I think the most important one is the effect of moisture on the opening of the cones. To overcome that we installed a blower which was intended to force the hot air through the furnace into the drying room, and it was so arranged that we could draw the moist air out of the drying room. Our blower was a little too small, and we have never successfully worked it yet, but I am satisfied that in any modern cone extraction plant we have got to arrange some contrivance so that we can get rid of the moist air in the room. My intention now is to run pipes along the roof of the room, where the steam and moist air is, letting them run through the floor to a blower and draw all the air out of the top of the room, which would take out the moisture, and I believe I can reduce the length of time required to open the cones almost one-half."

The question was asked whether a threshing machine could be used for extracting seed from cones, and Mr. Imes, who had tried it, said it was not practicable; too many of the seed were broken, and the results were in every way unsatisfactory. Referring to the amount of clean seed obtained on the Black Hills (N) last season, he said that about 27,000 pounds of Western Yellow Pine was obtained.

Supervisor Pierce discussed Methods and Seasons for Planting. He gave the history of the Halsey Nursery. Experiments proved that commercial fertilizers for seed beds were of little value, but animal manures should be used. The seed is sown in the spring at a rate unit to produce 100 seedlings per square foot. Great loss resulting from damping-off, fungi and blight. Blight could be lessened first, by increased use of water, second, by preventing too rapid evaporation and withdrawal of moisture from the ground, by cultivation of the soil, by shading, by increasing the spacing of the trees; third, by preventing too rapid transpiration, obtained through shading and by spraying; fourth, by increasing the fertility of the soil; fifth, by increasing the vigor of the trees, by using seed of high germinative ability, and thin stands from 75 to 100 per square foot; sixth, by the transplanting of thrifty seedlings. The transplant stock gave better results than seedlings planted in their permanent site. Supervisor d'Allemand had better success upon the Kansas Forest with conifers than he did with hardwoods. Yellow pine seedlings were less liable to damping-off. Mr. Riley stated that in New York Pettis had

practically eliminated damping-off from his seed beds. No seed beds are planted without surfacing them. He first puts on the amount of moisture he wants and then puts in the seed, the soil used being brought from a distance and free from the spores of fungi.

Supervisor Kelleter stated that he had had success in direct sowing and has covered 3,000 acres. The rodents bothered him, but this was overcome by poisoning the seed areas with wheat containing strychnine.

Supervisor Allen stated that he used the Cyclone seeder in broadcasting the seed and found it very useful. They cost $2.50 each.

Silvics.

Mr. Bates asked for results of experiments in planting.

Mr. Reinsch stated that he had better success in using a drill built on the principle of a garden hoe than of any other method of seeding. The seeds were dropped one inch apart in the drills and covered with a garden rake. This cost about $8 per acre.

Mr. Bates emphasized the fact that a complete record should be kept in detail of the experiments. He also spoke at length upon the need of growth studies, and advocated an empirical stand table to be compiled by as big a representation of ages and rates of growth from the different Forests for each species as could possibly be obtained.

Products.

January 25, 1911. Chairman, Mr. H. S. Betts.

Mr. Betts requested that the discussion take the form of questions. The following points were brought out:

The treating tanks weighed 480 pounds, and held from 10 to 15 posts. In a very rough country, cost of treatment was about 25 cents per post, including transportation.

Care should be taken that the tank does not catch fire.

The brush method of treating is not especially good, but better than no treatment.

That a treating plant brought into demand a large amount of dry timber.

Crude oil has value as a preservative, but does not compare with creosote.

Mr. Betts stated that he intended to carry on some experiments in regard to obtaining turpentine from Western Yellow Pine and Pinion pine. That the supply of turpentine was becoming limited and that it might become a commercial proposition in the West.

Grazing.

January 25, 1911, 4 p. m. Mr. Nelson, Chairman.

Supervisor Kavanagh read a paper on the results accomplished on the National Forests in District 2 through grazing administration, summarized as follows:

The administration of the grazing lands within the National Forests by the Forest Service is rapidly growing in favor with the people. Successful grazing administration has brought the subject of forestry to the attention of thousands of people who under other circumstances would have given it only passing attention. Grazing promotes reproduction by working up the soil. Many improvements to the National Forests in the way of roads, trails, telephone lines, etc. are brought about by grazing. The stockmen put out thousands of fires. The consumption of the grass greatly lessens the danger from fire. The existence and welfare of the small cattlemen in the West depends to a large extent upon the National Forest range.

Here followed a general discussion of range problems.

A plan of experiments was advocated that would determine the effect of grazing on reproduction.

January 26.

Supervisor Blackhall stated that sheep on his Forest were trailed over fire guards thus increasing the efficiency of the fire lines.

Supervisor Ratliff read a paper on Advisory Boards. The following points were brought out.

Stock associations are formed (1) in order to compete with monopolistic large owners; (2) by the need of range adjustment among themselves; (3) by realizing the necessity of some form of legal regulation of the use and conservation of the range.

Advisory boards have proven a great help in settling range difficulties. It is much easier to come to an understanding with an advisory board than a whole community and considerable time

is saved. The advisory usually consists of level-headed men with whom the Service can readily adjust matters pertaining to grazing.

To sum up, advisory boards mean a better enforcement of the regulations, increased benefits to the users, the adjustment of misunderstandings, and a means by which information concerning present and future difficulties may reach us.

Here followed a general discussion on advisory boards.

Range improvements were then taken up and discussed. Some of the Supervisors had marked success in sowing timothy upon the range. It was the sense of the meeting that separate dates should be advertised by which grazing applications should be received for the different classes of stock. It developed that a large amount of work had been done on grazing reconnaissance upon the different Forests, also a large number of forage plants had been collected.

The game question was taken up and discussed.

Supervisor Kavanagh stated that a plan of restocking the range with wild game had been carried out on the Big Horn as a carload of elk were shipped in from the Jackson Hole country. It was the opinion of the meeting that a law should be passed, compelling people to screen their headgates, and a greater effort should be made to protect game.

Operation.

January 26, 1911, 3 P. M.

A lengthy discussion took place in regard to systematizing the field work, and what was needed in the way of trails, telephone lines, and fire lines for patrol purposes.

A majority of the Supervisors were in favor of some sort of a written plan for future work for every officer on the Forest.

Supervisor Gregg stated that the best tool for fighting fire, in his opinion, was a hoe having a blade 6"x6", catalogued as a "hazel hoe."

A lengthy discussion of fire prevention followed and a committee was appointed who made the following recommendations for the suppression of Forest fires:

Increased field force.

Increased funds for:

Properly equipped lookout stations.

The purchase and distribution of fire tools.

An adequate system of roads and trails located with respect to their use as fire lines.

Fire lines to be kept clear by using as stock driveways and located with respect to their use as roads and trails.

Intensive and systematic patrol, with adequate telephone systems.

The reduction of inflammable material by the removal of dead and down timber and the disposal of brush on timber sales by piling and burning.

Smaller administrative units for Rangers and Supervisors.

Definite and intimate cöoperation between Supervisors of neighboring Forests, and Rangers of neighboring districts.

The following measures are recommended for immediate adoption:

Increased field force.

Increased funds.

The complete equipment of the more commanding lookout stations.

The systematic extension of roads, trails, and telephone lines.

Intensive and systematic patrol.

The heavy grazing of areas where it would reduce fire danger.

Smaller administrative units.

The proper equipment of all railroads operating through the Forests.

Definite and detailed cöoperation between neighboring Forest officers.

After a lengthy discussion on examinations for rangers a motion was carried to request the Civil Service Commission to extend the probationary period for Assistant Rangers to one year.

January 27, 1911.

A lengthy discussion on claims took place. Many individual cases were discussed and Mr. McInery, Chief of the Fifth Field Division, stated his opinion in numerous land cases. He also stated that the Department of the Interior wished to cöoperate with the Forest Service in every particular.

Superintendent Ainsworth, of the Bureau of Fisheries of Colorado, took up the fish question with the Supervisors. He sug-

gested that each Supervisor make up a list of the number of fry needed and send them in as soon as possible.

The subject of Uses and Settlement was discussed. It was the opinion of many of the Supervisors that legislation should be passed whereby a permit could be made to operate for five or ten years.

Supervisor Lowell opened the discussion on Settlement. He thought that it would be better to have the lines run out with a transit although good results had been obtained with the compass.

Meeting called to order at 9 a. m., January 28.

The discussion of Settlement was continued.

Supervisor Bushnell stated that oftentimes one man made several applications, and several different tracts of land were listed. He believed this to be undesirable, and thought a regulation or law should be made to prevent it.

In Supervisor Imes' opinion, it did not make any difference as he thought that the quicker the agricultural land was listed, the better it would be.

Mr. Riley stated that the present policy was not to concern ourselves in any way with the intention of the applicant, and that the Service should not hesitate to examine a second application for a man who is not satisfied with the first. Arrangements were made whereby several men would be detailed to the various Land Offices to obtain the status for all the Forests.

After a discussion of Law and Accounts, the meeting was closed by an address by Mr. Riley.

He complimented the Supervisors on the work they had accomplished and emphasized the fact that the further progress of the work depended to a larger extent upon their initiative. The man of the future is the Forest Supervisor. The District Office is an organization for the purpose of assisting Supervisors with their problems.

Mr. Wheeler moved that the Supervisors express their appreciation of the help given by the District Office, not only in the meeting, but also during the past year.

The motion was seconded and carried.

FRANK J. PHILLIPS.

An Appreciation.*

When American forestry lost Frank Jay Phillips it lost one of its rising beacon lights. Alas for the futility of our hopes! For one brief moment, like a brilliant falling star under the desert sky, his life flashed across the heavens of our science, and was gone. But the afterglow is with us still. It will be with us for years to come. It can never be entirely effaced, but will live on and on, though mayhap receiving new auroral coloring from other minds and souls, to generations yet unborn.

Born and reared in the forests of Michigan, thoroughly grounded in the problems of the farm and the woodlot at the Michigan Agricultural College, his training was carried to a high standard of completion in the forestry courses of the University of Michigan. Ever striving for a higher mark, however, he pursued work for a doctor's degree, and had intended to go abroad this present summer to carry on his forestry studies. He was also a leader in other lines, holding some excellent track records, and winning a high place in inter-collegiate oratory. After a period of hard and effective work in the United States service, covering many states, he was called to the head of the forestry department in the University of Nebraska, which position he held on the date of his untimely end, February 12, 1911. At this time he had been offered a position on the forestry faculty at Ann Arbor. At a previous time, his powers of observation were recognized by the offer of the position of traveling dendrologist in the forest service. Again, his capacity for organization and leadership won high recognition by the tender of the position of chief of the Indian forest service under the national government.

In addition to his arduous and successful labors as head of a growing department in a great univerisity, Professor Phillips set himself with a vim to the task of turning out original research work, and it was his intention to publish at least two articles

*Although we have printed on p. 168 a brief reference to Mr. Phillip's decease, we gladly give additional space to the above appreciation of a worthy member of our profession—Editor.

each year. His papers on "Bird Dissemination of Juniper Seed," and "Hail Injury to Forest Trees" are unique and excellent pieces of observational work. His "Study of Pinyon Pine," published in the Botanical Gazette," is a fine type of dendorlogical study. He was associated with Dr. Fernow as one of the contributing editors of the "Forestry Quarterly," and had in mind the establishment of a "Planting Magazine." At the time of his demise he had in preparation several articles, including one on the trees of the Mexican boundary. A very interesting note on branchless conifers has appeared posthumously in the "Plant World." During the summer of 1910, the writer had the pleasure and inspiration of being associated with him for six weeks in the field in southern Arizona. One day his sharp eyes detected mistletoe growing upon whiteleaf oak, a fact for which the writer had been looking in vain for some three years. He had a remarkable capacity for assimilating the facts of nature in general, and those bearing upon his specialty in particular. His enthusiasm was inspiring, his avidity to look and learn boundless, his keen eye perspicuous and probing for the best of things.

One of his finest characteristics as a forester was his breadth of view. While ever loyal and strenuous to the last degree to attain the immediately practical results that in the minds of some are the only measure of success, he had boundless admiration for related branches of scientific inquiry, whose practical application does not always lie on the surface, but which in the course of time are often fraught with unforeseen and incalculable value. As Professor Peirce has recently well said: "From the beginning, the study of plants in this country has been strongly influenced by the requirements of its inhabitants." He might have added, and by the ultra-materialistic American habit of mind. "Pure science has found scant support and still less understanding sympathy. We may deplore the fact, but we must recognize its adequate and persisting cause." While this is only too true, future progress in forest work in this country must lie along the lines of greater breadth and deeper foundations, a necessity that is gradually coming to be recognized, and is already taking concrete form in the establishment of thorough research work and permanent experiment stations. Professor Phillips was a live and enthusiastic exponent of this movement.

Phillips was deeply interested not only in dendrology and forestry proper, but in mycology, and was rapidly forging to the front as a teratologist. For years he had studied eccentricity and abnormality of growth. This was perhaps the natural outcome of much forest service practice in the counting of annual rings and the measurement of tree growth. He was a master of stem analyses. His quick and incisive definiteness, never satisfied with a haphazard or approximate result, no matter what the personal hardship incurred, won for him a measure of proficiency in this line that has perhaps never been excelled among American foresters. His rapid fire figures could be recorded with the greatest ease, for they rung out always clear, definite, and in order. His data had the only too rare quality of being high scientific value.

His life was sacrificed at white heat on the altar of high duty. He was a live wire, and his restless ambition drained his reserve energy faster than it could be supplied. When dread *la grippe* visited him it found him an easy prey. His was a noble ambition, unswervingly devoted to the main chance, the task of advancing, at the sacrifice of personal comfort and under other difficulties, his chosen life work and the interest of his science. He threw himself, heart and soul, into even the smallest task. With brilliant ability, and the most strenuous conscientiousness, his every energy and resource were bent to his work. Thus he achieved in a brief space of time some remarkable results, thereby giving the greatest promise for the future. But the possibilities of life are of infinite variety, and our best prognostications are but groping in the dark.

He cultivated intimate and painstaking personal touch with his students. He was a devoted husband and father, and the truest of friends. On one occasion, while on a long march in the mountains, the writer's feet became sore, and he had to stay behind. Nothing would do but Frank would exchange boots and send horses. And he did.

It is now some little time since he left us, but these few inadequate words in tribute to his memory may not come amiss, for such a memory deserves abundantly to be kept alive. His was a personality that can never be replaced in kind. We cannot but mourn deeply long after the world has forgotten. But by his life, though so brief, our life has been enriched, and quickened. To

have lost him is a sorrow, never to have known him would have been a misfortune. We are profoundly thankful that Tennyson's words are true once more:

> 'Tis better to have loved and lost,
> Than never to have loved at all.

J. C. Blumer.

Tucson, Arizona, May 23, 1911.

CURRENT LITERATURE.

The Principles of Handling Woodlands. By Henry Solon Graves. New York. 1911.

Mr. Graves' volume is one of those semi-popular technical books, which are needed not so much by the professional man, as by that most important class of woodland owners in whose hands finally the future fate of the forest lies.

It is the first attempt in print to discuss systematically silviculture with special reference to American conditions.

In simple and direct language the reader is briefly informed in some 40 pages of the undesirable conditions of American forests, the objects of silviculture, and its methods in general. It is interesting to note that the author places the extra cost of operating in the hardwoods under forestry methods as from 25 cents to $1 per thousand feet, the cost of reproducing at from $2 to $10 per acre, and the annual cost of protection, supervision and administration as from 2 to 10 cents per acre. It would be interesting to know how these figures are arrived at. He admits that forestry cannot be profitable to all private owners, but for some under favorable conditions it might, as for instance the plantings in New England have produced over 6 per cent. on the investment, and investments in second growth are also certain to pay well.

In the classification of silvicultural systems it appears to us a curious mix-up of conceptions to place under *clear-cutting* system the various methods which reserve seed trees, scattered or in groups or in blocks or patches, and which we would class separately as seed-tree methods.

The details in the operation of the four different systems or as we would prefer to say methods of silviculture are clearly described, namely, selection, clearcutting, shelterwood method and coppice, and examples are given from localities in the states to show under what conditions they are applicable. We are glad to find that the selection forest is not any more the only applicable one.

We are informed that the cost of marking in selection forest

has in the United States (presumably in National Forests) varied from 2.5 to 10 cents per M feet. The diameter limit is broadly discussed.

The strip system with marginal seeding described under *alternate cleared strips*, is perhaps more widely applicable than is intimated, namely, wherever uniform stands of light-needing species, e. g., Southern pineries, are to be operated and systematic transportation can be cheaply provided.

It seems to us a misconception of terms to place the proposed treatment of Longleaf pine in two cuttings separated by a period of from 10 to 20 years under *shelterwood* method. As the name implies, this is a method of providing shade or shelter for the young crop and certainly the Longleaf pine would resent such shelter even more than the Scotch pine. The description of the procedure answers rather more a seed-tree method, or according to the author, a clear-cutting, reserving seed trees.

While for a layman's easiest comprehension it might have been better to classify these operations more subordinately by genus, species and variety of procedure, the reader will by the more co-ordinate classification be more impressed with the fact that there are many ways of doing, dependent in their applicability on natural and economic conditions.

The chapter on improvement cuttings (thinnings) brings all that is essential. Over 80 pages, one-quarter of the volume, is taken up by a discussion on protection against fire; and 12 pages on protection from other injurious agencies.

One is left with the impression that a number of the silvicultural methods described are in actual operation in this country. It would be a useful piece of work, of more than historical value, for the Forest Service to collate with sufficient detail all the cases, where actually and consciously silvicultural methods have been applied.

We can only hope that this volume will come into the hands of many woodland owners who can make use of it. It will be first class reading for all underforesters, and even the students of higher degree can only benefit from its perusal.

B. E. F.

Light in Relation to Tree Growth. By Raphael Zon and Henry

S. Graves. Bulletin 92. U. S. Forest Service. June 1911. Pp. 59.

As stated by the authors, the aim of the Bulletin whose title is given above, is to bring together the principal facts with regard to the part which light plays in the life of the forest, and the different methods of measuring it. To this end the principal subjects discussed are: Light Intensities and Tree Growth, Tolerance and Intolerance of Trees, Factors Influencing Tolerance and Methods of Determining Tolerance.

That tolerance and intolerance have a physiological basis is shown by the experiments of Lubimenko who found that the chloroplasts of different species are sensitive to light in different degrees, the chloroplasts of shade enduring species being more sensitive than those of light needing species; that species with the more sensitive chloroplasts begin to decompose carbon dioxide and reach a maximum of assimilative energy in light of much lower intensity than species of less sensitive chloroplasts. The same fact was demonstrated by Grafe who found that when exposed to a light intensity of 1-50 full sunlight, birch leaves showed no presence of starch while beech leaves still continued vigorously to form it. A physiological basis for tolerance and intolerance of trees is also indicated by the experiments of Zederbauer who found that the crowns of various species exercise a selective power of absorption of light rays. The species generally recognized as most light demanding absorb, in addition to the red, only small portions of the blue and violet rays, while the shade enduring species absorb, besides the red, some orange and a large amount of the blue, indigo and violet rays. It may be that, as it were, the shade endurers make use of the crumbs which fall from the tables of their more fortunate neighbors.

The authors discuss the methods of determining the relative tolerance of the various species under three heads, namely: Observational, anatomical and instrumental methods. Under observational methods, one notes the density of the crown, self-pruning, number of branch orders, natural thinning of the stand, conditions of reproduction, relative height and the results of artificial shading. The anatomical method consists in comparing leaf structures, it being assumed that a high development of palisade tissue is due to exposure to strong light. The Bulletin closes with de-

scriptions of various photometers, notably those of Clements, Wiesner and Zederbauer with some results of their use in America and Europe.

A plant physiologist might question the statement of the authors that the measurement of the chemical light intensity by photographic paper remains for the present the nearest approach to the ideal in determining light values in a forest, for it is experimentally known to him that the greatest activity in starch manufacture takes place under the influence of the red rays whose intensity, if measured at all, is measured but feebly by photographic paper. And, moreover, according to investigations quoted in the Bulletin, the rays of high refrangibility, whose intensity is measured by photographic paper, are absorbed by the superficial layers of the leaf, but in the ordinary leaf most of the starch manufacture takes place in the mesophyll which absorbs the rays of low refrangibility screened out for it by the superficial tissue. Photometers, really actinometers, may be nearest the ideal but they have a long way to travel before they overtake it.

American silviculturists and plant ecologists are greatly indebted to the authors for bringing together so much valuable data concerning the fundamental but elusive problem of the light relations of trees. The Bulletin shows incidentally the position of Americans as investigators in the subject for it quotes two of them and no less than twenty-five Europeans.

C. D. H.

This bulletin does not bring anything essentially new (except record of a few measurements) and contains mainly what a good course in biological dendrology or silvics should (yet perhaps does not often) contain, but it is a very useful compilation of the knowledge on a subject which is of great importance to the forester. All the important data is assiduously brought together in a clear and simple language and concisely and critically presented on less than 60 pages.

Half the space is occupied with an account of the attempts to remove the determination of relative tolerance of species from the realm of personal judgment or empirical methods to that of actual measurements, physiological or physical. The authors seem to be inclined to consider the photometric methods, such as developed by Wiesner, Clements, Zederbauer and others, as most

promising, without realizing that by the addition of one sentence, they have destroyed the hope of ever arriving at a mathematical, practically useful, statement of light requirements, namely: In interpreting the results of the light readings, account must be taken also of other factors of tree growth, such as moisture content of the soil, age and vigor of the specimen, quality of the soil and relative humidity."

While, then, physical measurements should by all means be continued and may be expected to make us clearer as to the role which light plays in the economy of the tree and the forest, for practical purposes it would appear that the development of physiological methods, such as Medevev's, will bring us much sooner to a rational check on our personal judgment, which after all can never be dispensed with in silviculture and, indeed., in all operations which have to do with nature's creative forces.

To the very valuable literature reference we may only add Dr. McDougall's work which has been overlooked, and Dr. Engler's contribution briefed in this issue. B. E. F.

Chaparral Studies in the Dwarf Forest or Elfin-wood of Southern California. By Fred G. Plummer. Bulletin 85. U. S. Forest Service. Washington, D. C. 1911. Pp. 48.

The area within the United States covered by the true chaparral amounts to about 5½ million acres. It protects about three-fourths of the upper water-sheds of the streams along the coast in California for a distance, along the axes of the Sierras, of 450 miles. The forests are on the high elevations. Below is the chaparral. Still farther down is the sagebrush country, the growth becoming thinner and thinner toward the bare, arid or semi-arid, sandy belt bordering the ocean. Along the coast the average rainfall is thirteen inches, insufficient to support a forest, and only in a few places is it enough for a scattering woodland of oaks. The point where the rainfall, increasing with the altitude, is sufficient to support a forest averages about 2,000 feet. The topography is exceedingly diversified and it is said that between the ocean and the mountain summits, five distinct climates may be defined.

The author lists 16 species which dominate the chaparral and 55 species holding a secondary place. Besides these 46 species are listed as important. Greasewood or chamisal (*Adenostoma*

fasciculatum) is the most abundant and widespread, on the average composing 33 per cent. of the stand. It is exceedingly inflammable, is a poor soil binder and does not protect the ground from dry winds. The next most common species is the California scrub oak (*Quercus dumosa*) and in the region as a whole it makes up 13 per cent. of the chaparral. It is a very desirable member of the formation, since it is evergreen and grows on all kinds of soils and sites. If not too severely burned, it will produce a fair coppice within three years, a much shorter time than the average for chaparral species. Other leading species are deer brush (*Ceanothus divaricatus*), spasm herb (*Adenostoma sparsifolium*) and the big berried manzanita (*Arctostaphylos glauca*). Only the latter is considered a desirable species from the standpoint of soil cover.

Water is the most valuable mineral in Southern California. The supply for Los Angeles is brought 200 miles. Certain land without water or the prospect of it is not worth 50 cents an acre, but with water upon it would be worth $3,000 per acre. Those who are skeptical of the beneficial role of forest cover, even chaparral, upon the run-off and water supply in a semi-arid region should read this bulletin.

For the most part, the commercial species which occur in scattered patches over the chaparral and at the upper limits of the formation, are unable to extend themselves on areas dominated by the smaller growth. The Forest Service has made several unsuccessful attempts by sowing and planting to establish native commercial species on the exposed slopes. The author suggests the trial of Eucalyptus. C. D. H.

The Aspens: Their Growth and Management. By W. G. Weigle and E. H. Frothingham. Bulletin 93. U. S. Forest Service. Washington, D. C. 1911. Pp. 35.

The aspens discussed in the bulletin are *Populus tremuloides* and *P. grandidentata*. They stand third as contributors to the pulpwood supply in the United States, but that is only 6 per cent. of the total used. Aspen pulp is the most important source of supply for the manufacture of books and magazines. Aspen produces a high grade of excelsior and it furnishes a large part of that commodity on the market. In Europe aspen wood is used

extensively in the manufacture of matches and for the charcoal employed in making gunpowder. Because aspens mature early, and so require a short rotation as compared with other forest trees; because small sizes suffice for present uses so there is little waste in utilization; because the pulpwood logging has already badly depleted the merchantable stands in Northeastern United States the Forest Service has been led to make a study of their growth and management. The principal sources of supply of commercial aspen in the East are in Maine and New Brunswick and the stands arose after the fires of 1825 which burned over no less than five million acres. It is estimated that this area contained 10 million cords and that not one half of it has yet been cut or burned. Tables showing the development and decadence of aspen stands in Maine are given. The average age of dominant trees probably falls between 70 and 80 years. The stands originating from Miramichi and other fires of 1825 are so rapidly deteriorating from white rot (*Fomes igniarius*) that the pulpwood bolts are now culled from 5 per cent. to 20 per cent. Ten years ago culling for this cause in the same region was unknown.

The authors suggest a rotation varying between 50 and 80 years according to the condition of the stand. Owing to the vigor of reproduction both by seeds and root suckers, clean cutting and burning the litter to facilitate seeding are advised.

C. D. H.

Properties and Uses of Douglas Fir. By McGarvy Cline and J. B. Knapp. Bulletin 88, U. S. Forest Service. Washington, D. C., 1911. Pp. 75.

"Douglas fir may, perhaps, be considered as the most important of American woods. Though in point of production it ranks second to southern Yellow Pine, its rapid growth in the Pacific coast forests, its comparatively wide distribution, and the great variety of uses to which its wood can be put place it first. Estimates of the available supply range from 300 billion to 350 billion feet board measure. It is very extensively used in the building trades; by the railroads in the form of ties, piling, car, and bridge material; and by many of the manufacturing industries of the country. As a structural timber it is not surpassed, and probably it is most widely used and known in this capacity."

Lumbermen commonly recognize two varieties of the timber—red fir and yellow. Experiments show that they have practically the same strength; the yellow variety, however, contains fewer defects and is of more even grain.

The average weight per cubic foot of Douglas Fir is, oven dry, 28.8 pounds; thoroughly air seasoned, 33.1 pounds; green, 38.4 pounds. Within limits, strength varies directly as the dry weight of the wood. The greatest strength in small specimens is most frequently associated with an average rate of growth of twelve to sixteen rings per inch of radius. In grading structural timbers, however, average rate of growth has little significance.

The bulletin is replete with tables, figures and diagrams, showing the relation of the physical characteristics of Douglas Fir to its mechanical properties. Of special interest is the comparison of different grading rules and specifications for Douglas Fir, based on data secured from tests on green material, with pertinent suggestions for their modification in order to secure the best results.

S. J. R.

Preservative Treatment of Poles. By William H. Kempfer. Bulletin 84, U. S. Forest Service. Washington, D. C., 1911. Pp. 55.

This bulletin embodies in convenient form the results of the investigations by the Forest Service of methods for prolonging the life of poles. Though most of the data has been previously published in separate circulars, there is included additional information gained by more recent experiments.

In treating poles it is seldom considered practicable to impregnate the wood throughout, an outer protective envelope around the untreated interior wood proving sufficient. The antiseptic should penetrate deeply enough to prevent exposure of the untreated wood by abrasion, checking or other action. It has been the aim of the Forest Service to perfect cheap and simple methods for applying such creosote treatments locally and without expensive plants, thereby overcoming the chief hindrances to general adoption of the practice.

The more important conclusions from the investigations discussed in the bulletin are summarized as follows:

"Seasoning poles reduces their weight, commonly from 16 to

30 per cent., and even more for some species, with a corresponding decrease in the cost of transportation. Thorough seasoning is essential if the poles are to be treated with preservatives.

"In general, poles cut during the spring and summer lose weight most rapidly. Poles cut during autumn and winter lose weight less rapidly but more regularly. Too rapid seasoning may be detrimental to the timber by causing excessive checking.

"Shrinkage of poles during seasoning is very slight and does not exceed one per cent. on the circumference.

"A simple and inexpensive way of using a preservative consists in applying it to the surface of the pole with a brush. Treatments made in this manner with a good preservative may be expected to add two to three years to the life of the poles and more than repay their cost, but are not as effective as impregnating the wood with the preservative.

"Impregnation of many pole timbers, especially the sapwood of round timbers, may be successfully accomplished in open tanks, without the use of artificial pressure, by immersion in hot and cold preservative, the cold following the hot.

"The open-tank process for the treatment of poles has the advantage that it is possible to apply the preservative to the butts only, with a great saving in the amount used. Plants for butt treatments may be constructed in a simple and inexpensive manner.

"Preservative treatment is profitable financially, the increased durability of the timber decreasing the annual service charge. Relatively greater benefits are derived from the treatment of non-durable woods than from the treatment of those which possess great natural durability.

"Preservative treatment makes possible the use of poles of smaller butt circumference, since allowance usually made for deterioration need not be considered, when it is certain that the full size and strength of the poles will be retained through a long period of years.

"By the application of preservative treatment, many species of timber not naturally durable and formerly not considered suitable for poles may be used for this purpose, thus opening up new sources of supply, and greatly relieving the pole situation from the threatened exhaustion of those woods now most commonly used."

S. J. R.

Sixteenth Annual Report of the Forestry Commission of Minnesota, for the year 1910. 184 pp.

With this report closes the long and valuable service of the forestry commissioner, formerly chief fire warden, General C. C. Andrews, whose interest in forestry began some forty years ago, when Minister to Sweden. On April 12, 1911, the office was legislated out and a state forester with scientific training under a Forestry Board, similar to the Wisconsin arrangement was substituted. Thus closes the first mainly educational stage of establishing forest policy in Minnesota, which General Andrews efficiently and fearlessly pursued, and it is to be hoped that the statesmanlike, cheese-paring attitude of the legislature which hampered the chief fire warden's work may have also come to an end.

With reference to the unprecedented dry season of 1910, culminating in the tornado-swept fatal Baudette forest fire of October 7th, in which 29 people perished and a million dollars worth of property was destroyed, he thinks that if the legislature of 1909 had apropriated the $39,000 he asked, instead of only $21,000, he could have continued ranger service after September first and that probably the calamity would not have occurred.

For pay and expense of patrols and rangers and necessary fire lines, lookouts and telephones and for suppressing fires, he recommends an annual appropriation of $200,000, and $30,000 in addition for prosecutions. "The forest fire laws" he says, "will not be respected unless enforced. The state cannot keep a watchman over every heedless person in the forest regions. Examples must be made of those who violate the law, so that others will be restrained from negligence in the use of fire."

Of special interest are the references to the practicability of burning slash, quoting especially Mr. F. E. Weyerhaeuser, who having had experience with this practice in the Leech Lake Indian Reservation logging, believes such legislation as was defeated in 1908 would now be supported by lumbermen and the proposition is supported by a majority of the fire wardens as practicable. Yet the bill of the Forestry Commissioner providing for such slash-burning was not pressed in the legislature for 1911, but the law instituting the State Forester places properly in his discretion the ordering of such burning.

Altogether this bill, which provides for an annual appropriation

of $75,000, of which $4,000 salary for the State Forester, which was drawn by the Forestry Board, seems judiciously constructed in leaving discretion with the State Forester in almost all points.

Nearly two-thirds of the report is taken up with descriptions of the forestry practice in twenty countries of Europe secured by correspondence. B. E. F.

Forest Products of Canada, 1909: Poles Purchased. By H. R. MacMillan. Bulletin 13, Forestry Branch. Ottawa, Canada. 1911. Pp. 7.

The total number of poles reported as purchased in Canada during 1909 was 358,225, an increase of 172,448 poles over 1908, due to an increase in the purchase of short cedar poles by telephone and telegraph companies. For the same reason the average price of all poles fell from $1.53 in 1908 to $1.39 in 1909.

Of the poles purchased, 94.5 per cent. was cedar, 4.5 per cent. larch, and the remainder spruce, Douglas fir, and unspecified species.

Telegraph and telephone companies bought 83 per cent. of the poles used in 1909, nearly one and one-half times as many as in 1908; steam roads used 12 per cent; with the electric roads, power and lighting companies the least important users.

The average prices, by five-foot classes from 20 feet up, were: Cedar, $1.02, $1.90, $3.15, $3.99, $5.77; larch, $1.23, $2.50, $3.50; spruce, $0.79, $1.82, $2.51, $4.00, $5.00.

The preservative treatment of poles in Canada is recommended, resulting in economy of money and forest resources. Although cedar poles are cheaper in the United States than in Canada many American companies give them preservative treatment. Thus the steam railroad companies of the United States treated 31 per cent. of the poles they purchased in 1908, the electric companies 14.7 per cent, and the telephone and telegraph companies 8.5 per cent. Assuming labor $1.75 per day, creosote 8 cents per gallon, and fuel $15 per cord, poles can be thoroughly creosoted for $1.40 each. The annual charge on untreated cedar poles, costing $9 set in the line, and lasting 12 years (the average given by Canadian users), is $1.07 (money 6 per cent.). Treated cedar poles will cost $10.39 set in the line, but will last 20 years or

more, and will then cost only 91 cents for each year of service. This is an annual saving of $6.40 on each mile of line.

J. H. W.

Forest Products of Canada, 1909: Tight and Slack Cooperage, Boxes and Box Shooks. By H. R. MacMillan. Bulletin 19, Forestry Branch. Ottawa, Canada. 1911. Pp. 12.

Tight Cooperage.—Canada possessing practically no oak, the tight cooperage manufactured is not high grade. The industry is chiefly concerned with supplying barrels for the shipment of fish, packing house products, syrups, molasses and glucose. For the handling of these, barrels of elm, spruce, Douglas fir, basswood, and ash, are used. The shippers of alcohols and oils import from the United States either their barrels, or their staves and headings, or the logs. Nearly four-fifths of the tight staves used in Canada are imported in the manufactured state.

On account of the species used, the great bulk of the tight staves manufactured in Canada are sawed; bucked and split staves formed only 6 per cent. and ale and beer stock 1.5 per cent. of the total. The relative qualities of these are reflected in the average prices: $16.94 for sawed staves, $73.14 for ale and beer staves, and $86.88 for bucked and split staves, per thousand.

The manufactures totalled 9,071 thousand staves, valued at $199,204, and 425,014 sets of heading, valued at $47,912, a total of $247,116. The tight cooperage import was valued at $292,013.

Slack Cooperage.—The Canadian woods are better adapted for slack cooperage, and in 1909 there were manufactured 103,982 thousand slack staves, valued at $809,649; 8,310 thousand sets of slack heading, valued at $432,343; and 35,771 thousand hoops, valued at $353,127; a total of $1,595,119 for the slack cooperage industry.

As regards the species used in the manufacture of slack staves, elm furnished 64 per cent, spruce 16.5 per cent., and poplar 6.1 per cent. of the staves.

Basswood, elm, and poplar staves at $10.83, $8.46, and $7.28, per thousand, were the most valuable, these being largely used for flour and sugar barrels. Spruce and balsam being used for the roughest class of cooperage, were the cheapest, at $5.80.

Of the heading manufactured 31 per cent. was of poplar, which

is rapidly replacing basswood, 27.7 per cent. elm, 21.2 per cent. basswood, and 19.1 per cent. spruce. The average prices of these, per thousand sets, were, respectively, $70.00, $42.65, $57.43, and $30.68.

Of the hoops, 82 per cent. of the entire output was of elm, the remaining 18 per cent. being of basswood, birch and beech, maple and spruce, about equally. All species sold for about $10 per thousand, except spruce which brought $5.94.

Most of the slack barrels used in Canada are of domestic manufacture. The chief imports are of hoops together with small quantities of gum and sycamore for flour barrel staves.

Slack cooperage brings higher prices in Canada; the United States prices per thousand were, for 1908: staves, $5.72; heading, $45.71; hoops, $6.91; as contrasted with $7.78, $52.03, and $9.87 in Canada for 1909.

Boxes and Box Shooks.—The figures of boxes and box shooks are incomplete, representing about 60 per cent. of the quantity of lumber used during 1909 by the box manufacturers of Canada, and do not include the lumber used by shippers who manufacture their own special crates and packages.

The reported consumption was 82,972 thousand feet of lumber valued at $1,264,376. Of this amount spruce furnished 52.7 per cent. and pine 30.3 per cent., with an average value of $15.15 and $15.09 per M, respectively. "Allowing for the amount used by factories not reporting, it is probable that about 140 million feet of lumber, worth about $2,100,000, is used annually for the manufacture of boxes. About 50 per cent. of this is used in Ontario, 30 per cent. in Quebec, and the remaining 20 per cent. in British Columbia, Manitoba, New Brunswick and Nova Scotia.

A comparison of the mill run price of the chief lumber used for boxes in a province with the price paid for the same species of lumber by the box manufacturers of that province brings out the fact that in Quebec and British Columbia the latter price is higher and in Nova Scotia almost equal. This means that cull lumber and mill waste are not used for boxes. This is because of lack of competition from other woods, and because good spruce can be bought as cheaply as cull pine. The utilization of lower grades and of species not now desired for other purposes has no place in Canada as yet. J. H. W.

Forest Products of Canada, 1909: Tan Bark and Tanning Extract Used. By H. R. MacMillan. Bulletin 20, Forestry Branch, Ottawa, Canada. 1911. Pp. 6.

The total value of the vegetable tanning materials used by Canadian tanneries in 1909 was $1,126,004, consisting of 76,792 cords of bark, valued at $646,679; 17,313,500 pounds of liquid extract, valued at $428,283; and 1,372,470 pounds of raw tannins, valued at $51,042. This represents about 90 per cent. of the real consumption.

The tanning industry is confined chiefly to the eastern provinces. Ontario with 36 tanneries used materials to the extent of 66.7 per cent. of the total value of all materials used in Canada; Quebec with 26 tanneries, 23.6 per cent.; Nova Scotia with 2 tanneries, 6.5 per cent.; and New Brunswick with 3 tanneries, the remainder.

The supply of easily accessible hemlock has been used up and the importation of tanning materials has become common. Thus, in 1909, bark represented only 57.4 per cent. of the value of the total tannins used. The use of hemlock bark was most general in New Brunswick where it constituted 73.4 per cent. of the value of the materials used in that province; in Quebec it constituted 64.5 per cent., in Ontario 54.5 per cent., and in Nova Scotia 44.1 per cent. The average cost per cord at the tannery was $8.42.

Liquid extracts represented by value 38 per cent. of the materials used in 1909. The average value was 2.5 cents per pound. The most largely used were quebracho, oak, hemlock, and chestnut, all being imported except the hemlock extract. A few tanneries import their materials in the raw, chiefly quebracho.

The two chief tanning agents used in Canada are hemlock and quebracho. The former is the only home produced tannin, constituting 61.1 per cent. of the value of the total tannins used. The other 38.9 per cent., over half of it quebracho, is imported chiefly from the United States and South and Central America.

Besides the above materials used at home, Canada exports hemlock bark and its extract, the former going all to United States, and the latter, to the extent of 90 per cent. to the United Kingdom. In 1909 there were exported 19,659 cords of bark valued at $122,118, and 3,299,500 pounds of extract valued at $79,437. Both exports are steadily falling off. The total value of tanning

materials produced by the forests of Canada in 1909 was thus $889,894.

A comparison with the hemlock lumber cut shows that western hemlock bark is not utilized at all, and eastern hemlock bark only to the extent of two-thirds. J. H. W.

Report on Timber Conditions Along the Proposed Route of the Hudson Bay Railway. By J. R. Dickson. Bulletin 17, Forestry Branch. Ottawa, Canada. 1911. Pp. 27.

This report covers the territory from The Pas to Split Lake, a distance of some 235 miles. The object of the inspection was the estimation and location of areas of commercially valuable timber that could be made use of in the construction of the railway. Any such timber within eight miles of the line was classed as available, and beyond that distance wherever waterways give access; timber under eight inches breast-high was conisdered not merchantable. The method followed was to run lines back into the country adjoining the route at three to six mile intervals; field glasses were carried and tall trees climbed at advantageous points.

The report summarizes thus: "In the region we traversed, only five species—spruce, poplar, tamarack, birch, and jackpine—have any possible commercial value, and of these, speaking generally, only the spruce is large enough for sawmill purposes or tie material.

"The poplar, birch and jackpine are invariably too short, spindly, limby and crooked for any use save fuel or pulpwood, and what mature tamarack there was is now standing dead from insect attack. We did not find over 200 green tamarack above 10 inches in diameter all summer. Black spruce is easily the predominant species in all that region; except on very occasional well drained tracts where it reaches 10 to 14 inches breast high it is a small spindly tree, only 4 to 8 inches diameter breast high at maturity, useless even for second class ties. This is the condition in which the jackpine also occurs.

"The white spruce therefore is the only species large enough to furnish construction timber, sawlogs or even railway ties, and the supply is very limited. In the first place this species occurs only on the best drained spots, and in the second, the fires of the past 100 years have destroyed nearly all the old stand.

"To sum up, then, only a mere fraction of one per cent. of the area we surveyed now carries merchantable timber. There is probably enough timber available to build the rough construction work of the Hudson Bay Railway."

The territory inspected was some 8,000 square miles. The total timber found was 361,300 ties and 9,424,000 feet of lumber, and one-half of this is believed to be commercially inaccessible to the railway. J. H. W.

Uses of Commercial Woods of the United States: I. Cedars, Cypresses and Sequoias. By W. L. Hall and Hu Maxwell. Bulletin 95, U. S. Forest Service. Washington, D. C. 1911. Pp. 62.

This is the first of a series of bulletins in which it is planned to bring together the available information on the uses of the different commercial woods.

Each species is considered separately. The physical properties are first given, namely, weight, specific gravity, ash, fuel value, modulus of rupture, modulus of elasticity, and character and qualities of the wood. This is followed by a discussion of the commercial range and supply, uses, manufacture and products, by-products, etc. Each topic is elaborated in great detail, the treatment resulting in what one might term the historical technology. The bulletin is accordingly replete with information gathered from very many and widely scattered sources, covering the period from the earliest settlement of the country to the present. It forms most interesting reading.

The present issue deals with the species of Thuja, Chamaecyparis, Juniperus, Libocedrus, Taxodium and Sequoia.

J. H. W.

Economie Forestière. Par G. Huffel. Vol. 1, 2nd ed. Paris. 1910. 342 pp., fr. 10.

This second edition of the first volume of Huffel's great work, the first edition of which we reviewed on its appearance in 1904, has been largely rewritten and is considerably enlarged, comprising, as it does, only the first two studies of the original vol-

ume, with 342 pages as against 422 pages, a second part to bring the other two studies.

Especially the study on the utility of forests is very much improved and enlarged, while the history of the development of forest legislation and property conditions has experienced extensive additions.

The author does not hesitate to ascribe to a forest cover a considerable influence on rainfall.

In a review of the historical part by Schwappach, the learned reviewer takes issue with the conclusion of the author as to the non-existence of the mark communities in France, and adduces good arguments that at least in the part occupied by Alemanni and Franks this institution was developed.

That this is a standard work was recognized in our previous review, and with this enlargement it is even more so.

B. E. F.

OTHER CURRENT LITERATURE.

Wooden and Fiber Boxes. By Hu Maxwell and H. S. Sackett. Circular 177, U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

The Growth and Management of Douglas Fir in the Pacific Northwest. By T. T. Munger. Circular 175, U. S. Forest Service. Washington, D. C. 1911. Pp. 27.

Fustic Wood, Its Substitutes and Adulterants. By G. B. Sudworth and C. D. Mell. Circular 184, U. S. Forest Service. Washington, D. C. 1911. Pp. 14.

Gives the distinguishing physical and anatomical characteristics of genuine fustic wood and of its common substitutes.

The Olympic National Forest: Its Resources and their Management. By F. Burns. Bulletin 89, U. S. Forest Service. Washington, D. C. 1911. Pp. 20.

Forest Products of the United States: 1909. Bureau of the Census. Compiled in coöperation with the U. S. Forest Service. Washington, D. C. 1911. Pp. 178.

Studies in the Sawfly Genus Hoplocampa. By S. A. Rohwer. Technical Series, No. 20, Part IV, Bureau of Entomology. Washington, D. C. 1911. Pp. 139-148.

A Revision of the Powder-post Beetles of the Family Lyctidae of United States and Europe. By E. J. Kraus. Technical Series, No. 20, Part III, Bureau of Entomology, Washington, D. C. 1911. Pp. 111-138.

Progress of Game Protection in 1910. By T. S. Palmer and H. Oldys. Circular 80, Bureau of Biological Survey, Department of Agriculture. Washington, D. C. Pp. 36.

Seed-Eating Mammals in Relation to Reforestation. By N. Dearborn. Circular 78, Bureau of Biological Survey, Department of Agriculture. Washington, D. C. 1911. Pp. 5.

Contains the results so far obtained in devising methods of protecting forest seeds from destructive rodents. Instructions are given for the preparation and application of poisoned baits.

Food of the Woodpeckers of the United States. By F. E. L. Beal. Bulletin 37, Biological Survey. Washington, D. C. 1911. Pp. 64.

The Use of Soils East of the Great Plains Region. By M. Whitney. Bulletin 78, Bureau of Soils. Washington, D. C. 1911. Pp. 292.

Crown-gall and Sarcoma. By E. F. Smith. Circular 85, Bureau of Plant Industry. Washington, D. C. 1911. Pp. 4.

Proceedings of the Society of American Foresters. Vol. VI, No. 1. Washington, D. C., 1911.

Contains: In Memoriam—Frank J. Phillips; Working Plans for National Forests of the Pacific Northwest; Strip Thinnings; Hardy Catalpa—A Study of Conditions in Kansas Plantations; Forests and Stream Flow—An Experimental Study; The Philippines as a Source of General Construction Timbers; Economic Possibilities of *Pinus sabiniana;* History of the Investigations of Vessels in Wood; Experiments in the Preservation of Forest

Seeds; Eucalyptus Possibilities of the Coronade National Forest; Notes on the Management of Redwood Lands; Efficacy of Goats in Clearing Brushland in the Northwest.

Instructions to Forest Fire Wardens and Woodland Owners Regarding Forest Fires. By A. F. Hawes. Forest Service Publication No. 7, Vermont. 1911. Pp. 19.

A Summer School of Forestry and Horticulture. Forest Service Publication No. 8, Vermont. 1911.

Landscape Gardening, How to Lay Out a Garden. By Edward Kemp. Edited, Revised and Adapted to North America by F. A. Waugh. New York. 1911. Pp. 292.

Bulletin of the Harvard Forestry Club, Volume I. Cambridge, Mass. 1911. Pp. 45.

Contains: An Account of Operations in the Harvard Forest, 1908-9, by R. T. Fisher; Trees and Other Woody Plants found in the Harvard Forest, by J. G. Jack; Growth of Western Yellow Pine in the Black Hills, by G. W. Parker; Lumber Flumes, by F. R. Steel; Land Surveying in Forestry, by U. S. Howard; A Forest Fire Wagon, by H. O. Cook; Investigations Concerning the Ratio between D B H and D I B at Stump for White Pine in Massachusetts, by H. F. Gould.

The Wilt Disease, or Flacherie, of the Gypsy Moth: How to Aid the Spread of This Disease. By W. Reiff, under the direction of F. W. Rane. Boston, Mass. 1911. Pp. 60.

Fifth Annual Report of the Commissioner of Forestry Made to the General Assembly at its January Session, 1911. Providence, Rhode Island. 1911. Pp. 46.

Biennial Report of the Connecticut Agricultural Experiment Station, 1909-10. Part XI: Report of the State Forester. New Haven, Connecticut. 1911. Pp. 775-804.

The Treatment of Telephone and Telegraph Poles for Preventing Decay as Practised in Europe During the Year 1910.

By H. von Schrenk. Read before National Electric Light Association Convention at New York, May, 1911. Pp. 20.

Trees, Forestry and Lumbering: A List of Books and References in the Brooklyn Public Library. Brooklyn, N. Y. 1911. Pp. 40.

Penn State Farmer: Volume 4, Number v, Forestry Annual. Pennsylvania State College. 1911. Pp. 50.

Report of the West Virginia State Board of Agriculture for the Quarter Ending December 20, 1910: Forestry. Charleston, W. Va. 1911. Pp. 14.

Biltmore Timber Tables. By H. R. Krinbill. Biltmore Forest School, Biltmore, N. C. 1911. Pp. 12.

A Sesquiterpene and an Olefine Camphor occurring in Southern Cypress. By Allan F. Odell. Reprint Journal of the American Chemical Society. Vol. XXXIII, No. 5. May, 1911. Pp. 755-758.

The fractional distillation of saw dust of Southern Cypress (*Taxodium distichum*) yielded the writer two new compounds which he terms *Cypressum* and *Cypral*. The former is a yellowish-green, viscous and almost odorless oil, while *Cypral* is a light yellow, mobile and very fragrant oil.

Preliminary Study of Forest Conditions in Tennessee. By R. Clifford Hall. Extract (A) from Bulletin No. 10, Forest Studies in Tennessee. State Geological Survey in Coöperation with U. S. Forest Service, Nashville, Tenn. 1910. Pp. 56.

Preliminary Report on Storage Reservoirs at the Headwaters of the Wisconsin River and Their Relation to Stream Flow. By C. B. Stewart. Wisconsin State Board of Forestry, Madison, Wis. 1911. Pp. 60.

Practical Forestry in the Pacific Northwest. By E. T. Allen. Western Forestry and Conservation Association, Portland, Oregon. 1911. Pp. 130.

Second Annual Report of the Commission of Conservation, Canada. Ottawa, Canada. 1911. Pp. 230.

Contains the following papers of forestry interest: Conserving the Forests, by J. Hendry; The Swedish Forest Conservation Law, by B. E. Fernow; The Forestry Problems of British Columbia, by A. C. Flumerfelt.

Commission of Conservation: Report on Lands, Fisheries and Game, and Minerals, for 1911. Ottawa, Canada. Pp. 519.

Forty-first Annual Report of the Entomological Society of Ontario, 1910. The Legislative Assembly, Toronto, Canada. 1911. Pp. 124.

Contains several articles on insects injurious to forest trees.

Report of Boundary Survey of Rocky Mountains Forest Reserve. By G. H. Edgecombe and P. Z. Caverhill. Bulletin 18, Forestry Branch. Ottawa, Canada. 1911. Pp. 27.

Successful Tree Planters, Letters of Testimony from the Prairie Provinces. Unnumbered Bulletin, Forestry Branch. Ottawa, Canada. 1911. Pp. 37.

Afforestation in Scotland: Forest Survey of Glen Mor and a Consideration of Certain Problems Arising Therefrom. By Lord Lovat and Captain Stirling, of Keir. (Issued as Volume XXV of the Transactions of the Royal Scottish Arboricultural Society, Edinburgh). 1911. Pp. 91.

Note on the Relative Strength of Natural and Plantation Grown Teak in Burma. By R. S. Pearson, Government Forest Bulletin, No. 3, (new series). Calcutta, India. 1911. Pp. 9.

The conclusions derived from a number of tests is that it "may provisionally be assumed that as regards the strength of natural and plantation grown teak from the Zigon Division, there is little difference" while in any event "the strength of the latter is so high that little apprehension need be felt as to its excellent quality."

Memorandum on Teak Plantations in Burma. By F. A. Liete.

Government Forest Bulletin No. 2 (new series). Calcutta, India. 1911. Pp. 21.

Review of Forest Administration in British India for the year 1908-09 with a Quinquennial Summary. By F. Beadon Bryant. Calcutta, India. 1910. Pp. 58.

Die Prärien in Zentralnordamerika und ihr Wert für Forstkultur. By H. P. Baker. Dissertation. München, Germany. 1911. Pp. 94.

PERIODICAL LITERATURE

FOREST GEOGRAPHY AND DESCRIPTION.

Forests of Kamtschatka.

This part of Russia is forestally useless, only in the very valley of the Kamtschatka river is found coniferous forest *Picea obovata* and *Pinus cembra,* as yet inaccessible, so that Petropawlowsk is short of building timber. The growth on the mountain slopes is *Betula ermani,* 40 to 50 feet high and 12 to 14 inches diameter: *Betula albo* var. *japonica* with a dense thicket of *Pinus puwila, Alnus alnobetula* and *Sorbus sambucifolia.* Along watercourses *Salix* and *Alnus hirsuta* are found, *Betula nana* and *Vaccinium* species with *Lonicera edulis, Grossularia* and *Ribes* are common. Fire is rare, the nations being careful. Labor is scarce and is imported from Japan as well as wood.

From *Lesnoj Journal,* 1910. Allgemeine Forst- u. Jagdzeitung. April, 1911, P. 133.

BOTANY AND ZOOLOGY.

Shade and Light Plants.

Based upon phenological observations continued for 12 years at the Swiss Experiment Station, Dr. Engler has come to interesting data regarding the phenomenon of budding in beech and other species, but especially on the difference in behavior of plants grown in shade or in light.

Young beech, maple, ash and oak under cover of old stands open their buds earlier and are in full foliage earlier than young plants without cover or medium and old trees. In the deciduous forest, generally speaking, the foliage develops from the base to the top, first the regeneration under cover, then the lower branches and twigs of the old stand, the most shaded parts of the crown become green from 3 to 7 days later, then the tops, and last the uncovered regeneration, for beech from 11 to 15

days later; the other species showing different differences. Again, on north slopes, the buds in beech start 6 days earlier and complete their foliage 9 days earlier in the average than on south slopes.

Calling the buds formed and plants grown in the open "light buds" and "light plants," and those grown under cover "shade buds" and "shade plants," the investigator found by transplanting experiments with young trees that this progress of budding is due to the characteristic of buds formed in the shade to bud earlier than those formed in stronger light; in other words, the tendency of earlier or later budding is not merely due to ecologic conditions, but it is inherited in the bud, and only gradually, after several years, does an adaptation to new light conditions take place: the shade plants for several years bud earlier than the light plants and vice versa. Also leaf and twig position and the specific anatomical structure of the leaves of shade and light plants persist: the effect of a certain light intensity outlasts the cause. On the other hand, seedlings of beech grown in the shade while budding earlier than unshaded ones, did not show in 1 to 3 year olds, much of this influence: the shade and light plants can be without danger, transferred to opposite conditions, although a small advantage of light plants was observed.

Light buds are larger, heavier, stouter and more closely covered with more numerous scales and have the *anlage* for a longer shoot with denser foliage and of the structure of light leaves, as the shade leaves are also recognizable in the structure of the bud.

Some practical conclusions for silvicultural treatment are deduced and some of the practices receive new explanation from these observations, as, for instance, the damage resulting from too rapid removal of nurse trees above a young regeneration, creating light conditions to which the young plants are not adapted. Too slow removal on the other hand, produces decided shade forms, which, when freed, only slowly or not at all recuperate. The spreading habit, which Hauch lately made the basis for determining the spacing in plantations, the author finds variable according to climatic differences and consequently difference in light intensity.

In planting fail places with material secured from natural regeneration, no shade plants should be used and for under-

planting light plants of some age are to be avoided, although 1 to 3 year olds from seedbeds, as stated before, may be used in any condition, while transplants that are to be used after several years should be grown under conditions similar to those in regard to light as they are to be used in.

Untersuchungen über den Blattausbruch und das sonstige Verhalten von Schatten- und Lichtpflanzen der Buche und einiger andrer Laubhölzer. Mitteilungen der schweizerischen Centralanstalt für das forstliche Versuchswesen, 1911. Banx, pp. 107-175.

Water Movement in Trees.

Professor von Schermbeek publishes a contribution to the explanation of water movement in trees, based in part on older theories, in part on manometric measurements of his own on live and dead wood. He concludes:

1. The cause of the ascent of water in the living tree is caused by a difference in pressures (deficit) which is provoked in a higher part of the tree trunk relatively poorer in water as long as a lower part can still enrich the cell walls of its tissues with water by imbibition.

2. The degree of volume increase of the imbibing tissue is determined by the ion contents (i. e. amount of soluble salts) of the imbibed water.

3. Transpiration and assimilation maintain the necessary difference in the relative water contents of the neighboring higher and lower parts.

4. Conducting vessels can be supplied with water from their cell walls. When these organs come under the influence of this pressure difference, an accelerated movement of water sets in, provided, that the eventually present gaseous substances are absorbd by the imbibed water.

5. The imbibition proceeds fully only as long as the colloidal cell wall substance is still capable of swelling.

6. If this is not the case, then a part of the trunk can secure its water only by conduction, equal volumes of gas and water being exchanged.

7. The conduction is the slower, the greater the resistance which is opposed to the movement of gases. Hence the water absorption in a slowly dying part is smaller in a given time than in a killed part by destruction of tissues.

8. The gradual dying is a kind of preservation of wood, the artificial killing causes an accelerated decomposition.

Ueber die Kräfte welche das Emporsteigen des Wassers in unsren Nadelhölzern und Laubhölzern verursachen. Allgemeine Forst- u. Jagdzeitung. June, 1911. P. 204.

Insects and Forest Floor.

The removal of the litter from the forest floor reduces, according to Dolles, the variety and number of insects in the forest. This is a detriment, since the reduction is least among those insects which are injurious to the forest because their food supply remains undisturbed. It is greatest among those neutral species which live in the leaves and grass on the ground. These species are called neutral because they neither attack trees nor prey upon other insects which are injurious. But they have an important function in that during the absence of noxious species they serve as hosts upon which beneficial parasitic insetc are propagated and as prey for predatory species keeping these alive in sufficient numbers to render effective service in combating a sudden outbreak of injurious insects.

Parasites do not confine their attacks to weakened individuals, but once parasitized, the insect is weakened to a degree which prevents it from pushing deeply into the soil to pupate. Most parasites accordingly develop in the ground cover or on the surface of the soil and are either removed with the litter or are eaten by birds after the litter is removed. The healthy individuals of the injurious species are undisturbed because they pupate deep in the soil.

The preservation of the ground cover further checks the development of insect pests by affording nesting-places for many insectivorous birds and ants and by harboring entomogenous fungi.

Einfluss der Streunutzung auf die Vermehrung unserer Waldschädlinge. Silva IV. Feb., 1911. Pp. 49-50; 59-61.

New Genus of Bark Beetles.

Forstrat Seitner gives a lengthy account, with illustrations, of the bark beetle, which has *Pinus cembra* for host plant. While this beetle had formerly been supposed to be *Polygraphus poligraphus L.*, specific on spruce, Seitner adduces features to show that this is not only a different species, but should be made into a new genus which he calls *Pseudopolygraphus.* The character of the galleries and breeding chambers is curious and entirely different from those of any other European species; the beetles have distinctive features. A full description is given. Incidentally, the occurrence of *Polygraphus grandiclava* on *Pinus strobus* as well as on *cembra* and on cherry is mentioned, and an interbreeding of various bark beetle species suggested.

Bemerkungen zur Gattung Polygraphus und Aufstellung der Gattung Pseudopolygraphus n. gen. Centralblatt f. d. g. Forstwesen. March, 1911, pp. 99-109.

SOIL, WATER AND CLIMATE.

Relative Soil Humidity and Moss cover.

A further interesting contribution regarding influence of litter on water conditions of the soil comes from the long continued experiments carried on by the Austrian Experiment Station. The first contribution was briefed in F. Q. Vol. IV, p. 161. Now Dr. Wallenböck reports additional data corroborative of former results and discusses also methods of procedure. He develops the idea of the *"relative soil humidity,"* a conception similar to relative air humidity, namely the percentic relation of the actual water contents to the absolute water capacity of the soil, with which the loose terms based on individual notions and judgment, wet, moist, fresh, dry, arid, might find a more precise expression and conveying more clearly than weight or volume per cent. of soil humidity the fact whether a wet or dry soil is under consideration.

Without going into the interesting details of method and results, we may summarize the experiences. In dry years, the area covered with moss dries out more slowly than the one that is yearly deprived of its cover by raking, but light summer rains do not become available because the moss

and surface layers of soil of higher water capacity prevent penetration. On the other hand, the naked soil can derive use of the lightest precipitation and thus in the very most dangerous season supplies moisture to the roots. On this area the drying out, but also the watering is most intensive, hence in very dry years, the moss cover is a disadvantage, the interception being more dangerous than the prevention of evaporation effective.

Hence, as briefed before, the raked area had in the dry year 1904 shown less loss in increment than the unraked. Yet the damage of moss cover in dry years appears much greater than its advantage in wet years.

Vergleichende Bodenfeuchtigkeitsbestimmungen, etc. Centralblatt f. d. g. Forstwesen, May, 1911, pp. 187-269.

Cause of Bog Formation.

The large and growing area of bog land in northern Sweden seriously lowers the productivity of the forests in that region. It is according to Hesselmann, not the water which prevents vigorous forest growth on these bogs, but the fact that the bog-water carries very little or no oxygen in solution. What oxygen is absorbed from the air is fixed by the humus the water contains. It has been shown that humus, especially when wet, absorbs oxygen very rapidly; also that trees grow well in those bogs where conditions permit a normal amount of oxygen in the water. Removal of the water by drainage is being undertaken to remedy this condition.

Ueber den Sauerstoffgehalt des Bodenwassers und dessen Einwirkung auf die Versumpfung des Bodens und das Wachstum des Waldes. Silva IV. Pp. 65-6. (March, 1911.)

SILVICULTURE, PROTECTION AND EXTENSION.

Selection Strip Method.

As a result of an inspection visit of a number of prominent forest managers to Gaildorf, the district in which Wagner developed his now well known method of regeneration a somewhat detailed report of their findings is given by Müller.

The main object of Wagner's method is to obviate large felling areas and progress as far as possible by use of natural regener-

ation slowly in strips, with conifers from north to south, with broad-leaf species from northwest to southeast, treating each strip in selection method with regard to the need of the young growth, removing the old growth when the regeneration is knee high; and planting up fail places or to secure a mixture. The method is mainly applied to spruce and pine.

The resumé is that in the locality referred to the method has been successful, although "the condition of the strips is very variable according to soil, age and exposure," the regeneration was found very ample and on north sides on better soils ideal, but also good on other soils and exposures.

Of course, the method is not applicable everywhere. Where climatic and soil conditions are favorable and appropriately mixed stands exist, and a well considered road system and market for small material permitting the many small felling areas, and small districts under competent managers are involved—there it is a first class method.

Der Wagner'sche Plentersaumbetrieb, etc. Allgemeine Forst- u. Jagdzeitung. April, 1911, pp. 113-118.

Perfection in Planting.

Further experience in the use of Splettstösser's new planting tool described in F. Q. vol. VII, p. 467, and also referred to in vol. VIII, p. 504, sustains the enthusiastic dictum of Dr. Moeller, director of the Forest Academy at Eberswalde, that it is *unquestionably technically perfect and approaches as near as possible the ideal of pine planting. Its most significant advantage is the cheapness of its work.*

Kranold records in tabular detail the experience in 74 plantations made in 1910 in West Prussia, comprising about 1,900 acres on old forest soil, and over 2,000 acres on waste lands. The cost of these plantations, including plants and every outlay varied between $2.20 and $8.50 per acre, most of them having been spaced 1.3x.5 to .8 meter i. e. 4,000 to 6,000 plants per acre. The making of holes and setting of plants varied between 21 cents and $1.23 per M plants, wages being for men 43 cents, for women 28 cents, for boys 24 cents. (Considering the higher wages but the greater efficiency of American male labor this cost

should be multiplied by between 3 and 4, for American conditions, say from $1.00 to $3.50, average $2.50).

In most cases man labor is not required, except on stony and rooty soil, and the boring of the plant holes if the tool is properly used not hard work.

The manipulation of the three tools which complete the outfit, namely the borer, the plant holder and the presser (to be had from Bach and Mahlow, Berlin, Sophienstr. 32, for $5 to $6 according to size, diameters 8 to 15 cm, 10 cm being the most usually applicable), is given in minute detail.

In boring the holes the smallest amount of force is to be used; how many turns are to be made and how often the borer is to be emptied depends on soil conditions and length of root; the hole should be made as deep but not deeper than the roots. If boring in loose sand which has a tendency to flow out, the boring must be made into the more solid ground, which will cork the bottom. The plant holder can be widened for stouter plants ad libitum. Its manipulation is the finesse of the operation; it permits the placing of the plant in the middle of the hole at the appropriate depth, while the planting is done by hand comminuting the soil with the fingers. After a third of the hole is filled the presser is used by carefully firming without pounding, close to the wall of the hole, so that the soil in the center remains somewhat loose; a second pressing is done after two-thirds of the hole is filled, and after the final filling the soil is firmed with the hands, and the holder is carefully withdrawn. Precision in every part of the manipulation is needful also keeping the borer sharp. The little troubles that first occur with green hands are explained.

It is important that the planting proceed as fast as the boring i. e. it is undesirable to let the boring get much ahead. How many planters one borer can keep busy depends upon the soil conditions. In easy conditions four planters, in difficult one to two can be kept going by one planter (one man and two women can plant 180 plants per hour).

The applicability of this tool is very general, although not unlimited; heavy loam and very stony soil are excluded, because of the expense. On sandy soils, even when rooty, it is most useful, with or without previous soil preparation (furrows or plats) to remove the surface cover. It is difficult to judge when such preparation is necessary and how much. The writer considers

that the inclination is to do too much in this respect. Often a slight burning of the cover is sufficient. When proper judgment in this direction has matured by experience he expects the planting to become still cheaper.

We repeat the illustration from Vol. VII on p. 513, and recommend to our readers trials with this new tool so highly recommended, accentuating that all new tools must first be carefully studied in their operation before they appear practical.

Die Kiefernzangenbohrer-pflanzung. Zeitschrift für Forst u. Jagdwesen. April, 1911, pp. 358-367.

A New Dibble.

A heavy, wedge-shaped steel planting iron has been designed by Dr. Raess, of Darmstadt, to replace the dibble used in forest planting. It consists of a solid steel blade seven inches long, six inches wide and two inches thick, with a shank about three feet long, at the top of which then is a cross handle like that of a ship's auger. The tool weighs fourteen pounds. It is used in much the same way as the dibble, and the advantages it possesses over the lighter instrument are not given. Two persons work together in setting out trees with this planting iron, one handling the tool while a helper holds the plant made by the first stroke of the instrument until a second stroke closes the earth firmly about its roots.

Der Stahlkeilspaten. Silva, IV. April, 1911. Pp. 105-6.

Races of Pine and Silviculture.

In a very readable article Dr. Kienitz presents observations and thoughts of thirty years on the great variability in form of Scotch pine and points out the important silvicultural deductions from this fact. The article is illustrated by 20 figures drawn from photographs, which exhibit this form variety of the most important European forest species.

Considering that the field of distribution of this species extends from the North Cape in Norway to the southern slope of the Alps and to Spain, and from Cape Finisterre to the Amur, a field of the most varied climate, this highly developed variability of form is to be expected, and, since to a certain degree these forms are hereditary, the importance of securing seed from given localities

is accentuated, since one race may in a given locality be quite worthless which elsewhere would have good value.

The forms differentiate by morphological characteristics of needles, buds, cones, ramification, growth, probably of root-system, as well as different response to soil and climate. The author confines himself mainly to a discussion of crown and shaft form.

The pictures gathered from many points of the botanical field and different situations exhibit the variety. They show that the old pines from southern and middle Scandinavia, from Livland, but also from the Black Forest, those from the Bavarian Alps and the mountains of southern France are alike in the straight erect bole which holds out to the very tip like a spruce, with thin, relatively short branches and short stout, vigorous needles—so much like spruce in form that in a picture they are apt to be confounded. Quite different is the short stout tree of the Mark Brandenburg with an immense, rounded off, paraboloid or hemispherical form, with stout, gnarly, often bent and broken branches and bushy long needles. While in each locality one or the other form is prevalent, the most varied forms can and do occur in the same locality. The greatest variety of form is to be found in the lowlands with mild climate, where only rarely here and there the desirable spruce-like form occurs. The severer the climate, the farther north and northeast, the higher in altitude the more slender, spruce-like becomes the form. Since, however, everywhere different forms are found together, these cannot be varieties or races specially adapted to the site, but for each site a form developes from the variable species, which is specially favorable; hence where all ecological conditions are favorable, the greatest variety of form is found; where broad crowns are an advantage, these will prevail, and where this broad form is disadvantageous as in the snowy mountains and northern latitudes, this form will be scarce. The influence of snow pressure in causing form is argued at length; on the other hand Mayr's dictum, that the higher air humidity on good soils causes trees to grow not only higher but more slender, is combated as regards the latter proposition.

The spreading habit, to be sure, can to some extent be corrected by education—dense planting and by mixing with spruce, provided the latter is as well fitted to the locality as the pine. On

sites on which naturally the pine developes the slender form, it will do so in pure plantations. In localities where the tendency is to develop spreading form and pine and spruce in mixture is to be grown, the former must be planted so close as to form a dense stand, when later the spruce, first undergrowth, may force its way through, otherwise spreading valueless pine will develop.

Soil has an influence on crown only as far as it accelerates or retards growth. On the poorest soils the straight growing form with a bole holding out to the tip will develop although remaining low, but on fertile moist soil the coarse and spreading form will only become more so. Even in open position the two forms will follow to a degree their inherited character.

Unfortunately it has not yet been possible to recognize cones of the various forms. A little better success is promised in morphological and physiological character of branchlets, buds and needles, by which Schott tentatively recognizes nine forms in West and Middle Europe alone. A peculiarity of the East European pines is mentioned, namely the assuming of a protective color by one year seedlings in September, later and later when going westward until finally the habit is lost.

Results of trial sowings with seed of varied derivation instituted through the International Association of Experiment Stations, are recited. Race differences were evident in the seedlings during the first summer, namely in the size of plants, color and length of needles, and time of cessation of development in the fall, and winter color of plant.

Very considerable differences in size and weight of the plants were found, namely up to 40% in length, and nearly 400% in weight. In the transplants, after a years growth the general relation of the different races in length remained practically the same, although the amounts varied, the greatest difference being 100%. Scotch, Russian and French plants remaining smallest, Belgian and Rhenish plants the largest. The color variation also persisted through the second winter while in the third season the relative position as regards length remained practically the same, the rapidity of development during the season, however, was essentially different, the Scotch and Russians having made by May 8 about double the length of shoot of the Belgian and Rhenish.

The fourth year shoot being longer in all races, accentuated

still further the difference in total height the rapid growing races making nearly twice the length of the slow growing , but a tendency to broaden is already noticeable in the Rhenish race. Altogether the rapid growers make a stouter appearance due to stouter needles. The winter coloration of the eastern race is striking, while the western remain practically green.

Deductions for silvicultural practice follow. First we must break with the usual assumption that the pine makes the straightest branches where in mild climate it finds the most favorable conditions of growth and is the dominant species. Just where in a harder climate it has to battle for centuries against storm and snow, the form most suitable with short branches, a race of slender form is developed which with considerable assurance propagates itself in the progeny, no matter whether grown in the open, in loose or dense position, and which persists if transplanted into soil and climate not too different. To be sure, they take with them other characteristics which may not be desirable, like slow growth of northern and alpine races. The races with spreading habit can only in dense stand produce straight boles. In mixture with other species when more rapid growing than these they grow into broad crowns, if not in advance they are shaded out.

The seed of a perfectly formed tree in the locality of mixed forms may have been fertilized by an inferior form, hence may not propagate the better form of its one parent. Here is a dilemma as to what locality to choose seed from.

Broad crowned trees, to be sure, have other advantages, they have a very much larger increment, as measurements on properly selected specimens of slender and broad crowned forms, both dominant show. In a 58 year old stand the large crowned averaged nearly 40% larger diameter than the small crowned trees; in older stands even more. and the contents were nearly double. The value per acre of a fully stocked acre of the broad-crowned the author estimates, would be one-third more. Hence there is no reason why in a pine region other than the home form should be used for pure pine forest. But then it is necessary to be circumspect in growing them densely, and especially attending to the timely removal of the worst forms. Where, however, the pine is not at home it would be proper to secure the seeds of the best form from a region similar in climate to the locality where they are to be used. The character of the progeny shows itself

quite early, and of plants which lag in the first few years not much is to be expected, while those that start out properly have the promise of success in them.

Formen und Abarten der germeinen Kiefer. Zeitschrift für Forst- u. Jagdwesen. Jan., 1911, pp. 1-32.

Seed Supply.

The question of the influence of the derivation of seed is being carefully looked into by the Swedish Forest Experiment Station. Gunnar Schotte reports on experiments started in 1903 with pine seed from different localities in Sweden. The results are not yet definite in all respects, but it is evident that the far northern form of *Pinus silvestris* (*lapponica*) furnishes smaller plants than the seed from more southern localities. Whether the age of trees from which seed is secured is of influence on the resulting plants could not be fully decided, except that the oldest seed trees with a few exceptions furnished the poorest plants. The stoutest plants were secured sometimes from middle aged, sometimes from the youngest mother trees. Nevertheless the author thinks that the prejudice against seed from young trees is justified. In the form of plants a strong variation is visible, the Norrland pines having very much shorter branches and generally narrower form with shorter but broader leaves.

Om betydelsen af fröets hemort och moderträdets alder vid tallkultur. Meddelanden fran Statens Skogsförsöksanstalt. H. 7, 1910.

Coloring of Imported Forest Seed.

In the annual report of the Swedish Forest Experiment Station for 1910 appears an article by Gunnar Schotte which should be of interest to American foresters in view of the fact that we are inclined to ignore the influence of the source of seed in artificial afforestation. The article is devoted largely to a description of the methods employed by the Government for limiting the importation of southern seed, rather than to a demonstration of its inferiority for Swedish culture, the latter point apparently having been already established. It is the latter phase of the subject, however, which is of special interest to us.

It has been found in Sweden that pine forests (*Pinus silvestris*) established from seed imported from southern coun-

tries, especially Germany, although appearing very thrifty in the early stages, usually die at an age of from twenty to thirty years. Large quantities of pine seed were imported from German seed firms during the decade 1860 to 1870, and considerable quantities were imported in the years following this period. So universally disastrous were the results from this seed that in 1886 steps were taken by members of the Riksdag to place a prohibitive tariff upon imported pine seeds. In 1888 the Riksdag decided upon a moderate tariff of 50 öre (about 13 cents) per kg. for pine and spruce as well as all other forest seeds.

In the discussion preceding the adoption of this tariff, instances are cited where extensive pine plantations from twenty to twenty-five years old present a very unpromising appearance while adjoining stands from native seed are healthy and vigorous. No conclusive facts are advanced against the use of foreign spruce seed, but spruce is included in the tariff as a measure of precaution.

Despite the tariff, the importation of pine and spruce seed increased at a rapid rate during the following decade, with the result that in 1898 the tariff on pine was raised 3 kr. (about 80 cents) per kg. while the tariff on spruce was raised to 1.5 kr. (about 40 cents) per kg. In the discussion over the adoption of this increased tariff, reference is made to the occurrence of large areas of pine plantations grown from German seed in different parts of the country which died at an age of twenty to thirty years, and which, upon investigation, proved to be infested by a fungus disease heretofore unknown in Sweden, and evidently introduced with the German seed. As a result of this experience, the Government prescribed that in all state forests, only Swedish seed should be used.

In practice the tariff was extended to all seeds in the names of which the words "pine" or "spruce" entered, thus covering a great many species of Pinus, Picea and Abies. Vigorous protests were entered by forest men, on the ground that there was no reason for imposing the tax upon anything but the ordinary pine and spruce (*Pinus silvestris* and *Picea abies*), but that on the contrary the introduction of many of these trees should be encouraged. The Riksdag, however, finally decided to retain the tax, on the ground that new foreign seeds whose adaptability was

not known might be imported in large quantities with disastrous results.

In recent years, owing to the high price of Swedish pine seed, it has been the practice among some dealers in spite of the high tariff to import German pine seed and sell it as the Swedish article. In order to protect the public against such frauds the Government has adopted a system of coloring all imported coniferous seed. This coloring is accomplished by injecting an alcoholic solution of eosin into the seed sacks, at sufficient close intervals to color approximately 15% of the contents.

It has been found that the eosin solution, through the action of the alcohol, reduces the germination per cent. in various degrees. Fresh seed is less affected than old seed. Considering the fact that only 15% of the seeds in a sack are actually colored, the actual loss through the treatment was found to be only from .6 to 3.6 per cent. for four different species of coniferous seed tested.

On April 4, 1910, a proclamation was issued by the King, requiring that all foreign seeds of the genus Pinus, excepting *P. cembra* and *P. siberica,* and all species of the genus Picea, may be imported only in sacks marked plainly on the outside with the words "Foreign Seed"; and further, that all such seed must be treated with the eosin solution in accordance with a prescribed method. G. A. P.

Om färgning af skogsfrö i syfte att utmärka utländsk vara. Meddelanden fran Statens Skogsförsöksanstalt, Häftet 7, 1910.

American Species in Germany.

Dr. Walther reports on the success of planting exotics in Hesse during the last 25 years or more. Most of the species used are American. Among broadleaf trees, the Red Oak is specially praised on account of its adaptability to less favorable sites and more rapid growth than the native oak, both in rate of growth and quality excelling on such sites. The older plantation, on run-out oak-coppice soil, now 47 years old, showed in 1907, when 42 years old an average height of 57 feet and diameter of 5 inches with 4,000 cubic feet to the acre. Thinnings in 1905 brought over 10 cents per cubic foot. In spite of frost, the species outgrows the native oak.

Of nut trees, *Juglans nigra, cinerea* and *Carya alba* are said to be useful only in protected situations on account of frost danger. Hickory 20 years old is 16 feet, Walnut 10 years old, 7 feet No special advantages are attached to the American maples, except perhaps the Sugar Maple.

The American Ash is said to recover from overflow more readily and resist late frosts better than the German. Curiously enough our Black Cherry is supposed to be outranked in value by the native cherries, evidently a misconception.

Of conifers, next to *Pinus Strobus,* which is considered almost a native, the palm is given to the Douglas Fir. Much distinction is made between the green (from the Pacific Coast), the slow gray *glauca* from the dry (Rockies) and the rapid gray variety *caesia* (from the transition zone) The species is found not adapted to dry and to heavy clay soils, indeed, makes considerable demand on both soil and air humidity. It recovers remarkably from attacks of Schütte, a 10-year Douglas Fir, entirely defoliated by the disease recovering entirely.

Picea pungens, the species of our driest mountain slopes, is found successful in boggy situations where *P. sitchensis* had failed, and is generally hardy, but requires patience as it grows slowly (3 feet in 8 years). Its seed comes often mixed with *P. engelmanni.*

Picea alba is outgrown by the native spruce. With 18 years the latter is 16 feet against 13 feet for the former; besides it suffers from late frost, and is no better on moor soils than the native.

Pinus Banksiana is greatly preferred to *rigida,* especially on poorest sands and on wet cold, higher elevations, where it does better than the native *silvestris.*

Of firs, *Abies concolor* is declared the most desirable introduction, growing more rapidly than the native *pectinata* both in plain and mountains. It does not stand wet feet, especially not wet-cold clay soils. Seven year old plantations average 4 feet in height, with leaders of 10 inches. *Abies Nordmanniana,* while less liable to frost than the native fir, is much slower (20 inches in 6 years, 13 feet in 21 years, etc.).

Chamaecyparis Lawsoniana adapted to sand soils and loess, but not to frost holes and wet-cold clay, at first slow, soon ac-

celerates and makes 15 feet in 17 years, and has the useful quality of being shunned by game.

Juniperus virginiana is very liable to be injured by game and needs warm situation or protection.

Sequoia gigantea does very poorly on dry soil and is not quite frost hardy.

Anbau fremdländischer Holzarten. Allgemeine Forst- u. Jagdzeitung. May, 1911, pp. 154-167.

Combating the "Nun."

Dr. Laspeyres brings evidence from a very extended trial of insect lime against the nun on some 30,000 acres in East Prussia, of its ineffectiveness, and combats the position taken regarding this theme by Putscher in the November number of the same magazine.

Two other contributions on the theme from Saxony from which state Putscher secured data to prove effectiveness of the insect lime also negate the evidence and agree with Dr. Laspeyres

Other more favorable experiences were recorded at a meeting of the Saxon Foresters' Association.

Zum Kampf gegen die Nonne.
Zur Nonnenbekämpfung in Sachsen.
Zum Nonnenkrieg in Sachsen.
Zeitschrift für Forst- u. Jagdwesen. May, 1911, pp. 424-435.
Centralblatt f. d. g. Forstwesen, May, 1911, p. 235.

"Schütte" Fungus.

As a contribution from the mycological laboratory of the forest academy at Eberswalde, the result of three years' work, Oberforster Haack publishes an extensive article of over 75 pages on the biology of the fungus which causes the dreaded damping off or "Schütte" and which in Germany attacks plantations as well as nurseries, with practical deductions.

When in 1852 Göppert suggested a fungus as cause of the phenomenon practitioners refused to accept the explanation, and even until 1884 this position was maintained. Nevertheless it remained for practitioners to suggest the remedy, copper sulphate spray, in 1898 and 1900.

It is now absolutely certain that the disease is occasioned by *Lophodermium pinastri*, which attacks the healthy needles of 1-7 year old pines and causes their death, the first signs being found

the end of September. The reddening increases through the fall and winter, until in April-May not a green needle may be seen; a large number of plants, however, recover themselves with green shoots. When the needles fall, as yet no fruit bodies are to be seen, which form later. The principal time of infection takes place the end of July until middle of September, when alone spraying is of use.

A number of questions remain to be solved. The fungus occurs also on old trees but is then comparatively harmless, seemingly saprophytic. Is this a different form or species, or is there danger of its propagation to be transferred to seedbeds in their neighborhood and become parasitic, or are the needles of old trees immune. Authorities differ, and it appears that the biology of the fungus is but little known.

By careful cultures under investigation, explained in great detail, the author has been enabled to show up various fallacies of Tubeuf and Mayr and develop very fully the biology of the fungus, which shows it to be a parasite, to be sure, but little adapted to parasitic life—just emerging from the saprophytic stage; but in its ability to penetrate into healthy needles and to exist there untroubled by competitors lies its strength.

We can from the very interesting detail select only a few points.

The fungus on old trees is the same as that which attacks the young, but here, probably due to different physiological characteristics, it does not do damage. Practically it is therefore desirable to locate nurseries out of reach of old infested pine. Immunity is gradually attained in the 7th to 10th year, but needles which by girdling are weakened succumb even in older trees to the fungus.

The needles which drop in the spring are the ones that spread the disease in late summer. The infection takes place within a short time. Only on young plants are the healthy needles attacked,—it is an infantile disease.

By spraying only those spores may be rendered innocuous, which have located a few days before or those which locate while the liquid hangs on. Spraying is of use only on older seedlings. The needles of yearlings are covered by a fine waxy cover which prevents the spray from sticking. An attempt, successful, to first dissolve this waxy film by soap or other solvents, which permitted the spraying mixture to hang on well, led to a drying up

of the seedlings; the cover is a necessary protection against excessive transpiration.

The author combats the idea that the use of heat in securing the seed from the cones predisposes them to the disease. As regards influence of the locality from which the seed is derived on the susceptibility of the plants to the disease the author comes to somewhat different conclusions from Prof. Mayr (see p. 301 of this volume), especially, he denies that there are immune races; simply more or less predisposition to the disease can be claimed.

The practical results of the careful work are summarized as follows:

1. For choice of plant material, the best homegrown seed of high germination per cent. should be relied upon.

2. Infection takes place mainly from middle of July to end of September.

3. The spores develop on old as well as young needles, but the heaviest infection is found in young plantations, the least in vigorous mixed growth.

4. The infection may be either at a distance (by flying spores uniformly over large areas) or in proximity (by contact in close plantations).

5. To avoid infection, seedbeds should be located away from infected places.

6. To avoid infection by contact, sowing and transplants should not be placed side by side; only the healthiest most vigorous material should be transplanted; the poor material should not be left lying, but be burned or buried. In the forest dense sowings are to be avoided, or planting substituted for sowing.

7. It is desirable to make plantations so that they will rapidly grow out of the danger period and close up, avoiding the necessity of planting up fail places, such plantings being especially liable to infection and propagating it. Hence good soil preparation, the use of the best seed or plants from good soil help to secure immunity.

8. Spraying when the first apothecia open may be necessary every year, especially when plantations are still quite young and on the most endangered places, if thorough work cannot be done on all.

Der Schüttepilz der Kiefer. Zeitschrift für Forst- u. Jagdwesen. April, May, June, 1911, pp. 329-357, 402-423, 481-505.

MENSURATION, FINANCE AND MANAGEMENT.

New Self-recording Caliper.

According to Forstamtsassessor Wild, of Lindenhardt (Ober Franken) the existing self-recording calipers have not found entrance into general use because they are too complicated and hence get easily out of order. The reason for their complication he finds in the fact that they have counting register, which require not only a large number of wheels but as many springs, so that for a caliper with 30 diameter graduations 90 wheels and 90 springs are required, if constructed for one species only, and three times as many for three species. The inventor overcomes the difficulty by substituting for the counting apparatus an arrangement in which small steel balls, for different species of different size, register the number of trees of different diameter and can be sorted afterwards by size (species) and counted.

To do this the moveable arm at its base has attached receptacles for the balls, as many as species to be measured, each receptacle being provided with a press button to release balls and let them fall into another receptacle which is divided into as many compartments as their diameter graduations, the proper compartment being automatically presented for the ball to fall into. To sort the balls sieves of different size are used, and to count them they are measured by 25s in cartridge-like boxes, which operations require a few minutes only. The ball supply receptacles must, of course, be marked for the species they represent; the smallest caliber for the most frequent species, and, of course, for use with a single species only one supply receptacle is needed. The weight when loaded is less than four pounds; the construction is simple, and the instrument works in any kind of weather.

So far the instrument is not yet manufactured generally, indeed, not yet patented. The inventor invites correspondence as regards furnishing instruments.

Eine Selbstregistrirekluppe für mehrere Holzarten. Forstwissenschaftliches Centralblatt. June, 1911, pp. 305-308.

New Increment Borer.

In a most enthusiastic and, with 20 pages, most complete article does Oberforster Dr. Heck introduce the reader to a perfected increment borer and to the incalculable value of self-instruction by the persistent use of such borer, reviving Pfeil's noted advice, "Ask the trees!"

As is well known Pressler was the originator of the brilliant idea of the increment borer, but the instrument left much to be wished for. An improvement was made by Bretschneider, especially in the handle, but the perfect borer is made in Sweden by Mattson, and the most perfect type of this only since August, 1910, as a result of Heck's suggestions.

The superiority of the Mattson over the Bretschneider was shown by trial as follows:

Species.	*Number of half turns.*		*Time Minutes.*		*Length of Cylinder mm.*	
	B.	M.	B.	M.	B.	M.
Elm,	90	22	7	3	89	137
Walnut,	90	21	5½	2½	82	137
Spruce,	15	21	4	1½	91	130

Originally, different borers for hard and for soft woods were necessary and especially the former got often into trouble; the new type, Mattson's No. 3 works perfectly in both soft and hard woods, a faultless tool, and the only improvement the writer can think of is some electric power to do the boring. Yet, with this instrument the writer could extract 25 cylinders from 40 year old spruce 4 to 5 inch long in 57 minutes; in hardwoods, to be sure, the effort is much greater, three to four minutes being required for the hardest.

The instrument is extremely practically arranged, works rapidly and surely, makes beautiful cylinders, much better than Bretschneider's, and long, and so smooth that only in few cases a magnifying glass is required.

There are four types made by And. Mattson, Mora, Sweden, varying merely in length of bore by two inches from 4 to 10 inch, and for use in hardwoods (as well as soft woods) being of harder steel the prices run from $3.50 to $8.50.

Merely to show what interesting data as regards increment and

the influences upon it, the author tabulates the results of some 80 borings.

He points out that in Sweden over 1,000 borers are in use—the reviewer can attest that every forester he met there had his borer handy and was on the qui vive to use it—and enlarges upon the value of its uses for self education. "It belongs to a forester's outfit as the plane to the carpenters," and whoever has once begun to use it will, like the author, find such fascination in it as to make its use a mania!

A few remarks on the increment per cent. according to Schneider's formula explains the relative reliability of the latter.

A table gives comparison of the detail of the various makes.

A few hints regarding the use of the instrument are given. Oiling (with fat pork) is not at all necessary in soft woods and not absolutely necessary in hard woods but makes the work easier. It is easiest to bore at the height of the elbow; first bore horizontal and to the center, with force but slowly as far as the thread goes, then, when the instrument is solidly in, turn rapidly until towards the end when the turning becomes slower; then after a short back turn introduce the needle, which is very easy in soft woods, in hard woods requires some coaxing or rather trying for a place where it goes readily. In 700 borings the author did not break a needle. Close the bore hole with a twig end tightly. No unfavorable results of the boring having been observed in 10 years. Recording the cylinders and keeping them best in a flat pencil case, and cleaning the instrument like a gun and careful protection of the cutting edge are also necessary.

Neues und Altes vom Zuwachsborer. Forstwissenschaftliches Centralblatt. May, 1911, pp. 247-268.

Measure of Crown Density.

The Russian Medwiedew, the originator of the idea of relative height which he used to determine relative tolerance of species, has developed an interesting new method of determining density classes by a careful investigation. After a discussion of generalities regarding height growth and influence of light and density on development of stands, he comes to the conclusion that the diameter increment in open position exceeds that in dense position

by one and one-half, even on best sites, while the height growth corresponds here to that of the poorest sites.

Calling the relation of height to diameter the relative height, he finds this relation to be dependent on the light enjoyment, and it is largest in dense cover. In the average of a large number of stems, if grown under persistent thinning practice this relative height was found for pine 24.9, spruce 39.8, beech 38.4; if grown in densest cover for pine 126, spruce 130, beech 157.6. The relative height sinks with age and rises with decrease in soil quality.

To classify densities, the author proposes to use the relative height and the sum of the cross-section areas on a given area unit. The higher the former the smaller the crown and the denser the cover; also the older the stand the lower the relative height and the larger the total of cross-section areas. Multiplying the latter per acre with the relative height for a given age and soil class, a tolerably constant result is found for each species, which may be used as density factor.

The author constructs a table for pine under given conditions from 60 to 140 years old, and by using this multiplication of relative height and cross section area, he finds at all ages the density factor to be 343 for I site class, 326 for II site, 304 for III site. Hence the procedure: Determine on sample areas (average trees) age *n*, diameter *d*, absolute height *h*, cubic contents per acre, relative height and sum of cross section areas *c*, then $\frac{h \times c}{n}$ gives the site class, $\frac{h \times c}{d}$ the density factor (supposedly to be compared with normal figures for these).

From Lesnoj Journal, 1910. Allgemeine Forst- u. Jagdzeitung. April, 1911, pp. 135-136.

Value of Increment and Quality Increment.

Hufnagl makes a very interesting contribution to forest valuation. He points out, that it is necessary to distinguish between value of increment and quality or value increment. While in a sustained yield management it is usual to assume correctly that in a normal management class the sum of the current increment on all age classes is equal to the volume of the oldest age class, this is not true for the

values. The volume increment which takes place as the annual ring can have only the unit value which pertains to the age class or dimension class on which it occurs; if the increment occurs on wood worth 5 cents a cubic foot it can not be worth more than 5 cents, except as with the increase in diameter an increase in use value and in money value comes about. Multiplying the volume increment in each age class with the value pertaining to that age class and adding up, one secures the value of the increment of the management class. This value can be influenced by influencing, through thinnings, etc., the volume increment.

Regretting the unfortunate mixing up of the terms "value increment" and "price increment," the latter dependent on market fluctuations, without any change in the sale object itself, he points out that in the forester's value increment or quality increment, the volume increment is involved: by the mere year's increment suddenly without any effort of the manager the whole tree receives a higher value per cubic foot—a value increment.

It is not 100 year old wood, which comes to sale when a 100 year old stand is cut: only the first year's smallest growth is 100 years old, each annual layer, however, has experienced a value increment, which in a way exhibits the progess of value increment in all 1 to 100 year old stands of a management class, and the amount of this increment is expressed by the difference of the value of the oldest age class and the value of the current increment.

In a tabulated example referring to given market and price conditions, in a pine forest on III site the value of the 80 year stand is figured as 12,500 cubic feet×4.5 cents=$562; the values of the increment of each 10 year age class, calculated with the price per unit of the age class, added up, give $356, hence the value (quality) increment of the whole management class is 562 —356=$206. Similarly, the value of a spruce management class in its oldest member at 80 years is $1,336, the value of the age class increment adds up to $706, hence the value (quality) increment of the management class (normal stock) is $630. In both cases this value is much less than half the stock value of the oldest age class. In these examples, there are of this total annual value increment of the normal stock, in case of the pine, 63% represented by increment value, 37% by value increment, in case of the spruce, 53% by increment value, 47% by value increment.

The significance of this distinction is shown in an example of the soil rent theory and another in taxation of forests.

Der Wert des Zuwachses und der Wertszuwachs. Centralblatt f. d. g. Forstwesen, March, 1911, pp. 109-112.

Valuation of Württemberg Forests.

Schickhardt makes an elaborate calculation to determine the value of the 450,000 acres of productive areas of State forests. An official calculation had made the value around $97,000,000 with a 3% return, while Dr. Wagner believing the used interest rate too high makes the capital value over $110,000,000.

The author in determining the forest capital makes volume calculation for 20 year age classes, reducing the yield table data by estimated actual average degree of full stands. For the two youngest age classes, stand cost values are used, for the others sale values determined by a special index method. The data is tabulated. They show the youngest two age classes to occupy each 22 per cent. of the area, the subsequent age classes representing 16, 15, 13, and the one over 100 years, 12 per cent., Site classes by species show spruce and fir as representing 60%, pine 10%, beech 30%, mostly in II and III site class, the average production for each of these three types 105, 57, and 55 cubic feet per acre respectively. Both main and intermediate stand are determined in volume., the latter ranging from 4 to 5% of the main stand.

The total stock including intermediate stand, without deductions for quality of stands figures out from yield tables 1,588 million cubic feet. The main stand therefore, 3,350 cubic feet per acre average, while the normal stock would be 3,575 cubic feet. This makes the actual average rotation 95 years and not the calculated 103 years. Various considerations lead to a reduction figure of .75 on the average for incomplete stands making the actual stock on hand 1,190 million cubic feet or say 2,600 cubic feet per acre.

Authorities differ as to how to evaluate large forest areas like the one involved.

According to Judeich the cost value of stands should be the basis; according to Martin, stands up to 40 years should be figured at cost value, the older according to sale value with interpolation

for the middle age classes, and he advocates estimating since absolute certainty is unattainable. Wimmenauer calls for expectancy values for the younger stands. Other methods are cited. The author choses a method like Martin's, using cost value for the age classes 1 to 40 years, constructing a sale value curve for the rest and correcting this curve by a tax value curve, which connects the space from 40 to 60 years. Prices were secured by average of actual sales for 8 years. The total capital value of the stock is then figured to be $130 million. The cost of production is then set in with 35% of the gross wood value and the final stock value of the Württemberg forests is set down as around $93 million, to which is to be added the soil value with $19 million, making the entire forest value $112 million.

As regards interest earnings, either the material stock may be compared with the annual felling budget or the forest value with the annual income.

While the normal volume increment per cent. is figured at 3.1%, taking the cut for 1908 with 86 cubic feet per acre the relation to actual stock was 3.3%, that is to say higher than that corresponding to the rotation of 103 years—an over cutting of .2%. The annual net money returns represent the interest not only of the stock capital but of all other investments involved. For 1908 the total income was $3.2 million; this related to the forest value of $112 million gives the interest rate of a little over 2.7%. But if note is taken of the over cutting, this rate is reduced to 2.5%.

Der Kapitalwert der württembergischen Staatsforsten. Allgemeine Forst- u. Jagdzeitung. April, 1911, pp. 118-126.

High Forest Versus Coppice.

The income of small forest owners in the Schwarzwald depends upon which of the two sharply contrasted forms of forest they possess. The owners of the higher slopes which are clothed with conifers, have a dependable income large enough to well repay this labor. Their forests are well stocked and well managed. The owners of the lower forests adjoining the meadows and farm lands in the narrow valleys are less fortunate. Here coppice management obtains with crops of grain interspersed. Now the income from coppice stands has declined markedly in the last quarter-century and there is no prospect of a rise. The growth of transportation

facilities has broadened market conditions and removed dependence on local supplies of material. The importation of tanning materials has made the production of tanbark in managed forests unprofitable.

To secure a reasonable income from these areas which are under coppice a change to high forest is necessary. Such a change will preclude the use of the ground for grain every fifteen or twenty years—a fact which complicates and retards the change. This complication has been removed by making the change to high forest on but half of the area, continuing and improving the present practice of coppice growth on the other half.

Bäuerliche Privatwaldwirtschaft im Wolf- und Kinzigtal des badischen Schwarzwaldes. Silva IV. April, 1911. Pp. 113-4.

Production of Selection Forest.

The history of a communal forest of about 250 acres, located in the Black Forest, of Württemberg, near Rippoldsau, exhibits conditions such as may be repeated in our country.

In the forties, the whole forest was thoroughly logged, so that only polewood and smaller trees with a few trees of advance growth had been left—such condition as our loggers would leave the woods. In the fifties a wealthy man bought the forest and treated it conservatively; yet, during the 25 years while in his possession he cut annually at the rate of 75 cubic feet per acre in the average. After his death the forest was offered for sale, and various valuations were made which showed stock varying between 3,000 and 3,575 cubic feet per acre. In 1879 the sale was effected for $36,000 or $144 per acre, of which $30 may be figured for soil value, and $114 for wood value.

In 1899 the whole stand was calipered and showed 7736 cubic feet per acre, while during the period 1072 feet per acre had been cut; hence the total production during the 21 years had been at the rate of 250 cubic feet.

Since according to prices prevailing in 1900 (when this calculation was made), the value of the stand was close to $700, its value increment per cent. for the 21 years was 8.8!

From Führer zur Excursion in Waldungen von Rippoldsau, 1900.

UTILIZATION, MARKET AND TECHNOLOGY.

Dynamics of Logslides.

Dr. v. Almburg developes with great mathematical apparatus the dynamics which are of interest in the operation of the logslides such as are in common use in mountain country, especially the influence of the grade on the velocity of the movement of logs; the effect of brakes to slow down the movement, in which he shows the low efficiency of the so-called "wolf," a brake consisting of a suspended log which must be lifted by the sliding log; the influence of curves and the form of the slide on the velocity; the minimal radius of such curves.

Beitrag zur Kenntniss der dynamischen Vorgänge beim Abriesen des Holzes in Holzriesen. Centralblatt f. d. g. Forstwesen. April, 1911, pp. 161-179.

Wire Rope Ways in Switzerland.

An experience of 30 years in the use of wire rope ways for the purpose of transporting logs from steep mountains to valleys, has, according to Schmid, developed their usefulness, not only for temporary exploitation of two or three years' duration, but for permanent use in forest work. While the author holds that the ideal way is still to build roads, there are conditions where this is too difficult and too expensive, and here the rope way is in place.

The community of Roveredo owning a 5,000 acre tract with an annual cut of 70,000 cubic feet installed in 1908, one permanent rope way of about 2 miles length, with an impermanent portable rope feeder of 1 mile in length, and several simple wire ways for conveyance of cordwood.

A road would have cost $20,000; the rope way cost $5,500 for the permanent and $2,400 for the movable one. The cost of transportation, including amortization at 4.5% in 10 years and repairs have cost $2.44 per 100 cubic feet, while on a road which with 10% grade would have had to be about 6 miles long it all would have been at least $354 for teaming alone.

Another ropeway of 1½ mile length, now 10 years in use, costing $3,600, intended to transport 35,000 cubic feet for 10 years, made the cost of transportation $2.46.

A few illustrations show the construction of these very simple ropeways. If constructed of good grade material and carefully supervised, the structure may last 20 years. The steel ropes which are required to carry heavy loads with 3,200 feet spans, are made of six strands of seven wires, the main carrying rope 1 inch in diameter and a tensile strength of 60,000 lbs., the return carrier 3-5 inch and 30,000 lbs., the return haul rope ½ inch and 16,000 lbs. strength. The legs are carried in a cradle. Usually only the upper station has a brake which works according to the grade with one or two 3.5 foot disks moving in the same plane, moved by a double lever.

Die Dratseilriesen im Forstkreis Misox. Schweizerische Zeitschrift, April, 1911, pp. 105-113.

Kiton Roads.

Schullerman reports on a series of trials with the new road material Kiton, which makes a dustless road, with a view to determine its wear and cost. Kiton is a mixture of 60% tar, 30% water and 10% clay, which mixture has the property of not taking up water after once having been dried. The price at the factory in Ludwigshafen is about $15 per ton. It requires from 7 lbs. per square yard up to make a good road, the maximum being for every inch thickness of cover 55 lbs of Kiton, an emulsion of 40 to 60% Kiton being used. Broken stone as in macadam, rolled, is the basis and a sand cover tops it off; in a remarkably short time the cover becomes solid and in a few weeks it is ready. For country roads the broken stone is not necessary, any gravel or even coarse sand being sufficient.

The experience with the eight trial sections, differently constructed in 1910, are summarized as follows:

1. With a soft sandstone the result was unsatisfactory, especially on high grades.

2. Mending poorly kept roads with a thin layer of coarse sand and Kiton makes first a good appearance, but does not promise well for long.

3. Roads unfavorably located as regards drainage can be satisfactorily changed into dry, hard roads.

4. If gravel is somewhat expensive the use of Kiton cheapens the road, because a smaller amount of gravel will do, and the rolling is by 25% cheaper with Kiton.

Labor in Forestry.

Interesting data regarding labor requirements in forestry work are furnished by the forest department of Bavaria, referring to the average results of 358 forest districts into which the two million acres of Bavarian State forests are divided. While altogether 74,656 people had been occupied with forest work in 1908, only 22% of the man workers or 12.7% of all workers made forest work their main occupation; only 6% of the laborers are occupied for 2-3 of the year, 12% for at least half a year, and the bulk, or 9-10 of all workers are occupied less than half a year. Only 58% of these workers are men, 23% are women and 19% children. Only 89 work days per laborer is the average. For each 100 acres of the productive forest area, 22.4 days of labor are required. Of the 4.5 million total day's work, 59% were taken up by logging, 11% by road building, 24% on cultures and 6% on miscellaneous work. A ten-hour day prevails from April to October, 9 hours for spring and fall and 8 hours in winter.

The average pay for men was 58 cents (up to 72 cents), for women only 40 cents (up to 52 cents), and this is mostly higher pay than for other rural labor. In piecework, however, the earnings are better, for summer felling 92 cents, in winter felling 70 cents, in thinnings 64 cents on the average.

Mitteilungen aus der Forstverwaltung Bayerns, 1910, 157 pp.

Labor Distribution in National Forests.

The following calculation of the distribution of effective work by hours and days for one month, from April 15 to May 15 inc., 1911, refers to performance of the crew in the Deerlodge National Forest, U. S.

Class.	Hours.	Days.	Per Day.	Labor and Expense.
Planting 1-0,	118	14 5/8		63.67
Planting 2-0,	417.5	52 3/16		225.29
Cornplanter,	396	49 4/8		213.68
Seed Spots,	86	10 6/8		46.41
Broadcast plain,	1	1/8		.54
Broadcast brushed,	5	5/8		2.70
Broadcast disked and brushed,	9	1 1/8		4.86
Surveying (all areas),	151	18 7/8		81.48
Poisoning (all areas),	38	4 1/8		17.80
Fencing(all areas),	120	15		64.75
Planting totals,	1336.5	167 1/16	4.3168	721.18

Reconnaissance survey,	40	5		21.58
Reconnaissance estimating,	108	13 4/8		58.28
Office work,	100	12 4/8		53.96
Total other effective work,	248	31		133.82
Total all effective work,	1584.5	198 1/16		855.00

Items of Cost.

Salaries (nine men),	$615 00
Food,	165 00
Salary (cook),	75 00
Total for period,	$855 00

Total cost per effective day of all classes of work was therefore $855.00÷198.0625=4.3168.

DETAILS OF PLANTING COSTS AT BERNICE ARE REPORTED AS FOLLOWS:

Class	*One year Seedlings*	*Two year Seedlings*	*Seed Spots*	*Corn Planter*	*Broadcast Plain*	*Broadcast Brush*	*Broadcast Brush Disked*	*Totals*
Acres	3.76	12.47	5.90	66.26	1	2	1	92.39
Labor and expense days	14.66	52.18	10.66	49.50	⅛	⅝	1⅛	
Labor and expense	63.67	225.29	46.41	213.68	.54	2.70	4.86	557.15
Survey marking	3.31	11.00	5.21	58.44	.88	1.76	.88	81.48
Fencing	2.63	8.74	4.14	46.44	.70	1.40	.70	64.75
Poisoning			1.81	20.28	.30	.61	.30	23.30
Cost of Seedlings	9.55	33.00						42.55
Cost of Seed			9.00	102.00	6.00	10.00	5.00	137.00
Cost of Equipment				1.35				.90
Totals	76.16	278.05	66.57	442.19	8.42	16.47	11.74	907.13
Cost per Acre	21.05	22.29	11.11	6.67	8.42	8.23	11.74	9.81

From The Deerlodge Ranger.

STATISTICS AND HISTORY.

German Forest Conditions.

A most interesting compilation of statistical data are contained in Forstassessor Sempor's review of conditions in Germany for 1909, similar to the one for 1908, briefed in F. Q. vol. VIII,, p. 549, the latter a year of depression, the latter year improving towards the end. Some of the data are outside of direct forestry interests, such as the monthly statements of the status of the national bank, of the

labor market, of the railroad earnings, of the prices of grain and various others adduced for discussion of the general economic condition of the empire.

Of forestry statistics we may abstract the following of interest in the distribution of private forest properties, according to size. Dividing the private forest area of 16.5 million acres into five size classes, namely below 25 acres, between 25 and 500 acres, 500 to 2,500, 2,500 to 12,500 acres, and those above 12,500, it appears, that over 50 per cent. falls into the two smallest classes with nearly one million owners, and only 59 owners hold over 12,500 acres, namely altogether a little less than 1.2 million acres. The bulk of the government forests falls, of course, into the last two classes, yet there are over 700 districts in small parcels. The corporation forests are found mostly in the third size class. Taking all forests together, nearly 52 per cent. are held in parcels of less than 2,500 acres, and over one-third of the area is managed in aggregates of between 2,500 and 12,500 acres. A complete table of property distribution is given for Prussia by provinces.

Generally speaking, State forests and large private holdings prevail in the Eastern provinces of Prussia and in Hanover and Hesse, communal forests in the middle provinces and small private ownership in the western provinces. In this State 13 per cent. are found in large properties, mostly in fidei-Kommiss, i. e. under State surveillance by contract.

The increase of State forest property during the last 40 years is striking, namely, nearly one million acres, and the end of purchases is not yet. These purchases took place mostly in the eastern provinces; unfortunately in the west, this policy of eradicating the undesirably mismanaged, because too small, private forest properties is not applicable policy, hence attempts at consolidated or associated management and other persuasive measures through the provincial forestry bureaus (see F. Q. vol. V, p. 438). A table exhibits the activities of these bureaux in the way of acting as temporary or permanent advisors, making working plans, furnishing or negotiating plant material, giving assistance in reforestation, etc.

Some $200,000 were spent in Prussia in combating obnoxious insects, especially the pine geometra and the nun, which latter in East Prussia alone necessitated an extraordinary cut of 124 mil-

lion cubic feet of spruce. "Extensive" forest fires are reported, 34 of them having destroyed 2,200 acres entirely or partially!

The annual cut in the Prussian State Forests has increased since 1870, almost regularly, from year to year, so that now it is almost double what it was 40 years ago, with now 58.3 cubic feet timberwood and about 12 cubic feet other inferior wood, and the timberwood per cent. increased from 30 to 63 (75% in conifers), showing most strikingly the improvement of the forests. But the income has more than doubled, the gross income having risen from $1.66 to $4.35, the net yield, however, only from 87 cents to $1.94. Indeed, 1907, the net yield was higher, namely $2.42; this decrease is largely due to the generous improvement of the salaries. The rise in wood prices has been since 1895 when they were at a lower level than the two previous years from 7 cents per cubic foot for workwood to 9 cents in 1909, and for fuelwood from $2\frac{3}{4}$ to $3\frac{1}{2}$ cents per cubic foot. But these are also decreases from conditions in 1907, when the corresponding prices were 10.6 and $3\frac{3}{4}$ cents. This loss is due to general depression and increased importations from Russia, in some districts also to the increased cut occasioned by the ravages of the nun.

A further depressing influence is found in the increased use of *metal ties,* so that now 35% of the railroads are on metal, the purchase of wooden ties having fallen from 7.6 millions in 1906 to 3.3 millions in 1910, and this mostly (over 70%) imported, at fuelwood prices. In the direction of mine timber as well as building timber, the competition of iron is also felt.

The movement of wood of all kinds on the German railways amounts now to around 19 million tons, mostly (except 2 million tons) home product, as imports are mainly carried by water. The imports have increased until in 1907 they amounted to over 7.5 million tons, then sinking to 7 million in 1909, which is still between 40 and 50% more than the first quinquennium of the century.

This import translated into cubic feet represents around 380 million cubic feet of round material. Over 50 per cent. of the import of sizeable material comes in logs to be manufactured in the country. The imports are discussed in some detail, showing that Russia increasingly ships to Germany, now furnishing over one-half of the workwood, and Austria sending over one-quarter,

Sweden only 6% and the United States without much change for the last 10 years less than four per cent.

Forstwirtschaftliche Rückblicke auf das Jahr 1909. Zeitschrift für Forst- u. Jagdwesen. June, July, 1911, pp. 459-481, 545-563.

Swiss Forest Administration.

As is well known, the Confederation as such does not own forests, hence its entire activity in forestry matters is directed towards encouragement and restriction of the forest use of cantons, municipalities, or private owners.

The character of this activity may be seen from the budget for 1911 which reads as follows:

1 Salaries	Francs	54,900	12 Do. for roads, etc.	Francs	90,000
2 Traveling expenses	Francs	14,000	13 Amalgamation of small holdings for common management	Francs	3,000
3 Office expenses	Francs	3,000	14 Subvention to forestry association	Francs	5,000
4 Printing	Francs	2,000	15 Do. to underforesters' association	Francs	1,000
5 Photography	Francs	1,000	16 Do. for alpine gardens	Francs	4,000
6 Contributions to salaries of cantonal and municipal foresters	Francs	380,000	17 Do. for seed establishments	Francs	3,000
7 Contribution to accident insurance of these	Francs	10,000	18 Do. alpine museum	Francs	500
8 Examination of higher grade foresters	Francs	4,000	19 Do. Swiss forest statistics	Francs	6,500
9 Instruction of lower grade foresters	Francs	9,000	Total	Francs	1,065,900
10 Surveys	Francs	25,000			=$213,000
11 Subventions for reboisement	Francs	450,000			

Assisting in the payment of salaries for competent foresters and subventions for reboisement represent four-fifths of the total outlay. There were employed in 1910, foresters of the higher grade to the number of 193; of the lower grade, 1904; the federal government contributing somewhat over one-quarter of the salaries of the higher grade and one-seventh of that of the lower grade.

In order to secure employment in the higher grades (by election) certain requirements are made by the government, a special commission being appointed to hold examinations. There are a number of ranger courses carried on by the federal govern-

ment, lasting 8 weeks in two sessions, also fire ranger courses of one to two weeks duration.

A triangulation is still in progress under federal authority, but forest surveys are also at least checked by it, and especially the segregation of protective forests, which are made by the cantons.

The subvention for reboisement work represented in 1910 over one-half the actual outlay of nearly $150,000. An interesting educational feature is an excursion of forest officials through the Confederation to which the government contributes.

Schweizerische Zeitschrift für Forstwesen. Jan., Feb., May, 1911, pp. 21-29, 55, 57-64, 157-160.

Statistics of Bern State Forests.

A very comprehensive account largely in tabular form of the results of management through the 20-year period of 1885-1905 of the cantonal forests of Bern is of interest in showing how management of a small property pays. The area involved is only 34,300 acres, having increased through purchase by 2,000 acres in that period, its value for taxation purposes being $3.2 million. The growing stock is placed at 2,860 cubic feet per acre and the yield at 57 cubic feet. These low figures are accounted for by the large area of newly forested (purchased) lands. The average rotation in 1885 was 100 years, but in 1905 had been increased to 114 years, due to the need of the protective alpine forest. Of the 60 cubic feet of average cut, 43 per cent. was taken in thinnings. While in the first decade the workwood per cent. was 29, in the second decade it had increased to 38. The price movement is interesting. A sudden jump of prices in 1876 was followed by depression with lowest level in 1884, then followed a steady rise for the 20 years from 6.6 cents per cubic foot to 10.3 cents in 1905, a rise of 3¼ per cent. in gross receipts. meanwhile the logging cost also rose from 1.5 to 2.4 cents. Altogether expenses rose from $64,000 in the average in the first decade to $81,000 in the second, but the net yield from $111,400 to $144,200; in either case 64 per cent. of the gross income. Great differences in cost and returns are shown in different districts. In Bern itself, for instance, the net yield is 71 per cent. of the gross or $6.90 per acre and year, while in a mountain district the net yield represents only 43 per cent. and $1.44.

Taking the capitalization estimated for tax purposes as above the management has paid $4\frac{3}{4}$ per cent. interest.

Staatswaldungen des Kanton Bern. Schweizerische Zeitschrift für Forstwesen. April, 1911, pp. 124-126.

MISCELLANEOUS.

Value of Hunting in Germany.

From a review of a volume by Dr. Erler discussing in a most exhaustive manner the economic significance of the hunt in Germany we abstract the following interesting data:

The meat value of the annual kill of game in Prussia, which in 1886 was about 3.7 million dollars has risen in 1910 to 5 million dollars, 46% of which is furnished by hares, 16% by roebuck, 18% by partridge, only 5% by stags (elk) and 2% by wild boar. The value of skins adds about $250,000. The attempt to figure what the production of these values costs, stands naturally on very slender basis. The author disclaims damage from the hare, only wild boar is considered very damaging and next to it, elk. In the main he considers the low game as alone economically valuable.

Higher values than in this meat production are now-a-days secured from renting the hunt. These leases amounted in 1907 to around 4 million dollars or 7 cents per acre, while hunting permits in 1906-7 brought in Prussia over $600,000, and in the other states of the federation nearly $900,000.

Zeitschrift für Forst- u. Jagdwesen. May, 1911, pp. 453-455.

Forestry Association in France.

The first general association of professional foresters in France was formed in 1910 under the name *Association des Agents des Eaux et Forêts,* the first meeting being held in Paris on July 16, with over 500 members It appears that at least two-thirds of the members are officials of the forest service and that the association will be largely used to advance the interests of these.

Revue des Eaux et Forêts.

OTHER PERIODICAL LITERATURE.

Canadian Forestry Journal, VII, 1911,—

Forest Statistics of Canada for 1909. Pp. 73-75.

Synopsis of statistics of lumber, square timber, laths, shingles, pulpwood, ties, poles, cooperage, boxes and shooks, tan bark and tan extracts.

Forest Fires in May and June, 1911. Pp. 75-77.

Detailed facts of all known fires in Canada and United States.

The Botanical Gazette, LI, 1911,—

Two Sprouting Conifers of the Southwest. Pp. 385-390.

Describes the sprouting habit of alligator juniper (*J. pachyphloea*) and Chihuahua pine (*P. chihuahuana*).

The Terminology of Soil Bacteria. Pp. 454-460.

Suggested changes in classification in accordance with physiological functions.

Science, XXXIV, 1911,—

Blue Stain on Lumber. Pp. 94-96.

Shows that the uncertainty of the soda dipping process is related to the varying acidity of the boards. One at least of the fungi concerned is sensitive to alkalies. Experiments on a large scale showed that freshly cut red gum and yellow pine sap boards required 8 per cent. sodium carbonate or 10 per cent. of the bicarbonate to prevent stain by this fungus.

The Ohio Naturalist, XI, ,1911,—

The Evaporation Gradient in a Woodlot. Pp. 347-349.

Bulletin of the Southern California Academy of Science, X, No.1, 1911,—

The Twisting of Pines. P. 9.

The author attempts to explain the occurrence of spiral grain of trees thus: "The branches on the south side or sunny side of the tree are usually markedly better developed,

with denser foliage. The trade winds blowing steadily and strongly from the west all summer bear greatest pressure on the larger and denser limbs so that the natural grain of the wood becomes twisted towards that side on which the wind produces the greatest pressure. When a number of trees grow closely in a group only those on the outside show unilateral development and those twist left or right according to the position of their heavier branches.

The Journal of the Board of Agriculture, XVIII, 1911,—

The Use of Manures in Forestry. Pp. 139-140.

Planting, Cleaning, and Cutting Willows. Pp. 207-214.

Increasing the Durability of Timber. Pp. 281-288.

Quarterly Journal of Forestry, V, 1911,—

The Sweet Chestnut as a Timber Tree. Pp. 205-220.

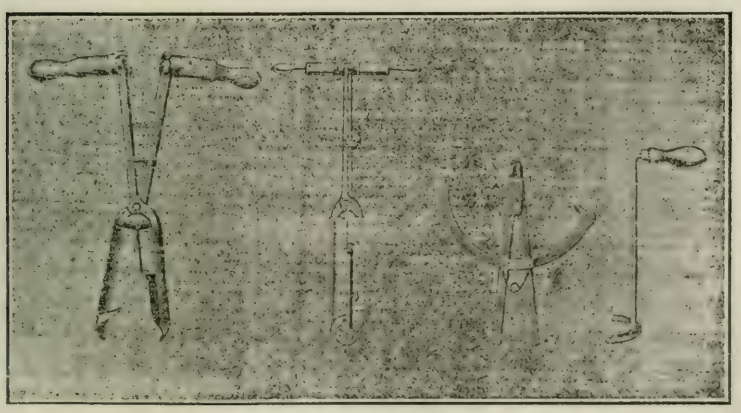
Planting Distance. Pp. 226-231.

Mountain Pines with Split Branches. Pp. 263-265.

Bulletin de la Societe Dendrologique de France, No. 20, 1911,—

Les Cèdres du Liban dans Cur Pays d'origine. Pp. 125-134.

Graines et Plantules des Conifères. Pp. 134-205. Keys for identification.



Splettstösser Planting Tools.
From Vol. VII, p. 483.

NEWS AND NOTES.

Senator Smith, of Maryland, a lumberman of many years' experience and a member of the National Forest Reservation Commission, has introduced in Congress a bill providing for the appropriation of $500,000 annually to acquire lands along the Potomac River adjacent to Washington, for a national park and forestry purposes. The provisions of the bill in regard to the acquirement of the land and other legal phases are similar to those of the Weeks' bill. Five per cent. of the receipts from timber sales are to be paid to the States in which the forest may be located.

Press reports indicate that serious insect devastations are occurring in the spruce forests of Maine, the damage being caused by the sawfly, which destroyed most of the tamarack in Maine in the early 80's. It is reported that the present outbreak is confined to spruce and for this reason it was not believed that the insect could be the sawfly. The State Department of Agriculture, however, has identified the insect as the sawfly, claiming that the damage is due to slits made in the smaller twigs by the female insect in preparing a place to deposit her eggs.

New York has added another nursery to its list of State forest activities. It has put under cultivation at Geysers, about two miles from Saratoga Springs, about six acres in charge of F. A. Gaylord, with M. D. Steele as local superintendent. Of the 1,400,000 seedlings transplanted, 1,100,000 were white pine, 250,000 Scotch pine, and 50,000 tamarack.

The New York State Superintendent of Weights has notified his scalers that 16-inch sticks piled 4x8 feet do not make a cord. A full cord is 8x4x4 feet. Since the sticks in a ship cord are 52 inches long, it is likely that the woodsmen will be legally sustained in a demand for the extra value of their cords over and above the 4-foot lengths.

The New York State Conservation Commission, created by a

recent act signed by the Governor on July 12, will carry on the work formerly handled by the Forest, Fish and Game Commission, the State Forest Land Purchasing Board, the State Water Supply Commission, and the Black River Water Power Commission. The three members of the Commission are each to receive a salary of $10,000 per year, under appointment from the Governor for a term of six years. The Commission is to appoint three deputies and a secretary, each at $3,500 per year, and a chief engineer and a counsel each at a salary of $7,500 per annum. The members appointed are: Hon. George E. Van Kennen, Chairman, ex-Mayor of Ogdensburg, New York; James W. Fleming, of Troy, a successful business man; and John D. Moore, of New York City, a hydraulic engineer.

The law provides for the establishment of divisions under the Conservation Commission to cover Lands and Forestry, Fish and Game, and Inland Waters. The first division wll not only have the care and administration of the State Forest Preserves, but also of other lands owned by the State. The forestry work is to be developed to the fullest extent and an effort made to establish the principles of forestry in the handling of woodlands on both State and private property. The work of the second division will include the propagation of fish, the protection of game, and the enforcement of all fish and game laws. The third division, Inland Waters, comprises not only the maintenance of proper water supplies, but the development of water power and the drainage of woodlands.

At the meeting of the Board of Directors of the American Forestry Association at Bretton Woods, N. H., August 2-3, Hon. Robert P. Bass, Governor of New Hampshire, was elected President of the Association to succeed Hon. Curtis Guild, whose resignation followed his appointment as Ambassador to Russia.

A very interesting forest conference was held at Bretton Woods, N. H., on August 3, under the auspices of the Society for the Protection of New Hampshire Forests. The program, however, was not limited to the New England Society, but included several members of the U. S. Forest Service, the U. S. Conservation Commission, the New Hampshire Timberland Owners' Association, Directors of the American Forestry Asso-

ciation, several State Foresters, and railroad representatives. Hon. F. W. Rollins presided at the general conferences and among the speakers were Hon. Robert P. Bass, Governor of New Hampshire; Mr. Thomas Nelson Page; Congressman Hawley, of the National Conservation Commission; Messrs. Henry S. Graves and William L. Hall, of the U. S. Forest Service; Messrs. W. P. Brown and F. H. Billard, of the New Hampshire Timberland Owners' Association; and Messrs. E. C. Hirst, A. F. Hawes and S. N. Spring, State Foresters of New Hampshire, Vermont and Connecticut, respectively. Mr. Philip W. Ayres, Forester of the Society for the Protection of New Hampshire Forests, presented his annual report and spoke on the forests in the White Mountains.

Announcement is made that "American Conservation," the official magazine of the National Conservation Association, will be discontinued after the August issue and "American Forestry," the organ of the American Forestry Association, will be sent to all subscribers to "American Conservation." This will bring about a desirable consolidation of the current conservation literature, and it is quite in keeping that "American Forestry," since forestry was the basis of the conservation movement, should represent all of the conservation interests.

The law relating to forest fires passed at the last session of the Washington legislature provides that where wood-waste material is destroyed in incinerators, they shall be equipped with effective spark arresters, and the same applies to smokestacks, chimneys, or any other outlet for sparks. Where forest products are being manufactured within one-quarter of a mile of forest material, the destruction of slabs and refuse must be provided for in a manner which will not endanger surrounding property. Locomotives, donkey engines, etc., must be provided not only with an effective spark arrester, but with devices which will successfully prevent the escape of live coals from fire boxes and ash pans. The felling of trees so that tops lie in adjoining timber is prohibited, unless the permission of the owner of such timber is procured. Whenever rights of way are cleared, the slashings must be piled and the burning done at such time as the fire warden considers safe. Watchmen must be kept at donkey en-

gines for two hours after operation ceases, and all snags over 25 feet in height within 50 feet of each donkey engine must be felled.

At a discussion of spark arresters by members of the Oregon Forest Fire Association and others interested, it was brought out that the railroads are inclined to burn coal rather than oil because they find it cheaper and less damaging to their fire boxes. It was reported that on logging railroads oil was used because it was found to be as cheap as, if not cheaper than, wood. The desire on the part of all railroad operators to maintain efficient spark arresters and to do everything possible to prevent forest fires was evident.

At the committee hearings on Wisconsin forestry legislation, the lumbermen made it clear that the expense for fire patrol should be met by a direct appropriation from the State Treasury out of the funds raised by the State, since it is so generally conceded that the stoppage of forest fires is a matter of public concern. The proposal in the bill under discussion was to levy a special tax of 2½ cents an acre upon all wild and unoccupied land in the northern twenty-two counties of the State.

China's first trained forester, Ngan Han, who spent four years at Cornell and two years at Michigan, is preparing a book on elementary forestry in the Chinese language. In the press interviews, Han says: "The forests of my country are badly cut and wasted. We've been as reckless as the Americans in the waste of our trees. Our forests are practically all cut over excepting in the northern part of Manchuria, where there are some left, and in the mountains in the west and north where it is difficult to go. I have studied American forestry, and now I must work on the forestry problem in China. It is an unknown proposition. We do not know what trees we have in China. I must first find what does grow, or has grown there. I must experiment with foreign trees to find what is best to introduce into the country. It is to be all experimental for the next thirty years. Thirty years is a long time to wait for Americans, but we are a race schooled to wait; we are not impatient for results."

Dr. Hopkins has located a forest insect field station at Spartanburg, S. C., for the purpose of more effectively co-operating with timber owners in eradicating the southern pine beetle, about which he says: "It has been known for more than forty years that this particular beetle has existed in the Southern States, and our extensive studies of it within recent years indicate that it has occupied the region since time immemorial. It appears, however, that only at long intervals does it increase to such numbers as to cause widespread depredations, such as, for example, the great invasion of 1890-1893 in the Virginias. Under the normal conditions of its life and habits, a few scattering trees are killed by it each year in nearly every county throughout the Southern States where the pine is common. If, however, there are from any cause favorable conditions for the multiplication of the insect, it is thus able to kill groups of trees, and if these groups increase in number and size the following year, they constitute the danger signal of an outbreak with resulting widespread depredations. These are just the conditions found in the localities observed, and, from the reports received from different sections of the South ranging from Texas to Virginia, it is evident that they prevail throughout the greater part of at least the shortleaf pine belt. Therefore there is every reason to believe that unless prompt and properly directed action is taken by owners of pine timber throughout the region during the coming winter, a large percentage of the best old as well as middle aged and young pine will be killed within the next two or three years."

At the last session of the Pennsylvania Legislature, a bill was passed providing for the appointment of a commission to investigate and combat the chestnut blight. The sum of $25,000 was appropriated for the expenses of the commission, whose members shall serve without pay, and there is a further appropriation of $250,000 available on the approval of the Governor for the performance of the duties required, as for quarantine, removal of diseased or other trees, etc. The commission, which is to be called "The Commission for the Investigation and Control of the Chestnut-tree Blight Disease in Pennsylvania," is composed of Mr. Winthrop Sargent, Chairman; Mr. Harold Pierce, Secretary; and Messrs. T. N. Ely, Samuel T. Bodine and George F. Craig. Mr. S. P. Detwiler, Assistant Professor of Forestry at

the University of Minnesota has been engaged by the Commission as its forester. Offices have been secured in the Morris Building, Philadelphia, and the work will be pushed vigorously.

The rapid westward spread of the chestnut blight in Pennsylvania is indicated by the report to the department of forestry of its existence in Adams, Centre and Snyder counties. This discovery may cause a revision of the plans of the commission, as the disease was unknown west of the Susquehanna river except in York county, where the commission is now combating it.

The National Irrigation Congress will hold its nineteenth session in Chicago December 5 to 9, when it will have formally brought to its attention by the Western Forestry and Conservation Association the need for its assistance in spreading the gospel of fire prevention. On this subject E. T. Allen says:

"One of the worthy objects of the Congress is to 'save the forests,' and next to food itself, no product is so necessary to the human race as wood. People must have it for fuel, for their houses, barns, and fences, to build ships, railroads, and irrigation flumes, and for almost every article used by civilized man. Having plenty of it, we not only get all these things cheaper ourselves, but can sell it to those states and countries that have no forests.

"Lumbering is an important industry in the Pacific Northwest. It brings about $125,000,000 a year, or more than $332,000 a day, into the five states of California, Oregon, Washington, Idaho, and Montana, and nearly all of this money is paid out for labor and supplies so that every family shares it. It contributes to every line of industry as well as to the farmer, the merchant, the mechanic, and the professional man. No other product of these states furnished employment for so many people or brings in so much money. Lumber makes up 75 per cent. of all the freight we ship out of these states by rail or boat.

"Our forests are useful and necessary, as they keep the flow of our streams even, preventing floods in the wet season and furnishing water for irrigation and power during the dry season; they pay taxes to support our roads, our schools, and our government; they shelter our wild game and fish, and in many other ways make our country healthier and pleasanter to live in. In

most of our western states, the public schools are supported largely by the sale of timber from state forest lands.

"Although not always as serious as they were last year, forest fires in Oregon, Washington, Idaho, Montana, and California annually destroy timber which, if saved for manufacture, would bring in $40,000,000. We not only lose this income, but we have to pay higher taxes on the rest of our property and higher prices for the forest material which escapes. These fires kill the young trees, so new forests cannot follow the old ones, and, by leaving the ground bare, also hasten the rapid run-off of snow and rain and make our streams low in summer. Other losses are human lives and the destruction of buildings and stock.

"Primarily, our chief work is to encourage legislation to protect our forests and secure the appropriation of state funds to carry out the laws, also to provide for fire patrols, and to teach men, women and children the value of knowing what to do, not so much in the way of fighting fires as in preventing them. We need the support of the National Irrigation Congress to assist us in spreading the gospel of fire prevention, and with that end in view hope to bring the matter to the attention of the Congress in a formal way at the Chicago convention.

"Forests are necessary to successful irrigation, as the trees retain the rain and snowfall and thus assure sufficient moisture for crop purposes during the dry season. Irrigation, which makes intensive farming possible, is largely responsible for the well developed country districts in the Northwest, where the rural communities are so thickly populated they resemble suburbs of cities."

Consul General Thackara has reported from Berlin another tree felling machine, in part as follows:

"A machine for felling trees has been invented by Hugo Gantke, of Berlin. The principle of the invention is that by pulling an ordinary steel wire rapidly back and forth around the tree to be felled, sufficient heat is developed by the friction to burn a smooth groove through the stem of the tree. The machine has been patented in Germany, Great Britain, Austria, and a number of other countries, and a patent has been applied for in the United States.

"The inventor illustrates his invention by means of an ordi-

nary steel wire about a yard in length, which is provided with a single handgrip at each end, which he pulls rapidly back and forth around a chair or table leg, the wire thus burning a groove into the wood.

"A small wire is used on trees, to the end of it being attached cables run by an engine or motor.

"In cutting down trees the cable is chosen long enough to make it possible to place the machine out of reach of the falling tree. The machine may also be used in cutting logs or timber already felled, in which case a shorter cable may be used. The power required for European varieties of wood range from 1.5 to 7 horsepower, depending upon the hardness and dimensions of the timber. A 4-horsepower machine is said to cut down a pine 2 feet in diameter in about 5 minutes. The machine requires less than one-half of the time required for sawing down a tree by hand and about two-thirds of the time required for sawing logs or timbers that are lying on the ground. In the case of larger stems the machine requires only about one-fourth the time for sawing by hand.

"The wires are cheap and the whole machine with motor costs $650."

A manufacturer of wood block paving machinery has suggested that "the most economical way to get out blocks is for several miles in one city or, say, within a radius of ten to twenty miles, to put in small block machines right near the edger where the regular crew can do the cutting. Then, by shipping their blocks to a central creosoting plant, all the mills so doing can save a great deal in fixed charges, fuel, and many other expenses which otherwise would be incurred."

A. O. Vorse, Yale '10, has left the Delaware & Hudson Railroad to develop the forest management work of Peters, Byrne & Co., entomologists and landscape architects, of Ardmore, Pa.

F. E. Olmsted has resigned his position as District Forester in District 5 of the U. S. Forest Service to join the consulting firm of Fisher & Bryant at Boston, Mass., which will now become Fisher, Bryant & Olmsted.

A forward step in the conservation of Missouri's resources has been taken by the University of Missouri in the appointment of Professor J. A. Ferguson, of State College, Pennsylvania, to the position of Professor of Forestry in the College of Agriculture. Professor Ferguson is a graduate of Yale Forestry School, and has for nearly two years been acting head of the Department of Forestry at State College, Pennsylvania.

The College of Agriculture owns fifty thousand acres of forest lands in the southern part of Missouri. It is planned to utilize these lands as an out-door laboratory for the instruction in practical forestry. It is probable that a portion of the forestry instruction will be given on these forest lands.

Additions have been made to the teaching staff in the Department of Forestry at Pennsylvania State College by the appointment of J. B. Berry, of the University of Minnesota, and R. R. Chaffee, of Harvard. Both of these men are graduates of the forest schools of their respective universities, and each has been engaged in field work for the Forest Service. These changes are the result of the resignation of Prof. J. A. Ferguson to take charge of the forestry department of the University of Missouri and of the necessity for enlarging the teaching staff because of the increased number of students.

Two changes have been made in the faculty of the Forestry Department of the University of Nebraska. The vacancy left by the death of Professor Frank J. Phillips was filled by the promotion of O. L. Sponsler from Adjunct Professor and W. J. Duppert was appointed Adjunct Professor. Mr. Duppert received both his Bachelor's and his Master's degrees in Forestry from the University of Michigan. His experience along forestry lines extends over several years in New York, Ohio, and as Forest Assistant on the Coconino Forest, Arizona.

After a lapse of eight years, there is again a forestry department at Cornell University. The new work is a department of the New York State College of Agriculture at the university.

The following lines of work are to be conducted by this department during the year 1911-1912:

(1). Help for the farmers and other forest owners of the state

in the care of their woodlands. This will include instruction in farm forestry and in general silviculture at the University; extension work to reach the people of the state; and field studies of woodlot conditions and needs. (2) Experimental work relating to the woodlot and general forest problems of the state.

The courses in forestry to be given the present year (silviculture, farm forestry) are not planned for students intending to make forestry a profession and do not lead to forestry degree.

The woodlands of the university farms and some open land have been put under the management of this department, and will be used as experimental and demonstration areas.

Mr. Walter Mulford is Professor of Forestry, in charge of the work. An assistant professor of forestry is also authorized, and is soon to be appointed.

The Commission of Conservation of Canada issues the following Bulletin:

Considerable uneasiness and even alarm has been felt by lumbermen and others interested in forest products, over the depredations in different parts of Canada, of the spruce bud-worm (*Tortrix fumiferana*). It was feared that the spruce might suffer a fate similar to that of the tamarack which was killed by the larch sawfly about twenty-five years ago. As a result, however, of careful investigations begun by the Division of Entomology of the Dominion Department of Agriculture during 1909 and still in progress, the situation appears to be much more satisfactory and reassuring than was first considered possible.

The destructive work of the budworm was first reported two years ago from Vancouver Island, where the Douglas fir was attacked; and from Quebec, where the spruce and the balsam suffered chiefly. In the case of Quebec, the pests were at first confined to the west-central portion of the Province, but during 1910 areas on the east of the St. Lawrence were also attacked. It was this latter circumstance that roused timber owners to a sense of the possible extent of the danger.

While in the caterpillar stage these insects destroy the buds of the spruce and balsam, especially at the tops of the trees. They also bite off the leaves, which, together with the excrement of the caterpillars, cause the tops of the trees to assume a reddish brown

appearance. When a large area is attacked it appears as if it had been swept by fire.

As such plagues of air insects can only be controlled by natural means, the Dominion Entomologist visited a number of the infected districts for the purpose of discovering a natural remedy that would meet the situation. Various enemies or parasites were found, that prey upon the budworm, and these are being used to destroy the pest. As the percentage of important parasites, especially of the minute species which attack the eggs of the budworm, is unusually large, there is abundant reason for hoping for the extermination of the latter. Judging by previous experiences in studies of this nature, it is not improbable that the insect will be controlled by its natural parasites in the course of a year or two, that is, before it has inflicted any serious damage to the spruce and balsam by repeated defoliation.

In May the federal Parliament of Canada passed a new Forest Reserves and Parks Act repealing the Act of 1906. The provisions relating to the withdrawal of lands from sale and occupancy for the purpose of creating reserves, to the constitution of these and provision for control, are left unaltered. The Governor-in-Council is given power to expropriate private land within a reserve, this method replacing the former one of exchange. Denuded timberlands may be withdrawn from leased or licensed areas within reserves upon notice being given. Railway companies must pay one-half the cost of fire patrol along their lines under construction. The powers of rangers are greatly increased. They are given summary power to arrest; to seize timber, minerals and game taken from the reserve; and the right of search of buildings, etc., in the reserve and ten miles beyond. Various changes in the boundaries of the reserves and parks leave the aggregate area now 25,186½ square miles (of which the Rocky Mountain Reserve comprises 18,213 square miles) as compared with 16,312¼ square miles formerly. The chief officer is henceforth to be known as Director of Forestry.

During the same session two important amendments have been made to the Dominion Railway Act.

By one amendment the Board of Railway Commissioners are given power to require any railway company "to establish and

maintain an efficient and competent staff of fire-rangers, equipped with such appliances for fighting, or preventing fires from spreading, as the Board may deem proper, and to provide such rangers with proper and suitable equipment to enable them to move from place to place along the line of railway with all due speed." The Board may also require the company "to maintain an efficient patrol of the line of railway and other lands in the vicinity thereof to which fires may spread, and generally define the duties of the company, and the said fire-rangers, in respect thereof." "The Board may require the company," the clause continues, "to make returns of the names of fire-rangers in its employ in the performance of the above-named duties and of the places or areas in which they are from time to time engaged. For the purpose of fighting and extinguishing fires, the said fire-rangers may follow the fires which spread from the railway to, over and upon the lands to which they may spread."

Another amendment of much importance is the rendering of the railway company liable for damage to "any property," instead of merely for "crops, lands, fences, plantations or buildings and their contents," by which amendment timber lands are clearly brought among those things for damage to which the company is liable.

An idea of the active forestry life in Germany may be gained from a table of details in the Zeitschrift für Forst- und Jagdwesen in which we find enumerated 15 forester's associations with 5,483 members. These are all higher grade professional foresters or large timberland owners.

The oldest, the Badische Forstverein, dates from 1839, the two youngest are the Harz-Solling Verein (1910) and the Deutscher Forstverein (1899) which is a general association with 2,065 members, while the others are more or less local.

Each of them publishes an annual report, among which that of the Schlesische Forstverein (since 1841) at least takes high rank.

An association of private forest officials in Germany was organized in 1903, which, besides maintaining a school for underforesters (at Templin) provides occasional courses in special branches for its members.

The question of proper seed supply has become so important in Germany that the Forestry Council has instituted a standing commission to work out and supervise regulations for this purpose. Such have been formulated and approved. Seven firms and all the seed establishments of the Mark Brandenburg and others have obligated themselves to furnish only German pine seed. The necessary precautions to insure this by way of inspection of books, establishments, freight receipts, etc., have been organized. A fine up to $1,200 and loss of membership to this association of seed dealers formed and maintained through the Forestry Council is provided for breach of conditions.

COMMENT.

The desire and need for exchange of thought and opinion and thereby co-operation is growing apace with the increase in professional work that comes to the practicing foresters. This necessarily concerns often more local interests which only indirectly may have a bearing on problems in other localities or districts. Nevertheless we believe that a few minutes spent in reading the reports of transactions of Supervisors meetings will often throw light on our own problems unlooked for and repay the effort. The QUARTERLY has, therefore, gladly undertaken to publish these proceedings and wishes to extend its thanks to those who kindly have undertaken the labor of preparing the reports. This exemplifies the spirit of co-operation which our budding—almost flowering—profession needs.

In this connection we should also make reference to another expression of the desire for inter-communication, namely, the publication of strictly local journals.

There comes to our desk from time to time, apparently as near as possible monthly, *The Deerlodge Ranger,* which is a means of keeping the force of the Deerlodge National Forest, some 38 persons, informed of local happenings, social as well as official, also technical notes, fostering thereby the feeling of community.

The contents are typewritten, some 6 to 8 pages, multiplied, in a simple brown printed cover. From a statement in the heading we find that this journal was originated by Mr. C. C. Hall in 1909, it is, therefore, in its third year. Mainly to give an idea of how useful the occasional notes can be, we print on page 505 an extract from the Ranger of May, 1911.

This reference to a monthly publication makes us think of the time when the QUARTERLY must become a monthly journal. It will be observed that, without any attempt on the part of the editor—and indeed to the financial loss of the publisher—the quarterly issues are growing in size (and we hope in quality) until now two issues contain as many pages as the whole volume

five years ago. Is there any standard to the size of a quarterly publication and is there any virtue to a monthly magazine above the quarterly? The reading capacity of the average subscriber and the variety of interest represented and the activity of professional development would appear factors which must play part in answering the first question, as well as the character of the contents. The average practicing forester can probably not devote much more than 3 hours of professional reading, if that much, per week, and if he wants to digest and think over what he has read, he will be satisfied with say 200 pages a year. Whether this be presented in four instalments or in twelve, does it matter from the standpoint of the reader, and from the standpoint of editor and publisher? We would like to hear from readers whether they would prefer 100 pages every month, or 300 pages every quarter.

To us, it would seem to be somewhat as the difference between a book and a magazine, a more serious attitude towards the bulkier, a less intent consideration of the smaller issue. And this difference of attitude would also likely develop in the contents a more ephemeral, less solid supply of matter; for the editor a more strenuous time to get copy ready. Indeed, what can now be done by a few devoted unpaid devotees would have to be done by paid employees with financial backing. Yet, as the profession grows not only in numbers but in diversity of occupation and interests, literary as well as practical, and especially in lively activity, we expect to see our quarterly superseded by a monthly in the natural development of events.

Women stringing Plants. The stand upon which the board is placed should be of proper height to facilitate easy stringing and should be protected from the sun and wind.

Two "trenchers," two filling in about the plants, and two carrying the boards. Four women "stringers" were employed with the above crew.

YALE TRANSPLANTING BOARD IN OPERATION.

FORESTRY QUARTERLY

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THE YALE TRANSPLANTING BOARD.

By J. W. Toumey.

The cost of planting forest trees in this county for the purpose of the production of forest crops is, in most cases, excessive. If regeneration by planting is to rapidly increase in the near future, methods must be devised looking toward the reduction of cost. In planting operations the cost may be distributed as follows:

(1) The cost of producing nursery-grown seedling stock.
(2) The cost of producing transplants from seedling stock.
(3) The cost of the preparation of the planting site and of planting.

In these three items of expense the second can be greatly reduced by the use of special tools or implements.

The trade catalogues of American dealers in forest nursery stock of coniferous species show that the price of one and two year old seedling trees vary from $2.00 to $4.00 per thousand, while for three and four year old transplants the prices vary from $8.00 to $20.00 per thousand, a cost which practically prohibits their use for forestry purposes. Because of the larger size and heavier root system of coniferous transplants as compared with seedlings, they are much preferred for planting on most sites. Heretofore their excessive cost has forced many planters to use seedling stock with a consequent high loss from planting operations.

The planting of coniferous species in this country with reasonable assurance of profit demands the production of transplant stock at far less cost than in the past. It is the opinion of the writer that such stock must be purchased or grown at a cost not to exceed $4.00 to $7.00 per thousand in order to make planting attractive under present conditions.

Four years ago, the writer in an effort to reduce the cost of making transplants, devised the implement known as the Yale transplanting board herein described. This board has now been used for four seasons at the Yale Forest School and for one or more seasons by various state foresters and others in eastern United States. The important place that this board has taken is shown in the following letters which are but a few of those received in reference to it.

August 4, 1911.

Professor J. W. Toumey,
Director, Yale Forest School,
New Haven, Conn.

My dear Toumey: Your letter of August 1st in regard to Yale Planting Board received. We have used your board for two years with great success. I believe the best estimate of its usefulness is that we have been able to reduce the cost of transplanting from $1.40 to, approximately, 60 cents per thousand. When our transplanting approximates five million per year, you can readily estimate the value of this board. It also practically precludes any doubling of the roots. Under the old trowel method, the roots, especially tap roots of the tap root varieties, were doubled, which greatly interfered with the future growth. In this case the roots are all straight and no injury of this nature results.

We are also able to accomplish more in the same amount of time, therefore, during the season when the time for planting is short, the value of the board is again demonstrated.

A spade is used in conjunction with the board for digging trenches and therefore one-half to three-fourth inch of frosts in the surface of the soil does not interfere with the work and permits planting, whereas if trowels were used, it would be necessary to suspend the work until the ground had thawed out. Similarly, the men are not required to be upon their knees and are therefore able to work during light rains and at other times when they would ordinarily quit if they were using trowels.

These are all important factors, because time is of great importance when a large number of trees have to be planted in a very short period.

I wish to congratulate you on the success of the board.

Very truly yours,

C. R. Pettis, Supt., State Forests, New York.

Professor J. W. Toumey,
Yale Forest School,
New Haven, Conn.

Dear Prof. Toumey: We used the Yale planting board at our Morrisville Nursery this spring and found that for transplanting one and two year old coniferous seedlings it is very efficient. By its use the cost of transplanting was reduced fifty per cent.

We used a crew of four men, one stringing seedlings, one digging a trench, one handling the planting board and one filling in the soil and smoothing the ground.

We shall certainly continue the use of the board in the future.

Very sincerely yours,

E. A. Sterling, Forester of the Pa. R. R. Co.

Professor J. W. Toumey,
Yale Forest School,
New Haven, Conn.

Dear Prof. Toumey: We like the Yale planting board very much, and find that it has reduced the cost of transplanting a great deal and the plants are put into the ground much better. The cost of transplanting in the State nurseries with the board has varied from about 35 cents to 50 cents per thousand. At the Pembroke nursery where we use French labor, a crew of five planted 18,000 per day. This was the first time we used the board. The crew consisted of 2 boys at 75 cents per day each, 2 men at $1.50 per day each, and 1 man at $2.00 per day. The average cost on this job was 36 cents per thousand. At the Boscawen nursery we had soil conditions that were not favorable for fast work, but we had better labor and were able to plant from 20,000 to 23,000 per day. Average cost per thousand, 45 cents.

Yours very truly,
E. C. Hirst, State Forester, New Hampshire.

In the past, coniferous seedlings have been set in the transplant beds in this country chiefly by use of trowel or dibble. In a few instances transplant boards of European origin have been used, but with indifferent success. The superiority of the board herein noted over others seen by the writer, is chiefly due to the following:

(1) The firmness with which the plants are held in the board.

(2) The attachment of the strip which holds the plants in place, directly to the handles, making its action rapid and certain.

(3) The certainty of the depth of planting, resulting from the handle strips on the back of the board fitting over the trenching board when the transplanting board is in position.

(4) The rapidity of filling the trench after the plants are in position because of the protection afforded the tops by the strip holding them in place.

In using this board the transplant beds can be laid out 6 ft. wide and of indefinite length, the rows running crosswise of the bed or the bed can be of indefinite width as well as of indefinite length. In the former case the rows are usually 6 in. apart where white pine and similar conifers are transplanted. In this case the beds are kept clean by hoeing and weeding. In the latter case the rows are usually 10 in. apart which permits the working of a hand cultivator. In either type of bed a board 5 in. wide and of proper length should be used on which the men stand in trenching. In the process of trenching, a nearly straight spade should be used, the "trencher" standing with one foot on the board and the other on the bed. By inserting the spade vertically by the side of

the board, a V-shaped trench can be made of the proper depth. The rapidity of trenching depends very largely upon the condition of the transplant bed. It pays to have the bed in good tilth, the soil loose and free from stones. When the trench is made and the trenching board still in position, the transplanting board filled with plants is brought to the trenching board and placed in position so that the ends of the handles on the back of the transplanting board fit over the edge of the trenching board. This will permit the roots of the seedlings to hang down in the trench at the proper depth and will require no attention on the part of the man handling the board to adjust it so that the seedlings will be planted at the proper depth. When the board is placed in position the earth can be quickly filled in about the seedlings and firmed down with the feet. The keys on the transplanting board are released and with a slight upward movement the board removed.

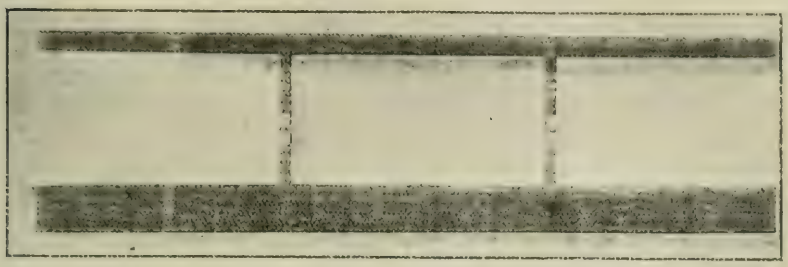
In filling the transplant boards the "stringers" should hold a bundle of plants in the left hand, and beginning at the right end of the board, put the plants in position in the board with the right hand, being careful to adjust them to the proper depth. When the board is filled, the upper strip is swung into position over the plants and fastened. The man who takes the transplanting board to the trench should seize it with both hands, facing the board from the front, lifting it so that his thumbs point toward the upper end of the handles. If five persons are working in a crew, it is usually best for two to trench and fill in about the plants, two to string, and one to handle the transplanting boards in placing them in position. Where ten persons work in a crew, there will ordinarily be two trenches, two men filling in about the plants, two carrying the boards, and four stringing.

In working these boards it is very necessary for the foreman to eliminate as many unnecessary motions as possible and develop rapidity of movement in the workmen. The work is light and rapidity of movement is absolutely necessary in order to reach high efficiency. With a well-trained crew of five persons working on loose soil free from stones, from 25,000 to 35,000 coniferous seedlings should be set in the transplant bed in a single day. If properly handled, this board will set plants better and more uniformly as well as much more rapidly than they can

View of transplant beds of White Pine two weeks after setting with the Yale transplant board. The rows are 10 inches apart which gives space for the working of a hand cultivator.

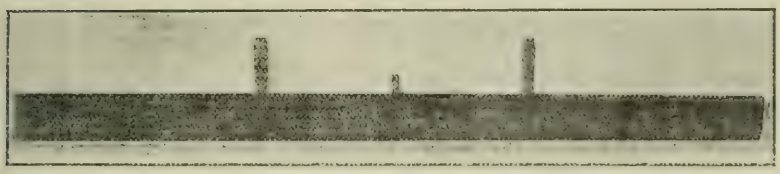
View of transplant beds of Scotch Pine one month after setting with the Yale transplant board. A crew of six men and four women set from 50,000 to 65,000 plants per day.

be set with a trowel or other tool or implement known to the writer.



Rear View.

Open View.



Front View.

NOTE: It may be of interest to note in this connection that the idea of using a transplant board for placing seedlings in the trench is a feature of Hacker's Transplanting Machine which has been in use in Europe for a number of years (See F. Q., vol. IV, p. 154). The machine makes the trenches and also plants and firms the seedlings. This machine is largely used in Austria and Germany, and, for demonstration purposes, has been used at the Toronto forest school. It sets 30-40 thousand plants per crew of five. The main or only objection to it, is that the plants are not necessarily, but usually set across a 4-5 foot bed, which prevents or impedes weeding by machinery.—ED.

THE RISE OF SILVICULTURE.

By Dr. Jentsch.

Translated by Frederick Dunlap.

A new era has just dawned in forestry. A hundred years ago, when Hartig, Cotta and Hundeshagen put the practice of forestry on a scientific basis, there were two problems to be solved: Some system had to be introduced into the natural woodlands they found at hand, and the yield had to be permanently increased. These pioneers, and especially those who followed them, solved both problems by establishing pure stands of even-aged high forest and by clear cutting and artificial reproduction. These practices constituted a real solution, for the fellings were systematized and the yield increased, while its perpetuity was assured. Accordingly, we find that the high forest, clear cut and replanted, is the common form, at least in northern and central Germany, since the middle of the last century. The effort of modern foresters to meet the growing demand for structural timber by increasing the production of spruce and pine has greatly favored this form of forest.

The management of this new sort of forest made new demands upon the knowledge and ability of foresters and led to the formulation of theories of forestry, especially of mathematical theories. The regulation of the yield and the bases therefor have been the chief topics discussed in technical circles for fifty years and more. This period was one of substantial, permanent progress, yet the science of forest production was neglected. For reproduction by planting appeared to so completely fulfil all demands that further study in this direction seemed unprofitable. At first glance, it may appear that the issue between forest rent and soil rent, between compartment and stand management, is as sharp as ever; yet a certain understanding has been reached, for all parties have recognized the rent theory as applicable in forestry, as elsewhere.

Even while these mathematical discussions were progressing, practical foresters were meeting new problems. The pure, even-aged high forest approached maturity and disclosed inherent

defects which, in spite of all its advantages of simplicity in management, easy regulation of the fellings, and perfect, schematic reproduction, made the outcome uncertain and threatened the very existence of the stand. It came to be recognized that the simple, self-evident formula after which the forest was managed had become unexpectedly unelastic, and in many ways encountered the relentless antagonism of the natural requirements of forest growth. Thus a new era was inaugurated—an era which brought the natural sciences to the aid of forestry, and broadened and elaborated those branches of science concerned with the production of marketable material in the forest. At first, but a few far-seeing students emphasized the necessity of ultimate reliance on Nature. In 1878, Gayer set forth the advantages of mixing species and later developed the formation of uneven-aged, mixed stands. "Not unpunished may we depart from the basis of long-continued development for centuries under natural laws." In 1885 Borggreve pointed out the evils of clear cutting and the advantages of natural seeding over the expensive practice of planting. The conflict of theories lost interest, and a large amount of painstaking and richly productive research was directed toward the study of the natural laws underlying silviculture. These activities characterize the latest epoch. It may be called the epoch of the development of the theory of forest production from the underlying sciences. This movement has resulted in quite a number of recent publications, largely original.

The International Congress of Agriculture and Forestry at its meeting in Vienna in 1907 took occasion to outline the prevailing theories of silviculture. In conclusion, the object of silviculture was declared to be the intelligent cultivation of forests for producing wood and conserving the soil under practices which give due recognition to all relevant facts revealed by the latest advance in the natural sciences. There was perfect agreement that these fundamental sciences give no hope for the formulation of general rules—that no form of reproduction was adapted to all conditions. The simplest method of producing a crop without sacrificing the soil was to be the sole criterion between natural and artificial reproduction and between pure and mixed stands. Reuss, who was a member of this committee at Vienna, thoroughly established this thesis in his splendid manual of forest reproduction published in 1907.

Two more recent books, Wagner's "Blendersaumschlagwirtschaft" and Mayr's "Waldbau auf naturgesetzlicher Grundlage," have taken a much more radical stand. Both have been widely discussed and the ideas they advocate are now generally known. Both Wagner and Mayr are opposed to managing large areas as a unit. Wagner prefers natural reproduction to any artificial means because this produces a race of trees adapted to the site and gives rise to mixed stands. His practice is to cut the forest in narrow strips running east and west, beginning at the northern edge of the forest, a narrow strip being thinned in advance of cutting, to start the natural reproduction. There are thus, "at least in theory," three strips along the northern edge of the uncut forests; (a) a thinning to set the crop of seedlings, (b) young seedlings under nurse trees, (c) the clear cut strip on which reproduction is complete. Artificial reproduction when used as a makeshift. Mayr's ideal is quite contrariwise, a small pure stand. Species are not to be mixed as individuals but as stands of from 0.3 to 3 hectares. For soil protection, he resorts to underplanting in about the fifth decade. His ideal stand can be established by planting after clear cutting, as well as in any other way. It should be perpetuated by natural reproduction, though no advantage is anticipated in the production of a race of trees adapted to the site. Wagner has developed and tested his method in the forest, and advances it as the most advantageous method of reproduction—the only one worth practicing—yet he recognizes the difficulty of carrying it out under unfavorable site conditions. Mayr deduces his procedure from purely theoretical grounds and accordingly claims universal applicability for it. It is not only suited to German conditions, but works just as well throughout Europe, in Africa or in the East Indies. He attempts to establish silviculture as a science dependent on other sciences and thus give it the sufficient and necessary conditions for world-wide service and to show that theoretical knowledge and logical thought are all that is necessary to apply this science of silviculture to each and every problem.

These carefully thought out and well elaborated books have indeed ushered in a new epoch during these past few years; they have not only given silviculture a distinctly novel turn, but have interpreted our existing knowledge in a new way, and used the old ideas along with their new conceptions in building up the new

silviculture. The lively opposition with which they have met among foresters only proves the point. The hard-headed practitioner balks at both because they each claim general applicability and universal validity. The new ideas submitted and the old ideas rehabilitated in these books are of permanent value, just as were for example the epochal works of Borggreve and Pressler. These theories must expect the same treatment accorded to those. They will not be swallowed whole, but will be accepted and assimilated only in so far as they prove of service to the conservative practice of forestry working on a great variety of sites and with long-lived stands, worked by short-lived men.

A closer scrutiny shows that these two are not alone in the field, though receiving first notice. A great many others, both before and since, have published the results of their reflections and experiences in silviculture. To me it is a significant and gratifying sign of the times that men deep in practical problems should do this. Their ideas may attract less attention because they modestly limit them to local conditions; by some they may be disregarded. Yet, it is quite possible that the new but tested ideas they contribute may have greater value than those pretending to world-wide validity. A few only of essential and unusual importance in the development of forestry will be here mentioned.

In the West, interest centres about the heath and its conversion to forest, in the East, the problem is the reduction of the areas under pure stands and of the practice of clear cutting. In the West are the thoughtful, but abstruse Dutch, van Schermbeek, the theorist Gräbner, and the practical Erdmann; in the East, Godberssen first wrote in 1907, Düesberg, and Dittmar more recently. Van Schermbeek, now lecturer in the Dutch high school at Wageningen got his ideas in practical work, and put them into practice on the heath at Breda. It is a pity his writings are hardly understandable, partly due to differences in language, partly due to his ever increasing tendency to encumber them with insufficiently explained fundamentals of soil chemistry and physics. Foresters have avoided his writings instead of seeking them out, and they have been the butt of undeserved sarcastic criticism. But no one who has visited him and seen what he has accomplished and attempted, and has heard his explanation of it all will deny its importance in the development of silviculture. A resumé of his work has been attempted in "Forstwissenschaft-

liches Centralblatt" for 1901, page 225. His problem was to change the run-down and moribund pure stands of pine on the heaths of Holland into profitable forest. He first set about to discover the reason for the failure. He diagnosed the trouble as soil sickness, due as Ramann and others have shown, to caking and souring of the sandy soil and insufficient aeration; these all due in turn to the presence of pure pine stands or of the exposure of the bare soil. Restoring the healthy, flocculated condition to the soil is the complete remedy. His work is noteworthy, even though it neither has led nor can lead to hard and fast formulas. He specifically points out the danger of cure-alls; each case requires individual attention. The only broad rules he suggests are: beware of pure stands; avoid clear-cutting large areas; and when planting in heath soils never cultivate deeply. Even on sites where only pine can be planted and expected to thrive, he plants broadleaf species until the soil is improved. Moreover, according to circumstances he sows or plants or regenerates naturally, uses clear cutting or some shelterwood system, sometimes devotes the soil to farm crops for a few years; he cultivates the soil in various ways, provides a soil cover by some crop, or indeed may even apply fertilizers.

Forstmeister Erdmann in Newbruchhausen has also developed a solution under similar circumstances for a local and closely related problem. His practices are the result of clearsighted and diligent studies analyzing the factors of silviculture into their ultimate components. The thorough study of the intimate and changing relations between soil and stand has led Erdmann to novel results regarding the action of stands of forest trees upon heath soils. The salient features of his practices are a strong preference for mixed instead of pure stands, steady regard for the economic influences of silviculture, avoidance of clear cutting, and finally partial reproduction under high forest and underplanting with relatively short rotation.

The writings of Godberssen, Dittmar, and Düesberg deal with the plains of northeastern Germany where the pine prevails. They also wisely lay no claims to universal validity. All three are experienced, thoughtful and earnest practitioners, each giving independently the theories he has formulated from wide experience and careful reflection.

Godberssen's book, "Die Kiefer," published in 1904 pretends

to nothing new, but attempts to set forth the accepted principles of managing pine forests for private forest owners in a way to help them handle their property with profit. The position an experienced practitioner takes upon the most important silvicultural question gives this book its interest. We are told that mixtures are *per se* better than pure stands, that there are dangers in clear cutting, but on the other hand that natural reproduction is far from an ideal practice and that after all is said the fact remains that the current practice of clear cutting and planting has produced good results and will continue to do so. Dittmar is more critical in his book written especially for young foresters, but not unsuited for older foresters and for forest owners to read and refer to. Experience, observation and reflection have convinced him that clear cutting is unnatural and that natural reproduction is best because it approaches nearest to nature's method.

And next comes Düesberg, the most logical, the pithiest and the most original of Prussian writers on silviculture. His present views were published in substance as early as 1898 in the "Mündener forstlichen Heften." The very title of his book "Der Wald als Erzieher" arrests attention. For this form of title has been popular since J. Langbehn published his "Rembrandt als Erzieher" two years ago, and set the reading public agog. Langbehn emphasizes the value of personality in every manifestation of the mind and inveighs against adherence to custom and the blind following of a beaten path, and prizes a new thought not only for its own sake but because it means there is a thinker busy somewhere. Düesberg's book exemplifies this attitude. It is in a class by itself. It is not merely silviculture, nor yet a mere textbook of forestry. It might be termed a philosophy of the forest. The rules and principles which this painstaking thinker has developed in the narrow field of his professional activities, the pine forests of eastern Prussia—developed with due regard to the intricate historical, economic, legal, ethical and aesthetic correlations in nature and in society—unite in his mind to produce a theory for the natural and logical improvement of these pine forests; but this is not all. They lead him further to an ideal business and social system for his country and its people. However dispassionately Düesberg deals with facts, however caustically he criticizes deeds, his radiant idealism, his warm love for his woods, his people and his country, his noble enthusiasm for

truth, virtue and beauty shine through it all like the eyes of the fairy prince shone through the shaggy muzzle of the bear into which he had been changed. The book has a fascination none can withstand, and a value which remains, even if the sober and conservative statesman decide against the changes Düesberg calls for in the forest and in society and be forced to oppose his scheme in detail. "Der Wald als Erzieher" has sounded the alarm which, however scantily its own ideals are realized, will drag out many practices now accepted on authority or through thoughtlessness or indolence or which are merely conventional, and scrutinize them, test them and finally improve them. The indifferent, the self-satisfied, he who is contentedly jogging along in the same round of work and duty his father trod must needs heed this scolding, urging, warning, and withal seductive voice out of the Pomeranian pine forests, and even though, having attended, he returns to his day's work with much head-shaking he will have had his eyes opened to many things and henceforward will regard himself and his work in a different light.

Düesberg avowedly intends to introduce something better in place of what he censures without reserve and opposes vigorously. After a short sketch of conditions in the forests of eastern Prussia he outlines the development of forestry. A hundred years ago the mismanaged native forests were turned over to political economists, trained after the fashion of the time but ignorant of any natural science, and by these men their regulation and use were determined upon. The simple, comprehensive style of subdivision into cutting areas and cutting periods was their solution. This plan of necessity resulted in pure stands differing from one another in size, age and species, and since the discontinuance of pasturage in the middle of the last century, has also resulted in clear-cutting and planting. Continuing, Düesberg describes how forest regulation lost its subservience and became a set formula, monotonous and tedious and despised, and how the forest lost its native beauty.

The following section, "Aufbau des Waldes," treats of the reciprocal relations between the tree and the soil, the principles of tree growth, the interdependence of stem, branches and roots, the root habitus in close and open stands and when isolated, and the productivity of even-aged stands. Every page of this section contains new and shrewd observations and a wealth of detailed

experiences, the significance of which Düesberg points out, the complete explanation of which he persistently seeks, setting each in proper relation to all the rest and to whatever facts scientific investigators have contributed either to support or contradict. In the light of this critical examination of the interdependence of forest and soil he shows how the even-aged high forest outrages nature. And "Every offence comes home in time." Unguided Nature produces a prosperous harmony from the reaction of soil and plant and animal life in the forest. Man is not to interfere with a high hand in Nature's work, but must exert himself to understand the growth of an unmanaged forest and observe the natural laws of its development, and then, with conscious design and a clear understanding of the proper methods, try to further this natural growth, to lend a hand and direct it towards the production of economic values. Following such a course Düesberg —to our astonishment—developes the selection forest. "Beauty vigor, soil, protection and freedom from disease, and, as a result of all these things, high yields are the characteristics of the selection forest and the reasons for advocating it." Merely because it does not lend itself so readily to forest management and administration, as do less cumbersome though less productive forms of forest, most foresters have hesitated to advocate this, the most natural kind of a forest. To remove this hesitancy Düesberg proposes a simple type of selection forest which recognizes every essential feature of the uneven-aged forest, produces the highest yields and is most simply managed. His selection forest has for its units small areas of a size determined by the diameter of the crown of a full grown tree in the virgin forest. These areas thus differ with different species. Their typical shape is that of the regular hexagon. Seven of these hexagons, one central and six peripheral are termed a Group *(Gruppe)* and form the cutting area for one complete rotation. Cuttings are not made in each group every year, but only at regular intervals. If cuttings are made at intervals of five years five groups epitomize the whole forest. Each one of the seven hexagons in a group is termed a Clump *(Trupp)*. The clump is 2-, 3-, 4-, 5- or 6- partite according to the number of age-classes it contains. If in a mixture all species are eventually to be introduced into each group, the sizes of the group and of the clump are determined by the crown breadth of the broadest-crowned species. The Pedunculate oak

has the broadest crown of any German species with a diameter of ten meters making 646 square meters to a group and fifteen groups to a hectare. The felling age is always equal to the number of age-classes in each group multiplied by the number of years intervening between successive returns to a group. For pine under a rotation of 168 years and with a four-year return there are $\frac{168}{4}=42$ age classes in each group and each of the seven clumps is six-partite. These six parts are arranged like the stories of a building, the young under the older. The high yield of 15 festmeters per year and hectare (210 cubic feet per acre) can be obtained in the productive twilight of such a stand. Practically every tree cut in such a forest is mature and of high value, the amount of small and cheap material being reduced to a minimum. The money return is large accordingly. Düesberg without apparent good reason expects gross yields of 600 marks instead of 100 and net yields of 540 marks instead of 50 to 60 per year and hectare (1 mark per hectare=10 cents per acre nearly). Poorer sites can be managed on a lower rotation and with smaller yields by reducing the number of parts in a clump and by lengthening the period of return to a particular group. Thus for pine in four-partite clumps and a return every fifth year we have twenty-eight age classes in a group and a rotation of 140 years with an annual production of 1.44 festmeters per hectare (20 cubic feet per acre). Carefully considered and detailed instructions are given for converting existing, even-aged pure forests into this form of selection forest, for their care and management and for regulating their yield.

Of course, the question keeps asserting itself: Should we ever undertake to convert any large forest or the forest of any considerable region as Düesberg advises, will no new Düesberg arise in the course of the century or more necessary to make the change, and, criticizing what we have already accomplished, offer something better? This is the heel of Achilles common to all methods of forestry and particularly characteristic of such as Düesberg's which so frankly rests on newly deduced principles of biology and political economy, regarding them as the best.

The question now arises: Is this policy Düesberg so clearly and enthusiastically proposes so well founded and free of fault that every open minded forester will accept it as his guide, and

if such is the case, is this policy so readily inaugurated and carried out as he declares. History answers, "No" to the first question. Let us admit for the sake of argument that the prevalent formalities of red-tapery, that mere convenience and want of thought are largely to blame for the truly serious and ominous conditions to which German forests have come under the constraint of the inflexible clear-cutting system. Still we cannot assume that all the leaders in the theory and practice of forestry during the last sixty years have been out of touch with the mass of their colleagues and misunderstood by them, or that they have been either dunces or drones. All, or nearly all of them, have honestly and earnestly striven to advance forestry and to make use of newly found scientific facts and the demands of political economy to this end. To-day the same as a half century and a century ago Germany enjoys the reputation of standing first in the theory and practice of forestry and especially in silviculture. The condition of German forests bears out this reputation in spite of obvious shortcomings. Even the most ardent advocate of natural reproduction, uneven-aged and mixed stands, must admit that the much abused practice of clear-cutting and the objectionable custom of planting yearling pine seedlings have given rich yields and promising, thrifty stands over large areas. Neither indifference nor custom nor blind devotion to Pfeil has prompted the change, under way since the forties of the last century, from natural regeneration to the artificial reproduction of pure forests. Weise has shown (Münd. forste. Hefte. V. p. 1, 1894) how gradually Pfeil himself abandoned natural regeneration and how hesitatingly at first he advocated planting and how he gave the reasons for this change in his writings. This change has increased the yield of the State forests and promises to continue to do so for generations to come in spite of the greatly increased risk and damage it entails. It is my conviction that the clear-cut high forest is distinctly worth continuing; that it is a valuable and convenient form of forest. It is no more a sovereign remedy than Düesberg's selection forest, and it must never fail to properly respect the natural laws of forest growth. But wild nature and man's culture are irreconcilable and any attempt to return to nature in managed forests must needs fail. Economic efficiency is the criterion for managed forests, and earlier ages made quite different demands than does the present. Fuel and forage were

once its chief products, but coal mining and potato culture have changed all this so that structural timber and saw stuff are at present the most important forest products. If Düesberg advises a return to forest pasturage I am sure his words will fall on deaf ears. Modern herd management no longer needs or asks such privileges—with rare exceptions. If Pfeil and the men of his day turned from natural regeneration to artificial they did so in response to the economic needs and demands of the times. And it behooves us in our generation to make further changes in the principles of forest management to meet changed conditions. If our more intimate knowledge of the laws of nature and our experience of sixty years shows that clear cutting and even-aged stands are inherently wrong and invite disaster, or that they are not the most advantageous for all times and conditions as we used to think, our task is to make the change to better forms, where a change is desirable; in other places to free the old forms of their impediments and develop them to their best. That improvement is possible and practical has been pointed out by Gayer, Ney, Borggreve and Wagner among others, and practical experience has warranted their opinions.

Thoughtlessness and mere formalities are to be opposed everywhere and all the time. Düesberg's clear warning deserves attention and will receive it. But bureau chiefs can never disregard the fact that rules and regulations which are to be applied to such a large area as the Prussian state forests cover and for a long period of time must not be addressed solely to the ever present zealous and capable few, but must rather be addressed to the average forester who does his routine duty each day and accomplishes little more. Individual freedom to alter prescribed regulations can be and is recognized. This is true throughout Prussia. Call the regulations as unyielding as you will, the fact remains that to each one who undertakes to develop a new and improved practice is given opportunity to test his ideas. Heyer and Borggreve, Homburg and Mortzfeld, Erdmann and Metzger, and finally Düesberg himself bear witness to the fact. A code of general regulations must be prepared to serve the purposes of the whole organization. Düesberg recognizes this, and formulates general rules for the application of his system. But his system impresses one as too complex for general introduction; too difficult to insure its success in the hands of the average forester. The brief sketch given above is sufficient to show this.

A consideration of the technique of silviculture opens more questions. The assumption that the growth of the younger age-classes in the partial shade of the older will continue thrifty until the removal of the older trees or that there will be any growth at all, is possibly warranted for good sites but not for all sites, certainly not for the sterile sandy soils which cover so large a part of northern Germany. Pfeil who is recognized as a careful observer, has concluded that the Scotch Pine does not endure shading after the fifth year, that continued shading reduces its vitality, and that stands which have been regenerated naturally contain too little saw timber to make natural regeneration appear advisable. Again it is possible in the high forest to make such mixtures of species as may be desirable for soil protection on poor sites. The ways to accomplish this have been pointed out by Erdmann and von Schermbeek in the moist climate of the West, in the East, by Frick and by many others, notably by Godberssen and Dittmar. It is neither desirable nor possible to think of disregarding these methods and to follow Düesberg alone. The proper course to pursue is to let all practices persist side by side and by careful experiment to determine what procedure leads most certainly to given results on different sites, under different forms of forest and with different objects in view.

The profusion of excellent observations and admirable conclusions with which Düesberg's book abounds contribute no less strikingly and effectively to the theory and practice of forestry because the hopes of an enthusiastic advocate of the selection forest remain unfulfilled. The value of his work is not to be measured by the extent to which the forest of Germany or of north-eastern Prussia are converted into "Groups" and "Clumps." His scheme is just as artificial and rests on a few happy experiments just as much as did Gayer's *"Femelschlag,"* Ney's *"Ringfemel,"* or Wagner's *"Blendersaumschlag."* The important point is that every trained forester should learn to consider well what technical methods and what business procedure are best adapted to the fundamental laws of nature and the economic demands of the community. Once understood, these methods and procedure become the ideal toward which he should move steadily but slowly and without seriously disturbing the existing state of affairs in the woods. Düesberg's book is a good guide in this field because it contains a detailed, incisive criticism of the purely

formal treatment of the forest, a penetration to the bottom of the basic principles of silviculture and the relation between particular practices and the results produced, and finally directions and advice based on all these things. And what goes far to further make the book an agreeable and ingratiating companion is the enthusiasm and love for the forest and for the beauties of nature which permeate it.

It is to be hoped and there is reason for anticipating that the immediate practical effect will be that more attention will be devoted to natural regeneration than heretofore and to the formation of uneven-aged, mixed stands. That such is locally possible and is necessary to maintain and advance the productivity of the forest is sentiment which like a golden thread, runs through all discussions of silviculture and their journalist reviewers.

The second section of the book treats of the woods as a monitor in the realm of industry and sociology. Here even more than in the first section the reader feels himself carried off his feet on the hobby of this genius, who as he looks out of his quiet Pomeranian forest lodge sees every thing, his fellows, his country and the whole political and business world, through the trees of his selection forest. Düesberg advocates in business and in government a harmony borrowed from his ideal forest, takes up the cudgels against individualism and the undue emphasis given to selfishness under the capitalistic regime, and constructs a new business and social order mainly on physiocratic bases, though in part on land reforms. He would emphasize and advance service as fundamental and reduce capital's income from industry by heavy taxation, employing productively the means thus made available. Düesberg had already set forth these ideas in a small brochure, "Reform in Taxation and Administration for the German Empire" (1905)—a pamphlet which has attracted little attention. It is a glowing picture he paints of a state of society where equal opportunities are afforded each one, yet the whole is securely held intact by a genuinely German aristocratic view of life. Only too gladly would we follow the enthusiastic and inspiring teacher of these doctrines! Even if the hard-headed, matter-of-fact reader balks at following he will unreservedly give assent to the closing sentences. "The ideas and proposals here developed may seem too ambitious to many, and many of the opinions may seem too incisive, but they are sprung from sincere convictions. There is no taint of servile-mindedness."

WINTER RECONNAISSANCE IN CALIFORNIAN MOUNTAINS.

By R. F. Hammatt.

In the winter of 1909-10, three Rangers, running lines on skis in a flat country, discovered a timber trespass which, upon further investigation, proved to amount to a little over 5,000,000 feet B. M. This ski work was done in a country so brushy that it is practically impossible to travel the country in the summer except on the trails. Thus was born the definite idea of winter reconnaissance in California.

In the summer of 1910, at an elevation of 5,500 feet, a log cabin 14 by 20, with three good-sized windows, was constructed. It was well daubed with sand and cement (excellent material for this work), and was tightly ceiled. Three double bunks were provided. The cabin complete cost $225.00.

The snow held off until late, and on January 3 about 2,000 pounds of bedding, provisions, stoves, etc., were hauled to Deter Camp. On January 5, the crew of five Rangers, with a Forest Assistant in charge, also left town. The first thing done after reaching camp was to choose a cook for the first week. On January 7 we had our first storm. For the rest of this month the weather was extremely bad, and the work proceeded pretty slowly. In spite, however, of the loose snow and stormy weather, the men blocked out, by retracing survey lines, three solid weeks' work. This and about five days' estimating was all the work the weather would permit during January. During February and March the weather cleared considerably, and the winter became more normal, although the snowfall had been, and remained throughout the winter, much heavier than usual. These months gave a very fair indication of what can be done in future years and under what conditions it is possible to do winter reconnaissance.

At first the camp was divided into one crew of three men and one of two. Ordinarily each crew worked on a section of its own. It soon became the general rule in camp that no crew was to show up at night until its section had been completed, and this

rule, except in bad weather, was pretty well adhered to. After a short time the cook also worked, for he soon got tired of staying alone in camp all day, and thereafter three crews of two men each were formed. The crew in which the cook worked generally took the section nearest headquarters.

The compassman carried, besides his standard compass, a chain, note book, aneroid barometer, and tally register. The cruiser had his tally book, a diameter tape (which is much easier to carry on the snow than calipers) and hypsometer. In extra heavy timber, or at long distances from camp, three men were used to a crew, and it was found, throughout, that the compassman always had to wait for the cruisers. The strip method was used, the strips always run across the contours, and four strips were taken to each section. In this way a very good topographic map was secured. The compassman ran the lines, and generally paced rather than chained. He made topographic and type maps and took notes on the quality and condition of the timber, amount of fire, fungus and insect damage, etc. The estimator in the two man crew, following the compassman's snowshoe tracks, estimating for a chain on either side, and checking up frequently on his diameters, heights, and the width of his strips. In the three-man crew, each of the estimators took strips one and one-half chains wide on either side of the compassman. One beauty of the winter work is the ease with which the compassman's tracks can be followed by the cruisers, and the corresponding ease in checking on widths of strips and on corners, without holding the compassman back.

But the general methods of reconnaissance work are well known, and there is no need of further discussing them here. I wish to give an idea of the conditions under which the work was done, the equipment in the way of snowshoes, etc., used, the actual results obtained, and the cost of the work as far as it has gone.

During February and March, on the ground covered, the snow was from four to eight feet deep. By this time it had settled somewhat, so that, except for a few days just after each new storm, we did not have to contend with much light, fluffy snow. Only few times, however, was the snow hard enough to make walking without webs possible. Each crew left camp between six-thirty and seven-thirty in the morning, and the walking was

fine until eleven o'clock. From eleven till three in the afternoon the snow became sticky, the shoes loaded up badly, and the walking was difficult. After three o'clock the snow hardened again, and the work was nearly as easy as in the morning.

Right here there are two points about which questions will be asked and which I want to explain. (1) How can the work be tied to existing survey lines and corners with from four to eight feet of snow on the ground, and, (2) How can diameters breast high be obtained? As a matter of fact over two-thirds of the work done was tied absolutely,—not to the exact corners, but to the place where the corners should be between two, three or four witness trees. In other words, in by far the majority of cases the witness trees for the section and quarter corners were found, and it was very easy to follow the old line blazes. In fact, our compass and line work was done so accurate that we felt no hesitancy in using corners and lines established during the winter unless they were more than three miles from a corner, the witness trees to which had been actually found on the ground. The fact that so many corners were found and so many lines followed was due to the settling of the snow around all trees. This point may be illustrated by the following experience: A stake, marking a corner, was set so that it projected one and one-half feet above the snow. Two hundred yards from this stake was a large yellow pine, with a line blaze about six inches above the snow level. One day after the stake was set, a new fall of snow covered it entirely, but the blaze on the yellow pine (and other blazes for two miles) was still visible. We found that it was very easy to pace accurately with the webs—although we had, of course, to be careful on account of changing snow conditions. As a whole the chaining, pacing and compass work was easier and more accurate on the snow than it was on bare ground in the summer.

The fact that old survey lines were followed, and witness corners found—during a winter when there was more snow than the "oldest inhabitant" remembers for twenty-five years—answers the question of getting diameter at breast high. The snow is, of course, of somewhat different depths on different exposures, but if the depth is measured at the base of trees and an average taken, I doubt if the estimate suffers materially.

Another question which naturally arises is, "How far from

camp—for it is well to have a well established camp—is it practicable to work?" Our work was done in a country where every alternate section is patented to the Central (Southern) Pacific Railway Company—and in addition there is considerable other patented land. It was found that work could be done to good advantage in such country within a radius of five miles from camp. With good going in the morning, three miles an hour was made while walking to the work. At night, with the men tired and the walking a little more difficult, the speed was, of course, considerably less. At the five-mile limit, unless under exceptionally favorable circumstances, it was very seldom that a two-man crew completed a full section in a day.

It may be interesting to outline briefly an actual day's work near the five-mile limit for a three-man crew. Work was started at seven A. M. and from a section corner previously determined. Two miles of line was run using a compass and pacing distances. All the corners on this line were found. From the section corner thus found two more miles of line were run, and the country traversed was mapped. From this point, which was established on vacant government land, the actual reconnaissance work began and an additional two and one-half miles of line was run and all the timber within a strip three chains wide was estimated. Within the last one-half mile the elevation varied from 4,700 to 5,300 feet. The work stopped three miles from camp and the cabin was reached at five-thirty that night.

With much patented land it is impossible to work for three months from one camp. Moving camp on the snow—by man power—is, however, entirely practicable. On February 16 and 17, seven men moved 2,400 pounds of provisions, bedding, cooking utensils, instruments, clothes, etc., twelve miles on two sleds. The snow was soft and sticky—in fact the webs sunk in about two inches throughout most of the day. One sled, which had narrow runners, had to be left at two o'clock on the first day, but was rescued the next morning when the snow was harder. Light loads from 100 to 250 pounds can be hauled by three men (with the snow in fair condition) if the country is not too rough and broken and the grades too heavy. For loads over 250 pounds, more than three men are needed, unless the country is fairly level or there is a down-hill pull.

Skis will not do for this work. With them it is impossible to

survey lines up steep slopes or across rough and broken ground, or to pace accurately—except possibly on level ground. It is *almost* impossible to work with them when the snow is wet and sticky in the middle of the day, and they require constant "doping."

Webs can be used in rough country or in smooth. Accurate pacing can be done on them. You can work with them whether the snow is dry or whether it is wet and sticky. If they break it is comparatively easy to fix them up. The only thing needed is a couple of extra rawhide thongs in your pocket. Last but not least—no *learning* is required with webs. Anyone can walk all day and every day, provided he is physically sound.

We tried webs from three different firms, and webs of various sizes and shapes. The poor webbing in the New York shoes makes them worse than useless for work under California conditions. The Alaska Trapper shoe from Tacoma, Washington,—a shoe 60x12 inches—at $8.00 per pair, is a very fair shoe, although the toe is a little too large and full and the webbing stretches too much. The best all round shoe—and one which is extremely satisfactory—is obtained from A. M. Dunham, Norway, Maine. This is a hand-made shoe throughout, and has a coarse webbing which resists wear extremely well, and which absolutely will not stretch or sag under any conditions. Mr. Dunham guarantees the webbing in this respect and everyone of his shoes (eight pairs) have stood up perfectly. Of Dunham's shoes we got four pairs, 14x48 inches, model four ($5.50) and four pairs 12x60 inches, Peary Model ($8.00), both with toe clips. Of the two I believe the 14x48 inch shoe is the best, because it has more surface and will support a man better in loose snow and because it is a little easier to handle in rough country and particularly in heavy timber and thickets of young growth. If, however, it is known that most of the work is to be in light powdery snow, I believe Model No. 2 —15x54 inches would be best; while if hard snow is to be expected for most of the time a shoe 12 inches wide would be best. The Dunham webbing and toe clips make these shoes far superior to any I have seen—although even with them, extra webbing should be ordered, or a rawhide bought, for repair work.

A very good sled can be bought of the Seattle Hardware Company—the Yukon Sled—for $6.50 at Seattle. This sled has one and three-quarter inch steel shod runners. For the work in Cal-

ifornia it is absolutely essential to have three-inch runners, and a width of four inches would be better. The sleds can be re-shod by any local blacksmith, although a hard maple runner, well doped, is better than iron, steel or brass. Ordinary skis were found very satisfactory as sled runners by one crew.

The crew of six men covered forty-five and one-half sections of vacant government land and mapped in addition fifty sections of patented land. In other words, they worked over an area 14x16 miles in extent. One-half of the estimates and type and topographic maps were also finished in the field. Throwing all the cost of the work on the government land alone, the work cost $34.37 per section or $.054 per acre. Five of the men were receiving $91.66 per month and the sixth $100.00 per month. Had we worked men getting the same salaries as the men for summer work, the cost would have been $.032 per acre.

Next winter, knowing conditions and being sure that the work can be successfully done, we can reduce the figure of $.054 per acre considerably.

A word in closing. It is too early yet to give figures showing the final cost of the work, since the notes on reproduction, ground cover, humus, etc., must be obtained in the summer—preferably by some member or members of the original crew. It has, however, been demonstrated that winter reconnaissance on webs is entirely practicable in California—and, I think, anywhere where there is a good fall of snow on the Pacific Slope. Then, too, it can be done during the slack season when the District and other Rangers are not pressed for time. It means that, if necessary and advisable, the full summer force can be kept employed to good advantage throughout the entire winter, and it means that our reconnaissance work can be finished much sooner than otherwise.

In addition, the work can be done from tents, as was demonstrated by another crew, which worked from tents entirely and moved camp more often, although otherwise working under conditions similar to those already described.

On the whole, this is the finest, cleanest, most wholesome and satisfactory work that I personally have done for some time. We plan to continue it here in the future.

THE "HAND-LOGGERS" OF BRITISH COLUMBIA.

By Louis Margolin.

A unique form of forest exploitation, little known outside of the region where it is practiced, is the so-called "hand-logging" in the immediate coast region of British Columbia. Trees, often from 5 to 10 feet in diameter, are felled, bucked, shot into the sea and made up into booms or rafts without the help of any machinery or animals such as are commonly used in logging operations. This method of logging receives its sanction from the Provincial Government under Section 60 of the "Land Act," which reads substantially as follows:

"The Chief Commissioner may, upon payment of the sum of twenty-five dollars therefor, grant a general license to cut timber from Crown Lands, not being timber limits or leases, and within such area as may be specified or designated in such license or lease; but such license shall be personal, and shall only grant authority to the person named therein to cut timber as a hand-logger, and such license shall be in force for one year from the date thereof, and no longer.

"The holder of a license granted under this section shall not use steam power or machinery operated by steam power, in carrying on lumber operations under such license."

The most peculiar feature of the above section is the prohibition of the use of steam or steam-power machinery in the operation, whence the term "hand-logger" is derived. Nothing is said in the act about the use of horses or oxen but the topography of the country is such that the use of animals in logging is practically precluded. Before proceeding with the description of the operations, it may be well to describe briefly the physiography and the forests of the region under consideration, which make hand-logging possible.

The coast of British Columbia consists of an almost uninterrupted chain of mountains rising directly out of the ocean, and having an elevation of from one or two hundred to several thousand feet. Flat land in the immediate vicinity of the sea is so scarce that logging camps, and even entire settlements, are some-

times built on rafts of logs held in place by boom-sticks and chains fastened to the shore. The slope of the land varies from 5 to 10 per cent. to 50 degrees or more, and the surface is often broken by rocky bluffs and ledges.

The forest along the coast consists principally of a stand of Douglas fir, Western red cedar (*Thuja plicata*), Western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*) locally known as larch, Sitka spruce (*Picea sitchensis*), yellow cypress (*Chamaecyparis nootkatensis*) and occasionally Western white pine. Douglas fir and cedar are the two principal species, the former occurring in almost pure stands at the lower elevations and south of Cracroft Island in Johnstone Strait (50° 30′ North Latitude), while the cedar predominates at higher elevations and farther north. The trees of these two species are of large size, individuals of from 6 to 12 feet in diameter being frequently found. Single trees scaling 24,000 board feet are on record. The per acre stand is heavy, usually averaging from 25 to 60 M board feet over large areas, and logs scaling 200 to 300 M are said to have been cut from exceptional individual acres.

In hand-logging the trees on the steeper slopes are felled in such a manner that they can be made to slide into the water by force of gravity. If the slope is steep enough the tree, in falling, will jump and slide a long distance and may reach the sea without any more effort on the part of the loggers. In most cases, however, the tree will stop before it reaches the "salt-chuck" (or ocean) and it then becomes necessary to help it along in its downward course by means of a jack-screw. When once it gets a good start there is nothing that will stop it, except a depression in the slope, and it will cut a clean swath down hill by its own weight, sweeping away all obstacles, uprooting stumps and shattering good-sized trees. In the process of sliding the tree effectively limbs and trims itself, at least on one side. Should the tree slide into a depression in the surface of the ground, it will either be smashed or else it will bury itself for a distance in the ground. By judicious bucking and lifting with the jack-screw, it may be possible to save such a tree, but in many cases the hand-logger will prefer to let it go to waste, and spend his time and energy on a new tree.

The distance which a tree can be made to slide by this operation is truly remarkable. In favorable situations records of half

a mile and even 3,000 feet have been made, though the average distance logged in this manner is probably less than 1,000 feet. The amount of timber cut by the hand-loggers is considerable. A crew of two men will usually put in from 2 to 4 thousand board feet of logs per day, or about ten "swifters" (each containing from 35 to 50 thousand feet) in a season of eight months. In exceptional cases 700 and even 800 thousand feet have been boomed in a season, by the more capable crews. In 1907, when this industry was at its height, there were about 1,000 hand-loggers' licenses in force, and the cut of timber under this system must have approximated 100,000,000 feet in that year,—a not inconsiderable quantity.

The logs are usually sold in the boom at the camp, and the purchaser assumes the cost and risk of towing them down to Vancouver or some other mill-site. They bring the hand-logger $5.00 and up per thousand board feet. In the highly prosperous days of 1907, prices as high as $8.00 and $10.00 were paid. Thus, for a season's work a crew of two men will normally receive from about $1,500 to $3,500. If the log market is unusually dull the more thrifty logger will hold over his cut for a season, towing his logs for this purpose into fresh or brackish water in order to protect them from the attack of teredoes, to which both the fir and cedar are subject.

It takes a capital of about $300 to start in this business. The complete outfit consists of a saw for felling the trees, a saw for bucking them into logs, axes, wedges, a sledge, a jack-screw (which costs about $45.00), and a row boat. A certain amount of "grub," mostly in the form of canned food, is necessary to start with, though the hand-loggers draw a large part of their subsistence from the forest and water. Venison, squirrels, ducks, trout, salmon, rock cod and clams form a considerable part of the bill of fare. A stove, cooking utensils, etc., make up the rest of the outfit. Since there are practically no roads or trails in this country, and since, furthermore, the operations are often conducted on isolated islands, a boat is indispensable. Every outfit, therefore, possesses at least one row-boat, while often each man in the crew will have his own boat. In the last year or two some of the wealthier and more ambitious loggers have obtained inexpensive gasoline launches.

As soon as the tract to be logged is chosen and the required

license is obtained, the men build themselves a house, usually constructed of shakes or split clap-boards, and placed on a raft or boom which can be towed from place to place. With this as a center the operation begins, and day by day the boom grows, as log is added to log and "swifter" to "swifter." The loggers most often work in pairs, and theirs is a lonely life. Far removed from all lines of communication, scores of miles from the nearest other human habitation or post office, and hundreds of miles from the nearest railroad, telegraph or telephone station, their isolation is complete. Occasionally they may be visited by a launch belonging to some prowling timberman or by a tug-boat in search of logs, but outside of these rare visitors they are alone.

The men who engage in this industry are usually the younger and more ambitious "lumber jacks," tired of working in the logging camps for a wage, and eager to strike out for themselves,—to be their own "boss." Their chief ambition is to save up enough money to purchase a steam "donkey" and go into "legitimate" logging. Few of the men, however, realize this ambition, for, after the solitary life in the wilderness, often eight months at a stretch, the saloon lights and the red lights of the city shine with an irresistible brightness, and the earnings of the whole season are spent in a few days.

From an economic standpoint this system of logging is of considerable importance. Like the small logging-contractor in the East, the hand-logger, by dint of personal effort and personal attention is able to deliver the logs at a minimum cost, and can thus successfully compete with the larger camps employing hired men. As has already been stated, they furnish a considerable per cent. of the logs cut on the coast of British Columbia.

From the timber owners' and the foresters' point of view the hand-logger is an unmitigated nuisance. Like the shake-maker in the California Sierras he selects the best and most accessible trees in the forest, wastes enormous quantities of timber to get a relatively small amount of merchantable logs, and by leaving slash and debris on the ground greatly increases the danger from forest fires. Hardly a "limit" in the immediate vicinity of the coast but has been partly cut over by the hand-loggers, for they do not always confine themselves strictly to the tract of Crown timber specified in their licenses. Formerly, when timber was considered practically of no value in this country the hand-logger

plied his trade almost anywhere he saw fit—on private holdings as well as on the Government Reserve. With the increase in the values of timber, however, and the stricter watch on privately owned tracts, the hand-logger finds his field of operation greatly curtailed. The number of hand-loggers operating this year is insignificant when compared with the number engaged in this industry three or four years ago. With the more easily accessible timber already logged, and with the stricter watchfulness on the part of the private owners of timber, the hand-logger will soon disappear. His exploits, however, will be long remembered on the Coast of British Columbia.

ROTATION OF CUTTING TO SECURE A SUSTAINED YIELD FROM THE CROWN TIMBER LANDS OF BRITISH COLUMBIA.

By Leonard S. Higgs.

British Columbia is to be congratulated upon the fact that unlike many countries in a like stage of civilization it has not as yet mortgaged the future of its forests: and there is little room for doubt, if the Government acts vigorously and at once, that a way of escape may be found from the menace of the permanent timber scarcity that is already felt in so many portions of the earth. The eventual fate of our fifteen or twenty million acres of forest will be of little import to the markets of the world, but to us and our descendants it will be pregnant with the gravest issues, and the responsibility of initiating a thoroughly conservative policy with regard to it rests with the present generation.

We are still in the enviable position of having used only a small fraction of our forest heritage, for although till the present time logging operations have been carried on with a reckless disregard for the sound business principles of forestry, the area of forest destroyed, and the total amount of timber cut, are still inconsiderable when compared with the whole area of merchantable timber, and the available stumpage therein contained.

This may be plainly seen from the following figures: the total cut from the earliest days of lumbering in the Province until 1910 has been roughly 5,745,000,000 board feet, representing at an average of 13,000 b. f. per acre, 430,000 acres. A conservative estimate of the entire stand of the Province made by the Forestry Commission in 1910 gives it as 200 billion feet on about 15 million acres, excluding the Dominion timberlands in the railway belt, and the holdings of the C. P. R. in the Kootenays. That is, the forest has been only depleted to the extent of about one-thirty-fifth of both area and quantity.

A constant annual yield of timber making possible a sustained rotation of cutting depends in great measure upon the methods used in logging operations now and in the future, and the institution of stringent regulations governing those operations is of the first importance. In this matter we are lucky enough to be in a position to benefit by the collective experience of other countries,

and notably that of the United States in the Rocky Mountain and Pacific Coast forests where the conditions and species dealt with are in many instances similar to those of British Columbia.

Rotation-cutting demands that the forest shall produce annually an amount of timber equal to that of which it is denuded, and that there shall be a proper proportion of trees of the requisite ages remaining in the stand. Briefly, the forest problem for the Province to solve is to induce and maintain upon logged-off lands an adequate second growth; and wherever possible, to secure the reproduction of Douglas fir to the exclusion of less valuable species, and at all costs to protect the growing forest from even the menace of fire.

Our ignorance of the actual stand of timber is distressing. Experience teaches us that the estimates of stands of merchantable timber rise decade and decade as new areas are discovered, and the definition of the term "merchantable" admits a more liberal interpretation. Timber becomes merchantable by lapse of time as the minimum cutting limit is lowered, and timber of poorer quality, lighter growth and less accessibility is pressed into use. The following figures are taken from "The Timber Supply of the United States," Kellogg, 1907. U. S. Census estimate, 1880, gave total stand as 856 billion feet. After 25 years cutting and burning "The American Lumberman" in 1905 estimated it at 1970 billion feet. The U. S. Census estimate for conifers in 1880 was 420 billion feet. Five hundred billion feet have already been cut, and it is estimated that there are still 1,400 billion feet in the two western forests alone. The "Pacific Lumber Trade Journal," 1907, credited British Columbia with 150 billion feet. Fernow's estimate in 1908 was 300 billion. These are some of the most glaring under-estimates which have been officially made.

In discussing the question of rotation-cutting it is necessary to use arbitrary figures for the area of our forest and our stand of timber as a hypothetical basis upon which to work. The Forestry Commission has had the best possible facilities for arriving at these figures, and therefore greater reliance may be placed upon the probable correctness of their interpretation, than upon that of others originating in less authoritative sources. For the present purpose, therefore, 15 million acres will represent the area of forest to be dealt with, and 200 billion feet the entire stand of timber. It may be objected with reason that the future forest

regulations as to cutting, etc., will not apply to the areas held under Crown grants, nor to the E. & N. Timber belt, which together amount to 1,200 thousand acres. There may also be a certain percentage of Crown timber held under license and unrenewable lease, which when logged-off will be found to be fit for agricultural settlement. To this it may be answered that, to offset these areas, there is an unknown number of millions of acres (but probably not fewer than five) upon which the stand is at present either immature, inaccessible by available methods, its yield below eight thousand feet to the acre, or the quality poor, which has now no commercial value and is therefore still the property of the Crown.

Furthermore, an attempt must be made to find answers to the three following questions:

(1) What will be the duration of the visible supply of timber?

(2) What will be the possible constant annual yield per acre?

(3) What will be the probable legitimate period of rotation?

(1) Until 1910 the scaled output of our forests was under 700 million feet per annum, or less than 50 feet per acre. A reasonably liberal figure must be assumed for the probable increase of the demand which governs the supply. The annual increase in lumber consumption has been spasmodic rather than constant. Between 1888 and 1892 the output doubled; remained stationary till 1894; doubled in 1898, 1902 and 1905, and increased nearly 40% in 1909, when the production reached 607 million feet. If the demand were to keep on increasing 10% each year the available supply would be exhausted in sixty years, even at Fernow's estimate of 300 billion feet. If, however, an increase of only 5% be conjectured, the time-limit of exhaustion of the present stand would extend to 120 years.

During the century from 1807 to 1907 the output of lumber in the United States increased from perhaps 100 million to 35 billion feet, representing a cumulative annual increase of about 8%. The anology is far from perfect, owing to altered conditions, and especially to the introduction of steam. But he would be bold indeed who would assume that the present crop of our British Columbia forest would last more than 100 years.

(2) Unfortunately, in speculating upon a possible sustained annual yield per acre, we have no data gathered from our own forests bearing upon the subject, and therefore it will be neces-

sary to rely upon the experience of European countries which practice intensive forestry, and upon certain data for the Pacific Forest published by the Forest Service of the United States.

It has been fully proved, firstly, that only a high standard of technical management and commercial methods combined can secure a sustained yield without depletion of capital, and, secondly, that, with these advantages, forests conservatively managed will produce timber of greater density, less unsoundness, and more desirable species, and of a four times greater yield. Thus, in seven million acres of Prussian forest the constant annual yield is 65 cubic feet an acre, with a net revenue therefrom of $2.50 per acre. Saxony surpasses this with 430,000 acres whose yield is 95 cubic feet, and revenue $5.30. In the state forests of France the yield is 40 cubic feet; revenue $1.75.

Let us now turn to conditions and species which approach closely those in existence in our own Coast Timber Belt. The following data were gathered and tabulated by Thornton Munger, U. S. Forest Assistant, in the western foothills of the Cascades in Oregon and Washington, and were published in May, 1911. They were based upon even-aged stands of Douglas Fir in various stages of growth, upon 361 sample plots, aggregating 252 acres, on first class soils. They show in his own words, "that a piece of land cut over this year and properly managed, will yield 60 years from now 41,000 feet of saw-logs to the acre; 100 years hence it will have 79,800 feet; that is, 800 feet of lumber will grow on that acre every year. Expressed in cubic feet the yield is also surprisingly large. Between 40 and 60 years of age a stand of Douglas fir produces upon each acre annually 200 cubic feet of wood."

Now, assuming that no artificial re-afforestation can be undertaken, and that it is only worth our while to assist natural re-afforestation on three-quarters of the fifteen million, or 11,250,000 acres of our B. C. Forests; and that owing to inferior soil, poor location, and the growth of less desirable species giving a smaller yield, or finally through accident by fire, the annual yield per acre will be diminished by one-half of that above quoted, we obtain a constant annual production of four and a half million board-feet. Although that amount is over five times greater than the demand calls for at the present time, at the rate of 5% yearly increase, it would hardly suffice for the annual supply 40 years hence.

(3) The legitimate period of rotation which appears to be indicated from the above considerations, may be said to be in the neighborhood of 100 years. That would allow the felling of 112,500 acres a year, carrying a yield per acre of 40,000 b. f., or 4½ billion b. f. altogether. The actual period of rotation may prove in the end to be either greater or less than 100 years. If it should prove to be 120 years, the area available yearly would be 94,000 acres with a production of 4,747,000,000 feet; and if, on the other hand, the visible supply should be depleted in 80 years, the acreage available each year would rise to 140,000, yielding 4,200,000,000 feet.

Although there would not be so great a difference in the total annual yields for the two periods, as might be expected, owing to the compensating effect of the change in area available, it may be said that the longer rotation period would be the more advantageous, not only on account of the greater proportional production and higher stumpage value, and therefore increased revenue, but also because at 120 years there would be a greater percentage of clear lumber and a finer quality.

Again, it is hardly an exaggeration to say that the strictest economy in logging might conceivably lengthen the rotation period by at least ten years. The average yearly output for 100 years would be two billion feet. The waste is represented by 10% which is left in the woods, or 200 million feet a year, which for 100 years would be 20 billion feet, representing ten years supply.

The value of the crop in any particular decade must be based upon an assumption of the probable rate of increase in stumpage-values. Authorities differ widely on this question: some going as high as 25c a year. The assumption has been published by authority of the U. S. Forest Service that the value will have increased to $5.00 a thousand in 40 years time, and that thereafter the price will increase 50c every ten years. At this very conservative estimate we find that the gross value of our stumpage would be, at 80 years $213 an acre; at 100 years, $320; at 120 years, $454; or a gross revenue from the areas available for cutting of those years of 29 million, 36 million and 42 million dolars respectively.

Many difficulties will have to be overcome before a sound scheme of rotation-cutting can be established. For instance, 112,500 acres represents an area probably three times greater than

that now annually felled. How then shall 112,500 acres ripe for felling be obtained 100 years hence if only a small proportion of the 430,000 acres already denuded be found to be satisfactorily re-stocking? Again, only by continuous and patient investigation of young growth of known ages can the probable average increase in the growth per acre be determined with any certainty; and the dividing-up of the entire forest into a proper number of tracts carrying trees of the requisite ages will be an arduous and lengthy task for the forest service which is about to be established.

All that we can do now to prepare the way for the establishment of sound business methods such as these is to devote a proportion of the income derived from the forests at the present time to that purpose, together with whatever contribution may be drawn from owners of timber lands in part payment for protection from fire. The expenditure of this proportion of forest income has been strongly recommended by the Forestry Commission. The forest expenditure for the fiscal year 1909-1910 was 3-5c an acre, and for 1910-1911, 1 7-10c an acre. It may be noted that Saxony spends $3.00 an acre in the administration of her forests; France 95c and Austria 56c.

In the opinion of the present writer the Crown Forests are capable of supplying a constant annual yield as great as the total amount taken from them in the course of the last 30 years, and from six to eight times greater than the present yearly supply: and to devote to their conservation every cent that can be reasonably spared is absolutely essential for the future of the lumber industry and the prosperity of our Forest Province.

The appended table reveals the possibilities of yield and revenue for rotation-periods of from 50 to 120 years.

Possible Yield of Fir, Spruce, Cedar and Hemlock.
(One-half Munger's Estimate of Douglas Fir.)
Stumpage value calculated at $5.50 in 1902, increasing 50 cents per decade.

A. D.	*Rotation period years.*	*Rotation Acreage.*	*Board feet.*	*Value per acre.*	*Stumpage value per M.*	*Annual Rotation yield. Million of feet.*	*Total revenue from stumpage. Thousands of dollars.*
1962	50	225,000	14,000	77	5 50	3150	17325
1972	60	187,500	20,500	123	6 00	3742	23062
1982	70	160,700	25,800	167	6 50	4160	26837
1992	80	140,000	30,500	213	7 00	4200	29820
2002	90	125,000	35,000	262	7 50	4375	32750
2012	100	112,500	40,000	320	8 00	4450	36000
2022	110	102,000	45,000	382	8 50	4590	38964
2032	120	94,000	50,500	454	9 00	4747	42676

A CONFUSION OF TECHNICAL TERMS IN THE STUDY OF WOOD STRUCTURE.

By C. D. Mell.

The anatomical structure of wood is essentially a technical subject. The pivotal point in this study is the correct knowledge of the elements composing wood, and inseparable from this knowledge are the names of these elements. In other words, as the student is acquiring a definite notion of wood elements he ought to have a name that will be definite, approximate and above all constant. At the same time there should be a clear limitation or line of demarkation between certain elements that are sometimes difficult to distinguish, as, for instance, between wood fiber and tracheids, or between tracheids and vessels.

There are at present no text books dealing especially with this subject, though numerous authors have written extensively along lines relating to it. No two writers agree absolutely in terminology. The majority of investigators differ so widely that it constitutes a very serious hindrance to students. In the days of the early plant anatomists, Grew and Malpighi, who worked with very defective microscopes, there was an excuse for this widely differing nomenclature, for the reason that no two observers saw the same thing exactly alike. At present, however, the microscopes have reached such a degree of perfection that there should be no difficulty for all investigators to see the structure of elements exactly alike. Now is the time to remove the barriers that perplex the student, for the condition of nomenclature is such that it will greatly depreciate or even preclude effective work of beginners. A number of terms now used are obsolete, unscientific, and unnecessary. The student is obliged to devote much time learning what certain names mean. Of course, all names are more or less arbitrary, but any particular name should be associated with only one kind of wood elements. At present the student does not find, for example, that the term tracheae is constantly associated with elements having their abutting ends perforated, but also with elements known as tracheids having both ends closed. This confusion of names is true especially in the

writings of earlier authors, as above mentioned. When the student takes up another author he is obliged to spend a good deal of his time in learning the different names the author uses. Unfortunately writers on wood structure do not hold themselves bound to employ a recognized set of terms, but they feel themselves privileged to invent terms unfamiliar to a large body of readers.

One unfamiliar with the results of investigations published between the years 1800 and 1860 can not appreciate the hopeless confusion met with, and it is very difficult for a student to master all the terms used during that time. Any student, and particularly the young student, considers the name of an element he once learned to be a part of that element, and it is not until his mind is mature when he sees a certain structure exactly alike under three or more different names. Give a student the name trachea for a tracheid, which is what some writers are doing, he will naturally change his notion of one or both of these elements.

This chaotic condition of nomenclature was thought to be practically settled when Sanio in 1863 published his work entitled "Vergleichende Untersuchungen über die Elementarorgane des Holzkörpers." Although he had his opponents, the majority of writers and investigators followed him, and even to-day there are a number of investigators who do not propose to accept any other nomenclature and classification. Since 1863 a great many discoveries were made, and Sanio's terminology of necessity suffered changes to a certain extent, especially in as far as the general grouping of the elements is concerned. For example, the elements of the pith rays can not be classed with the wood-parenchyma fibers. The pith-ray cells are a slight modification of primary tissue, while wood-parenchyma fibers are elements that may be classed more appropriately with wood fibers and tracheids (wood prosenchyma). The following are lists of names used for the same elements:

Vessels.—Other names in use: tracheae, ducts, tubes, pores, fistulae, vasa, and wood-vessels.

Tracheids.—Other names in use: tracheae, fibrous elements, wood fibers, and vascular fibers.

Wood fibers.—Other names in use: libriform fibers or cells, fibrous cells, fibrous elements, xylem elements, woody fibers, prosenchyma fibers, and wood prosenchyma.

Wood-parenchyma fibers.—Other names in use: fiber cells, cell fibers, parenchymatous-wood cells, starch-containing cells, and parenchyma cells.

The above list of synonyms gives in part the various names of elements used at present in works dealing with wood structure, and from among these an investigator could select standard terms to be used in future publications on this subject. To work out and adopt such a terminology would probably wound the feelings of some few recent authors who have pet names for certain structures, but the aim should be to select terms most familiar to the majority of students of wood structure. It is important to avoid all useless technicalities, in order to render the subject matter as clear as possible. A number of authors would be willing to make a sacrifice of their favorite names when the general good of the subject requires it. There are numerous laymen interested in wood structure, and the less technical the terms are the more attention will be directed to the subject and a great many difficulties will disappear if a uniform terminology can be determined upon.

REPORT OF COMMITTEE ON FOREST FIRES, CANADIAN FORESTRY ASSOCIATION.

Your Committee on Forest Fire Laws, having collected with the aid of the Secretary all the existing forest fire legislation in Canada and most of the United States, as well as literature on the same, and having received expressions from competent persons as to the working of these laws and suggestions as to their improvements, begs to report as follows—

A. Existing Legislation.

We find that while every province and the Dominion has legislation to protect forests from fire, the laws vary greatly in detail and their efficiency probably varies as much. Briefly reviewing and comparing these laws we may make the following statements:

Nova Scotia. The law is designed primarily to protect private forest property which comprises the bulk of the forest area. It provides efficient machinery with appointed wardens in each county of the province to which it applies. It is based on the municipal organization, and secures the expense of the service in part by a pro rata assessment on the properties, except the salaries of chief rangers and of the provincial chief ranger, which are paid from the provincial treasury. This is probably the most efficient fire protection so far designed in Canada, fitting the conditions of the province, and needing only to be applied generally throughout the province and further to be elaborated.

New Brunswick. This law seems to make no distinction between private and public forest, although the latter comprises the larger part of the forest area. The machinery is indefinitely left to be provided by the Surveyor General, the law authorizing the employment of special officers, but limiting the expense to be paid for such service from the provincial treasury to $2,000.

Quebec. The law is primarily designed to protect the Crown domain. The declaration of certain territory as "fire district" and the organization of a service is left to the discretion of the Minister of Lands and Forests, except that the law provides the appointment in each established fire district of an inspector paid by the province, and for the purpose of the law all agents for the sale of Crown lands, all employees of the Department, all sworn land surveyors and all fire and wood rangers employed by the Department are *ex-officio* justices of the peace, authorized to impose penalties for the contravention of the law. In practice, the wardens are nominated and paid (in lieu of a fire tax formerly collected) by the limit holders, the government clothing

them with authority; and half of all labor in extinguishing fires on timber limits up to $2 per diem is paid by the province. In case railroads are involved each of the three parties pays one-third. A superintendent to direct the service and assistant superintendent are also instituted and paid by the province.

Some useful amendments to the law are suggested by the Superintendent, a member of this committee, providing for continuous patrol by fire rangers; for determining the number of rangers to be employed by the limit holders, and for the substitution of government rangers in case of failure to employ the proper number; for arrest of offenders, and for forcing assistance in extinguishing fires; for screening smoking cars and mill chimneys; for fixing responsibility of escaped fires on owner of land; for railway patrols; and for various minor objects.

Ontario. This law is primarily designed for the protection of Crown lands. This province was perhaps the first to recognize the necessity of machinery to carry out the law and of making limit holders in part responsible. As in Quebec, the declaration of fire districts, within which the law applies and the organization of a service of fire rangers not only licensed but also unlicensed territory, is in the discretion of the Minister of Lands, Forests and Mines, but the law differs from Quebec law in that it contains sections defining duties of fire rangers.

The appointment of rangers on licensed lands is primarily made at the request and upon the nomination of candidates by the limit holders, unless the Minister determines without such request the necessity for their employment. The appointment of these and other officers as justices of the peace is also forseen.

In Ontario, not only are half the wages of fire rangers paid by the limit holders, but also half the salaries of supervisors and inspectors. The same arrangements holds with railway construction enterprises, the railway paying half the expense of fire protection. There are also fire rangers appointed and fully paid by the province to range on forest reservations and unlicensed lands.

In the *Manitoba* law, the principle of municipal interest is definitely carried out, every rural municipal council being authorized to appoint fire guardians, and these may co-operate with the fire guardians of adjoining municipalities in carrying out the law; municipal councils make rules and regulations under the law and pay the bills. Here also the salutary provisions of penalties for neglect of duty on the part of fire guardians is met for the first time, and the liability of the municipality for damage, if not otherwise recoverable. Moreover, the provincial fire commissioner may under circumstances work into the organization.

In *Alberta* and *Saskatchewan* the provinces themselves, through the Commissioner of Agriculture, appoint and pay fire guardians or wardens with sheriff's power, and all members of

the North-West Mounted Police are *ex-officio* fire guardians. The details of the organization are, however, left obscure as well as the question of liability for damage or cost of fire fighting.

British Columbia. The law makes the declaration of fire districts a matter for an order in council. It makes it the duty of various officials to prosecute contraventions, besides that of a special officer or chief fire warden under the Chief Commissioner of Lands. Such an officer may be appointed and rules and regulations made by the Lieutenant Governor in Council. Divisional and district or assistant fire wardens, and the cost of fire fighting are also paid by the Province, although not mentioned in the Act.

For the *Dominion,* with the exception of the Railway Act, which prescribes requirements for preventive measures to be adopted, the protection of forest reserves and other timber lands is a matter of executive administration purely, and otherwise the laws of the province prevail.

All the laws have more or less specific regulations for prevention of fire from locomotives, but as it is doubtful how far such provincial laws apply to transcontinental or interprovincial railways, their effects cannot reach far.

In almost all the provinces the setting of fires is permitted under the futile injunction of caution; only in Nova Scotia, Manitoba, and British Columbia does the requirements exist of a permit from proper authority, at least for clearing fires.

In the five provinces (Nova Scotia, New Brunswick, Manitoba, Alberta and Saskatchewan) the fire guardians can call out any able-bodied citizen for assistance.

The principle of placing the burden of disproof as to responsibility for a fire upon the accused is adopted, at least in part, in Nova Scotia, New Brunswick, British Columbia, Alberta and Saskatchewan.

B. Generalities.

1. It is evident from the experience of the past that legislation is ineffective unless a thorough organization for the carrying out of the law exists. Moreover, it should be realized that no half-hearted or partial measures but only a supreme effort which includes a change of attitude on the part of the people at large will ever stop the fire evil. Hence, besides legislation and enforcement of law, special means for popular education are needed.

2. It must be realized that the same methods which are efficient in one section are not necessarily applicable and efficient in other sections with different conditions. Hence, a general forest fire law with details cannot be formulated. The excellent results of the forest fire service of Nova Scotia are possible only because the country is settled in all parts and the woodlands mostly in possession of small resident owners, who have a personal interest in their protection. In unsettled parts of the country, in the

backwoods of Quebec and Ontario, this system would not work.

3. It is, therefore, apparent that different laws and organizations even for different parts of the same province may be desirable, or else a law which divides the province into fire districts and leaves latitude to executive officers to devise methods applicable in the different districts. Altogether, it is wisdom to make laws as little as possible specific in prescriptions, but place authority in competent hands to frame rules for the execution of the law, which may be changed as circumstances suggest.

4. Preventive measures, including the rapid discovery and extinction of incipient fires, are the most needful; legislation and organization to prevent or reduce the chances of fires are of more moment than the threat of punishment and attempts at extinguishing fires after they have spread. All provinces have laws designed to deter incendiarism, but in the majority of cases the legislation is negative rather than positive, permissive rather than mandatory. In view of the gravity of the situation and of the careless attitude of the public more restrictive and special educative measures are needed.

5. Three different agencies are mainly responsible for forest fires, and must be provided for separately, railroads, settlers, and other persons coming into the woods for various purposes. The first two are readily found out and made responsible; special means are necessary to find out and make responsible the casual visitors.

C. Railroad Legislation.

An exhaustive report by the Public Service Commission of the state of New York made in 1909, discussing in great detail, supported by expert testimony, the possibilities of preventing fires from locomotives, which seem to be responsible for somewhat less than 40% of forest fires in the Adirondacks forms an excellent basis for discussion of this problem. The report declares: "The remedies proposed by the railroad companies which include improvements in coal burning locomotives, cleaning right of way, patroling, telephone system, fire trains, are inadequate, because:

"First, the improvements in coal burning locomotives are not sufficiently radical to meet the conditions;

"Second, the remedies proposed are complex, involving continuous and effective supervision, and past experience has shown that such supervision may not be efficiently exercised when most needed;

"Third, the legal restriction mentioned (in cleaning right of way, peculiar to New York) handicaps the railroads in the effective application of their remedies."

The Commission orders the installation of oil-burning locomotives during the day time, while the dangerous season lasts, it having been shown that no fires start at night.

While your Committee recommends the study of this report in detail for its careful analysis of the causes of fires originating from locomotives and for its valuable suggestions, it does not go so far as to suggest the necessity of such radical change in fuel, especially as it was declared by experts that safe coal-burning locomotives can be constructed, although difficult to keep in safe condition. Possibly, however, the use of oil-burning engines might in the end prove as cheap, or cheaper, than other modes of preventing fires from locomotives. No legal restriction in burning of right of way existing in Canada, it would appear that the methods suggested by the railroads themselves, if properly carried out, would answer.

The improvement of locomotives to prevent sparks from stack and ashpan escaping is fully discussed in the report by two locomotive experts, and it is stated that, without loss of draft, screens can be used if properly constructed and placed, but that no absolute safety may be expected except by unusual care in fitting and keeping in order on the part of the round-house crew. It would appear from discussion that the stereotyped prescription of several Canadian laws as to the use of a certain mesh screen is not justified, since other matters like the character of coal, the position of exhaust nozzles, etc., must be related to the screen. The necessity of frequent inspection of locomotives by an *expert,* or at least a thoroughly instructed fire ranger not only as to screens, but also as to ash boxes and other conditions was accentuated by locomotive experts. The proper construction of ash boxes is as important as the screens since it is declared that 50 per cent. of locomotive fires are due to the faulty construction and use of these. Finally firemen and engineers must be willing to use their tools properly and keep them effective.

As to clearing the right of way, the evidence brought out that fully 90 per cent. of fires start within fifty feet on each side of the right of way; hence, hardly any greater width need be cleared. It is, in the opinion of your Committee, a mistake to clear a broad fire strip along the right of way. Such a strip, even if cleared as well as is practicable, is dangerous in two directions besides being unnecessarily expensive; it dries out under the influence of the sun and wind and if between tall timber creates a draft which will fan any incipient fire rapidly into action. Instead, a strip of fifty feet outside the right of way and under forest shade from which the easily inflammable material is removed would serve a better purpose. This proposition advanced some years ago by the Chairman of this Committee was generally accepted by the experts as a most efficacious measure. The cost, it was estimated, would be in the neighborhood of $250 per mile for the first cleaning. In Pennsylvania it has been done for $180 per mile. It is open to question whether the cleaning of this part should not be

made the duty of the forest owner rather than of the railroad company. The location of drain ditches on the outer side of the right of way instead of as is usual near the track would in many cases help to prevent the spread of fires.

The only effective way in cleaning right of way is by burning it over, which is dangerous and should be done as soon as the snow leaves, but most probably be repeated when the chances of the fire spreading are greater. To make this operation easier, the cleared strip should be sodded, when the grass could readily be cut and burnt. That the local fire warden, if any, should have supervision of this burning goes without saying.

The most important precaution is the fire patrol, when properly organized. Since only during the hours of 9 a. m. to 5 p. m. is there danger of fires spreading, and since rainy days reduce the time, the hours would be short, and by proper organization the cost of such patrol can be reduced to a minimum, the patrolman to be also employed otherwise. If all the other precautions are taken two men with a gasoline car equipped with a fire extinguisher, following every train, say, within 15 minutes, could ordinarily probably protect five miles of right of way and attend to other track work besides. This patrol as to time of the year during which it is to be maintained should be made under orders of the officer in charge of the fire service. In the absence of such patrol by the company the Forest Fire Service should have the right to do the patroling at the expense of the company. It should also be a requirement that the railroads are to transport, free of charge, men needed in extinguishing fires along the line. The requirements of the New Brunswick law that the railway company shall keep section men to watch and extinguish all fires, and that these men shall pass over the road at least once a day is one of the loose requirements which is insufficient in time of actual danger and needless in rainy days and seasons.

Other minor precautions might be suggested like the screening of smoking cars or compartments, the placing of barrels of water on steep grades, where sparks are apt to be emitted under forced draft, etc. A valuable suggestion is that specially dangerous places along the road be so marked by signs, and that special attention be bestowed on them by the men in charge.

The legal prescriptions regarding the placing of responsibility upon the companies and their agents are well taken care of in the legislation proposed by the Commission of Conservation. It should also be compulsory for all train crews to report fires at the first stop at a telegraph station and the operator to report same to the proper officer.

The provision advanced by the Commission of Conservation to make railways liable to a fine of one thousand dollars for every fire set and placing the burden of disproof on the railway com-

pany is endorsed by this committee. It should, however, be pointed out that the existing legislation which limits liability for damage on the part of the railway company to $5,000, unless neglect is proved by the damaged party, may work hardship.

Your Committee would suggest that besides penalties provided against neglect by the employees the co-operation of these men could undoubtedly be secured by proper education and premiums for immunity from fire damage.

In justice to the railway companies it should be stated that of late they have waked up to their responsibility and are attempting to improve fire protection, as may appear from the following extracts of the instructions issued last summer by one of them to their employees, which will at the same time show some of the practical needs of preventive measures.

"Ash pans must be equipped with nettings. Nettings and plates in front end must be examined throughout the entire year at intervals not exceeding one week. Engines must not be allowed to leave terminal unless nettings and plates are in proper condition. Ash pans and dampers must be examined throughout the entire year on every engine entering their home....or on branch lines or work train service on every trip. Men appointed to make inspection of nettings and dampers——must sign for each engine inspected. This form to be initiated by locomotive foremen to prove that they have supervised the work."

D. Legislation Regarding Settlers.

The case with the settler is comparatively simple, since he is definitely located, although carelessness in handling fires when burning brush and clearing has been the cause of many most destructive fires. Here, an educational campaign ought to do much. The province of Quebec is to be congratulated in having the assistance of the clergy in this campaign of education, the bishops authorizing the reading of letters of caution from the pulpits.

All laws contain sections prescribing a closed season when fires may not be set. Such close seasons are at present given in the laws by definite dates. This is not good practice as the danger ceases or commences within the same province at different dates and in the different years also, which can be however, more or less predetermined. Discretion on the part of the Forest Fire Service in fixing these dates variably is desirable. Some (Nova Scotia, Manitoba and British Columbia) but not all require that a permit to set fires at other times be obtained from an officer in charge, and some require that notice of the intention to burn brush be given to neighbors to keep them on the alert or posted at the nearest schoolhouse seven days beforehand. Both these latter requirements seem desirable. The only objection appears to be

that communication with the officials is not always easy for the distant colonists. This could be overcome by having special patrols at the proper season make a circuit of the district to afford the opportunity of making the necessary arrangements for permits. This requirement, to be sure, is mainly of educational value accentuating the feeling of responsibility.

E. Legislation Regarding Other Persons.

The most difficult, and at the same time the most dangerous class of persons responsible for forest fires are the many different people who visit the woods for business or pleasure, or who are merely passing through. The laws make distinction of railways and settlers, but this third class remains, as a rule undifferentiated. It would appear that at least three classes may be made, namely those who are in the woods for business connected with the woods, loggers and the like; those who are engaged in business other than connected with the woods, such as prospectors and miners; and lastly visitors of various descriptions, hunters, campers, etc. It would appear that the first two classes should and could be dealt with separately, for they are, as a rule, definitely located, although for a shorter time than railroads and settlers.

Is there any reason why the lumber company should stand on a different footing towards the community at large as regards responsibility for forest fires, than the railroad company? Is the logger or the miner or prospector in any different condition than the settler excepting perhaps permanency of location? The conditions and needs of these two classes are known and, therefore, definite prescription is as possible as for the railroad company and the settler. It is our opinion that the lumberman have been in the past, and are still, indirectly at least, the greatest cause for destructive conflagrations, simply because of the debris which has been left after their operations. It is tolerably certain that without the debries and the opening up to the sun and wind of large areas the virgin woods would usually be without extensive fires. Just as the railway company is to be forced to reduce the danger from fire, since fire is one of its tools, so for the opposite reason the logger should be forced to reduce the danger from fire, because he creates the condition for its most destructive force.

It is needful to accentuate that the worst damage to the country at large does not come from the burning of the timber—which can usually be utilized—, but from the burning of slash which consumes not only the young growth and seed trees, but often the soil itself, leaving it barren and useless forever.

There are two methods of reducing the danger from slash in logging operations, namely, systematically burning it while the logging is going on, and 'downing' tops and branches so that they

may lie close to the ground and rapidly decay. Both methods have been tried and found practicable and not too expensive. Brush burning has been applied in Minnesota with success in the pineries. Lopping of tops has been employed in spruce forests, under law, in the Adirondacks with entire satisfaction.

The cost of brush burning can under favorable conditions be kept within 25 cents per M. feet; the cost of downing tops is from 10 to 15 cents per cord of pulpwood in ordinary conditions, and often the cost is balanced by the easier skidding and gain in wood. In some places the one, in other places the other method is preferable, and there may be places where neither can be entirely, or only partially applied. Hence, any legislation requiring the reduction of debries must not be specific but leave discretion to the officials as to how the object is to be obtained in each case. When these precautions are taken the government can well afford to furnish fire protection even without charge to the limit holder.

It must not be forgotten that the timber limit holder is not the owner of the forest property, and cannot therefore be expected to take much interest in the future, and fire protection in these slashes is a provision for the future. Heavy penalties for fires set by employees of lumber companies should be levied on the employers. At least a limited liability should be established for such fires.

In order to hold miners, prospectors and, indeed, all others in proper check, it should be required that *everybody* who sets a fire in the woods be provided with a permit from a proper officer, such permits to be for stated periods and renewable only to those who have not offended, even though refusal to others might appear harsh. In fact it may be justifiable to demand such a permit for the mere entering of any woods.

There is no reason why at least, prospectors should not be placed under obligation of obtaining a permit for entering the woods for this purpose whereby a check on their presence is established. They may also properly be required to take under the direction of the Forest Fire Service precautions to prevent any fires from originating on their claims. The throwing or dropping of burning matches, ashes from a pipe, lighted cigar, or any other burning substances, or discharge of firearms with wads during the close season without extinguishing any such burning material should be forbidden.

F. Legal Points.

On the legal side some new principles should be established by statute regarding prosecutions, fines, penalties, and damages.

1. The burden of disproof of responsibility for the origin of a forest fire should be placed upon the defendant, be it corporation or individual.

2. Forest Fire Service officers should have not only power to arrest without warrant, but to prosecute and secure convictions in a summary manner before any justice of the peace. This not only when a person has actually committed, but when there is a reasonable suspicion that he has committed or is about to commit an offense against the fire laws.

3. Fire rangers should have authority to trespass in case of necessity, to build back fires, and place guards to prevent the breaking out again of fires that have been extinguished.

4. Fire rangers should have power to command witnesses with a view of finding out cause, origin and nature of fire and the damages.

5. In the estimation of damages the cost of reforestation should be included.

G. Organization.

There is no hope of any adequate result of legislation unless sufficient and efficient machinery and organization exists to apply it. With the attitude of the people as it is, a supreme effort in the beginning will be necessary to change that attitude; then, when better habits have been inculcated the machinery may be considerably reduced.

Such organization must be of a central, permanent and fixed character, as only the government can institute, but it may act very well in co-operation with municipalities, local boards, timber limit holders, private woodland owners, or associations with similar interests. Where the government is the largest owner and has therefore the largest interest, it should naturally take the lead; but even where this is not the case, the broad scope of governmental interest, and the economy which comes from patrolling, irrespective of ownership, makes a provincial organization preferable. Yet that even private owners or timberlimit hoders alone could cheaply and efficiently protect their own holdings is shown by the Forest Fire Associations in the United States, of which there are ten in the West.

The Washington State Forest Fire Association is one in which owners of from twenty acres up to hundreds of thousands of acres are clubbing together and assessing themselves by acreage for co-operative fire patrol. A chief fire warden is at the head of the organization. The territory is divided into districts, each having its local patrolmen. Eight to twelve districts are formed into a group, with an inspector for each, whose duty it is to travel through the districts in his group, supervise the patrolmen, employ additional ones where necessary, and in general keep the machinery moving. The state merely clothes the officials of the association with authority and places, as in Idaho, its own holdings under the system. With such an organization, in 1909, the driest season in Washington State for 41 years (except perhaps

last year), the owners of three million acres lost only 1,600 acres or 1-20 of one per cent. Of over 1,100 fires extinguished only 200 were of sufficient size to permit of description, all others being put out in their incipiency.

In the Idaho Association there is spent for patrol alone only 1½ cents per acre, but as this association extensively builds trails and installs telephones the assessment reaches up to 2 to 5 cents per acre. The Cœur d'Alene Timber Protective Association with 1,200,000 acres, at 2 cents an acre lost only $40,000. The Potlach Association spent 4½ cents per acre for patrol, purchase of tools and making trails. The United States Forest Service in District I, the Northern Rockies, which lost so heavily in 1910 spent less than ½ cent on thirty million acres, losing $40,000 worth of timber. All these lands are located in difficult territory, and for several years this system has given satisfaction, except during the unusual drought of last summer.

In the disastrous season of 1910 the association staved off serious trouble for two months by special effort, but in August, due to indifference and lack of protection of intervening properties,—accentuating the need of state-wide co-operation—the system broke down. Yet the report of the secretary of the united associations is, first, that the 'losses were few and insignificant when the area involved is considered; second, that had it not been for the timber owners' effort the contrary would have been true. The really bad fires can be counted on the fingers, while those extinguished number by thousands.'

The *essentials* of a proper organization are:—

1. A proper head, an officer with experience and with well defined powers and duties, but with large discretionary powers, who shall devote himself to this interest alone.

2. A proper personnel carefully chosen—not necessarily nominated by limit holders—of permanent, paid rangers with constables' power and the right to arrest without warrant any one suspected of having contravened the law, who during the off season can work in preparing for the dangerous season. The success of the organization depends on the character of these men.

3. Additional paid patrolmen during the dangerous season, a variable number according to needs, and obligation on every citizen to aid under penalty when called upon, in extinguishing fires;

4. Responsibility properly divided, enforced by penalties, and inspectors, active in looking after the rangers, and concerned in educating the people and improving the service;

5. Districting the country with a view of collocating similar conditions in such units as a patrolman can readily oversee, or an inspector inspect, and making these officers responsible for the safety of their unit;

6. Early discovery of an incipient fire is essential; hence there

should be watch towers or lookout stations, properly distributed. Such watch towers fully equipped cost, with shelter house, between $300 and $500; one every 20 miles even would save its cost the first year by reducing the number of wardens necessary.

7. Rapidity of getting to a fire is essential, hence building of trails to make districts accessible and connecting watch towers by telephone lines, which can be built and equipped for $25 to $50 per mile.

8. Ample funds by special taxes to organize, equip and keep up the service and enforce the law.

The main requirement is the head man who, if a capable organizer, would work out the detail fit for each condition, and, if left to act with authority and considerable latitude, would soon have the whole community assisting his efforts.

Your committee believes that the country is ready for this supreme effort to get rid of the fire evil and thereby to make the beginnings of forestry, a rational management of forest lands, possible.

The Committee:

B. E. Fernow, *Chairman,*
Thomas Southworth,
Judson F. Clark,
G. C. Piche,
W. C. J. Hall,
Frank Davison,
Ellwood Wilson.

CANADIAN VOLUME TABLES.

By Ellwood Wilson.

Forestry Division, Laurentide Paper Company.

The measurements on which the following volume tables were based were made thruout the Valley of the St. Maurice River in the Province of Quebec between latitude 46° 30′ and 48°, and west longitude 74° 30′ and 76°, during the winter of 1910-11.

The sawyers were followed and as soon as a tree was felled and sawed up into logs it was measured as follows:—height of stump, diameter inside and outside the bark on the stump, at each thirteen and one-half feet cut, and total length of top. Diameters were measured to nearest millimeter, heights of stumps to nearest centimeter and lengths of tops to nearest decimeter. Metric measures were used as being easier to make and as facilitating calculations. Diameter breast high, outside bark was also measured and the trees arranged in inch classes according to breast height diameter, $\frac{3}{4}$ inch to $\frac{3}{4}$ inch representing whole inch class, i. e. trees having diameters between $6\frac{3}{4}$ and $7\frac{3}{4}$ inches were put into the seven inch class.

For the board feet tables, the number of board feet corresponding to the diameter inside the bark at the small end of each log was taken from the official Quebec table and volumes of logs added to get volume of tree.

The volume in cubic metres was calculated for each tree by the following formula:

$$\text{vol.} = l(a+2b+2c+d)\tfrac{1}{2}$$

in which a=basal area on stump, b=basal area at first cut, c=basal area at second cut, and d=basal area at third cut, and l=length of log.

To facilitate calculations, which were all done by machine, a table was prepared giving the basal area corresponding to each millimeter in diameter, multiplied by half the log length. Cubic metres corresponding to the diameters could thus be taken direct from the field sheets and added on the machine.

All the values for each inch class were then added together

and divided by the total number of trees in that class. These average volumes were then plotted and curves drawn from which the values given in the tables were taken. Total heights were averaged and plotted in the same way and final values taken from the curves.

These tables give merchantable lengths according to local practice, merchantable volumes and total heights corresponding; average volumes and average heights corresponding to diameters breast high.

I am indebted to Mr. E. H. Roberts for field measurements and help in the calculations and to Mr. R. H. Stephenson for some of the computations.

"Height of Trees in feet" means that no tree whose volume is given under the figures had a total height from ground to tip of over the larger or under the smaller figure in the heading.

"Merchantable Length (feet)" means that no tree had a merchantable length more or less than number of feet in heading.

The Quebec log rule for small sizes as here involved is almost identical with the Scribner rule; if anything a little more favorable.

WHITE SPRUCE, *Picea Canadensis.*

St. Maurice Valley, Quebec.

Volume in Cubic Feet, Merchantable, without Bark.

Average Stump Height 25"; Diameter of Top inside Bark 4".
¾" to ¾"=1" class.

	Total Height of Trees (Feet)								
	51-61	60-66	71-80	82-91	95-100	97			
	Merchantable Length (Feet)								
D. B. H. Inches	27	40.5	54	67.5	81	94.5	Aver. Cu. Ft.	Aver. Height	Basis Trees
7	5.65	9.89					6.00	53.3	6
8	7.42	10.59					9.08	62.5	18
9	9.53	12.54	15.18				12.54	65.8	25
10		15.18	18.72				16.39	67.5	47
11		17.52	22.25	23.66			20.48	69.5	72
12		19.60	25.96	29.84			24.65	71.3	76
13		22.53	28.78	34.96			28.46	73.6	43
14		26.31	31.85	39.55			33.20	75.8	43
15		31.43	36.44	43.82			39.02	76.5	30
16		39.02	40.86	49.44			44.85	76.6	25
17		48.38	44.85	53.96			50.96	77.5	19
18			49.09	59.61	69.75		57.21	78.5	18
19			54.74	66.92	77.55		63.92	79.5	7
20				73.28	85.46		73.28	90.6	4
21					93.41		89.52	96.0	2
22					101.10		102.76	100.0	2
23					108.94		111.77	100.0	1
24					116.54	119.01	115.05	99.0	1
25					124.69		117.84	97.0	2

WHITE SPRUCE, *Picea Canadensis.*

St. Maurice Valley, Quebec.

Volume in Board Feet by the Quebec Rule.

Average Stump Height 25″; Diameter of Top inside Bark 4″.

Total Height of Trees (Feet)	51-61	60-66	71-80	82-91	95-100	97			
Merchantable Length (Feet)									
D. B. H. Inches	27	40.5	54	67.5	81	94.5	Aver. Bd. Ft.	Aver. Height	Basis Trees
7	19	38					21	53.3	6
8	24	38					32	62.5	18
9	32	44	53				45	65.8	25
10		55	69				60	67.5	47
11		65	86	97			78	69.5	72
12		76	105	131			99	71.3	76
13		90	120	154			120	73.6	43
14		111	136	171			142	75.8	43
15		132	153	191			170	76.5	30
16			173	221			200	76.6	25
17			195	245			230	77.5	19
18			208	270			258	78.5	18
19			217	309			287	79.5	7
20				353			325	90.6	4
21					470		414	96.0	2
22					511		495	100.0	2
23					596		610	100.0	1
24					643		643	99.0	1
25						666	666	97.0	2

BLACK SPRUCE, *Picea Mariana.*

St. Maurice Valley, Quebec.

Volume in Cube Feet.

Average Stump Height 26″; Diameter of Top inside Bark 4″.

Total Height of Trees (Feet)	46-47	55-60	64-68	76-78	81-89			
Merchantable Length (Feet)								
D. B. H. Inches	13.5	27	40.5	54	67.5	Aver. Cu. Ft.	Aver. Height	Basis Trees
7	3.53	5.58	8.23			5.76	57	46
8	4.84	6.96	9.64			8.23	60	61
9		8.26	11.26			10.81	63	71
10		9.22	13.42	18.05		13.60	66	52
11			16.07	20.31		17.13	69	40
12			18.89	23.45		21.36	72	14
13			21.26	26.66		25.36	75	16
14				29.77		29.13	77	10
15				33.80		33.55	78	4
16				39.16	40.36	37.79	81	2
17				41.92		41.14	81	
18				43.51		43.51	81	1
19						45.77		
20						48.10		

BLACK SPRUCE, *Picea Mariana.*

St. Maurice Valley, Quebec.

Volume in Board Feet by the Quebec Rule.

Average Stump Height 26"; Diameter of Top inside Bark 4".

Total Height of Trees (Feet)

46-47 55-60 64-68 76-78 81-89

Merchantable Length (Feet)

D. B. H.	13.5	27	40.5	54	67.5	81	94.5	Aver. Bd. Ft.	Aver. Height	Basis Trees
6	9	15						14	54	7
7	12	19	29					20	57	46
8	19	24	35					29	60	61
9		29	42					39	63	71
10		34	50	72				51	66	52
11		36	60	82				65	69	40
12			70	95				83	72	14
13			82	108				102	75	16
14				128				121	77	10
15				158				145	78	4
16				213		171		171	81	2
17				192				192	81	1
18				208				208	81	1
19								225		
20								242		

SPRUCE—*Picea Canadensis & Mariana.*

St. Maurice Valley, Quebec.

Volume in Board Feet by the Quebec Rule.

Average Stump Height 26"; Diameter of Top inside Bark 4".

Total Height of Trees (Feet)

44-47, 52-56, 59-65, 68-78, 83-88, 96-100, 112

Merchantable Length (Feet)

Inches								Bd. Ft.	Height	Trees
6	6	15						11	54	9
D. B. H.	13.5	27	40.5	54	67.5	81	94.5	Aver.	Aver.	Basis
7	9	19	27					21	55	82
8	18	23	34	44				30	57	161
9		28	42	56				39	59	208
10		34	55	71				55	63	187
11		40	68	88	101			76	67	189
12			80	104	132			94	70	161
13			92	118	154			112	72	
14			110	132	172			138	75	99
15			130	149	197			164	79	91
16				169	227			190	83	47
17				193	251	294		225	87	47
18				211	278	331		256	86	36
19				226	309	372		280	85	16
20					340	413		324	90	10
21						470		414	96	2
22						511		495	100	2
23						596		610	100	1
24						643		643	99	1
25							666	666	97	2

BALSAM—*Abies balsamea*

St. Maurice Valley, Quebec.

Volume in Cubic Feet.

Average Stump Height, 23″; Diameter of Top Inside Bark, 4″.

Total Height of Trees (Feet)

56-63, 63-67, 74-83, 89-91

Merchantable Length (Feet)

D. B. H. Inches	27	40.5	54	67.5	Aver. Cu. Ft.	Aver. Height	Basis Trees
7	6.00	8.47			6.71	58	140
8	7.42	10.24	13.42		9.53	60	390
9	8.47	12.36	15.89		12.01	63	537
10	9.89	14.12	18.72		14.48	66	350
11	10.59	16.60	21.54		18.01	68	208
12	11.65	18.36	24.72		21.54	70	108
13		20.83	27.90	28.96	25.78	73	58
14		22.60	31.08	41.32	31.08	76	63
15		24.72	34.96	48.30	34.61	79	19
16			37.08	50.50	39.90	83	1
17			40.96	52.62	44.50		3
19			44.14		48.38		1

BALSAM—*Abies balsamea*

St. Maurice Valley, Quebec.

Volume in Board Feet by the Quebec Rule.

Average Stump Height, 23″; Diameter of Top Inside Bark, 4″.

Total Height of Trees (Feet)

39-52 56-63 63-67 73-83 89-91

Merchantable Length (Feet)

D. B. H. Inches	13.5	27	40.5	54	67.5	Aver. Bd. Ft.	Aver. Height	Basis Trees
6	9	12				12	49	15
7	11	20	29			23	60	139
8	13	26	37	50		33	63	347
9	15	29	46	62		44	66	541
10		34	57	75		57	68	355
11		51	67	90		73	70	213
12		85	75	106		91	73	108
13			84	123	147	112	76	59
14			95	137	175	133	79	65
15			107	154	203	159	83	19
16				172	233	189	83	1
17				189	262	211	82	3
18				206		222		1
19						232		
20						244		
21						255		
22						266		

WHITE PINE—*Pinus Strobus*

St. Maurice Valley, Quebec.

Volume in Board Feet, Quebec Rule.

Average Stump Height, 32"; Diameter of Top Inside Bark, 8".

	Total Height of Trees (Feet)						
	60	62-86	71-100	96-100			
	Merchantable Length (Feet)						
D. B. H. Inches	27	40.5	54	67.5	Aver. Bd. Ft.	Aver. Height	Basis Trees
10					54		
11					69		
12	56	99			84	76.5	3
13		104			106	70.7	4
14		112	163		130	69.2	3
15		131	193		160	71.3	2
16		159	221		192	69.7	2
17		204	242		224	77.0	6
18		276	252		250	81.8	1
19		353	272	293	284	90.7	3
20		433	330	336	342	91.1	8
21			381	388	384		0
22			411	444	411	95.3	3
23			438		438	93.4	2
24			479		479		0
25			520		520		0
26			562		562	99.4	1
27					603		

CURRENT LITERATURE.

Phytogeographic Survey of North America. By John W. Harshberger. Leipzig and New York. 1911. Pp. 790, plates 18, figures 32, map 1.

The book with the above title is Volume 13 of *Die Vegetation der Erde* series of Engler and Drude. The contents of the volume are divided into four parts. Part first: History and Literature of the Botanic Work and Explorations of the North American Continent. Part second: Geographic, Climatic and Floristic Survey. Part third: Geologic Evolution, Theoretic Considerations and Statistics of the Distribution of North American Plants. Part fourth: North American Phytogeographic Regions, Formations, Associations.

The geographical, historical and theoretical considerations, exclusive of the very complete index, occupy approximately one-half of the volume. From these one might select some interesting speculations. For example, there were three great waves of vegetation after the retreat of the ice sheet, being in order of progress, the peat bog, the tundra and the coniferous forest. The northern extension of the conifers in the West was much slower in point of time than in the East, because of the longer continuance of local glaciation. That is to say, the boreal climate persisted so much longer in the West that the coniferous forest had time thoroughly to establish itself over the whole region before the present climatic conditions obtained. Once established it held the ground by mere pre-emption.

The author describes the probable advance of the members of the Atlantic Forest from their post-glacial centre of distribution in the Southern Alleghanies. His order of northern extension, however, does not correspond with the northern limits of the same species as given in Sargent's "Manual," or in the publications of Canadian botanists. He believes that the Bald Cypress, Longleaf Pine and the Loblolly Pine came down from the hills to the westward and occupied the Costal Plain.

The treelessness of the prairies is due, according to the author, to the previous pre-emption of the soil by the matted grasses, and

to the natural compactness of the prevailing loess. It would seem that Schimper, and other foreign botanists, had a clearer conception of the conditions in the treeless region for they perceived the floristic and ecological differentiation of the great plains and the prairies which the present author has failed to do, since he uses the two terms interchangeably.

It is, however, by the phytogeographical discussions that the value of the present volume will be judged. The author states that the classification of the North American continent into zones and sections is to demark geographical locations, while the regions, districts, areas and formations differentiate natural phytogeographical entities. With this statement clearly in mind, let us proceed to analyse Harshberger's conception of such distributional groups of vegetation.

The subarctic forest region of North Canada and Alaska is subdivided into the Labrador District, the Hudson Bay-Keewatin District, the McKenzie District and the Alaska District. With the exception of the last, where *Pinus murrayana* is substituted for *P. banksiana,* and *Abies lasiocarpa* for *A. balsamea,* these divisions seem to be merely geographical, at least so far as the forest trees are concerned, and the differences in the other vegetation are not made clear in the text. The Atlantic section of the north temperate zone is divided into three regions, namely: the St. Lawrence-Great Lakes Region; the Atlantic-Gulf Coast Region and the Piedmont-Appalachian-Ozark Plateau-Mountain Region. The St. Lawrence-Great Lakes Region is further subdivided into the Maritime District and the Lake District. Practically the whole of New England and that portion of Canada south of the subarctic forest and east of the Ottawa River are included under the "Maritime District," while the region west to the prairies is comprehended in the Lake District. By this arrangement the forests of the Adirondacks and of the Green Mountains, practically identical in their composition, are placed in different phytogeographical entities. Surely this must be merely a geographic division.

The New Brunswick Area, a subdivision of the Maritime District, is made to include: "The northern portions of Maine, New Hampshire, and Vermont (including their mountain ranges), its southern boundary being determined by the southern limit of *Pinus banksiana, Picea alba,* as well as the northern limit of the

tulip poplar, *Liriodendron tulipifera*" (p. 361). The southern limit of *Pinus banksiana* in Maine is Penobscot Bay and that of *Picea alba*, Casco Bay, points that can be located in "The northern portion of Maine" only by one woefully careless in his statements. If the sentence quoted above be taken literally, the northern limits of *Liriodendron* should be found in the *northern* portions of the three states mentioned. According to Sargent's, and other tree manuals, the northern limits of the Tulip, in England, may be approximately determined by drawing a line from the northeast corner of Rhode Island to the southwest corner of Vermont. If this were the southern limit of the New Brunswick Area, then the forests of White Oak, Black Oak, Chestnut and the hickories of southeastern Vermont and eastern Massachusetts would be placed in the same phytogeographical entity with those of New Brunswick where none of these species occur! If the southern limit of the Banksian Pine were the boundary, then the greater portion of the Green Mountains and the White Mountains would be excluded from the New Brunswick Area, a thing which the author did not do, as shown by the parenthesis, "including their mountain ranges" in the first sentence of this paragraph.

If, as Harshberger states, the forests of New Brunswick and Nova Scotia are identical, he may give an erroneous impression of both, but he surely does for those of Nova Scotia (p. 362). The mixed forest is the prevailing type, but Sugar Maple and Paper Birch are not the dominant members. Taking the Province as a whole, the Beech is more prevalent than the Sugar Maple and the Yellow Birch is more abundant than the Paper Birch. And, moreover, the conifers (Red Spruce, Balsam and Hemlock) and not the hardwoods are the dominant members of the mixed type. The author must have been only looking at the peat bogs and their low separating sandy ridges when he got the idea that Black Spruce, White Pine and Larch were the controlling members of the forest in Minas Basin (p. 364). The only place specifically mentioned in Minas Basin is Grand Pré, and this is unfortunate from the standpoint of forest description for, as the name suggests, the place is a prairie. The forests in sight, however, on the tops of the adjacent mountain ranges, are of the mixed type with Red Spruce and Balsam predominating. The description of other places mentioned in Nova Scotia are nearly as far from

the mark. In order to get a correct impression of the Nova Scotia forests, one must get away from the main routes of travel.

In discussing the formation of Mt. Washington, the author makes this statement: "South of the northern forest mentioned, the flora belongs to the New England Area, but it may be stated here that some of the southern species like the White Oak, *Quercus alba,* and the Red Oak, *Quercus rubra,* here reached their northern limits and mingled with those more characteristic of the north" (p. 374). It is to be hoped that he had in mind only the state of New Hampshire for then the statement will not be in such glaring contradiction to the well-known facts that the White Oak extends as far north as the city of Quebec, and that the Red Oak reaches the Hudson Bay watershed in Ontario and Lake St. John in Quebec. The statement in regard to the White Oak, however, is repeated further along in the text. (See the next paragraph.)

The phytogeographic conception of the New England Area, the second subdivision of the Maritime District, is as confused as that of the New Brunswick Area for the author says: "The flora of this area is characterized by the absence of *Picea alba,* etc." In the very next paragraph, however, he gives the White Spruce as one of the characteristic species of his first subdivision of the Area, namely, Sea Island (coast of Maine). To quote further: "But its (New England Area) chief characterization depends on the presence of such trees as *Quercus alba, Q. prinoides, Q. coccinea, Juniperus virginiana* and *Castanea dentata,* which here reached their northern limit," etc. (p. 378.) For the northern limit of *Quercus alba,* see the paragraph above. *Q. prinoides* never becomes a tree in New England and is unknown in Maine. *Quercus coccinea* and *Castanea dentata* are found only in the southeastern part of Maine, yet according to the author's delimitation of the New Brunswick Area (p. 361), nearly the whole of the state is included in the New England Area.

The Lake District of the St. Lawrence-Great Lakes Region is subdivided into the Lacustrine Area and the Adirondack Area. As stated above, the Maritime District is defined as extending westward to Lake Champlain and the Ottawa River. One would expect, since the Ottawa River is its western boundary, that Quebec province belonged to the Maritime District, but its flora is discussed under the head of the Lake District!

The reviewer has pointed out the author's inaccuracies only for those regions with which he is familiar. It is to be hoped that they are not so frequent in other portions of the book. While appreciating the difficulties of the task, the careful reader of the volume can hardly refrain from wishing that the author had more thoroughly digested his data and more critically read his manuscript before publication. The work under review may be an example of the present unfortunate tendency to rush into print without proper preparation, owing to the existing standards of valuation in academic life which make publication rather than the quality of teaching the criterion of success.

C. D. H.

Windbreaks: Their Influence and Value. By Charles G. Bates. Bulletin 86, U. S. Forest Service. Washington, D. C. 1911. Pp. 100.

The Forest Service has conducted experiments to obtain data on the influence of windbreaks upon the atmospheric and soil conditions which affect the growth of plants. The object of the author's investigations was to find out whether the combined protective and timber value of windbreaks were equal to the value of field crops which might be grown on the area occupied by the trees. The Bulletin is divided into four parts whose headings are: A synopsis of Conditions; Measurement of Physical Factors; Direct Results of Windbreak Planting—Timber Yields; Summary.

In the second part, we find that the amount of light used by trees in the north-south row is considerably greater than that taken up by trees arranged in east-west lines and the shading is not only greater in volume but greater in extent. This is due to the fact that north-south windbreaks receive sunlight from one side or the other during about two-thirds of the day, while in the east-west row, especially in midsummer, the shadows fall outside of the area covered by the branches. Crops adjacent to a north-south row will, therefore, suffer more from shading than those adjacent to an east-west windbreak. The author recommends the east-west arrangement in the middle West where most of the winds are northerly or southerly and in the northern prairies and Lake States, the north-south rows.

The probable competition for water between the roots of trees and the roots of crops was only approximated by determining the average root extent of the various species used for windbreaks. Contrary to the general opinion, it was found that the cottonwood has the least extensive roots of any of the broadleaf species and hence has the least power to damage crops in dry seasons. In regard to the efficiency of windbreaks in checking evaporation, the author states that the area protected is proportional to the height and density of the windbreak and the distance to which protection is felt increases with the velocity of the wind. The protection is appreciable to a distance equal to five times the height in the windward direction and to fifteen or twenty times the height to the leeward. The windbreak in extreme cases, may save 70% of the moisture ordinarily lost by evaporation. Portions of certain wheat fields in the protection of windbreaks showed a gain in yield of 60% over the general average of the entire field.

In respect to temperature, the author makes this statement: "Other conditions being equal, both the highest maximum temperture at midday and the lowest minimum temperature at night are found at the same point relative to the windbreak and exceed about equally (in this case about $4\frac{1}{2}°$ F.) the maximum and minimum temperatures in the open." (p. 58.) A windbreak, according to the author, produces a hot house condition on a large scale, and once it reduces evaporation at the same time, its total influence is clearly favorable to vegetation. A cornfield in Nebraska on the north side of a dense windbreak 38 feet high, made a yield in the 18 rows nearest the windbreak at the rate of 18 bushels per acre greater than the general average of the unprotected portions. Similar results are shown in the case of orchards. In a season which had been preceded by three frosts in May, twenty-eight out of thirty unprotected orchards gave a yield ranging from less than one to three pecks per tree. Partially protected orchards gave an average yield per tree of one-half bushel to three bushels, while well protected orchards in the same locality gave an average yield of 4.9 bushels. The value of the windbreak in this case is given as four-fifths the value of the orchard per acre over a belt ten times as wide as the height of the windbreak.

Practically all of the author's investigations point to the conclusion that windbreaks pay for themselves, without considering

their fuel or timber value, by the increased yield of crops due to their protection.

The Bulletin closes with recommendations for the proper species in different soils in the various regions of the United States.

C. D. H.

Forest Conditions of Illinois. By R. Clifford Hall and O. D. Ingall. Bulletin, Illinois State Laboratory of Natural History, Volume 9, Article 4. Urbana, Illinois. 1911. Pp. 175-253.

The survey leading to the present report was made by the Illinois State Laboratory of Natural History in co-operation with the Forest Service, and is based upon investigations conducted in the winter and spring of 1910. For purposes of description and authors divide the State into the Northern District and the Southern District, the dividing line being approximately the southern limit of the middle Illinoisan and early Wisconsin glacial drift, being roughly located by a line running from St. Louis to Shelbyville and thence east to the northeastern corner of Clark County. South of this drift margin, the State was originally chiefly forest with little prairie, while north of it the region was chiefly prairie with little forest.

The Southern District is divided into the Bottomland type, the Upland Hill type and the Upland Plain type, while the Northern District contains only two types, namely, the Bottomland type and the Upland type. The composition of each type with its variations in different localities is given in detail, including tables giving the composition percentage for each county studied. From these tables it is shown that the Bottomland type of the southern counties is controlled by Pin Oak, Sweet Gum, Elm and Hickory, while that type in the northern counties is dominated by Elm, Soft Maple, Cottonwood and Willow. The Upland Hill type is an extension of the Ozark Plateau of Missouri and is dominated by Black, Spanish, Red, White, Post and Chinquapin oaks, which form 60% of the stand. In many places, the drier slopes and upper south slopes are controlled by the Post Creek, mixed with Black-jack Oak, Black Oak and Pignut Hickory. The Upland Plain type is characterized by oak-hickory associations on well-drained undulating country having a yellow-gray or a yellow silt

loam soil and by the post-oak association on poorly drained shallow light gray silt loam having a light clay subsoil. The forests of the northern Upland type are similar to the oak-hickory type of the southern region but are characterized by an increase in proportion of Basswood, Black Walnut and Sugar Maple. As the extreme North is reached, the presence of Aspen, Black Birch, Paper Birch and the sporadic occurrence of White Pine mark the overlapping of the more northern tree associations.

The present forest area of Illinois is estimated at two million acres, or 5½% of the total land area.

The considerations outlined above occupy approximately one-half of the bulletin, the remaining half being concerned with such subjects as ownership and taxation, timber industries and forest management. We find that 115 million feet, exclusive of fuel, post and ties, were cut in the State in 1909.

It is unfortunate that a deficiency of funds did not allow the publication of the map of forest types which was submitted by the authors but not published.

C. D. H.

The Blister Rust of White Pine. By Perley Spaulding. Bulletin 206, Bureau of Plant Industry, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 88.

The issuing at this time of an exhaustive bulletin on the "blister rust of the white pine" seems to be timely, for legislation aided by the intelligent co-operation of importers of pine seedlings, promises to prevent this pest, which has made such serious ravages in Europe, from getting a foothold in America. The fungus itself, is probably native to Eurasia, where it has been long known. It passes its life history on two hosts, the aecidial stage on some few species of pines (possibly originally on *Pinus cembra only*) and the uredo—and teleuto—stages or various species of currents and gooseberries (26 species of Ribes in all, and none is known to be immune). The attention of Europeans was first seriously directed to this disease by the damage wrought to white pine, which has been so great in many places as to actually interfere with its successful culture. The blister rust fungus is essentially a bark disease of seedling pines and young branches of older trees. It reveals its presence by swellings of

infected portions of the stem, and by the appearance on these regions first of blister-like patches of bark, which soon crack, permitting the escape of small drops of a sweet, sticky, colorless fluid, and later of yellowish-white pustules, aecidial fructifications. Diseased seedlings and young trees are usually killed by the fungus. Once a seedling or tree is infected there is no known way of eradicating the disease without destroying the host. The five-leaved pines are peculiarly susceptible.

In order to guard against the establishment of the disease in America, it is recommended that importation of European stock be stopped or permitted only by special license, that Ribes stock be inspected, and, if suspected, planted at least 500 feet from the nearest white pines, and finally that diseased plants, whether of Ribes or Pinus, be rooted out and burned. It is of interest to note that the Canadian government have already adopted precautionary regulations relative to imported European nursery stock. The bulletin closes with a complete bibliography on the subject.

J. H. F.

The Timber Rot Caused by Lenzites sepiaria. By Perley Spaulding. Bulletin 214, Bureau of Plant Industry, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 46.

Lenzites sepiaria (Wulf.) Fr. is cosmopolitan, having been reported from every continent in the world. In the United States alone, it is estimated that about one-quarter of the structural timber brought into use annually is attacked by this fungus. Its attacks are all but restricted to coniferous woods, and of these few, if any, are immune. Lenzites is a saprophyte; there is no clear record of its occurrence at any time on living wood. The disease is mainly disseminated by means of spores, which are produced in vast numbers by the fruiting bodies. These infect the wood mainly through season cracks or checks. Interesting details are given in the article relative to the development of the fruiting body, germination of the spores, methods of culture of the fungus, inoculations of sound timber, and the gross and microscopic appearance of the affected wood. There is also a review of the factors favorable to the growth of wood-rotting fungi, with which everyone having anything to do with the handling of timber

should be acquainted, and on which methods of preservation are based. In order to prevent decay caused by Lenzites the following advice is given: (1) cutting during late summer, fall and winter; (2) floating of timber; (3) good drainage of ground on which the wood is used; (4) rapid seasoning followed by painting with preservative substances; (5) the use of composite timbers instead of single large ones. But the most effective way is by treatment with solution of chemicals of which creosote is the best. The collection and burning of the decayed wood is also advisable. An exhaustive bibliography is appended.

J. H. F.

A Biologic and Taxonomic Study of the Genus Gymnosporangium. By F. D. Kern. Bulletin 26, New York Botanical Garden, Volume VII, 1911. Pp. 392-494.

Part I deals briefly with problems of distribution, culture methods, life histories and pathological phenomena. The attacks of these fungi on apple, pear, and quince trees are sometimes so severe as to cause considerable damage. Orchardists have tried spraying, but with very indifferent results. The conifers affected belong exclusively to the genera *Juniperus, Chamaecyparis, Libocedrus and Cupressus.* Part II is an important contribution to the taxonomy of the genus, successfully attempting as it does "to present a systematic treatment of all the species known to occur in any part of the world." Forty species in all are described. Complete analytic keys and an extensive bibliography constitute a valuable part of the paper.

J. H. F.

Volatilization of Various Fractions of Creosote after their Injection into Wood. By C. H. Teesdale. Circular 188, U. S. Forest Service, Forest Products Laboratory Series. Washington, D. C. 1911. Pp. 5.

In this experiment, forty-eight specimens of sap loblolly pine were treated with five fractions of creosote obtained by redistilling a good commercial grade of coal-tar creosote. Weekly weighings determined the volatilization, other experiments showing that the loss in weight was not related to the moisture con-

tent of the pieces. One set of specimens was treated with creosote similar in composition (as shown by fractional distillation) to the creosote from which the fractions were obtained.

The results indicated that "the lighter fractions of creosote, when separated by distillation and separately injected into sap loblolly pine, will volatilize much more rapidly than the fractions combined in the original creosote. This might be explained by the supposition that when creosote containing both low-boiling and high-boiling oils is injected into wood, the light oils volatilize chiefly in the outer portions of the wood and leave oil that is much less volatile. The outer cells thus become more or less sealed and tend to prevent the volatilization of the lighter oils in the interior of the wood.

"It is possible that with a light treatment, where the ducts and cells are not filled with creosote, but the cell walls are simply coated with oil, the tendency here noted would be very much less apparent. Nevertheless, it may be inferred that a creosote, to be of most value, at least for treating loblolly pine, should contain considerable quantities of high-boiling fractions, which appear to plug up the outer cells, and so insure the retention of the lighter oils in the interior of the wood."

Biennial Report of the Connecticut Agricultural Experiment Station, 1009-1910. Part XI: Report of the State Forester. New Haven, Connecticut. 1911. Pp. 775-804.

This report deals entirely with forest fires and is a resume of the progress made during 1909-1910. The present number of town and district fire wardens is given as 605, with an average district of 2,480 acres. A marked increase in efficiency of wardens from year to year is noted, especially in the matter of organizing to prevent and quickly suppress fires. The use of simple fire fighting apparatus, especially bucket pumps for one or for two men, is advocated, and is made possible by the absence of mountain topography and abundance of running water. A cut is shown of the two-man bucket pump. This has been of use both in extinguishing light fires and in controlling back fires in a heavier blaze. The report discusses the question of railroad fires and methods of control, and the operation of the brush burning permit law.

H. H. C.

Sixth Annual Report of the Forest Park Reservation Commission of New Jersey, for the Year Ending October 31, 1910. Patterson, N. J. 1910. Pp. 74.

The subject of forest fires is given full discussion. The conclusion is reached that the State should supplement her present system of town wardens by employing state patrolmen to devote their whole time to the work of fire prevention. An exceptional record is shown of convictions secured for violation of fire laws, but it is held that without the above modifications, the present system will not successfully prevent fires. The state forest reserves aggregate 13,720 acres, and will not be increased until better fire protection has been made possible. Co-operative work with individuals, and shade tree work is touched upon. The suggestions regarding extra state wardens were acted upon by the legislature, and six division fire wardens were created, thus giving New Jersey an organization resembling that of such states as Minnesota, Maine and New York, where great efficiency has been reached in fire prevention.

H. H. C.

Relation of Light Chipping to the Commercial Yield of Naval Stores. By Charles H. Herty. Bulletin 90, U. S. Forest Service. Washington, D. C. 1911. Pp. 36.

This bulletin contains an account of recent experiments made by the U. S. Government to conserve the naval stores industry of the South. Experiments begun in 1902 demonstrated so conclusively the superiority of the cup and gutter system over the old and destructive box method that the commercial introduction of the system resulted.

The next important feature of turpentining presenting itself for investigation was in regard to the proper depth, width and height of the wound made on a tree in chipping. Some of the results of the comparative experiments conducted on a commercial scale under normal conditions demonstrate that combined shallow and narrow chipping increase the yield; that the number of trees killed is decreased; and that the damage to the lumber in the butt cut of chipped trees is reduced. Light cupping, that is, restricting the operation to timber over twelve inches in diameter, and

closely limiting the number of cups per tree, has proved to be highly advantageous since it prolongs the period during which a crop can be worked and by exempting the young trees prevents the exhaustion of the timber available for turpentining in future, thus assuring stability and perpetuity to the naval store industry.

The author refers to the so-called "secondary resin ducts which pour out crude turpentine over the wounded surface as a healing balsam." In this connection the investigations of Dr. Simon Kirsch* are interesting. They appear to show conclusively that the vertical strands of cells containing the resin ducts are the same in character as the rays and perform the same primary functions, viz: the conduction of elaborated foodstuffs to the growing wood cells and the storage of food; that the duct is merely an intercellular space of schizogenous origin and owes its existence to the different tensions present in the various elements of the tissues; and that resin is excreted (not secreted) during the vital processes of both the ray cells and their counterparts—the vertical parenchyma cells, and is not a substance manufactured especially for antiseptic purposes, or in traumatic phenomena for healing wounds. The wounding due to chipping stimulates the vital processes at the seat of injury and greatly increases the by-product—resin; and in consequence there is an increase in the number of ducts or passages necessary to contain it. The phenomena which the author of this bulletin cites as confirmation of the other theory are in entire harmony with the view just cited and which to the reviewer seems the more likely.

S. J. R.

Proceedings of the Third Annual Session of the Pacific Logging Congress. Compiled and issued by the Timberman, Portland, Oregon. Pp. 68. Illustrations 121.

A valuable publication containing many papers of great interest to both loggers and foresters. One of these deals with the Regulations Governing the Removal of Timber from the U. S. National Forests; another with British Columbia's Forest Policy;

* The Origin and Development of Resin Canals in the Coniferae, with Special Reference to the Development of Thyloses and their Correlation with the Thylosal Strands of the Pteridophytes.

Paper presented before the Royal Society of Canada at Ottawa, May, 1911.

and there are two papers dealing with logging conditions in British Columbia.

Other subjects dealt with are the Construction of Logging Engine Fire Boxes; Increased Life and Efficiency of Donkey Boilers which are kept covered; The Use of Three-Drum Donkeys in Redwood Logging; The Part Played by Wire Rope Makers in the Development of the Logging Industry; Causes of Inefficient Service Charged to Wire Rope; Gasoline Logging Engines; The Adaptation of Electric Energy to Logging and How to Obtain the Best Results. There are also papers dealing with the probability of the loggers becoming large users of electric energy and the use of electric lighting in the camps.

Overhead Cable-Way Systems are dealt with at considerable length in no less than four admirable papers. The necessity of railroads for the future development of the logging industry in Montana is dealt with, and there are two good papers dealing with the subject of Topographic Maps for the Laying Out or Logging Railways. On the subject of Cable Locomotives on Steep Grades there are two papers, and there is one dealing with Objections to Compressed Air. The subject of keeping systematic logging camp records is dealt with in an admirable fashion and shorter papers deal with methods of increasing camp efficiency by the creation of better sanitary conditions, etc.

The subject of Personal Liability Legislation created considerable discussion, as did also that of Forest Fire Legislation. Timberland Taxation did not come in for its usual share of attention. Other papers dealt with such subjects as the Need for Uniform Methods of Grading Logs: The Charpitting of Stumps; The Profitable Utilization of By-Products of Camp and Mill; and the Development of Logged-Off Land.

A. H. D. R.

Timber Bonds. By T. S. McGrath. Chicago, Ill. 1911. Pp. 504.

This volume deals with a subject comparatively new in the United States. Timber bonds were first issued in the country in 1902 by Southern lumbermen to provide funds for the development of their property, which would not be callable at short notice and which could be repaid as fast as the product offered as

security, was marketed. Since 1902 many bond issues have been floated, some of them sound, some unsound.

The author aims in the present book to bring out the different phases of timber bonds and to provide sufficient information to guide prospective purchasers past unsafe investments. A large part of the book is taken up with two sample trust deeds and copies of bond circulars.

The author appears to have furnished but little original material for the work, but it is of interest to those desirous of learning something of timber bond issues.

The volume closes with a chapter on "Words and Phrases" taken from Bulletin No. 61 of the Bureau of Forestry. This contains the terms used in forestry and logging arranged in alphabetical order and is for the purpose of supplementing the vocabulary of bond agents when selling their wares.

The author would have better met the needs of such men by eliminating the technical forest terms from his list, since very few lumbermen or bond purchasers are conversant with them.

R. C. B.

The Bradley Bibliography. A Guide to the Literature of the Woody Plants of the World, published before the beginning of the Twentieth Century. Volume I, Dendrology. Part I. Compiled at the Arnold Arboretum of Harvard University, under the direction of Charles Sprague Sargent. By Alfred Rehder. Cambridge, Mass. 1911.

This bibliography is intended to contain the titles of all publications relating wholly or in part to woody plants, including books, pamphlets and articles in periodicals and other serials in all languages published up to the end of 1900.

The work will be published in five parts, of which the first, on dendrology, is now available. The second volume will contain references to literature on woody plants restricted to a particular family, genus or species. Volume III will deal with the economic products and uses of woody plants, and with arboriculture. The fourth volume will be devoted to forestry, and the fifth will contain an alphabetical index to all titles enumerated in these four volumes.

The author has spent more than ten years in the exploration of

the principal libraries in the United States and Europe, and has brought together a most valuable reference list.

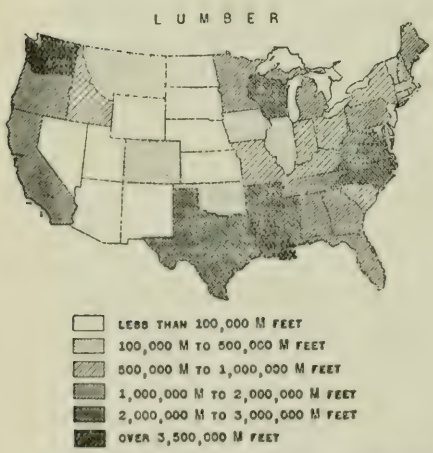
Volume I on Dendrology is classified by subjects and is the most comprehensive work of its character yet published.

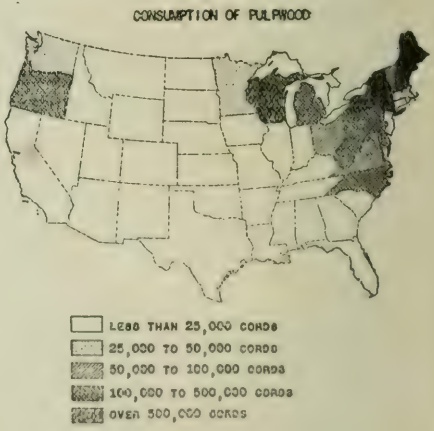
The coming volumes will be awaited with great interest.

R. C. B.

Output and Consumption of Forest Products in the United States for the year 1909. U. S. Department of Agriculture, Forest Service.

This is an interesting compilation showing at a glance on small maps the distribution in quantity of the single items of forest products; in the various states, 14 maps being combined into one





sheet. A similar sheet showing distribution of lumber production by species has also lately been prepared. We reproduce the two maps showing the production of lumber and consumption of pulpwood, the two most important items.

Die Rotbuche. Wirtschaftliche und statische Untersuchungen der forstlichen Abteilung der Hauptstation des forstlichen Versuchswesens in Eberswalde. Von Dr. Adam Schwappach, 1911. Pp. 231.

This very important contribution not only to the silvicultural management of the beech and silviculture in general, but to the

methods of investigation discusses the influence of the method of treatment on increment and profitableness of the species, all based on extensive tabulations of measurement.

The most valuable basis is furnished by an area for 36 years—from the 48th to the 84th year—under systematic management by thinnings in three different degrees of severity. During this period of 36 years the total volume production with light, medium and severe thinning was 7,823, 8,483, and 8,420 cubic feet respectively, showing the moderate thinning most effective.

In another case, the performance with the severe thinning was the same as that with moderate thinning.

Generally speaking, Schwappach finds that between the limits of a cross section area of 225 and 265 cubic inches lies the optimum of the increment of beech. Schiffel in reviewing the work and combining the data differently, namely making allowance for difference of conditions of stands at the beginning of the investigations, finds that this statement in its generality is not always borne out. Schiffel's tabulation seems to prove that, as with other species, the open position, if the opening does not exceed the limit of the ability of the stand to close up again without regard to age or cross section, does not produce more volume than the close position. The opening produces merely an improvement in quality and value increment.

Other deductions are, that the current volume increment under proper treatment can be maintained for decades at about the same amount (see same for pine, F. Q., Vol. VI, p. 432), and that it is even in older age higher than has been usually believed; that larger intermediary returns from thinnings without damage to the stand can be secured than has usually been assumed. Based on these experiences yield tables for open and usual density are constructed.

Schiffel throws some doubt on these tables also, and thinks that the intermediary harvests are stated too high.

B. E. F.

Au Pays Landais. Par J. H. Ricard. 1911. Pp. 250.

This is a full history of the remarkable reclamation work of the Landes in south-western France, their past and present condition, and proposals for their proper management.

It appears that Brémontier, who is usually recognized as the father of this reclamation work, was preceded by Baron Charlevoix de Villiers and by M. Desbiey. The last mentioned had as early as the year 1776 first proposed the use of the Maritime Pine and had planted it in various places.

De Villiers, an engineer, was the first to claim the fixation of the sand dunes as necessary for the protection of the pine plantations which he recommended for the reclamation of the Landes. He never had a chance to put his propositions into action. Nor did Bremontier quite solve the problem of the dunes. It was Peychan who invented the idea of the front dune and of the mechanical covering of the shifting sands.

The largest amount of the work of establishing the pineries was, however, called forth when the war of the rebellion stopped the naval store supplies from the United States, and prices for these rose to four times their present average. Some one and three-quarter million acres were planted with Maritime Pine.

These pineries, as far as managed by the State, only 130,000 acres, are under a rotation of 75 to 80 years, which will probably be reduced to 60 years, in 5-year periods. In the periodic age classes I to IV (1-20 years) weedings go on; in the areas V to IX (20-45 years) all trees which interfere with the development of the main stand are bled to death (*gemmage à mort*), and, of course, removed in thinnings. In the older age classes X to XIII (45-65 years) only the smaller trees are bled to death, the others are carefully bled. The last age class (70-75 years) is bled to death in five years, and a clearing is then made, natural regeneration having been secured in the last years.

Private owners who control the bulk of the area, and corporations work under no such well planned management, their interest centers in the largest rosin production.

The conservative method of bleeding with the use of pots was devised by Hughes de Tarnos in 1844, but did not find general application until much later. The bleeding begins when trees are only 6 inches in diameter; 1,000 pines furnishing 6 to 10 casks (*chalosse*) of 340 liter, worth usually 70 francs, in 1907 over 112 francs.

Mine props furnish the most important return freight for English trading vessels from Bordeaux, over 50 per cent. of the

export trade from that harbor being the products of these pineries.

B. E. F.

Indian Forester, July, 1911.

An unsigned article on "Pensions" reviews and criticises the present scale and system of Indian Forest Service pensions. The writer believes that after retirement a European pension of £500 is too small and advocates pensions after a definite age limit rather than after a period of years service. Assuming the average forest officer to enter at twenty-three years, it is recommended that the retiring age be placed at forty-eight with a possibility of continuing service in meritorious cases provided that additional pension funds can be secured. The new plan advocates continuing an officer's service say to the age of 55 with the maximum pension for Conservators at £750, for Chief Conservators at £800 and for Inspector Generals at £850.

A reprint from the "Pioneer" entitled "Provincial Forest Service" gives the new regulations in regard to the pay of the Provincial Forest Service.

"Influence of Forests on Atmospheric and Soil Moisture" indicates that the Government of India is considering experiments to determine:

"The local differences in the rainfall, temperature and humidity inside and outside forest areas."

"The local differences in the level of the underground water table in areas near to, and far from, forest lands, respectively."

"The local differences in the height and duration of floods after similar amounts and durations of rainfall in channels fed from forest and non-forest areas, respectively."

The article is concluded by a note by Dr. G. T. Walker on the effect of forests on climate and rainfall.

"Want of a Definite Forest Policy in Burma" makes a plea for the establishment of a definite forest policy and particularly emphasizes present abuses. The writer urges the establishment of experimental forest gardens, closer regulation of the annual cut, provincial schemes for roads, closer forest preservation, restriction of cultivation, better regulation of improvement work on forests not under working plans and in addition the creation of

a staff to assist in forest engineering, marking of timber and collection of revenue.

"Review of Forest Administration in British India for the year 1908-1909" (with a quinquennial summary) is an appreciation of the work initiated and carried out by Inspector General Eardley-Wilmot during five years of his service as inspector general. It appears that progress has been made in securing better salaries, more permanent improvement work, better fire protection, larger grazing facilities, increased value of minor forest products and an increase in the annual net revenue.

Under the title "Fire Protection of Chir Forests" is a note by M. R. K. Jerram calling attention to the fire damage and a letter from V. A. Stowell advocating regulated burning.

The issue, in addition, contains the usual correspondence, and notes on shooting.

T. S. W., Jr.

OTHER CURRENT LITERATURE.

California Tanbark Oak: Part I. Tanbark Oak and the Tanning Industry, by W. L. Jepson; Part II. Utilization of the Wood of Tanbark Oak, by H. S. Betts; Part III. Distribution of Tannin in Tanbark Oak, by C. D. Mell. Bulletin 75, U. S. Forest Service. Washington, D. C. 1911. Pp. 34.

Shows how the complete product—wood as well as bark—may be utilized, with a view to discourage the present waste.

Grazing and Floods: A Study of Conditions in the Manti National Forest, Utah. By R. V. R. Reynolds. Bulletin 91, U. S. Forest Service. Washington, D. C. 1911. Pp. 16.

Leads to the conclusion that the floods in this region have been due to overgrazing in the Forest.

Scrub Pine, (P. virginiana). By W. D. Sterrett. Bulletin 94, U. S. Forest Service. Washington, D. C. 1911. Pp. 27.

A monograph dealing with the silvical character, characteristics of the wood, silvicultural management, etc.

Uses of Commercial Woods of the United States: II. Pines.

By W. L. Hall and Hu Maxwell. Bulletin 99, U. S. Forest Service. Washington, D. C. 1911. Pp. 96.

This issue is a treatment along the same lines as the first of the series, reviewed in F. Q. vol. IX, p. 469. All the species are considered.

"Colombian Mahogany:" Its Characteristics and its Use as a Substitute for True Mahogany, by G. B. Sudworth and C. D. Mell; *With a Description of its Botanical Characters,* by H. Pittiér. Circular 185, U. S. Forest Service. Washington, D. C. 1911. Pp. 16.

Gives the distinguishing characteristics in detail.

Consumption of Wood Preservatives and Quantity of Wood Treated in the United States in 1910. By H. S. Sackett. Circular 186, U. S. Forest Service. Washington, D. C. 1911. Pp. 4.

The statistics show a great increase in the amount of material treated and a growing tendency toward the treatment of certain classes of material heretofore seldom treated, with creosote gaining steadily in favor. Only 29 per cent. of the creosote used was of domestic source.

National Forest Fire-Protection Plans. By Coert Du Bois. Unnumbered Circular, U. S. Forest Service. Washington, D. C. 1911. Pp. 8.

Record of Wholesale Prices of Lumber (PerM. Ft. B. M.) based on actual sales made f. o. b. each market for, April, May and June, 1911. List A., U. S. Forest Service. Washington, D. C.

Regulations and Instructions for Officers in Charge of Forests on Indian Reservations. Office of Indian Affairs, Department of the Interior. Washington, D. C. 1911. Pp. 64.

Fire Prevention and Control on the National Forests. By. F. A. Silcox. Reprint from Yearbook of Department of Agriculture for 1910, pp. 413-324. 1911. Washington, D. C.

Progress in Saving Forest Waste. By Wm. L. Hall. Reprint

from Yearbook of Department of Agriculture for 1910, pp. 255-264. 1911. Washington, D. C.

The Management of Second Growth Sprout Forests. By Henry S. Graves. Reprint from Yearbook of Department of Agriculture for 1910, pp. 157-168. 1911. Washington, D. C.

The Agricultural Duty of Water. By W. J. McGee, Soil Water Expert, Bureau of Soils. Reprint from Yearbook of Department of Agriculture for 1910, pp. 169-176. 1911. Washington, D. C.

The Forests of the Philippines. By H. N. Whitford, Part I, Forest Types and Products. 94 pp. Part II, The Principal Forest Trees. 113 pp. Bulletin 10. Bureau of Forestry, Manila, 1911.

The Game Markets of To-day. By Henry Oldys, Assistant Biologist, Biological Survey. Reprint from Yearbook of Department of Agriculture for 1910, pp. 243-254. 1911. Washington, D. C.

The Utilization of Logged-Off Land for Pasture in Western Oregon and Western Washington. By Byron Hunter and Harry Thompson. Farmers' Bulletin No. 462, U. S. Department of Agriculture. Washington, D. C. 1911. Pp. 19.

A discussion of the preparation of logged-off land for pasture; pasture plants; pasture mixtures; when to sow the seed; management of the pasture; winter feed and stock to pasture.

Letters from the Secretary of War transmitting, with a letter from the Chief of Engineers, Report on Preliminary Examination of Merrimac River, Mass., from Haverhill to Lowell, together with a Report on an Investigation on the Influence of Forests on the Run-off in the Merrimac River Basin. House of Representatives. Document No. 9, 62nd Congress, 1st session. Pp. 123, plates 25. Washington, D. C. April 11, 1911.

The Movement of Soil Material by the Wind by E. E. Free, *With a Bibliography of Eolian Geology*, by S. C. Stuntz and E. E. Free. Bulletin No. 68, Bureau of Soils. Washington, D. C. 1911. Pp. 272.

Crop Plants for Paper Making. By Chas. J. Brand. Circular No. 82, Bureau of Plant Industry. Washington, D. C. 1911. Pp. 19.

A brief review of the experimental manufacture of paper from cellulose producing plants. The author has made paper from various plants, but he is not yet prepared to state that paper can be profitably manufactured from any of them. In any case, it will be possible to find only a partial substitute for wood. The circular is printed on five different kinds of paper: namely shredded corn stalks (80 per cent.) and cotton hull fibre (20 per cent.); shredded broom corn stalks; rice straw soda pulp (77 per cent.) and sulphite spruce pulp (23 per cent.); broom corn soda pulp (50 per cent.) and poplar soda pulp (50 per cent.); pure long fibre pulp of corn stalks.

Birds of Arkansas. By A. H. Howell. Bulletin 38, Biological Survey. Washington, D. C. 1911. Pp. 100.

Proceedings of the Society of American Foresters. Vol VI, No. 2. Washington, D. C. 1911. Pp. 117-270.

Contains: The Essentials in Working Plans for National Forests, by Barrington Moore; Conservation and Chemical Pulp, by Dr. B. Herstein; Seed Production and How to Study it, by Raphael Zon; Better Methods of Fire Control, by W. B. Greeley; Fire Problem on the Florida National Forest, by I. F. Eldredge; In Memoriam—William Russel Dudley: Bibliography of Southern Appalachians, by Helen Stockbridge; Amended Constitution; List of Members.

Four Insect Pests. By O. A. Johnson. Maine Agricultural Experiment Station, Orono, Maine. Pp. 24.

The Typhoid Fly and its Allies, one of the subjects treated, is of interest to foresters concerned in the care of men in logging camps.

Seventh Annual Report of Newark Shade Tree Commission. Newark, New Jersey. 1910. Pp. 66.

Report of Committee on Preservative Treatment of Poles and Crossarms. Read before the National Electric Light Association Convention at New York, May, 1911. Pp. 122.

The report discusses at length the specifications covering coal-tar creosote oil, and method of analysis; methods of treatment and standard appliances; damage to poles by wood-boring insects; and statistics of poles, crossarms, brackets and insulator pins, 1909.

Lumber Freight Rates from Minneapolis to points having lumber yards in the following State: Illinois, Iowa, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. 1911. Pp. 122.

Prepared by the Northern Pine Manufacturers' Association, Minneapolis, Minn.

A Bud and Twig Key. By O. L. Sponsler. Reprint from Forest Club Annual, University of Nebraska, Volume III. 1911. Lincoln, Neb. Pp. 61-79.

Windbreaks and Hedges. By C. B. Waldron. Bulletin No. 88, Government Agricultural Experiment Station. Fargo, North Dakota. 1910. Pp. 10.

Oregon Forest Fire Law, enacted by the Twenty-sixth Legislative Assembly, 1911. Salem, Oregon. Pp. 16.

Proceedings of the Third Annual Session of the Pacific Logging Congress Held at Vancouver, B. C., June, 1911. The Timberman, Portland, Oregon. 1911. Pp. 68.

Eucalyptus Culture in Hawaii. By L. Margolin. Bulletin 1, Division of Forestry, Board of Agriculture and Forestry. Honolulu, Hawaii. 1911. Pp. 80.

A Brief History of Forestry. By B. E. Fernow. Second, revised and enlarged edition. Toronto, Canada, and Cambridge, Mass. 1911. Pp. 506.

The inaccuracies of the hastily prepared first edition are corrected, and the chapter on France entirely rewritten. A very full index has also been added.

Treatment of Artificial Tree Plantations. By E. Secrist. Circular 110. Ohio Agrucultural Experiment Station, Wooster. Pp. 21, figs. 16.

The Elm Leaf Beetle. By G. W. Herrick. Circular No. 8, Cornell Agricultural Experiment Station, Ithaca, N. Y. Pp. 6, figs. 9.

Forests of New York. By G. M. Wiley. Arbor Day Annual New York State Educational Department, Albany, N. Y. 1911. Pp. 53, pl. 1, figs. 31.

Outlines are given on the teaching of forestry along with geography, agriculture, civic and physical geography. A list of forest schools and a reference list of books on forestry are included.

Memorandum on Teak Plantations in Burma. By F. A. Leete. Bulletin No. 27, Indian Forest. 1911. Pp. 21, dia. 4.

Notes on the relative Strength of Natural and Plantation—Grown Teak in Burma. By R. S. Pearson. Bulletin No. 3 (new series), Indian Forest. 1911. Pp. 9.

Seasoning Wood by Electricity. No. 149, Daily Consular and Trade Reports. U. S. 14, 1911. P. 1373.

A brief description of a new process of seasoning wood by electricity in France.

PERIODICAL LITERATURE.

BOTANY AND ZOOLOGY.

Self Fertilization.

An interesting, although not yet completed, series of experiments in self-fertilization of pine and spruce is reported by Nils Sylvén. The method pursued is the usual one of isolating fruitbuds by means of paper bags. On the pines, the cones were poorly developed (perhaps on account of improper tieing with iron wire); the cones did not open, and the seeds were all imperfect and non-germinative.

In spruce, the isolated branches having been twice shaken to assist pollinization, four out of five trees developed good cones and contained good germinative seeds so far as not destroyed by the gall wasp; but with the exception the germinating per cent. was lower than that from open branches. Of one of the trees, however, 72 plants were grown from self-pollinized seed, 36 or 33 1/3% having died during the summer, while only 9.9% of plants from other seed were lost; the surviving plants of either derivation being equally vigorous.

It is pointed out, that while self-fertilization depresses the germinating per cent., the growing of special favorable races, e. g. the green-coned, late-budding spruce, will only be accomplished by this means. This consideration lends practical value to this kind of inquiry.

Ueber Bestäubungsversuche mit Kiefer und Fichte. Mitteilungen aus der forstlichen Versuchsanstalt Schwedens. Heft 7, 1911.

Phenology of Flowering.

Interesting observations, continued for 15 years on the influences which determine the flowering of plants in the neighborhood of Brussels are reported by Vanderlinden.

The greatest variation in the date of flowering is observed in the very early and the very late flowering plants, while the amplitude of those flowering in May is very small. The reason is, that with all early flowering plants

the buds are perfected in the summer and their volume increased at the expense of reserve materials.

Small temperature rises (light is not an element of influence) above freezing point induce their opening, especially if the higher temperature continues for some time. The later bloomers rely upon the food materials prepared in the flowering year and hence upon the foliage of that year. Here light plays a great role as it is needed for assimilation. The later the blooming the more dependence on the presence of foliage to prepare food materials. In all cases temperature and humidity are the main factors.

Plants flower preferably on given dates fixed by heredity. The climatic conditions of fall or winter are without recognizable influence on the flowering in the following spring and summer. The second flowering in summer or fall is said not to be dependent on the climatic conditions of the preceding season. Sunspots have no influence on flowering.

To permit a plant to flower it must have passed a rest period to make it responsive to outer stimuli. While such plants can be brought to premature flowering by immersion into warm water of 28° to 30° *C.*, those that have had no such rest period will not respond to that treatment.

Die periodischen Vegetationserscheinungen in ihren Beziehungen zu den Klimatischen Variationen. Centralblatt f. d. g. Forstwesen. August, September, 1911. Pp. 420-422.

Evaporation Experiments.

At the University of Chicago, Fuller is studying the rate of evaporation within various plant associations on the Lake Michigan sand dunes and adjacent areas. From a preliminary report of his investigations, we find that the pioneer tree association on the dunes is dominated by the Cottonwood; older dunes by conifers, Jack Pine in the case of the one studied. In time the conifers are displaced by Black Oak and White Oak. The amount of evaporation beneath these three kinds of stands, as measured by the porus-cup atmometer was compared with that beneath the climax beech-maple forest.

Upon a percentage basis, the average rate per day throughout the season in the beech-maple forest taken as a unit, the comparative evaporation rate in the oak dune is 127%, in the

pine dune 140%, and in the cottonwood dune 260%. The average amount of water evaporated per day beneath the beech-maple forest was 8.1 cc. The evaporation in the various associations varies directly with the order of their occurrence in the succession, being greatest in the youngest and least in the oldest association. Thus it may be said that the atmospheric conditions in the lower stratum of the cottonwood dune association during the growing season are 2.6 times as severe for plant life as those in the same stratum of the beech-maple association during the same period.

Evaporation and Plant Succession. The Botanical Gazette, September, 1911. Pp. 193-208.

SILVICULTURE, PROTECTION AND EXTENSION.

Results with Exotic Trees.

Of more and more intense interest are the experiences with exotic species in Germany, which are now for 30 years continued, and permit now the establishment of sample areas to secure data for an estimate of forest production.

Dr. Schwappach brings together these experiences from all the trial planting in Prussia, discussing species by species with estimate of the value of each and giving a tabulation of all the trial plantings with measurements—a very full report, worth studying.

Out of 1,600 acres of exotic plantations in 1900, 1,040 remained in 1910; the Douglas spruce leading with 325 acres.

Of the six Abies species tried, *amabilis, concolor, firma, grandis, nobilis* and *Nordmanniana, Abies concolor* has proved the best, being the most rapid grower, rivaling even the Norway spruce on fresh, humose loam soils. It differs from the other firs by being less tolerant, especially of overhead shade; it is almost light-needing. Its resistance to frost and heat and to damage by mice and game is also praised. It is the only Abies of special value.

Of Picea five species, *ajanensis, alcockiana, engelmanni, pungens, sitchensis,* have been tried; only the last is found forestally of value, and especially near the seashore in the northern latitudes, where on account of its freedom from Schütte, as well as

of resistance to seawinds, it is destined to supplant the native spruce. It also is fit for peaty, moist soils. It produces larger amounts than the native spruce; a sample area showing the enormous increment of 380 cubic feet timberwood in five years. It thrives on sites to which the native spruce is not adapted, and is altogether highly recommended.

Of the five pines, *banksiana, jeffreyi, ponderosa, laricio, rigida* (*strobus* is considered fully established) the first is only fit to cover the poorest soils and perhaps to serve as nurse crop and filler. It bears seed from the 8th year on. It suffers from the game, *tortrix* and "nun" very much.

The two Rocky mountain species have not developed any points of distinctive value for North Germany; nor is *laricio* of special value except where *silvestris* is not at home.

Pinus rigida has behaved very badly, most of the trees died, broken down by snow and killed by fungi. Only scientific interest is attached to it. Its value as an admixture to *silvestris* on poor sites on account of its more plentiful leaffall is, however, recognized.

Juniperus virginiana has not proved of value in North Germany.

Of larches, *Larix leptolepis* from Japan continues to be favorably reported on. It grows more rapidly than the native larch for the first 25 years, but its height growth culminates early (50 to 55 feet and 7 inch diameter at 23 years recorded). Its resistance to the larch moth and to fungus disease is an additional recommendation.

Of Cypresses, three *Chamaecyparis* were tried, namely *obtusa* and *pisifera* from Japan, and *lawsoniana* from United States. The former two are found most subject to damage by mice, yet on account of its superior wood quality *obtusa* is useful as an admixture on better sites in mild climate. *Lawsoniana* thrives most excellently in most varied situations; average fresh loamy soil is best; on dry soil forking seems more frequent. It is an intolerant species, but requires side protection, and is entirely unfit to be used on large cleared areas, but is recommended for filling out openings. Branches remain alive a long time, since it has no spreading habit. Fungus diseases and damage by mice are not infrequent, but on account of its excellent wood it should be used more freely. "*Pseudotsuga douglasii* has fulfilled in full

measure the high expectations which were placed on it, *if seeds are secured from proper localities.* It is the most valuable of the introduced exotic species, and has paid completely for all the expense incurred in finding it out. This refers to the green variety from Oregon and Washington, not to the gray one from Colorado. It is found best on fresh sand to mild loam, except near the seashore. Some records of its being frost killed when 20 years old were found to be due to the sudden removal of a protective stand, when drouth from exposure to winds resulted.

Only in seedbeds and transplant beds does frost affect especially the habitual second shoots which do not find time to ripen their wood; but the damage is readily repaired.

The question of seed supply is discussed in favor of the green rapidly growing variety from the Fraser River. Growth data are given showing remarkable production. The stand, to secure both height and diameter growth, must be kept open. In plantation no closer spacing than 4.5 to 5 or even 6 feet is desirable, and four-year old transplants are best used. Smaller stock may be used and closer planting (3.5-4.5 feet) for mixture with pine and spruce, saving expense; the Douglas spruce from the eighth year on shooting ahead and finding good growing space. Thinnings should be made early and at once severe. Certain experimental plats showed that the second thinning in the 28th year should remove as much as 50% of the stem number, the stand at 30 years retaining 360 to 400 trees.

A few figures of production are given below.

Thuya gigantea, if grown on suitable, i. e. better soils, loamy sand or fresh mild loam, and with side protection, has been found better than expected a decade ago; it is somewhat liable to succumb to drouth, and being very tolerant, it clears itself with difficulty. Early, severe thinnings, however, are necessary after the clearing.

Of hemlocks, *Tsuga heterophylla* (*Mertensiana*) loses its last shoots readily by frost but as readily recuperates, and on account of its silvicultural characteristics (shade endurance?) and good quality of wood (?) is considered worthy of use. Beauty is all that can be claimed for *T. canadensis.*

Of broadleaf species as unquestionably commendable with due consideration of the requirements on the site are cited *Carya alba*

and *porcina, Juglans nigra, Quercus rubra,* and *Magnolia hypoleuca.* Of only limited value are *Betula lutea, Fraxinus americana,* and *Prunus serotina,* and for their esthetic value only our maples, although *Acer saccharum* is considered excellent in coppice with standards and selection forest.

Tables showing in detail forest conditions and measurements of some 26 areas from 20 to 30 years old are given, in which some 11 different species or combinations are shown. Of these perhaps of most interest is the large volume increment for the third decade in *Pseudotsuga,* namely from 320 to 388 cubic feet of workwood (over 3 inch) per acre.

The figures for the best stand show in the 27th year 499 trees with an average diameter of 7 inch and height of 53 feet, a volume of workwood of 753 cubic feet, the thinnings having removed 454 trees with 345 cubic feet, the average increment during the last 5 years being 382 cubic feet of workwood. (See experiences in Hesse, p. 490 of this volume!)

Die weitere Entwicklung der Versuche mit fremdlandischen Holzarten in Preussen. Zeitschrift für Forst- und Jagdwesen. August, September, 1911. Pp. 591-617; 757-782.

Plantations of Taxus baccata.

Burkhardt breaks a lance for this rare and usually unconsidered species. Citing the literature of the species he gives a brief life history of its development. It reaches a height of over 60 feet, and diameters of over 4 feet are on record. An account of various trial plantations is given, and on account of its excellent wood for special uses its occasional employment is recommended.

Anbauversuche mit der Eibe. Forstwissenschaftliches Centralblatt August, September, 1911. Pp. 457-468.

Management of Pine Forest.

In a long article continued through several numbers of the journal Forstmeister Wiebecke gives an account of the methods pursued in Eastern Germany in the cultivation of the Scotch Pine. Hardly anything short of a translation will do justice to the account which covers every detail. We can, therefore, only refer to it as a useful reference article.

Ostdeutscher Kiefernwald, seine Erneuerung und Erhaltung. Zeitschrift für Forst—und Jagdwesen. September, 1911. Pp. 686-708.

Fertilizer in Forest Production.

Dr. v. Lorenz reports on an experiment of 7 years duration on 10 areas to find out whether the substitution of a commercial fertilizer (Thomas slag, Chili saltpetre and potash salts), as much as could be purchased for the amount which was secured from the sale of litter in a rather dry pine forest (Vienna Forest), 70 years old, namely $6.00, would compensate for the loss of the litter by increased wood production.

There was an actual increase of from 175 to 250 cubic feet on the area involved, but the money returns were such as to leave an annual deficit of about 20 cents per acre per year.

The deduction is that, at least on dry soils, fertilizers do not pay.

Ein Dúngungs versuch in Schwarzföhren-Stangenholz. Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs. Heft XVI, 1911.

Seed Supply.

Experiments reported by Gunnar Schotte show that the age of seed trees of pine do not appear to influence the progeny appreciably.

From the extensive tabulated results with seeds of different derivation it is again proved that seeds from northern localities furnish generally smaller plants than from southern. Their annual shoots are shorter, as well as their branches, hence the habitus is a more slender, narrow one. The needles of the northern stock are generally shorter, but a little broader, and more yellow in winter; the bark somewhat lighter than those of the plants from southern Sweden.

Ueber die Provenienzfrage und das Alter des Mutterbaumes bei Kiefern Kultur. Mitteilungen aus der forstlichen Versuchsanstalt Schwedens. Heft 7, 1911.

Selection Method for Private Forest.

An anonymous G. Z. pointing out that in Switzerland private forests, mostly in small holdings, are not managed as they should be, and that increase in production is highly desirable, advocates for this purpose the selection forest method.

His arguments consider the soil, the stand, the conditions of the owner and requirements of political economy.

For the maintenance of favorable soil conditions the selection forest has many advantages and no disadvantage.

Size of property is a requisite for a compartment system of silviculture, while the selection forest is adapted to any size of property; the soil is not only protected but is improved and, as the author claims, made ready for natural regeneration. The selection forest is the treatment most independent of a neighbor's doing, and increases the interest of the owner by requiring him to select and pay attention to the young growth, while a compartment system is apt to lead to neglect of the felling area.

In furnishing the requirements of the farm and occupation in winter for men and animals the selection forest furnishes the best opportunity and permits to satisfy the variety of wants for different kinds and sizes.

The author thinks that the selection forest, because of the distribution of sizes and kinds provokes less to speculation than the concentrated even-aged forest, and less to overcutting because the speculator cannot as readily determine quantities, as in the simple compartment. Hence in Switzerland the worst conditions of private forest is found where a clearing system has been introduced, and the best in the selection forest.

The author agrees that to carry on a rational selection system more knowledge and skill is required than in simpler clearing systems, but does not place much weight on this objection. Therefore, gross mistakes will be rarely made.

The protective value of the selection forest is then accentuated, which in the mountainous country of Switzerland is of great importance.

Privatwald und Plenterbetrieb. Schweizerische Zeitschrift für Forstwesen. September, October, 1911. Pp. 247-255.

Combating the Nun.

The literature on this dangerous enemy of the spruce and pine is still growing. A long article on the polyeder disease of the Nun *(Lymantria monacha L.)* by Dr. Wahl runs through various numbers of the Centralblatt f. d. g. Forstwesen; an article by Klock also enlarges from the practical side on the use of this disease, in the Forstwissenschaftliche Centralblatt.

Dr. Sedlaszek reports on experiments through four years in

Bohemia with the use of insect lime. The results of this series of experiments show that the use of insect lime is only a partial protection and not reliable. The shorter the duration of the invasion, the sooner the disease appears and other enemies decimate the caterpillars, the more effective the lime rings.

In the same Mitteilungen, Dr. Zederbauer discusses the influence of climatic conditions on the propagation of this insect and a few others.

It appears that there is a relation between rainfall and caterpillar multiplication. In rain-poor regions and rain-poor, dry and warm periods the mass multiplication of these insects is favored. Such enormous multiplication is limited toward the north and vertically by the July isotherm + 16° and the rainfall of 60 to 100 *cm.* The most endangered regions are those having less than 60 *cm.* rainfall. Regions with rainfall above 100 *cm.* do not know the pests, while those having rainfall of 70 to 100 *cm.* show large development only in dry years.

Ueber die Polyeder Krankheit der Nonne. Centralblatt f. d. g. Forstwesen. June, 1911. Pp. 247-268, and earlier numbers (1909.)

Neue Anregungen aus der forstlichen Praxis zur Bekämpfung der Nonne. Forstwissenchaftliches Centralblatt. July, 1911. Pp. 377-393.

Versuche zur Bekämpfung der Nonne mittelst Leimringen; and *Klima und Massenvermehrung der Nonne und einiger andrer Forstschädlinge.* Mitteilungen aus dem forstlichen Versuchswesen Oesterreiches. Heft XXVI, 1911.

MENSURATION, FINANCE AND MANAGEMENT.

Effect of Errors in Measuring.

Schiffel discusses at great length and with much mathematical detail the influence of faulty measuring of the factors on the resulting volume of round wood.

Price, i. e. value, depends in the first place on volume, and with the increase of price per unit the question of correct measurements is becoming more and more important. While at present the middle diameter and length of a log is supposed to suffice for a determination of volume, the author expects eventually the use of several diameters and formulas, as developed by him. (See F. Q., vol. II.)

I. Errors in Diameter Measure.

I. Errors in diameter measurements with calipers come most frequently from the fact that one, or both of the arms are not at right angles to the scale. This error, *if the scale is pushed close to the stem or log,* is proportional to the angle by which the arm or arms are not at right angles, and are in direct relation to the true diameter, i. e. the diameters of large and small logs are read off faultily in the same proportion.

The following table gives the errors in per cent. of the true diameter for different angles of error:

angle of error.....	0°30′	1°	2°	3°	4°	5°	6°
per cent of error:	.40	.87	1.74	2.57	3.49	4.37	5.26

If, therefore, the angle of error on one, or both caliper legs is 3°, the diameter will be measured 2½% short. With this table it is possible to correct caliper results obtained by a faulty caliper.

The error is different when, as most frequently with small logs, the scale cannot be pushed close to the log. Here the error is uncertain, depending on the vertical distance of the scale from the log. Hence, for practical work the caliper should be so constructed (short arms) as to permit close contact of scale to log. If this is not done, the same faulty caliper measures the smaller logs with absolutely and still more relatively greater error, than the larger; and the error can be quite considerable. For instance, for an error of angle of only 2½ and a true diameter of 4 inches with a distance of the scale from the log of 10 inches the error would be 8.7%, while if the scale could have been pushed close to the log it would have been only 1.44%.

2. Another frequent error arises from applying the caliper so that it will not be at right angles to the plane in which the true diameter lies, when the measured diameter is necessarily larger.

The amount of error depends, of course, upon the angle at which the caliper deviates from the right angle. From the following table it appears that the error is not great until about 7° deviation is attained.

angle of error, .	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	12°	16°
per cent. of error:	.02	.06	.14	.24	.38	.55	.75	.98	1.25	1.54	2.23	4.03

This error works in opposite direction to the first one dis-

cussed, hence these errors may compensate. But this is not to be relied upon, since an error of 4% due to a loose caliper arm, would not be compensated by a less than 15% shifting of the caliper from the diameter plane.

3. The error resulting from omitting fractions of inches (centimeter) and rounding off downward, is, of course, percentically less for stout, than for small diameters; it is a function of the diameter, and assuming that the average neglect is .45 *cm.*, the percentage of error is $p = \frac{.45}{d}$. Translating 5 centimeters into 2 inches the following relations appear:

diameter, ...	4	6	8	10	12
per cent. of error, ...	4.5	3	2.25	1.8	1.5

The error is decreasing with the diameter, but at 18 inches it is still 1%, if only 1/5 of an inch is dropped.

When measuring two diameters of the same cross section the dropping should be applied not to each but to the arithmetic mean, when the error is minimized. This double measuring also checks errors in mere reading of the scale.

II. Errors in Determining Cross Sections.

If measuring two diameters and the result is nearly the same the cross section may be assumed to be a circle; but if the difference is great, the question may arise how to determine the area. Three ways are practicable: namely, to determine the area for each diameter and take the mean; calculating the area from the mean of the two diameters; or taking the diameters as the axes of an ellipse and calculating its area. Usually the second method is used. G. Heyer proved long ago that the calculation as ellipse gives always the smallest areas. That is to say, the usual practice of calculating the cross section area from the mean of two very unlike diameters as circle gives too high results. An investigation shows that, as a rule, the error is so small that it does not call for correction. Only with small diameters and great difference of the two does the error appear significant: e. g., if d = 4, d2 = 6, then p = 4.17%.

III. Errors in Measuring Log Lengths.

These are too simple to require discussion.

IV. Influence of Dimension Errors on Volume.

Errors of diameter measurement. These depend on whether only one or several cross section areas are used.

If the cubing is done by the use of the middle cross section, as is usual with logs in Germany, the volume errors are in direct proportion to the diameter errors and the volume error per cent. is double the diameter error per cent. If, e. g. in measuring a diameter of 12 inches, an error of ½ inch or 4% has been made the error in volume will be 8%.

It can also be shown that the volume error per cent. grows with the same diameter error as the diameters, or with equal diameter error per cent. the volume error per cent. grows with the diameter. Practically this means that the dropping of fractions, the rounding off, should be gauged according to diameters, if a certain volume error per cent. is not to be exceeded.

If, for instance, a volume error of 5% is to be the limit, then the following must be the maximum diameter errors:

diameter, ...	6	8	10	12	14	16	18
permissible error, ...	3.75	5	6.25	7.50	8.75	10	11.25

The error increases in arithmetic progression. The errors resulting in the use of different formulae for cubic contents are similarly traced.

It appears that by cubing logs on the basis of two cross sections errors of measurement are largely compensated, at least as far as the faulty choice of place for measurement and the measuring of diameters in an oblique plane to the diameter is concerned.

Errors in length measurement produce the same error in volume, that is to say, if a log has been measured 2% short it will be calculated 2% short in volume if only one cross section area has been used in the computation, and the same if several areas are used. In the latter case, the error in length measurement may also shift the position of the area whose diameter is to be measured and complicates matters.

In summarizing, the need of properly constructed calipers, the close contact of scale stick of the caliper to the stem or log, are accentuated.

An example shows the importance of looking after little things.

By the faulty caliper arms the small error of 1% may be experienced, by oblique application an error of 2%, by rounding off the diameter an average error of 2%, altogether 5%, which results in an error in volume of 10%. Add 1% in length measurement and over 10% on price is lost.

Ueber den Einfluss fehlerhafter Bestimmungen der Dimensionen auf den Inhalt von Rundholz. Centralblatt f. d. g. Forstwesen. August, September, 1911. Pp. 371-390.

Volume Tables and Felling Results.

While we are accustomed, estimating by board feet, to find as a rule the mill cut overrun considerably even the closest estimate or the best log scale, Gayer states the interesting fact that in Germany, notably Baden, the felling results almost invariably remain below the measurement of the stands made by use of general volume tables, the reason being that the latter are made as accurate as possible, while in working up the stand there are practically various losses, of which the volume table does not or cannot take cognizance.

Determining the volume of logs by middle diameter gives from 2-4% lower results than the sectioning usual in constructing volume tables; the usage of dropping fractions in the diameter measurement may amount to 5-11% loss; the full length of the log is not always measured; a bark per cent. allowance of 10% does not in all species tell the story; the stump which for volume tables is allowed to be one-third of the stump diameter is frequently too low for logging practice; while volume tables are made on green stands, the logscale and cordwood are measured half dry, entailing a loss of four or more per cent.; brushwood below 3 inches is always many per cent. below the xylometric measurements; and loss by chips, etc., does not appear in the volume tables. In the literature all these losses are stated at from 6 to 15 and even 20 per cent.

The author has made careful comparisons on 13 sample areas of pine from 61 to 100 years old, in which the difference between the stock by volume tables, checked by Schiffel's form quotient measurements, and the logging results varied between 2.4 and 14.7%, in the average about 8%, and including the cordwood up to 15%. In another investigation on selection forest material

of spruce and fir the difference was 12.5 to 16% of the measured stand.

In order to obviate these discrepancies between tables and actual result the forest administration of Baden last year ordered for all conditions a reduction of 10% in the use of volume tables for working plans.

In Bavaria on the other hand, the new regulation for working plans, of 1910, calls for the opposite method, namely addition to the actual felling results.

The author points out that by these arbitrary methods the possibility of comparison of results is vitiated. Especially if deductions are to be made as to changes in stock and increment, conclusions become dangerous, since a 10-year increment per cent. may be entirely lost in these allowances. Such inquiries, therefore, must be separately conducted and not be based on this kind of booking.

Ueber Bestandesmassenberechnung nach Massentafeln und Schlagergebnisse der Praxis. Forstwissenschaftliches Centralblatt. August, September, 1911. Pp. 430-441.

Relative Increment of Tree Classes.

An article by Japing with elaborate tabulations and diagrams as a result of measurements continued for 18 years in a spruce stand, at the time of beginning 47 years old, brings data to show the participation of different tree classes, differentiated either according to Kraft (see F. K., vol. III, p. 41), or simple diameter classes arranged by equal numbers, in the progressive volume production, and the changes in position of the different tree classes.

The five diameter classes—the same number of stems in each class—beginning with the stoutest, participated, varying at seven different measurements, to the following extent in the total increment percentically:

Class I, 35 to 41%; class II, 24 to 30%; class III, 16 to 23%; class IV, 10 to 14%; class V, 4 to 9%.

It was found again, as previously by Weise on the same sample area that "the stoutest stem classes participate in the total increment with the same per cent., that they have in the total volume;

the lower classes, however, not even with the small per cent. which they form of the total volume."

The remarkable fact is that in a 10-year increment period more than half the stems changed their position in class. If a stem in one period of five years did not keep its place in relation to the increment increase of all other stems, i. e. lapsed, it would still further lapse in the next period. The same tendency in the opposite direction was observed for stems which got ahead.

The middle stem classes showed the greatest variation in growth energy, while the stoutest and the slimmest trees showed the least or altogether no change in position in these five- and ten-year growth periods. The change in relative growth energy of the single trees of a stand appears much greater than has been usually assumed.

As regards the stem classes according to Kraft's prescription they show more sharply these changes and contrasts.

The author points out that in the practice of thinnings the Kraft tree class differentiation is the best one by which to determine the laggards to be removed and the vigorous growers to be favored.

Ueber das Wachstum der Kraftschen Stammklassen im Verlauf einer zehnjährigen Zuwachsperiode. Zeitschrift für Forst-und Jagdwesen. September, 1911. Pp. 663-686.

Relations between Volume and Value Production.

In a very thoughtful article, Eberbach proves mathematically that the money rate per cent. at which a management class under sustained yield works is always less than the volume increment per cent. The latter, however, gives an approximate idea of the money interest (p) attainable, which as a rule, remains 20 to 30% under the volume interest (q). Therefore, to improve p, one must improve q, which can only be done by either raising the felling budget or reducing the stock capital, and as the latter alternative rarely recommends itself, all effort must be made to increase the increment, which can be mainly done by a proper thinning practice, generally speaking by taking out the trees which do not grow at a profitable rate and leaving those which do, no matter how old or stout they

are—a change from compartment clearing to a form resembling the selection forest.

If *q*, i. e. the volume increment, is not any more capable of being increased, then the growing stock (capital) must be reduced to secure a higher *p*.

The objection usually made to this, that this means a reduction of rotation and, therefore, of older valuable age classes, is refuted by the author by means of two diagrams, triangles as usually used to represent growing stock, and showing that the reduction can be done in two ways, namely by cutting off the end of the triangle, i. e. reducing the last age classes, shortening the rotation, or else curtailing the area of the older age classes from the 40th year on, but preserving all the age classes of the original rotation (shaving off a part of the triangle so as to make an unequal quadrangle).

The diminution of the stock in this way can be accomplished even with a lengthening of rotation. In this way *p* may be increased not only due to the reduction of capital, but by the very probable increase of increment of felling budget.

The only other way to raise *p* is to secure better prices or better financial results by more careful utilization, reduction of expenses, generally economic administration.

Soil values exercise a compensating influence on *q*. High soil values depreciate, (low values favor), *p*. until it may reach zero; the soil is too expensive to practice forestry on.

The author then develops the relation between volume and money interest in the crown forests of Baden for the year 1907.

The budget was 577,950 *fm*, the stock capital 25,820,990 *fm*, hence the increment per cent. (budget per cent.) 2.24. Having established an average net value per *fm* of 8 *Mk* (5.4 cents per cubic foot, of which 41.4% is workwood) for the net yield of the felling budget (21.2 million cubic feet), against which all expenses of management have been charged and 10.4 *Mk* (7 cents per cubic foot) for the standing stock of wood (stumpage value without cost of administration) over 40 years old (89% of the total stock), and figuring the soil value at 58% per acre, for the round 220,000 acres, the value per cent. which has been attained is only 1.44, or 36% less than the volume per cent.—a poor showing!

The argument that the forest value has been figured too high because it could not be secured by a forced sale the author demolishes very cleverly by pointing out that the condition of forced sale is not likely to occur, and that his values have been secured from actual sales of parcels, and he nails the method of calculating the forest value by capitalizing the present net yield of about 1.3 million dollars with an arbitrarily chosen 3% interest rate to about forty-two million dollars instead of the eighty million dollars as above.

The author then deplores the lack of sufficient data regarding increment on which to base closer calculations as to whether the best relation between stock and increment is attained. He advocates the establishment of a reserve fund to eke out uneven felling budgets, and to this end a reduction of stock capital by withdrawing double the present felling budget for a number of years (amounting to 46. million cubic feet) and placing the 3.6 million dollars thus derived from the forest on interest, thereby easing the silvicultural management and booking the interest to the forest credit.

In the further discussion the subdivision of costs is of interest. The total cost of producing 100 cubic feet is $4.17, of which $1.31 goes for personnel of the administration; $1.50 for wood choppers; 24.6 cents for cultures; 64 cents for roads, new construction and maintenance; other general expenses, including labor, insurance, etc., 47.4 cents.

In these items the author thinks that really only the cost for roads (new construction, not maintenance) can be reduced; he is doubtful as to whether expense for cultures can in the end be profitably reduced by fostering natural regeneration; he suggests keeping the personnel costs from growing by applying the principle of not letting an expensive man do what a less expensive man could do as well, i. e. the mechanical work of the forest.

The whole article is worth pondering over; the article itself speaks in simple mathematical formulae developing this forest value theory, which we have translated into common language.

In a short note in the same journal Wimmenauer takes exception to the idea that to the material of the felling budget should be given a lower value than to that of the standing timber. He has come to the conclusion that the cost of administration is

covered by intermediary incomes, so that forest net yield and felling budget net yield exceeds mostly from 1 to 10% the net stumpage value of the felling budget. With this assumption the stumpage value of the stock capital comes in the large average to .6 per unit of the ripe wood, and the interest rate varies between .6 and 2.5, so that it can be higher than the volume per cent.

Ueber die Beziehungen der Massen-und Geldverzinsung in Hochwaldbetriebsklassen mit besondrer Berücksichtigung der badischen Domänenwaldungen. Forstwissenschaftliches Centralblatt. July, 1911. Pp. 357-377; also October, 1911. Pp. 541-542.

Forest Valuation.

In a rather convincing, and short argument Oberforstrat Frey points out that exchange values, i. e. present market prices determined by present offerings and demands are the only tenable ones in forest valuation; that both, stand cost values dealing with the uncertain past, and expectancy values dealing with the still more uncertain future, are mere theoretical valuations without any practical value, unsafe and dubious, all factors entering the calculation being unsubstantiated estimates, and hence leading to wide differences. The question is how to secure acceptable exchange values, which are the true present values.

Incidentally, the author accentuates the fact that all values are estimates of buyer and seller, approximations to a true value, one bidding up, the other down, until, when an agreement is reached, the exchange value is determined.

For forest valuations he proposes the construction of local wood-money-yield tables, which for stands of different age near the age of ripeness approximate their actual stumpage sale value. It is evident that the exchange value of a forest cannot be less than the exchange value of the stands composing it; hence the exchange value of each stand may be ascertained from the table and the soil value added. For the older stands near ripe age, the present felling results may furnish the basis for the calculation.

For the younger stands he proposes to take the average value increment at the age of ripeness and multiply it by the age and acreage of the stand. Since they can only be cut at that later age the increment corresponding to that age and not their present

average increment is to be taken. (This after the precedent of K. Heyer.)

The sum of the stand values (or stock value) thus determined, which gives the owner the possibility with a given rotation to continuously reap the annual wood value increment upon which the calculation is based would then form the *lowest* price at which to buy or sell. To this may then be added the soil value, also as present exchange value, either based on actual present market value of farm soils of lowest valuation, or by capitalizing the net yield of the forest determined in the above calculation with varying interest until buyer and seller agree. The seller will ask perhaps 50 to 100 times the net yield as capital value (i. e. figure with 1-2%), the buyer probably will offer 25 to 50 times the net yield (figuring at 2 to 4%). By using the proposed wood-money tables the soil value is indirectly found by subtracting the sum of the stock values as determined above from the capital value of the net yield that can be secured, which difference gives the soil value.

The idea of introducing values for by-products is dismissed as irrelevant.

Ueber den Gegensatz zwischen Tauschwert, Kostenwert und Erwartungswert. Zeitschrift für Forst-und Jagdwesen. August, 1911. Pp. 637-643.

Loans on Forest Property.

According to a canvass of loan banks in Germany made some 9 years ago, the basis for the loans varies with different banks: only two base the "loan value" yield of forests under sustained yield management upon the wood yield; others base their loans upon the value which has been ascertained for taxation purposes; some take into consideration the actual stumpage value, if a systematic sustained yield management is possible; some do not give any loans for forest properties, and others again loan on the soil value only. Small woodlots or stands, and woods not in connection with farm property are not objects for loan by any bank.

Forestry Associations have discussed and recommended a more uniform practice for negotiating loans on forest property without coming to very definite conclusions as to the method of ascertaining the loanable value.

A circular inquiry from 60 German credit institutions sent out this year elicited further information which Tafel summarizes.

The same variety of attitude still prevails. It is interesting to note the figures which are communicated in some cases. In West Prussia the soil credit bank loans according to tax assessments from $1.20 to $9.30 per acre (farm soil assessment ranging from $4 to $60). In Saxony 8 tax classes are made for farm soils assessed at from $20 to $200, but the tax is about half the above. In Westphalia, banks also usually loan on tax assessments, but in two cases where a property was mostly forest, the bank loaned on the capitalized annual yield technically determined and capitalized at 4%; in the one case the yield value figured about $185, in the other $82 per acre.

In Pomerania, Posen and East Prussia only the oldest age class (20-year period), or as much of it as can be cut during the next 20 years is considered loanable property, the loan being based on the yield. From the money value of the felling budget in coniferous woods 10% is deducted to reduce the risk, also all costs of administration and culture according to a settled schedule, and the rest is capitalized with 3 1/3 to 5%, according to the length of the rotation, to ascertain the loanable value.

The newest method is devised by the soil credit institute of Silesia, where the yield of the two oldest age classes or periods, say the oldest 40-year stands are considered loanable, even if the felling budget consists only of thinnings, but the latter must not exceed 20 cubic feet per acre in the unripe stands under a thinning plan devised for five years. Selection forest is nowhere an object of loans according to yield; and to be loanable at all, the property must contain at least 125 acres in some, and 250 acres in other provinces. Coppice must be at least 125 acres to be loanable. Only in East Prussia are forests from 12½ acres upward loanable; in these small areas the soil value is determined in four quality classes with maximum in values of $8 to $50, which may be increased up to 50% in consideration of the determined stock value. This increase in value may in forests up to 250 acres and stands up to 50 years old be not more than 60% of the cost of cultures; for stands over 50 years and selection forest not more than 15% of the wood value; for forests over 250 acres with stands up to 50 years not more than 45% of the cost of cultures, and with stands

over 50 years and selection forest not more than 9% of the stock value.

The original cost of cultures is set for pine at $10 per acre, for spruce at $8, for the better class of broad leaf species at $15 and for other broadleaf species at $7; and the figuring is done at 3% interest rate.

The stumpage value is ascertained by using the official yield tables reduced by 15% and multiplying with local prices.

Of the 60 banks canvassed, 26 make no loans on forest property, 13 base loans on soil values; 14 base loans for regularly managed forests on the yield, with a working plan as basis, and some making conditions as to the personnel of the administration, fire insurance, etc.; two banks have special prescriptions how the yield is to be ascertained and capitalize it at 5% interest rate. It is of interest to note that the credit institutions which are mutual, i. e. not organized for money-making, loan only on stumpage at present exploitable. Altogether in bank circles only present values appear loanable. Future values do not appeal to practical financiers.

The reason why most of the banks do not loan except on forest property in connection with farms is explained by the fact that the latter are more readily saleable and they can be rented. Especially forests in intermittent management do not offer satisfactory security for loans and only their soil value may form a basis for them. In the valuation of 21 forests containing 23,000 acres the soil value figured out $17.70 per acre, while the yield value was $61.70.

The author then declares and defends the position that a forest which does not contain any usable stock furnishes no solid basis for a valuation which would be acceptable to bankers, the soil rent theory not furnishing such a basis. This theory is based upon one equation with two unknown quantities, the forest value itself and the interest rate.

With the usual interest rates too low or even negative values result, and the use of a lower rate on the ground of the increase in wood prices is looked at doubtfully by financiers. He sees this rise in prices partly in a lowering of money value, partly in development of means of transportation which cannot go on for a much longer time. He even foresees the possibility of a lower-

ing of prices due to hereto unopened sources of supply in export countries becoming accessible (!).

Die Beleihung von Waldungen. Forstwissenschaftliches Centralblatt. October, November, 1911. Pp. 523-535.

Yields of Coppice with Standards.

An excellent article by Mathey, describing a typical composite forest or coppice with standards gives a clear insight into this form of management which is most highly developed in France. Since we believe that this same form will serve in this country as a transition to timber forest in many Eastern woodlots, it is worth while to pay attention to the same as practiced elsewhere.

In France the production of oak workwood is perhaps the principal aim of this management.

The main problem is the determination of the overwood amounts.

Formerly, a large number of stems was supposed to be the desirable aim, and the three age classes were distributed in numbers as 1:2:3, etc., when 150 to 160 trees per acre were a maximum. Later, volumes were substituted for numbers; but, as in that case one stand of branchy overwood might produce a large amount of mere fuelwood, another with the same volume a larger amount of workwood, it became necessary to introduce a quality consideration, if the description was to furnish a true picture, so that Broillard introduced the distinction of stands rich in volume *(balivages riches)* and those rich in numbers *(balivages serrés)*. Experience showed that the maximum of workwood production could be attained when the three overwood classes were distributed as follows: 5-10% of the youngest; 25-30% of the middle-aged; 60-70% of the oldest of 17 inch diameter and over; altogether averaging around 50 trees. In this composition the oak standards produce 30 to 40 cubic feet of workwood per acre and year, or in value say $8 to $12. In the alluvial soils, south of Dijon the total wood production varies between 72 and 115 cubic feet, or 93 cubic feet per acre, and experience shows a workwood per cent. of 66, i. e. 62 cubic feet. With the lengthening of the rotation in the coppice the workwood per cent. increases; e. g.

if in a rotation of 20 years the product is 34 cubic feet in a 30-year rotation it will be, say 60, and in a 40-year rotation, 65 cubic feet per year; and the shaft length will also be improved.

To attain such remarkable production (in the balmy climate and first-class soil of France. Ed.), i. e. the maximum of work-wood in shortest time and with the least working capital, the following rules should be followed:

1. Avoid leaving too many trees for overwood in the younger age classes.

2. Leave the largest number in the oldest age class, the *élite* or *batallion sacré.*

3. Avoid the leaving of the less valuable and shady beech, which smothers underwood and oak.

4. In the underwood favor the rapid growers, elm, ash, birch, which furnish good enough fuelwood and do not impede the oak.

Mathey himself agrees that this form (as a permanency!) belongs to the fertile soils and can by no means be substituted for the timber forest everywhere.

The average results which are being attained in these, as yet imperfect, forests near Dijon are stated as $2.50 to $5.00 per acre, which the author thinks can be doubled.

Schweizerische-Zeitschrift für Forstwesen. September and October, 1911. Bulletin Société forestière de Franche-Comté et Belfort, 1909.

UTILIZATION, MARKET AND TECHNOLOGY.

Rüping Process of Impregnation.

Laris very briefly discusses critically the Rüping process of impregnation, introduced in 1903, which has in view the cheapening of treatment with tar oils.

After pointing out that of the many antiseptics proposed, only zink chloride, carbolic tar oils and chloride of mercury remain practicable and that zink chloride by itself is unsuitable because readily washed out and being injurious by its free acid to the rails, while tar oil impregnation is expensive (60 cents per tie) and the combination of tar oil with zink chloride costs only 15 cents—he formulates the requirements of a faultless method of impregnation as follows:

1. The liquor used, besides its antiseptic qualities, must have the

property of entering such an intimate chemical compound with the cell walls and any remaining protein contents, that all cells or vessels are permanently, mechanically closed on the outside to prevent effectively the entrance of atmospherilia and their concomitants;

2. That the metal parts coming in contact with the wood are not attacked by acids becoming free, since then the antiseptic effect is offset by mechanical wear.

The Rüping method (see F. Q. vol. III, p. 321) intended to cheapen the process and introduced on the Prussian and Imperial railroads, consists in fully impregnating the tie with tar oils and then partially evacuating them again, so that a normal beech tie contains only 45 lbs. of oil instead as formerly, 80 lbs. The removal of the surplus leaves the lumina of cells and vessels empty, and hence there is nothing left to seal these openings by the subsequent thickening of the oils; only the walls profit by the absorption of the phenyl acid.

That the full amount of tar oil is needed may also be deduced from the fact that the amount of a mixture of tar oil and zink chloride which a tie will take up amounts to 76 lbs.

The author doubts whether the impregnation of the cell walls alone suffices.

Kritische Beleuchtung des neuen Rüpingschen Schwellen-Tränkungsverfahren. Schweizerische Zeitschrift für Forstwesen. September, October, 1911. Pp. 255-259.

STATISTICS AND HISTORY.

Forest Ordinance of Würzburg.

Students of the early forest history of Germany will welcome the verbatim reproduction of the forest ordinance of Bishop Julius for the cloister forests of Würzburg from the year 1574, the property comprising at some time over 150,000 acres. This ordinance laid down the principles under which the property and other broadleaf forests were managed for centuries.

Forstwissenschaftliches Centralblatt. August, September, 1911. Pp. 476-496.

POLITICS AND LEGISLATION.

Correction of Torrents in Galicia.

An article by Kruk on this subject is interesting in showing by figures the influence of forest cover on waterflow, and in contributing to the evergrowing problem of waste land reclamation.

The Austrian government has begun in a small way to regulate the flow of Galician streams, but has not yet done much to correct the forest conditions which are claimed to be the cause of the irregularity of the river flow.

The writer claims that the forest per cent. of the watershed of the Dnjester and of the Vistula has in the last three decades been reduced from 37% and 25.8% to 25% and 18% respectively. At the same time destructive floods have appeared more frequently. While in the first 80 years of last century only four such floods were experienced (in 1813, 1843, 1867 and 1875), in the last 30 years 10 such floods have occurred (1882, 1884, 1889, 1895, 1899, 1901, 1903, 1906, 1907 and 1908), not counting minor annual floods occasioning small damage. He estimates the damage in the last 30 years as exceeding one hundred million dollars. Details are given of the 1884 flood, which inundated over 560,000 acres affecting some 400,000 people. Official data record

3,541 industrial concerns, damaged . Kr.	462,240
7,000 acres entirely washed away, ..	1,224,716
12,500 acres covered with gravel and débris, ...	1,359,780
Damage to riparian works, ...	24,492,340
Damage to roads, ...	439,386
Damage to railroads, ...	1,994,522
Kr.	29,972,984

or around $5,500,000, a loss occasioned within a few days. This, for a generally poor country, enormous loss has been several times repeated within these 30 years. While in well-forested watersheds the experience is that 30 to 35% of the precipitation reaches the rivers, on naked slopes some 25% more is shed over the surface.

In the Vistula watershed there are some 25,000 acres of absolute wastelands and nearly 330,000 acres of poor pastures bringing not over 20 cents taxes per acre. In the Dnjester watershed the area of wasteland is 17,000 and of poor pastures 280,000 acres. If the pastures were reforested the forest per cent. would rise to 46 and 32 respectively, and the regulation of waterflow would be increased to double its efficiency.

The character of the torrents and watersheds is described at length. The government has so far spent fifteen million dollars to merely regulate the flow in the rivers without taking recourse to reforestation.

Die volkswirtschaftliche Bedeutung der Wildbachverbauung in Galizien. Centralblatt. f. d. g. Forstwesen. August, September, 1911. Pp. 361-370.

OTHER PERIODICAL LITERATURE.

American Forestry, XVII, 1911,—

The Forest Ranger. Pp. 445-455.
An account of his work.

Forestry and the Utilization of Land. Pp. 456-462.

A Forest School in the Philippines. Pp. 517-521.
Description of the training given in the new school opened in June, 1910.

Public Aspects of Forestry. Pp. 525-530.

Forest Schools in the United States. Pp. 479, 522, 537, 542, 549.
Description of the courses and training in different schools.

Transactions of the Royal Scottish Arboricultural Society, XXIV, 1911,—

The State and Private Woodlands. Pp. 121-131.

The State in Relation to Afforestation. Pp. 150-153.

Larch Seed. Pp. 179-185.

Continental Notes—Germany. Pp. 194-208.

Quarterly Journal of Forestry, V, 1911,—

Experiments with Scots Pine Seed from Various Sources. Pp. 303-312.

How Big Timber is Felled and Manipulated in British Columbia. Pp. 317-335.

The Gardeners' Chronicle, L, 1911,—

Indian Loranthuses and Their Hosts. Pp. 104-105.

The Germination of Juniper Seeds. Pp. 127.
Recommends plunging into boiling water.

Graft Hybrids. Pp. 161-163; 185-186.

Juglans cathayensis. Pp. 189.
Description.

European Elms. Pp. 202-203; 221.

The Indian Forester, XXXVII, 1911,—

Recruitment of the Imperial Forest Service. Pp. 403-413.
The writer claims the new rules to be framed rather to encourage British universities to found chairs of forestry than for the benefit of the Indian Service.

A Method of Measuring the Height of Standing Trees. Pp. 454-458.
A modification of the Christen method.

Progress Reports of Forest Administration in the Central Provinces; in the Lower Provinces; in the United Provinces; in Jammu and Kashmir State; in Burma; in Mysore; in Bombay and Sind, for 1909-1910. Pp. 458-469; 500-507; 575-579.

Indian Forester, XXXVII, 1911,—

Influence of Forests on Drought. Pp. 477-489.
One more reply to Mr. Moore's assertions.

Journal of the Board of Agriculture, XVIII, 1911,—

Forestry in Norway. Pp. 385-394.
An historical account of the progress of scientific forestry.

School of Working Foresters, Forest of Dean. Pp. 498-500.
Statement of the course of training.

Willows and Their Cultivation. Pp. 557-562.
Conclusion of the series on this subject.

The Philippine Journal of Science: Botany, VI, 1911,—

Philippine Gymnosperms. Pp. 149-177.
Minute description of twenty-six species, with keys, distribution, bibliography, synonymy, and eight plates.

Two Important Borneo Timber Trees. Pp. 179-180.

Philippine Dipterocarpaceae. Pp. 231-287.
A treatment of this group along the same lines as the same author's account of the Gymnosperms (above).

Forest Leaves, XIII, 1911,—

The Saxon State Forest Academy of Tharandt. Pp. 72-74.
Description of the method of instruction.

Rhodora, XIII, 1911,—

Populus virginiana. Pp. 195-199.
Taxonomic.

Range of Betula lenta. Pp. 206-207.

Canadian Forestry Journal, VII, 1911,—

Ontario Shade Tree Legislation. Pp. 91-93. Given in detail.

Notes on Some Bavarian Forests. Pp. 101-107.

Log Scaling in British Columbia. Pp. 111-112.

NEWS AND NOTES.

The Forestry Branch of the Dominion of Canada has lately began to follow the methods of the U. S. Forest Service in sending out press bulletins. From these we cull the following facts of interest:

The survey work of the Riding Mountain Reserve has been completed by the Dominion Forestry Branch but there is still necessary a program of improvement work which will cover four or five years. To protect the timber from fire the trails must be extended so that every part of the Reserve may be reached quickly by the rangers and fire fighters; fire guards must be kept cleared every year, the rangers must be located permanently on the Reserves at suitable ranger stations where cabins, stables and corrals will be built by the Forestry Branch, and every ranger station must be connected with headquarters by telephone, so that news of a fire and a call for assistance may be sent quickly.

In outlining a policy calling for the protection and improvement of the Forest Reserves, the Canadian Forestry Branch is following the example of the most progressive countries in the world. Fortunately it is not necessary for Canada to depend upon experiments for experience in forest administration. The United States Forest Service, employing over 2,000 trained men and spending about $5,000,000 yearly, has during the past few years developed in the National Forests of the United States an almost perfect (?) system of fire protection, reforestation and timber administration. It is the intention of the Forestry Branch to benefit largely by the experience of the United States; a proof of this is that one of the officers of the headquarter's staff together with Mr. Albert McLeod, Chief Forest Ranger in charge of the Riding Mountains Reserve, will spend a portion of October studying the methods of administration and protection developed in the Superior National Forest in Minnesota.

Sixty per cent. of the hardwood used in Canada was imported from the United States in 1910. The United States, although with a much larger supply of hardwood on hand, is also seeing

that the annual consumption far exceeds the annual growth and that the virgin supply is being rapidly reduced. To stimulate attention to the growing of hardwoods, the Forestry Branch of the Dominion is taking a practical interest in the farmer's woodlots of Ontario, in an effort to make otherwise useless land supply hardwood lumber to an eager market, with profitable returns to the woodlot owner. Foresters will be supplied by the Department to look over tracts of timbered land, estimate the quantity of timber, advise as to what species to encourage or plant according to the locality and general conditions, and suggests a general working plan.

The exportation of pulpwood in a raw form from Canada into the United States is increasing yearly, and by just so much as this is so does Canada lose the benefits to be derived from manufacture and the increased value of raw products. Over a million and a half cords of pulpwood were cut in Canada during 1910, worth nearly nine million, eight hundred thousand dollars. Over sixty per cent of this amount was sent out of Canada without further labor being expended on it. The value of this pulp, derived from this wood, for which Canada received six million, two hundred and ten thousand dollars as pulpwood, is figured by the Forestry Branch at over thirteen and a half million dollars at the average prices paid in 1910 by United States importers of pulpwood. Thus Canada did not get one-half the amount she would have received if all pulpwood were converted into pulp on Canadian soil.

Within two years, the number of the kinds of wood used for laths in Canada has been doubled, statistics collected by the Dominion Forestry Branch for 1910 showing that twelve species of wood were used in the production of the 852,000,000 pieces of lath produced worth $1,943,000. The first six species in importance were spruce, white pine, cedar, Douglas Fir, hemlock and balsam which also are the woods used for some time in the manufacture of laths. The remaining six; jack-pine, red pine, yellow pine, poplar, basswood and larch are the new species increasing in importance. Spruce and white pine laths, the two most important species, show a decrease in 1910 from the year previous, but together form nearly seventy per cent. of the annual output.

Some million and a half more pieces of cedar were cut in 1910 than in 1909, and the amount for this species of seventy million pieces made up one-twelfth of the total. Prices ranged from $1.25 for yellow pine to $3.18 per thousand for poplar.

Over nine-tenths of the two billion shingles produced in Canada during 1910 were of cedar and over one-half of these were western cedar cut in British Columbia. The consumption of spruce and White Pine, for shingles has decreased suddenly in 1910, eighty-two per cent. less of the former being made than in 1909, and scarcely one-fifth the usual amount of white pine being produced. Nova Scotia and Quebec cut most of the spruce shingles. The White Pine shingles are mostly of the species Pinus, monticola and are cut in British Columbia. Nearly three million more of hemlock shingles were produced in 1910 than during the year previous and of the total of fifteen million pieces, over nine-tenths was produced in Ontario and Quebec. The above four species furnished over ninety-eight per cent. of the wood used in shingles. Balsam, Dougles Fir and Jack Pine, although of less importance, were used during 1910 in increasing quantities and for the first time; tamarack and red pine were reported as shingle wood. There was less fluctuation in the value of the species than formerly. Balsam shingles were the cheapest at $1.48 per thousand and tamarack the most expensive at $2.49.

The Commission for the Investigation and Control of the Chestnut Blight in Pennsylvania has issued very rigid instructions to all nurserymen and common carriers in regard to the inspection of all chestnut nursery stock. The instructions provide that no shipments shall be made until the stock has been examined by the Commission, and no trees can be forwarded which do not contain a certificate of inspection. Uninfected stock will be permitted to go out after it has been dipped in an approved fungicide, preferably Bordeaux mixture; while diseased trees will be burned.

The question of scientific management is at present receiving a great deal of attention from engineers and the administrative heads of industrial concerns, and its principles will no doubt eventually be given consideration in connection with forest manage-

ment. In October, the Amos Tuck School of Finance and Administration of Dartmouth College held a conference on scientific management at Hanover, N. H., which was attended by the leading exponents of scientific management in America and by some two hundred prominent manufacturers in New England. Among the various subjects discussed was one on the management of timber properties and lumbering by W. R. Brown, of the Berlin Mills Co. Informal addresses were also made by visiting foresters and lumbermen.

A reunion of the alumni of the Yale Forest School is to be held in New Haven on December 20 and 21, 1911. A brief program, class smokers and a banquet will comprise the chief features of the entertainment. Although the number of forest school alumni is comparatively small and they are scattered throughout the United States, the attendance, from present indications, promises to be surprisingly large.

Mr. Nelson C. Brown, Deputy Supervisor on the Kaniksu National Forest in Idaho has accepted the position of Assistant Professor of Forestry at the Iowa State College, at Ames. Mr. Brown received his collegiate training at Yale, graduating in 1906. He immediately took up graduate work in the Yale Forest School and in 1908 received the degree of Master of Forestry.

It is reported that Jas. O. Hazard, Yale Forest School '10, has been appointed assistant to Alfred Gaskill, State Forester of New Jersey, to have charge of shade tree work.

An interesting publication by the Department of Commerce shows the progrees of the United States—changes of conditions during the century—"in its material resources" from 1800-1911. It does so, however, only as far as financial changes express it. The population has grown from 5 1-3 million to 93¾ million (at the rate of 2¾ per cent. annually); the public debt advanced from $83 million through $2,675 million in 1865, to $1,015 million in 1911, a gratifying reduction per capita from $15.63 to $10.83. Money in circulation advanced from $4.99 to $34.35 (less than 2% annually.) Bank depositors have increased since 1820 from 9,000 to over 9 million; deposits from 2 billion dollars in 1875 to 15 billion in 1910 (Government receipts, from $2.04 per capita

to $7.45, one-half of what they were in 1866 (about 1% per annum.) Exports rose from $32 million to $2 billion—about 3¾ per cent.; while imports rose from $91 million to $1.5 billion—little over 2.5%. It is in these last two items that the story is mainly told, but an analysis of the make-up of exports and imports is necessary to make out whether this denotes progress or diminution of natural resources. We hope to return to this volume again.

A circular of the Department of Commerce and Labor shows the extraordinary increase in prices of many imported articles, like coffee, tea, rubber, wool, flax, hemp, tin, many of them having increased in price 80 to 90 per cent. in the last decade, showing change in conditions of supply in the countries from which shipped.

The Commission for the publication of an international forestry bibliography (see F. Q., vol. VIII, p. 270) announces, that it has at its disposal Mk 19,566, an amount just barely sufficient to venture on the work of compiling the bibliography of former years. The payment of subscriptions is being called for. The Forestry Experiment Station of Switzerland will do the editing at the expense of the Federal Government.

For the card catalogue of the new bibliography only 109 subscriptions are so far received which makes the cost on white cards $10 per 3,000 cards per year, beginning with the year 1911.

Professor Dr. Bühler Tübingen is the chairman of the Commission.

COMMENTS.

In a speech at Yellowstone Park, Walter A. Fisher, Secretary of the Interior, rather clearly stated that it was his conviction that the Forest Service should be in the Department of the Interior. This, coming from a man who is supposed to be friendly to the interest of the Forest Service, leads to rather serious doubts as to whether the position of the Forest Service is as stable in the Government administration as could be wished. If the question of the transfer of the Service is raised at the coming session of Congress, it will at least give an opportunity for the opponents of Government forestry to attempt a change, in the hope that it will be detrimental; while the friends of the Service may have difficulty in proving that the present organization is a correct one. To all who are familiar with the situation, it is evident that the remarkable development in National Forest work has followed—in part, at least—from its being carried under the Department of Agriculture. On the other hand, this department is fundamentally a scientific one whose function is mainly advisory, with little administrative authority outside of its own departmental functions. Yet, under it has developed the Forest Service, which has administrative jurisdiction over large areas of public land. In the Department of Interior, on the other hand, is vested the control of most of our public lands, and, theoretically, the Forest Service would logically fall under its jurisdiction. If all our government departments were the smooth-running, well-managed organizations they should be, it would make very little difference in our forest policy whether the Forest Service was transferred to the Interior Department. But, unfortunately, the traditions of the Department of the Interior, and particularly the Land Office, are against an able business administration of our public lands such as the Forest Service has inaugurated, and the transfer to this department would probably retard the development of a national forest policy to a very great extent.

The very thoughtful and readable article of Dr. Jentsch, one of the sanest foresters of Germany, made accessible by Mr. Dunlap in this issue, brings home to us the enormous advantage under

which the young generation of American foresters are starting their work, when compared with what the conditions were when Hartig and Cotta began their labors of reclaiming mismanaged forests. We have the entire theory and experience with an apparatus of knowledge, which was unknown to the early workers. For, whatever may be said against Mayr's ambitious attempt to write a volume of silviculture for the whole world, he is right in his contention that silviculture as far as it is based on natural laws, is universal; the fundamental principles involved are the same anywhere. But, to be sure, judgment as to their practical application under given conditions cannot be dispensed with any more than in any other business.

We have the advantage that we have nothing to unlearn or to undo. There is a German proverb, "the good is the enemy of the better." Having in silvicultural lines nothing good we have a chance to apply the better, provided we have an open mind and do not fall into the error of the early empiricists, of generalizing and limiting ourselves to the belief that one medicine can be the remedy for all evils.

The strenuous work of American foresters and pathologists in arresting and trying to prevent the introduction of so destructive an enemy as the White Pine rust could readily become deserves our highest commendation.

At the same time, it is only just to point out that the danger is to a large extent minimized, if not entirely removed, by the action of the German nurseries from which the disease was imported.

In Dr. Spaulding's bulletin, reviewed in this issue, the one nursery which probably has the largest trade of nursery stock for forest planting, Heins & Sons at Halstenbeck, is repeatedly quoted as the source of the evil. It is, perhaps, if not the only nursery which ships material of this description, yet the one which does so in the largest amounts.

From a representative of the firm we learn that to obviate any further propagation of the evil not only was the entire remaining stock of infected White Pine seedlings destroyed, but the nursery for growing this material removed six miles from the original location, and a German official of the pathological bureau employed to inspect the new plantation and make sure that no traces

of the fungus or its needed host-plant, Ribes, were to be found in or near it.

Knowing that the firm is a thoroughly honest and efficient one—as everybody who may have had dealings with them will attest—these statements may be relied upon. Self-preservation and the desire to keep its world-fame for reliability must be sufficient motives for such a concern not to remain under a cloud. *A man who has been sick, is not necessarily a sickly man.*

The above comment was communicated to Dr. Spaulding, and he takes issue with it.

It is fair that we should advise our readers of his strictures, which are that he is not satisfied with the representations of the representative of Heins Sons, and that, as late as 1911, fruiting bodies of the fungus were found in shipments from this nursery, and he considers this nursery a chronic case.

We are, of course, quite unable to decide whether or not the claims of the firm are *now* truthful, and agree with the writer that positive proof of the health of their stock must be forthcoming to remove all suspicion.

ERRATA

By inadvertence of printer and proof reader on page 408 of this volume in the last formula for the Biltmore stick the + sign has become a × sign, which readers will, please, correct.