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CONTENTS.

Page

Pitch Pine in Pike County, Pennsylvania __________ *John Bentley, Jr.* 1

The Movement of Wood Prices and Its Influence on Forest Treatment *B. E. Fernow* 18

An Expert Opinion on the Cornell College Forest Experiment _______ 32

An Adaptation of Methods in Forest Work _______ *William F. Hubbard* 91

The Minnesota Experiment __________ *S. B. Elliott* 99

Comments on "The Minnesota Experiment" __________ *B. E. Fernow* 105

Burning Tops __________ *Sylph* 114

Damages for Injuries to Forest Property __________ *Ernest Bruncken* 116

Considerations in Appraising Damage to Forest Property _ *B. E. Fernow* 119

Volume Tables __________ *Henry S. Graves* 227

Methods of Scaling Logs __________ *Henry S. Graves* 245

Forest Terminology __________ *B. E. Fernow* 255

Forest Legislation in California __________ *E. A. Sterling* 269

A Practical Xylometer for Cross-Ties __________ *Frederick Dunlap* 335

The Measurement of Sawlogs and Round Timber ______ *A. L. Daniels* 339

Note on Increment of Spruce in West Virginia and Fire Losses *B. E. Fernow* 346

Notes on the Growth of Red Cedar, Red Oak and Chestnut *H. S. Graves* 349

Methods of Making Discounts for Defects in Scaling Logs *H. D. Tiemann* 354

Catalpa Craze __________ *B.* 358

Notes on Forest Terminology __________ *E. Bruncken* 360

CURRENT LITERATURE, REVIEWS __________ 39, 143, 275, 362

For titles see Index.

OTHER RECENT LITERATURE, Titles __________ 43, 160, 289, 381

PERIODICAL LITERATURE __________ 46, 165, 290, 388

- Forest Geography and Description __________ 165, 290
- Forest Botany and Zoology __________ 46, 166, 297, 388
- Soil, Water, and Climate __________ 51, 169, 299, 391
- Roads and Survey __________ 55
- Silviculture, Protection, and Extension __________ 56, 172, 302, 393
- Mensuration, Finance, and Management __________ 65, 195, 313
- Utilization, Market, and Technology __________ 66, 202, 319, 405
- Statistics and History __________ 71, 203, 323, 405
- Politics and Legislation __________ 78, 209, 326
- Miscellaneous __________ 79, 210

NEWS AND NOTES __________ 82, 213, 328, 412

INDEX TO VOLUME III.

ACCLIMATIZATION of N. A. species in Germany, 389.
Accretion, value in Beech, 197.
Adirondacks, planting, 218, 419.
Algeria, Forest Law, 408.
Alps, planting practice, 394.
Alsace-Lorraine, statistics of forest administration, 74.
  planting plan, 75.
Altitude influencing light requirement, 388.
Artificial vs. natural regeneration, 57.
Austria, Forest school, 421,
  exhibits, 402.
  history, review 152.
  exotics in, 303.
  irrigation experiments, 299.
  pruning, cost, 304,
  silviculture, 302.
  statistics, 79
  wood prices, 27, 303.

BADEN, thinnings, results, 183.
  wood prices, 26
Bavaria, shelterwood system, 173.
  statistics, 204, 325.
  wood prices, 26.
Beech, value accretion, 197.
Belgium, lumber trade. 323.
BENTLEY, JR., JOHN, article, 1.
Black Forest, shelterwood system, 173.
Biology, *Lophyrus pini*, 169.
  range of species indicating, 305.
  heredity, 306.
  races, 307.
Boarmia crepuscularia and *consonaria*, notes, 169.
Bohemia, forest practices, 290.
Bosnia-Hercegovina, forest conditions, review, 143.
Botanical Congress, rulings, 2.
Borggreve method of thinning, 184.
BRUNCKEN, ERNEST, articles, 116, 360.
Brush forests, treatment in Bosnia, 149.

CALIFORNIA, forest legislation, 269, 274.
  forest planting, 408.
  lumber shipments, 208.
  reasons for forest planting, 193.
  state forester, 332.

Canada, cut in 1901, 76.
  fire losses, 211.
  forestry report, review, 376.
  lumber exports, 209.
Carency phenomena (Möller), 51.
Catalpa Craze, article, 358.
  note, 378.
Cedar, Red, growth rate, 349.
Champlain log rule, construction, 342.
Chestnut, growth rate, 352.
  volume tables, 231, 232, 238, 242.
Cimex on White Pine, 51.
Clearing System, variations, 393.
Climate, influence on growth rate, 167, 306.
  influence on light requirements, 307.
Coal companies, interests, 413.
Connecticut, forest laws, reference, 289.
  forestry association, 220.
Cooperage, statistics, 206.
Coöperative forest management, 326.
Coppice, loss of sprouting vigor, 191.
  suitable standards, 180.
Cornell Forest Experiment, by Dr. Jentsch, 32-38.
Cotton from pine, 319.
Crown classes in Sweden, 62.
Cruising vs. strip survey, 96.
Cull tables, 253, 356.
Cultivation, influence, 402.
Cup and Gutter system, review, 288.
Current Literature, 39, 43, 143, 160, 275, 289, 362, 382.

DAMAGE by game, evaluation, 197.
Damage to forest property, assessing, 116, 119.
DANIELS, A. L., article, 339.
Defects, methods of discounting, 251, 354.
Dendrology, Manual of Trees of North America, review, 151.
Density, see spacing.
Dulichium spathaceum. review, 379.
Dunes, fixation in France, 364.
DUNLAP, F., article, 335.
Durability influenced by position, 405.
  of telegraph poles, 203.
Dwarf growth, recuperated, 398.
Dwarf trees, 50.

ECOLOGY, Flathead Valley, reference, 289.
Economie forestière, Huffel, review, 40, 159.
Eisenach, Festschrift, review, 287,
ELLIOT, S. B., article, 99.
England, American trees in, 298.
  forest conditions, 292.
  wood trade, 203.
Exotics in Germany, 389.
  in Austria, 303.

FARM and Forest crop combination, 398.
Farm forestry in Pennsylvania, 312.
  in Hungary, 402.
  management and forest planting, review, 284.
FERNOW, B. E., articles and notes, 18, 105, 119, 255, 346, 361.
Fertilizer, cost of, 400.
  applicable in forest use, 193.
  effects on seedlings (Möller), 51.
  for forest crops, 391.
  recuperating dwarf growth, 398.
Finance, damage assessment, 116, 142, 197.
  determining a rotation, 318
  forest rent vs. soil rent, 65.
  influence of planting cost, 314.
  interest rates, 65, 198.
  practicability of management, 200.
  profitableness of regeneration methods, 59.
  profitableness of White Pine, 195.
  See also Prices.
Fir, Red, in Germany, 297.
  value accretion, 196.
Fires, attitude of lumbermen, review, 285.
  burning tops, note, 114.
  insurance, rates, 311.
  losses in spruce, 346.
  protection in France, 403.
    in Prussia, 309.
Fireproofing wood, objections to, 70.
Flathead Valley, forest ecology, 192.
Forest Congress, American, 158, 280.
Forest Economy, by Huffel, review, 40, 159.
Forest Influence on ground waters, 370
  on snow cover, 54.
Forest Litter, fixing nitrogen, 169.
  influence of removal, 302.
  water absorbing capacity, 170.
Forest protection, relation to fish and game, 211.
Forest rangers in Forest Service, 412.
Forest rent vs. soil rent, 65.
Forest Reserves in Idaho, review, 375.
  Regulations and Instructions, review, 275.
Forest schools in United States, 332, 416, 417.
Forest Service in United States established, 82.
  regulations in reserves, 275.
Forest Survey, methods in Yellow Pine and Red Fir, 92.
Forestry Literature, Jahresbericht, review, 38, 286.
  primer of, review, 158.
France, fire protection, 403.
  forest conditions, 362.
  instructive forest areas, 367.
  prices of oak, 196.
  reboisement cost and effect, 405.
  shelter wood system, 174.
Freight rates and tariff in Germany, 78.

GAME, damage, 197.
  protection, 211.
Germany, Colonial Policy, 77.
  exotics in, 389.
  forest types, forest ownership, 72.
  Forstwirtshaftsrat, 333.
  freight rates on wood, 78.
  tariff arrangements, 210.
Gipsy Moth, suppression, 51.
Graded volume tables, review, 374.
GRAVES, H. S., articles, 227, 245, 349.
Greece, forestry movement, 90.
Ground water, forest influence on, 370.
Group system, 172.
Growth in relation to weather, 167.
Growth, rate influenced by climate, 306.
  Red Cedar, Red Oak, Chestnut, 349.
Gum, Red, by Chittenden, reference, 289.

"HAUBERG" practice, 398.
Hawaii, Forester's report, review, 157.
Heredity, of form, 306.
Hesse, oak prices, 201.
HUBBARD, WM. F., article, 91.
Hungary, Experiment Station, 402.
  farm forestry, 402.
  Robinia in, 309.
  Sequoia gigantea, growth table, 402.
Hunting in Prussia, Statistics, 76.
Hypsometer, new, 195.

IDAHO forest reserves, review, 375.
Impregnation by Rüping process, 321.
works in United States, 323.
Improvement Thinning, review, 282.
Increment autograph, ?
Increment, influenced by irrigation, 172.
Increment influenced by light, 168.
Insect injuries to forest products, review, 282.
Insects, gipsy moth suppression, 51.
Lophyrus pini, 169.
nomenclature uniform, 168.
protection by traps, experiments, 404.
the nut weevils, review, 283.
Interest rates for different forest types, 198.
variations, 65.
Interglacial flora, review, 379.
Irrigation experiments in Austria, 299.
Irrigation influence on increment, 172.

JACK PINE regeneration, 108.
Jahresbericht für das Jahr 1903 and 1904, reviews, 38, 286.
JENTSCH, Dr., on Cornell Forest Experiment, 32.

LARCH forest near St. Petersburg, 308.
Light, effect on soil and production, 167.
influence on increment, 172.
Light requirements and climate, 307.
in relation to altitude, 388.
Litter, see Forest litter.
Locust, note, 378.
Log rules compared, 343.
construction, 339.
Log scale, discounting defects, 354.
Lophyrus pini, biology, 169.
Lumber cut in Lake States in 1904, 77.
Lumbermen, attitude towards fires, 285.

MANURE, see Fertilizer.
Maple Sugar Industry, review, 281.
Marchet, Holzproduktion, review, 287.
Match wood, requirements, value of species, 66.
Mensuration, construction of volume tables, 227, 244.
cull tables, 253, 356, 357.
discount for defects, 249, 254.
Mensuration, instruments for scaling logs, 245, 246.
log rules construction, 339.
compared, 343.
measuring Cross-Ties, 335.
measuring saw logs and timber, 339.
scaling logs, 245, 254.
Meteorology at Eberswalde, 301.
Mine Timbers supplanted by steel, 320.
Minnesota Experiment, forest reserve, 99, 113.
Mixed forest, practice in Alps, 397.
Montana, park planting at Helena, 328.
Mutation, de Vries theory, review, 380.

NAVAL STORES in Germany, revival, 69.
New Hampshire forest conditions, review, 150.
New Zealand forestry, 296.
News and Notes, 82, 213, 328, 412.
Nitrogen in forest litter, 169.
Nomenclature of Insects, uniform, 168.
North Carolina, examination of forest tract, review, 288.
Norway, ancient oak forest, 80.

OAK, ancient forest in Norway, 80.
prices in France, 196.
Red, growth rate, 350.
rise of price, 29, 201.
Ontario Forest Reserves, 410.
Ontario Oregon lumber industry, 207.
Organization simplified, 316.

PALM, Royal, note on identity, 51.
Papaw for paper, 320.
Paper from papaw, 320.
Pennsylvania forestry movement, 90.
farm forestry, 312.
Pentatoma baccarum and *prasinum*, 51.
Periodical Literature, 46, 165, 290, 388.
Philippines,
forestry conditions, 87.
forestry report, review, 279.
Physiology of resin flow, 48.
Pine, carency phenomena, 51.
Longleaf, range, new station, 166.
natural regeneration in Sweden, 294.
Pitch, in Pennsylvania, 1.

Pine, Red, regeneration, 108.
  Red Rot in (Möller), 47.
  root development, effect of soil, 53.
  Western Yellow, yield table, 77.
  White, Cimex on, 51.
    decline of, 77.
    lumber price, 29.
    rate of production, 195.
    reproduction, 100, 108.
    profitableness, 195.
    stumpage prices, 21.
    supplies, 208.
    wood turned into cotton, 319.
  Yellow, rise of price, 29.
Pinus rigida, growth in Penna., 1.
Pitch Pine, growth tables, 16.
  in Pike County, Penna., 1.
Plantations in Russian Steppe, 63.
Plantings in Adirondacks, 218.
Planting, cost influencing profits, 314.
  in California, 193.
  plan, sample from Alsace, 75.
  practice in Alps, 395.
  by railroads and coal companies, 413, 414.
  spacing, 311.
  spruce with ball, 312.
  spruce and thinning, 185.
  vs. natural regeneration, 103, 109.
Pure vs. mixed forest, 303.
Preservation, by Rüping process, 321.
  plants in United States, 323.
Preservatives for building materials, 70.
Prices, method of averaging, 24.
  Wood, Movement, article, 18.
  oak in Hesse, 201.
  influenced by diameter, 196.
  use, 29.
  stumpage in Bosnia, 146.
    in Sweden, 295.
    in Switzerland, 202.
  of wood in Austria, 303.
    in Prussia, 72.
    in Switzerland, 27.
    in United States, 28.
Profitableness of regeneration methods, 59.
Protection against locomotive fires, 309.
  against sunscald, 64.
Pruning cost in Austria, 304.
  method and cost, 202.
  review, 378.
Prussia, fire protection, 309.
  forest department, budget, 203.
  forest types, forest ownership, 71.
Prussia, hunting statistics, 76.
  movement of wood prices, 25.
  wood prices, 72.

Rabbit bush, source of rubber, 50.
Reboisement, cost and effect in France, 364, 405.
Red Cedar, growth rate, 349.
Red Fir (Douglas) in Germany, 297.
Red Oak, growth rate, 351.
Red Pine regeneration, 108.
Red Rot in Pine, (Möller), 47.
Regeneration, methods, value of different, 56.
  terminology, 57.
  natural systems in Bavaria, Black Forest and France, 172, 173.
  of Jack Pine, 108.
  natural vs. artificial, 57, 103, 111.
  of Red Pine, 108.
Resin flow, physiology, 48.
"Resurrection" cuttings, 149.
Reviews:
  Akerman's Improvement Thinning, 282.
  Anderlind's Verhütung der Hochwässer, 42.
  Beauverie's Le Bois, 287.
  Braniff's Determining Timber Values, 374.
  Canada Forestry Report, 1904, 376.
  Chittenden's New Hampshire Conditions, 150.
  Chittenden's Nut Weevils, 283.
  Clothier's Farm Forestry, 284.
  Davey's Tree Doctor, 378.
  Dengler's Verbreitung der Kiefer, 42.
  Dimitz's Verhältnisse Bosnien's, 143.
  Eckstein's Forstschutz, 42.
  Forest Congress Proceedings, 280.
  Forest Reserve Regulations, 275.
  Fox and Hubbard's Maple Sugar Industry, 281.
  Gershel's Terminology, 160, 267.
  Green and Waid's Trees suitable for posts, 378.
  Hartz's *Dulichium* in interglacial moors, 379.
  Hawaii Report, 157.
  Heck's Durchforstung, 40.
  Herty's Cup and Gutter System, 288.
  Hopkins' Insect Injuries to Forest Products, 282.
  Huffel's Economie forestière, 40, 159, 362.

Reviews, continued,
Idaho Forest Reserves, 375.
Johnson's Guide to Government Lands, 375.
Kirchner's Spezielle Oecologie, 42.
Marchet's Holzproduktion und Handel, 287.
McMurray's Type Studies, 377.
Oesterreich. Forstwesen Geschichte, 152.
Oppokov's Swamps regulating waterflow, 370.
Philippine Report 1904, 279.
Pinchot's Primer, 158.
Reed's North Carolina Forest Tract, 288.
Reynard's L'Arbre, 38.
Riebel's Waldwertrechnung, 41.
Sargent's Manual of Trees, 151.
Schenck's Lectures on Silviculture, 372.
Sterling's Forest Fires and Lumbermen, 285.
Tolsky and Henry's Eaux souterraines, 369.
deVries' Species by mutation, 380.
Wimmenauer's Jahresbericht, 38, 286.
Woodruff's Forest Laws, 159.
Roads, economy of, 55.
profitableness in Wurtemberg, 304.
Robinia pseudacacia in Hungary, 390, 402.
insect enemies, 414.
Root development of pine, effect of soil, 53.
Root growth, studies in Switzerland, 46.
Rot, Red in Pine, 47.
Rotation, methods of determining, 318.
Roystonea floridana, identity, 51.
Rubber, derived from rabbit bush, 50.
Rüping process of impregnation, 321.
Russia, plantations in Steppe, 63.
statistics, 325.
wood supplies, 28.

SAFETY strips in Prussia, 310.
Saw, crosscut by compressed air, 331.
Saw mill on wheels, 79.
Saxony, budget, 325.
wood prices, 27.
Scaling logs, methods, 245, 254.
Schiller, relations to forestry, 328.
Schools, forest, notes, 332, 416, 417.
Seaside, plant succession, 391.
Seedlings, effects of fertilizers, 51.
Seeds, prices, 90.
vitality, 390.
Selection forest undesirable, 397.
yield table, 147.
Sequoia, Fossil, new species, 50.
Sequoia gigantea, growth in Hungary, 402.
Servia Forest Conditions, 407.
"Shade-coefficient," new term, 168.
Shade-leaves, transpiration, 49.
Shelterwood system in groups, 172.
Silviculture, notes from Austria, 302.
Biltmore lectures, review, 372.
biological basis, 305.
in Bohemia, 290.
coppice with standards, 180.
methods described, 172.
biology relation, new attitude, 60.
open questions, 192.
open stand management, 303.
pure vs. mixed forest, 303, 304.
Sizes of small trees, 390.
Snow cover in field and forest, 54.
Soil, effect of light, 167.
Soil rent vs. forest rent, 65.
Sowing, broadcast, results, 412.
Spacing in Alpine regions, 396.
in relation to spreading habit, 181, 311.
Species by mutation, review, 380.
Spreading habit of species, 182.
Spruce, Douglas, in Germany, 297.
planting and thinning, 185.
rate of growth, 346.
seeding, 415.
Standards, suitable in coppice, 180.
Statistics, Alsace-Lorraine administration, 74.
Austria, 76.
Bavaria, 204, 325.
Belgium, imports and exports of wood, 323.
Canada, cut in 1901, 76.
export in 1903, 209.
fire losses in 1903, 211.
cooperage, 205.
Prussia, hunting, 76.
Russia, 325.
Saxony, 325.
Stem analysis, improved method, 219.
Stem classes by Heck, 41.
STERLING, E. A., article, 269.
Strip survey vs. cruising, 96.
Stumpage prices, 21, 146, 202, 295.
Sun-leaves, transpiration, 49.
Sunscald, protection against, 64.
Swamps regulating water flow, 370.

Sweden, export regulations, 69.
forest conditions, 292, 296.
forest experiment station, 61.
Switzerland, education, 205.
studies of root growth, 46.
shelter wood system, 174.
stumpage prices, 202.
White Pine in, 195.
wood prices, 27.

TANBARK, oak, industry declining, 68.
Tariff revision in Germany, 78.
Taxation, principle of, 209.
Taxodium imbricarium, new species, 166.
Terminology, by Gershel, review, 160.
article by B. E. Fernow, 255, 268.
Notes on, 360.
of regeneration methods, 56.
Tharand Forest Academy, history, 410.
Thinning, degrees in Sweden, 63.
effect of early, on spruce, 185.
Freie Durchforstung by Heck, review, 40.
results in Baden, 183.
Wagener method, 188.
in Zurich City forest, 400.
TIEMANN, H. D., article, 356.
Timbers of commerce and their identification, review, 51.
Timber values, by Braniff, reference, 289.
Timbering in mines supplanted by steel, 320.
Torrents, cost of fixing in France, 405.
Torreya, physiology of reproduction, 164.
Trametes pini (Möller), 47.
Transpiration in relation to water supply, 167.
by sun- and shade-leaves, 49.
Turpentining, cup and gutter system, review, 288.
Type Studies, review, 377.

UNDERPLANTING, experience in Sweden, 294.
United States, California, lumber shipments, 208.
forestry methods compared with German, 80.
forest schools, 332, 416, 417.
Forest Service established, 82.
movement of lumber prices, 28.
Oregon lumber industry, 207.
Puget Sound exports, 207.
Vermont forest laws, 289.

VALUATION of forest damage, 135.
Valuation, Waldwertrechnung by Riebel, review, 41.
Value accretion, exemplified in fir and beech, 196.
of timber by grades, review, 374.
Vermont, forest laws, reference, 289.
Volume, simple determination, 313.
tables, Chestnut, 231, 232, 238, 242.
graded, review, 374.
method of construction, 227, 244.

WAGENER method of thinning, 188.
Water flow influence of forest and swamp, 370.
Water supply, relation to transpiration, 167.
West Virginia Spruce, rate of growth, 346.
White Pine, see Pine.
Wind mantle, species for, 191.
Wood Commerce, Marchet, review, 287.
Le bois, review, 287.
Movement of Prices, 18–31.
prices in Prussia, 72.
quality influenced by density, 187.
Red Fir vs. Blue Gum, 210.
strength of mine timbers, 321.
Woodlot in Pennsylvania, 312.
and farm management, review, 284.
Woody plants of Ohio, Key, 391.
Working plans methods, adaptation, 91, 98.
Wurtemberg, wood prices, 26.

YIELD TABLES, selection forest, 147.
Western Yellow Pine, 97.

XYLOMETER for Cross-Ties, 335.
precision,

ZURICH CITY forest, practice in thinning, 400.

PITCH PINE IN THE OPEN

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PITCH PINE IN PIKE COUNTY, PENNSYLVANIA.

Among our native pines in the northeast, perhaps none has been less studied than the common Pitch Pine (*Pinus rigida* Mill.), which is so familiar to all who are acquainted with the forests of our eastern States, from Maine to Georgia. The reason for this neglect is evident; the Pitch Pine has never been thought of as possessing any great economic value, and lumbermen of the east have been concerned chiefly with the White Pine (in earlier days) and, in these later times, with the Yellow Pine and the Longleaf Pine. But with the growing scarcity of more valuable timber, the Pitch Pine may yet assume an important position in the list of timber trees, in the east; already, it is locally used for bridge-timbers, piles, beams, and other construction timbers, and for the manufacture of excelsior; it has even been used for paper pulp of an inferior grade, and during the last summer was bringing $14 per thousand in Milford, Pike County, Pennsylvania, where it grows in great abundance, and is relatively cheap. Furthermore, with the advance of forestry and its problems it has become evident that a species may have a value other than a purely economic one; it may, on account of its peculiar silvicultural characteristics, be of great service to the forester in assisting him to produce a good crop of some more valuable species. It may have some obscure but important function to perform which contributes materially to the welfare of the forest as a whole.

With a view to obtaining more reliable figures and data concerning the life history and growth of the Pitch Pine, it was made the subject of a careful study by Professor H. S. Graves, Director of the Yale Forest School, assisted by members of the Junior

Class. The work was conducted during the summer of 1904, in Pike County, Pa., near Milford, and the results of the study are herewith presented to the readers of the FORESTRY QUARTERLY.

A brief description of the physiographic features of the region under consideration will not be out of place, and may assist in the correct understanding of the problem.

Pike County occupies the northeastern part of the State of Pennsylvania, and is bounded on the northeast and southeast by the Delaware River, and on the west by Wayne and Monroe counties. In general, the region may be described as a plateau 1,000 to 1,400 feet above the sea, which has been dissected by the streams into numerous ridges, benches, and valleys, the latter frequently becoming steep-sided enough to be termed ravines. The streams of the county, which are abundant, though not of great size, all empty into the Delaware River, and afford waterpower for many sawmills. The county, as a whole, is preeminently adapted, both as to soil and climate, for forest growth, and with the exception of a few fertile valleys into which the agriculturalist has had the courage to penetrate, and those tracts (unfortunately large) where forest fires have raged, the territory is covered with a thrifty forest of mixed hardwoods and pines, which reaches its finest development in the ravines, where rich soil, plenty of moisture, and protection from high winds all unite to make ideal conditions for forest growth. The soil of the higher ridges is of a much inferior grade; consequently, in those situations there is a poorer forest, both as to development and as to the species composing it. But in general, soil, rainfall and climate all conspire to make Pike County a natural home for forests, as is evinced by the large number of native species there, and the luxuriance with which they grow.

We are now ready to consider the Pitch Pine in detail, and shall notice, in order, the following points:

1. Local Distribution.
2. Form and Development.
3. Silvicultural Characteristics.
4. Reproduction.
5. Growth in Volume, Diameter, etc., as shown by Tables.

1. Local Distribution.

Among the silvicultural characteristics of the Pitch Pine, two stand forth prominently as determining, in a large measure, its limits of local distribution. These two characteristics are: (1) its extreme intolerance of shade, and (2) its ability to withstand adverse conditions, such as poor soil, exposure to wind, fire, etc. As a result of the first of these two qualities, the Pitch Pine is forced to retire from the more favorable situations, and put up with the poorer ones, not because of its inability to grow on good soil, but because the hardwoods, being more tolerant, crowd it out; and Pitch Pine of any size or value is extremely rare in the forests of the lower slopes and ravines, where the conditions are the best. As a result of the second of the two qualities mentioned, the Pitch Pine is able to grow and thrive where many another tree would find the conditions of life too severe. Consequently, as we ascend the slopes, and the fertility of the soil decreases, the Pitch Pine becomes more abundant because the hardwoods with which it has to contend find a less congenial situation, and cannot grow so luxuriantly. On some of the lower slopes and benches we find the Pitch Pine in its best development, because the conditions are so balanced that both the Pine and the hardwoods can exist in mixture, and the latter tend to force the Pitch Pine to grow straight and tall. (This point will be more fully discussed in the next section).

It is on the tops of the ridges, however, that the Pitch Pines occur in greatest numbers. Here the rocky glacial soil and the exposure to wind and fire, make life too hard for almost everything but the Pitch Pine, Scrub Oak, Sweet-fern, and Huckleberry bushes. The pines which grow here are quite apt to be of small size and much misshapen, but nevertheless they persist, are extremely prolific, and scatter the seeds for other generations which may find better conditions. In a word, the Pitch Pine is a "left-over" tree; wherever the conditions of life are too severe for other trees, there it manages to exist and reproduce its kind.

2. Form and Development of the Pitch Pine.

This question may best be considered by observing the trees of all ages, from seedlings to veterans, in relation to their surroundings: hence I shall discuss, in succession, typical trees growing in the open, in pure stands, and in mixtures.

(a) *Pitch Pine Growing in the Open.*

As the tree requires plenty of light for its best development, we find good specimens for study growing in the open. Abandoned fields form a splendid place for the seedlings to grow in, and many of the old pastures about Milford are dotted with the young trees, which are generally vigorous, thrifty and straight, unless trodden upon or otherwise injured when in the seedling stage. The crown is full and bushy, and soon assumes a broadly conical shape, the top often becoming somewhat flattened as the lateral branches develop strongly. The growth in height proceeds but slowly; observations upon a great number of seedlings from 1 to 10 years old showed the average increase in height to be only 6 inches per year. This is due to the vigor with which the lateral branches grow; indeed, one of the lateral branches may become even stronger than the leader, and overtop it, thus giving rise to a crooked bole and causing the tree to look very irregular. As the tree advances in age the same general shape is maintained, but the lower limbs are quite likely to die because they are deprived of sufficient light; and these dead branches, remaining attached to the bole, give the tree an untidy appearance. The percentage of clear bole in trees growing in the open is scarcely worth mentioning.

Mature trees in the open are almost invariably irregular, and rarely exceed 50 feet in height. The bole is seldom straight, and never clean, and has a rapid taper; the crown is fullest at the top, where the stem branches profusely, but becomes thinner as we descend until, near the ground, there remains only a few straggling branches. The limbs which leave the trunk about half way up are frequently large, awkward, and cumbersome, so that they droop at the tips, while little patches of foliage springing from adventitious buds on the trunk and branches add still another touch of irregularity; altogether, the impression left upon the mind is that of a tree which is far from neat or conventional, but often quite picturesque.

(b) *Pitch Pine in Pure Stands.*

Pure stands of Pitch Pine are comparatively rare; a few such stands were studied during the summer, and in all but one instance the trees composing them were young and of about the same age.

The first of these, covering perhaps an acre, consisted of trees about 18 years old, and ranging in height from 10 to 16 feet. All of these trees had been seeded from one old tree situated in the center of the stand. The young trees stood very close together; a sample square rod at a distance of 12 yards from the parent tree showed 27 young trees, of which 11 were dominant. As a result of this crowding, the crowns were thin and spare, narrowly cylindrical in shape, and occupied only the upper quarter of the stem; the crowding also caused a more rapid growth in height than is usually the case with trees in the open, and the stems were in general straight, with only a moderate taper, but covered with a mass of dead and dying twigs and branches. The dominant trees were naturally the most vigorous of the lot, and there were trees in all the intermediate stages from dominance to suppression. It was interesting to note how many trees were thriving, notwithstanding the fact that they were growing so close together; it would have been impossible for them to grow so crowded, had they been surrounded by hardwoods instead of growing pure.. But the foliage of the Pitch Pine growing pure is not so heavy but that plenty of light filters through to the ground, a fact which accounts for the density of the stand, and attested by the presence of several seedlings of Gray Birch and Red Maple in the thickest part of the stand.

The second pure stand observed was a little larger (2 acres or more) and the trees averaged a little older (25 to 28 years); but the height was noticeably smaller for the age, being only from 14 to 16 feet. This was undoubtedly due to the fact that the soil was extremely poor. As before, the thin, scraggly crown occupied only the upper fourth of the moderately straight, but poorly pruned stem. The light conditions were about the same as in the previous case, but the whole stand presented a more unhealthy and untidy appearance, due, as stated above, to the poor quality of the soil.

A third pure stand, consisting of older trees and occupying an area of from fifteen to twenty acres, was observed by Prof. H. S. Graves and Mr. W. O. Filley, and to them I am indebted for the use of the figures which follow.

The stand was located in New Jersey, about one mile south of Port Jervis, and a short distance east of the Delaware River, upon a loose, moderately fine, fresh, sandy soil, covered to the depth of an inch with a litter of pine needles and leaves from the hardwood undergrowth. The half-inch of humus present was not very well decomposed, but was thoroughly mixed with the soil. The stand, which had undoubtedly sprung up in an old field, was practically even-aged (about fifty years), and was for the most part fully stocked, that is, it had a density of 1.0. The dominant trees were apparently perfectly sound, and many of them were bearing cones; but all the trees of the stand were very poorly pruned. In some places, an undergrowth consisting of young Chestnut, White Oak, Black Oak, Soft Maple, and Gray Birch, formed a "second story" twelve to fifteen feet in height, while in other places a sparse growth of tolerant herbs and shrubs occupied the ground. Occasional seedlings of White Pine and hardwoods were also noted.

A sample plot of one-sixteenth acre was laid out, and the following figures obtained.

Pure Stand of Pitch Pine in New Jersey, Near Port Jervis, New York.

Diameter breasthigh inches	*Number of trees on 1/16 acre*			
	Dominant	*Crowded*	*Oppressed*	*Suppressed*
3	.	.	.	1
4	.	.	.	5
5	.	5	6	2
6	.	3	.	1
7	5	4	.	.
8	8	.	.	.
9	3	.	.	.
10	1	.	.	.
11	.	.	.	.
12	1	.	.	.
Total	18	12	6	9
Average diameter	8.2″	5.9″	5.0″	4.3″

Average age, 50(?)years. Density, 1.0.

Height: average, 44 feet; maximum, 52 feet.

Crown length: average, 15 feet; maximum, 21 feet.

Crown width: average, 12 feet; maximum, 15 feet.

Diameter growth: average, 1 inch in 10 years; maximum, 1 inch in 6 years.

(c) *Pitch Pine in Mixed Stands.*

The trees with which Pitch Pine is oftenest associated are the Oaks, Chestnut and White Pine; and this mixture occurs quite frequently on the gentle slopes and the numerous benches of the region. Wherever this mixture is found the woods are either rather open at present, or have recently been so; or else the Pitch Pines are the dominant trees. In other words, Pitch Pine is so intolerant that I do not believe that any seedlings which might chance to start life in an even-aged mixed stand would ever reach maturity unless something occurred to open up the woods enough to permit the entrance of plenty of sunlight. In those mixtures where the Pitch Pine is the dominant tree, I believe that it is because it is older than the other trees of the mixture. This could happen in either of three ways: (1) the Pitch Pine withstood a fire which killed the other species; (2) the other species were cut down or severely thinned, allowing the pines to remain; (3) the Pitch Pine occupied an abandoned field first as a pure stand, the hardwoods coming in later. So intolerant is Pitch Pine, that I believe it impossible for the tree to hold a dominant position among hardwoods unless it has had some advantage in early life. More than likely, it is the remnant of some former growth, and does not belong to the same generation as do the trees that at present surround it. Pitch Pine, to persist in mixtures, *must get the start, be a dominant tree when young, and always remain a dominant tree,* for as soon as its neighbors overtop it it weakens and dies. Much evidence is at hand to testify to the truth of the statement regarding it ability to resist fires. In many cases, Pitch Pines persist with scorched and blackened boles, while all around them the charred remains of hardwood stumps are putting forth new shoots; thus showing, beyond question, what has been the history of the stand.

Having shown that it is possible for a tree so intolerant as the Pitch Pine to exist as the dominant species in a mixed stand, let us turn to the consideration of its typical form and development under such conditions. Measurements of more than sixty typical trees of this class were taken, and showed the following average results:

The trees grow to be from sixty to seventy feet in height (exceptional trees measured 80 feet), with a slow-tapering bole sufficiently straight to yield two or three good sawlogs, ten inches or more in diameter inside the bark. The percentage of clear bole ranges from fifteen to thirty-five, twenty per cent. being an average figure. Most of the trees possess a slight excentricity of bole (1 to 1½ inches), which seems to increase with the steepness of the slope on which the trees grow. The crown occupies about one-third of the total height of the tree, and varies in width from twelve to twenty feet. It is almost invariably one-sided, the result of wind or of crowding, and branches profusely towards the top, where it is fullest. It rapidly thins out toward the bottom, where it is succeeded by a number of dead branches adhering to the tree, greatly reducing the amount of clear lumber. The shape of the crown in all instances seems to be the direct result of the light relations as they may be affected by the surrounding trees. If the pine has plenty of room, its crown will be full and thrifty; if it is crowded by the hardwoods, the crown will show the effect, and become irregular.

It is this type of Pitch Pine—dominant among hardwoods—that is of the greatest economic value. The hardwoods have stimulated its height growth enough to make the bole grow fairly straight, and to maintain its fullness well up into the crown. Many a square mile of Pike County is covered with a growth of Pitch Pine which has withstood all adverse factors, and which is dominant among the hardwood sprouts which belong to a later generation. As an illustration of this type of forest growth, I submit an enumeration of the Pitch Pine on five sample acres, chosen from a number made in the vicinity of Milford. Together with the forest description which follows, these figures may serve to give the reader some idea of the conditions under which Pitch Pine most frequently grows. In this enumeration, only dominant trees are included; that is, trees which are, or will be, merchantable; all suppressed and dying trees are excluded from the count.

PITCH PINE IN MIXTURE WITH HARDWOOD.

MILFORD, PIKE COUNTY, PENNSYLVANIA.

Diameter breasthigh Inches	*Number of dominant trees per acre*				
	Acre 1	*Acre 2*	*Acre 3*	*Acre 4*	*Acre 5*
6	7	8	35	24	5
7	2	9	23	9	2
8	1	5	10	4	2
9	3	5	5	4	3
10	2	2	1	4	3
11	2	3	.	2	3
12	1	1	1	2	3
13	2	.	2	1	3
14	3	1	.	1	1
15	3	1	1	1	.
16	2	.	.	.	1
17	.	1	2	1	.
18	.	.	1	.	.
19	.	.	.	1	.
20	.	.	.	.	1
Total	28	36	81	54	27
Average diameter	10.35″	8.53″	7.54″	8.13″	10.18″

These five sample acres were situated on a ridge which ran north and south, with gentle slopes toward the east and west. The absolute altitude was somewhat over one thousand feet, the relative altitude about two hundred. (Above the Sawkill). The soil was an extremely stony sandy loam, of little depth and covered by a good litter of leaves. The humus was from ½ to 1 inch in thickness, and rapidly disintegrading. A dense undergrowth of Scrub Oak and Huckleberries make it impossible for the Pitch Pine to reproduce itself, but there were numerous seedlings of White Pine, and many hardwood sprouts. The trees in the mixture were Pitch Pine, Chestnut, Black, Red, and Scarlet oaks, and some scattered young hickories. Silviculturally, the place looked almost hopeless, as is the case with miles of Pike County, where the fires have left desolation in their track. The Pines were the only merchantable trees on the tract.

3. SILVICULTURAL CHARACTERISTICS.

As mentioned in preceding paragraphs, the most striking characteristics of Pitch Pine are its intolerance and its ability to withstand adverse conditions. It seems to be most intolerant in youth, for in many cases, where older trees occur in mixtures, there may be seen beautiful reproduction of White Pine and hardwoods, but not a single seedling of Pitch Pine, notwithstanding the fact that old trees bearing cones are in the immediate neighborhood. This would seem to indicate that unless an abundance of light is present, it is impossible for Pitch Pine seeds to germinate.

A series of observations were made on trees varying in age from twelve to twenty-five years, and it was found that when growing singly, the minimum amount of growing space with which a Pitch Pine must be supplied in order to develop into a thrifty tree was a circle whose radius was from eight to ten feet. In proportion to their height, seedlings require even more growing space, and it seems safe to say that they will not thrive unless there is sufficient light for the growth of grass. When growing in groups, however, which they frequently do, the individual trees get along with less space, and are mutually protective. It is a common sight to see a group of young Pitch Pines entirely surrounded by hardwoods, which gradually encroach upon the group, suppressing the outermost Pines at first, and at length reducing the number. The trees in the center usually survive, if they can attain a height which will enable them to get light from above.

The Pitch Pine will grow on almost any kind of soil, but prefers a sandy, loamy, or even a stony soil to the heavy clay soils. It can get along on comparatively small amounts of moisture, hence we find it growing on the most exposed ridges where the soil is often very dry and stony.

One of the most valuable characteristics of the tree is its ability to resist the attacks of fire; to this fact it owes its very existence to-day in many parts of Pike County, where there have been extensive forest fires which have destroyed almost everything excepting Pitch Pine. The reason why it can still live while other trees perish, is because of its heavy bark, which in mature trees is often as much as one and one-half inches thick. Even if the bark be burned through, the tree seems to be able to resist the attacks of fungi and insects, and if badly burned, will develop sprouts from the dormant buds in the root-collar.

Pitch Pine is useful silviculturally because it acts as a nurse to more valuable species, especially White Pine. The shade cast by Pitch Pine is never dense, and as the tree requires considerable growing space, we often find light conditions similar to those aimed at by the forester when he makes reproduction thinnings. Some of the finest reproduction of White Pine in all Pike County occurs in the woods where Pitch Pines are common in the mixture. For instance, one of the types of forest most frequently met with is the "Oak-Chestnut-Pine" type, consisting of hardwood sprouts 30 to 40 years old, with old Pitch Pines scattered through as the dominant trees, while Scrub Oak, Sweet-fern, and Huckleberry bushes cover the forest floor. Here and there are little groups of mature White Pines which have escaped the axe and fire, and these scatter their seed to good purpose, for in many of the more favorable spots great numbers of White Pine seedlings may be discovered. Further study will doubtless reveal the fact that Pitch Pine is a valuable silvicultural agent, and one with which the forester could ill afford to part.

4. Reproduction of the Pitch Pine.

We have observed that Pitch Pine is quite likely to be crowded out of the more favorable positions, and forced to endure many hardships during its existence. One would naturally think that in order that the species may be perpetuated vast quantities of seed must be produced to offset the great losses which must inevitably result from the vicissitudes of life. Such we find to be the case. Cones have been discovered on little Pitch Pines only eight years old, showing how early in life the tree makes an effort to continue the species. But in almost every case, the cones from such very young trees were observed to be sterile.

Trees from twenty to thirty years of age seem to be capable of producing some fertile seeds, but do so at the partial expense of their vitality. A great many of the cone-bearing trees of about this age were observed to have thin, spare crowns, although enjoying a reasonable amount of light. It is only when a tree has a superabundance of energy—more than enough to carry on the process of assimilation and growth—that it produces an abundance of fertile seeds and at the same time maintains its health and vigor. Hence we look to the middle-aged and mature trees, situated either in the open or in thin woods, for an example of the typical seed-tree.

The seed-tree in the open has a full bole with a fairly rapid taper, and a widely spreading, well developed crown, which usually occupies somewhat more than half the total height of the tree, and is rather orbicular than conical in shape. One excellent tree observed had a breasthigh diameter of twenty inches and a height of 53 feet. Seed-trees in mixed stands present nearly the maximum height growth of the species; the best ones have well developed but flattened crowns, which occupy about one-third of the total height of the tree.

The power of bearing seed continues into old age, for the greatest amount of reproduction can be traced to the old trees, even making allowances for the superior advantages of dissemination which they enjoy by reason of their height. An old tree in the open, with its greater crown, has more room for producing cones, and bears more seeds than does the smaller-crowned tree of the mixed stands.

Opinions as to the frequency of seed years differ. From observations of cones on the trees, it would appear that seed-years occur at intervals of from three to five years. But when the seedlings about a parent tree are observed it is found that they can be grouped roughly into age-classes, and the results of this method indicate that seed-years are not of such frequent occurrence. This last method is of doubtful accuracy, however.

The cones of Pitch Pine are very persistent, for which reason the seeds frequently ripen and fall from the cone while it is still upon the tree. The number of cones falling to the ground before opening is inconsiderable. When the cones are dry, the scales open, and the seeds, being winged, are easily scattered by a warm, dry wind. In moist weather, the scales swell, and the cones are tightly closed.

As to the distribution of the seed, wind seems to be in most cases the important agent. The seeds do not form an article of diet for birds, hence they cannot be made responsible for the distribution. The light winged seeds may be blown by the winds a considerable distance, especially if there is a crust of snow or ice upon the ground; shifting their position from day to day they may at length come to rest and germinate a long distance from the parent tree. Areas of Pitch Pine reproduction have been seen where the seeds had been blown to a distance of 110 yards, and scattered seedlings have been found on open tracts, which indicate that under favorable circumstances the seeds may be carried to a much greater distance. It is evident that seeds will be scattered farther upon open ground than where other trees interfere. Seed-trees at the edge of a wood bordering some old pasture are in a favorable position to scatter their seeds over a wide area.

Whatever else the young Pitch Pine seedling has or does not have, there is one thing that is absolutely indispensable to its existence, and that is light. It must have light, and have it abundantly, if it is ever to arrive at maturity. Even in woods of small density, there is very little reproduction of the Pine, and what there is, is usually dwarfed or creeping. It is unnecessary to say that heat is required in proper amounts for germination and subsequent development, but comparatively little moisture is needed. Old fields and abandoned pastures seem to form a very favorable seed-bed for Pitch Pine in the open, while in the woods open spots where grass is beginning to creep in or where the leaf litter is not deep, form good places for the introduction of the seed.

A single tree in the open has been observed to scatter its seed to a distance of over 100 yards, while trees at the edge of a piece of woods are responsible for seedlings nearly 200 yards away. Old roadways and open places in the woods are quite likely to present their share of young Pitch Pines, and many examples of this are to be found in the woods about Milford. As to the density of seeding, the following illustration may be presented,—

An even-aged pure stand of seedlings, all of which came from the seed of a single tree in the open, showed a density which decreased from the tree outward; but that part of the stand which displayed the best developed trees was in the form of a ring of several yards width, and about twelve yards distant from the old tree. Plots of one square rod each were selected, at different distances from the seed-tree, and showed the following results from the figures of Mr. S. L. Moore:

Plot No.	*Distance from seed-tree Feet*	*Number of trees*	*Number of dominant trees*	*Average age Years*	*Average height Feet*	*Average diameter breasthigh Inches*
1	3	70	19	17	15	1.75
2	35	27	11	17	18	2.50
3	150	18	6	20	20	2.50

The figures show that the close to the parent tree a proportionately small number of dominant trees are found, and that they do not develop as well, for the average diameter of the trees in Plot 1 is smaller by 25 per cent. than the diameter of the trees in Plot 2. The height growth of trees in Plots 2 and 3 is also better than in Plot 1. The percentage of first class dominant trees resulting from natural seeding, averaged from the above figures, is 34 per cent.

Pitch Pine is one of the few conifers that will send up sprouts from an old stump. Sprouting takes place from dominant buds in the bark, especially in the region of the "root-collar," and occurs most frequently after a change in the environment or life of the tree has happened, as after fire, cutting, thinning, or mechanical injury; stumps cut off, or burned to the ground, will send up abundant sprouts, and trees suddenly exposed to increased light by thinning will sprout from the bole in order to supply more foliage. In one case noticed, a tree which had been injured sent up from the stump sixty-four sprouts. Another young tree, cut close to the ground, began to develop most of its dominant buds within ten days. But the sprouts very seldom attain any merchantable size, and their chief function is to enable the tree to survive injury and to withstand adverse conditions.

5. Tables of Volume and Growth.

The following tables are based upon figures averaged from stem analyses of sixty-seven Pitch Pines cut during the summer of 1904 near Milford, Pa. Most of these trees were dominant among the hardwoods, and ranged in age from 49 to 185 years; they were situated partly on a gentle eastward slope, and partly on a nearly level bench. The soil was a fresh sandy loam of good depth, and the humus well disintegrated and mixed with the soil. Most of the hardwoods among which these Pines grew were not above 40 or 50 years old, and were sprouts from old stumps, so that the Pitch Pine had enjoyed the advantages of a dominant position for some years. At the time of cutting some of the younger Pines were being crowded by the hardwoods, however, and the crowns already showed the effects. The undergrowth consisted of Scrub Oak, Huckleberry bushes, etc., with occasional seedlings of White Pine.

In all cases where cordwood is mentioned in the following tables, it includes timber down to three inches in diameter inside the bark. No logs were cut which measured less than six inches in diameter inside of the bark at the small end. Where board feet are given, Scribner's Rule has been used. Diameter breasthigh is always taken outside the bark.

(I will take this opportunity to say that with these tables it was hoped that some definite figures could be given out with regard to the number of trees to the acre which, at different ages, would constitute a fully stocked stand, but owing to the incompleteness of the figures, this cannot at present be done. The method pursued was this: the crown of each tree cut was accurately measured, and compared with the height of the tree and its general development, etc. By computing the amount of growing space required by each tree, the number per acre could be found. But the results showed such wide differences that it was decided to wait until more figures, based upon trees which had been growing under known conditions, could be collected. With proper data to work from this method ought to afford some interesting and valuable result.)

John Bentley, Jr

TABLE I.—VOLUME OF PITCH PINE.

Diameter breasthigh	Fuelwood		
	45′-54′ trees	55′-64′ trees	Trees of all heights
Inches	Cubic feet	Cubic feet	Cubic feet
9	9.6	....	9.6
10	11.9	15.7	12.3
11	14.6	17.8	15.5
12	18.0	20.5	19.2
13	22.1	23.9	23.4
14	27.0	28.1	28.3
15	....	33.4	34.0
16	....	39.8	40.1
17	....	47.8	47.3

TABLE II.—VOLUME OF PITCH PINE.

Diameter breast-high	Lumber and Fuelwood					
	One-log trees		Two-log trees		Three-log trees	
Inches	Bd. ft.	Cords.	Bd. ft.	Cords	Bd. ft.	Cords
9	99	0.045	28	0.023	..	....
10	22	.059	33	.028	43	0.017
11	27	.075	41	.033	52	.021
12	33	.095	51	.039	63	.026
13	41	.120	64	.047	76	.031
14	52	....	79	.057	93	.038
15	..	....	97	.069	114	.046
16	..	....	117	....	141	.056
17	..	....	....	....	177	.070

TABLE III.—BARK AND SAPWOOD IN PITCH PINE.

Diameter breasthigh	Percentage of the total volume that is bark	Percentage of the wood volume that is sapwood
Inches	Per cent.	Per cent.
9	25.6	84.8
10	24.9	83.4
11	24.2	82.0
12	23.7	80.3
13	23.2	78.4
14	22.6	76.5
15	22.0	74.5
16	21.5	72.5
17	21.0	70.5

TABLE IV.—RATE OF GROWTH IN DIAMETER OF PITCH PINE.

Age	Diameter breasthigh	DIAMETERS INSIDE THE BARK					
		1′ high	11′ high	21′ high	31′ high	41′ high	51′ high
Years	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
10	2.7	2.1	...	...	...	...	...
20	4.6	4.0	0.6	...	...	...	...
30	6.4	5.8	2.7	0.8	...	...	...
40	8.0	7.4	4.6	2.7	0.2	...	...
50	9.4	8.8	6.2	4.3	2.0	...	...
60	10.5	9.9	7.4	5.6	3.6	0.7	...
70	11.2	10.6	8.4	6.7	4.9	2.5	...
80	11.6	11.0	9.1	7.7	6.0	3.7	0.6
90	11.9	11.3	9.6	8.3	6.8	4.8	2.0
100	12.1	11.5	10.0	9.2	7.4	5.7	3.2

TABLE V.—RATE OF GROWTH IN VOLUME OF PITCH PINE.

Age	FUELWOOD		LUMBER		
	Whole trees		One-log trees	Two-log trees	Three-log trees
Years	*Cu. ft.*	*Cords*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
40	6.5	0.073	....	....	....
50	10.6	.119	20.0	29.7	....
60	13.4	.161	24.3	36.9	47.2
70	16.3	.182	28.0	42.9	53.8
80	17.7	.198	30.5	47.1	58.4
90	18.8	.210	32.3	50.3	61.9
100	19.6	.219	33.8	52.6	64.4

THE MOVEMENT OF WOOD PRICES AND ITS INFLUENCE ON FOREST TREATMENT.*

A Preliminary Study.

One of the best known and most widely quoted of English statisticans, Mulhall, in his History of Prices (1885), after giving what he considers pertinent statistics, states the following conclusions: "The supply of timber being practically inexhaustible, there has been a fall of 36% in price (during the period from 1850 to 1851), notwithstanding the rapid increase in consumption." And again: "The area annually felled by woodcutters is only 19,000,000 acres and may be increased to 40,000,000 before reaching the annual average increase of forest trees."......"There is, therefore, no ground for the alarm that our posterity in the next century may have to pay famine prices for timbers; on the contrary, we may look for a continued fall in prices as facilities increase for conveying timber cheaply to the seaports of the world."

If we believe Mulhall's statistics and deductions, the efforts to induce private forest owners as well as governments to engage in forestry—*i. e.*, to treat forest properties with care for the future instead of exploiting them roughly—would be futile, at least with regard to private owners, for their proper policy would certainly be to go on exploiting for the best present advantage since a constant decline in wood prices would surely make the holding of forest properties for the future unprofitable, let alone spending money on their care. For, whatever incentive governments may have for entering the forestry business, private owners can be expected only to consider the financial gain; and, if the price of forest products is bound to decline continually under methods of exploitation—*i. e.*, more harvesting of Nature's bounty, it is not likely that forest production, which involves expenditure, either direct or indirect, to secure a new crop—a financial sacrifice for a benefit in the future—will prove attractive.

Fortunately for the advocates of forestry methods the in-

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*Read before Section I of the American Association for the Advancement of Science, Dec., 1904.

sufficiency of the data as well as the impropriety of the deductions by the English statistician can be readily proved. Indeed, anyone familiar with the subject, studying Mr. Mulhall's statements, will realize at once the slipshod and mistaken use of irrelevant data which characterize the work of the authority quoted. Especially the conclusions as to the supplies for the future lack a proper basis, but the determination of the movement of prices is no less unsatisfactory.

We need not analyze the method by which the data have been combined, the price-level method, regarding the value of which opinions differ, but can content ourselves with the proof that the data themselves are useless and irrelevant to the discussion for which they have been used. In passing we may, however, state that nearly all other authorities discussing price changes during the same period show for all commodities combined, increase rather than decrease in prices.

The prices which Mulhall used are deducted from the Government Trade and Navigation tables which give the quantities and values of the annual imports into Great Britain of lumber and other wood materials. Apparently no better data could be thought of for getting a true expression of the world's valuation of timber supplies, since Great Britain imports practically all her wood consumption and draws from all parts of the world to an amount which now exceeds $125,000,000 annually. But, unfortunately, there is serious doubt whether these figures represent what they pretend to represent, namely, real value, for as Palgrave (Dictionary of Political Economy) points out, the values up to the year 1854 were founded on a valuation settled in 1694 (!) so that at the end of the period it was found that the real values exceeded the official ones by $22\frac{3}{4}\%$. Nor is there more confidence to be placed in the valuations since that time, for they now are merely declarations by the importers and, according to Palgrave, are "only estimates of what they ought to be worth," with a tendency to adopt some average price for whole periods. Confirmation of this lack of reality in the figures comes from the discovery that not only prices remain remarkably uniform, neither rising nor falling as Mulhall predicts, but that for 25 years, at least, the prices at which hewn timber is listed are practically the same which are applied for manufactured lumber.

Only since 1899 does a change in this method seem to have taken place, for since that time the difference between the two classes becomes considerably greater and the prices are rising. Under these circumstances the figures which lead Mulhall to such sweeping, but to our mind erroneous, deductions must be considered quite useless for the purpose of discussing the movement of prices and of making predictions for the future.

There are still statisticians employed who "count hogs, dogs, and logs alike," and as a consequence the material furnished by them is rarely satisfactory for the use of the economist. It is not yet generally recognized that the schedule for the collection of data at least must be devised by an expert in each field, and the analysis and discussion of the data promises also full value only when in similar hands.

While for everyday business in the single case, random personal judgment may still be placed ahead of statistical and mathematical methods, for the large and more complicated enterprises, especially those which contemplate a long future and involve millions of capital, and for determining tendencies of national economy, correct statistics and correct mathematical methods in their use should alone satisfy us as a basis for the judgment which is to determine whether and at what sacrifice to embark in new undertakings. And the most indispensable basis for argument to enter upon them is a forecasting of the tendency of prices in the given business.

There is probably no other business which requires such probability or expectancy calculations more than the forestry business, since it deals with the production of a crop which matures only in many decades or centuries; he who sows is not likely to reap the fruit of his labor except in special cases. The forester works for a long future and another generation. He must therefore proceed in the faith that the usefulness of his crop of 50 or 100 years hence will be at least what it is supposed to be at the present and that the expenditure in its production tied up for such a long period will be returned with interest and profit in due time. This faith of the forester in the future, this willingness of making present expenditures or foregoing present revenue for the sake of a future revenue, uncertain in amount, must be based upon the experience of the past and upon the general considerations of the character and usefulness of his material which will make it continuously desirable to mankind. Hence to him a study of the tendency of wood prices becomes paramount. It is not, however, so much the prices from year to year or from period to period of short range which are influenced by multifarious local conditions of trade and which are very variable, as it is the long range survey that concerns him, in which the inequalities, the ups and downs, are evened out and the few-deep-seated secular causes and the constant, abiding, economic conditions find expression.

In the price curves accompanying this paper it will be seen that any position—rise, fall, or equality of prices—can be proved from them according to the selection of the shorter periods for consideration. Only the long period tells the truth.

Unfortunately data of sufficient accuracy and value for long periods are scarce. Moreover, the true change in value of any commodity is obscured by the fact that other values included in the value of the commodity, especially that of money and labor, which cannot be discounted in values of products change also.

In case of wood, we must not overlook that *lumber* prices do not really represent *wood* prices, for the price of a manufactured product like lumber at places of consumption includes the cost of manufacture, the cost of transportation, of brokerage, etc., and finally is influenced by the competition of manufacturer; the changes in all of which conditions are reflected in the price. Thus it has happened that, owing to improvements in machinery, cheapening of transportation, change in methods of trade and active competition, lumber prices (which in a way are continental) have for quite long periods remained stationary, while stumpage prices, *i. e.,* wood prices pure and simple (which are local) have risen. For instance, the stumpage of White Pine in Michigan rose during the 20 years from 1866 to 1887 from $1.00 per thousand feet, by constant steps without a break, to between $4.50 and $6.50, while White Pine lumber (log run) fluctuated during the whole period only between $11.50 at the beginning and $13.00 at the end, being never higher than $14.00 and for five years of that period sinking as low as $9.00 and $10.00.* From this example alone we see

*Report of Saginaw Board of Trade.

that lumber prices do not move proportionately to wood prices and cannot by themselves be used for the discussion of the latter. For our purpose, namely, to find a financial incentive for forestry practice, *i. e.,* wood production, it is, of course, the stumpage prices that we must rely upon.

The same difficulties which beset all inquiries into changes of prices and their interpretation are, of course, present in the inquiry into the changes of wood prices, namely, changes of money value, the variation in quality of material, the proper determination of average prices, the method of comparison of periodic changes, and finally the difficulty of delimiting the territory for which the calculations apply.

In regard to the influence of change in money values, we readily perceive that an increase in the value of money would have a tendency of depressing the value of commodities relatively, while the opposite would be true with a decrease in the value of money; only if this value has remained the same would the apparent rise or fall of prices of a commodity be a true expression of its changed value? Actually all economists are agreed, I believe, that money values have sunk, some figuring the decrease for 50 years up to 1885 at the rate of 1½%, others at less than 1%. If, as some contend, the rise in wages represents a fall in value of money, unquestionably such fall is attested by the change in the scale of wages.

For our inquiry we may be satisfied to state that if we find any increase in prices of wood it would have been greater than the apparent one, if no depreciation of money value had taken place.

With regard to the variation of quality we must keep in mind that wood is a material which serves two very different classes of purposes, namely, such in which the substance is consumed or destroyed in its coherence, namely, as fuel, paper pulp, excelsior, etc., and such in which the substance is used as a whole for shapes, lumber, construction. While in the first class of uses, quality of material and especially size, although a requisite, may vary within wide limits, for the second class of uses, more definite qualities and especially certain size which in wood is itself a quality, are requisite. Size is a function of age and the other qualities which make satisfactory logs for lumber manufacture, namely, clear material, free from loose knots and small taper, are also in part results of age. Hence this use of wood and this portion of the forest growth, the log timber, is the more important one: and here the time element enters prominently, which makes wood from the economic point of view a material *sui generis* different from any other product, owing to the long time which its production requires.

As a consequence we may find for a given region, as for instance Massachusetts, that the price for fuelwood has not changed or, if anything, has decreased while that for saw timber has increased, the reason being that the local supply of material only fit for firewood has become relatively greater since the cut-over lands were robbed of the old timber and young or inferior growth has become a general feature. Similarly we will find the prices of the best quality lumber varying in a different manner from those for inferior grades, the latter as a rule being in over-supply and sagging in price.

Again the importance and hence the quantity of consumption of different kinds of wood varies. The soft woods and especially the conifers, answering the greatest variety of purposes, are the largest and most important requirement of our civilization, the hardwoods being less prominent in our consumption in the proportion of three to one. Hence, although prices of the latter may be higher, their economic importance is, generally speaking, inferior to that of conifers. Especially when we survey the world's sources of wood supply we must not class the large amount of hard, beautiful, tropical wood, which are mainly fit for ornamental purposes with our structural timber supply of the temperate zone. The value of ornamental and structural woods differs in economic importance as does the value of diamonds and iron in the mineral field; we can much more readily dispense with the former than with the latter. This difference in the uses of wood introduces also a difference of position of the different classes with reference to substitutes; the possibility of substitution influencing both the employment and the price of wood. Coal, for instance, is the great competitor of fuelwood alone, while iron and stone compete with structural wood, and ornamental woods find little competition except among themselves.

Regarding the territorial limits for which a comparative study may be made with the hope of a more general application of the result, it must be kept in view that the constant development of means of transportation tends to obliterate local markets and to establish continental and world markets and prices, even for wood. Nevertheless, wood being a bulky material, is less readily shipped for long distances than, for instance, grain or other produce; especially with the inferior wood materials, because of their relative abundance and low price, the limits of profitable shipments is soon reached. Hence we shall find greater fluctuations in local prices for certain classes of woods than for others, and greater fluctuations for wood in general than for other commodities. Local supply plays in wood a more important role in price making than with materials which can be more readily transported and hence in order to arrive at conclusions which may not be tinged by local influences beyond measure, a large territory must be taken into consideration, which presents either a singularity of position, as for instance England, which imports practically all her wood supplies, or one which presents a great variety of economic and timber supply conditions such as the United States, or at least some large State like Prussia.

The methods of averaging and comparing prices from period to period and over long periods with their many ups and downs have been discussed with much detail by a number of economists. Among them the method devised by Lehr (Statistik der Preise by Julius Lehr, 1885) may perhaps claim greatest mathematical accuracy. He determines by the use of least squares the proper values of the initial and the final price, and with these values determines the percentic progress of the average curve, which equalizes all the rises and falls. Where no mathematical accuracy is demanded and annual prices are available, the mere graphical method leads to sufficiently close results, especially if the relation of the scales for the ordinates of price and time are so chosen as to secure a tolerably flat curve of price notations, when with some judgment the eye can approximate initial and final average values; then by dividing the initial into the final value, the price change per unit is found and from a compound interest table the annual rate of progress can be read. Lehr's calculations of the initial and final value are, however, simple enough to make the method preferable wherever greater accuracy is desired, and have been employed in the following discussion. The rate thus established is the average annual compound rate of increase (or decrease) and, if established for long periods, may be considered a safe guide for future expectations as long as no radical changes in conditions take place.

To come now to a concrete inquiry as to what has occurred in the matter of wood prices, we are fortunate in having data at hand which are exceptionally valuable for the purpose of exhibiting tendencies.

The Prussian government is the owner of somewhat over 6,000,000 acres of woodland distributed over all parts of the kingdom, representing about one-third of the total forest area of Prussia and one-sixth of the forest area of Germany. This large forest property has been carefully managed for 100 years or more and we have a record of the results of the annual sales of all the wood cut on this area. The cut regulated so as to represent the average annual growth comprises from year to year very nearly like or very gradually increasing amounts. Before 1868, *i. e.*, before the aggrandizement of Prussia to its present size, the annual cut was only 140,000,000 cubic feet, since that time it amounted to between 250,000,000 and 300,000,000 cubic feet, including wood of all descriptions, the total sales at present representing annually from $13,000,000 to $15,000,000. This wood is sold, at least the great bulk of it, in the forest, not on the stump but cut into log lengths and set up in cords, so that the price contains that much labor cost. This cost has amounted in the average for the last 20 years between 2/3 and 4/5 of a cent per cubic foot. The character of the material has changed somewhat, the proportion of the more valuable workwood having increased over the firewood, that is to say, out of the same annual cut a larger proportion of log and bolt material has been secured. This charge has been specially pronounced in the last twenty years when the so-called timberwood per cent., *i. e.,* wood over 3 in. in diameter rose from 29% to over 50%, while before that time the proportion of firewood to log wood varied but little. Yet, strange as it may appear, this change is not appreciably reflected in the price, probably because the influence of importations has tended to keep prices of log timber down.

Market conditions have, of course, also changed, especially through increase of importations, which have trebled in the last 30 years, and railroad development by which some of the wood supplies of the eastern provinces have become available; but since the total cut has varied only slightly, this latter cheapening influence of accessibility of new supplies may be left out of consideration. On the other hand, industrial development generally has increased the demand to such an extent as to overcome whatever other cheapening influences were at work. At any rate, the fact that prices for wood under these conditions have increased with remarkable steadiness during the last 72 years is beyond question. An inspection of the price curve shows that during the period from 1830 to 1863 variations from year to year were only small, probably on account of the easy adjustment of local supply to local demand. After that period when active railroad building and modern industrial development changed methods, violent disturbances are more frequent, but withal the average rise of prices proceeded at about the same or an only slightly accelerated rate. This rise was figured by Lehr for the first 52 years to have been at the rate of 1.36% per annum. For the years 1885 to 1888 the data were not at hand, but assuming equality of price during those three years, we find that since 1865, when Germany began to import large quantities, in spite of the ever increasing imports which have proceeded at a rate of about 2½% per annum, prices increased for that period at a rate of over 1%. Figured for the last 15 years the rate was not less than 2% and for the last ten years more nearly 3½%. Or, taking the entire period of 73 years the progress was at the rate of 1½%. That is to say, the prices now for the home-grown wood of all descriptions are double what they were 50 years ago and nearly treble what they were at the beginning of the period.

Lehr, who discusses with great care and detail the data furnished by the Prussian Statistical Bureau for the period to 1882, figures also from similar data the changes for other of the German States but for shorter periods, and finds:

For Wurtemberg, 1850-1882, a rise at the rate of	1.75%
Saxony, 1850-1859,	2.01%
Bavaria, 1850-1859,	2.94%
Baden, 1850-1859,	2.61%

These are, to be sure, much smaller, more densely populated, and industrially more highly developed territories.

A number of local price fluctuations and for different species of wood show invariably the same tendencies. For instance during the period from 1800 to 1879 for different districts in Prussia, the price for oak increased by 1.16% to 4.33%; for pine by 1.1% to 4%; for spruce by 1.09% to 1.95%; for beech by 1.08% to 2.38%.

The influence which development of means of transportation exercises is interestingly exhibited in a comparison of the price prevailing in the district of lowest and that of highest price. This relation changed in the years from 1860 to 1890 from the proportion of 100 to 600, gradually to the proportion of 100 to 220, or one quarter of the original difference.

Lehr's conclusion from a careful survey of prices generally, contrary to Mulhall's position, is that forest products have risen more rapidly than agricultural products and more than wages.

Another investigator, Dr. Jentsch, investigating the same records, comes to the same conclusions, namely:

1) The tendency of prices for agricultural products as well as wood has been toward a rise.

2) Prices for wood have increased more rapidly than those of these staples (imports!), less rapidly than of potatoes, beef and butter.

3) Prices for wood have risen more *steadily* than those for agricultural products.

4) The relations between prices for wood and for wheat and rye shows a tendency in favor of greater rise in profits from forestry than from grain production.

5) Prices for wood promise to rise further for an indeterminable time.*

Other indications from the same field may be adduced.

In Saxony, from 1850 to 1893, the average price of wood per cubic foot in the State forests (similarly ascertained as in Prussia) was from 5.6 cents to 9.9 cents, *i. e.,* at a rate of somewhat less than 1½% per annum.

In Austria, still one of the surplus and export countries, a painstaking investigation by Guttenberg develops that in the

*Zeitschrift für Forst-und-Jagdwesen, 1887.

50 years from 1848 to 1898 the rate of increase in prices has been for workwood at a rate between 1.6% and 2%, for fuelwood between 1% and 1½%, the prices having doubled or nearly so.

For Switzerland in the State forests of the Canton of Zurich, carefully collated statistics for the period of 1871 to 1899 start with a minimum price for workwood of 11.5 cents in 1871, rising steadily with small fluctuations to 15.5 cents in 1889, corresponding to a rate of just 1% per annum, while the average price for all classes of wood without distinction rose from 9.2 to 12.4 cents with a maximum of 13 cents in 1897, corresponding to an annual rise of just the same rate. At present good stumpage for workwood is worth in the neighborhood of 17 cents per cubic foot for coniferous kinds. Switzerland seems to pay as high prices as England if the prices in the English import tables, 15 to 16 cents for "hewn fir," can be trusted to at least approximate the truth.

Comparing prices in different localities of Prussia Dr. Jentsch finds that in the eastern well-forested districts the workwood prices during 1895 to 1899 averaged 7.4 cents as against 9.5 cents in the Rhenish provinces, that is 13% higher in the western territory, while lumber prices averaged 45% higher.

In passing we may note the position of Europe with regard to wood supplies. The three great industrial nations, Germany, France, and England, have long ago ceased to secure their needed supply from home sources, and rely on imports to an extent of 15%, 80%, and 90%, respectively, of their consumption. The so-called surplus countries on which they draw are Russia, Sweden and Norway, Austria, and the small Slavonian States, with Canada and the United States to a limited extent. With the exception of Russia, the Slavonian States, and Canada, the others have undoubtedly overstepped the limit of that forest exploitation when new growth is replacing what is being cut. In the case of Sweden at least the danger has been recognized and restrictive legislation has been passed within the year. Russia undoubtedly has still large supplies, but the Siberian forest area, according to all accounts, is not as promising as it had been credited.

Turning to the United States, everybody who has to do with timberlands in this country knows from experience of the rise of stumpage prices in a general way, but definite data are mostly private and inaccessible. We have, however, at our command, a valuable series of lumber prices compiled for the period of 1840 to 1891 for the Aldrich Senate Committee and from 1890 to 1903 by the Department of Commerce and Labor.

We have pointed out that the price of lumber does not go parallel with stumpage prices, the tendency being to more uniform and relatively cheaper lumber prices owing to the continental competition in the market as well as to the cheapening of processes of manufacture, trade, and transportation. Moreover, the different grades of lumber vary considerably in price and fluctuate differently, so that it is difficult to get at an average price.

Nevertheless, when prices of lumber of all grades rise steadily, the ultimate cause may be sought in the increased cost of the raw material.

In the reports referred to we have a short and probably valueless series of prices for White Pine in the log which came as near as possible to stumpage prices, and we find that from 1859 to 1890 the price rose from $8 to $12 with prices of $15 to $16 during the war years. Leaving these latter excessive rates out of consideration the rise during the 32 years appears to be at a rate of not much more than ½%. Hemlock logs rose during the same period from $6 to $8 or at the rate of about 1%. White Pine lumber (1 inch clear) on the other hand rose from about $30 in 1840 to $50 in 1891, or at the rate of 1%, but from 1890 to 1900 the rate of rise in Uppers was from $44 to $57.50, or 2½%, while from 1900 to 1903 the phenomenal rise to $80, or at a rate of over 6% has taken place. At the same time the price of No. 2 1-inch boards rose from $16.80 to $24, or at the rate of 2½%. The change in quality appears in the two converging curves of the earlier period, the quality Uppers combining the two after 1890.

It is now well known that the end of White Pine as the great lumber staple is near at hand and hence this sudden rise. But the price of other woods also has risen, if not quite so rapidly. For Hemlock inch boards the rate during the last 25 years has been 2¼% and during the last 10 years 3½%, namely, from \$12 to \$16.80, and if we go back 45 years and leave out of consideration the influence of the war years, the increase has been at the rate of $1\frac{3}{4}\%$.

Oak has steadily risen from 1868 at a rate of $1\frac{1}{4}\%$ (from \$30 to \$44.80) and of $1\frac{1}{2}\%$ during the last decade, being now about 50% higher in price than at the beginning of the period, 35 years ago.

Yellow Pine, of which still large supplies are in sight, has shown little change, having in the last 14 years hardly moved upward, although fluctuating \$4 and more within that period. This evenness of price is due probably to the rapidly increasing competition among mill men in the southern section of the country, for it is well known that stumpage prices have especially in the last 10 years grown at an almost incredible rate, stumpage of pine being held now at \$2 to \$3 per M, which 10 years ago was bought for 50 cents to \$1.

We may then conclude that as far as lumber prices reflect stumpage prices these, even in the United States, in spite of the apparently large home supplies, have steadily risen and are now rising much faster than in the period before 1890. In fact, we have reason to believe that stumpage prices are rising relatively faster than lumber prices for the latter have a tendency to be depressed, as we have stated before, by trade competition and by new supplies becoming available and being thrown on the market; the necessities of the case forcing mill men, especially in times of industrial retrogression, to accept inadequate pay, while timberland owners can afford much better to await for improvement in market conditions. It is the writer's belief that as *knowledge* of the conditions of timber supply in the world grows the prices will everywhere rise at an accelerated rate until that level has been reached which forces reduction of consumption.

That practical business men share this belief may be inferred from the policy of some of the lumber barons. It is known to the writer that in Mississippi some half a million acres of the best pine land are held by three owners for the future rise of prices, these owners refusing to-day \$3 per M when elsewhere in accessible situations \$2 is considered a fair price.

It is easy to see that when our supplies have been reduced so that their limits are recognized generally, when our so-called "surplus" is gone, prices will be higher than those at present prevailing in the European "no-surplus" countries, like Germany, France, England, which now supply a large proportion (England practically all) of their consumption by importations, thereby keeping the value of home-grown materials lower than it would otherwise be. The statistics of Germany furnish a most satisfactory basis for making a forecast of these future prices, being not only carefully collated but coming from a country where for more than a century earnest efforts have been made to secure the largest continuous forest product attainable from the home area.

I believe we shall be quite below the truth if we figure the present average stumpage price in Europe for workwood at 6 cents per cubic foot, which would be equivalent roughly to 1 cent per foot board measure or $10 per M. This is the stumpage price now paid for the best located White Pine.

It is to the credit of some of those who have urged reform in the treatment of our woodlands to have pointed out, in spite of the ridicule by trade journals and pseudostatisticians, that our timber resources instead of being "practically inexhaustible" as Mulhall has it, are really quite limited, considering the rapid growth of our population and still more rapid growth of our civilization which induces increase in the use of wood.

Two years ago I exhibited before this section statistics to show that the per capita consumption of wood had during the last 40 years risen in every industrial nation at a rate of probably not less than 3% in value. Now, making allowance for the rise in price at say 1½% of the consumption in quantity would be not less than at the rate of 1½%. Substitutes and surrogates for wood, then have not been able so far to reduce wood consumption. The only thing that will do so effectively is a rise in lumber prices to the proper value of the wood, based either on the quantity available or capable of production. And this rise in prices to a proper level will come about when actual *knowledge* of supplies in sight exist. At present we have little more than surmises and guesses, opinions and sham opinions.

Nevertheless all the evidence seems to lead to the conclusion that knowledge of available supplies is increasing and exercising its influence and that a more rapid rise of wood prices than in the past is to be anticipated.

B. E. Fernow.

AN EXPERT OPINION
ON THE CORNELL COLLEGE FOREST EXPERIMENT.

In the fall of 1904, two officers of the Prussian Forest Service sent by their Government, made an extended tour of inspection through some parts of the United States. They were Oberforstmeister Riebel, director of the Forest Academy of Eberswalde and Forstmeister Dr. Jentsch, professor at the Forest Academy at Münden. These two competent experts visited the demonstration forest of the New York State College of Forestry in the Adirondacks with a view to finding an explanation of the sudden collapse of this first institution of the kind in the United States.

As a result Prof. Jentsch publishes in "*Zeitschrift für Forst- und Jagdwesen,*" for February, 1905, a review of the case and an opinion regarding the methods pursued. This latter at least, coming from an entirely unbiased and certainly competent source, must be of general interest to every student of forest history in the United States and of professional interest as well. We therefore give, leaving out unnecessary personal allusions, a verbatim (as nearly as possible) translation of the passages in point, words in parenthesis being additions by the translator for the sake of explanation.

"When the State College of Forestry at Cornell University was founded, a forest area in the Adirondacks, round 30,000 acres, was turned over to it for thirty years. The forest was intended to serve, besides introducing students to practical forest work, for experiments in forestry methods according to the judgment of the director of the institution. The territory was located about 2,000 feet above sea level in a mountain range of granite, with a minerally strong sand soil and considerable humus cover. The stand was formed mainly of hardwoods, Sugar Maple, Birch and Beech, and originally mixed to a large degree with conifers, White Pine, Hemlock, Spruce and Balsam. The former owner, the Santa Clara Lumber Company, had, however removed all the mature spruce and pine down to 10″ diameter, only the smaller trees of that description remaining. The stand at present showed about 16 trees and 20 cords of hardwood per acre. Fernow saw before him the question as to the method by which this natural forest, depleted of conifers, could be transformed into an economic forest. The aim would have to be to replace the poorly marketable broad-leaved forest by a coniferous growth, especially of White Pine, which, valuable now, is expected to be still more so in the future, and occurs and succeeds well in the Adirondacks. This species, here as well as in entire North America is approaching extinction, because being the most serviceable conifer it is in general demand and is regardlessly slaughtered. The re-establishment of this most valuable and at the same time rapidly growing species was, therefore, a consideration of first importance. Fernow chose the method of clearing and the artificial reforestation with conifers, the hardwoods to be reproduced by natural regeneration, but these were in the future forest to play mainly the secondary role of nurse crop and soil cover. In the felling the exposed slopes and hilltops were to be left untouched or only picked over by selection, and on the felling areas a number of seed trees were to be left. The natural regeneration by the selection method would, to be sure, have also given rise to a new forest as is to be seen in the Adirondacks everywhere; the old burns, of which there are many, grow up mostly first with White Birch and Aspen and other softwoods, but gradually coniferous trees find an entrance, especially Hemlock and Balsam, and with proper use of the axe finally, it would have been possible to secure a conifer forest. Under such a method, however, the most valuable species, White Pine, would, if at all represented, have come in only sparingly. As a third alternative there could have been in question regeneration by groups, with planting and sowing on failplaces. But from such a method Fernow did not expect as good results as could be secured by the clearing system, especially as that method presupposes a more intensive management and an organized forest service, both of which were here entirely absent.

"This really correct principle met, however, difficulties in its execution. At the time of the beginning of Fernow's administration, the hardwoods could not be marketed; it was, therefore, necessary first to find a sure method of disposal for the annual felling budgets, and that not so much for the logs which could perhaps be sold as for the fuelwood which in volume was the larger part. Fernow secured a large, financially capable firm which contracted to take the entire cut of fuelwood down to 3″ diameter for 15 years at $2.04 per cord, together with all the log timber that would fall with it; with the condition, however, that annually at least 10,000 cords of fuelwood would be delivered, for only under that condition would it pay to erect at Tupper Lake a wood alcohol plant and a stave factory. According to the estimates the entire available stock on hand on the property was about 25 cords per acre. To furnish the contracted quantity of fuelwood, since in the fellings about equal amounts of workwood and serviceable fuelwood were secured, a round 600 acres had to be cut over yearly; hence within thirty years, the whole forest would have to be cut over and regenerated. Fernow intended to locate the annual felling area in numerous smaller areas distributed over the whole forest and, therefore, asked for a working capital of $50,000, in order to construct a logging railroad and necessary roads so as to be able to reach the more distant portions of the property. He was, however, allowed only $20,000, a sum too small to establish these means of transportation. Thereby a further trouble of much consequence arose. The felling areas could not be distributed, but had to be located in some part near Tupper Lake. In this way large contiguous areas were denuded at one time, and the regeneration of the broad-leaved woods made more difficult, the danger from fire increased, and the seed trees of hardwood and spruce which had been left on the shallow soil (in the first year's cut) were thrown by the winds. The planting could not be done at once after the felling, for the large masses of brushwood had to be got rid of first. This could be done only by bringing it together in heaps and burning it in installments. In the first year, naturally, plant material was lacking. Fernow secured this from Germany (and from home sources) and planted first an old burn with three- to four-year-old White Pine, Scotch Pine, Norway Spruce, Douglas Fir (and other species), spacing them so that about 1,200 to 1,500 plants came to the acre. In the same manner other blanks, run-out pastures, and the like, were planted up. These plantations were done cheaply (about $6 per acre), and are decidedly a success. The large felling areas Fernow could not plant up himself, on account of discontinuance of the experiment, and they were planted during the last two years by the officers of the University.

"*It cannot be doubted that from the standpoint of rational forestry the clearing system was justified, and was suited to secure the desired aim, namely, to establish, under the existing conditions quickly, surely, and cheaply, a conifer forest with an admixture of broad-leaved trees.* The practical execution, however, showed defects and naturally aroused doubts. The better plan would perhaps have been first to survey, map, subdivide, and describe the tract; then, or if the existing survey was sufficient, based on it, to make a working plan, even if only a superficial one, and thereby determine the felling area and the area for planting. If, as the transfer of this tract to the University had contemplated, experiments were to be made and special object lessons for teaching purposes were to be secured, smaller parcels could have been segregated. To the German forester accustomed to an old fashioned, well regulated forest organization, it must appear as a defect that Fernow began a management without an area or volume allotment, and that he did not first on small, properly distributed areas experimentally try the principle of clearing and artificial planting which he had recognized as the proper one, but contracted right from the start to treat in this manner every year 600 acres. The reasons necessitating this procedure, which really had not been desired by him, are, to be sure, readily explained. In this I follow his own testimony mainly, but also that of others familiar with country and conditions. One reason has already been mentioned: the need of finding a market for the hitherto unsaleable hardwood, especially the portion which was fit only for firewood. This could be done only by assuring to the contracting firm an annual minimum of considerable amount. Another consideration was that the execution of a survey and working plan had, to be sure, been contemplated by Fernow, but this was not to delay the beginning of operations and was to be done while operations progressed. This work of survey and of making working plans was an especially desirable field for his teaching purposes. At any rate, for such work, as well as for the technical carrying out of the ideas and plans of Fernow, there was at first no personnel available. This, too.

was first to be educated in the new institution. Fernow himself was entirely unable to personally superintend the execution of details. He had undertaken such other duties as would absorb fully the powers of even such a capable and ready man. Moreover, the forest was distant from Ithaca, being a railroad journey of 12 hours. Even if Fernow took the night from Saturday to Sunday for the journey, and the following night for return, which he did as often as possible, he had only one day for the woods, and that the one on which in America no work is done. Hence it happened that many of his perfectly practical orders were not executed by his only partially qualified, if ever so willing, representatives, or at least not as desired. The most trouble, however, according to Fernow's statements, was deficiency of funds. Lastly, there was a deficiency of personnel for protection against fire dangers, etc. By the combination of all these circumstances, which are independent of the sound intentions and the good will of the manager and proved insuperable, a forest condition was created which appeared dubious and undesirable for the present and future, not so much to the eye of the forester, as to that of the unenlightened layman. A felling area in the virgin woods always looks horrid, especially when the young growth is still small and invisible. The danger from fire is indeed increased by clearings when no organized forest protection exists, since a large amount of small brush remains in the fellings, and the humus cover becomes dry. The complaints of influential adjoiners regarding this so-called forest devastation, the illegal use of state forests, and the damage to their hunting interests increased. Appreciation of rational forest treatment and of the slow growth of values which is characteristic of all forest management, calling for sacrifices in the present in favor of a future, is altogether but little developed in the United States. A lawsuit, as yet not decided, as to violation of the Constitution, and a veto of the appropriation for the school at Ithaca, which came most unexpectedly to all concerned, including Fernow, was the final result.......

"The defects cannot be charged to the principles, only to the practical execution, for which, from what has been said, the director can be made only partially responsible. But, even if the opponents of Fernow could have shown him egregiously wrong, it still is inconceivable to the unbiased observer that one failure after all the long years of useful work, should wipe out in the eyes of his compatriots the unquestionable service which he has rendered to his country through a lifetime......"

For the sake of correcting a few misconceptions or inaccuracies and explaining some of the professional points, Dr. Fernow has added a few words:

The annual felling areas so far had not by any means been clearings of 600 acres; but the cut had extended over that acreage, leaving balsam swamps, steep wooded slopes and strips of uncut wood to interrupt and make the actual clearing (with some nursetrees left) about 50 per cent. of the worked-over area, reducing therefore so much the admitted objections to large clearings.

A careful survey, and even a relief map, of the whole tract had actually been made, and a subdivision into 40-acre lots of the part in which work was begun as well, together with a rough estimate, sufficient to form a basis for proceeding with operations, of the stock on hand. Some other facts are incorrect, but their correction is not essential.

As for making a working plan upon the basis of area or volume allotment, such as are customary in Germany, strange as it may sound to professional ears, except for educational purposes, there was no need or call. Practical rather than theoretical and ideal considerations were at the base of the proceedings. If there had been an established market for the wood, permitting the determination of a felling budget based on the so-called sustained yield, or if there had been the task of organizing a large forest domain, as for instance that of the State of New York, sustained yield ideas and regulations of the yield according to the recognized methods of forest organization would have been indicated.

As it was the main object of the whole enterprise was to demonstrate *silvicultural* methods; others than the one actually employed would also have been used as soon as the business was in running order. Moreover the felling budget was by the necessities of the market predetermined. All that needed to be done, therefore, or could have been done, was to find out precisely how long this budget could be supplied; for this purpose, the rough estimates and calculations were sufficient for a beginning. If later it had been the desire of the State to secure a forest area organized for sustained yield, all that was necessary would have been to add enough territory so as to *make* the actual felling budget, which was forced by market requirements, appear as the sustained yield.

It may perhaps be of interest to recall in this connection a curious historical fact, which seems to have repeated itself in the collapse of the College, ostensibly on account of its choice of silvicultural methods: The first school of forestry in France, founded in 1824 at Nancy, was organized by Lorentz, who having studied with Hartig tried to introduce the advanced ideas of German foresters and especially the shelterwood system, to supplant the selection system and the *methode à tireaire.* On account of this heresy (!) he was disgracefully dismissed in 1839. His successor, Parade, having studied under Cotta in Tharandt, also preached the acknowledged superiority of the shelterwood system, and as a consequence the school came near being abolished in 1847, after a savage attack in the legislature against this "German heresy" and its propounder.

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge.*

L'Arbe. Par J. Reynard, 214 pp. Clermont-Ferrand, Paris, 1904.

This booklet is made up of several articles originally published in Les Nouvelles in Algeria and in Paris in the organ of the fourierists, La Renovation. It is more of a general than a technical character, having in view principally the general public and teachers. The book consists of three parts. The first is devoted to the tree-cult, its origin, present and ancient cult, Arbor Day, and similar topics; in the second the tree is considered in its relation to the rest of nature and to human societies, covering such subjects as Tree and Climate, Tree, Water, and Mountains, and Tree and Human Societies; in the third, the smallest part, are considered the nationalization of forest soil in France and the laws necessary for making reforestation certain. The author treats all the questions in the vein of a moralist and publicist, the whole book being a strong appeal to the mind and heart of the reader for the urgent need of reforestation and education of the people toward respecting and appreciating trees.

R. Z.

Supplement Zur Allgemeinen Forst-und-Jagdzeitung, Jahresbericht, etc., für das Jahr 1903.
Herausgegeben von Karl Wimmenauer, J. D. Sauerländer, Frankfurt am Main, 1904.

This most useful résumé of the more important forestry literature, mostly German, but also foreign, has been published for a number of years. It enables the reader to review rapidly what of interest to the profession has been discussed during the year in over 100 journals. The more important subjects are briefed, others given by title only. The subject matter is divided into nine sections, each with several subsections and reported on by some well known forester or specialist, as for instance: Silviculture and Utilization by Dr. H. Mayr; Forest Mensuration, Regulation, Finance and Statistics by Dr. U. Müller; Forest Administration, History, Politics, Statistics, etc., by Dr. Borgman; Zoölogy by Dr. Eckstein; Soil Knowledge by Dr. Bleuel; Forest Botany by Dr. Beck. The absence of an index, as in so many German publications, reduces the value of this otherwise excellent work for reference use.

B. E. F.

Economie Forestière. Par G. Huffel. Tome premier. (L'Utilité des forêts, propriété et legislation forestière, politique forestiêre, la France forestière statistique.) Lucien Laveur, Editeur, 13 Rue des Saints-Peres, Paris. 1904. Price, $2.30.

This is the first volume of an encyclopædic work, written by one of the professors of the forest school at Nancy, the first of its kind in the French language, planned somewhat after Lorey's *Handbuch* in German. As appears from the headings of the different sections given above, the first volume forms a kind of introduction and a discussion of forest political subjects. New in its form and completeness is the historical and statistical part, which for the first time, so far as we know, brings together data of the historical development of forestry in France and a clear statement of present conditions. The make-up of the book is first-class. B. E. F.

Freie Durchforstung. Von Dr. K. R. Heck. Berlin, 1904. Price, 75 cents.

The subject of thinnings, which occupies so much space in modern literature and has become so prominent in experimentation, is even in its fundamental principles not yet fully established. Upon the basis of extensive experiments and observations at the forest experiment station of Tübingen and elsewhere, Dr. Heck announces the principles he wishes to lay stress upon as follows:

"It does not suffice any more that we engage in a soil management under which no ray of sun reaches the soil cover; it does not suffice any more that we bury the dead, or utilize the oppressed, reduce the worst 'Protzen' and heal or kill the sick. We must rather seek (1) to utilize the soil to the full by an even distribution of the best main stems, (2) to utilize the limited air space also by the best stems, and (3) to protect at the same time the boles of this most important and so favored portion of the stand against sun-scald, water sprout formation, malformation, disease, interference of less desirable dominant or co-dominant neighbors, etc."

In other words the author accentuates what the French school, and independently the reviewer, urged about twenty years ago (Report of Forestry Division, 1887) namely, that the "final harvest crop," the *elite* of the French, was to have special consideration from the beginning. This final harvest stand needs attention all along to give it the best chance of developing rapidly into good form and accretion by permitting it a full and regular crown. The author does not consider that any of the existing methods of thinning sufficiently recognize these principles, especially because they either do not interfere enough with the dominant or else do not maintain enough density in the subdominant, the "nurse crop." In the experiment areas on which Dr. Heck applies his ideas, he groups the trees into "crown classes" according to the well known classification of Krafft, and into seven "stem classes:"

a. straight, fine, long-boled timber;
b. medium, short-boled timber;
c. crooked, rough, branchy;
d. double leader;
e. much branched (if in Cl. I or II: Protzen);
f. stool shoots.
g. sickly.

In case preference in removal is to be given, the higher stem classes should be favored, the general program being "unconditioned favor and care of those trees which within the rotation of ninety to one hundred years are sure to furnish timber, while as much as possible securing uniform distribution of the timber trees and preserving as far as possible a close crown cover in general and especially in the class V a." The results of the experiments made under this plan are elaborated in detail and in tabular form. B. E. F.

Waldwertrechnung und Schätzung von Liegenschaften. Von Franz Riebel. Leipzig, 1905. Pp. 465. Price, $3.15.

This is the most complete work on forest valuation that has so far appeared with a well selected collection of practical problems elucidated in masterly fashion. The theory of this branch of forestry was once for all laid down by Gustav Heyer, whom the author follows in the theoretical part, although adding new ideas to the methods of calculation. In general the author stands on the platform of the soil rent theory but pays attention also to other methods of forest finance. By assuming for large owners an interest rate of 2.5 per cent. and for small owners 3 per cent., the latter requiring no outlay for administration, etc., rotations over eighty years appear hardly profitable. The special value of the book lies in the simplified calculation which it develops. B. E. F.

Untersuchungen über die Naturlichen und Kunstlichen Verbreitungsgebiete einiger forstlich und pflanzengeographisch wichtigen Holzarten in Nord- und Mitteldeutschland. I Die Horizontalverbreitung der Kiefer (Pinus silvestris L.). By Dr. A. Dengler. Neudamm, 1904.

The first instalment of a very comprehensive co-operative work on the geographical distribution of the more important forest trees under the auspices of the International Association of Forest Experiment Stations. For us this work has perhaps interest mainly in the manner of handling the subject, which is more thorough and exhaustive than has ever before been attempted. B. E. F.

Lebensgeschichte der Blutenpflanzen Mitteleuropas. Specielle Oecologie, etc. Band I, Lieferung 1 and 2. Von Dr. O. Kirchner, Dr. E. Löw, Dr. C. Schröter. Stuttgart, 1904. Price 90 cents each Lieferung.

The first and second parts of this handbook of ecology discuss Yew, Fir, Spruce, Larch, and Pine, their physiology and phænology, relations to soil conditions, plant associates and geographical distribution, manner of germination, and the ecologic phenomena of young and old plants and their parts. B. E. F.

Die Technik des Forstschutzes gegen Thiere. Von Dr. Karl Eckstein. Berlin, 1904. Price, $1.10.

An exhaustive treatise on the methods of preventing damage from animals, especially insects. It is written with full knowledge of the needs of the practitioner and with a critical discernment by a most competent man, the professor of zoölogy at the forest academy of Eberswalde and director of the zoölogical section of the forest experiment stations of Prussia. B. E. F.

Ein System von Mitteln zur Verhütung schädlicher Hochwasser. Von. O. V. Leo Anderlind. Leipzig, 1904.

The employment of horizontal ditches and other mechanical means for catching the rushing waters on bare and openly forested mountian slopes, and in the lowlands a system of dikes subdividing the forested area into squares of two or three acres extent is advocated in this book, which contains nothing that is new. Most of the propositions were ventilated years ago by Ludloff. The expense of practical application will probably be prohibitive in most cases, although the philosophy as to the effectiveness of the proposition cannot be denied. B. E. F.

OTHER RECENT LITERATURE.

Trees: a handbook of forest botany for the woodlands and the laboratory. By H. Marshall Ward. University Press, Cambridge, England, 1904. 2 Vol. 619 pp. 12°. Ill.

Incendies en forêts. Evalution des dommages. Par A. Jacquot. Ouvrage couronné par la société nationale d'agriculture de France. 400 pp. 8 francs.

Forest Conditions in the Absaroka Division of the Yellowstone Forest Reserve, Montana. By J. B. Leiberg. Professional paper No. 29, U. S. Geological Survey. Washington, 1904. 148 pp. 3 Pl. Map.

Forest Conditions in the Little Bell Forest Reserve, Montana. By J. B. Leiberg. Professional paper No. 30, U. S. Geological Survey. Washington, 1904. 75 pp. 4°.

Forest Conditions in the Lincoln Forest Reserve, New Mexico. By F. G. Plummer. Professional paper No. 33, U. S. Geological Survey. Washington, 1904. 47 pp. 4° (including map and diagram).

The Luquillo Forest Reserve, Porto Rico. By J. C. Gifford. Bulletin No. 54, Bureau of Forestry, U. S. Dept. of Agriculture. Washington, 1904. 52 pp. 8°. Pl. Map.

The adaptation of land for afforestation. Two prize essays. By A. C. Forbes and W. R. Fisher. Loughton & Co., Ltd., Essex st., Strand, London. 104 pp. 10 figs.

Forests, wild and cultivated. By Augustine Henry. Royal Dublin Society. Economic proceedings. Vol. I., part 5, No. 11. Pls. ix-xx. Price 1s 6d.

Einiges über die Rolle des Lichtes im Walde. Von Dr. Adolf Cieslar. XXX Heft der Mittheilungen aus dem forstl. Versuchswesen Oesterreichs. Wien, 1904. 105 pp.

Indiana Board of Forestry, Fourth Annual Report. Indianapolis, Indiana, 1904. 111 pp. 8°. Pls. Maps.

Maine Forest Commission, Fifth Annual Report. Augusta, Maine, 1904. 144 pp.

Michigan State Board of Agriculture, Forty-third Annual Report. Contains second annual report of forestry department. pp. 76-77.

Minnesota State Forestry Board, Report. St. Paul, Minnesota, 1904. 11 pp.

Forestry Problems of the United States. By B. E. Fernow. Pearson's Magazine, April, 1904, pp. 364-76.

Die Begrundung naturgemässer Hochwaldbestände. Von R. Jankowsky. 107 pp. Price, 2.50 mark.

Massregeln zur Verhütung von Waldbränden. Von Dr. M. Kienitz. Julius Spruger, Publisher. Berlin, 1904. 17 pp. Price, 50 pfg.

Wuchsgesetze normaler Fichtenbestände. Von A. Schiffel. William Frick, Wein, 1904. 106 pp.

Forest Utilization. By C. A. Schenck. Biltmore, N. C., 1904. 118 pp. 8°.

Report on the condition of treated timbers laid in Texas, February, 1902. By Herman von Schrenk. Bulletin No. 51, Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1904. 45 pp. 8°. Pl.

Imports and exports of wood and manufacturers of wood, 1902-1904. From monthly summary of commerce and finance, December, 1904. Bureau of Statistics, U. S. Dept. of Commerce and Labor, Washington. P. 2170 and pp. 2204-24.

Literaturnachweise zur Gesdischte der Waldungen, Forstwirtschaft und Forstwissenschaft. Giessen, 1904. 15 pp.

Federal and State forest laws. Compiled by G. W. Woodruff. Bulletin No. 57. Bureau of Forestry, U. S. Department of Agriculture. Washington, 1904. 259 pp.

Die forstlichen Verhältnisse und Einrichtungen Bosniens und der Herzegovina. Von Ludwig Dimitz. Wilhelm Frick. Wein, 1904. Preis, 16 Fr.

English Estate Forestry. By A. C. Forbes, F. H. A. S. Edward Arnold, 41 and 43 Maddux street, W., London, England. 8°. 12s. 6d.

Forestry as a Profession. By H. P. Baker. Iowa Agriculturist, October, 1904. pp. 125-30.

Yale Summer School of Forestry. By J. W. Pinchot. World's Work, October, 1904.

Webster's Forester's Diary and Pocketbook. William Rider & Son, 164 Aldersgate street, London, 1905. Price 2s. 6d.

PERIODICAL LITERATURE.

In Charge:

Botanical Journals, ... R. T. Fisher.
Foreign Journals, ... B. E. Fernow and R. Zon.
Propagandist Journals, ... H. P. Baker.
Trade Journals, ... Filibert Roth.

FOREST BOTANY AND ZOOLOGY.

The Growth of Tree Roots.

At the Forestry Research Station of Switzerland studies of the growth of tree roots have been carried on for three years, with such species as Silver Fir, White and Scotch pines, Beech, Oak, Birch, and Maple. Two methods of making observations are employed: the first is to periodically take up and examine the young plants; the second to plant them in glass-covered boxes, sunk in the soil in such a way that the roots can be kept under observation.

It has been found that the development and production of roots are not continuous throughout the year. They are interrupted by periods of repose, which in addition, do not correspond exactly to those when the ærial parts are at rest. Among resinous trees vegetation of roots is entirely suspended from November to March or April, while among the deciduous trees, on the contrary, this vegetation does not undergo any complete interruption in the winter. February and the beginning of March are the least favorable seasons for the growth of roots.

The deterrent effect on vegetation in winter is a consequence of the lowered temperature of the soil. It is established that in general roots begin the process of development in the spring before ærial development starts. The beginning of their growth may precede by several weeks the opening of the first buds, but sometimes this period is reduced to only a few days.

Besides the winter rest, the growth of roots undergoes another interruption due to the dryness of soil during summer. This interruption may last 3-8 weeks, according to its beginning more or less early. In October a new period of activity, more intense and more prolonged among the deciduous than among the coniferous trees, succeeds the summer rest.

General observations in reference to the best time of the year for planting are drawn and it appears to be correctly settled that spruce and pine should be planted in the spring, while deciduous trees may just as well be planted in the autumn. The article concludes by saying that the results of these root studies may not be of any considerable importance to Canadian tree planters.

From *Revue des Eaux et Forêts,* in *Rod and Gun in Canada,* November, 1904, pp. 297-299.

Red Rot in Pine. Dr. A. Möller, director of the pathological experiment station at Eberswalde, has concluded an investigation of five years' duration on the necessity and possibility of an effective warfare against *Trametes pini*, Fries, the red rot which affects pine trees over 50 years old.

Reference is made to Hartig's work on this fungus and to the lack of attention to its eradication. By means of circular letters the extent of the damage was ascertained, which is stated in detailed tabular form to amount conservatively in the Prussian State forests, to $300,000 annually on a cut of about 80,000,000 cubic feet; by virtue of the reduced price of the defective wood marketed, the probability is that this loss may be doubled and, if private and other forest properties are included, much more. The method of calculating the damage (on the basis of an essay by Geralein, Zeitschrift für Forst- und Jagdwesen, 1899, p. 210) is detailed in an interesting manner. In the worst cases, 60, 80, and even 100 per cent. of the trees in some countries were affected; and the average depreciation for the districts concerned figured 8.34 per cent. or about 4 cents per cubic foot. In regard to the distribution of the fungus it is observed that it occurs much less frequently in the southern part and is best developed in the northeast, the natural home of the pine. Relation to soil conditions in its development could not be established; but the preponderance of fruit bodies on the west and the north sides of trees, especially the west, was observed; also the frequency of distribution in spots from which the disease spreads, and on exposed forest boundaries. The west and north positions are explained by the frequency of the winds which carry the spores from those quarters and the greater humidity on those sides, which keeps the branch stubs moist. With age the danger and the losses grow.

The idea of curing trees or arresting the progress of the rot in them or to render the trees immune "belongs to the realm of dreams." That *Trametes pini* is the only fungus causing the disease was perfectly proved by Hartig. By inoculation it was possible to infect trees and study the progress of the disease, and thus it was proved that entirely healthy trees can be affected; but the infection must be able to reach the heartwood, the sapwood protecting itself by resin flow. The infection comes, of course, from the spores of the fruit bodies, locating on broken branch stubs that have exposed heartwood, and on such only can the fungus start. Being a strictly parasitic fungus, the only place to find it is in this situation, and not in out-of-the-way places, like the soil or the root or any other wood as with the pine root rot and other fungi, which have saprophytic existence. This rot starts always at the top or at a branch (not from bark injuries), and although it may eat its way down to the roots, it is not, at least in nature, saprophytic. A study of its development in cultures is described at length, as well as of its progress in nature. The breaking off and destroying of fruit bodies and the closing of the wound with raupenleim (or probably some other antiseptic) prevents their reappearance and reduces the chances for spread of the disease. Continued energetic removal of the infected trees before spores have escaped is, however, the only efficient and desirable means of eradicating the disease. The possibility of reducing it by growing the pine mixed with broadleaf trees is admitted; but pure pine forest is favored for other considerations.

Über die Notwendigkeit und Möglichkeit wirksamer Bekämpfung des Kiefernbaumschwammes, Trametes Pini Fries. Zeitschrift für Forst- und Jagdwesen, November, 1904, pp. 677-715.

Resin Flow. From a very exhaustive series of observations and experiments on resin flow carried on for six years, A. Tschirch feels warranted in considering these excretions pathological rather than merely physiological. He argues that if in scarifying a tree all the resin ducts were opened and discharged, the secretion could not be very large—certainly not many pounds if there were no new production of it. Moreover, some plants which do not have any resin ducts, like *Styrax benzoin*, when wounded have a resin flow, which can be only of pathological character. Besides the experiments in Germany, a parallel series was conducted by Prof. Treub in Buitenzorg on tropical plants. The investigations develop that the secretion follows the same law in both Angiosperms and Gymnosperms; that it is partly of primary, partly of secondary nature; that the primary excretion, absent in plants without resin ducts, is small and of short duration (mastix sandarae, Strassburg turpentine); that the secondary, constant flow begins some time after the incision and is dependent as to quantity on the size of the wound. The stimulus of the wound produces the formation of pathological woundwood in which resin ducts develop in large numbers in a network of anastomose vessels, by cell division (chizogen) and enlarged by cell fusion (lysigen). The stimulating effect of the incision is felt for only a few centimeters more upwards and sideways than downwards (as in callus?) outside of which zone the tissues remain normal. Hence new scarification is necessary, and the methods of bleeding are rational from that point of view. The flowing resin then must be considered like pus in animals, as a pathological excretion with the function of assisting in healing a wound.

An unfortunate reference is made to *Pinus taeda* as the tree mainly subjected to bleeding in the United States. Its resin flow is so sluggish that it is rather avoided in the turpentine orchard.

Über den sogenannten Harzfluss. Flora, 1904, V. 94, pt. 1, pp. 179-198.

Transpiration by Sun and and by Shade Leaves.

An interesting article by Joseph Y. Bergen deals with the result of a study of the relative transpiration by sun leaves and shade leaves of *Olea europea* and other broad-leaved evergreens. After comparing the color, size, shape, and structure of sun leaves and shade leaves, the author gives the following general conclusions from his experiments: "Under conditions normal for each class, the sun leaves transpire from three to ten times as much as the shade leaves of the same species. With both classes under abnormally equal conditions the sun leaves of the species studied transpire one and one-half times as much as the shade leaves." This latter result is interesting as reversing published statements in regard to transpiration.

Transpiration of Sun Leaves and Shade Leaves of Olea europea and other Broadleaved Evergreens. Botanical Gazette, October, 1904, pp. 285-296. (11 figs.)

Fossil Sequoias.

Professor E. C. Jeffrey has described and named a new species of fossil Sequoia, which he calls *Sequoia penhallowii.* The wood on which the description is based was taken from the line of the Central Pacific Railway, under 60 feet of conglomerate. Although the species most nearly resembles *Sequoia gigantea* of living sequoias, it has features which strongly suggest the Abietineæ.

E. W. Berry calls attention to the fact that Otto Kuntze in his "Lexicon Generum Phanerogamarum" (Stuttgart, 1904) refers our two species of Sequoia to the fossil genus *"Steinhanera."* If *Sequoia sempervirens* should ever be found to be identical with the fossil species which it closely resembles, the name Sequoia will—if priority be the rule followed—have to be given up. (We doubt the correctness of this inference.—Ed.)

A Fossil Sequoia from the Sierra Nevada. Botanical Gazette, November, 1904, pp. 321-332. (2 pl.)
Otto Kuntze on Sequoia. Torreya, October, 1904, pp. 153-4.

In the *Botanical Gazette* for November, 1904, Prof. Conway MacMillan offers a curious instance of the dwarfing of *Picea sitchensis, Tsuga heterophylla* and *Thuja gigantea* or *plicata*, specimens of which he found upon windswept rocks on the west coast of Vancouver Island. The largest of the trees observed, which was also the youngest, was sixty-eight years old and less than two feet high.

Of interest to western foresters is the discovery referred to by T. D. A. Cockerell in a revision of the genus *Hymenoxys*, in the *Bulletin of the Torrey Botanical Club*, for September, 1904. It has been found that the roots of the plant known as rabbit bush will yield a fair quality of rubber, and arrangements are being made for its extraction on a large scale.

Prof. N. L. Britton records, in *Torreya* for October, 1904, some observations on the identity of the *Royal Palm* of Florida. After studying the Florida palms and comparing their character with those of the Royal Palm of Cuba, asserted by O. F. Cook to be distinct, Prof. Britton concludes that the two palms are one and the same species. In other words, *Roystonea floridana* and *Roystonea regia* are synonyms.

Among the book notices in the *Journal of Botany* for November, 1904, is one on "*The timbers of Commerce and their Identification,*" by Herbert Stone, F. L. S., F. R. C. I., published at William Rider and Sons, London, 1904. This should be a valuable reference book, especially since the familiar aspect of the woods are dealt with, as well as their structure and properties.

Gypsy Moth.

War against the gypsy and brown-tail moths is absolutely necessary if the forest and shade trees in Eastern Massachusetts are to succeed. *Woodland and Roadside,* for December, 1904, says: "There is no more important phase of forestry in this State than is presented by this problem of how to suppress the terrible ravages of these pests......Unless they both are checked real estate values will be seriously affected." It also gives in full the system of organization for fighting these pests and an extended review of a report upon both moths by Dr. C. L. Marlatt, of the United States Department of Agriculture, with a call for contributions to be sent the State Forester.

Cimex.

Record is made of two species of Cimex feeding on White Pine, namely *Pentatoma baccarum* L. and *Pentatoma prasinum* L. The shoots of young plants are sucked and a resin flow is the result, injuring even to killing the plant.

Wanzenschaden an Weymouthskiefern, Dr. Hess. Allgemeine Forst- und Jagdzeitung, October, 1904, p. 379.

SOIL AND CLIMATE.

Effects of Fertilizers.—Dr. A. Möller, director of the pathological station at Eberswalde, comprises under the name of *Karenz* (English, carency) all phenomena in plants which are produced in consequence of the withdrawal or insufficiency of important nutrients, as for instance the well known chlorosis. He proposes to use the observations made by him on the carency phenomena of the pine as an argument for employing manures in nursery and forestry practice. In a longer article he describes a series of investigations to determine the influence of withdrawal of nitrogen, phosphorus, sulphur, magnesia, potash, and lime on one- and two-year old Scotch Pines. The results are briefly as follows: Deficiency in nitrogen produces light yellow green, short, and relatively slim needles, a phenomenon often experienced in sandy soils without humus; which by additions of humus, green manuring, or otherwise, can be overcome, but according to Möller and others not by the use of saltpetre, which has been recommended for use in nurseries. Although there is no practical interest in the result of withdrawal of sulphur, it is interesting to state that the deficiency of no other nutrient has such decided result, rapidly causing death.

The carency phenomena under deficiency of phosphorus were signalized by blue red to violet discoloration of the cotyledons and lowest leaves long before frost, which may produce a similar color, had set in. A colored plate exhibits this as well as the color change due to withdrawal of magnesia. The influence of the latter does not appear in diminution of size, but in a varicolored display: the tips orange yellow, shading towards the base into brilliant red, with normal green at the base, the leaves drying and browning gradually. By applying a solution containing sulphate of magnesia recovery of color and turgescence could be secured. By analysis of plants from a seedbed, some of which showed the orange tips, and of neighbors normally green, a difference in the contents of magnesia prove the relation, showing also that the contents of assimilable magnesia must vary greatly in the same ground. Fertilizing with kainit is recommended in such soils.

The absence of potash was characterized by diminution of size, as observed under absence of phosphorus, and somewhat by discoloration, as in the case of sulphur, but a decided describable carency phenomenon could not be stated. Here, too, recovery could be secured in the second year by watering with potash solution.

Karenzerscheinungen bei der Kiefer. Zeitschrift für Forst- und Jagdwesen, December, 1904, pp. 745-756.

Effect of Soil on the Root Development of Pine.

A series of most interesting observations as to the relative effects of sandy and black soils upon the structure of the root system in Scotch Pine has been conducted by A. P. Tolsky. His observations covered seventeen trees ranging in age from three to thirty-seven years seven of them having grown on a black soil with a clayey subsoil and ten on sand. The measurements included the total lengths of all the roots of each individual tree, the total length of the horizontal and the vertical roots, the length of the longest horizontal and the longest vertical root, and, finally, the length of the tap root. There has been established an interesting relation between the total length of the superficial roots to that of the vertical ones. This relation is 1.5 on black soil and 5.8 on sand, *i. e.*, on black soil pine develops principally vertical roots, while on sandy soils superficial roots predominate. This difference in the character of the root system of pine grown on black soil and on sand the author explains by the tendency of the roots to develop and spread in those layers which contain in greatest quantities the substances most needed by the plant. Sandy soils are as a rule richest in their upper layers containing the humus; therefore the bulk of the roots are found in these layers. In rich, black soil, where there is no lack of nutritive substances in any of the layers, roots are guided in their development mostly by moisture, and go deep into the ground after the water.

The amount of nutritive substances in the soil influences the total length of roots; on pine grown in black soil the total length of all roots is almost half of what is found in pine on sandy soil. This was only natural to expect. The activity of the roots is directed mainly toward extracting nutrition from the soil; therefore wherever there is an abundance of nutritive substances in the soil, there is no need for a great development of roots; on poor soils, however, the nutrition is spread over a large area, and in order to get it in sufficient quantity trees need numerous roots. Not without interest also are the observations regarding the development of the tap and lateral roots. Till the fifteenth year the tap root has the greatest length in black soil; after this age the lateral roots begin to develop, and at the age of twenty-five years the longest root is one of the lateral roots, being from two to three times as large as the tap root. In sandy soil the superficial root remains at all times the longest, and at the age of twenty-five years the same relation exists between the lateral and the tap roots as on pine grown in black soil.

Work of the Forest Experiment Stations in Russia. St. Petersburg, 1903.

Snow Cover in the Forest and on the Field.

Daily and weekly observations made by A. P. Tolsky during the winter of 1901-1902 on the grounds of the Parfinsky Forest School, near the town of Staraya Russa, Russia, have enabled him to arrive at the following very interesting conclusions:

I. The depth of snow cover.

(a) On the field snow forms an even layer, becoming slightly deeper inlandward from the river. Young growth, shrubs, fences, and similar obstacles possess the greatest capacity for accumulating snow.

(b) In the forest snow lies in less even layers, depending on the composition, density, and age of the stands and on the topography. In stands with a thin upper story and a dense undergrowth more snow accumulates than in dense stands without any undergrowth; on low situations and slopes the accumulations of snow is greater than on more elevated places.

II. The specific volume of snow.

(a) In the forest snow is less compact and the variations in specific volume are greater than in the open, as can be seen from the following table:

Specific Volume	Forest	Field
Maximum,	4.7	3.7
Minimum,	3.4	3.1
Variation,	1.3	0.6

(b) The compactness of snow in the forest increases from its surface toward the surface of the earth; on the field the most compact snow is found in the middle of the snow cover, whence its compactness decreases in both directions.

III. The length of time for which the snow lasted and the rate of its settling were as follows:

	Snow lasted *days*	Snow settled daily *Centimeters*
Field, ...	139-141	3.9
Edge of Forest, ...	164-167	2.5
Within forest, ...	176-179	1.6

These figures prove better than words that thawing proceeds more slowly in the forest than in the open. They show that the snow remained in the forest thirty-seven days longer than it did on the field and that it also settled faster on the latter.

Transactions of the Imperial Forest Institute, Vol. X, St. Petersburg, 1903.

ROADS AND SURVEY.

Value of Good Roads.

The economy resulting from a properly constructed system of roads is the subject of a note by the designer and builder of such a system in the demonstration forest of the forest academy at Münden, Forstrath Mühlhausen.

The district in question was somewhat over 11,000 acres. The system was designed in 1872 and its execution had proceeded more or less rapidly from year to year with varying appropriations. The total expenditure and the miles of road of different classes are not stated, but a calculation is made to show difference in price obtained due to improved transportation in comparison with a similarly situated adjoining district not so favored. Comparing the average prices obtained per festmeter of workwood alone for the period 1890-95 with those for the period 1896-1901, the price difference in the undeveloped district was 0.67 Mark, the difference in the district developed by the road system was 2.60 Mark, hence the value of the roads is 1.93 Mark per festmeter (1.3 cents per cubic foot). This corresponds to a rise in value of 21 per cent. in six years, due to better transportation.

Die finanzielle Wirkung des Wegebaues in der Oberförsterei Gahrenberg. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 655-658.

SILVICULTURE, PROTECTION AND EXTENSION.

Silvicultural Characteristics. The new spirit of testing all the old theories and practices of silviculture by scrutiny on scientific basis and by careful experiment has given rise to a series of articles in the Centralblatt, which we may consider together, as they are dependent on each other, and being on principles, are therefore useful to our readers.

The cause for these articles was furnished by a report on the sessions of the Bohemian Forest Association by A. Schiffel, appearing in the April number, in which the reporter expressed disagreement with some of the statements made regarding the silvicultural methods employed in one of the visited districts, the keynote of it being found in the sentence: "By the methods pursued, namely, giving up as far as possible the clear cutting method and favoring as far as possible natural regeneration, it is hoped that bye and bye there will be re-established the original forest type of the Bohemian Mountains, unique as regards volume and value production and resistance." The speaker at the meeting (Neumann) praised the beech as an improver and conserver of soil vigor and as nurse for many other valuable species, which "nowhere grow so quickly and surely to such perfection as under its protecting cover," and "in proportion as the beech participates in the mixture with conifers......the pine is not at all adapted to the situation." Various other such generalizations and generalities, especially his preference for the Bavarian *Femelschlag* (group system), lead Schiffel to take exceptions, both in the first mentioned report and later in an extended article in which also the position of Wapples, stated in the following paragraphs, is discussed.

In refutation of the strictures raised by Schiffel, Dr. L.

Wapples, a high authority from Bavaria, discusses the principles and applicability of a method of *regeneration under nurses* (Femelschlag) practiced in Bavaria. A few historic remarks as introduction are of interest to us at the present time, when terms and definitions are under discussion. The term *Femelschlag* was originated by C. Heyer simply in juxtaposition to *Femelbetrieb* (selection forest) and *Kahlschlag* (clearing method). Gayer introduced finer distinctions of the high forest forms, reserving the name *Femelschlag* for regeneration in groups (*Löcher* or *Gruppenwirthschaft*), and the regeneration which worked with a uniform opening up of the stand he called *Schirmschlagform* (shelterwood), and this distinction has now been generally accepted.

In a foot note the author proposes further systematic distinctions, namely, according to the manner of cutting (*Hiebsform*—well amended by Schiffel to *Hiebsart*), and according to the location, area, and sequence of procedure (*Schlagform*). A. Manner of cutting: *Plenterhieb*, cutting single trees or groups without enlargement—selection forest; *Femelhieb,* cutting single trees and groups, enlarging these openings, now called *Femelschlag*—successive fellings in groups; *Schirmhieb*, uniform opening up—shelter wood system; *Löcherhieb,* checkerboard distribution of small clearings—group system; and *Kahlhieb*, clearing. B. Manner of Location: *Platzweise,* irregular at any place; *Kulissenweise,* in echelons; *Saumweise,* in strips; *Zonenweise,* in wider strips; *Schlagweise,* by compartments.

By combining these two designations the different methods can be described, and the regeneration can proceed by one or by a combination of several methods. Speaking of the need of considering the profitableness of different methods, which Schiffel finds better satisfied by artificial reforestation than by natural regeneration, it is pointed out that in exposed situations it is dangerous to deviate from the *natural* forest types (*Waldform*): "Nature is still more obstinate than foresters and usually remains in the right; the cost of the quarrel falls to the loser." The Bavarian practice relies, therefore, on a mixture of 0.6 spruce, 0.2 fir, 0.2 beech, the proportion of the latter (less than in nature), although apparently less profitable, having been found necessary and also sufficient to protect the spruce against windfall, etc.

In the end, indirectly at least, the value production of these mixtures proves equal to pure spruce forest.

The perfect practicability of the natural regeneration method applied to such a mixture with differences of light requirement, height, growth and adaptation and its superiority over artificial reforestation is claimed.

The procedure in this method is to take first in suitable places the stoutest trees (especially those with poor accretion, poor form, undesirable, or more than needed species) in order to induce seeding; *i. e.,* to create conditions which the character of the respective species requires for such seeding. This *Femelschlag* method does not prescribe the schematic progress of fellings—preparatory for seed, for light, and final removal—over the whole area evenly, but the fellings follow in every part of the worked area the development of the seedling growth, and if several species have come up consider that which is to be favored, opening up around the reproduction and enlarging the openings as needed. The result is a local separation or groupwise collocation of the species, which insures the permanence of the mixture. On soils liable to weed growth careful judgment of the manager as to the effects of the fellings is, of course, necessary. Where such weed growth has come in, it may be cut out once or twice at a cost of 30 to 40 cents per acre (probably three times as much with us.—Ed.).

In this method all stages of regeneration are found side by side in the stand as in selection forest, while in the shelterwood system they are found uniformly throughout the whole stand. In the former method the felling does not necessarily follow the regeneration, but, if there is no young growth, it is induced by the fellings, and since these fellings occur only on limited area, the risk of failure is not great. That this method leads toward a selection forest is denied, but it is admitted that if the regeneration fails, strip system or clearing becomes necessary.

This last claim, Schiffel thinks, could come true only if strip system and clearing with artificial reforestation were systematically combined with the Bavarian regeneration method. He does not deny the propriety of the method under the special conditions, especially the need of the protective influence of forest cover, which prevails in the Bavarian different from the Bohemian Mountains. But it either leads, if the progress of the felllings is very slow, as in the long regeneration period of 40 years practiced in the Black Forest, to a selection forest, or else if the regeneration is rapid, to the regular, more systematic, cheaper, and in every way preferable shelterwood system, judiciously applied with reference to the needs of the young growth.

The most interesting and highly suggestive part of Schiffel's article to us, however, is not this controversy regarding a special method of regeneration, but the discussions of the general principles of silviculture, in which he exhibits the ignorance of foresters in general on important questions—"that we still do not know much that we need to know"—by pointing out problems which are still waiting for solution, regarding choice of species, form of mixtures, choice of method of regeneration.

He starts with the very sound, modern, truly American general principle: Where the choice between several species and their mixture is free, only the comparative profitableness (Rentabilität) has to decide these matters, as well as the method of regeneration. How much do even the German foresters know of the profitableness of different species? Generally speaking that species or mixture is most profitable, which with the same cost of production in the same time produces the highest yield. To determine this the yield tables, although much improved, are still insufficient, for they combine and average too many differently located stands, if only height and volume at a certain age, *i. e.*, site class agrees, and they do not distinguish between artificially and naturally regenerated stands, sowed and planted stands, or stands regenerated in longer or shorter regeneration periods, or by different methods of regeneration, all of which factors influence very greatly the rate of growth and final yield. Little is therefore known regarding the progress of stands on different sites differently treated. Even if knowledge exists perhaps locally regarding existing forest types and treatment, there is no measure for calculating profitableness of new introductions. Indeed, the "silvics," the adaptation and requirements of species regarding the site, are most imperfectly known—their requirements as to maximum, minimum, and average temperature, the duration of their vegetative period, their need of humidity on different exposures, altitudes, longitudes, their mineral, physical, and mechanical requirements in the soil.

What we do know is perhaps sufficient to guard against the crudest mistakes, but not to make any sure judgment of choice. Exact comparative experiments based on better knowledge of physiology and biology must supplant the onesided experience. We know that thinnings produce accelerated increment, but we do not yet know how far in this the different factors, light, change of soil, competition of roots, etc., participate, nor do we know that this increment is distributed to height and diameter with different species at different ages and in different forest types *(Waldform):* we do not know how the vegetation under the trees—grass, undergrowth, and intermediate stand—influence the accretion of the stand, nor when to avoid or when to favor this vegetation; nor is it sure that a woody vegetation, called protective cover, is really more useful than a vegetation of weeds or grass; nor how far continued use of one species or a change to another, different in moisture, different in treatment, will influence the soil.

As soon as it comes to new introduction of mixtures we stand before unsolved problems. Schiffel asserts that *each species grows best with itself.* We know that, but not to what degree soil conditions influence the height growth of different species variously, and how to use such knowledge in the choice of mixtures. We do not yet know how manner of starting the crop, spacing, and thinning influence development of stand and soil conditions: We even formulate general rules of thinning when undoubtedly each species makes special demands. We know that spruce is a pronounced light-needing species in the Alps at tree limit and becomes tolerant in the lowlands; but we do not know where the limits lie nor how admixture might be utilized to secure the best financial results. A number of recommended and practiced mixtures are shown up as deterring examples, followed by some assertions: "No species needs a nurse (*Treibholz*) if the stand is of a density adequate to its characteristics and to the site." In Schiffel's opinion to grow beech and fir as soil cover in oak, pine, and larch stands in a costly measure, unless it is intended that after the harvest of the latter the former are to take their place. From the growing practice of groupwise mixture, the deduction is made that "every species prospers best in its own company," which may then lead to pure forest.

Finally as to a choice of a regeneration method, the argument that it should be a natural one is met with the question, whether "planting or sowing is unnatural; nature does not permit anything unnatural." Wherever it is easier, less costly, possible in shorter time without other disadvantages to soil and stand, than with natural regeneration, to secure a new stand, artificial reforestation is indicated. Even for given sites the question cannot yet be answered with dogmatic certainty, although for beech and fir (tolerant) the author thinks the natural method the rational one. The advantages of the artificial method are stated as saving in time, avoiding difficulties, damage in the harvest and its removal, greater ease in tending regular even-aged stands, independence of the harvest from the course of the regeneration both as to quantity and value. "That naturally regenerated stands on the same sites require longer rotations to furnish the same values as planted ones, is hardly any more in doubt; nor do I doubt that the felling and transportation in the selection forest requires more care, labor, and is more costly than in clearing." Moreover, the natural methods require more skill and labor. Since the practitioners cannot very well wait to have all these questions settled by actual experiment, they have to help themselves as best they can by local experiences against absolute failure. But whether they secure the best results we shall not know, until silviculture is based not on a sum of rules gathered from unrelated empiric data, but on biology, physiology, meteorology, climatology—in other words, on real science; that silvicultural methods are the important factors in determining profitableness, and not formulas and working plans, we may know. Until a better scientific basis is furnished the exchange of opinion can hardly claim to be scientific or to be above the level of a chat.

(If this severe arraignment of ignorance can be made against the German foresters by one of their leading lights, it certainly must teach modesty to us and it must postpone the desire to have a "silviculture on biological basis."—Ed.)

Die 55. Generalversamlung und Exkursion des böhmischen Forstvereines in Pilsen.

Über das Prinzip und die Anwendbarkeit des Femelschlagverfahrens.

Waldbauliche Kontroversen.

Centralblatt für das gasammte Forstwesen, April, 1904, pp. 163-174; October, 1904, pp. 387-394; November, 1904, pp. 435-451.

Forest Experiments in Sweden. Dr. Metzger, the expert attaché to the German legation at Copenhagen, reports that forest meteorological stations, to study forest influences, were started in Sweden in 1876 and that results were published in 1884, 1887, and 1895. After seven years of discussion a forest experiment station was established in 1902 at Stockholm, independent of any other institution, with the object of studying all forest-biological and purely forest-technical questions, which are basic for Swedish forest management, with a very miserly annual appropriation of $4,300. The two divisions, botanical and forestal, are under the direction of two experts, with an assistant to each. The institution is under the Department of Agriculture, and its working plans are determined every three years by a commission of at least five, besides the two directors. The director of the forest school, the professor concerned, and three outsiders complete the commission. The first plan is for the botanical division to make biological investigations of forest types (*Waldformen*); to investigate the different races of spruce and pine in Sweden; to study a typic example of bog formation; and to inspect and determine upon a method of control for Swedish seed. The attention of the forestal division is to be diverted to experiments in thinnings on comparative areas; to construction of yield tables; and to establishing experiment areas for different methods of natural regeneration in the selection forest of Norrland and Darlekarlien. In the latter direction the influence of leaving or removing the brush, of burning over, of harrowing or plowing the ground, of assisting natural regeneration by sowing spruce and pine, will be determined, all on small areas not over one to three acres in extent.

For the experiments in thinning a classification of stems is made, slightly different from the usual.

A. Trees participating in upper crown cover.

1. Dominant with normal crown and well formed shaft.
2. Dominant with abnormal crown or poor shaft form.

   (a) Compressed sidewise; (b) wolf trees; (c) double leaders or other malformations; (d) whips; (e) damaged.

B. Trees not participating in upper crown cover.

3. Laggards, with crown still free at the top.

4. Oppressed, but still growing.
5. Dying and dead, also damaged by snow.

The degrees of thinning also vary somewhat from the German program.

Grade A, "cleaning," removes only class V, the area serving merely for comparison with the original stand. The other grades are called "help thinnings," since they are made to help the main stand. Grade B, corresponding to the German "moderate," takes classes IV, V, and II b, d, e, so far as these cannot be improved by trimming. Grade C, the German "severe," leaves only class I, except that part of class III required to fill blanks. Grades D and E, called "crown thinning," take all trees of class V, as well as II b, c, d, e, besides trees to open up too dense groups of trees of even value, leaving class III and IV, grade E, confined to older stands, taking also whatever impedes the development of class I. In addition, two grades of openings (Lichtungen) are differentiated, the moderate taking 20 per cent., the severe 40 per cent. of the cross section area of a stand after a C grade thinning.

The experimental areas are to be not less than half an acre, isolated by openings ten to fifteen yards wide, a complete series requiring nine areas. The inspection is to be made every five years.

The referee is skeptical regarding these latter experiments, because they are too complicated and follow too closely German ideas. He believes that the Danish practice would form a better basis for these plans. This is questionable, since climatic and forest conditions on the small insular territory of Denmark can in no way furnish indications for the extensive (50 million acres) forests of Sweden, which are mainly coniferous.

Das forstliche Versuchswesen in Schweden. Zeitschrift für Forst- und Jagdwesen, November, 1904, pp. 721-722.

Forest Plantations on the Russian Steppes.

A note based on a report by Borchardt, attaché to the German legation at St. Petersburg, is of interest in giving a rather discouraging account of the result of the planting begun on the Russian plains by German colonists at the end of the 18th century. By the middle of the 19th century, when the government began operations, these plantations aggregated over 25,000 acres. "The problem of afforesting the plains is still unsolved. Whether and to what extent an influence upon the climate, especially upon the devastating winds, which cover fields with shifting sands, exists cannot yet be answered. The practitioners think a forest management with 40 to 50-year rotation possible; science considers it impossible to establish and maintain compact forests on the open steppe, mainly because the roots find sufficient moisture only at a depth of 10 to 12 feet, and hence mostly die early." Nevertheless the interest of the population is great, because they hope for protection to their farms from the plantings, and the State distributes plant material free of charge. Besides rabbits, the insect damage is great. Ash, and more or less elm, maple, and oak plantations have been destroyed entirely by *Cassus aesculi.* The State plantations are executed by Mennonites under military discipline, six companies of 100 each being employed. Oak, ash, elm, maple, basswood, and basswood and *Juniperus virginiana* are being planted; also pines on the shifting sands, the Scotch Pine being a success. The method in general is to plow up to sixteen inches deep and plant with heavy hoes; the cost is said to be $10 per acre. While formerly only willows were used on the sand dunes, now pine, aspen, birch and Black Locust also are employed. The last decade seems to have seen new impetus to this movement.

Aus den Steppenforsteien Südrusslands. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 652-653.

Group System.

To prevent the disadvantages of the group system, which consists in the drying out of the soil of the stand surrounding the group and in the sunscald of the trees of the stand exposed on the south and southwest, it is proposed by Forstmeister Kullman, of Darrmstadt, to cover the exposed area with brush, which also keeps the game from the young growth and the grass down, at an expense of $1.00 to $1.30 per acre, and to tie brush to the trees with flower wire, at a cost of about 2 cents per yard. Satisfactory protection was secured at $1.50 to $2.00 per group.

Beitrag zur Boden-und Bestandspflege, insbesondere für die Gruppenwirtschaft. Allgemeine Forst- und Jagdzeitung, October, 1904, pp. 379-380.

MENSURATION, FINANCE, AND MANAGEMENT.

Forest Rent Versus Soil Rent.

The quarrel between the two schools of forest finance, that of the forest rent and that of the soil rent, continues, although it ought to be easy to agree that the latter has theoretically the only correct principle. But practically its application is largely impossible, owing to lack of data with which to make a sure calculation, namely, a tenable interest rate and a knowledge of future prices. Forstrath Usener accentuates these difficulties. In 1815 State loans in Germany bore 6%; gradually the interest rate sank to 4% in 1830, and during the next decade still lower, to rise in consequence of the revolution of 1848, and remain for a long time, at 5%. At present Prussian consols are worth 3.5%, English consols 2.8%. Whether in the 60 to 160 years which must elapse until the harvesting of a forest, the interest rate will have fallen or risen, and how much, nobody can tell; the rate to be used in soil rent calculations can, therefore, be only speculative. The actual soil value varies considerably within small range; in Alsace, for instance, it lies probably between 30 and 170 cubic feet of production per acre, but soil prices vary quite independently of production by force of location. Knowing that prices for certain woods and dimensions have in the last twenty-five years risen 100% and more—in Alsace during the last fifteen years at an annual rate of 2.35%—that other sortments have fallen in price, and that a whole industry (tanbark) has become entirely unprofitable, it seems untenable to use any present values, interest rates, etc., for deriving from future yield a forest value. The author has therefore used another method of valuation which he thinks led to practical results; but the method is not revealed. He points out that the determination of increments is expensive in time and money, especially as it has to be made for each territory separately, for he found that to attain a diameter of 24 inches in one locality 75, in another 150, and in third 300 years were required. In a selection forest matters become still more complex, almost impossible of statement, and similarly in mixed forest. Furthermore, after the felling budget corresponding to a rotation is determined, windfalls are constantly disturbing it and forcing to a different budget. Considering, therefore, the unreliable nature of the soil rent calculations, the value accretion which comes from longer than soil rent rotations, the price accretion, and the fellings which are unforeseen as results of damage, the author thinks there can be little doubt which school to follow for the policy of State or communal property.

Waldreinertrags- und Bodenreinertragswirtschaft. Allgemeine Forst- und Jagdzeitung, October, 1904, pp. 345-351.

UTILIZATION, MARKET, AND TECHNOLOGY.

Matchwood Requirements and Species.

An amusing incident, namely, ignorance on the part of German match makers as to the identity of "Cork Pine" with our common White Pine, led Dr. Mayr into the investigation of its value for matches as well as the value of other species. Dr. Mayr himself does not seem to know that cork pine is a term used to designate pine of a certain quality which is now largely a matter of the past, and proposes to use it as the general name of the pine.

The points to be considered in the qualities of wood for match manufacture are low specific gravity, high degree of elasticity, even structure, a quiet even flame, ease of penetration for paraffin, and cheapness. Light wood saves in freight, is softer and hence easily manufactured, favors ready ignition and continuance of flame, and permits easy penetration of paraffin. So if of sufficient strength and elasticity, wood below 0.4 specific gravity is preferable to heavier woods.

Dr. Mayr refers to the natural law announced by him fifteen years ago—that in every species the weight diminishes from the optimum or central field of its distribution toward the outskirts, no matter whether the ring width grows (toward warmer climate) or diminishes (toward colder climate), the same law ruling with regard to the change from a certain optimum soil for the species to less favorable ones, change in density of stand, etc. Conditions of the Norway Spruce are adduced to illustrate this law, the alpine and northern limits of the Spruce furnishing the lightest wood as well as the warmest situations in its field of distribution; the absolute best, rich garden soil, forms the lightest porous wood, and so does the open position which gives rise to quickest growth. Dr. Mayr very wisely points out that owing to differences in growth conditions there can be found side by side trees with heavy wood and trees with light wood, hence the insufficiency of state—based in single determinations. Farther on, however, he permits himself to make from entirely insufficient data (a few trees) the deduction that in Germany White Pine makes neither heavier nor lighter wood than in its native habitat; and other deductions also appear, but poorly supported so far as data are concerned. He adduces the weights given for *Picea engelmanni* (34.5) and *Picea pungens* (37.4) in the Tenth Census as probably *abnormally* light, else these species would be better for matches than White Pine. Because they exceed the specific weight of 40, the genera *Juniperus, Thuja*, and *Cupressus* are excluded from consideration. The fact that heartwood formation accompanied by change of color increases the weight (the color bodies being heavier than the plasma bodies from which they are formed) is alluded to. The best matchwood is declared to be *Cunninghamia sinensis*, with a specific weight of 26.7 and sufficient strength; next all the *Chamaecyparis* (in spite of weight!), a number of *Thuja* (in spite of weight!) *Taxodium, Sequoia, Cryptomeria,* etc. Dr. Mayrs wonders why *Abies* are not more used; they should be excellent for matchwood. The yellow pines are excluded. Of broadleaf woods all those with fine, even pith rays and specific weight under 50—under 35 is too soft—Magnolia are at the upper limit. *Tilia, Populus,* and *Salix* are especially important, and it is stated that most foursided matches (in Germany) are manufactured from veneer sheets of these genera. Besides, *Liriodendron, Negundo,* and *Nyssa* (? !) are considered adapted, as well as several Japanese species.

As to strength, the conifers are preferable because less liable to cross grain, though they also are subject to this fault, "especially on sunny and shallow sites." Cross grain is rarely found in White Pine. No conifer with "normal" (straight?) grain is insufficiently strong for matchwood. Those which, like the white pine group, do not develop a pronounced summer wood zone are most serviceable because of the ease of penetration by paraffin. Resin contents, although increasing inflammability, interfere with strength and penetrability, and also smoke and smell.

Finally, experiments on the adaptation of various woods were made with fifty probably useful species, by using foursided matches and noting the time they needed, when placed horizontally, to burn down, to 3 cm. (a little over 1 inch), either with or without paraffin impregnation. Without paraffin the duration was longer in broadleaf woods than in conifers, the flame more even and less spluttering, which in conifers makes it necessary to turn the match to prevent its extinguishment. *Cunninghamia* and the white pines, and the *Cupressus* species behaved the best. Impregnation with paraffin hastens the progress and illuminating power of the flame by 4-6 seconds in the average. With such impregnation the following scale gauged by duration, luminosity, and size and regularity of flame, *i. e.*, quality, was obtained: *Tilia, Populus, Salix, Liriodendron, Alnus, Juglans,* and then the conifers with *Cunninghamia* and the white pines first, which also throw less sparks and splutter less than the rest of the conifers.

A discussion of price follows, in which the statement of interest is that White Pine from Canada, delivered loco Reinach in Baden, in the shape of prisms, sells at 40 to 50 cents per cubic foot ($34-42 per M board feet), a price which it is claimed is attained in the German forest only by the best ash or oak—hardly by the finest spruce resonance wood. (We are inclined to think that there is some error in the comparisons, and that the investigations lack in precision.—Ed.)

Über Hölzer fur die Zündholzindustrie, insbesondere über die "Korkkiefer." Allgemeine Forst- und Jagdzeitung, October, 1904, pp. 351-359.

Oak Tanbark. How a forest industry may decline owing to the competition of substitutes is shown in an article on the market for oak tanbark by Dr. Hess. This industry, which relies on oak coppice with short (12- to 16-year) rotations, has been very lucrative in the Rhenish provinces until 1876, when the price per 100 pounds was nearly $2.50; but the price then gradually declined to 45 per cent. of that rate in 1903, while labor wages rose, and an import duty directed against quebracho and other substitutes did not have any effect. The necessity of conversion to timber forest, oak on the better, conifer on the poorer sites, is suggested.

Ergebnisse des Eichenrinden-Marktes zu Hirschhorn. Allgemeine Forst- und Jagdzeitung, September, 1904, p. 313.

Lumber Monopoly in Scandinavia.

A note based upon a report by Dr. Metzger speaks of the efforts of some mill owners in Scandinavia to regulate the output in order to control prices, the cut in 1900 being reduced 40 per cent. and in 1902 20 per cent. Nevertheless, the exports increased again in 1902 to the extent of 100,000 Petersburg standards (165 cubic feet each). The bulk of the exports goes to England, with 75 million cubic feet, France taking 26 million, Germany 16 million, the total being about 165 million cubic feet. "A general increase in prices on the russo-finnish-scandinavian market was to be expected, in which the reports from America had an influence to the effect that the increase in consumption by home industries has reduced American competition more and more." The formation of a trust among the millmen to control the Swedish wood market is under consideration; and the forest owners are trying to combine in order to counterbalance the effects of monopolistic organization among the millmen; while the Swedish forestry association formed in 1902 has the objects of combating the excessive exploitation and of introducing rational working, protective legislation, etc. A similar movement goes on in Norway.

Waldbenutzung und Holzexport in Skandinavien. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 653-555.

Naval Stores in Germany.

Under the title "A Neglected Industry" Mr. Grunwald points out that Germany could and should revise the naval store industry in its forests, using as it does about 50 million pounds of spirits of turpentine and 175 million pounds of camphor, etc., or about 8 million dollars' worth of naval stores, most of which comes from the United States, which furnish four-fifths of the world's consumption, the rest being produced by France and Austria. The Naval Store Trust of the United States gives rise to these discussions, having in the years from 1897 to 1904 raised prices for spirits 100 per cent., and the French producers also found it necessary to combine into a syndicate. Substitutes are being used as far as practicable, but they are mostly not satisfactory. Under reference to the fact, that during the war of secession a naval industry was established in Corsica, which collapsed when the prices sank again after the war, it is pointed out that the industry abandoned in the middle of the last century might be profitably re-established, now, especially to prevent an outflow of German capital to the United States.

Eine vernachlässigte Industrie. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 640-643.

Preservatives for Building Materials.

The Technical Bureau of the Austrian army has made tests of various preservatives for building materials. It is stated that not the depth of penetration, but the concentration of the preservative is essential: Painting with sufficiently strong and concentrated antiseptics protects against rot even when fungi are already established in the interior; the stronger the antiseptic the more superficial may be its application; the weaker the antiseptic the deeper it must penetrate to secure resuls.

Fluoric acid (50% concentration) and fluorine compounds are specially recommended, besides the phenols, which for building materials can be used by painting and dipping; the former being not only more effective but cheaper. A mixture of ferric fluor or zinc fluor with fluoric acid is recommended. Antinonnin, antigermin, and antipolypin were found satisfactory materials.

Über Holzkonservierung im Hochbaue. Centralblatt für das gesammte Forstwesen, October, 1904, pp. 398-403.

Fire-proof Wood.

The United States Navy Department favors the discontinuance of the use of "fire-proofed" wood in naval construction.

The following are the main reasons advanced for this discontinuance: (1) The cost; extra expense in working, due to the fact that the salts contained in the wood injure the tools; extra cost and repairs due to the lessening of the strength of the wood by the process and that the salts contained have an injurious effect on the paint used for its protection; also the deterioration of metal fittings upon contact with the wood, due to the corroding effect of the contained salts. (2) There is a reduction of the fire-resisting qualities in time, especially in the case of exposed timbers.

Report of the Chief of the Bureau of Construction and Repair. Reviewed in the St. Louis Lumberman, January 15, 1905, p. 102.

STATISTICS AND HISTORY.

Prussia. The Royal Statistical Bureau of Prussia has issued its first yearbook, for 1903. The total forest area of Prussia in 1900 was 20,426,000 acres, of which just about one-half was in private ownership, the State owning 6,318,000 acres, and communal or corporation forests occupying somewhat over 3,500,000 acres.

The different methods of forest management were distributed as follows in their rounded off proportions:

	Percentage of total forest area.			
	State.		Others.	
Deciduous	25		30	
High forest		90		56
Selection forest		3		10
Simple coppice		6		25
Coppice with Standards		1		9
		100		100
Coniferous	75		70	
High forest		99.2		87
Selection forest		.8		13
	100	100.00	100	100

The age class distribution in high forest exhibits the near approach to sustained yield management, especially in the State forests and the failure to approach it in private forests for rotations over 60 years, corporation forests holding middle ground.

Ownership.	Age Class—Years. Over 100	81 to 100	61 to 80	41 to 60	21 to 40	1 to 20	Clearings and blanks.
	Area—Thousand Hectar.						
State	386	310	375	489	464	465	67
Corporation	70	107	155	213	248	230	29
Private	111	160	320	569	763	779	126

The total cut produced in the Kingdom during the year 1900, in addition to 230,000,000 cubic feet of brush, stumpwood, and the like, was workwood to the amount of 340,000,000 cubic feet and fuelwood over three inches in diameter, 296,000,000, or only 31 cubic feet per acre.

The price of wood in 1900, somewhat higher than in the following two years, was a little less than 10 cents per cubic foot for workwood (stumpage with logging cost added) and for fuelwood 3¼ cents per cubic feet, which may be roughly translated into $17.00 per M feet and $3.00 per cord.

Statistisches Jahrbuch für den Preussischen Staat. Price, one mark. Reviewed in Zeitschrift für Forst- und Jagdwesen. November, 1904, pp. 727-730.

German Empire. The above statistics for Prussia are supplemented for the entire German Empire in the Quarterly of the Statistical Bureau, 1903, II, which contains the census of 1900. The total area of forest has grown slightly (0.9 per cent.) during the last twenty years, and is now (1900) 34,526,000 acres, or 25.89 per cent. of the total land area; in addition there are 1,580,000 acres fit for reforestation, mostly in Prussia. For larger districts or states the percentage of forest cover varies between 18 and 38 per cent. The ownership conditions also have changed slightly, private and corporation forests having grown less by 2 per cent., so that now the following proportions obtain:

Forest.	Per cent.
Crown	1.8
State	31.7
State part owner	.2
Communal	16.1
Institute	1.5
Corporation	2.2
Private	46.5
	100.0

In Bavaria, however, the State property has been considerably reduced.

The distribution of species and kind of management shows that conifers have gained ground and deciduous woods have been reduced, the reduction taking place mainly in coppice with standards and apparently in selection forest. The distribution is as follows:

Forest.	32.5% Deciduous. Per cent.	67.5% Coniferous. Per cent.
Coppice	6.8	...
Standard in Coppice	5.0	...
Selection	2.3	7.4
High	...	60.1
20% oak	18.4	...
Pine	...	68.0
Spruce	...	30.0

Coniferous forest prevails in Eastern and Middle Germany, especially in Brandenburg, where it represents 83 per cent.; deciduous forest in the west and south.

Coppice and coppice with standards are mostly in private hands, as well as coniferous selection forest; the States control the timber-forest area to the extent of 90 per cent. of their holdings in deciduous and nearly 100 per cent. of their own coniferous forest, or nearly 40 per cent. of all coniferous forest. A tolerably good age class gradation appears in 40-year periods, at least in the deciduous forest.

Forest	Age Class—Years. Over 80 Per. Cent.	41-80 Per cent.	1-40 Per cent.	Blanks Per cent.
Deciduous	31.6	36.4	30.8	1.2
Coniferous	15.8	33.1	47.6	3.5

The conditions in the State forests alone are better:

Deciduous	37.4	34.3	27.1	1.2
Coniferous	24.2	34.0	39.1	2.7

The uncontrolled private forest, which comprises 12.5 million acres, shows a much smaller amount of old timber and a much poorer age class distribution:

Deciduous	18.2	34.5	44.8	2.5
Coniferous	8.4	30.0	56.4	5.2

The difference in yield also is instructive in showing the relatively poor results of the uncontrolled private forest, the State forests furnishing the largest amount of workwood, 43.5 per cent., and the largest amount of timberwood generally (over 3 inches) 40.3 per cent., while the uncontrolled private forests furnish from a larger area only 25.7 per cent. and 26.2 per cent. of the supply classes of wood. The total cut of workwood is somewhat over 700 million cubic feet (about 4 billion board feet), and of the better class of fuelwood 630 million (about 6 million cords), or altogether not quite 40 cubic feet per acre of wood over three inches in diameter. Further interesting detail is found in this publication in addition to three maps of distribution.

Die Forsten und Holzungen im Deutschen Reich. Zeitschrift für Forst- und Jagdwesen, December, 1904, pp. 773-780.

Alsace Lorraine. The results of a well managed smaller forest administration appear in the statistics of Alsace Lorraine. They refer to round 375,000 acres of State forest and 450,000 acres of corporation forest. The cut on the former was in 1902-3 round 23.6 million cubic feet outside of brush, etc., or not quite 60 cubic feet per acre, with 55 per cent. workwood, while in the corporation forests it was 72 cubic feet, with only 33 per cent. workwood. The cost of logging and cordwood in the latter came to 1¼ cents per cubic foot. The price obtained averaged 7.66 cents. The prices for different species were:

Species.	Workwood.	Fuelwood.
	Cents per cubic foot.	
Oak	18.6	5.1
Beech	9.9	6.2
Softwoods	8.2	4.2
Conifers	9.0	4.5
Average	10.2	5.6

In the State forests the total expenditure was $2.12 per acre, the gross income $4.56 in the regular management; but through windfalls and in other ways extraordinary expenditures and incomes bring the yearly balance to $3.80 per acre, as against the regular result of $2.44 per acre. The expenses per acre differentiate themselves into management and protection, 65 cents, or 31 per cent. of the total; woodcutting, 81 cents, or 38 per cent.; planting, 13 cents; roadbuilding, 10 cents; or altogether, $90,000.

The wages during the logging season were 52 cents per day;

during summer felling, 72 cents; while planting cost 50-53 cents for men and 30-35 cents for women. A man's average earnings were 54 cents in spring and summer, 48 cents in fall and winter; the logging cost about 2-3 cents per cubic foot and about the same per cord foot.

The items of the planting plan may be of interest by the makeup and cost items to justify its reproduction here, with figures somewhat rounded off.

Chapter I. Natural regeneration.
- a. Initiation of same: 118 acres @ $4.26 per acre.
- b. Repairing imperfect regeneration:
  1. By seed: 35 acres deciduous and 18 coniferous, @ $2.30 per acre.
  2. By planting: 335 acres deciduous and 425 coniferous, @ $7.65 per acre, or $2.45 per 1,000 plants.

Chapter II. Artificial reforestation: 1,040 acres new, 730 acres repair.
1. By seed: 278 acres deciduous, 275 coniferous, @ $3.64 per acre.
2. By planting: 630 acres deciduous, 875 acres coniferous, @ $8.00 per acre, or $1.66 per 1,000 plants.

Chapter III. Underplanting: 378 acres new, 134 acres repair.
1. By seed: 24 acres deciduous, 8 coniferous, @ $3.95 per acre.
2. By planting: 420 acres deciduous, 90 coniferous, @ $5.85 per acre, or $1.12 per 1,000 plants.

Chapter IV. Nurseries: 112 acres with $11,500.

Chapter V. Purchase of seed and seedlings: for seed $4,400; for plants, $1,500.

Chapter VI. General care of felling areas and trees: 17,100 acres with $10,500.

Chapter VII. Care of Soil: For irrigation, $120; for drainage, $380; for care of ditches, $820; for protection ditches and leaf catches, $440.

Chapter VIII. Planting tools: $870.

Chapter IX. Sundries: 26,000 yards of fence, etc., $3,800; other improvements, $2,370.

Total expenditure, $60,000, or 16 cents per acre.

Forststatistisches aus Elsass-Lothringen. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 659-664.

Austria.

The *Statistisches Jahrbuch* of the Austrian Department of Agriculture for 1903 brings the following data of interest referring to conditions for 1900:

Total forest area is a round 24 million acres, of which not quite 8 per cent. are State forest, somewhat less than 4 per cent. forests under State administration, 13 per cent. municipal forest, 17 per cent. belonging to various institutions, and 58 per cent. private forest. Coniferous forest covers 60 per cent of the area, deciduous forest a little over 20 per cent., and mixed forest the balance. Coppice and composite forests are found on only 4 per cent., the balance being timber forest. The annual accretion in timber forest is stated to be 45 cubic feet, with 45 per cent. workwood, in composite forest 35.2 cubic feet, with 20 per cent. workwood, in coppice 34.5 cubic feet, with 11 per cent. workwood.

Hunting in Prussia.

Since everybody in Prussia who desires to hunt must pay for a permit, we know from the statement of the forest administration the precise number of hunters for each year. From April, 1903, to March, 1904, there were 180,771, of which, however, 22,550 had only a daily pass. The income from this source was a round $540,000.

Nachweisung der im Preussischen Staate ausgegebenen Jagdscheine. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 658-659.

Canada.

From the second volume of the Fourth Census of Canada we glean the following: During the last census year the square, waney, and flat timber cut amounted to 11,726,914 cubic feet, with a value of $1,480,312. Compared with previous years this shows a great decline. In 1891 the total production was 44,-711,868 cubic feet; in 1881 it was 111,633,862 cubic feet, and in 1871 it was 65,669,871 cubic feet. In addition to the falling off in these classes of timber, the aggregate production of logs of all kinds diminished by 25 per cent. during the last decade, and the only increase in miscellaneous products was in wood for pulp, of which there were produced 261,110 cords in 1891 and 668,034 in 1901. The value of forest products of all kinds in 1901 was $51,082,689, in addition to which furs of wild animals were obtained to the value of $899,645.

Lake States. Nine pages of tables in the American Lumberman for January 21, 1905, give detailed information of the different milling districts in Michigan, Wisconsin, and Minnesota. The significant fact which should be noted by every forester is that nearly 600,000,000 board feet less of White Pine and Red Pine were cut in 1904 than in 1903. The decline of the cut in our Lake States is becoming more rapid every year.

German Colonial Policy. The efforts to secure a rational forest policy in German Africa seem, according to an official document, not to have had satisfactory results so far, because of lack of personnel and the great variety of economic and site conditions. In Southwest Africa a nursery has been established successfully and next year forest planting is to begin. In East Africa the immediate aim is to preserve the small forest area of the government and add to it by reserving suitable areas of bushland for afforestation, and also to extend Government control over the private forests. The Government forest under management comprises so far only about 45,000 acres. Yet a cut of nearly five million cubic feet was made in 1903, that with some bark netted $5,400. For reforesting the bushlands the species used, besides bamboo, mangrove, *Albizzia Lebbeck*, and *Cassia florida*, are teak, mahogany and a wood similar to it, *Erythrophlorum guineuse*, and *Chlorophora excelsa odum*. Private management begins to develop favorably; now all the better woods from clearings are utilized, while formerly they were allowed to rot. Several planters own sawmills and bring lumber to market, especially in Zanzibar.

Forstliches aus den deutschen Schutzgebieten in Afrika. Zeitschrift für Forst- und Jagdwesen, December, 1904, pp. 771-780.

POLITICS AND LEGISLATION.

Differential Freight Rates.

A long, very well written article on import duties and freight rates for wood, by Prof. Jentsch, quotes Bismark as to the necessity of adjusting railroad rates at the same time as revising import duties. The situation in Germany is briefly stated: German forestry needs a protective tariff, because its product is not as that of most of the exporting countries, a free gift of nature roughly exploited; but secured by economic effort with the necessity for capital and labor in its production, *i. e.*, more expensively. But since Germany cannot produce all the wood needed, the tariff is gauged so that it will not prevent importation, namely, about 5 cents per 200 pounds on raw materials, while manufactured wood pays six times as much, or about 30 cents per 200 pounds. Austria, which sends to Germany most of the manufactured lumber imports—a round 25 million dollars' worth—is most concerned in the tariff, especially since Austrians have engaged on a large scale to exploit the forests of Bosnia, creating thereby a severe competition to their own country and threatening the German mill business as well as the forest administrations. Moreover, Austria has met the German tariff by reduced freight rates on the State railroads and increased export duties on round logs, so that the import duty has become nugatory. Interesting examples and calculations are given. The author suggests meeting this condition by differential and discriminating rates on the German railways. It is shown by statistics that, although importation is necessary, there is need of enabling some of the eastern German provinces to compete with the importers in the western provinces by shipping their surplus at lower rates. A calculation of the shipments from these provinces to the western, highly industrial centers of consumption shows that probably 60 per cent. of their cut, or 50 million cubic feet of woodwork, is shipped, while about 120 million are received by the western provinces from foreign sources in competition with the East. The consumption of the territory concerned is about 260 million (35 cubic feet per capita as against 16 cubic feet for the whole empire), of which only 30 million are produced in that territory, the balance being imported by way of the North Sea.

It is also believed that by favoring the eastern shipments a better equalization of wood prices may be obtained. During the period of 1895-99 forest prices for workwood were 7 to 8.8 cents, or 13 per cent., higher in the Rhenish provinces, while lumber at the same time was about 45 per cent. higher. A different freight rate for the long and the short haul, against which so much objection is made with us, is advocated.

Beiträge zur Festsetzung der Zollsätze und Eisenbahnfrachttarife für Holz. Zeitschrift für Forst- und Jagdwesen, October, 1904, pp. 611-629.

MISCELLANEOUS.

Saw-mill on Wheels. The increased difficulties of logging in winter and the desire to minimize the amount of labor have led Mr. Wm. Cook, a prominent lumberman of Hillsdale, Ontario, Canada, to build a mill that can be transported from place to place as the cutting proceeds.

The mill is built in the same manner as the stationary mill, with engine and boiler and lumber, shingle, and wood-cutting machinery in one frame. The lower story is 70 feet by 12 feet, having two bents running lengthwise, built and bolted together like the framework of a bridge. The engine, boiler, shafting, and wood-cutting machinery are on this lower floor. On the upper story, 70 feet by 18 feet, is the sawmill proper.

Along each side of the mill are five flanged wheels, through each of which extends a short shaft $2\frac{1}{2}$ inches in diameter, with a bearing at each end to support the mill. A space of six inches is left between the bearings and the flange of the wheel, so that the wheel may successfully round a curve.

The wheels are placed on an ordinary railroad rail, which is spiked to a 6 by 10-inch timber laid upon ties. The mill is moved by means of a block and tackle, the power being supplied by the engine operating the mill.

The daily capacity of the mill is 25,000 feet of lumber, 20,000 shingles, and as much cordwood as is on the ground when the timber is cut. The land is cleared of everything but brush, and when the timber for about 200 feet ahead is cut, the mill is moved along. The longest haul would not be over 300 feet.

This mill has worked well in practice, and by its use the cost of the lumber from the stump to the finished product is said to be but $3.00 per thousand.

Modern Methods of Sawmilling. Canada Lumberman, January, 1905, pp. 48.

An oak forest estimated to date back at least 6,000 years has been found in a turf moor in southern Sweden, 20-25 feet below the surface. The stumps are of enormous size and the wood so well preserved that the minutest detail is recognizable and much of its life history, such as the attacks of parasites and insects, now unknown, can be read from it. Several horns of elk found show a very different flatter and broader form than those of the present. The underwood appears to have been mainly birch and pine, also well preserved. Conditions surrounding this interesting find suggest that it represents a landslide into the basin of a lake, similar to a more recent occurrence of that nature in Norway.

Notizen. Centralblatt für das gesammte Forstwesen, November, 1904, p. 477.

An interesting article in the Forum (January-March, 1905) on German and American forestry methods, by Guenther Thomas, editor of *Die New Yorker Staats Zeitung,* seems to have been inspired by the forestry exhibits at the Louisiana Purchase Exposition, which he declares "has been a revelation to the American visitor."

The introduction deals with the fundamental hindrance to the advancement of forestry in this country, viz: the indefinite idea of the masses as to what forestry really means, and the failure to realize that it has a sound economic basis. He points out that the proper time to check reckless use of timber resources is too often missed, while forestry is not resorted to until an actual shortage is felt. The result of inaction is shown in Spain, where the country's decline dates from the time her timber supply became exhausted.

The historical sketch of the development of forestry in Germany and America is too brief to be satisfactory, and, in common with that of the development of forestry instruction in Germany, seems somewhat foreign to the title of the article. Of greater interest is the outline of study at the present forest academies of Eberswalde and Hann-Münden, and the subsequent steps in the foresters' career until he becomes "Oberforster."

For America there are described the conditions under which the American Forestry Association was founded, the early days of the Bureau of Forestry, the work of Dr. Fernow, and the creation of the New York State College of Forestry. Governor Odell's action in abolishing the College of Forestry at Cornell is severely criticised.

The writer is evidently not intimately acquainted with the policy and field work of the Bureau of Forestry, although it is well brought out that American foresters are dealing with conditions peculiar to this country and are carrying on their work regardless of the methods used abroad.

The title leads the reader to expect a more comprehensive comparison between the administrative and silvicultural methods employed in the forests of Germany and America, but outside of disappointment in this direction, the article is both interesting and instructive.

NEWS AND NOTES.

E. A. Sterling, *in Charge.*

Of all the much good forestry legislation under consideration during the present legislative session throughout the country, none will be so important a development for the profession of foresters and for the advancement of forestry in the United States as the forest reserve transfer approved by President Roosevelt, February 1. The principles to govern the administration of the Federal forest reserves by a trained Forest Service are outlined in the following letter:

"United States Department of Agriculture,
"Office of the Secretary,
"Washington, D. C., February 1, 1905.

"*The Forester, Forest Service.*

"Sir: The President has attached his signature to the following Act:

"'An Act providing for the transfer of forest reserves from the Department of the Interior to the Department of Agriculture.

"'*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of the Department of Agriculture shall, from and after the passage of this Act, execute or cause to be executed all laws affecting public lands heretofore or hereafter reserved under the provisions of section twenty-four of the Act entitled, "An Act to repeal the timber-culture laws, and for other purposes," approved March third, eighteen hundred and ninety-one, and Acts supplemental to and amendatory thereof, after such lands have been so reserved, excepting such laws as affect the surveying, prospecting, locating, appropriating, entering, relinquishing, reconveying, certifying, or patenting of any such lands.

"'Sec. 2. That pulp wood or wood pulp manufactured from timber in the district of Alaska may be exported therefrom.

"'Sec. 3. That forest supervisors and rangers shall be selected, when practicable, from qualified citizens of the State or Territories in which the said reserves, respectively, are situated.

"'Sec. 4. That rights of way for the construction and maintenance of dams, reservoirs, water plants, ditches, flumes, pipes, tunnels, and canals, within and across the forest reserves of the United States, are hereby granted to citizens and corporations of the United States for municipal or mining purposes, and for the purposes of the milling and reduction of ores, during the period of their beneficial use, under such rules and regulations as may be prescribed by the Secretary of the Interior and subject to the laws of the State or Territory in which said reserves are respectively situated.

"'Sec. 5. That all money received from the sale of any products or the use of any land or resources of said forest reserves shall be covered into the Treasury of the United States, and for a period of five years from the passage of this Act shall constitute a special fund available, until expended, as the Secretary of Agriculture may direct, for the protection, administration, improvement, and extension of Federal forest reserves.

"'Approved, February 1, 1905.'

"By this Act the administration of the Federal forest reserves is transferred to this Department. Its provisions will be carried out through the Forest Service, under your immediate supervision. You have already tentatively negotiated the transfer with the Commissioner of the General Land Office, whose powers and duties thus transferred I assign to you. Until otherwise instructed, you will submit to me for approval all questions of organization, sales, permits, and privileges, except such as are entrusted by the present regulations to field officers on the ground. All officers of the forest reserve service transferred will be subject to your instructions and will report directly to you. You will at once issue to them the necessary notice to this effect.

"In order to facilitate the prompt transaction of business upon the forest reserves and to give effect to the general policy outlined below, you are instructed to recommend at the earliest practicable date whatever changes may be necessary in the rules and regulations governing the reserves, so that I may, in accordance with the provisions of the above Act, delegate to you and to forest reserve officers in the field, so much of my authority as may be essential to the prompt transaction of business, and to the administration of the reserves in accordance with local needs. Until such revision is made, the present rules and regulations will remain in force, except those relating to the receipt and transmittal of moneys, in which case Special Fiscal Agents of this Department will perform the duties heretofore rendered by the Receivers of Local Land Offices in accordance with existing laws and regulations. The Chief of Records, Forest Service, is hereby designated a Special Fiscal Agent, and you will direct him at once to execute and submit for my approval a bond for Twenty Thousand Dollars.

"On December 17, 1904, the President signed the following order:

"'In the exercise of the power vested in the President by section 1753 of the Revised Statutes and acts amendatory thereof:

"'It is ordered, That all persons employed in the field and in the District of Columbia in the "protection and administration of forestry reserves in or under the General Land Office of the Interior Department" be classified and the civil-service Act and rules applied thereto, and that no person be hereafter appointed, employed, promoted, or transferred in said service until he passes an examination in conformity therewith, unless specifically exempted thereunder. This order shall apply to all officers and employees, except persons employed merely as laborers, and persons whose appointments are confirmed by the Senate.'

"This order classifies the whole Forest Reserve Service, now transferred, and places it under the civil-service law.

"In the administration of the forest reserves it must be clearly borne in mind that all land is to be devoted to its most productive use for the permanent good of the whole people and not for the temporary benefit of individuals or companies. All the resources of forest reserves are for use, and this use must be brought about in a thoroughly prompt and businesslike manner, under such restrictions only as will insure the permanence of these resources.

The vital importance of forest reserves to the great industries of the Western States will be largely increased in the near future by the continued steady advance in settlement and development. The permanence of the resources of the reserves is therefore indispensable to continued prosperity, and the policy of this Department for their protection and use will invariably be guided by this fact, always bearing in mind that the *conservative use* of these resources in no way conflicts with their permanent value. You will see to it that the water, wood, and forage of the reserves are conserved and wisely used for the benefit of the home builder first of all; upon whom depends the best permanent use of lands and resources alike. The continued prosperity of the agricultural, lumbering, mining and live-stock interests is directly dependent upon a permanent and accessible supply of water, wood and forage, as well as upon the present and future use of these resources under business-like regulations, enforced with promptness, effectiveness, and common sense. In the management of each reserve local questions will be decided upon local grounds; the dominant industry will be considered first, but with as little restriction to minor industries as may be possible; sudden changes in industrial conditions will be avoided by gradual adjustment after due notice, and where conflicting interests must be reconciled, the question will always be decided from the standpoint of the greatest good of the greatest number in the long run.

"These general principles will govern in the protection and use of the water supply, in the disposal of timber and wood, in the use of the range, and in all other matters connected with the management of the reserves. They can be successfully applied only when the administration of each reserve is left very largely in the hands of the local officers, under the eye of thoroughly trained and competent inspectors.

"Very respectfully,

"JAMES WILSON, *Secretary.*"

The positions of Forest Superintendent for Southern California and for the northern division of the Sierra reserve, formerly held by Col. B. F. Allen and Charles S. Newhall, have been abolished.

Former Forest Supervisor Charles A. Taggart of the Stanislaus and Lake Tahoe reserves has been superseded by S. L. N. Ellis, formerly Forest Ranger-at-Large of the northern division of the Sierra reserve.

F. S. Bartlett, formerly Forest Supervisor of the San Jacinto and Trabuco Canyon reserves, has resigned, his place being taken temporarily by Forest Ranger J. B. Bell.

The death of Forest Supervisor I. B. Hannah of the Pecos River reserve, occurred on January 14th; his place is filled temporarily by Forest Ranger L. F. Kneipp, who was formerly on the Prescott reserve.

Forest Inspector Louis A. Barrett is temporarily in charge of the western division of the Santa Barbara reserve.

Forest Inspector H. D. Langille has left Washington for Alturas, Cal., where he will organize the local administration of the Modoc and Warner Mountain reserves.

The planting work in the San Gabriel Mountains near Los Angeles will be begun this spring with much promise of success. The recent heavy rains throughout Southern California have made conditions more favorable for planting on the arid mountain slopes of that region than they have been for years. This is very fortunate since the planting experiments, which have been carried on under the direction of T. P. Lukens, have reached a stage where the seedlings now in the nurseries should be planted out upon the mountain slopes. Preparations for planting have been under way for some time by cutting lines through the brush and digging holes for the plants. The wet weather has now made possible the transfer of seedlings to the places prepared for them. If the winter continues rainy, some seventy-five acres will be planted to the various species adapted to the region, and by several different methods, in order to give the greatest experimental value to the work. If sufficient municipal funds are available, planting will also begin in Griffith Park, a forest tract recently acquired by the City of Los Angeles and which is to be planted according to plans prepared by G. B. Lull.

G. W. Peavy, with F. B. H. Brown and E. C. Clifford as assistants, has gone to Santa Barbara, California, to begin extensive planting on the chaparrel-covered mountains of that region. A forest nursery will be established this spring and the actual work of planting on the mountain slopes begun as soon as seedlings can be grown. This work meets a popular desire on the part of the people of that region, and is an important step in the enormous task of reforesting the important watersheds of Southern California.

The assistant professorship of forestry recently established in the University of Michigan has been filled by the appointment of Mr. Walter Mulford to the position.

Mr. Mulford graduated from Cornell in 1899, with the degree of B. S. A., and then returned to the New York State College of Forestry, from which he graduated in 1901 with the degree of F. E. He was forester to the Connecticut Agricultural Experiment Station of New Haven from April, 1901, to July, 1904, and was also State Forester of Connecticut from July, 1901, to July, 1904. During the summer term of 1902 and the fall term of 1903, he taught forest mensuration and silviculture in the Yale Forest School. Since July, 1904, he has been in charge of commercial tree studies in the southern Appalachian region for the Bureau of Forestry. Mr. Mulford has been president of the Connecticut Forestry Association since May, 1903; is an Active Member of The Society of American Foresters; was vice-president of the American Forestry Association for Connecticut for

1903 and 1904; and was on the Board of Editors of the FORESTRY QUARTERLY from its beginning until the present year.

As soon as he completes his report on the Appalachian hardwoods, Mr. Mulford will study in Europe for several months, returning next fall to assume his duties at Ann Arbor, where he will lecture and have charge of the field work in silviculture and mensuration.

Forestry has increased to such proportions in Massachusetts since the appointment of Alfred Akerman, M. F., as State Forester, in June, 1904, that the position of Assistant State Forester has been created, and Mr. Akerman has selected Ralph Chipman Hawley of the Bureau of Forestry to assist him.

Mr. Hawley graduated from Amherst College in 1901 with the degree of B. A. In 1904 he graduated from the Yale Forest School with the degree of M. F. During the summer of 1903 Mr. Hawley assisted in the preparation of working plans by the Bureau of Forestry for tracts in northern New Hampshire. In June, 1904, he was appointed a Forest Assistant in the Bureau of Forestry and assigned to the charge of a party making a working plan for coal and oil lands in West Virginia.

Mr. Hawley will leave the service of the Bureau to assume the duties of his new position about April first.

The Cleveland-Cliffs Iron and Coal Company has during the last few years inroduced in a tentative way some practical measures upon their extensive holdings of lands in the northern peninsula of Michigan. S. M. Higgins, of the New York State College of Forestry, has been in the service of the Company for nearly two years in the capacity of forester, and its professional force has lately been increased by the employment of Thos. B. Wyman, a recent graduate of the Biltmore Forest School. A more elaborate organization of the forest corps is contemplated by the Company in the near future.

Willard W. Clark, F. E., Cornell, '02, who has been in the Philippines since the spring of 1902, makes many interesting statements regarding the work of the Philippine foresters, in a letter written to a friend here some time ago. He states that the geography, people, and trees are the three things the forester first learns on going into a province, and of these the first is the most simple, the last the most difficult.

In connection with the trees the feat of learning to recognize the species is easy compared to finding what to do with them. The really good trees which the market demands are few and scattered, and the methods of exploitation so crude and expensive that inferior species are left untouched. To the logging is added a high cost for sawing, which is done by hand, and for transportation. The cost of getting timber from the beach in the province of Masbati to Manila is 17 cents gold per cubic foot. As a result, Red Fir takes the place of the native timbers for many purposes, its retail price in Manila being $40 per M. Molave, one of the most valuable native timbers, sells in Manila for 50 cents per cubic foot.

One of the most difficult tasks is to mark the trees that are to be removed and to get the chopper to cut those marked and use the poor stuff. The blazes on a tree grow over so rapidly that they are soon obliterated. The metric system has been in use for about a year, and is said to work very satisfactorily, although confusing at first.

Mr. Clark expects to visit the United States the coming summer.

The following is but one of the many indications that point out a bright future for forestry and foresters:

TRAINED FORESTERS WANTED.—As showing the practical interest which lumbermen are now taking in forestry, Mr. Thomas Southworth, Director of Colonization and Forestry, recently received a letter from an American owning large limits in Algoma, asking where he could get a trained forester. He wants an expert in that line to make an examination of his limits and lay down a plan for cutting timber in such a way as to conserve the young growth.—*Canada Lumberman,* January, 1905.

It is especially gratifying to note the great interest in the proceedings of the American Forest Congress manifested by all the prominent lumber journals. Almost without exception they gave extensive accounts of the various sessions of the Congress, many of the speeches and papers delivered being reproduced in full.

It argues well for the future of forestry in this country when the solid business interests of the lumber trade are ranking themselves on the side of conservative management of forest properties.

In the conventions of most all the various lumber manufacturers' associations, held during the past few weeks, considerable time has been given to forestry as concerning the future of the lumber industry. The following is a portion of the address of President R. H. Van Sant, at the opening of the convention of the Hardwood Manufacturers' Association of the United States, meeting at Nashville, Tenn., January 21-25, reported in a recent issue of the St. Louis Lumberman:

"Therefore, it is timely to suggest that we have reached the period for conservative and economical methods in the handling of our forests, if we are not so entirely selfish as to purpose not to leave for posterity any remnant of the timber wealth. The time for conservation in hardwood timber cutting is certainly at hand.

"In this connection, I want to compliment the President of the United States for his interest in the subject of forest conservation and the rebuilding of American forests, which was manifested by the aid and support he gave the Forest Congress, which convened at Washington on the second of this month. The educational features promulgated at that meeting should be of interest to every hardwood lumberman in the United States, and the carrying out of the practical suggestions there made should contribute very largely to their commercial success in the future."

As reported in the *Southern Lumberman*, we quote the following from the address of President R. A. Long, before the Southern Lumber Manufacturers' Association, which was in session at New Orleans, La., January 24-25, 1905.

"I do not lay the same stress on the consuming of the forest that President Roosevelt does, viz.: 'That its wiping out means commercial disaster to this country,' for I am of the belief that should such a condition be reached, viz.: entire consumption of our forests, that some kind of a substitute would be made therefor, yet, as stated previously, I regard the raw material which we are supplying as being so very different to the raw material applying to any of the more important manufactured products, that we ought to consider it in a different way, or give more weight to its probable value a few years hence than we now give it, for should this view be taken, I am satisfied we would also give greater consideration to its present value. In determining the value of coal, the metals, and, I might say, all of the products that are covered by mother earth, we can only with safety figure on the matter of immediate supply and demand..........

"The same applies to all other raw materials that are factors in the prominent industries of to-day, except that of timber. It stands above ground; it is not a difficult proposition to estimate carefully the amount of lumber it will produce. On the one side, we find the population of the country, backed up by its immense wealth; with both a rapid accumulation of people and money, growing industries, etc., as set forth in the figures just related. On the other side, coming up to the same line, we find the timber resources of this country. At the close of each year, timber retreating, men and capital advancing, and in both cases, at a rapid rate.........

"I believe, without a single exception, there is not a holder of timber properties of any great consequence in this body to-day that would not be worth more money ten years hence should he burn down his mills and sell his timber at the expiration of that time, than he will be worth by continued operations until his forests are consumed, provided we continue to credit our timber account with an amount so much less than its real value, as is true to-day. To say the least, I believe there is sufficient in this thought for us to relinquish our efforts somewhat in the operation of our mills, cutting out the night running at least, and possibly reducing the day running to an extent. I trust whatever else you may do with the remainder of this address, you will give careful consideration to this particular feature."

The above is well worthy of attention, for although the speaker possesses that optimism so characteristic of the history of lumbering in our country and believes that a substitute is sure to follow upon the destruction of our forest resources, still, despite this exhibition of faith, he is keenly alive to the business end of the matter, and advocates a reduction of the output of our large mills, as assisting in staving off final disaster.

There is a general optimism prevalent among all trade journals as to the market for every variety of wood products during the coming year. In the lumber trade this feeling is especially apparent.

Large building operations planned for the year, the increased popularity of some of the hitherto little recognized species, and the stability of the established grades, all point to a year of unparalleled prosperity.

The agitation in favor of the Red Gum is most marked and the firms disposing of this class of timber have begun an active advertising crusade.

The great interest in forestry and the reforestation of waste land existing in Pennsylvania is shown very forcibly by the recommendations in Governor Pennypacker's address to the State legislature of 1905. He said in part: "I recommend that legislation be at once enacted, that the Board of Property dispose of no lands belonging to the State until they have been first examined by the Commissioner of Forestry to ascertain whether they are adapted to forestry purposes, and if found to be so fitted that they may be retained for these purposes ......I recommend further as one means of diminishing the loss which comes from fire, that the railroad corporations of the State and those having railroad lines passing through it, be required under a fixed penalty and the payment of resultant damages, to put out fires within one hundred feet of the track, except in municipalities ......It is high time that attention be given to the preservation of our streams, gifts of God to humanity which are essential to happiness and comfort and even to life. Our streams are losing both beauty and utility and are being encroached upon by filling along their banks and using them as dumps for the refuse and pollution which comes from mills, factories and habitations."

Forestry in Greece is developing only slowly on account of the many laws of olden time (and popular malpractice) which cannot be overcome. Nowhere in the world (?) are forest fires so frequent as in Greece. There are large and excellent forests of fir which the State tries to exploit.

The following prices per lb. are quoted for American and other exotic seeds by the well known firm of Johannes Rafn in Copenhagen, who reports also a poor crop for *Pseudotsuga*, but a very good year for *Abies concolor, Picea engelmanni* and *pungens* and *Pinus maurrayana.* Most of the species have, to be sure, small interest for forest planters. *Abies concolor* $1.50, *Picea engelmannia* $3.50, *Pinus murrayana* $7.00, *Larix leptolepis* $1.60, *Abies nordmanniana* 30 cents, *Picea omonica* $10, the latter from Servia with 99 per cent. germination.

FORESTRY QUARTERLY

VOL. III] MAY 1905 [No. 2

AN ADAPTATION OF METHODS IN FOREST WORK

The work of applied forestry in the United States is so varied in its practical form that the utmost pliability in methods is necessary to bring about satisfactory results. The following concrete case of adaptation in accepted field methods may be of interest to the profession.

Any general line of work being decided on, the next care is to so arrange the details of field work that the best results may be had in the shortest time. In every case the measurement work falls under these heads:

1. The construction of a map.
2. The determination of the number and occurrence of the merchantable species.
3. The measurement of average trees of every age to get the normal growth and volume of the desired species.

The construction of the map and the counting of the trees can of course be done at the same time, but a method must be employed which is most expeditious and efficient. Properly, the method selected should vary with every broad type of forest encountered.

At McCloud, California, where the methods about to be described were put into effect in the preparation of a fire plan for a lumber company, the western yellow pine type of forest is generally very open after logging, with six to twelve scattered young poles to the acre. The ground cover is more or less dense chaparral interspersed with excellent reproduction often in large thickets. In many places the young trees occur in dense stands, generally in long, narrow strips. In very broken forest of this kind the usual strip valuation is of little value unless a high per cent of surveys are taken and an average acre used for the whole tract.

Since an estimate of the present and future yields of timber on each quarter-section separately was needed in the fire plan discussion and it was not feasible to spend time and money on a great number of strip surveys, some variation of that method had to be adopted. After experiment it was decided to run a series of cruisings which would give an actual tally of the trees on the tract. After laying out a base line through the middle of the tract along the township line, stations at ten-chain intervals were laid off in each section and numbered consecutively from the western corner of each section. From these stations the cruisings were run north and south. Two men were used in the work, one carrying the chain and compass, the other tallying the trees. The tally unit was an area five chains on each side of the compassman and ten chains long—equal to ten acres. Two such tallys went across a forty, giving eight to the section. A little practice makes the ocular estimate of five chains very exact and in the generally open pine stands it is easy to count and classify the trees above six inches on the area. Separate tally blanks were kept for each section in the following form:

FORESTERS' CRUISING TALLY

SECTION 5, TOWNSHIP 39N, RANGE 2W

SPECIES	NUMBER OF TREES ON EACH 10 ACRES															
	Going S *from Station* 30								*Returning* N *to Station* 20							
Western Yellow Pine	1	2	3	4	5	6	7	8	25	26	27	28	29	30	31	32
1"—3"																
4" & 5"																
6"—10"																
11"—15"																
16"—20"																
20" & over																
W. Y. P. culls																
W. Y. P. stubs																
Sugar Pine																
Red Fir																
White Fir																
Incense Cedar																

In this way it was possible to get a good approximation of the actual count on each forty, quarter-section, or section, as desired. As shown, the trees six inches and over were thrown into five-inch classes and an attempt made to count the stand below six inches, though the results in the latter case were not to be used, the main idea being merely to get the exact location and area of scattered saplings and sapling thickets. The usual full notes were taken on the backs of the tally sheets. From them, therefore, we have a reasonably good located count of the trees in the given diameter classes, accurate data in a north and south direction for the map, and complete notes on the points necessary for future reference and general checking of results.

In order to perfect both the notes and the map and to get the average diameter of the trees in the tally classes from actual caliperings, a five per cent series of regulation strip surveys was run east and west through the middle of each forty in the sections. An average acre for each quarter-section was made from these, and on it average trees were found in diameter classes corresponding to those of the cruising. Besides, the average number per acre of young trees under six inches was taken from these surveys as probably more accurate than the ocular tally of dense groves of saplings. The strip surveys, however, were not used to determine the number of trees above six inches. From these joint, right-angled data an accurate map can be made and quite definite figures given for the extent, occurrence, and size of species on each quarter-section.

This combined work of cruising and strip valuation survey was carried on simultaneously and engaged seven men. In the same time and with the same number of men it would not have been possible to make a higher strip valuation survey than ten per cent. Yet there is every reason to believe that such a survey in this type would have failed to give equally certain results. A specimen tabulation of final results from the combined methods and a comparison of each method separately are given below.

In marked distinction to the pine type, the fir type of forest in the locality under consideration is extremely homogeneous in character, even after logging. Therefore it was not tallied by the cruisers, who confined themselves to determining its extent and to making notes on the fire conditions. Such a forest is particularly liable to fierce fires and its area and location are most important factors in the position of fire lines. The composition of the type was determined by a number of the usual strip valuation surveys and sample plots.

The owners of the tract in question expect to log their entire holdings within 40 years, so it is of importance to forecast what they can get per acre if they commence a second cutting on the logged land as soon as their virgin timber is exhausted. On this account and because trees for analysis were present in every age and the growth seemed uniform throughout the tract, it was decided to dispense with the decade measurements in the stem analyses, taking only such measurements as were required to make an estimate of future yield on a forty-year basis. The form was therefore simplified to the following:

STUMP					*Diameter breast-high*
Height	*Diameter inside bark*	*D. i. b. 40 years ago*	*Growth in last 40 years*	*Age*	
Feet	*Inches*	*Inches*	*Inches*	*Years*	*Inches*

Total height	*Number of graded logs*		*Diameter inside bark every 16 feet above stump*					
			1	*2*	*3*	*4*	*5*	*6*
Feet	*A*	*B*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*

An attempt was made to carefully select every analyzed tree, and all abnormal growth, either great or small, was rigorously excluded. The results from these measurements are thoroughly satisfactory for this particular case.

Apart from the analyses, the usual sample plots and analyses of average trees were made in all ages of densely stocked thicket, of pole stand, and of fully stocked young standard forest which have been left standing on certain areas. The results of these sample plots give the history of the dense thicket very satisfactorily in regard to age, diameter, height, and number per acre. The results from the analyses and sample plot figures were tabulated thus:

DEVELOPMENT OF A WELL-STOCKED SEEDLING THICKET OF WESTERN YELLOW PINE

DOMINANT TREES				*Total number of all trees per acre*	*Number of 6-foot mine props per acre*
Average total height	*Average d. i. b. on stump*	*Average age on stump*	*Number of trees per acre*		
Feet	*Inches*	*Years*			

The average height has been used as a basis to make it easier for the layman to recognize the various stages of the thicket when any one of them is before his eyes.

The purpose of the work was to show that there would be a paying yield on logged land within reasonable time and that fire protection was, therefore, a matter of business interest.

The forty-year estimates were generally given for each quarter-section separately. The general form for this quarter-section estimate was as follows:

ESTIMATED STAND AND YIELD IN FORTY YEARS

Township....., Range....., Section....., Quarter......

Diameter class	AVERAGE DIAMETER		*Total number of trees on....acres*	*Total yield in 40 years on....acres*	*Average yield per acre in 40 years on....acres*
	At present	*In 40 years*			
Inches	*Inches*	*Inches*		*Board feet*	*Board feet*
1–3					
4 & 5					
6–10					
11–15					
16–20					
20 & over					
Total					

Deducted for thicket, ... acres; for non-forest, ... acres; for different type, ... acres; total, ... acres.

General notes:

As described on page 92, this table is based on cruisings. The count of trees below six inches, however, was taken from the average acre of the strip surveys on each quarter-section, and the average diameters in the tally classes also came from that source. The 1-3-inch trees were not included in the estimates of yield in forty years if the quarter-section had no large areas of continuous thicket, although there will be excellent yields of mine timber from scattered saplings of this diameter class. Where thickets of unusual size exist, however, their area was deducted from the quarter-section estimate, and the forecast put in a separate table showing not only the final yield in 40 years, but several intermediate yields of mine timbers.

FUTURE YIELD ON ...... ACRES OF FULLY-STOCKED SEEDLING THICKET OF WESTERN YELLOW PINE

Township ....., Range ....., Section ......

PRESENT DOMINANT TREES			*Yield of 6-foot mine props in 10 years*	*Yield of 6-foot mine props in 20 years*
Average height	*Average d. i. b. on stump*	*Average number per acre*		
Feet	*Inches*			

IN FORTY YEARS				
Height	*Stump d. i. b.*	*Number of trees per acre*	*Average yield on....acres*	*Total yield per acre*
Feet	*Inches*		*Board feet*	*Board feet*

In concluding, it may be of interest to compare an estimate for a quarter-section obtained from the cruising with one based on the average acre of the strip surveys in the same area. The average tree in the tally classes is of course taken from the strip survey in both cases.

ESTIMATE OF FUTURE YIELD ON A QUARTER-SECTION FROM CRUISING VALUATION SURVEYS

Diameter class	AVERAGE DIAMETER		*Total number of trees on 160 acres*	*Total yield in 40 years on 160 acres*	*Average yield per acre in 40 years on 160 acres*
	At present	*In 40 years*			
Inches	*Inches*	*Inches*		*Board feet*	*Board feet*
1–3					
4 & 5					
6–10	7	19	384	124,568	......
11–15	13	26	690	677,580	......
16–20	18	31	762	1,379,220	......
20 & over	25	38	338	1,153,594	......
Total				3,334,962	21,520

ESTIMATE OF FUTURE YIELD ON A QUARTER-SECTION FROM STRIP VALUATION SURVEYS

Diameter class	AVERAGE DIAMETER *At present*	AVERAGE DIAMETER *In 40 years*	*Total number of trees on 160 acres*	*Total yield in 40 years on 160 acres*	*Average yield per acre in 40 years on 160 acres*
Inches	*Inches*	*Inches*		*Board feet*	*Board feet*
1–3	2	14	3,282	....	......
4 & 5	4	16	375	....	......
6–10	7	19	502	164,154	......
11–15	13	26	242	237,644	......
16–20	18	31	562	1,017,220	......
20 & over	25	38	1,165	3,976,145	......
Total				5,395,163	33,719

The above quarter-section is one of the best stocked on the tract. For that reason it should be more favorable to the strip method than the usual quarter in the pine type. For the purpose of experiment, this area was cruised with more than usual care, and the tally may therefore be taken as nearly correct. It happened that the strip survey ran through two patches of timber rather larger than the average, and, in consequence, the 20-inch-and-over class was unduly exaggerated. The same check was put on several other quarter-sections, and in each case the cruisings ran under the strips, although often not to such an extent. It is quite possible that the estimate for the smaller diameters, which were taken from the average strip acre, is also overestimated. As they were not used in the forecasts of yield, however, this is of small importance. They are at least accurate enough to show what may be expected in the way of ties and mine props.

It may be well taken that the above comparison between an actual count of trees and a 5 per cent strip survey is unfair to the latter. General criticism is not intended, the comparison being instituted only to show how unable the usual strip method was to cope with a particular problem. The necessities of the case made three points necessary, viz., speed, an estimate of future yield by quarter-sections, and an especially accurate map to help in the planning of fire lines. In the case of the fir type the strip survey filled all these conditions, but in the open pine type that method seemed impracticable. In the latter the full tally was easy to accomplish by quarter-sections, and the lines north and south and east and west promised to give the best possible data for the map.

The strip acre is probably the most widely practical form of forest valuation survey, and covers the vast majority of cases with entire satisfaction. There are instances, however, when the valuation work must be adapted to meet conditions less favorable to it. In our wide range of forest work a well-considered adaptability of method is at least reasonable.

William F. Hubbard

THE MINNESOTA EXPERIMENT[1]

In accordance with the provisions of an Act of Congress the Forester of the Department of Agriculture is charged with the selection—subject to the approval of the Secretary of the Interior—of 231,400 acres of land from the Chippewa reservation in northern Minnesota. This area is to include 200,000 acres of pine land. According to the report of the Forester, a selection of 104,459 acres has been made.

I have never read the act which provides for this reservation but, from statements of the Department concerning it, conclude that it stipulates that the Department, as it should do, is to formulate rules and regulations for its management; and that among these there is a provision that five per cent of pine trees shall be left; also that all pine trees under a certain size shall not be molested. Undoubtedly the five per cent of the mature trees are to be left for seed trees, and those under the stipulated size to also serve as seed trees as well as left to grow to maturity—all this with a view to natural reproduction.

This must be so, for the American Forestry Association, of which Hon. James Wilson, Secretary of Agriculture, is president, held a meeting at Minneapolis, last August (1903), and its members were urged to attend for the reason that "Great significance is attached to this meeting in connection with the recent establishment of a National Forestry Reserve at the headwaters of the Mississippi, with a stand of pine timber amounting to over 1,000,000,000 feet, part of which is to be cut this winter under the direction of the Bureau of Forestry, with a view to reproducing the pine."

This scheme embodies two features:—One, the proper harvesting of timber and the other the reproduction of a pine forest by

[1] This article, written by one of the Forest Commissioners of Pennsylvania, was received over a year ago, but by various accidents its publication has been delayed, for which an apology is due the author. The Editor is rather pleased with the delay, however, as it enables him to add his own views after a personal visit to the experiment under discussion and to ventilate his ideas on the general questions involved.—EDITOR.

natural seeding, aided by allowing five per cent of the mature trees, and all small trees, to remain for seed trees. I do not propose to consider the first feature. The condition of the stand of pine must determine whether it is advisable to harvest it now in the face of an almost certain advance of its value in the near future. The latter feature, however,—reproduction on a large scale of a White Pine forest by natural seeding—is one that may well be discussed as it has to do directly with forestry methods and practice throughout the remaining White Pine region of our country, and it may well be called the Minnesota Experiment. But in such reports of the proceedings of the Minneapolis meeting as I have seen, the reproduction of a stand of pine, in accordance with the suggestion in the call for the meeting, was not discussed. It may have been and, if so, what will here be said may have been anticipated. However, in the absence of such consideration appearing in the reports published in the newspapers, it cannot be far wrong to discuss that scheme at this time, in a spirit void of criticism and with a high appreciation of the efforts of the Bureau of Forestry to avert the impending calamity of a timber famine.

The reproduction of pine forests in this country has, heretofore, been left almost entirely to unaided Nature, and it is well to consider whether such aid as is suggested by the Act of Congress, or the regulations of the Department, can be given whereby it will be as profitable, in the end, as to clear the ground at once and plant trees, as is largely practised abroad where there has been centuries of experience. In deciding this we should first profit by what observation has shown to be the habits of the pine, and the probability of its natural reproduction amidst its changed surroundings; and it may be that by such investigation and consideration we may determine what method is best without depending alone on foreign experience.

It is fair to assume that the Minnesota White Pine forests are, in general characteristics, substantially the same as were those that once stood in the eastern states. In the typical pine forests of Pennsylvania a good stand consisted of trees of approximately the same age. Some were larger than others because of different ages, but in the main they were so from more favorable conditions of growth. In practically pure stands, or where mingled with Hemlock and other large trees, there were no very small pines, seldom any below 10 inches in diameter. Of course they were all tall and well cleaned of limbs, with live ones principally at the top. No young trees of moment were observed where dense shade was cast, and what few were there were weak and feeble and could never amount to anything. The reason why this was so is too well known to be discussed here.

To be sure, there were areas where a comparatively small amount of pine grew and where other trees occupied more or less of the ground, and frequently small pines were found there; when large pine trees were among deciduous trees and were tall and clean, the timber manufactured from them was of excellent quality. But there were so few of them and so unevenly distributed that such tracts should not be considered as a model for reforestation. The most profitable pine forest should, when mature, consist of that tree standing so closely as to cause them all to be tall, straight, and well cleaned.

It was in such a forest as described that the eastern lumberman began and carried on his work. As there was a great abundance of sound, straight, full-grown trees, and his profits were small at best, he chose only the good ones, seldom cutting, in the early days, any trees below 14 or 15 inches in diameter. More or less of the uncut timber was injured by the falling trees. A few years' experience, however, showed that it made but little difference whether a tree which had been left was injured in that way or was not touched. About all died from being blown down by strong winds or succumbed in consequence of their changed conditions and surroundings. A few years witnessed the practical destruction of all that the ax had left. Pine resents much interference by man. Even moderate pruning of a young tree standing in the open will check its growth and sometimes kill it outright. It can prune itself by the slow process of depriving its lower limbs of light and air, but a sudden removal of many at one time is somewhat perilous. It will grow tall and clean when standing closely with its own or other trees, but not without that aid. There will be an important problem to be solved in the future as to whether it shall be best to thin an artificially planted pine forest by cutting down trees, thus making a sudden change, or girdling them and letting them die and decay gradually, as the weaker ones will naturally do, and without injury to those left.

The observant lumberman soon learned that it was bad practice to cut down trees here and there. He found he must "cut clean," as he termed it, and even when he did so the trees standing in the borders of the adjoining tract soon began to die. All this led to a failure of a second growth of pine, for there were no seed trees left. It is a well known fact that only in rare cases, and then in very limited areas, does a White Pine forest reproduce itself on the same ground, and this led to a general belief among old lumbermen that it could not. Of course they saw young pines occasionally come up in open places, and in fields adjoining tracts of pine, but not under the pines themselves, and they concluded that there was something resulting from the growth of pine, to ground occupied by it, that unfitted that ground for a new growth. It did not occur to them that pine is unable to endure much shade, nor that the seed did not find a genial place to germinate under the branches thereof.

Careful observation and long experience on my part confirm the conclusion of old lumbermen that, even where fires have not wrought destruction, it is seldom that a natural second growth of pine can be found of any value, and if it shall be it is only in small patches. Of course, isolated trees spring up here and there, mostly among other varieties, and sometimes a mass will come up together, but unless so situated they are generally heavily limbed and are valueless for anything but seed trees.

There is another thing which should not be forgotten. White Pine is by no means a prolific seed bearer, and those that have grown in dense forests less so than those grown in the open. At best it cannot be depended upon to produce a fair crop oftener than once in five years. Thus it will be seen that even if the trees shall be preserved in this Minnesota Experiment, and they shall not be destroyed by fire or wind, nor die in consequence of their changed surroundings, it must take a long time to reforest any large area by so-called natural process. As time is an important element in the production of a forest, this is a matter for serious consideration. Nor can one claim that trees from seed scattered by the wind can be expected to appear so evenly that a full crop of merchantable timber will be produced. The average, no, not even the best, of our White Pine forests ever equaled those of Germany, raised from seed procured in the United States. Why, then, adopt a system that cannot, at the very best, bring forth a full yield?

Again: Pine forests from natural seeding do not mature in much, if any, less than 150 years and, where the trees are badly crowded, some not so soon as that, while from 100 to 120 years serve well for one artificially planted and cared for. The money invested in land and labor is continually exacting interest.

The important question then is, can the reproduction of a pine forest be more quickly, profitably, satisfactorily, and certainly obtained by artificial planting of trees than otherwise? It seems to me that an affirmative answer is the only one that can be given. It is true that artificial planting cannot be carried on unless the slashings from lumbering be first cleared from the ground. Neither can natural seeding go on successfully without that. We all know the danger from fire. Through accident or design it is almost certain to run over land from which pine timber has been cut, and if it shall, it will not only destroy seedlings but seed trees as well. While fire injures the ground by destroying the fine litter, and more or less of the humus, it is, all things considered, probably best to let the fire run over the ground at once and then plant. While this appears like vandalism it is exactly what the pioneer in the forest was forced to do when he cleared his land for cultivation.

The question of a clean stand of pine, or a mixture of other varieties as nurse trees, need not enter into this discussion. That would be only a matter of detail. The main conclusion would be the same.

It may be that this Minnesota Experiment is a compromise with public opinion, and as such may be the best that can be done, for it is a fact that the American people are not yet awake to the necessity of tree planting. However, I fear that there is great danger that it will prove a failure. When we awake to the fact that planting trees is a sure, certain, and expeditious method of producing a profitable pine forest—and for that matter nearly every other kind—we shall be on the road to success, and not until then.

S. B. Elliott

COMMENTS ON "THE MINNESOTA EXPERIMENT"

Nothing can promote the advancement of forestry practice in this country more than a free and unbiased discussion of its aims, as well as of its methods and their relative value. The QUARTERLY welcomes, therefore, contributions like the above, which raise honest doubts inviting to fair discussion, especially when coming not from a technically educated forester, but from one who represents a large and important, I might almost say the most important, portion of the public as regards introduction of forestry methods—the lumbermen. It is these whom we must be able to convince of the soundness of our propositions, of the adequacy of our methods, in order to induce them to follow our advice in the treatment of their forest properties. If Mr. Elliott does not represent the large forest owners, he represents the points of view, the attitude, and the experience in the woods, which the majority of the lumbermen claim, and, therefore, he deserves our respectful attention.

While I am not in the counsels of the Bureau of Forestry and do not have any call to appear as the defender of its practices, I may be allowed to discuss the strictures raised by Mr. Elliott from the technical points of view, since they are of far-reaching general interest. In this I have the advantage of having lately visited the experiment and, consequently, of personal acquaintance with the conditions.

I may say at the outset that I was pleased with what I saw and glad that at last a beginning like this has been possible. I have seen nothing more hopeful for the introduction of forestry methods in the United States, nothing that will teach the lumbermen so readily the two important lessons; namely, that brush should be burned and can be burned at little expense, and that reproduction can—under conditions—be secured with little or no present outlay. I do not wish to be understood that what is being done is ideal or even what a great government ought to be able to do, but it is sufficient for a first attempt under crude conditions; it is the practicable. It is, indeed, a compromise not only with the public, but with economic conditions; yet it is a justifiable compromise.

There is a vast difference between what should, what might, and what could be done, and this difference must not be overlooked when judging of such undertakings.

The main value of the experiment is not so much in the demonstration that pine can be reproduced by natural seeding, which every forester at least knows, as in the demonstration that brush can be burned with ease, without danger, and with little expense, thereby increasing the chances for young growth to establish itself.

Leaving out minor points, the inquiry of Mr. Elliott may be formulated into four questions:

1. Is there any propriety, with the certainty of rising wood-prices, in cutting the timber?

2. Is the method adopted a proper one? and this involves answer to the questions:

3. Is pine adapted to reproduction by natural seeding; can good results be secured by natural regeneration and in what way?

4. Is planting preferable to natural regeneration from financial and silvicultural considerations?

The argument of rising stumpage prices against cutting timber is a specious one. Whatever force it may have with private owners and speculators—lumbermen seem to disregard it largely —it is obviously not an argument for a nation and government to consider, for if applied to its logical end it would mean stagnation, retardation of development. Such speculative financial policies, relying upon the "unearned increment," surely cannot be made the basis of government action.

Moreover, in this particular case several other considerations, more patent than financial ones, were uppermost. However futile the attempt, the timber was to be cut and sold to make the Chippewa Indians independent and induce them to become farmers; the returns from the timber being expected to form the basis for such independence. That there is no likelihood of success in this direction is another story. The establishment of a forest reservation, as anybody who has knowledge of how things are done in a republic might know, was of course a compromise, the cutting of the timber being the concession. In a way, therefore, not only the cutting of the timber but the method of procedure was undoubtedly forced by other than silvicultural considerations. Nevertheless it was proper to embrace the opportunity of establishing some object lesson, even if it were not the ideal one.

The question as to proper methods in forestry cannot in most cases be considered from the one-sided aspect of silviculture. Even if we did know positively what the best silvicultural method in a given case would be — the method which would surely produce the largest amount of the most valuable material in the shortest time — financial considerations will limit its application, unless, as was intended in the demonstration at the Cornell College Forest, educational purposes exclude these considerations. And since the time of reaping is so far removed from the time of sowing, these financial considerations are much more serious and complicated than in any other business. Unfortunately there is by no means agreement as to value and results of silvicultural methods even in that country which for more than a hundred years has gathered experiences in this field, Germany. Who, then, will set himself up in this country as authority to decide which is the best method?

Any method which is not demonstrably bad and ineffective is desirable in our present stage of development. Even if nothing else were done than giving Nature a chance to reproduce, burning the brush properly, and keeping the fire out, we should welcome this as a beginning upon which we may improve in time.

Now, as to the applicability of a method of natural regeneration to the pine under the conditions prevailing in the Minnesota experiment, it is necessary first of all to state that there are four entirely distinct types of forest involved in the operation; namely, the Red or Norway Pine lands, the Jack Pine lands, the White Pine lands, and the mixed pine lands in various subtypes. There is as yet only one season's cut made in the first type and none in the last (just beginning to be cut), so that we cannot speak of results, except as to looks.

The logged Red Pine area reminds me of many Scotch Pine areas, which I have seen in Germany where natural regeneration is still practised instead of planting. The five per cent of seedtrees left means about six trees per acre, if anything more than necessary; the ground is clear of brush, cleaner than my Scotch Pine areas, the burning having been done by piling brush more thoroughly than necessary; and enough young volunteer growth, two to five years old, is on the ground to leave no doubt of its going to be readily filled out by the left-over seedtrees. These may, of course, be thrown by the winds, but with their deep-going rootsystem and having grown up in rather open stand the danger is not great, and their function will most likely be fulfilled before they succumb. The ability of the Red Pine to reproduce itself satisfactorily enough by natural seeding, even in the light grass cover in the open, on the sandy soils to which it is adapted, is beyond question. It is the best tree that could be suggested for these situations, and only where the Jack Pine, which is more prolific and reproduces still more readily under the same conditions, has a chance to come in, will there be interference by other vegetation. As long as the addition of the Jack Pine is not in too large proportion, its presence is not objectionable, since the Red Pine readily outgrows it.

As to the adaptation of the White Pine for natural regeneration, I could refer to what I have said on pages 43 and 62 of the monograph on White Pine (Bulletin No. 22, Division of Forestry), which seems to cover the ground; yet Mr. Elliott's observations are in part perfectly pertinent. Anyone who has seen the natural White Pine groves of New England knows how readily this tree propagates itself in the open; but where it is in competition with hardwoods, left in the culled forest, its success in establishing a regeneration depends very largely on the amount of opening which the removal of the timber makes, or in other words on the density of the hardwood admixture; for although White Pine is the most shade-enduring of all the pines, it is still a light-needing species. Since the admixture of hardwoods occurs in varying degrees the result of a method which leaves about three seedtrees to the acre (that is what the five per cent amounts to approximately in White Pine) will vary accordingly, if nothing else is done. Of course, there is nothing to prevent, where desirable, assistance by removing the hardwood (or Hemlock) shade, if it were only by girdling and also burning the ground over at the proper time.

All that is done by the five per cent reservation is to reserve the possibility of a natural regeneration, which will partly be realized. For greater success, it appears to me, a judicious use of fire would do much. The necessity of the logger prevents deferring the cutting or regulating it with reference to the seed-years, which in White Pine occur only every 3 to 5 years. Unlike the Red Pine its seeds do not fall during the winter and are not washed to the ground with the melting snow, but are released from the cones altogether during the month of September. This is in part an advantage, as they are then covered over winter by the deciduous foliage and snow. But if 3 to 5 years have elapsed since the cutting, before the seeding occurs, other vegetation will have taken possession of the ground and the chance for a pine regeneration is considerably reduced. By burning over the ground shortly before the seedfall with a light fire at the proper season this chance could be greatly increased. Where, when, and how such assistance by fire and by reduction of shade should be given to the regeneration is a matter of judgment in each case and requires a manager. To think that a general prescription will secure a satisfactory regeneration, except by lucky combination of conditions, is to expect that by putting a brush and paint-box into a greenhorn's hands a masterpiece will result. All that has been done in the reservation of seedtrees, is to prevent the spilling of the paint-box, and that, to be sure, is needful for the coming painter.

This brings us to the question of the preference of clearing and planting to a natural regeneration. The first difference between the two methods is that the latter requires knowledge and judgment for good results, while the former requires only a minimum of knowledge, judgment, and skill; but, on the other hand, planting requires a definite cash outlay at the time of planting, while the expense of the natural regeneration, apparently nil, distributes itself through the rotation and is expressed in the difference of results at the final harvest. Although it may be inferred from this one statement, that I favor the artificial method as more advantageous in the end, from every point of view, financial as well as silvicultural, I still admit the propriety of relying on natural regeneration under certain conditions. For instance, as long as and where it is still impossible to have reasonable insurance against forest fires, it would be folly to make the present outlay for planting and thereby increase the eventual loss; here we had much better leave the future to pay by the inferior results of the natural seeding, which requires less present outlay.

This question of preference of artificial to natural reforestation is by no means settled even in Germany, and especially lately has been a subject of continued controversy. The most successful forest management, that of Saxony, relies almost entirely on artificial means, and the large pineries of Prussia are almost entirely reproduced by planting; yet under the lead of Gayer, in the southwest (largely in deciduous and mixed forest), a reaction against the extension of artificial methods has taken place within the last 30 years. In the last number of the QUARTERLY an article by Schiffel, a competent judge, was briefed, in which the following language occurs (p. 60), and it expresses the writer's attitude toward this question very nearly:

"As to choice of a method of regeneration, the argument that it should be a 'natural' one is met with the question whether planting or sowing is 'unnatural.' Artificial reforestation is indicated wherever it is easier and less costly to secure a new stand in shorter time without other disadvantages to soil and stand. Even for given sites and conditions the questions cannot yet be answered with dogmatic certainty, although for Beech and Fir (tolerant species) the natural method may be the more rational one. The advantages of the artificial method lie in the saving of time, in avoiding difficulties and damage by the removal of the harvest, greater ease in tending even-aged stands, independence of the fellings from the needs of the young crop.

"That natural regenerations require on the same sites longer rotations to furnish the same values as planted ones admits hardly any more of doubt; nor do I doubt that the felling and transportation in the selection forest requires more care, labor, and expense than in clearings. Moreover, the natural methods require altogether more skill and labor. This is, of course, all based on the assumption that the young crop is the main consideration."

There is one point which we must never overlook when referring to discussions of such questions in the old countries: they deal largely with soils and forests which have been worked for centuries and require much more care to prevent deterioration of the soil, which is supposed to be more readily done in natural regeneration, while we, dealing with virgin soils and forests, do not need to be as careful on that point, and, indeed, may find the accumulation of duff and litter rather a hindrance to satisfactory reproduction.

Some 20 years ago when I was still young and an enthusiastic advocate of natural regeneration, but indifferently acquainted with conditions in the United States, I opposed the opinions of the wellknown veteran horticulturist, Thomas Meehan, who held that the best policy for much of the American forest would be to remove it as rapidly as possible and supplant it by planting new forest. Today I am a convert to this idea to a large extent; for I have seen thousands of square miles on which the highest skill will never produce anything worth having by natural regeneration, after having fooled away valuable time and energy. While there are conditions where luckily a combination favorable to natural regeneration exists, a much larger area of our mixed forest, in which valuable and undesirable species share, will be best replaced by a planted forest, when that becomes practicable. Two conditions must first be fulfilled to make this practicable: protection against fire, which will make people willing to risk their dollars in planting, and rise in stumpage values, which will make it easier to show the profitableness of investments in this direction. At least States, corporations, and similar longlived institutions may then see the advantage of using now useless soils in that way.

Stumpage prices are now rising as rapidly as we could wish and there is little doubt that in a very few years at least the present highest values prevailing in France and Germany for coniferous growth (say $12 per M feet), will have become world values. Even if no further rise should take place, a 60-year-old White Pine forest, planted at an expense of $15 per acre (a high figure) will then yield at least $600, or better than a 6 per cent investment; if we assume that by natural regeneration the same result could be secured 30 years later, the expense involved must not be more than about $3 per acre, leaving out in both calculations any cost of management and any intermediate returns. In many places the planting cost can be reduced to half the assumed figure, when the earlier maturity more than wipes out the costlessness of the natural regeneration.

I may add a few words regarding the use of fire for beneficial purposes. Experience in the Cornell College Forest has shown that even in an almost pure hardwood forest the burning of brush if properly handled can be kept below $3 per acre for a clean job, cleaner than necessary. In the Minnesota Reserve, the burning has been done in such a manner that accurate accounting is not possible; but when the jobbers admit that it costs less than 25 cents per M feet, we may be sure that such would be a maximum cost. In the Red Pine one extra swamper for two skidders is employed to fork the brush together, which is burned in winter as the work proceeds, when it would cost about 10 cents per M feet (6-7 cents for piling, 3-4 cents for burning), or from 60 cents to $1.00 per acre. In summer the brush would have to be piled separately to be burned in the fall or winter, which may bring the cost to the maximum, not exceeding $2.50 per acre. On the Indian allotments outside the reserve brush is also burned; here without piling it, but burning the whole ground over, and leaving it less clean. Yet the result is so satisfactory that I am informed some of the companies propose to extend the practice to their own lands when logging them, for the protection it furnishes.

The notion that green pine brush will not burn can be readily disproved by a trial: it is just in the very best state for burning, as the flame is less hot and can be checked by piling new brush on. (See article by Sylph on p. 114).

The only improvements then, which could be carried out with little expense in the "Minnesota Experiment," admitting that the ideal is unattainable, would be to increase the protection against fire by surrounding the cut and burned areas with fire-lanes or ditches where practicable, to distribute if possible the felling areas, so that they will not be contiguous, to organize otherwise for protection against fire, and to use fire and axe as indicated for a better reproduction of White Pine.

The future will then be grateful for this beginning.

B. E. Fernow.

Between the ideas of setting fire everywhere in the slashings left by loggers, burning them over to make adjacent standing timber or nearby mill property safe by obliteration of the forest, and the forester's idea of clearing up the debris without injury to the trees, however small, there is such an extreme contrast that the results are opposite; yet in the popular mind the term "burning tops" has passed for both operations and has caused no end of confusion and cross purpose, resulting in little progress and a great deal of firing into their own ranks by all parties concerned.

Tops can be burned not only in these two extremely different methods, but also in all the intermediate methods; therefore it is well to be specific when advocating the burning of forest debris and define exactly what sort and degree of burning is desired.

The old-time lumberman may find difficulty in believing that tops can be burned without injury to seedlings and saplings, and it is surely a very risky proceeding with unskilled and careless labor. The very common disfigurement of groves and woodlots when attempting to improve them by clearing out brush exhibits the general ignorance or lack of skill in handling fire for such purposes.

Recently the writer, with the president of a village improvement society, was noting the decreptitude of a large grove kept within the village limits for its benefits to the village. The soil was fertile loam, the undergrowth was vigorous.

"It looks as though fire ran through it sometimes."

"None to hurt the trees though."

"Let us see — what is the matter with this Basswood? It is a young tree but dead in the top — ah, the bark is loose here in the grass at the butt, scorched hard enough to kill the bark nearly half way round. Like borers in apple trees such injuries by fire are not very apparent at first."

"We did set fire a few years ago to clear out the brush."

"You made more brush in two ways, the injured trees and brush sent out root sprouts and the increased light through the injured trees favored the undergrowth of brush and weeds."

Returning along a newly opened street, that, if carefully cleared out through the woods, would have been beautifully over-arched with oaks, maples, and lindens, prominent among the green boughs were dead ones with brown leaves, trees half dead, and blackened bushes. Instead of attractive, the scene was repulsive, because the workmen in clearing the roadway had piled the debris on each side, and when dry had set fire to it.

"It would have paid you better to have hauled all this stuff to your dumping ground and burned it there; yet you could have burned it safely as soon as cut here, in the middle of your street."

"You are wrong there, green brush will not burn."

"Let us see. They are cutting now on that side street, let us go down there and try it"—gathering an armful of dry sticks on the way, a vigorous fire was quickly started, then small green boughs were laid upon it, almost smothering it for a few minutes, then all burst in flame. Successive armfuls were dried and burned about fast enough to keep one man busy dragging together and piling on the green boughs and brush. The flame was vigorous but not wild, the heat from it was frequently checked by the new armfuls of wet fuel, and the surrounding foliage was not injured, though only ten feet away.

"Well this is a lesson to me!"

I hope it may be to the reader also if he needs it.

SYLPH.

DAMAGES FOR INJURIES TO FOREST PROPERTY

There seems to be no longer any reasonable doubt that in American forest economy the time has arrirved, when a care for the reproduction of the forest becomes as important as the harvest of the unaided gifts of nature. This step forward in development involves not a few changes of attitude towards existing forests. It is the purpose of this paper to trace one of these changes in the field of private law.

In all those parts of the country where lumbering has at any time been of importance, the courts have had much occasion to interfere in disputes regarding trespasses. Claims for damages for unlawful cutting of timber, or to a less extent unlawful destruction by fire, are a very fruitful source of litigation. In most cases, heretofore, the injured parties have sought compensation merely for the value of the merchantable timber converted or destroyed. The question of reproduction, of injury to the young growth, and to the productive capacity of the soil has nearly always been tacitly neglected.

In the new phase of development, these neglected factors must assume an unexpected importance. Where a man has taken pains and incurred expense to insure the reproduction of his forest, it would be manifestly unjust if, for example, all the damages he could recover from a railway company negligently setting his promising young growth afire were what the poles might have brought as fire wood. Yet there is a danger of such judgment being rendered through a misapprehension of the true meaning of the numerous decisions which hold, that in such cases the measure of damages is the value of the timber at the time of the trespass. Unfortunately, the "case lawyer," who is unable to penetrate to the principle underlying a precedent, is all too frequent both on the bench and at the bar. Therefore it will often be advantageous if the forester is able to point out to the attorney the changes in the application of legal principles which become necessary on account of the development of our forest economics.

The underlying principle is obviously the rule that the measure of damages in cases of injury on property is all the loss the owner sustained, so far as it can be proved with reasonable certainty. In the cases where the value of the timber was held the measure of compensation, it was either assumed by all concerned that no other element of injury existed, or at least that it was impossible to estimate the other factors of loss.

There are, however, even at present a few cases in which the courts have seen that there must be more injury than the loss of the present value of the standing timber. The earliest of these cases seems to be that of Wallace *vs.* Goodall (18 New Hampshire, 456), where it was held that "the trees considered as timber may, from their youth, be valueless, and so the injury done to the plaintiff would be but imperfectly compensated, unless he could receive a sum that would be equal to their value to him while standing upon the soil." The idea here expressed somewhat obscurely is apparently the correct one, that the measure of damages must comprise the future increase in value of the timber.

In Striegel *vs.* Moore (55 Iowa, 88) the court says: "The measure of actual damage is the fair value of the trees to the land, immediately before they were dug," while the defendant had contended that he should pay only their value as they were lying on the ground. Similar decisions are found in the cases of Chipman *vs.* Hibbard (6 California, 162): Knisely *vs.* Hire (28 N. E. Reporter, 195); Argotsinger *vs.* Vines (82 New York, 314).

While there will be few lawyers to dispute the correctness of this rule in the abstract, the difficulty will be in its application. It will be said that it is quite impossible to estimate the future value of a young wood, let alone the injury done to the productivity of the soil by unskillful cutting or by fire. Such estimates would be mere guess-work and speculation, and should therefore be excluded. These objections cannot be overcome by the lawyer without the aid of the forester. It will be the latter's business to devise some means by which such damage can be proven in court by his expert testimony. In a country like Germany, where there is an approved and customary routine of managing forest property, setting a minimum standard of skill and care recognizable by the law, and where there are yield tables and other devices to help in estimating the expectation value more or less accurately, it is of course much easier to arrive at satisfactory conclusions than in the United States. But the matter is of such great and growing importance to woodland owners that American foresters as a body will really fail in their professional duty towards the community, if they do not soon undertake the solution of this problem. There is no reason why the expert forestry witness should not become as recognized a factor in the trial of injuries to forest lands, as the medical or handwriting expert in their proper fields. It is quite certain that the testimony of forest experts may be made at least as definite and reliable as that of the latter.

Even from a purely pecuniary standpoint it will be worth the while of a certain number of American foresters to qualify themselves specially for such service, for the fees of skillful expert witnesses are by no means inconsiderable.

Only by a close and intelligent co-operation of the forester with the lawyer can our jurisprudence be made to keep pace with the new developments in economic life, which the spread of modern forestry is about to produce. On the other hand, the progress of forestry will be seriously retarded, if the courts should fail to recognize the modifications required in the application of the old rules by the new practices. For owners will have one incentive the less for the scientific treatment of a kind of property so peculiarly exposed to injury, if they cannot recover full and just compensation against a trespasser.

ERNEST BRUNCKEN.

CONSIDERATIONS IN APPRAISING DAMAGE TO FOREST PROPERTY

The question of the measure of damages to forest property, raised by Mr. Bruncken in this issue is, indeed, of more far-reaching importance to the progress of forestry in this country than has perhaps been recognized by most foresters, and now at the very beginning of forestry practice is the time to ventilate the subject and attempt to bring about the necessary change of attitude of courts and juries.

The writer responds, therefore, gladly to Mr. Bruncken's request, which accompanied his valuable suggestions, to enlarge upon the subject from the forester's point of view, and this the more readily as he has during the past season been called upon to appraise damages resulting from the forest fires of 1903 and hence has lately again studied the possibilities of methods of evaluation.

It so happens that in this issue of the QUARTERLY an article from one of the German journals is briefed on evaluation of damage by game — for which we can readily substitute "cattle"— giving an insight into the points of view which in actual practice in one class of damage are taken by experts and courts under the settled conditions prevailing in Germany.

That we must rapidly come to a similar attitude admits of little doubt, and rapid rise of stumpage prices with the consequent appreciation of all forest values will help towards it; meanwhile foresters must accumulate especially the knowledge which removes the ascertainment of the prospective or "expectancy" value of a young growth from the realm of idle speculation; they must also furnish argument for a different attitude, new points of view, on the part of the courts, which requires that they should fully understand the present attitude: "To establish a new rule or variation in application of principle, a new point of view must arise."

As is well known, the common law is based on precedent, "*stare decisis*," except so far as statutory law directs it; but interpretation of the precedents by the judges varies, and hence each of our States exhibits variations in the adjudication of similar cases. Nevertheless, the tendency is toward uniformity. If, therefore, one wise, broad-minded judge can be found,—a judge who appreciates "the almost insensible changes which are constantly going on in modes of business, customs of life, and moral standards, which really make law"—who will under the persuasive influence of a skillful pleader, recognize the propriety of breaking away from stereotype interpretations and will modify and broaden the principles underlying them, an imitation by others will follow as soon as a "leading case" has established the new attitude.

We must not overlook that, as Chief Justice Shaw of Massachusetts has declared, the common law is founded not only on reason and natural justice, but also on enlightened public policy, to which ultimately all law owes its origin. Our first appeal for change of attitude will have to be to this last element of the law. Enlightened public policy is beginning to attach to a forest growth a value and significance beyond that of an everyday commodity of purely private interest; various acts of legislation, among which are those establishing public forest reservations, indicate this public interest, and it is beginning to be recognized that damage and destruction of forest property is an injury to the public at large and especially to the helpless future citizens.

That this aspect of public interest may be sometimes directly called into play, in a most striking fashion is exemplified in the celebrated cases having reference to regulation of rates in Chicago grain elevators, Munney *vs.* Illinois, 94 U. S., 113, 1887, where also other cases of the superior influence of public interest are cited.

There are at least three points of distinction from other property which impart to forest growth a separate significance and public interest, namely: first, that it exercises a function beyond that of a material product, which in some cases may be of far-reaching public interest, as in regulation of waterflow; secondly, that it may render soils, otherwise absolutely useless, available for useful production; thirdly, and most important, that it involves in its production an unusually long time-element, mostly beyond the lifetime of an individual, by which it differs from every other known product and becomes *sui generis*. This fact that practically forest property and tree growth generally can only be replaced by time should be a forcible argument for admission of methods of appraising damages in which the time-element is fully recognized. Yet at first sight "expectancy" values seem to be ruled out from consideration by the insistence of the courts upon awarding only present demonstrable damage and excluding all elements of speculation and uncertainty.

At present the trees on the land are considered (with some exceptions) part and parcel of the real estate and not as personal property or a growing crop. Especially in the case of wild woods, as is quite natural, this conception prevails: the mature timber is merely a gift of nature and a stored amount of material. The conception that it is a growing crop and especially that the young unsalable forest growth should be looked at in that way appears as an innovation, but one that will be more readily admitted in the case of a planted forest.

As long as forests are merely exploited and their reproduction is left to nature and accident without any plan on the part of the owner the attitude of the courts is undoubtedly correct, except so far as it may be modified by considerations of public policy as referred to. As soon as forest owners, however, change their own attitude, apply working plans, make a conscious effort to direct regeneration, apply money, skill, and energy to secure results, that attitude will change the attitude of the courts.

Next to the recognition of the element of public interest, which may at least be a persuasive argument for special consideration, the conception of forest growth as a crop will give a chance to the forester to point out the proper measure of estimating damages. In this he will at first have to deviate not too far from the accepted principles and usage, merely modifying them in a degree, and to do this he must be familiar with this usage to some extent. Besides those cases which deal directly with timberland and trees, all those which rule on general practice, on methods of expropriation, on damage to land in whatever manner, and especially on damage to crops, furnish pertinent points for consideration.

Without an attempt at an exhaustive study we may derive the principal points of view from some of the cases as reported in the Century Edition of the American Digest, sufficiently clearly for the present purpose.

POINTS AT LAW

1. The main guiding principle and the asserted main object of the law in awarding compensatory damages for injury is to put the plaintiff in the same position, so far as money can do it, as he would have been had there been no injury actually sustained.

That this averred object is in very many cases practically not fulfilled is due to the actual or the supposed difficulty of determining the extent and the measure of the damage, and to the rules of the courts in adjudicated cases which have given rise to certain practices in assessing damages. If this principle were consistently applied, which it is not, cost of restoration to the identical previous condition, if practicable, would be the only equitable adjustment. And the restoration should be the promptest possible, no matter if most costly to the perpetrator of the injury.

We have not found many cases, however, where this main and evidently just principle has been broadly and fully applied.

2. The appraisement of damages is as a rule based on the opinion of so-called experts and of local witnesses who are supposed to be acquainted with ordinary standard values of properties. Rough estimates rather than careful calculations form the basis of appraisement.

3. Generally speaking the difference between the value of the property before and after the damage is the measure of award. In case of real property — and, with a few exceptional cases, growing wood is considered part of real and not personal property — the damage is measured by the difference in the value of the land with and without the destroyed part, with or without the house or other improvements, with or without the trees, the shrubbery, etc.

There are, however, also rental values and the loss of time in such rental values admitted, and also under circumstances the cost of replacement.

4. The loss in use of a property, or its rent value where lands are commonly rentable, has been deemed the measure of damage in many cases, and especially where the cause is remediable, as in the case of damage by flooding.[1]

Here, and wherever a temporary loss of the use of land is suffered, not the market value of the land but the difference in value of productiveness or the loss in rent value is admitted as basis. Where, however, lands are not commonly rentable, rent value is not a proper measure.

5. Curiously enough the cost of restoring or replacing the damaged or destroyed property, which would often appear the reasonable and least speculative measure of damage, has again and again been ruled out. Nor is the actual cost of production considered as a measure.

There are, however, some important deviations in rulings, the most important to us being where the damage of a meadow destroyed by fire was measured by the cost of re-seeding in addition to the rental value until restored.[2] In the same year Indiana courts admitted only the difference in value of the land before and after the fire, while elsewhere[3] either the diminution of the market value of the land, or the expense of re-seeding together with the value of its product while idle based on what the remainder produced, and not the mere rental value in the vicinity was deemed a correct valuation of the damage. This is a most important decision in establishing expectancy value and comparative yield as a basis.

Another, not less important, decision[4] ruled that when the property can be restored to former condition and the cost of such restoration would be less than the difference in values before and after, the measure of damage is the cost of restoration. Conversely, where the cost of restoration exceeds the value of the property destroyed or the actual damage it cannot be used

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[1] Adams *vs.* Durham & N. Ry. Co., 110 N. C., 325, 1892.

[2] St. Louis & S. F. Ry. Co. *vs.* Jones, 59 Ark., 105, 1894.

[3] Black *vs.* Minneapolis, etc., Ry. Co., 122 Ia., 32, 1904.

[4] Post *vs.* Meritt, 83 N. Y. S., 611, 1904.

for assessment.[5] Award for injuries to land by washing is not the expense of putting other soil in the place of that washed away, but the difference in the value of the land before and after washing.[6] The reverse rule we find laid down elsewhere, the replacing of soil removed being properly the damage. While in Tennessee in 1872 the broad principle was laid down that for destruction of property by fire from locomotives the cost of replacing it may not be claimed,[8] in 1896 in case of a damaged building restoration was awarded;[9] and in Washington the replacement of demolished outhouses, fences, and shrubbery was deemed proper compensation.[10]

6. What all courts most strenuously insist upon is that no remote, merely possible, speculative, contingent and prospective, or indirect damages be considered; that the damage must be actual, present, imminent, or reasonably certain to occur, a natural and proximate consequence of the wrongful act — damages which may be foreseen by ordinary forecast. Yet there are many cases where this principle is apparently not closely adhered to.

A broad interpretation was given to the principle of close relationship between damage and cause by a Wisconsin judge: "The maxim '*Causa proxima non remota spectatur*' is not controlled by time or distance nor by the succession of events. An efficient adequate cause, being found, must be deemed the true cause unless some other cause not incidental to it, but independent of it, is shown to have intervened." [11]

If remote and prospective damage is not based *solely* on conjecture, but is reasonably certain, it may be recovered,[12] when there are proper data for the calculation.[13] Damage to fertility

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[5] Harvey *vs.* Sides Silver Min. Co., 1 Neb., 539.

[6] Higgins *vs.* N. Y., L. E. & W. Ry. Co., 29 N. Y. Supp., 563, 1894.

[7] St. Louis Mang. Co. *vs.* Miller (Ark.), 11 S. W., 958, 1889.

[8] Burk *vs.* L. &. N. R. R. Co., 54 Tenn., 451, 1872.

[9] Anderson *vs.* Miller, 96 Tenn., 35 1896.

[10] Koch *vs.* Sackman-Phillips, 9 Wash., 405, 1874.

[11] Kellog *vs.* Chicago & N. W. R. Co., 26 Wisc., 223, 1870.

[12] Occidental Consol. Min. Co. *vs.* Comstock Tunnel Co., 125 F., 244, 1905.

[13] Nightingale *vs.* Scannel, 18 Cal., 315, 1861.

of land was not deemed too remote and speculative.[14] Slaves having been taken away from a plantation, damage to the crop resulting from the lack of the labor of the slaves could be recovered.[15]

The question of figuring loss of profits is in place here. The profits that "would have been" made on an abandoned logging contract are declared ascertainable and not speculative.[16] It is only uncertain and contingent profits which the law excludes.[17] Where the damage interrupts an established business and wherever with reasonable certainty[18] profits can be calculated and gains are prevented as a natural result of the damage their recovery is admissible.[19] Average profits which a tradesman was making immediately previous may be considered in estimating damages.[20]

Analogously the loss of wood increment should form a proper basis of computation, although it has been ruled elsewhere that loss of profits by destruction of an unmatured crop is usually too uncertain to be compensated, for this wood increment is not only possible and probable but occurs with certainty and its diminution from the normal is also ascertainable.

"Plaintiff is not obliged to prove with *absolute* certainty what profits would have been but only with *reasonable* certainty as will satisfy a jury of the reasonableness of his demand and estimate. Remote or doubtful contingencies are insufficient to destroy the reasonableness of such a demand." Profits for reasonable periods preceding injury may serve as base. Mere difficulty of proof is not a bar.[21] These are indeed, most hopeful points for foresters.

The principle of capitalizing a damage which is permanent, as would be the case in the total destruction of the soil, is estab-

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[14] Southern Ry. Co. *vs.* Morris, 119 Ga., 234, 1905.

[15] Johnson *vs.* Couts, 3 Har. & M., 510, 1796.

[16] Lee *vs.* Briggs, 99 Mich., 487, 1894.

[17] James *vs.* Adams, 8 W. Va., 568, 1875.

[18] Stewart *vs.* Patton, 65 Mo. App., 21, 1896.

[19] Tootle *vs.* Kent, 12 Okl. 675; Silver Springs, etc., R. Co. *vs.* Van Ness, 34 So., 884; Kitchen Bros. Hotel Co. *vs.* Philbin, 96 N. W., 487; all in 1905.

[20] Sturgis *vs.* Frost, 56 Ga., 188, 1876.

[21] Barrett *vs.* Raleigh Coal & Coke Co., 47 S. E., 154, 1905.

lished in Petersen vs. Roessler Chemical Co., 131 F. 156: "Where complete destruction of earning capacity has resulted the pecuniary loss is estimated by the capital which at a fair rate of interest will produce a sum equal to the average wages likely to be earned during the injured person's expectancy of life less such sum as at compound interest for the same period will equal and offset such sum." Altogether life insurance, dealing with long time and with expectancies, should furnish valuable precedents applicable to our cases.

7. Contingent and consequential damage in particular have been considered admissible in the case of a woodlot, when not only the separate value of the timber but the value which the woodlot added to the farm was admitted.[22] And again, when in an action by heirs not the value of the timber but the damage to the estate as a whole through the destruction of the trees was considered proper,[23] and elsewhere not the value of the trees,[24] or not only the value of the trees,[25] but the injury to the land was accepted as the principal damage. In a burned meadow not only the value of the grass destroyed but also the injury to the roots was deemed a proper charge;[26] but damages for the loss of crops for the next two cropping seasons due to overflow were considered too prospective and conjectural.[27]

On the other hand damages can be recovered even "for the unlawful deprivation of some legitimate gratification,"[28] the wise judge ruling that an award against a Telegraph Co. of $400 for cutting off the branches from two trees was not excessive. Somewhat in line with the idea involved in this award may be cited the ruling in a case of cutting timber over the line, when not mere compensation for the injury done to the land in addition to the value of the timber, but such damages as would deter repetition of the offense, was granted.[29]

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[22] Carner *vs.* Chicago St. P. M. & O. Ry. Co., 43 Minn., 375, 1890.
[23] Lowery *vs.* Rowland, 104 Ala., 420, 1893.
[24] Chipman *vs.* Hibbard, 6 Cal., 162, 1856.
[25] Skeels *vs.* Starret, 57 Mich., 350, 1885.
[26] Mo. Pa. Ry. Co. *vs* Ayers, 8 S. W., 538, 1894.
[27] Clark *vs.* Nevada L. & M. Co., 6 Nev., 203, 1870.
[28] Tissot *vs.* Great South. Tel. & Tel. Co., 39 La. Ann., 996, 1887.
[29] Kolb *vs.* Bankhead, 18 Tex., 228, 1856.

Here, too, the consideration of what is called "plottage," i. e., the value of a parcel as a part of the entirety, is pertinent.

8. In regard to the determining of prices to be used in calculating damages the rule is to apply prevailing market prices at nearest market (less cost of transportation), or prices realized on sales of similar property, or even *bona fide* offers may establish a value.

Market value is, however, not at once to be considered as the true value: it is merely inconclusive *prima facie* evidence of the probable true value; nor can a single sale be admitted as establishing a market value.

While the consideration of the *fall* of prices in the market after the damage occurred has been recognized as proper and, notwithstanding the price was unusually low at the time when the timber was wrongfully cut, this low price served as a basis for the award,[30] the benefits from a *rise* of prices have been elsewhere declared inadmissible in the computation of damages.

Deterioration in value of logs and depression in market price were considered too remote and speculative to be allowed as influencing the measure of damage.[31]

Value at the time of the damage is constantly insisted upon as the true measure, ruling out any value that "would have been" as too speculative. But where no market value for the property at the place of destruction is directly ascertainable, it may be ascertained from such elements of value as are attainable: "all facts and circumstances are admissible in evidence that tend to establish its real value at the time of destruction, as original cost, manner of use, general condition and quality, percentage of depreciation," [32] for it is recognized that a property may have a reasonable recoverable value, although no market value exists for it, for its reasonable value in view of all circumstances is intended by the law;[33] it may suffice to bring

[30] Schlater *vs.* Gray, 28 La. Ann., 340, 1876.

[31] Walrath *vs.* Redfield, 11 Barb., 368, 1851.

[32] Jacksonville, etc., R. R. Co. *vs.* Peninsular L. T. & M. Co., 27 Fla., 157, 1891.

[33] Atchison T. & S. F. Ry. Co. *vs.* Standford, 12 Kan., 354, 1874; also Prettyman *vs.* Oregon Ry. & N. Co., 13 Ore., 341, 1886.

merely evidence of the fertility of the soil to establish a value for it.[34]

The ruling that the probable value at maturity of a destroyed crop may not be used as measure[35] would not seem to preclude the determination of the present value with proper calculation. Indeed, it is very important to note that such determination of present value was admitted, when the court decided that the grass in a meadow partly matured affords the basis of measuring damage as for the value of the crops matured into hay, and that the usual crops of hay may not be considered merely conjectural and speculative, but form a good basis for calculation.[36]

In another case[34] it was declared that "a growing crop of wheat has an approximate value at every stage of its growth," but it stands to reason that such value can be approximated only from the value of the mature crop by some calculation and not directly.

This idea that the present value of a crop can be expressed only in terms of the mature crop is perhaps nowhere more definitely expressed than in Raywood Rice Canal and Mill Co. vs. Langford (Tex. Civ. App.) 74 S. W., 926: "In speaking of the value of the growing crop at the time of the injury, what is meant is its value for the purpose of continuing its cultivation to maturity, for in most if not all cases it will be valueless for any other purpose. In ascertaining the value of growing crops proof must be heard either as to the market price or its intrinsic worth, and it follows that any witness who undertakes to speak intelligently as to its value must base his figures on a sound estimate of what the crops would produce if well cultivated and uninjured and to deduct from that result the cost of cultivating and marketing."

9. A very important point is made by bringing into consideration as a proper element in the evaluation of damage the *purpose* to which the land or property is appropriated or adapted,[37]

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[34] Clark *vs.* Banks, 6 Houst., 584, 1883.

[35] Lester *vs.* Highland Boy Min. Co., 76 P., 341, 1905.

[36] Kyle *vs.* Ohio River R. Co., 38 S. E., 189, 1901.

[37] Gulf C. & S. F. Ry. Co. *vs.* Jagoe (Civ. App.), 32 S. W., 717, 1895; see also Perkins *vs.* Hackelman, 26 Miss., 41, 1853.

hence, although the value for another purpose, e. g., as pasture, was admitted by the claimant, this did not necessitate its use as a basis for determining its farm value. The most valuable present and possible future use for which the land is adapted can be made the basis of appraisement, provided that it is reasonably certain that such use can be made of it as to affect the market price.[38] Hence, although the ground has not been used for farming, its fertility and the possibility for using it as townlots or for some other purpose form properly an element of valuation. On the other hand the possibility of changing it to other than the *intended* use was not permitted to influence the price, except that the fact that complainant did not want to sell his property warranted making the compensation liberal.[39]

A large number of cases, in which expropriation under eminent domain is involved, introduce in the measure of value this idea of the fitness or opportunity or intention of using the property for a different, more valuable purpose than the one for which it was used, and that the most valuable use.

10. A few points regarding evaluation of damage to trees and timber especially, not referred to before by way of illustration, may be added.

If the value of trees can be ascertained without reference to the value of the land, the injury done them and not the difference in the landvalue with or without the trees may be made the measure of damage.[40]

Also, if the land was not injured, the value of the stumpage is sufficient basis for damage. The stumpage may under circumstances be determined deducting the cost of cutting, removing to mill, and manufacturing from the value of the manufactured timber.[41]

In the case of fruit trees not the cost of replacing them, not their woodvalue, but their value on the premises in connection with the rest of the orchard is the measure. This decision may form an analogy for the evaluation of seedtrees.

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[38] Illinois C. Ry. Co. *vs.* Trustees of Schools (Ill. App. C.), 112 J. & A., 488, 1903.

[39] Matter of Armory Board (N. Y.), 29 Misc., 174, 1899.

[40] U. S. *vs.* Taylor (C. C.), 55 Fed., 484, 1888.

[41] Skeels *vs.* Starret, 57 Mich., 350, 1885.

A distinction between ornamental and fruit trees is made in that for the former the value of the premises with or without the trees is adjudged, while with fruit trees their value as distinct from the land, if susceptible of such measurement, is relied upon.[42]

The value of wood when put to its best use is its true value, so that logtimber and bolts may not be assessed as cordwood.[43]

THE FORESTER'S POINT OF VIEW

We may now proceed to see what accentuation and what modification of rule the forester's point of view may make desirable and what the methods and difficulties are in appraising forest damage.

The forester's point of view is, of course, that forest growth is a crop of the soil, precisely like agricultural crops, the only difference being in the manner of originating, caring for, and determining the maturity or time of harvest. Whenever forest growth is not considered as a crop, as for instance in case of a pleasure park, it ceases to be strictly an object of the forester's expertise, and while his knowledge of tree growth and land matters generally may entitle him to a respectful hearing, he is not necessarily and by his profession, although he may be for other reasons, competent as a valuator.

His forest is the timber forest destined to produce wood as a crop.

The fact that the wood crop can in a fashion be produced by the mere forces of nature, reducing the amount of human labor to a minimum, almost to nothing, with only the necessity of non-use of the soil for other purposes, makes it no less a crop, just as the pasture is considered a crop. The fact that it is not annually harvested can hardly be urged any more than with other intermittent crops like some fruit crops as an objection to this conception. The Massachusetts farmer, therefore, who cuts his coppice of hardwoods every 20 years and by that mere act of cutting enables the stocks to sprout again and reproduce

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[42] Donahue *vs.* Keystone Gas Co., 85 N. Y. S., 478; and Atchison *vs.* Geiser (Kan.), 75 P., 68, 1905.

[43] Spink *vs.* N. Y. N. H. & H. R. Co., 26 R. I., 115, 1904.

the same harvest without any further act of cultivation or attention, except perhaps keeping the cattle out for a time, is entitled to have his forest growth considered as a crop.

Since, however, entirely unintentional reforestation takes place, it would be proper to insist that the intention and purpose to devote the land to forest use be proved.

Just as in farm crops greater intensity in the application of labor (including fertilizers) produces different results from careless, crude practice, so there are increasing degrees of intensity in management of the forces of nature in forest cropping, beginning with a mere leaving of some of the natural growth, then selecting seedtrees and carefully managing light conditions for the young growth, and ending in the making by hand of a plantation. From the standpoint of the valuator and of damage awards, the difference in the natural and the artificial method expresses itself in the fact that in the latter method a definite, ascertainable outlay of labor and money is necessary, while in the case of natural regeneration and seedtree management the cost is hidden in the harvest operations, or in mere abstemiousness by leaving unharvested a part of the growth, and hence withdraws itself from simple calculation. There is also the probability, although not certainty of difference in results; in other words the crop secured by natural regeneration is apt to be inferior in composition and progressing more slowly toward maturity than the artificial crop if properly started and tended: the intensity of management expresses itself in the value of the crops measured by quality and time to maturity.

Nothing is more distinctive in the forest crop than the manner of determining its maturity. In farm and fruit crops ripeness is a matter of season, but in wood crops harvest time is a matter of choice with the harvester. While other factors enter into the determination of harvest time, there are among foresters three conditions of maturity recognized as mainly determinative. He recognizes his crop as mature, either when the largest amount, pure and simple or of the most valuable product, compared with the time consumed in its production, can be secured, or when from the money point of view it is most profitable to cut. The time which elapses from the start of the young crop to the intended harvest, determined by whatever method, as is well known, is called the rotation, and so we have rotation based on volume, value, or financial considerations. When old timber that might be utilized at any time is concerned we may raise other points of view, but when discussing the value of immature young growth we can hardly dispense with the conception of rotation, and the term is useful.

The rotation determined on the basis of volume takes cognizance of the fact, that trees, single ones as well as entire stands, grow at different rates in the different stages of their life in such a manner that a year of maximum average volume production can be determined.

The rotation based on maximum value production takes into consideration, that with increasing size the quality and usefulness of the crop, hence market value, increases disproportionately, or rather that the proportion of small-sized material fit only for firewood to log-size material progresses in such a manner that a year of maximum average value production can be determined.

Similarly the financial rotations, which concern themselves with a comparison of money returns, represent the culmination either of the so-called forestrent or of the soilrent, the methods of determining either of these two financial rotations being well-known to foresters.

Whatever other ways of approaching the problem of determining the maturity of timber may be suggested, they all resolve themselves in principle into these four: every method relies upon the fact of the annual increment of trees and the knowledge of the laws of its progress; the choice as to the aspect from which the rotation is to be determined, is largely dependent upon the interests of the forest owner and aspects of market.

The laws of increment or accretion are recognized from the yield tables, such as the Germans have constructed with greatest care for different species and conditions, and such as we are gradually accumulating; but while such tables are useful in determining general questions, and as checks against unreasonable estimates in case of damage suits, a more direct local investigation of the increment conditions will be necessary in each case, such as a forester knows how to conduct.

There are two other primary facts, which need to be stated to place the non-professional student of the forester's point of view in condition to accept his reasonings:

The fertility of the soil for support of a forest growth is much more to be found in its physical condition, especially as this influences watersupply, than in its mineral composition, which is the important need of the farm crops. In the case of the latter the physical conditions can be regulated by artificial means (plowing, cultivating), not so to any extent with a forest crop.

The surface cover particularly has an important influence on the physical conditions of the soil, and hence, while the burning over of the ground when fit or intended for farm use may be no harm or even a benefit, if forest use is intended the loss of the soil cover may be most detrimental.

The other fact is that the wood increment is naturally in proportion to soil conditions, hence a deterioration of these is reflected in a reduced annual wood deposit as long as the unfavorable conditions last; the rate of growth is damaged and the reduction in rate may be used to determine the award.

This then is in brief the forester's point of view of his crop, the point of view from which he will seek to have the appraisement of damages considered.

POINTS IN ESTIMATING FOREST DAMAGE

We can classify forest damage into four categories, namely:

1. Loss of actually salable material;
2. Loss of young or prospectively salable material;
3. Loss of favorable conditions in soil and surroundings;
4. Injury but not entire loss in any of the three preceding directions.

In addition the cost of replacing the crop may come into question.

The value of material of commercial salability can usually be determined with considerable accuracy by its consumption or use value as a commodity, by measurements and consideration of the location to market, when within easy reach of market. But when located for the present inaccessibly, we do not see where under present rulings of determining values justice can be done. Accessibility to market is the keynote of forest values. Hence what was for years of none or trifling value all at once becomes highly valuable, e. g., by virtue of a railroad development. Properties are acquired and held with the expectation of their ultimate availability by the natural development of the country; yet such prospective values are ruled out from consideration, and so is the cost of original purchase. There are, to be sure, now probably few localities where not at least a customary asking price exists, and this would probably rule in the absence of other basis for valuation.

Another consideration which, being excluded, is apt to work injury unless the rules regarding loss of profit are more liberally interpreted, comes from the fact that in these times of rapidly advancing wood values more and more materials hitherto considered unsalable become of commercial value. The log standard changes; by the loss of the timber the owner is deprived from benefiting by this reasonably certain change, unless the plea of intention to hold for this change were admitted.

This time-element of deferred use may not readily appeal to the courts in case of mature or salable timber, and the argument which the forester is bound to bring that a tree or stand is mature when it pays best to cut it may not hold, when increment of market price and not increment of wood value is made the basis of the argument.

The case is different when young growths of unsalable material which have no consumption value, or by reason of their size are salable only for inferior prices, are concerned. Here the crop idea will appear more readily acceptable and the effort to establish a claim based on expectancy or future use-value may be successful.

From the start we shall clash with the generally accepted principle that prospective values shall not be admitted; yet there are already breaches made in this principle, as we have seen, and it should be possible to widen them in our favor.

The entire system of forestry is built upon time and futures, i. e., speculative elements; the present value of all its tools — the soil, the mould, the seedtree, the young growth — finds its expression only in a future value, namely that of the perfected crop.

Until, therefore, the courts admit the propriety of a reasonably-calculated expectancy value and the possibility of estimating by means of the wood increment the damage involved in the loss of favorable growth conditions, forestry practice will lack an important safeguard and incentive, namely: the assurance that money, economy, and enterprise employed in forest crops will find proper legal protection.

It is pertinent in this connection to point out that all valuation is based more or less on speculation or various assumptions, and an expert's opinion, if not a mere say-so, is bound to be based on calculations which include elements of speculation, whether he or the court be conscious of it or not.

Where things of every day use are concerned the knowledge of values is quite general, daily adjustments occur, market reports based upon a large number of transactions render it easy to give an expert opinion, but the prices are based, like all values, on speculation—speculation at large.

Where things of less general traffic are concerned the speculative element in making prices is much less definite, as for instance in the case of houses and still more in the case of unimproved real estate; as a consequence prices paid in one year may by the mere change in accessibility of the property double, and again without any apparent change of surrounding conditions tumble and stay for years far below the level of the original purchase. The expert's opinion in these cases is based on small basis indeed, and sale prices prove a most unreliable valuator.

Still more uncertain speculation underlies the estimate when the fine points of a horse must be considered, or a piece of art, a painting, a statue, is involved; here intuition, which is even less reliable than speculation on sound basis, to a large extent guides the expert and the court.

It is pertinent here to point out the well known fact that the same thing may not only be *estimated* to have, but actually *has* more than one value according to its use or application.

The courts insist that only the present value of an immature crop may be assessed, but it has been admitted in some cases that the value at maturity may be made the basis for determining the present value and, indeed, there is no other way of establishing the value of such a crop; it has merely a prospective or relative value; the question can only be as to the method of using the final harvest value for deducing the present value. It is evident that the only proper method is our so-called expectancy-value calculation, namely the final harvest value discounted to the present time, however variously this may be calculated, the expenses accruing being treated in the same manner. Just as a note maturing at some future date has an ascertainable present value with any banker, so there exist among foresters and are recognized by European courts well established principles and methods for determining the value of a forest growth maturing at some later time. The difference between a note or an annual crop and the forest crop lies in the greater length of time for which the calculation must usually be made in the latter case, and this time element introduces greater uncertainties; yet there are *reasonable* certainties and the remote or doubtful contingencies can be reduced to a minimum of speculation.

There are at least four speculative elements entering into the determination of a present value of a forest growth from a future harvest value; namely, the material yield and character of the harvest, the time of its maturity, the prices which will then prevail for the different qualities of wood, and the interest rate at which to discount the harvest value.

The first two points, time of harvest (rotation) and quantity as well as quality of production, are interdependent, and the complications arising even in these fundamental points are by no means small. Not only are we lacking any yield tables that can be used with confidence, but even if we had them their application is not as simple as might appear, especially where mixed forest is concerned. It must not be forgotten that it is not an academic discussion or a forecasting for a basis of management, but a case in court that is to be settled, a judge and jury to be convinced. The simplest way out, and for the present probably the only acceptable one, will be to assume, where such data are available, that a neighboring mature stand represents the likely harvest value of the immature stand, other conditions being reasonably equal. Or else, a rate of growth, preferably in percentic expression, may be locally established and its reasonableness checked by such yield tables as are available.

As to time of harvest (rotation) so long as we have no experience at home, it will be proper to rely on the rotations customary in European countries, modified by demonstrable differences in character of species and climate. Since a value is to be established a rotation based on value production would be the reasonable one; especially as all others would introduce for the present impractical complications.

The differences between the evaluation of a coppice and of a seedling forest does not need to be pointed out to foresters, who know of the differences in the rate of growth and necessity of short rotations in the former. There may be less agreement in recognizing the differences in results from a natural regeneration and an artificial plantation, pointed out before.

To go into any details of intermediate returns by thinnings or otherwise, except to point out their possibilities, would in most cases merely complicate matters without effect.

That wood prices are rising and will rise for an indefinable time in the future, there can be no doubt (See article on Movement of Wood Prices, pp. 18-31). It is indeed likely that they will rise more rapidly in the near future than they have in the past, since several export countries, whose woodshipments have kept prices low in the world market, are showing signs of weakening; hence prices must rise until a reduction in consumption steadies them. Nevertheless, it will be difficult to agree as to the rate of such rise, and the courts will probably not accept anything but the use of the highest prevailing prices as tenable in awards, although some injustice will thereby undoubtedly be inflicted.

Interest rates have the opposite tendency to prices: they are apt to decline in general. But, as is well known, they vary at any time with the character of the property and with the time for which they are to be applied, being as a rule lower for stable, safe, and long-time investments. Hence the interest rate must vary with the character of the forest: the deciduous forest is safer, hence a lower rate is applicable than the more exposed conifer forest; the coppice with a shorter rotation, making an earlier change of investment possible, demands a higher rate than the long-term timber forest. In this connection the proposed classification given in the paper above referred to in periodical literature of this issue; (see also vol. ii, p. 184-5) is suggestive.

For various reasons, which it would lead us too far to detail, a lower interest rate than is usual for real estate investments at the present time is especially indicated for long time calculations, particularly when it is considered that higher prices will make good the apparent loss in interest. It is, therefore, wise to concentrate on the argument for a proper interest rate, especially as the willingness to accept a lower than the current interest rate (lower by as much as the supposed rate of rise in prices) will appeal favorably to the court as a reasonable rate.

The argument is, of course, like this: A cash capital (the award) put out at interest is not likely to accumulate for say 50 years at present rates continuously, due to the change in rates and values and the probability of interest loss by reason of necessitated change in investment; hence a lower rate must be acceptable. On the other hand, the forest capital continued as such (soil and new growth, planted or otherwise) will benefit from the rise of prices and thereby increase the total return; a concession, therefore, on interest rate at a reasonable proportion to the expected rise of price is justified.

The fire risk, to which in the United States forest properties are especially exposed, would make interest rates on such investments from one-half to one and one-half per cent higher in order to take care of this risk. When, however, it is possible to recover full damages this difference will become smaller.

The agreement on interest rate at which the future harvest-value is to be discounted will probably make the foremost difficulty in establishing the method of expectancy value. In France and Germany forest management is so firmly established that customary rates and other elements of calculation are in existence and the calculation proceeds mostly on the assumption that not only a perpetual annuity is intended, but that besides the soil a certain amount of the growing crop, namely, such amount of varying ages as will furnish an annual or periodic harvest of proper age, is considered the forest capital, upon which finance calculations are to be based.

But with us at first, before systematic forest management is fairly established, the courts will probably insist upon term calculations as a more prominent and practicable basis; the idea of the forest capital will have to wait. Yet the principle involved in this conception has made its appearance indirectly in the conception of the "plottage" value as different from the unrelated value of the single piece. And when forest management is established, it will at least be posssible to apply this principle in the following consideration:

When a forest is under actual management with annual coupes, the loss of any single year's or series of years' felling area entails a damage besides the loss of the crop, by disturbing the regular progress of the business, continuing the necessity of maintaining the apparatus for annual business and of paying taxes without the annual income.

A like attitude is justified where a mill is established relying upon a continuous supply of material. Here the value of a forest property is quite different from what it would be in the hands of a speculator.

Similarly, additional value, besides the market value of the material, attaches to seedtrees left purposely to secure an aftergrowth, a new crop. And so in other directions the intention of the owner must be given weight in determining whether a special damage besides destruction of material has been inflicted.

That the evaluation of damages to the soil, which, as was stated, in forestry includes not only the mould but the surface cover, the accumulation of duff, litter, and even underbrush, is best done by reference to the reduced wood increment, we have pointed out.

If the soil is to be devoted to continued wood growing such damage to the soil cover is often most serious, and either the effort and expense and the time it takes to restore the soil to producing capacity or else, if the experience can be adduced, the value of the decreased increment due to such damage may be used for determining the damage. Water damage introduces still further complication most difficult of evaluation and of proof except by actual experience in the given case.

Regarding the partial loss or mere injury to timber crop or soil the considerations discussed in the paper referred to may suffice. We would only accentuate the fact that an injury is often outgrown, without leaving any appreciable damage and that a reasonable attitude on the part of the valuator or owner in this regard is apt to secure more favorable consideration of the real damage.

As a rule our forest owners after having cut the timber leave the ground to nature, unless it is turned into pasture or field. If it restocks itself with desirable growth it is an accident. Under such circumstances the question is properly raised whether and how far the cost of restocking might be claimed. Unless the design to devote the ground to timber cropping can be shown, in many cases the owner would be sufficiently awarded by the payment of the lost stumpage. In other cases, however, and especially when a young growth was already established the claim for the cost of reforestation may be justly considered, even where no definite forestry system is established. An extension of the rulings noted under 5 on p. 123, is most desirable.

The simplest of all problems is that of determining the cost of re-establishing or replacing the lost crop, provided it is to be a mere planting proposition. Although if seedtrees are left a natural regeneration by seeds falling from these may be affected without the necessity of a direct outlay, and although this argument will undoubtedly be offered in court, it should not be overlooked that this method requires time impossible to predetermine, it requires skill or good luck, it is uncertain in results: it does not make a prompt restitution.

Whatever method we may choose in managing a forest property to secure reproduction, when it is a matter of awarding damage, the simplest and surest method, even if expensive, namely planting according to most approved practice, should alone be admitted as a basis.

We must, to be sure, be reasonable in determining the cost of a plantation for forest purposes, taking due regard also, of the need for repairs in a first planting and the loss of time before the crop is established.

The following actually offered evaluation, for instance, which came to the notice of the writer, it should be easy to defeat in any court on account of its unreasonableness. The growth, a natural one on sand soil, had been destroyed by fire and this was what was figured for re-stocking per acre:

Preparation of ground	*$ 75*
2400 oak and pine @ $1.00 per M.	*240*
Labor, cultivation, pruning, thinning 18 days for 20 years @ $2.50	*900*
Humus, 2 inch @ $1.00 per yard	*180*
25 lbs. fertilizer per year for 20 years	*120*
Cost of reforesting one acre	*$1,630*

"*To which the matter of time lost and interest on investment should be added.*"

This calculation made by "experts" can only harm the cause of fair forestry and recovery of reasonable damage, for it is from 10 to 20 times above the most extravagant estimate of the very best practice. Moreover, it should be kept in mind that with us as a rule a well-planted new forest will be much superior to a natural forest.

Since the cost of its production is capable of more ready ascertainment than any future yields, it might be rational, in order to avoid the complications which are involved in the calculation of expectancy values, at least for young growths this side of the first half of a reasonable rotation, to make mere restoration the penalty. An ample allowance for actual planting cost and restoration of conditions, with time loss added, at highest prevailing money interest rates, would then be the whole award, outside of any other incidental losses. This may appear acceptable under the ruling cited on p. 123, that restoration is to be the measure when its cost is less than the difference in values of the property before and after the damage. An example figured with reasonable data will elucidate how such a principle would work.

Take a stand of White Pine, destroyed at 30 years of age, which at 60 years would have yielded 50 M feet worth $500; the award discounted at 3½ per cent would be $178.15. If on the other hand $40 per acre for planting were allowed (two to three times what it would cost at best), and the time loss for 30 years were added at 5 per cent, the award would be $172.87, near enough to the former figure. If the stand, however, were destroyed at 10 years of age the $500 at harvest time would be worth now $89.55, while the award based on the planting cost at 5 per cent would be only $65.16. That is to say the award would be smaller the nearer the planting time the stand was, perhaps not an unreasonable attitude considering the greater risks to which a younger growth is exposed.

It would be impossible to exhaust in a brief paper even the mere theory and principles which can be laid down for the appraisement of forest damage of various kinds. The object of this discussion will have been attained if it makes clear the complicated nature of the problems involved and the lines along which the valuator must proceed; and especially, if it can be used to enlist the interest and influence of attorneys and courts of justice in establishing the desired attitude toward forest damage.

B. E. Fernow.

CURRENT LITERATURE

HENRY S. GRAVES, *in Charge*

Die forstlichen Verhältnisse und Einrichtung Bosniens und der Hercegovina. Von Ludwig Dimitz, Wien, 1905. 389 pp.

The development of a forest administration in the territories of Bosnia and Hercegovina during the last 25 years forms a most instructive study for us, as it is a creation entirely of modern times; out of entirely undeveloped conditions and chaos a forest management adapted to such conditions has been organized by the Austrians, who in 1878 assumed administration of these two countries, which had hitherto been in Turkish hands.

Although in 1869 Omer Pasha issued a forest law, it remained mainly if not entirely on paper. It attempted to regulate property conditions, recognizing state, corporation, institute, and private forests; but a segregation of these and demarcation of the State forests as prescribed was never executed. Moreover, the people were allowed to supply themselves from the State forests without charge, not only with all their necessities, but also with wood materials for sale, and were allowed to pasture anywhere.

A very exhaustive account of the efforts of the Austrian government to bring order into this wilderness, a historical classic, the result of a personal inspection, has been published this year by the well-known veteran forester, Ludwig Dimitz.

The Austrian government began by sending a commission to inspect conditions, at the same time instituting a State forester and district foresters in each circuit with two or three rangers as assistants; by 1880 there were 27 such district officers, without, however, a central bureau. A full organization came into existence two years later and expanded into a complete system employing now about 500 underforesters and guards, 56 district managers, 12 county officials, 27 employees at the central government of the two countries, and two representatives in the ministry which acts for both countries.

The first work was a survey, which was done most cheaply and expeditiously with the plane table at $50 per square mile, the maps on the scale of 1 : 12500. After a most troublesome adjustment of ownership conditions, there was developed finally a surveyed and demarcated State forest area of around 5 million acres, a little less than 80% of the total of 6.3 million acres of forest, which represents 50% of the total land area; 62% being timber forest, 22% coppice, and 16% brush. The timber forest is largely Beech, with conifers, Pine, Spruce, Fir, and mixed forest in about equal proportions, and oak not to exceed 10% of the State forest area.

In 1890 a law was passed regulating supervision over private forest properties much in the spirit of the Austrian forest law of 1852, forbidding in general terms devastation and clearings in protection forests designated as such, making provisions for reforesting, for regulating rights of user, for employment of technically educated managers, etc.

The management of the State forests was based upon the principle of securing the best possible income without deteriorating forest conditions, or rather at the same time improving them. The first aim was to find means of developing and marketing the large stores of untouched virgin timber; for, although the rural population of herders had by pasture and otherwise devastated large areas, and other accessible areas had been exploited under Turkish misrule, the backwoods area on the mountains of over 1,500,000 acres, with not less than 25 billion board feet of log timber, half of which was coniferous, was waiting for development.

This problem has been most successfully solved, while at the same time paving the way for a regulated forest management and for improvement of forest conditions, through regulating the pasture, adjusting rights of user, which require annually some 60 million cubic feet, and in other ways.

Railroad building and development of other means of transportation, establishment of sawmills and manufactures was the first care of the administration. Working plans in the narrower sense were not made at first, being considered useless expenditures, especially in the coppice and in those districts where the population had the right to supply their needs. "It would have been useless to force any system of forest regulation on areas in which it is still necessary to overcome habits and prejudices established for centuries."

Only here and there where in the single case the necessity for special plans was apparent were special regulations issued. The main stress was laid on a survey and on the best development of the logging practice and proper utilization. As Dr. Hess (Giessen), when visiting the country, properly states: "The management of such extensive virgin woods can be organized and carried out only in broad features, without losing oneself in details. The first and most important task is to systematize forest utilization; to lift the stored treasures in such a manner that the forest is still maintained or can re-establish itself. This problem has been excellently solved by the Bosnian forest department."

Another authority, Reuss, expresses himself in a manner which it would be well for many American foresters, imbued with false notions of forest preservation, to ponder over. He counsels a more rapid utilization of the decrepit virgin forest in order to substitute a better, economic forest: "Although I admit that difficulties of transportation and need of soil protection may place widely different limitations upon the degree of selection cutting, I do not believe that these considerations should restrict a more intensive use, for on one hand good waterways have opened this forest wealth to the world markets and on the other hand there are on the virgin soils *such colossal masses of mould and raw humus accumulated, that soil deterioration need not be feared.* The intermediate stand which cannot be utilized as yet, furnishes anyhow sufficient soil cover, perhaps even *denser than is desirable or agreeable for natural seeding and regeneration.*"

As a consequence of carrying out these ideas, voiced by a number of competent practitioners, the forest administration was charged by the press with devastating the forests. *Tout comme chez nous!* It was charged, that the administration ignored all conservative principles of forest management by making long-time contracts for exploitation without previously determined working plans; that it sold its wood at lowest prices, making only small profits and disturbing the market, while failing to do anything for the care and regeneration of the forest. But the administration continued, and the charges, based on ignorance, have lost their force.

Due to the persistent efforts of the State forester, Petrascheck, a large timber area has been contracted away to private parties for logging. The history of the campaign for the consummation of this plan of developing commercially the vast Fir, Spruce, and Oak forests forms most interesting and suggestive reading. At first it was proposed that the Government should become partner in a large syndicate to exploit the entire coniferous area, the Government to attend to the logging part for better control; but finally contracts were made with responsible private firms, the largest of which comprises nearly 600,000 acres, the contracts running for 20—30 years, and sometimes for shorter periods; the Government building certain necessary railroads. Details of the contracts are given in the book.

The basis of the contracts is found in the annual felling areas determined by the working plans, the government officers marking trees if selection is to be practiced. The Government falls heir to all buildings and improvements at the end of the contract, can use all means of transportation without charge, and has reserved many other easements.

The prices for the stumpage are somewhat lower than those obtainable by the Government from its own fellings, but this is largely due to the location of the contract areas. Logs over 10 inches in diameter brought between 1.0 and 2.3 cents per cubic foot ($1.70 to $4.00 per M board feet), the higher prices for Pine, the lower for Fir; the fuelwood was paid for at 20 to 40 cents per cord. Oak was sold at $1.10 per tree.

By these contracts the Bosnian State forest management was placed at once upon a financially sure and safe basis, even though the income is modest. At the same time the State railroads which were necessary for the development of the country derive about 30% of their freight from these contracts.

The budget of the State forest administration shows an income of $600,000, and expenditures of $375,000 a net result of only $225,000; but in addition $225,000 worth of wood is given free to the people, besides $400,000 worth of pasture, and

$50,000 is spent for school and other purposes of improvement.

The total annual cut averaged for 10 years around 125 million cubic feet or 25 cubic feet per acre, of which 67% goes to supply the population. In the western section of Austria the cut per acre of State forest is 38 cubic feet.

A yield table for a virgin selection forest of Spruce and Fir gives the following picture of the stands for three site classes, only merchantable trees being included.

Density	Cross-section Area	I	II	III
	Square feet		*Cubic feet per acre*	
1.0	450	9800–7560	6440–4200	3080–1400
.8	375	7850–6020	5180–3360	2450–1120
.6	295	5880–4480	3780–2450	1820– 840

The first necessity for working plans in the stricter sense appeared in connection with mine and furnace properties, where a sustained supply of props and charcoal was desirable, and then for the contracted logging areas.

To disabuse those who harp upon the inapplicability of "European" methods in the United States, we reproduce the simple, very general directions which lie at the basis of the Bosnian working plans.

1. The basis of working plans is to be a tolerably accurate statement of all factors influencing yield, without going into minute details.

2. The propositions of the plan are to be adapted to the concrete forest conditions as well as to the other economic, social, and political conditions of the country in general and of the locality in particular; especially all detailed prescriptions regarding operations in the future are to be avoided.

3. In determining yields, especially of merchantable material, care should be taken not to overestimate.

4. By no means apply one and the same method of organization for all parts of the country, but choose the simplest which fits each case.

5. Working plans in their form are to be simple and easily intelligible.

6. The work is to be done as expeditiously and cheaply as possible compatible with the object.

Three degrees of accuracy in method were applied. The simplest, based upon a photographic copy of the general military map (1 : 25,000), requires a subdivision on the map into compartments and the locating in the field with a hand-compass of the intersecting points and of points in the division lines every 300 to 600 feet. These compartments serve for forest description and stock survey. The latter is made by estimating, and the increment is ascertained on sample areas. The more detailed survey is left to the future.

The more accurate methods improve on the area survey, substituting plane table or transit and stadia; the subdivision is more fully and carefully carried out, but mainly in those parts which are soon coming into operation, leaving the rest for the future; the stock and increment are determined by means of local yield tables or in very non-uniform stands by the chain method. Only in the most accurate method are the stands which are to be felled in the near future more carefully estimated (the intermediate stand only when some object requires it), and the increment is determined on model trees. The budget is then determined in various ways, more or less accurately as the case may demand, usually by area with a volume correction, assigning, however, to the first periods of the rotation, considerably more than the normal area (25 to 50 per cent more) so that in the last period some areas of the first period have to be cut again (partial reduction of the rotation), the object being to utilize the over mature wood capital sooner. Naturally, compartments and felling areas are made large and without reference to "felling series" and "distribution of age classes" such as a more intensive management would justify. A sustained yield management for single districts is, of course, not attempted, but for the country in general is nearly attained.

In this connection it is interesting to note that in order to expedite matters the larger part of the working plans was made under contract by a private forest regulation bureau (Bretschneider), namely for some 700,000 acres, while the forest administration made working plans for 250,000 acres.

The chapter on forest culture is full of suggestions for us. The attitude of the forest administration regarding the silvicultural program is as practical and considerate of the undeveloped conditions as its commercial program. Finding the virgin forest in "ideal" condition as regards composition and form, the aim was "to preserve these ideal conditions by way of natural regeneration, and only where nature fails or does not give satisfaction artificial reforestation is indicated; and then all extravagances are to be avoided, only the native species adapted to the sites to be sowed or planted. Avoid as much as possible clearings and favor the shelterwood system in all its most developed forms (*not* selection forest!) and proceed with the fellings in all favorably situated districts, not according to prescribed form but with regard to the requirements of the reproduction."

Where planting becomes necessary, under normal conditions sowing in seed plats is preferred to planting of seedlings, especially with Pine, Oak, and Fir, making the plats rather large on account of weed growth and using large amounts of seed, one species in the plat. The plats are marked with sticks so as to enable inspection and possibly repair or protection by weeding, etc. Only as much planting is done as can be thoroughly well done with the means on hand.

Planting is especially necessary in the "Karst" mountains, the well-known devastated limestone range along the seacoast, a continuation of the same range, which for many years has been a troublesome problem in Austria proper. A whole chapter is devoted to the efforts to rehabilitate these wastes.

Special attention is also given to the improvement of the brush forests, of which one million acres exist, a characteristic form of vegetation, counterparts of which can be found throughout the United States. They are the maltreated (by cutting, fire, and pasture) remnants of former forest glory in the oak zone, in which the tree species are reduced in number and dwarfed or mutilated, the shrubs being dominant, constantly trimmed by cattle.

These areas are to be turned into regular coppice and coppice with standards, and as the sprouting capacity in the mild climate is astonishingly strong, the mere exclusion of the cattle and judicious improvement cuttings, called after Wessely "resurrection cuttings," will readily restore such woods to production.

The cutting is done after one or more year's rest from pasturing, when the best oaks and seedlings of other tree species are left for standards. In a few years an improved aspect is noticeable.

We have devoted more than the usual space allotted to reviews because of the practical interest which we believe attaches to the book for our readers. We hope that some of them will find time to read it in full; they will be well repaid. B. E. F.

Forest Conditions of Northern New Hampshire. By Alfred K. Chittenden. Bulletin No. 55, Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1905. 100 pp. 8°. 7 pls. 2 maps.

A creditable piece of work covering the forest conditions of the White Mountain Region. After a physiographical description of the region, including its topography, geology, climate, and drainage, the land is classified and the forests are described by topographic sub-divisions — forests of the Presidential Range, the Carter Range, the Saco drainage basin, etc. — followed by short chapters describing the several species. The most valuable part of the report is that on forest fires, which gives their extent and damage, their effects on logged lands and future crops, the character of growth following fires, the causes of fires, and methods of fighting them. There is also a chapter on forest industries, the study for which was made by J. Girvin Peters, describing lumbering in New Hampshire, the paper and wood-pulp industry, the bobbin industry, and others.

The baneful effect of clear cutting and fire in the mountains, setting back a useful forest growth for several centuries, or sometimes, as on North Sugar Loaf Mountain, rendering the area permanently barren, is illustrated. Two maps accompany the report. One of them gives the drainage basins of Northern New Hampshire and has no particular value. The other contains valuable information as to character of the land, whether softwood, second-growth pine, hardwood, agricultural, burned, waste, or barren, but so jumbled together in the effort to tell too much at once, as to lose its effect. If the burned, waste, and barren areas had been shown separately the result would have been clearer. Tables of average stands per acre showing the number of diameters and the trees of each species are given. This information is not complete, however, as there are no statements of the average yield per acre, except a general division of lands "under 5,000 board feet per acre," "5,000–10,000 board feet per acre," and "over 10,000 board feet per acre," for softwoods, and "under 15 cords," or "over 15 cords," for hardwoods. The most serious defect of the report is that it lacks volume tables for the more important species in Northern New Hampshire, a very valuable item for woodland owners. This omission is the more marked in that less than half the amount appropriated by the State of New Hampshire for the purpose of making this report was used.

The conclusion and recommendations in this report are to the effect that a definite change in present policy and methods in Northern New Hampshire is necessary. Upon large areas of land valueless for other purposes a forest of some kind will continue to grow. Conservative logging, now seldom practiced, would greatly enhance the value of these lands, as well as preserve the attractiveness of the region, an important consideration for New Hampshire. Above everything else a state forester and fire warden, a trained man, should be put in charge, with necessary assistants, to control the forest fire problem, and the cut-over lands in the mountains should be acquired for reserve purposes without delay. This last recommendation bears upon the proposed national forest reserve in the White Mountains, although the report itself is careful to make no reference to this proposition. P. W. A.

Manual of the Trees of North America (*exclusive of Mexico*). By Charles Sprague Sargent. Houghton, Mifflin & Co., Boston, New York, Chicago, 1905. 826 pp. 8°. 644 figs. Postpaid, $6.00.

Ever since Prof. Sargent announced his intention to bring out a handbook of trees, foresters and others have been looking forward to its publication. Their expectations are fully gratified by the book, for it covers the subject of identification of trees in a way which has never before been attempted except by Prof. Sargent himself in his "Silva of North America." The Manual is illustrated with 644 drawings by Mr. C. E. Faxon. The leaves, fruit, and flowers of all of the important trees have been pictured. The book is particularly adapted to foresters and botanists pursuing special studies in trees. It is not suited to a beginner who has not had the advantage of a foundation in botany, or for laymen who do not wish to be bothered with technical terms. The work is purely botanical, although the author mentions in his preface that one of the objects of the book is to stimulate investigation in the silvicultural value and requirements of our native trees. As a matter of fact, a great deal of silvicultural information has already been gathered about many of our more important trees, which Prof. Sargent has not introduced into his book. This manual will be of great use as a text book in the forest schools. H. S. G.

Geschichte der Oesterreichischen Land- und Forstwirtschaft und ihrer Industrien von 1848 bis 1898. Wien 5 vols. Mk, 120.

The celebration some six years ago of the fiftieth anniversary of the accession of the Emperor Franz Joseph I to the throne of Austria-Hungary was made the occasion of the issue of a detailed and comprehensive review of the progress of agriculture and forestry in the empire during the half century. The report is in five large volumes of which the two last deal more particularly with the development of forestry, and these contain the facts here briefed from Zeitschrift für Forst- und Jadgwesen, Jan. and Feb., 1905, pp. 30-42 and 113-124.

Fifty years ago the forests of the empire were not by any means in the condition we now find them. In Bohemia, Moravia and Silesia a fair start had already been made in forest management, large properties, well developed industries, and the proximity of German ideals being the favoring factors in its development. Austria proper was somewhat behind these northwest provinces, and intermediate between them and the alpine states, where all the mountain forests were made subservient to the mining industries.

In the northeastern provinces, Galicia and Bukowina, the lack of market retarded the development of forestry and kept the virgin woods intact, while in the maritime provinces ready outlet and careless waste had already depleted the forest wealth to such a point as to discourage attempts at management.

To-day the forested area of the empire amounts to 24,000,000 acres (38,000 square miles), or 32.6 per cent of the entire country, this figure varying from 25 to 50 per cent in different provinces. In the provinces where forestry is oldest, it is shown that nearly one-third of the forests are private and held in large areas, while in upper and lower Austria and in the alpine regions small private forests are most frequent.

In the development of forestry the growth of railroads and subsidiary avenues of commerce have played a great part. To-day the cost of production is considerably higher, but the net profits also show a healthy growth due to higher prices for the wood produced. The value of the total raw product of the Austrian forests is at present estimated at between 20 and 25 million dollars.

The year 1848 marks an era in the rational treatment of Austrian forests, as then for the first time they were placed into the hands of men with some training; and to these early foresters, Feistmantel, Hausegger, Wessely, and Bauer is due the rapid development that followed soon after. Seven years later the policy of disposing of State forests was entered upon, to continue for nearly twenty years. Austria has not yet recovered from the effects of this mistake, only one-half the area disposed of having been regained since 1885.

The private forests fall into two classes, different to the manager's eye in their every aspect. The larger private estates are well cared for, standing quite on a par with the State forests; the smaller holdings have advanced but slowly even during this period of vigorous growth. In 1895, 40 per cent, or, leaving the small holdings out of consideration, 57 per cent of the wooded area of the entire empire was under management.

The demand at present is more for timber and less for fuel and charcoal wood than was the case fifty years ago. And owing to the heavy importation of substitutes, great attention is no longer given to the production of tanbark. Great changes have not, however, occurred in the methods of removing the crop, and the conservatism of the woods' laborers has on the one hand prevented the friction so lamentably frequent with other classes of labor, and on the other rendered the introduction of up-to-date equipment for woods'work extemely slow.

At the beginning of the present reign little use was made of planting or sowing, natural regeneration being almost universal. But first the barren areas coming into consideration and then the use of species unfitted to the natural system brought artificial reforestation into some prominence, while later study and experience resulted in many improvements in the current practices and customary implements. The largest problem in tree planting with which Austria has had to do lies in the southern crown provinces bordering on the Adriatic in the region referred to as the "Karst."

This is a limestone region with shallow soil, where over-drainage is responsible for protracted droughts in summer. This feature of the drainage and the occurrence in winter of the "Bora," a strong north or northeast wind which does considerable damage to young plantations, are the two most striking features of the climate, and these are greatly influenced by wide differences in altitude and latitude. The surface of the country is level, rolling, and mountainous. The flora varies from sub-alpine to sub-tropical. The northern plateau and the mountains are covered with Beech, Fir, Spruce, and Austrian Pine, no Scotch Pine or Larch being found; the central zone and lower altitudes are occupied by a mixed forest of deciduous trees; while at the coast the native trees are mostly broadleaved evergreens. Throughout this region the forests have been to a great extent annihilated by grazing sheep and goats; the chief reason for such wholesale waste being the land tenure. Such forests as are found have been held by the State for centuries, while communal holdings are everywhere barren of forests, and to-day the ratio of State to communal holdings expresses almost exactly the proportion of forest to open country. Forest fires, which are not unknown even to-day, have helped in the removal of the coniferous forests.

The first steps in tree planting were taken by the city of Triest before the middle of the last century. Various species were tried, but success came only from plantations of Austrian Pine. These early plantations are now some 15 meters high and 25 to 30 cm. in diameter and have so changed local conditions that Beech and Fir are successfully planted under their protection and the soil is entirely covered with a layer of humus.

In the sixties the Government took a hand in the work of reforesting, especially by easement of taxes and by furnishing trained foresters and plant material. Such a stimulus was thus given to planting that in 1880 further reforestation was opposed by the people as infringing on the pasture lands. Since that time progress in this direction has been more cautious. Up to 1897 some 11,000 acres had been planted; that is, about one-sixth of the area marked out for reforesting. In Dalmatia, where ecomonic conditions are less favorable and remnants of the early forests more frequent, activity has been almost entirely confined to protecting these open groves, and excellent results are reported. On the whole the Austrian Karst is fairly well on the road to reforestation.

Regarding silvicultural practices we cull the following notes: The theory of thinnings, the most important cultural measure, was developed in the present reign by R. von Feistmantel. Various schools advanced opposing theories, the most important among which was that of the Prag School under Liebich, his propositions threatening the practices in vogue most seriously. Liebich advocated the simultaneous use of the forest for wood production and grazing, but cautious tests early served to prove the fallacy of his ideas in practice.

The spread of the soil rent and similar theories served to further more careful studies of thinnings as influencing an increase of production and a shortening of rotations.

A practice of which Austrian foresters are less proud is the work of draining forests extensively undertaken early and soon overdone.

Artificial pruning, the latest developed practice of silviculture, was tried sporadically quite early, even in the eighteenth century. As the general economic conditions of the country advance, no doubt the practice will find more favorable reception and wider use.

Extensive damage has been done in Austrian forests by avalanches, wind, and insects. The ravages of a bark beetle in 1871 to 1884 and of a nun moth since 1888 or 1890 called forth the best efforts of the forest service before they were subdued and only after great damage had been wrought. The literature of these years is naturally full of discussion of the problems these pests brought.

In the development of means of transportation the practices of forestry have followed the economic development in other lines of industry more closely than in any other direction. Rafting is now a thing of the past, due in part to the lessened value of rafted material, and all carriage is now by land. Wagon roads are built in the more accessible forests, while in the remoter, larger, and less developed forests railroads are the rule. More recently systems of cars suspended from overhead cables, such as are employed in various industries in Europe but which one never sees in this country, have been employed.

In the development of practices of wood impregnation and pulp manufacture Austria can claim little part, very early work in treating timber proving of no value. This early activity was followed by a period of neglect during which the methods were developed elsewhere and only after their feasibility was fully demonstrated did they find use in Austria. Some two and a half million cross-ties are now treated annually, five stationary plants and ten portable ones mounted on railway cars being used for this work. Pulp is produced in excess of home needs, and in the markets of the world Austria must rely on cheaper material and favorable freight rates to compete with her neighbors.

Wood distillation has remained undeveloped as yet, though charcoal burning in more or less improved kilns is an old industry, being in fact more important thirty years ago, before the general use of coke, than at present. Rosin is collected from the Fir for pitch and incense, from the Larch in the alpine provinces for Venice turpentine, from the Scotch Pine for tar, rosin, pine oil, and pine black, and from the Austrian Pine for turpentine, colophony, and clear rosin. The yield is largest and consequent damage to the timber value of the tree least in Austrian Pine. Of late years most of the crude turpentine has been refined in Vienna. The abolition of a tariff on foreign, especially American, naval stores has reduced the profits from this industry considerably since 1890.

In a necessarily rather brief review of so volumnious a work, much of detail and even some of the broader questions treated, such as the forest schools and the present status of forestry education, the experiment stations, and the theoretical advances, especially on the mathematical side and of timber physics have had to be omitted. D.

First Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii, Honolulu, 1905. 170 pp.

I was astonished upon visiting the Hawaiian Islands recently and upon reading this report to find how much has been accomplished under the able leadership of Ralph S. Hosmer, Superintendent of Forestry. In spite of the fact that the appropriation for forestry was cut forty-one per cent in the recent general retrenchment, rapid progress has been made. Mapping of the public forests is already well under way, two forest reserves, one of 913 and one of 17,000 acres, have been set aside, and plans are under way to reserve all of the public land which it is desirable to keep under permanent forest cover. Mr. Hosmer has succeeded in securing the warm support of the officers of the Government and of the planters. Many of the latter now stand ready to plant trees as soon as the Territory or the Federal Government can give them the necessary advice and assistance. The field work of the Division of Forestry during the past year was largely devoted to exploration of the Islands and planning new reserves. Lack of funds prevented the extension of the existing public plantations, and prevented also an adequate protection of the public forests. Mr. Hosmer has given in his report very clear statements of the forest problems on each island.

H. S. G.

A Primer of Forestry. By Gifford Pinchot. Bulletin No. 24, Part II, Bureau of Forestry, U. S. Department of Agriculture, Washington, 1905. 88 pp.

The second volume of Mr. Pinchot's Primer is entitled "Practical Forestry." The subjects have been divided into four heads: The Practice of Forestry, Work in the Woods, Weather and Streams, and Forestry Abroad and at Home. In the first part, the author explains the principles of the practice of Forestry and describes how a forest is treated in order to obtain good reproduction and the highest yield in the long run. The second part explains how timber is cut and transported without injury to the forest which is left after lumbering. The last two parts deal chiefly with the influence of forests on climate and on stream flow and with the present condition of forestry in different countries. Mr. Pinchot has handled several large subjects in a very brief but at the same time perfectly simple and clear manner. It requires a master hand to present a technical subject in such a way that schoolboys can understand it, and this the author has succeeded in doing. The idea of the title, "A Primer of Forestry," has been admirably carried out. Other authors of forest books would do well to study Mr. Pinchot's clear and direct style.

H. S. G.

What Forestry Means to Representative Men. Circular No. 33, Bureau of Forestry, U. S. Department of Agriculture. 31 pp.

This circular contains extracts from the addresses delivered before the American Forest Congress held in Washington in January, 1905. The title of the circular is well chosen, for it would be difficult to secure a list of names more representative of the business interests which are allied to forestry. It is unfortunate that the extracts of the different addresses are so short. Enough is said to show the interest of these men in forestry, and what they say is so good that the reader constantly wishes that the whole address were given.

H. S. G.

Federal and State Forest Laws. Compiled by Geo. W. Woodruff. Bulletin No. 57, Bureau of Forestry, U. S. Department of Agriculture, Washington, 1904. 259 pp.

This is without question one of the most important and valuable bulletins ever issued by the Bureau of Forestry. Mr. Woodruff has brought together all of the important statutes and laws of the Federal Government and the different States relating to forestry. The matter has been presented in excellent form for reference. It always has been a difficult matter to get at the exact status of the laws of different States, chiefly because they are embodied in different legal volumes, which to the ordinary layman are difficult to use. Mr. Woodruff has arranged the laws under the different heads: Constitutional Provisions; Statutes Relating to Administation and Use of Timberland and Forest Reserves; Statutes Relating to Trespass on Private Forest Lands; Statutes Relating to Trespass on Public Forest Lands; Statutes Relating to Forest Fires; Statutes Relating to Bounties, Tax Rebates, and Tax Exemptions; Statutes Relating to Investigation, Education, and Public Observances. In an appendix is included a list of Federal Forest Reserves, National Parks, and Military Wood and Timber Reservations, but there is no list of State reserves. The laws relating to surveying and to measuring logs have not been included except as they are embodied in some general law. Mr. Woodruff's bulletin will serve as an admirable reference book for American forest law.

H .S. G.

Economie forestière. Par G. Huffel. Tome deuxième. (Dendrométrie; la formation du produit forestière; estimation et expertises forestières.) Lucien Laveur, Editeur, 13 Rue des Saints-Peres, Paris. 1904. 484 pp. Price, 10 fr.

The second volume of Prof. Huffel's Forest Economics has just appeared and is of no less, if not greater, interest than the first one. It deals with Forest Mensuration, Forest Production, and Forest Valuation. The most favorable impression which the first two volumes produce makes one wait impatiently for the third and last one, which will be devoted to Forest Management.

Forest Terminology in French, English, and German. By J. Gerschel. Ècole Nationale des Eaux et Forêts. Nancy, France, 1905. 203 pp. 3s. 6d.

This book is a revision of Prof. Gerschel's French-German and German-French Forest Terminology. The English equivalents of the foreign terms and the German and French equivalents of English terms are now given. The author has secured the aid of Prof. Fisher of the Cooper's Hill forest school in editing the English part. Naturally, many of the terms are English rather than American. The book is of handy size and well gotten up with flexible cover. It is recommended to every forester.

H. S. G.

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Forestry in Massachusetts. By Alfred Akerman. Bulletin No. 1, State Forester's Office, Boston, Massachusetts, 1905. 13 pp.

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Foreign Journals..B. E. FERNOW, R. ZON, F. DUNLAP
Propagandist Journals...............H. P. BAKER
Trade Journals............F. ROTH and J. F. BOND

FOREST GEOGRAPHY AND DESCRIPTION

The Florida Torreya

In a paper on the physiology of reproduction of the Torreya tree, occurs an extract from the notes of H. C. Cowles, of the Hull Laboratory, whose observations we quote herewith in full.

"My visit was to the northernmost colony, west of Chattahoochee village, and close to the Georgia line. The distribution lines on Chapman's map (I) would lead one to suppose that the tree is xerophytic and frequents the steep and dry eastern bluffs. I was much surprised to find that it was confined (in the Chattahoochee station at least) to the extremely mesophytic slopes of ravines, growing exclusively in the shade of trees, and in places that are continually moist, preferably on slopes facing north. The northern and southern known limits of the tree are only about thirty miles apart, and the east-west range is much less. Furthermore, on account of the great economic value of the wood, and the familiarity of the tree to all the inhabitants of the region, the likelihood of finding other areas is very slight.

"It is associated with a remarkable and somewhat extensive group of northern mesophytic plants, and the conclusion is irresistible that *Torreya* is a northern plant of the most pronounced mesophytic tendencies, and to be associated with such forms as the beech-maple-hemlock forms of our northern woods, our most mesophytic type of association. Probably it never becomes a large tree, although farmers always cut the trees as soon as they become at all usable. Rarely were any found over 30 cm. in diameter or more than 9 to 12 m. high. It has remarkable capacity for vegetative reproduction, almost equaling the redwood in this respect. Many suckers issue from cut stumps, and even from fallen trunks; even rotten stumps show vigorous suckers, and it seems to be as tenacious of life as the poplar. Staminate trees appear to be the more numerous; however, when in blossom they are far more conspicuous than the pistillate trees, and the conclusion as to proportion may not hold."

Gametophytes and Embryo of Torreya taxifolia. Botanical Gazette, March, 1905, pp. 161–178. (With 4 Plates).

Range of Longleaf Pine

In view of Prof. Sargent's statement that Longleaf Pine rarely extends beyond 150 miles from the coast, and the common belief to this effect, Roland M. Harper's observations in northwest Georgia are enlightening. The most surprising station that he found for the species was on Pine Mountain in Bartow County, from the 1,000-foot contour up to the summit at 1500 feet altitude. This situation is 260 miles from the coast, and quite unlike the ordinary habitat of the tree.

Some Noteworthy Stations for Pinus palustris. Torreya, April, 1905, pp. 55–60.

FOREST BOTANY AND ZOOLOGY

Another Taxodium

Pursuing investigations already reported (Bull. Torrey Club, June, 1902, pp. 383-399), Roland M. Harper, writing of the cypress previously described by him as *Taxodium imbricarium*, states definitely that "The conclusion is irrestible that *T. imbricarium* is abundantly distinct." The species shows characters, particularly of bark, shape of knees and buttresses, and distaste for direct contact with limestone formations, which remain constantly different from the corresponding characters of *T. distichum*. Furthermore, intermediate forms are far outnumbered by perfectly distinct specimens of each species. The new *Taxodium*, Mr. Harper says, is very abundant in the coastal plain of Georgia, and occurs in every country where oligocene or later rocks are found.

Further Observations on Taxodium. Bulletin of the Torrey Botanical Club, February, 1905, pp. 105–115. (With 7 Plates).

Growth of Pine

The first publication of the Swedish Forest Experiment Station brings results of investigations into the growth of pine. It is stated that the length of the annual shoot and the number of needles depends upon the weather conditions of the preceding period of vegetation, while those of the current period determine the length of needles and the diameter growth; both of these being greater in warm dry summers than in wet and cold seasons.

Meddelanden fran Statens Skogsförsöksanstalt. Häftet I, 1904. 53 p.

Transpiration and Soil Water

Experiments by V. M. Spalding at the Desert Botanical Laboratory of the Carnegie Institution define very clearly the relation between the water in the soil and transpiration. Recalling a previous article of his own on the creosote bush in its relation to water supply (Botanical Gazette, 38: 122. 1904), he says that "further observations on this and other desert plants . . . go to show that water in the soil is a controlling factor, and that even as efficient an agent as light may, in comparison, take quite secondary rank. . . . It was found that exposure to bright sunlight was uniformly followed by accelerated transpiration, whenever the plant under observation had a full supply of water, but that otherwise such acceleration did not take place."

Soil and Water in Relation to Transpiration. Torreya, February, 1905, pp. 25-27.

Light Effects

An interesting study of the effects of different degrees of light on soil conditions and on volume production is reported by Dr. Cieslar from the Austrian Forest Experiment Station.

The light intensity was determined by sensitive paper strips. The following absorption by the crowns of the total chemically active light was observed: severely thinned Fir stand, 80%; severely thinned Beech stand, 80-90%; severely thinned Austrian Pine stand, 60%; lightly thinned Beech stand (60 years old) when without foliage, 72%, with foliage, 97%; lightly thinned Austrian Pine stand, 80%.

The amount of light retained by the crowns (in per cent of the light in the open) divided by the number of trees the author calls the "shade coefficient." This coefficient becomes, of course, larger with increased opening, i. e., decrease of number. By comparing coefficients before and after the foliage is developed with the volume increment the author finds confirmation of Hartig's law, that Beech trees with large dense crowns in open position assimilate no more than those with smaller crowns in less open position, the leaves of the former assimilating more sluggishly. With Austrian Pine on the other hand proportionality of crown and increment was apparent.

A very comprehensive study of the relation between density and soil conditions shows the effects of reduction of the cross-section area in Beech to 65% as sufficient to produce a vegetation of weeds and shrubs inimical to regeneration, the light intensity under the leafless crowns being more than 60%.

Einiges über die Rolle des Lichtes im Walde. Mittheilungen aus dem forstlichen Versuchswesen Oesterreichs. xxx Heft. 105 pp.

Insect Names

At the Seventh Annual Meeting of the Association of Economic Entomologists, held in Philadelphia in December, 1904, the society, with the object of conducing to uniformity in the use of common names of insects, adopted a report of its committee on Nomenclature, recommending the publication of the accompanying list of names of insects, these names being the ones current throughout a large part of the world and throughout the region of the species. They urged that every entomologist use these names and these only, for English names; that the Latin name be included but once in as inconspicuous a manner as possible; and that copies of this list be furnished to the leading agricultural papers of the country, and that the editors of such papers be requested to use these, and these only, in all articles referring to such species.

Only names were placed upon the list that were agreed to *unanimously*, a much larger list remaining under consideration for future action.

Of the names submitted those of the following insects affecting trees may come within the field of the forester.

Army-worm, (*Heliophila unipuncta* Haw): bag-worm, (*Thyridopteryx ephemeraeformis* Haworth); brown-tail moth, (*Euproctis chrysorrhoea* L.); buffalo tree-hopper, (*Ceresa bubalus* Fab.); cottony maple-scale, (*Pulvinaria innumerabilis* Rathv.); cottony cushion-scale, (*Icerya purchasi* Mask.); fall canker-worm, (*Alsophila pometaria* Harr.); fall web-worm, (*Hyphantria cunea* Drury.); gypsy-moth, (*Porthetria dispar* L.); leopard-moth, (*Zeuzeura reticulans.*).

A New Enemy of the Fir

A butterfly, apparently unknown until lately and very similar to *Boarmia crepuscularia* HC. and *Boarmia consonaria* HC., which attacks in great numbers fir forests and causes considerable damage, has been described by E. Henry. The caterpillar eagerly devours the fir needles, but attacks the tall trees only after it has destroyed all undergrowth. *A forest affected by this butterfly strikingly resembles one damaged by fire.* After having appeared in a forest it remains there for several years and spreads rapidly. This butterfly would become one of the worst enemies of coniferous forests if its spread and development were not easily checked. The larvae winter in the upper layers of the soil and are readily destroyed by swine.

Un nouvel ennemi du Sapin. Revue des Eaux et Forêts, Dec., 1904, pp. 711–713.

Observations on the biology of a sawfly, *Lophyrus pini* L., capable of defoliating entire polewood stands of Scotch Pine are recorded by Loos. The service of birds and mice in destroying its cocoons is carefully observed.

Lophyrus pini L. im Herbste 1904. Centralblatt für das gesammte Forstwesen, February, 1905, pp. 60–64.

SOIL, WATER, AND CLIMATE

Nitrogen in Forest Litter

Some eight years ago, Prof. Henry of the École forestière at Nancy, published a paper on the increase of nitrogen in forest leaflitter. Viewing the problem in the light of the fact that, whereas the farmer must annually renew the vitality of his soil by the application of fertilizers, forest soils are never exhausted, he exposed leaves in boxes so that the quantitative results of decay could be measured, and detected an increase in nitrogen as expressed in per cent of the dry substance, this increase being considerable.

In a paper giving the details of the whole experiment, which were lacking in the report of Henry's work, the results of a carefully planned and patiently executed study of the variation of nitrogen in leaflitter have been presented by Dr. Hornberger. The details will interest only those who would not be satisfied with such a statement as we can give. The result is that of seven simultaneous tests made with Oak, Beech, Ash, and Black Locust leaves and Spruce needles, only two gave increases of nitrogen content; and they were insignificantly small, approaching the limit of accuracy of the method of determination. The five others showed losses, but two of these also were very small. The losses in the three others were considerable. The loss was greater in the litter of those species whose leaves are rich in nitrogen and also readily subject to decay, that is in Ash and Black Locust, while in the Oak and Beech where the opposite conditions obtain, the least loss occurred, or there was even a slight gain. It is impossible to account for this discrepancy, and while the author admits that under some conditions microorganisms living in decaying leaves may fix the free nitrogen of the air, this is by no means such a common or effective process as Henry's work would lead us to believe.

Streu und Stickstoff. Zeitschrift für Forst- und Jagdwesen, February, 1905, pp. 71–82.

Water-Absorbing Capacity of Dead Forest Groundcover

The data obtained by Wolny and others on the capacity of dead forest groundcover to absorb water does not correspond, in the opinion of E. Henry, to actual facts, because the investigations were too much of a purely laboratory character. Therefore, in order to come nearer to the truth and also to verify the conclusions of his predecessors, Prof. Henry made two series of experiments: One on the water absorbing capacity of the dead groundcover of Spuce leaflitter; the other on that of the dead groundcover of a pure Beech forest.

In a dense Spruce forest, 50 years of age and growing in limy soil, three sample areas were taken, each a half meter in size; the dead groundcover was carefully removed and carried intact to the laboratory, where it was immersed in water for several days. After having been fully saturated the groundcover was weighed, then dried at 100° C., and then weighed again, the difference between the two weighings giving the amount of water absorbed by the samples. It appeared that 100 grams of dry substance is capable of absorbing 415 grams of water, while according to the experiments of the German investigators the dry substance of dead Spruce needles did not absorb even 200 grams.

Prof. Henry explains this enormous difference only by the fact that his predecessors did not take into consideration the degree of decomposition of the leaflitter and in their experiments ordinarily ignored the layers of almost decomposed leaflitter, which are endowed with the greatest water-absorbing capacity.

By his investigations in the Beech forest Prof. Henry found that 100 grams of dry dead groundcover absorbed 5.38 grams of water, this figure also being twice that obtained in the experiments of Ebermayer.

Upon the basis of the results of his experiments, Prof. Henry roughly estimates the amount of precipitation necessary before the water saturating dead groundcover begins to penetrate to the mineral soil.

These experiments, like all other investigations of Prof. Henry, are exceedingly interesting, but they are yet too few to be conclusive, the more so because they, too, were made in the laboratory, under conditions differing essentially from those actually existing in nature.

Faculté d'imbibition de la couverture morte. Revue des Eaux et Forêts, June, 1904, pp. 353–361.

Irrigation and Forestry

The use of irrigation in humid regions has not even in agriculture found the attention it deserves. In forestry the series of experiments carried on since 1901 by the Austrian Forest Experiment Station in the Great Pine forest near Vienna is probably the first attempt to determine its value.

The present report by Böhmerle refers to a stand of Pine, 50 to 60 years old. The differences in the increment per cents of the cross section areas for the four years of observation were as follows:

	1901	1902	1903	1904
Without irrigation	2.3	5.2	4.5	3.2
With irrigation	5.0	7.4	7.1	5.5

or in four years a total difference of (25–15.2) nearly 10%. It was found that the favorable reaction set in the first year, especially in the lower tree classes, in which the influence was also more effective for two years, than in the larger tree classes; the middle classes coming later into the benefit. Full tables of increment determinations are given.

Bewässerungsversuche im Walde. Centralblatt für das gesammte Forstwesen, April, 1905, pp. 145–172.

SILVICULTURE, PROTECTION, AND EXTENSION

Shelterwood System in Groups

An excellent article by Prof. Engler throws so much light on the subject of natural regeneration that we translate large portions of it.

From textbooks and lecture courses it is hardly possible to gain an insight into the practice of natural regeneration except as to principles. The variations which the variable conditions of the forest produce in their practical application must be learned in the field. Those that have no opportunity of visiting and studying the results in the field can, however, enlarge their conceptions of the nature of natural regeneration by reading such detailed descriptions and elucidation of actual practice as Prof.

Engler gives of the socalled *Femelschlag*, as practised under various conditions, illustrated by a series of instructive pictures.

Neither our terminology nor the French is capable of conveying in one word what has become accepted in Germany since Gayer under the term Femelschlag. It is one of the variations of the nursetree or shelterwood system, (*Schirmverjüngung*), but instead of an even distribution of the nursetrees and an even and rather rapid progress of regeneration, in this method the regeneration is not attempted over the whole area or compartment at once, but in groups during a longer period of regeneration. Irregularity of progress and irregularity in the young growth, groupwise origin of the reproduction, and a long period in which it is secured are the characteristics. The three stages of Hartig's successive fellings occur side by side instead of following each other systematically. Preservation of soilconditions, easier regeneration, securing mixed growth, fuller utilization of light are the advantages claimed. The method is really an improved selection forest in which the number of age classes is limited to two or three and the old timber is removed entirely.

This method is applied with Spruce and Fir in the Black Forest, the regeneration period varying from 30 to 60 years; the rotation, although nominally fixed at 120 years, is actually extended to 140, 160, and more years. In the 80th or 90th year preparatory fellings begin, severer thinnings which remove poorly formed or damaged trees, even stout ones, and free the volunteer growth of tolerant species which may have established itself. These thinnings are made uniformly over large areas and are repeated every 5 or 10 years; their object is to strengthen the valuable members of the stand, to stimulate seed production, and to render the soil fit for seedbed. When in consequence of these thinnings groups of seedlings have gradually come in, the opening-up begins, the removals taking cognizanace of these groups. Where the Spruce is to be favored the opening takes place relatively rapidly; where Fir has established itself or regeneration is still absent the opening proceeds slowly. In this way the stand is gradually thinned out until only few old trees or open groups remain among the young wood, which ranges from thicket to polewood size.

The budget is controlled every 10 years according to Heyer's formula. The fellings necessarily are spread over large areas and hence the budget requirements do not hamper much the operations which silvicultural considerations necessitate. A large volume accretion (3 to 3.5 per cent on the old stock or 154 to 238 cubic feet per acre!) and large money returns are the result of the intensive utilization of the light.

In the neighboring French Vosges of similar climate, soil, and species the same treatment has been only lately introduced, especially in the extensive (200,000-acre) Fir forests (*sapinière*), which are best adapted to this storied composition (normally two to three ageclasses on the same area). Although this treatment has been taught in the forest school at Nancy for 30 years, by the momentum of old usage the selection method still holds sway in most parts, with a rotation of 144 years and mismanaged in other respects:

"At one place too much, at another too little is cut. Regeneration cannot keep time with the rapid utilization of the periodic area, while on the other periodic areas the proper time of the regeneration and for care for the young growth and utilization of the old is passed."

In Bavaria this shelterwood system in groups is very generally applied and highly developed. It is characteristic of the practice here to begin operations in young timber so as to secure isolated groups of regeneration. When the regeneration has come in, the groups are rapidly freed from shade and in relatively short time entirely exposed. Then by cutting around them their extent is gradually increased until they adjoin each other with little old timber left, the groups from their center falling off in height conically to their periphery. It is the aim to secure a mixture of groups each in itself as much as possible made up by one species. Planting in of Oak, Larch, Pine in groups of smaller and larger extent under open old timber or in failplaces is extensively practised.

In Switzerland the systematic application of the method dates a few decades back owing to Gayer's influence, although without conscious design it was practised more or less in the selection forest long before by force of circumstances. In the Alps more than on the plains it is necessary to free any existing groups of volunteer growth early and admit thereby the diffuse sunlight under the neighboring stand in order to prepare a seedbed. The pactice here is somewhat different from that of Bavaria. In close stands repeated thinnings by removal of damaged, misformed, branchy, and sprawly trees prepare the ground for seeding, which takes place in the more open spots where the soil becomes receptive and enough light and warmth for the development of the seedlings exists, while weedgrowth is still absent. As the regeneration groups establish themselves they are enlarged by further thinnings, the thinning following the seeding. "Since the progress of fellings in the mountains must be guided especially by the aim to admit to the interior of the stand sufficient light and warmth without baring the soil too much, the fellings have to be modified with regard to topography, altitude, exposure, soilconditions, frequency of sunshine, humidity, and height of the stand, all of which requires in each case careful observation and mature deliberation."

In the hill country too the regeneration is not as in Bavaria, started by groupwise fellings, but by more or less uniform openings over larger areas. Hence a more uniform distribution of the regeneration results, and only then a series of irregular thinnings seeks to complete the seeding, to secure the desired mixture, and to shape the profile of the young stand. Here, in the hill country, the rotation is mostly 90 to 100 years and the period of regeneration 20 to 40 years.

The description of a more definite case may assist in illustrating the principles. Take a mixture of Fir, Spruce, and Beech. Under the practice of thinning, Beech and Fir begin to regenerate when 60 to 70 years old. The regeneration of the former is then favored by light thinnings in seed years. When Fir and Beech cover the ground to some extent and weed growth is not to be feared any more, a severer thinning in proper places paves the way for the regeneration of the Spruce, which can easily make its way through the low, still open Beech and Fir regeneration, provided light is given to it at the proper time. Sometimes, to make room for the Spruce, Beech and Fir are cut out. Similarly, to maintain or reproduce the intolerant species, which may also be planted in, the light conditions are managed: By keeping dark the tolerant species are favored and even a difference between the Beech and Fir can be made, the latter supporting shade longer than the former, and being capable, if coming in later, of growing through the Beech regeneration.

In older, somewhat open stands Fir and Beech are regenerated in groups and the Spruce regeneration is secured among them by a strip method which introduces the necessary sidelight, a combination which has been quite successful.

Summing up the principles involved in these practices, the author first discusses form and mixture of these group forests.

The young stands resulting from this form of regeneration combine trees of various sizes in such a manner that the profile of the stand appears wavy or irregularly jagged. This form has the advantage over the uniform even-aged stands of one story, that a much larger surface of assimilating foliage is placed in favorable position toward the light; hence increased increment and better development of the single members of the stand results. The tolerant species, of course, are the ones most favored by this storied form, and the longer this form persists the more favorable the accretion.

This form can be secured only by non-simultaneous beginning and progress of the regeneration on small portions of the stand and by uneven shading of more or less even-aged young growth. Whether the young growth is a result of natural regeneration or of artificial means is irrelevant. In mixed stands the varying height growth and tolerance of the species adds to the effect of the silvicultural operations. Favoring of existing volunteer growth and planting out blanks are the first means of securing the object and changing even-aged Spruce or Pine stands to this desirable form. A long period of regeneration, which assures difference of time in the seeding, and variation in the shading of neighboring spots secures the difference of sizes in the natural regeneration.

Regarding desirable mixture the author points out that in the virgin forest, if soilconditions are uniform, the tendency is not for species to occur mixed in large groups. In young growths, to be sure, they congregate in groups and clumps, but in middle and old age only small groups and single trees remain. We are, however, forced to regenerate in larger groups, because our young growths originate under entirely different conditions from the regeneration in the virgin forest and because we often mix species which would not spontaneously occur together on the same site. In the virgin woods the different light intensities determine the character of the mixture. The more we are able to expose the different parts of the interior of the stand to different light intensities and to change (increase) these, the more readily can we dispense with the necessity of creating large groups. On the other hand in clearings the light intensity is from the start a given quantity and unchangeable, hence group-mixture is here unconditionally desirable. If the regeneration proceeds slowly under cover, it becomes possible, by locally opening up severely at the right moment or else by leaving a denser cover, if the species to be favored is a tolerant one, to secure for small groups or even for single individuals a start in height-growth which insures their not being overgrown, and making them the valuable final harvest crop. If the regeneration fellings proceed rapidly, the groups of the slow growers particularly must be larger, so that at least a clump will remain. Where, e.g., in higher inclement altitudes, Beech and Spruce are mixed, the former needs much larger space, for it can maintain itself in mixture with the Spruce only when its groups are of considerable size.

It is, however, not good policy to grow in large groups species which are liable to damage by wind, snow, fungus, and insects. If the mixture is to furnish those advantages which we expect from it, namely, of keeping stands healthy, these endangered species must with age be more and more isolated among the more resisting ones. If tolerant species like Fir and Beech form the basis of the stand, then admixture in clumps and even single individuals of rapid growing valuable species in localities to which they are adapted is the ideal manner of mixing. Where, however, Fir and Beech are mainly grown for soil cover and nurse purposes with other species, it is essential to give them a certain amount of headway by earlier regeneration. The determinative element lies then less in the size of the groups than in their number and their advance in height. It depends, therefore, entirely on the proportion and the objects of the mixture, as to whether or not the slow-growing species are to grow in advance of the rest.

Finally the intensity with which the thinnings can be carried on influences the question of the progress of regeneration and mode of mixture. With rapid regeneration and planting in of various species in small groups or singly as practiced in Bavaria, a more intensive and earlier care of the groups is necessary than with slow regeneration and a few naturally accruing species.

In extensive management where thinnings and care must be neglected, large groups promise maintenance of the mixture to old age better, while, where care can be bestowed, large groups may be dispensed with. Here even the faulty mixture of conifers and broadleaved trees in rows can be corrected and single oppressed conifers may be resuscitated by use of the axe. The less intensive the management the more important the size of the groups.

The manner and progress of fellings is different in Bavaria from the practice in the Black Forest, Switzerland, and France. In the latter parts the cutting is begun on large areas uniformly, and only when seedling groups begin to appear is a variation made in the uniform thinning by severer local openings to save and favor the established groups.

In Bavaria the first cuttings are at once made in groups more or less regularly distributed, so as to secure definite groups of seedlings. These openings are made either small clearings or often preferably open shelterwood thinnings, the removal of the shelter following rapidly after the regeneration is established. While the regeneration of the whole stand may require 30 years, the period for the single groups is a very short one, no matter whether tolerant or shade enduring.

Experience has taught that repeated preparatory fellings, which open the crowncover only slightly, favor regeneration very much. The best preparation of a stand for natural regeneration is an early begun, regularly continued practice of thinnings, when the stand gradually enters into the condition for regeneration. Such practice permits the utilization of a number of full and partial seedyears, following nature rather than forcing her. In unprepared stands it is more difficult to find the proper degree of opening, especially in mixed woods. Then when regeneration has occurred, which will always be in groups, the thinnings are adjusted to the needs of the young growth.

If the thinnings were made according to the principle of *éclaircie par le haut*, the conditions for a groupwise regeneration is still more favorable, and by opening in the subdominant it can be easily directed. Without previous thinnings it is a mistake, or "at least not consonant with intensive management," to open at once in group fellings.

The rapidity of enlargement of the groups by cutting around them determines the amount of gradation in the young growth, and must also be gauged very differently according to species. Pine and Oak, and even Spruce, require more rapid progress than Beech and Fir; only observation in the woods can direct the manager as to the manner and rapidity of opening up. The shade-enduring species may be regenerated under a form nearer to the regular shelterwood system, while for the light-needing species or on sites where species require generally more light, the strict method of groupwise regeneration is preferable.

The author considers the procedure of the Black Forest management the better, especially in utilizing the light accretion on the old stock. To carry on this management successfully, large areas are necessary over which the fellings can be distributed, one-third to two-thirds of the total area being at the disposal of the manager to secure his periodic budget. Budget regulation here is different, and requires repeated revision.

Reflecting on the applicability and significance of this silvicultural method the author concedes that in many regions the more rapid regeneration by successive fellings under shelterwood or strip system with shelterwood may be preferable, especially on climatically favorable sites, with only a few species, which regenerate easily (Oak and Beech in middle and western France, where 5 to 10 years regeneration period is ample; also in pineries of Gascony).

But when conifers are admixed with broadleaved species and become dominant, or on less favorable sites or on very variable sites, the group system is preferable. Here, indeed, the pure selection forest is even more in place, and this is what often becomes of the groupwise management, which is by some foresters considered the danger of the system; but the author considers the selection form the best for the mountains, and believes the group system to be here a desirable transition to the desirable selection forest.

Aus der Theorie und Praxis des Femelschlagbetriebes. Schweizerische Zeitschrift für Forstwesen. Feb.–May, 1905, pp. 29–35, 61–68, 99–103, 123–131.

Coppice with Standards

An extenisve discussion on the selection and management of standards in overflow lands of the Rhine took place during the sessions of the Palatinate Foresters' Association. The standards there have gradually approached a timber forest condition, the coppice becoming merely protective cover and nurse. Oak, Elm, and Ash are favored on the deep heavy soils; Maple, Robinia, and Basswood on good soils with sand and gravel subsoil; Beech and Blue Beech on gravel soils; White Birch and Pine on dry sands; Willow and Alder on wet sands. The use of other softwoods, especially poplars (Silver, Balsam, Canadian, Italian) is recommended, which are called for in furniture manufacture, Poplars and Willows, which in 40 to 50 years attain diameters of 20 to 24 inches (some of the former with heights of 100 feet), sell for 20 to 35 and even 40 cents per cubic foot, while the hardwoods require 60 to 70 years for such dimensions, and Oak is managed in 100- to 120-year rotations.

The planting is done with stout material, especially in the overflow lands; saplings (4–5 feet) are employed, and much repair of plantings is necesasry. Nursery-grown transplants, for softwoods from cuttings, are preferred. The spacing is done on the principle that all species which in natural regeneration sow themselves densely are also to be planted densely.

The planting is done by groups of species. With rapid growers, like poplars, individual planting or small groups are admissible. The more growing space a species requires the larger are the groups to be made. If single groups are overgrown by the coppice, it is advisable, instead of trying to correct by cutting back, to cut the coppice altogether as soon as the material is saleable, when a general improvement cutting can also be made and pruning may be practiced. For the painting of wounds a mixture of one part rosin, one part tar, and one-quarter part linseed oil is preferred to pure tar.

Some details regarding treatment and results of different species are given; our Cottonwood is especially praised for repair planting and for its rapid growth. Cuttings of 1- 2-year-old wood 10 inches long are placed in nursery rows 20 inches apart so that the last bud near the end is hardly covered, early in spring before the sap moves; transplanted in nursery in a year; and set out the second year properly pruned, planted singly or in groups every 12–16 feet between other species. It will never be overgrown, prunes readily, and avoids wet soils. On soils with dry surface but wet subsoil, Balsam Poplar does better.

Robinia, like Basswood, is adapted to soils which do not have a high watertable. Transplants 2–3 years old are used in small groups.

Die XVIII Versammlung des Pfälzischen Forstvereins. Allgemeine Forst- und Jagdzeitung, April, 1905, pp. 140–144.

Spacing of Plantations

An important contribution to the question of the spacing or density of plantations is made by a Danish forester, L. A. Hauch, author of *Haandbog i Skovbrug*, in the *Botanisk Tidskrift.* He bases his recommendatons upon the observation that the different species vary in their capacities to expand or spread their crowns; in one species only a small number of individuals will outgrow and suppress their neighbors, in others a large number become dominant and the struggle continues longer, its result being doubtful, while in others again all members of a group may grow up equally and remain small and undeveloped. Beech, Oak, and Pine exhibit great capacity for expansion, Spruce and Ash a very small capacity. Within the same species the soil produces variation in this direction, the capacity for spreading being increased on heavy loam, decreased on poor sand.

In spacing as a rule little attention has been paid to this difference, uniform distance being used with the various species, which explains some failures. In general close spacing is needed with species of spreading habit, while those in which this habit is less developed, i. e., a larger number of stems having a tendency to straight, stout growth, succeed best in more open position.

Very dense plantations are advantageous with Beech and Oak especially on cool, moist loam soils, while open ones may fail. Larch and Birch seem to be indifferent to density, developing equally well in wide or close spacing, while in Spruce and Ash, which have the spreading capacity little developed, dense position is detrimental. A density of 3200 to the acre with Spruce suffices to produce good timber, while in Beech the quarter million of a natural regeneration is most effective.

Pointing out that this habit is not in relation to tolerance, the author tries to relate it to root habit, finding that owing to root habit natural regeneration and sowing are most effectively applied to species of spreading habit, planting to those which have this habit less developed. The latter by transplanting in nursery develop a compact rootsystem with stout fibrils which resist drouth and damage in planting, while the species of spreading habit have fine and tender fibrils which dry out easily and great care is needed in transplanting.

Among European species Beech has the greatest spreading habit, hence in open plantations does not produce a high timberwood per cent. Its rootsystem, even when schooled in nursery, is not advantageous for transplanting, yearlings or plants with ball of earth being best material.

With Oak no density can be too dense; the denser the stand the better the result, hence sowings are preferable to planting, which is also objectionable on account of the tap root, except with yearlings from a humus soil.

Pines (Scotch, Yellow) behave similarly to Oak, although somewhat less density is desirable, sowing or planting of yearlings being best material.

Spruce, having little of the spreading habit, a relatively smaller number can be used; but to secure clear boles and fine-ringed wood a medium density of 3200–3600 per acre is desirable; it has a rootsystem most excellently adapted to planting.

Ash behaves similar to Spruce; if too dense, suffers; by schooling produces satisfactory plant material.

As to Maple the author is uncertain, except that the root-system fits it for planting. Birch and Larch on the contrary are better sowed and develop well in dense stand.

The Danish forest experiment station has undertaken to make further experiments in this direction.

Ueber das sogenannte Ausbreitungs vermögen unsrer Holzarten. Extract in Allgemeine Forst- und Jagdzeitung, February, 1905, pp. 41-45.

Results and Methods of Thinning

An extended discussion on thinnings is found in the report on the meeting of the Badish Forest Association, from which only a few definite data may be cited with profit. The growing importance of thinnnigs from both cultural and financial consideration appears from the statement that in the State forests of Baden in the period 1879-83 thinnings represented with 13.4 cubic feet 27 per cent of the main harvest per acre and year, while in the period 1898-1902 the thinnings represented 27.3 cubic feet or 40 per cent of the felling budget, an increase of 104 per cent.

A Spruce plantation, spaced 1.5 feet showed in the 32nd year 11,530 trees, 71.2 per cent of the original number (16,200 plants); a moderate thinning took 53 per cent of these, leaving only 33.2 per cent of the original number, namely 5378. A neighboring plantation, spaced 3 feet, had after 33 years 89.5 per cent of the original number of 4,000; a moderate thinning removed 32 per cent, leaving 60.4 per cent or 2400; half the number of the former position.

A sowing of Spruce in alpine locality on a pasture had of the original quarter million or more plants 5768 trees left in the 41st year; thinnings occurred in the years 41, 46, 52, and 57, taking respectively 40, 28, 27, and 18 per cent of the trees found, leaving about 2000 or probably only .5 per cent of the original number.

A series of thinnings in a natural reproduction of Beech removed in the years 35, 40, 45, 50, and 56 respectively 76, 25, 18, 13, and 17 per cent of the trees found.

Regarding effects of the socalled "Borggreve selection thinning," which from the 50th to the 60th year removes always the stoutest trees so as to give a chance to the third and fourth classes to develop, the results of three experimental plats are reported, which, thinned in the C grade (severe), produced in the thinnings 350 to 770 cubic feet or $9.30 to $46.50; thinned by Borggreve method produced 1400 to 2480 cubic feet or $95.40 to $107.70 per acre, without any deterioration of soilconditions in the latter case.

Nevertheless the referee questions the propriety of this method, since the large trees which are removed had the better conditions of growth, while it is questionable whether the laggards which are favored will produce as much and as good material as those removed.

The speaker concludes that in the interest of increased timberwood production poor forms are to be removed early and continuously. To permit this to be done without neglecting the care of soil and shafts a moderate thinning should be practiced from the 40th to the 60th year (B grade of the Germans); later, in uniform stands of good shaft form, it is proper to increase to C grade; while in mixed stands and where special care for the soil is necessary the severer thinnings in the dominant (éclarcie par le haut) is indicated.

Regarding the latter method another speaker made the following statements, having practised the same for 20 years in mixed forest of Beech, Oak, and conifers. Thinning in the dominant begins only when the differentiation of the subdominant is completed; before that time faulty members, wolves, and bushy forms, have been removed in as much as they would not become subdominant or useful as soilcover. The thinning in the dominant at the age of 25 to 30 differs from the old method only in so far as the A grade or lightest thinning is applied to the lowest and middle story or tier, while from the upper story are removed all trees which are faulty and undesirable for final harvest yield. On good medium sites this thinning removes from 140 to 200 cubic feet per acre and is repeated every 5 to 7 yeas.

After the 50th year, the existence of the lower story as a soilcover being then fully assured through preceding operations in the dominant, the middle tier assumes the function of clearing the upper tier, which latter is, however, given opportunity to develop full crowns by the removal of side pressure. The thinning, therefore, removes the co-dominant of the upper tier and those of the second tier which narrow in the crowns of the dominant. At the same time in the subdominant the A grade continues to be applied. All trees fit for log timber are pruned at least of dead and dying branches.

About 560 to 700 cubic feet are removed and the operation is repeated when the dominant trees begin to be again narrowed in and the underwood in the lower tier begins to suffer.

The rotation being 100 years under a system of natural regeneration, from the 70th year the thinnings confine themselves to the A and B grades, the upper story is allowed to close up, and whatever is undesirable in the underwood is removed to prepare the stand for regeneration in the desired form.

Die Durchforstungen im Lichte der neuesten Forschungen in Die 46 Versammlung des Bad. Forstvereins, Allgemeine Forst- und Jagdzeitung, January, 1905, p. 28.

Thinning in Spruce

It has long been the accepted practice in Germany to plant Spruce as closely as conditions permitted, thus forcing the young stand into rapid height growth and furthering the early clearing of the boles. Repeated and extensive experiments with various degrees of thinning have indicated no direct or considerable response to the increase of light these thinnings afford, so that the aim has been more and more to produce the largest number of clear stems, diameter being admittedly secondary.

In a somewhat detailed paper Dr. Schwappach gives the results from certain forests in Austria where, demand arising for small material, the management was forced to draw this from very young stands some time before the age at which thinnings would have been made under normal conditions. The results of this forced thinning were so remarkable as to attract attention and cast doubt upon the accepted practice, and new plans where soon tested, based on the theory that thinnnigs should be heavy and frequent and begin early in the life of the stand — much earlier than was previously deemed best. Studies of analyses of the long, clear boles from the virgin forest confirmed this view, showing as they did that these trees grew in quite open stand during their youth and not at all in the dense thicket the forester bends all his efforts to attain.

The admission that diameter is of secondary importance is certainly a serious thing and should long ago have set practitioners thinking. Forstmeister Bohdannecky, who first remarked this response of the young stand to the effects of thinning, directly began comparative studies of results from trees on similar sites in his regulated forest and in the virgin woods. He soon found that "the well-developed tree of the wild woods furnishes two to three times the return in volume and three to four times their return in value derived from a stand from seed and thinned late and sparingly."

Figuring back from the diameter desired at eighty years, which was taken at somewhat less than that found in the virgin growth but still such as to give the assortment demanded by the trade Bohdannecky found that the annual ring must average three millimeters, not one as it did. After some study Bohdannecky and Schiffel came to the conclusion that it was highly desirable to have the clearing of the bole much more gradual than current practice permits, the crown being reduced to one-half the stem only when the height growth was at its maximum or even later, and this ratio shall then be maintained during the rest of the tree's development. Practically it is found on the best sites that by the time thinnings are begun the crown ratio has already fallen to one-third, but can be maintained at about this figure by continued severe thinnings. In poorer stands the crown ratio falls more slowly.

In the light of this new theory certain results already tabulated from experimental stands first reveal their true meaning. Up to a certain limit height and diameter are found to vary inversely as the density of the plantation and the following beautiful example is given of the effect of early thinning:

Stand.	*Age years*	*Number of trees*	*Mean height meters*	*Basal area sq. meters*	*Timberwood volume festmeters*
Padrojen . .	*28*	*3520*	*13.3*	*36.02*	*222.4*
Warnen . . .	*25*	*5336*	*9.9*	*29.88*	*116.9*
Padrojen . .	*41*	*1688*	*19.1*	*36.52*	*361.9*
Warnen . . .	*42*	*1584*	*20.0*	*35.03*	*356.4*

This is what happens in young stands. A decade later the height growth is less, the crown occupies less of the shaft proportionally if not actually, and the response to thinning is less because no new branches arise from that part of the shaft already cleared. This, the author thinks, accounts for the negative results obtained from various degrees of thinnings in middle-aged stands.

Considering all the factors which here we can barely indicate or suggest the author recommends the treatment of Spruce about as follows: Plant five feet apart each way or even up to but never more than six feet. Thin at short intervals after the fifteenth year, and at first necessarily rather schematically since there is no differentiation into crown classes so early. At 25 years there should be about 1000 trees per acre. After the 25th year thinnings should be made every five years of intensity "C," which is designed to break up all groups and to produce trees with rounded crowns developed toward all sides. This is for the better sites and is detailed only to give a general idea of the procedure. It is fit work for the forest experiment stations to determine the exact procedure under various conditions.

Finally comes the question as to the quality of the wood produced. Is it not coarser grained and knottier than the market will accept? Comparisons of stands thinned according to Bohdannecky with adjacent stands treated in the accepted fashion show that the branches are neither larger nor more abundant. And while it is true that very wide-ringed wood has been proven less desirable, this method contemplates an average width of only three millimeters instead of eight or ten as is not rare. Timber with very wide rings is now accepted in the market in large beams, so such objections as arise will be purely theoretical.

As a result of his studies Dr. Schwappach formulates the following theses:

"1. By growing Spruce in dense stands the crowns are stunted and their food elaboration impaired.

"2. The accepted method of growing Spruce in dense stands throughout youth and making heavy thinnings only from middle age on is not calculated to fully utilize the site and is considerably to the detriment of the owner.

"3. In the Spruce the stunted crown is able to regain its vigor only gradually and on poorer sites never. Consequently too tardy thinnings have no considerable influence on the accretion.

"Rational treatment of Spruce therefore necessitates:

"4. Plantations, if this method is used, are not to be too dense, but of say 4000 to 6000 plants per hectare.

"5. The number of trees is to be gradually reduced by frequent thinnings as soon as the branches begin to die off to a height of 12–15 feet.

"6. The criterion of the thinning is to be: Production of the greatest possible number of vigorous trees with healthy crowns roundly developed, and in the most even distribution over the ground, always having in mind the breaking up of groups of trees.

"7. The active crown shall never be reduced to less than one-third the entire height of the tree."

In this paper Dr. Schwappach has reopened a question long considered closed, one upon which there was probably more agreement than upon any other of such far-reaching importance, and even in the face of the clear-cut assertions and apparently faultless reasoning it will be strange if considerable discussion of the points involved will not be provoked among practitioners. We shall expect to find the best of these criticisms in the current literature of the near future.

Wie sind junge Fichtenbestände zu durchforsten. Allgemeine Forst- und Jagdzeitung, January, 1905, pp. 11–30.

Wagener Method of Thinning

One of the most noted and fertile practitioners of Germany, Gustav Wagener, lately deceased, (Oct., 1904) leaves a posthumous article on objects and interpretation of results of experiments in thinning. Wagener is the author of the proposition, (Der Waldbau, 1884), to free at the proper time the crowns of selected final harvest trees so that every 10 years complete crowncover is again re-established, when the thinning is to be repeated. In argument of his proposition he formulates the results of his experiments and observations in five conclusions.

1. The crowns of the intermediate and subordinate stand in the timber forest are to be considered not from the standpoint of value production, but only as far as they preserve soil fertility by means of a loose, mouldlike layer of litter.

This statement is physiologically based on Sachs' demonstration that light which has passed through one leaf has lost its power to produce starch in another leaf, and experientially based on the exhibit of the yield tables, which show that this portion of the stand produces after the 50th year rarely as much as 10 per cent of the total production in volume and of course still less in value.

2. In all reliable yieldtables for timberforest it appears that stands with complete crowncover begin very early, mostly from the polewood stage, to reduce their current accretion. That this is not due to age merely appears from the performance of standards in coppice of which the author, who was manager of such stands for many years, gives the following interesting record for the current accretion per average tree on sites as noted.

	Beech		*Spruce*	*Pine*	
Decade	*Very good*	*Medium*	*Medium*	*Medium*	*Poor*
	Current increment per tree Cubic feet				
4	2.86	1.27	4.98	6.42	3.07
5	6.39	3.36	5.30	10.31	3.88
6	9.28	5.19	6.71	12.82	4.77
7	11.09	5.38	8.97	13.38	5.53
8	11.09	6.96	11.24	13.83	8.12
9	11.3	8.05	11.28	10.85	7.70
10	13.	8.12	11.97	12.82	6.82
11	12.3	10.31	9.81		
12	11.8	11.16			

From this record it would be proper to infer that the early maximum of current accretion in close stands is due to narrow-ing in of crowns rather than to age. In a note Wimmenauer points out, that the predominant trees in the closed stand would show similar growth; and that the retrogression refers only to the entire stand per acre.

3. The relation between diameter growth and crown expansion has been only imperfectly or not at all investigated for different species and sites.

So far the author can state that for the unimpeded development of the above mentioned standards in coppice the growing space for Beech on medium sites is a square with a side 20 times, and for Spruce and Pine 16 to 18 times, as large as the diameter breast high. Hence assuming a diameter increase of 1¼ to 1½ inch per decade a very small opening up for space around the crowns from decade to decade would suffice. Yet it is questionable whether the light effect of such small space would be the most productive; this the author desires to have ascertained by experiment.

4. According to the above stated relation between diameter and growing space the author finds that in standards a closing of crowns occurs when the cross-section area of the trees is 85 to 115 square feet per acre for Beech; for Pine, 105 square feet; for Spruce, 130 square feet.

Data from yieldtables are adduced, showing that for Beech timber forest the maximum product is attained when the cross-section is between 105 and 115 square feet per acre on third and fourth sites. For Spruce the production begins to sink when the cross section area has attained 130 to 200 square feet, varying with the sites, and for Pine the decline is conditioned by a cross-section area of 80 to 150 square feet from the poorer to the better sites, or for medium sites of 92 square feet per acre. This area is attained in Pine during the 30th to 45th year on good sites, during the 25th to 40th on poorer sites; and in Spruce on poorer sites not before the 60th to 70th year.

5. According to latest developments of soil knowledge it appears probable that a loose, mouldlike soilcover is more effective on production than a deep, dense, raw humus which excludes air. The influence on soil conditions of the opening-up should be more closely studied.

In this connection the author cites the experience of v. Seebach, who under peculiar conditions had to open up a 70–90-year-old Beech forest to a cross-section area of 48 square feet with the consequence of producing a hard, bare soil. It took 30 years to re-establish close crowncover with a cross-section area of 100 square feet, when "the top-dry stands had grown into most vigorous condition, the average diameter having increased from 8.6 to 14.2 inches and a leaf litter had formed such as is rarely found in timber forest under most favorable conditions."

Die wichtigsten Aufgaben der Durchforstungsversuche. Allgemeine Forst- und Jagdzeitung, March, 1905, pp. 85–89.

Wind Mantle

Exposed wood lots of broadleaf trees need protection against the baring of the soil by the winds blowing off the soilcover of leaves, hardening and desiccating the soil. Usually the planting of Spruce and Fir has been recommended for that purpose, but these cannot permanently furnish the desired protection, for by the time that this protection is needed, namely from the polewood stage of the deciduous forest, the conifers begin to clean themselves of lower branches. Hence Frey proposes the substitution of shade enduring shrubs, such as *Sambucus*, *Cornus*, *Prunus spinosa*, *Crataegus*, which maintain themselves easily and permanently and bushy to the ground.

Anzucht von Waldmänteln. Allgemeine Forst- und Jagdzeitung, April, 1905, pp. 127–128

Effect of Annual Cuttings upon the Sprouting Vigor of Coppice

The influence of annual cuttings of coppice upon their sprouting vigor is discussed by E. Mer, who first mentions the facts obtained by some French forester and then describes his own investigations and experiments. Since the methods adopted by Mer for his investigations were very imperfect, it is not worth while to describe them in detail; it is sufficient to state that he entertains most strongly the view that continuous annual cutting of coppice lessens its sprouting capacity and finally leads to its complete destruction.

We must confess that there is nothing new in this view.

That the sprouting capacity of the stump decreases with each successive cutting is now an axiom at least two centuries old.

Influence de l'exploitation annuelle sur la production des rejets. Revue des Eaux et Forêts, July–Sept., 1904, pp. 385–392, 449–455, 515–525.

Forests of the Flathead Valley

As a basis for a knowledge of silvicultural requirements in the Flathead region, the report of an exceedingly detailed study of its forest ecology, by Harry N. Whitford, should prove very valuable—especially as the writer has based his article on work originally done as a Colaborator in the Bureau of Forestry, and has therefore included much material that is of particular interest to the forester. After giving a minute account of the physiography, geology, and climate of the valley "in relation to climatic formations," the author takes up the forest growth by ecological types or "formations," showing the causes of the association and distribution of the principal forest species. He finally states his conclusions as to the silvical characteristics of the local trees, and the effect upon them of fire.

The Forests of the Flathead Valley, Montana. Botanical Gazette, February, March, and April, 1905, pp. 99, 194, 276. (With map and 23 figs.)

Silvicultural Questions

In the sessions of the Saxon Forestry Association, the question "which subjects discussed in the latest literature on forest producation are of importance to the practitioner?" was answered by Prof. Beck-Tharand:

1. The condensation of nitrogen by microorganisms and based on it green manuring applicable in forest management;

2. The mycorhiza and the results of observations on this symbiosis;

3. The question of the locality from which seed is secured and selection of stock in practical application;

4. The results of trials with exotics;

5. The root growth of species and its influence on the time of planting;

6. The modern principle of thinning in the dominant and its influence on quantity and quality production;

7. The call to return to nature's forest (mixed and natural regeneration).

In the discussion on the question of *Manuring* in the forest, we are mainly interested in the fact that the question can be at all discussed practically except as to application in nurseries. The referee recognizes that only where special reasons exist for accelerating development of young plantations, may artificial manuring be applied. Lime and Kainit seem in such cases useful.

Bericht über die 48 Versammlung Des Sächsischen Forstvereins. Allgemeine Forst- und Jagdzeitung, February, 1905, pp. 64–67.

Forest Planting in California

A comprehensive and practical article upon this subject, based on a study of fire protection and forest planting in California, has been written by E. A. Sterling.

Public forestry interest in California is quite largely centered in planting operations, probably because the more intricate processes whereby forests are utilized and perpetuated without recourse to planting are not well understood. While forest regeneration by natural methods is preferable because more economical, artificial reforestation must eventually be resorted to in many places, and the public interest in this phase of the subject is very helpful.

The people of California are particularly interested in forest planting because of the vast areas of non-forested land worthless for agricultural purposes, the great need for irrigating water, and the recognized value of a water-conserving forest cover on the mountains.

Considered from the economic standpoint there are two distinct reasons why extensive reforestation should be undertaken in California. The first is that the irrigation interests demand it. The amount of irrigable land in California is largely in excess of the water available to irriagte it, hence every acre of barren mountain land reforested and made productive of water will extend just so much the development under irrigation of the valley land suitable for agriculture. The second reason for reforesting unproductive areas is the production of a future timber supply. The lumber business now ranks third among the industries of the State, but at the present rate of consumption it must soon decline into a minor industry.

Broadly defined, there are two classes of land in California upon which forest planting may be advisable. The first is the barren or brush-covered areas which have never supported a forest growth. The second is land which was originally forest-covered but through logging or fire — in most cases both — is denuded beyond all hope of natural regeneration. The time has not yet arrived when forest planting can be profitably resorted to in order to change the composition of the present forest cover.

The barren or brush-covered areas in California which would support a forest growth are enormous, covering the greater part of the mountainous semi-arid belt from the Mexican border northward, including a large portion of the Sierra Madres and a belt along the foothills of the Sierra. This vast area is worthless for agriculture and of limited value for grazing, hence its chief value lies in its timber-producing powers.

The whole problem of the redemption of the waste lands in California by forest planting is based upon adequate fire protection. Until this can be assured there can be absolutely no prospect of success.

The tendency of California forests to reproduce themselves is remarkable, and if protection from fire can be given, young forest growth instead of worthless brush is practically certain on land recently logged.

The present problems must be worked out largely by experimental means. These experiments should be conducted by the State and Federal governments. Nurseries should be established and experimental plantations made in representative regions needing reforestation. Private interests may be of material assistance through their moral and financial support. The supplying of seeds, plants, and instruction to those who will contribute individual effort will do much toward awakening the interest of the people in this subject.

Practicability of Forest Planting in California. Water and Forest, April, 1905, pp. 1-3.

MENSURATION, FINANCE AND MANAGEMENT

A Simple Hypsometer

The simplest hypsometer, based upon a different principle from most, if not all, others, is described by Vorkampff-Laue. It consists of three points which may be noted on a walking cane by means of brass nails, or on a lath, or in any other way, the one point being fixed at one-tenth the distance between the other two points (on a lath noted advantangeously by a kerb). In using the instrument, it is held vertically, so that the upper and lower points are ranged in the line of vision to top and base of tree, when, by sighting through the third point, a point on the tree is located which denotes one-tenth of its height. This can be measured and the total height computed.

Baumhöhenmesser. Allgemeine Forst und Jagdzeitung, January, 1905, p. 36.

White Pine Profitable

Two small stands of Norway Spruce and White Pine in the same locality in Switzerland compared as follows when 42 years old:

	White Pine	*Spruce*
Yield per acre	*9950 cubic feet*	*7990 cubic feet*
Average increment	*238 " "*	*141 " "*
Value per acre, if cut	*$930*	*$445*
Interest rate on wood capital	*5¾ per cent*	*3¾ per cent*

The White Pine stand was thinned four years ago, and now the following conditions exist, at 48 years of age: Average height, 90 feet; diameters vary from 7 to 23 inches; yield (over 3-inch), 11,350 cubic feet; average increment, 235 cubic feet; value, $1,620; soil value, $65; annual charge for taxes and guard, 80 cents, capitalized at 4 per cent., equals $97; cost of planting, $24. Hence, a forest capital of $186 having netted 4¾ per cent. compound interest. The stumpage price paid for such wood down to 4-inch is, in Switzerland, where it is rare, nearly 16 cents per cubic foot, or about $8.50 per 1,000 board feet.

Does planting of White Pine pay?

Etwas von der Weymouthskiefer. Schweizerische Zeitschrift für Forstwesen, January, 1905, pp. 12-14.

Diameter and Price of Oak in France

The sale of fellings from about 25,000 acres in the same department (Mans) produced in one market 10.3 cents per cubic foot, in another 16.7 cents, the higher price here being due to the stout dimensions of the oak logs. The price per centimeter on the diameter at breast high was found to be 1 franc, on the diameter at middle 1.19 franc (7.6 and 9 cents per inch respectively). A comparison of the price for stout logs, 20-inch average, which brought 27 cents per cubic foot, and for small logs, 13-inch average, which brought only 18 cents per cubic foot, reveals, nevertheless, a uniform increase in price of 7.6 cents per inch of diameter: from 10-inch to 26-inch diameter breast-high exact proportionality of price per inch prevails. This experience is used as an argument to persuade private owners to lengthen rotations.

Prix des bois dans le Maine en 1904. Revue des Eaux et Forêts, January, 1905, pp. 21-27.

Value Accretion

In a contribution continued through several issues under the title, "German Pictures of Travel," which would be of interest to any American students who propose to travel through the forests of Germany, Dr. Heck gives the following interesting data, dividing into assortments and values three ancient trees each of Beech and Fir. The trees, chosen at random and averaged (from Eisenstein in Würtemberg), date back to the Thirty Years' War or longer.

Three Firs, showing 338 to 405, average 384 rings on stumps 28 inches high, with diameters of 54 inches on the average, furnished the following material:

50.5	*cubic feet woodwork, cl. I, @ 16c =*	*$ 8.08*	*Average*
763.8	*" " logs, cl. I...... @ 13c =*	*99.94*	
819.3	*cubic feet timberwood, total.........*	*$108.02*	*13.1c*
908	*" " cordwood, various qualities,*	*32.88*	*3.6c*
1727.3	*cubic feet total wood..............*	*$140.90*	*7.9c*
49	*" " brush....................*	*77*	
1776.3	*cubic feet total for tree............*	*$141.67*	
		$ 47.22 per tree	

Three Beech trees, showing 219 to 286, average 256, rings on stumps 20 inches high, with average diameters of 33 inches, furnished:

90.4 cubic feet logs, cl. I, @ 13c	=	*$11.75*	*Average*
225.9 " " logs, cl. II, @ 10.7c	=	*24.17*	
416.3 cubic feet timberwood total	. . .	*$35.92*	*8.6c*
494.2 " " cordwood	. . .	*20.16*	*4. c*
910.5 cubic feet total wood	. . .	*$56.08*	*6.2c*
brushwood	. . .	*92*	
		$57.00	
		$19.00 per tree	

The financial loss in allowing these trees to stand so long is apparent.

Deutsche Reisebilder Neue Folge. Allgemeine Forst und Jagdzeitung, March and April, 1905, pp. 73-85 and 113-120.

Evaluation of Damage

The question of determining more precisely damages to forest growth for purposes of recovery will become more and more important as the value of forest properties in the young stage of development grows. An article on the evaluation of damage by game by Oberforstmeister Pilz has interest for us mainly by exhibiting principles and methods involved in any calculation of damages, and substitution of "cattle" for "game" may give even direct practical value to the discussion.

The first difficulty is to find the data for calculations, especially where no systematic forest management and experiences from it exist. Prices, yield, and interest rate are the three factors of the calculation. Average prices for not less than 10 years, excluding extraordinary years, are to be used. For determinations of yield, if actual felling results are not obtainable, yield tables approximating the conditions under discussion may be used; they should be divided into size classes and assortments. For the interest rates, which are by necessity the most uncertain factor, being to an extent a matter of personal choice and judgment, and varying with conditions represented in and surrounding the property, the author proposes the following classification, keeping in mind the expected price improvement:

1.	*State forest: Deciduous Timber forest, over 100-year rotation.*	*1.5 per cent*
	State forest: Deciduous Timber forest, up to 100-year rotation.	*2 per cent*
	State forest: Conifer forest, up to 120-year rotation.........	*2 per cent*
	State forest: Coppice, pulpwood rotation, etc...............	*2.5 per cent*
2.	*Large private property, add 25 per cent to above positions.*	
3.	*Small private and communal property:*	
	Deciduous Timber forest...........	*2.5 per cent*
	Conifer Timber and Coppice........	*3 per cent*

[In the United States the fire danger will have to be taken care of by increase of interest rates, varying from .5 to 1.5 per cent. according to circumstances.]

Regarding damage by game the author points out that much of it is outgrown by the plant and does not need to be considered, this depending, of course, upon species and character of damage.

The method of calculating the author bases upon the well known soil rent formula; namely,

$$x = [(S + A) (1.op^{n} - 1) + c\ 1.op^{n}] \times \text{area.}$$

in which S is the soil expectancy value, A the administration capital, c the original cost of starting the crop, p the interest rate, and n the number of years for which the items have been employed.

Of interest are the special considerations which enter into specific cases.

1. In case parts of a young growth are destroyed the question arises whether these holes can be repaired or not. In the latter case it must be kept in mind that small openings become smaller or vanish as the stand grows up, and may be only a temporary damage. If the damage can be repaired, then not only the cost

of it but the disadvantage of having to choose a different species, of the poorer development of the later planting, of the diminution in trimmings if these could be sold, and of the deterioration of the soil and of the outside trees adjoining the openings must be evaluated.

2. In case of loss of single trees the prices charged by reputable nurseries for replacing them should be the lowest limit. It would be tenable to use a soil expectancy calculation for the growing space occupied by the tree.

3. In case an entire stand is damaged, the damage may be based either upon a soil expectancy calculation or upon increment determinations. The loss of increment due to the damage postpones the proper felling age for a number of years, the difference between the soil expectancy values figured with the normal rotation and with this delayed period is the damage, unless a quality loss is also demonstrable.

The question as to whether the stand must for the sake of a proper felling series be cut when planned or can be left until the yield has grown to normal also enters into consideration.

The difficulty of ascertaining current accretion in young growths except by assuming it equal to the average accretion, which may be deduced from yield tables, makes this method very incorrect, because the assumption is true only at a period when stands are past the damage of cattle or game. Moreover, the value of the accretion cannot be taken as that of mature wood: it has only prospective value which must be discounted; and other complications make this method less practical than it appears at first, and the results are usually too high.

4. In case only a part of a stand is damaged, the difference between the expectancy values of the normally developed and of the injured part denotes the damage, or in plantations the number of trees damaged can be used as basis.

5. The case of damage to a single tree may be best exemplified by a definite instance: A 20-year-old Ash was for 15 years gnawed to such an extent as to prevent not only increment, but damaging the tree so that it could become only cordwood. The normal tree would have been worth in the 120th year $20, the

damaged tree would have in cordwood produced only \$7.50, hence damage, when 2 per cent. is demanded,

$$\frac{20 - 7.50}{1.02^{100}} = \$1.75$$

Of other cases mentioned we may cite only the destruction of a young oak plantation, which had been made by sowing in the spring, and to the extent of 50 per cent. had been destroyed by hogs. Repair could be made in the fall of the same year, but acorns were twice as high in price.

If $S + A = \$100$, $c = \$10$; excess cost of seed $= \$5.00$, $p = 2$ per cent, then $x = \frac{1}{2} [\, 100 \,(\, 1.02 - 1\,) + 10 \times 1.02\,] + 5 = \$615$.

If the repair cannot be accomplished in the same year, then one year's loss of the expectancy value of the plantation must be added.

Aus der Praxis der Waldwertberechnung. Bewertung des Wildschadens. Allgemeine Forst und Jagdzeitung, Jan,-Feb., 1905, pp. 1-10 and 37-41.

Forest Finance

The aftermath of an article by Schiffel, questioning the applicability of soil rent calculations, which was briefed in Vol. II., p. 186, of the QUARTERLY, continues in the effusion of objectors. Mr. Vogel considers the practicability of such calculations established by the fact that the Saxon Forest Administration has (as asserted) carried on a strict forest finance management for 40 years on its large property (415,000 acres), and the writer himself claims to have done so on 25,000 acres for the same length of time.

He then inveighs against the formulæ and books which discuss these questions theoretically, and substitutes a series of simple (rather cumbersome?) calculations, from which those incapable of using the simple soil rent formulæ can secure a "clear insight" into finance calculations.

In these calculations he determines upon the basis of a yield table the wood value of each age class, sums up and adds the soil value, which gives the forest capital, then determines the value of the annual budget and finds what interest rate (simple) this represents as related to the forest capital; expenditures may be directly deducted from the budget.

After having pointed out the impropriety of the higher rotations, and having scored some of the State administrations for lack of finance calculation, he admits that there is a different aspect to the question according to whether the management can or cannot be intensive under existing market conditions. Where, for instance, wood of all descriptions and age is immediately saleable, the wood value is properly taken as the basis of the wood capital, while in undeveloped countries the aim for highest forest rent or highest average volume and value production is alone admissible. "The foresters of to-day still think and calculate too much with wood, too little with money; the best working plans determine the budget by wood volumes instead of values, etc."

[The difficulty lies in the fact that wood values are continuously shifting and are especially now bound to increase at an unknown accelerated ratio, which renders all financial calculation more or less futile.—Ed.]

Waldrente und Bodenrente. Allgemeine Forst und Jagdzeitung, April, 1905, pp. 121-127.

Intensive Management and Prices

With prices for oak logs at present prevailing in Hesse, an intensive management for stout clear timber by timely selection of the main harvest trees and by pruning them is indicated by Hillerich. The prices obtained at an auction in 1904 for logs cut, in the woods, ranged from 35 to 82 cents per cubic foot according to size and quality (the last figure may be translated into $48 per 1,000 board feet). The difference of prices for first (A) and second (B) knotty, crooked, and damaged grades furnishes argument for careful treatment. Average prices per cubic foot were as follows:

Middle Diameter.	*A.*	*B.*
Over 24 inch	$ 0.65	$0.45
20 to 24 inch	.57	.43
16 to 20 inch	.45	.42
10 to 16 inch	.42	.35

Oak tie timber 10 to 16 inches in diameter, tops, etc., brought 18 cents, and mine props 15 cents per cubic foot.

The best, straight and sound, most promising trees are selected, marked with red color and freed from interference in their crowns, leaving all sub-dominant growth which does not interfere for soil cover and to prevent watersprouts. The removal of interference must be cautious and gradual by two or more rapidly succeeding cuttings, as a sudden opening is apt to sicken or kill the trees.

After the thinning a second inspection is made to make sure of the proper selection of final harvest stems. These are then pruned after other logging operations are over (April to August.) If left to nature breakage and rot or knotty timber is the result. The pruning is best done with ladder and saw, two men working together, taking all dry branches and green ones down to 3 inches in diameter, as far as accessible, up to the base of the crown, tarring the wounds on descending. Large wounds must be tarred again after 3 to 4 years.

In 50-70-year-old stands one man prunes 16 Oaks, on the average, and twice the number of Pines or other conifers. With a daily wage of \$1, 28,368 trees on 1,400 acres were pruned at a cost of \$1,580, a little over 6 cents per tree, or less than \$1.25 per acre, which with us would in most places have to be increased, but hardly by 50 per cent., the difference in wages, since our labor is usually more efficient.

Nutzholzzucht, Baumwahl und Baumpflege. Allgemeine Forst und Jagdzeitung, February, 1905, pp. 45-47.

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UTILIZATION, MARKET, AND TECHNOLOGY

Swiss Stumpage Prices

For Switzerland prices for stumpage are in many places reported from 10 to 20 per cent. higher than in the previous year, the sales varying mostly between 12 and 15 cents, but sometimes for heavy timber going as high as 20 cents per cubic foot, or \$6 to \$12 per 1,000 board feet. In some of the communal forests it is customary to sell the stumpage of the annual felling areas at auction, while in others the cut wood is sold. The results are published from month to month in the Schweizerische Zeitschrift für Forstwesen.

English Wood Trade

A note on the English wood trade states that England produced about 50,000 tons of mine timber and some excellent oak timber for wagon work. Besides, it exports oak ties, which after being imported, are impregnated in England with creosote. All parts of the world contribute to the wood supply, the trade being surrounded with many variable conditions. The woods from the Baltic countries are sold by the St. Petersburg standard of 165 cubic feet, but other standards also prevail.

Ueber das Englische Holzgeschäft. Allgemeine Forst- und Jagdzeitung, March, 1905, p. 111.

Duration of Telegraph Poles

The relative duration of telegraph poles depends on the soil and climate where used, on previous treatment, and, according to Mayr and Cieslar, on the conditions under which they have grown, the durable ones with light colored bark coming from open position in greater enjoyment of light, which produces more liguin.

According to Havelik it is possible to judge the relative durability of impregnated poles (spruce?) as far as it depends on individual characteristics, by their color. The durable ones have an intensive, yellowish to brown, coloration throughout, while those with an ash-gray sapwood and colorless heartwood will prove less durable.

Ueber die Bestimmbarkeit der Dauer der Telegraphen-Stangen. Allgemeine Forst- und Jagdzeitung, February, 1905, pp. 67, 68.

STATISTICS AND HISTORY

Prussia

The budget of the Prussian Forest Department for 1904-05 shows an increase of $400,000 in expenditures, while the income is figured with only $90,000 increase over the previous year, still leaving a net result of 12.9 million dollars from the 6.3 million acres of State forest.

Over 1.3 million dollars in the expenditures figure for the purchase of forest soil and the building of forest roads, etc., \$36,000 for telephones, \$24,000 for tramroads, \$45,000 for the installation of three new schools for underforesters, besides the \$70,000 for the other schools and experiment stations.

In addition to the appropriations for the forest service, the budget for the Department of Agriculture, Domains and Forests, under which the forest service is placed, contains about \$450,000 for the advancement of agriculture and forestry, and \$60,000 "for the execution of the law regarding protection of forests, forest associations, and for furthering in general the culture of meadows and forests," and to assist in reforestation of private properties.

The Prussian government, then, spends, outside the forest administration and outside of purchase and reforestation of forest soil, nearly half a million dollars for the advancement of forestry generally.

Der Etat der Domänen, Forst und Landwirtschaftlichen Verwaltung für das Etatsjahr, 1905. Allgemeine Forst und Jagdzeitung, April, 1905, pp. 135-140.

Bavaria

According to an official publication of the Bavarian Forest Administration, referring to conditions in 1902, the total forest area of Bavaria is 6,450,000 acres, of which a little less than one-third, 2,315,000 acres, are State forest, 13,000 royal forests, 970,000 acres corpo ration and institute forest, the private forest property being 3,150,000, or nearly 50 per cent. of the whole forest area.

Of the total cut on the timber forest area of the State, 123.5 million cubic feet, a little over 50 per cent. was cordwood and nearly 12 per cent. came from thinnings; from coppice and standard coppice 2,300,000 cubic feet are added. The average per acre of timberwood (over 3 inches) was 60.8 feet. With a price per cubic foot of 10.2 cents for workwood and 4.3 cents for fuelwood, or a little less than 7 cents for all, the net receipts for wood per acre were a little over 25 cents. The total net income was somewhat over 5¼ million dollars, or $2.28 per acre, expenditures requiring about 33 per cent. of the gross income. Only 19 cents per acre was spent on planting, and 18 cents for roads. Sixty-three forest fires are recorded, but their extent is not given.

Mitteilungen aus der Staatsforstverwaltung Bayerns. Centralblatt für das gesammte Forstwesen, February, 1905, pp. 75, 76.

Switzerland. New regulations regarding the examinations of candidates for the higher forest service in Switzerland were enacted in July, 1904, for the scientific, in February, 1905, for the practical part of the examination.

In the conditions for admission of examination it is of interest that not only students of the Swiss forest school, but of other forest schools of equal standing are admitted and that exemptions are permitted in whole or in part, if the candidate has shown his ability in any of the branches by actual scientific work in them, or has served in a position which had required all conditions of the examination or has passed satisfactorily examinations of the same kind elsewhere; for foreigners this exemption exists only in case a similar right is granted by the country of their nativity. The broad democracy of Switzerland, admitting foreigners at all, is noteworthy. An admission fee of $10 is charged.

The scientific examination takes place before a commission composed of the professors of the forest school, in two parts, an oral one in April, which embraces only general educational subjects, and a professional examination in July for those who had passed or been exempted from the former.

This latter is both oral and written; the written examination consisting in the formulation of a working plan and an essay on a theme given by the faculty of the forest school. The written examination has double the weight of the oral.

In rating any dissension of members of the examining board must be noted, and the result is reported to the president of the school council, who determines the eligibility, as far as scientific fitness for the service is concerned, upon the basis of a rather high mark.

Only those who have passed the scientific examination are admitted to the practical test, and a further fee of $5.00 is exacted from the candidates, who must also bring a certificate of sufficient practical knowledge in surveying and road-building. This examination is preceded by a year's practical work and keeping a daily journal at one of the forest districts, at the end of which a working plan for 200 acres must be made in all details, to be finished within two months. During the first two months of this practicum a member of the commission must inspect and direct the candidate and at the end of the period examine and pass on the working plan. Finally an examination, both in the house and in the forest before the full commission, decides the availability of the candidate, and upon the basis of this double test the Department of the Interior decides upon the eligibility of the candidates, whose names are published. It is from their number that the cantons and corporations may elect their forest managers, the election being mostly for three years, with assurance of re-election if there are no objections noted.

Schweizerische Zeitschrift für Forstwesen, March and April, 1905, pp. 77-80 and 104-107, contains full text of the regulations.

Importance of Cooperage

It is estimated that the number of tight and slack barrels manufactured in the United States during 1904 reached 300,000,000. Their use was divided as follows: For the shipping of cement, 35,000,000 barrels; of flour, 72,500,000; of hardware, 18,000,000; of sugar, 15,000,000; of fruit, vegetables, etc., 5,000,000. The remaining 209,500,000 were tight barrels for the storage and shipment of whiskey, wines, oils and other liquids.

The use of the barrel is rapidly spreading, and in view of convenience of handling and comparative cheapness due to labor-saving machinery, the manufacture of barrels will steadily increase.

Our Annual Output of Barrels. Barrel and Box, March, 1905, p. 50.

Puget Sound Exports

Puget Sound District are interesting and in-
Statistics of the exports of timber from the
structive. The exports for February, 1905, were the largest ever sent out in a single month, reaching a total of 37,750,000 feet, valued at $420,850. The largest monthly exports previously reached were for June, 1904, when 28,486,000 feet, valued at $337,886, were shipped.

During February Australasia imported over 12,000,000 feet from this region, while the Chinese Empire, not represented at all one year previously, imported over 7,000,000 feet, being second in the list. The rapid extension of the market is plainly shown.

The average price per 1,000 board feet, however, dropped from $13, in February, 1904, to $11, in 1905.

Puget Sound Exports. Pacific Coast Wood and Iron, April, 1905, p. 10.

Oregon

Those of us not fortunate enough to get to the Lewis and Clark Exposition can gain some idea of the great lumber industry and resources of Oregon from the following figures for 1904: 480 mills, produced 1,405,-000,000 board feet, worth $12,650,000, by means of 5,735 employees, paid $2,627,500. In logging camps 6,000 employees received $2,612,500, while the whole lumber industry employed 14,-229 persons, at a total wage of $6,450,006.

The port of Portland shipped lumber aggregating 132,000,000 board feet during 1904. Shipments amounting to 87,000,000 feet were made to ports on the Pacific coast and the Hawaiian Islands, while the remainder, valued at $148,486, went to off-shore ports.

The amount of timber available in the entire State is estimated at 213,000,000 feet, of which 80 per cent. is in the western part. The predominating species is Red Fir, comprising 79 per cent. of the stand in Western Oregon, while east of the Cascades 80 per cent. of the timber is Western Yellow Pine. The yield per acre is said to average 17,700 board feet in Western and 41,700 in Eastern Oregon, and 12,200 for the whole State. The Red Fir over the State will average 36 inches in diameter and go 50 trees to 100,000 board feet.

The State is favored by the presence of many industries in which lumber is largely used and already Oregon manufacturers are becoming large exporters. The producers of the raw material thus have an abundant market for their product at home, and the possibilities of this market are unlimited.

Forest Products of Oregon. Pacific Coast Wood and Iron, February, 1905, pp. 9, 10.

California

The total shipments of lumber from the Bay of San Francisco to foreign points during 1904 amounted to 29,820,000 board feet, valued at $782,657. Of this amount 14,440,000 feet, valued at $478,930, and approximating 50 per cent. of the total, were consigned to Australia, while the remainder reached almost every timber importing country in the world.

The total Redwood shipments, domestic and foreign, for the entire State of California during 1904 show a heavy increase over those of 1903, aggregating 324,000,000 feet during the former as against 301,000,000 for the latter year. Over two-thirds of this entire shipment, or 221,000,000 feet, reached the Bay of San Francisco, while Southern California received 79,000,000 and Australia and Oriental ports claimed 14,000,000.

From these figures the enormous home consumption of the Redwood is evident, over 92 per cent. of the entire product being used within the limits of California.

Domestic and Foreign Redwood Shipments for Six Years. Pacific Coast Wood and Iron, February, 1905, p. 13.

White Pine in Lake States

The present amount of standing White Pine in Wisconsin is estimated at but 2,350,609,000 board feet. This figure is based upon the investigations of the Division of Forestry in 1897 and the amount of White Pine exploited since that time. The most accurate figures available place the stand of White Pine in Minnesota at 16,904,639,000 feet. The approximate accuracy of these figures is unquestioned, as they are based on the latest reports of the cruisers, by which the stumpage is bought and sold.

These statistics are interesting, in that they presage the speedy end of the White Pine industry in these two States. If the present rate of cutting is continued Wisconsin will cease to be a White Pine producer within three years, while the Minnesota output will be but a small item in the lumber market in seven years, even though the mills have adopted a policy of curtailment in their output.

Standing White Pine. St. Louis Lumberman, March 15, 1905, p. 75.

Canada's Lumber Export Notable features of 1904 Canadian Lumber statistics are the decrease in the Georgian Bay lumber production, and the falling off of the trans-Atlantic export of lumber all along the line. In the Georgian Bay district the decrease of 1904 from the production of 1903 was 5,000,000 board feet. The cut of the Ottawa Valley, however, showed a slight increase of 9,000,000 feet. The decrease in trans-Atlantic exports from the province of Quebec in 1904 was 77,000,000 feet in the shipments from the port of Montreal, while from the ports east of Montreal the decrease was even more marked, totaling 142,689,000 feet. European shipments from Halifax, N. S., show a decrease of 14,000,000 feet. The total export trade of British Columbia was 8,000,000 feet below that of 1903.

Annual Lumber Trade Review. Canada Lumberman, February, 1905, pp. 15, 16.

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POLITICS AND LEGISLATION

Principles of Taxation A discussion on principles of taxation distinguishes between three classes of taxes, namely, soil tax (Grundsteuer), income tax and property tax (Vermögenssteuer). Soil tax is to be based for forests managed under sustained yield methods on the forest rent yield; in forests which can be managed in only intermittent methods, on the soil rent yield.

In determining an income tax, incomes from extraordinary forest income, occasioned by natural forces (winds, insect) are to remain untaxed; the cost of planting of new ground formerly unforested should be deducted from the taxable value; the tax should be collected only on actually realized incomes.

Property tax, in case of forests that can be managed only intermittently should consider only soil values; but when applied to sustained yield management the capital represented in the growing stock is taxable.

The last kind of taxation is believed by the two referees as the most justifiable, the soil tax being considered antiquated.

Die siebente Tagung des deutschen Forstwirtschaftsrats. Allgemeine Forst- und Jagdzeitung, March, 1905, pp. 102-107.

New Franco-German Tariff

New tariff regulations and treaties will presently take effect in Germany, which reduces considerably the important duty on soft woods (conifers), France enjoying the "most favored nation" rates. The established weights per cubic foot are 37 pounds for conifers, logs and lumber, 50 pounds for hardwood lumber, 56 pounds for hardwood logs. Logs pay 1.2 cents squares and railroad ties 2.4 cents; lumber, 3.6 cents per 100 pounds.

Tarifs douaniers de l'Empire Allemand. Revue des Eaux et Forêts 1905, pp. 241, 242.

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MISCELLANEOUS

Superior to Red Fir

The English engineers in charge of the extensive building operations at Dover, England, have abandoned the use of Red Fir for piling. The species of eucalyptus commonly known as Blue Gum has been substituted, being imported from Tasmania, at a cost considerably in excess of that of the Red Fir. About 15,000,000 feet of timber will be used, largely in the form of immense piles, 20 inches square and 100 feet long. These large sizes are readily supplied by the American timber, but it is claimed that Blue Gum possesses marked advantages for this particular purpose. It is much heavier and sinks readily, whereas in driving a Red Fir pile in deep water the lower end must be weighted; it is immune from the attacks of the "teredo navalis" and other destructive sea animals and it is little injured in being driven.

The great strength and durability of Blue Gum has increased its popularity in great Britain and large amounts are being imported into South Africa also. It appears that this timber is to become a strong competitor of the large export timber of the United States, and bids fair to largely displace it in the regions named.

Australian Blue Gum for Harbor Piles. Southern Lumberman, April 10, 1905, p. 18.

Forest, Fish and Game Preservation

The relation of forest protection to the preservation of fish and game was discussed at some length before the North American Fish and Game Protective Association, which was addresesd on this subject by J. T. Finnie at its last annual meeting in Montreal, Canada. The real danger to fish and game lies not so much in the way in which sportsmen and hunters are destroying them as in the destruction by fire of the protecting forests. That immense areas in the wilder portions of this country are burned over every season is well known. If our forests are left without adequate protection game will rapidly disappear, as will the fish from the inland waters. Nature has been most lavish in her gifts of forest and stream, lakes and rivers, and unless these can be protected from the careless hunter, the fire fiend, and the reckless settler, there is little doubt but that the remaining game will be destroyed as were the buffalo and antelope upon the western plains.

In some of the provinces of Canada the direct loss as a result of fire well illustrates the extent to which not only timber of great value is being destroyed, but also the rapidity with which the game-protecting forests are becoming things of the past. The following figures show what the loss was in various provinces of Canada in 1903: Nova Scotia had 300,000 acres burned over, resulting in a direct loss estimated at $2,000,000; New Brunswick's loss was 180,000,000 board feet of timber, and one village was destroyed; Ontario had over 100 fires, and paid

$31,000 for fire protection; Quebec was burned over to the extent of 200 square miles, and expended $17,000 for forest protection. In the western provinces an enormous area has been destroyed, but exact data is not obtainable.

Forest Protection and Its Bearings upon Fish and Game Preservation. Rod and Gun in Canada, March, 1905, pp. 539–543

NEWS AND NOTES

E. A. STERLING, *in Charge.*

A native wood, known as bulacbacan, is gradually supplanting Red Fir for building purposes in the Philippine Islands, according to *Pacific Coast Wood and Iron* for April, 1905, p. 18. The wood is not too hard nor too soft and grows in great abundance in the southern islands. Several large steamers are used in taking the timber from Sagay (Negros) to Manila. These vessels have a capacity of 300,000 feet each, and are operated by the Philippine Transportation and Construction Company.

When one bears in mind that only a few years ago Williamsport, Pa., was one of the great lumber-producing towns in the United States, it is of special interest to read on page 17, of *Pacific Coast Wood and Iron* for April, 1905, that a train of 25 cars, each containing 20,000 feet of dressed curly and straight-grained Redwood, designed for interior finishings, had left San Francisco, Cal., for the former outlet of the extensive White Pine and Hemlock forests of the Keystone State.

The pecuniary advantage of an accurate knowledge of the amount and disposition of the timber on a forest property is well illustrated by a news item on page 11 of the *New York Lumber Trade Journal* for February 15, 1905. It seems that about a year and a half ago a 5,000-acre tract of Adirondack land was considered worth $25,000. Eight months ago it was sold for $50,000 to some Franklin County men. Two months later an examination of the tract led to its sale to a syndicate for $100,000. A month later, before the syndicate had paid their purchase price, a lumber company offered them $142,000 for the forest lands and the offer was accepted. Such losses as were sustained by the original owners, and even the second seller, would have been obviated by a survey, costing but a few hundred dollars.

Willis M. Slossen, of Nordhoff, Cal., has been appointed Forest Supervisor of the entire Santa Barbara Forest Reserve, which comprises about 1,900,000 acres. Mr. Slossen was formerly in charge of the Eastern Division only. The Western Division was formerly looked after by Col. B. F. Cawshaw, who is now engaged in examining lands in Southern California for new reserves.

Forest Inspector R. H. Charlton, is now temporarily in charge of the San Gabriel and San Bernardino reserves.

This season's planting operations on the Dismal River Forest Reserve, in Nebraska, have been finished. About 450,000 trees, mostly Jack Pine and Western Yellow Pine, have been set in the sandhills and the planting of the seedbeds in the nursery is now under way. One hundred thousand of the Jack Pine used were wild stock, collected near Brainerd, Minn. The Jack Pine seems best adapted for sandhill planting in Nebraska, but there has been a high percentage of loss in the nursery beds due to the ravage of the Red Fir blight.

Fifty thousand Western Yellow Pine seedlings from the Dismal River reserve nursery have been shipped to the Black Hills Forest Reserve for planting on burned areas in the vicinity of Custer Peak. About 100,000 pounds of Western Yellow Pine seeds will also be used in this region in an attempt to secure satisfactory restocking of denuded areas by artificial seeding. An equal number of plants was sent to the Pikes Peak reserve and planted on denuded slopes.

T. H. Sherrard, in charge of Forest Management, in the Forest Service, is in the West on a general inspection of cuttings and working plans for the forest reserves.

Geo. B. Sudworth, who has charge of the Forest Service exhibit at the Lewis and Clark Exposition, made a trip to Portland to install the models, charts, transparencies, bromides, timber-testing machines, etc., which comprise the exhibit, and represented the Service at the opening exercises.

The co-operative forest investigations between the State of New Hampshire and the Forest Service are being continued this year. C. A. Lyford is at present in New Hampshire making a forest map of the southern part of the State. During the season special attention will also be given to the condition of woodlots and second-growth.

Forest Management work in the Forest Service recently completed or now being carried in the field are: A study of woodlots in New York State by J. G. Peters and F. L. Pray; a mill study of Appalachian hardwoods by L. Margolin and H. D. Everett; commercial tree studies of Lodgepole Pine in Wyoming by P. G. Redington and of Scrub Pine in Maryland by W. D. Sterrett; and the preparation of a working plan for F. Newhall & Son, North Manitou Island, Mich., by S. J. Record.

Future cross-tie production is being studied by the Northern Pacific Railroad, in co-operation with the Forest Service. H. H. Chapman is at present in Minnesota engaged in this problem. The aim of the company is to acquire lands at the eastern end of their line, which, by proper management, if at present timbered, or by planting, will furnish an indefinite supply of cross-ties. The high cost of shipment from the sources of supply in the Northwest to the eastern divisions of the road makes the maintenance of the tie supply in the East imperative.

The growing confidence of railroad companies in the practical utility of applied forestry is again shown in the action of the Delaware & Hudson in connection with their Adirondack holdings. As a result of a preliminary examination made last year for the Bureau of Forestry by T. H. Sherrard, they have supplied the necessary funds for a detailed plan of management for a tract of 100,000 acres along their Chateaugay Division in northern New York State. This plan will provide for the management of the existing second-growth, cut-over hardwood and spruce and virgin lands, and for the reforestation of the extensive areas along the railroad which have been closely cut for charcoal and pulp and subsequently burned. Messrs. A. W. Cooper and G. B. Lull, of the Forest Service, are at present on the tract, the former making a working plan for the timbered areas, the latter establishing a forest nursery in which seed sufficient for 300,000 seedlings will be planted this season, after which he will prepare a planting plan for the 25,000 acres of denuded land.

Paul D. Kelleter left Washington in May to put into full operation the plan of forest protection prepared last season by W. F. Hubbard for the McCloud River Lumber Company, in Siskiyou County, Cal. This plan is one of the important pieces of co-operative work being carried on by the Forest Service and private timber owners, and is of unusual interest because of its high educational value in teaching lumbermen the practicability of systematic protection against forest fires.

As the result of a recent examination of the Fort Bayard Military Reservation, in New Mexico, and of the adjacent region, which will be included in the new addition to the Gila River Forest Reserve, by George L. Clothier, of the Forest Service, a large forest nursery has been established and field planting operations will be begun as soon as plants are available. It appears that excessive grazing and the timber cutting done by thieves and legitimately have denuded the mountain slopes to an alarming extent. Erosion is very active in the region, due to the nature of the soil and the torrential character of the rainfall. A long series of dry years was broken this season by excessive rains, which did incalculable damage by gullying the slopes and covering agricultural lands with sand and bowlders. The establishment of a forest cover on denuded slopes is obviously the only feasible way to control the flood waters. W. R. Mattoon and T. J. Taylor are at Fort Bayard directing the planting of an acre of seedbeds, which will give about 2,000,000 seedlings with which to begin the planting operations. The unprecedented rainfall of the past winter has made conditions unusually favorable for this work, and in extent and importance it promises to rank as one of the largest reformation schemes yet inaugurated in this country.

J. M. Fetherolf and W. B. Hadley, of the Forest Service, are engaged in reconnaisance of the Salt Lake Forest Reserve, with the object of preparing a reforestation plan for the more important denuded watersheds. The importance of this reserve from the standpoints of both timber and water supply, is fully realized by the people of the region and local sentiment is very favorable toward planting operations. The season's work is to determine the areas suitable or unsuitable for planting because of either their location or character. The suitable areas will be mapped to show the different planting sites and definite recommendations will be made as to the species to be used, nursery sites, cost, etc.

The unusually wet season in California has resulted in rapid progress being made at the work of reforestation in the San Gabriel Mountains. Owing to the steepness of the slopes, the inaccessibility of the important watersheds and the density of the chaparral cover, planting is necessarily slow ond expensive; lines had to be cut through the bush prior to planting and many of the trees had to be transported from the nursery to the planting sites on burros. But despite these handicaps, 35,700 trees of seventeen species were planted out this year on a variety of slopes ranging in altitude from 2,500 to 5,500 feet, at a total cost of $1,485. The species most extensively used were Knobcone Pine, Western Yellow Pine and Coulter Pine.

The value of the work lies in the importance of reforesting the watersheds adjacent to streams which supply irrigation water, and as an experiment to the possibilities of forest planting in the region.

As a measure of protection for the nursery at Henninger's Flats and for the plantation, a system of fire lines is under construction. These lines, which vary in width from 10 to 30 feet, run along the sharp "backbones" of the ridges, and will stop a brush fire or give opportunity to fight it at the point where it naturally declines or dies out.

In connection with the re-inauguration this season of reforestation work by the New York State Forest, Fish and Game Commission, it is interesting to note the condition of the plantations established by the Commission in the spring of 1902 between Lake Clear Junction and Saranac Lake Village. The site was comparatively level, broken in places by small areas of swamp land and second-growth, but in general open. It formerly supported a stand of Spruce, White Pine and hardwoods, but repeated fires after the timber was cut prevented reproduction, and the ground cover when the planting was done consisted only of brakes, briers and low shrubs. The soil was sandy in nature and of low fertility. The area planted comprised about 415 acres. White Pine, Scotch Pine, Norway Spruce and European Larch were the species used, spaced 5 by 5 feet. The stock was obtained from the Axton and Wawbeek nurseries of the New York State College of Forestry and ranged from two-year-old seedlings to five-year-old transplants. The entire cost for plants, cartage and planting was about $5 per 1,000. The results indicate that the Scotch Pine is best adapted for the location, as it is now the largest and most thrifty species on all situations. The White Pine is doing moderately well, but has been somewhat injured by the wooley louse (*Chermes pinicorticis*), and in exposed situations shows the effects of wind and frost. It has made the best showing in form and height in the open aspen and birch thickets. The European Larch promises well and is making very rapid growth where the sandy soil is not too sterile. The Norway Spruce, from which so much was expected, has made very little growth and evidently is not suited to this poor, sandy soil. A very large percentage of each species lived, but with the Scotch Pines running from two to three feet in height, the White Pine and Larch often exceeding 2 feet and the Norway Spruce seldom exceeding a height of eight inches or a foot, the tendency to eliminate the Spruce in future planting is strong. It is too soon, however, to draw definite conclusions. The Spruce may slowly establish itself and eventually make good growth, while the exotics, as the Scotch Pine and European Larch, may decline after a few years of astonishing thrift.

The planting this year was done on old pasture lands and barren fields between Paul Smith's and McColloms, in Franklin County. About 450,000 Scotch Pine, White Pine and Norway Spruce transplants were set, a considerable number being planted by the German seed-spot method.

In conjunction with the field planting work of the New York State Forest, Fish and Game Commission, a forest nursery of two acres was established in 1903, at Saranac Inn Station, on the New York Central Railroad, in Franklin County for the purpose of raising nursery stock for the reforestation of denuded State Lands. Forester C. R. Pettis is in charge. The capacity of the nursery, with the present arrangement of beds, is 250,000 transplants, with sufficient seed-bed space to produce 2-year seedlings for the nursery beds. The annual output will be 175,000 4-year-old transplants. The soil was a light, sterile sand, which has been enriched by the application of muck and stable manure. A plentiful supply of water is furnished by a storage tank, which is kept full by a hydraulic ram, which raises the water from an adjacent spring. The nursery at present is devoted almost entirely to nursery beds, in which 2-year-old seedlings obtained from various American dealers have been set. Seedlings were placed in nursery beds in the spring of 1904, and they will be transplanted to the field in 1906. This spring an additional 240,000 seedlings were set in beds and a small area of seedbeds planted. The spacing adopted in the nursery beds is 4 inches in the row, with the rows 6 inches apart. The beds are 4 feet wide and 50 feet long. The species used are White Pine, Scotch Pine, Norway Pine, Norway Spruce, White Spruce, Red Spruce, Douglas Spruce and European Larch.

The results of two stem analyses from Eberswalde were exhibited at the Louisiana Purchase Exposition. They were made according to Dr. L. Wappes' (Bavaria) improved method, which transfers the work from the woods to the house and secures much more rapid, exact and controllable results. After the tree is sectioned a half-inch prism is split out from each section (with special knife and mallet), either for the length of the radius or preferably of the diameter, the prisms being properly marked. (The easier way would be to saw off an inch section and split out the prism with chisel or hatchet.) With such a prism it is possible to transfer directly to paper the dimensions from 5 to 5 or 10 to 10 years and the volume calculations can be considerably reduced, using a method like Schiffel's or Pressler's, which works with two diameters for the whole stem.

The second meeting of the International Botanical Congress took place in June, 1905, at Vienna. The programme was full of subjects interesting to foresters. Besides the question of nomenclature, various biological problems were discussed, phe-

15

nomena of regeneration and the present knowledge of assimilation among them.

The annual meeting of the Connecticut Forestry Association was held on May 6 at the Memorial Hall in Hartford. Dr. E. H. Jenkins, Director of the Connecticut Agricultural Experiment Station, was elected President of the Association, to succeed Walter Mulford, former State Forester of Connecticut, and now with the Forest Service at Washington, who was President during the past two years. Dr. Jenkins has long been an ardent advocate of forestry in his State, and it was largely due to his efforts that the Experiment Station appointed a forester to its staff in 1901. It is of historical interest that this was the first office of forestry to an Experiment Station created in the United States. In the absence of President Mulford, Major Preston presided at the meeting. The Treasurer reported a balance of $196.09; the Secretary, 25 new members since the last meeting, and State Forester, Austin F. Hawes, notable progress at the Experiment Stations at Rainbow and Portland in forest planting and in the management of native forest growth. The work of the Association deserves strong commendation. It was through its influence that the bill was passed which gave Connecticut a State Forester, and by keeping the subject of forestry before the people, and through the personal enthusiasm of the members, the general movement is kept thoroughly alive.

Ralph C. Bryant, who has been in the Philippine Forest Service since the fall of 1901, has resigned his position as Assistant Chief of the Bureau of Forestry, at Manila, and has returned to the United States. Mr. Bryant was the first graduate of the New York State College of Forestry, and served for over a year as Forester for the New York State Forest, Fish and Game Commission before going to the Philippines. In the Philippine service he passed through the several successive grades until promoted to the position of Assistant Chief. He has entered the Forest Service at Washington and will continue in the Government forest work.

W. W. Clark, of the Philippine Bureau of Forestry, is on his way to the United States on a leave of absence. Mr. Clark went into the Philippine Forest Service in February, 1902, and for two years past has been Forester in charge of the Province of Masbate.

Prof. H. S. Graves has just returned from a trip to India and the Philippines, where he spent the winter studying the forest conditions and forest administration of those countries. The trip to the Philippines was taken on behalf of the Federal Bureau of Forestry. Mr. Pinchot is officially the technical advisor to the Philippine Government in forest matters. Prof. Graves was sent as his personal representative to report on certain matters connected with the administration of the Insular forests. The second object of the trip was to secure information regarding forest conditions in the East, in order to provide proper instruction at the Yale Forest School for those who are preparing themselves to enter the Philippine Service or to practice forestry in other tropical countries.

The Senior Class of the Yale Forest School met at Milford, Pa., at the end of April, for field work. The bulk of the term was spent on Advanced Engineering, particularly topographic work, which, at the present time, is of very great importance to the American forester. A course in Fish Culture was given by Dr. Barton W. Evermann, and a course in Forest Insects by Dr. A. D. Hopkins. One of the features of the spring work of the class was a course in Packing, given by H. W. Daley, Chief Packer of the United States Army. This course is particularly valuable to those who are about to take up work in the national forest reserves. A course in Forestry in the Tropics was given by Prof. Graves, designed particularly for those who are about to enter the Philippine service. It is expected that next year much more work in Forest Management will be given in the spring term of the senior year, because the class will have had more Engineering in the junior year than heretofore.

In the last issue of the QUARTERLY mention was made of the growing demand for trained foresters. That this desire on the part of States and corporations for the service of professional foresters is increasing is strikingly shown by the number of positions now open. The new forest law of Wisconsin provides for an assistant forester; a forester is wanted for Indiana, and a State forester and two assistants are provided for in the new forest law of California.

These demands on the limited number of trained foresters in this country not only offer splendid opportunities to the men of the profession, but indicate the change of attitude which shifts forestry from a sentimental or theoretical to a purely economic basis.

The E. P. Burton Company, of Charleston, S. C., have procured the services of Charles S. Chapman, of the Bureau of Forestry. Mr. Chapman graduated from the Connecticut Agricultural College in 1900, with the degree of B. A. S. He entered the Division of Forestry as a Student Assistant in the spring of 1900 and worked in Tennessee, Arkansas and New York, until he went to New Haven that fall. He received his degree of M. F., in 1902, as a member of the first class to graduate from the Yale Forest School. Since passing the Field Assistant examination in 1902 Mr. Chapman has had charge of field parties on Great Northern Paper Company lands in Maine (1902); on E. P. Burton Company lands in South Carolina (1902-1903); on Weyerhauser lands in Minnesota (1903) and Washington (1904); and on Houston Oil lands in Texas (1903-1904).

Mr. Chapman will be assisted by Max Rothkugel, who has been on the Cooper River holdings of the Burton Company since the first of the year. Mr. Rothkugel graduated at Eulenberg, Austria, in 1894, and then served as forest assistant on the private dominion of the Order of German Knights, Austria. He came to the United States in 1902 and spent a year at the New York State College of Forestry. He served in the Bureau of Forestry as Student Assistant and Forest Student at work on the Gauley timber lands, in West Virginia (1903); on Loblolly Pine, in Texas (1903-1904); and on Western Yellow Pine, in

Montana and second-growth hardwoods, in West Virginia, (1904.)

Another South Carolina logging and milling firm to secure recently the services of a member of the Bureau of Forestry is the Santee River Cypress Lumber Company, of Ferguson, South Carolina. Robert H. Allen, who had been a Student Assistant and Forest Student in the Bureau of Forestry a year and a half resigned to accept a position with the above named company on April 1.

Mr. Allen completed the course at the Yale Summer School of Forestry in 1903. At the close of the term at Milford he entered the Bureau and assisted in the study of Aspen and White Birch in Maine. His succeeding assignments were to a working party on the Kaul tract in Alabama; to a study of Western Yellow and Sugar Pines in California; to mill scale work in Tennessee and Virginia and to a study of Ash and Cottonwood in South Carolina.

W. J. Ward has accepted a position with the Brookings Lumber and Box Company, of Highland, California. Throughout his course at Cornell, from which institution he graduated in 1903, with the degree of B. S. A., Mr. Ward took all his electives in the New York State College of Forestry. During the summer of 1902 he worked on Squaw Mountain Township, Maine, as a Student Assistant in the Bureau of Forestry. He re-entered the Bureau in the fall of 1903, and served on the Kaul Tract, in Alabama; the Houston Oil Lands, in Texas; hardwood mill scale study in the Adirondacks and Sugar Pine and Western Yellow Pine studies in California until he resigned in May, 1905.

Mr. Ward will begin his work on the company's timber tract in the San Bernardino Mountains of Southern California, and later locate additional holdings at some other point on the Pacific coast. His position will be that of forester and woods superintendent.

Edmund J. Zavitz has been appointed Forester of the Department of Agriculture of the Province of Ontario, with headquarters at the Ontario Agricultural College, Guelph, Ontario, Canada. The work, under the direction of Mr. Zavitz, will include the establishment of nurseries to supply seedlings to landowners of the provinces desiring to plant up woodlots or to redeem waste areas, the furnishing to these planters of professional advice as to methods of formation and treatment for their forests, and the giving of a course of lectures on the handling of farm woodlots to the students of the Agricultural College.

Mr. Zavitz is a B. A. of McMaster University (1902), and received his training in forestry in the United States, spending one year at the Yale Forest School, and graduating as an M. S. F. from the University of Michigan this year.

Hartley B. Holroyd, who served as Student Assistant and Assistant Forest Expert in the Bureau of Forestry from July, 1902, until he entered Prof. Roth's department at Ann Arbor last fall, has gone to assist Mr. Zavitz in establishing the nurseries at the Ontario Agricultural College.

A biographical sketch of Dr. August Metzger, who, a year ago, laid aside the professorship of zoology in the Forest Academy at Münden, after having filled this position for a little over thirty years, appears in the January number of *Zeitschrift für Forst- und Jagdwesen,* while his portrait forms the frontispiece.

In connection with the celebration of the seventy-fifth anniversary of the founding of the Forest Academy at Eberswalde, a bronze statue of Danckelmann, for many years director of that school and editor of *Zeitschrift für Forst- und Jagdwesen,* is to be unveiled about the first of the coming August. The memorial is to be placed in the park before the old Academy.

Gottlieb Anton Müttrich, until a year ago professor of mathematics and physics in the Forest Academy at Eberswalde, and director of the meteorological section of the Prussian Society for Forest Research died quite suddenly last December, of apoplexy. Dr. Müttrich is oftenest remembered as furnishing us a protracted series of observations at double stations. Such records were obtained from seventeen double stations through a period of twenty-seven years, and are our most reliable data for the study of the difference of climatic conditions within and without a forest.

The *Indian Forester* announces the death, at Akyab, on March 12, of H. Slade, Conservator of Forests, Burma.

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VOLUME TABLES.

Volume tables show the average contents of standing trees of different sizes. They are of practical value in estimating the yield of wood and timber standing on specified tracts. They are used to determine the contents of a large number of trees grouped together, but are not accurate when applied to a single tree. Trees of the same species and same dimensions vary in form and hence in volume. On the other hand, for a given species growing in a specified class of forest, the *average* volume of trees of given dimensions is very uniform. Two individuals of the same dimensions may vary considerably, but the averages of two sets of twenty-five trees each, having the same dimensions, are so close that in the practical work of estimating timber, the difference is negligible. Therefore, volume tables are constructed from the average volume of a large number of trees, and are of value only when used to estimate the contents of a large number of trees.

Volume tables may be made for any desired unit, the cubic foot, the board foot, standard, cord, or other measure. Volume tables may also be constructed to show the contents of trees in ties, poles, shingles, or other desired product.

In the United States separate volume tables are made for different localities. The question whether it is correct to use general volume tables has been extensively discussed in Europe. There, however, the forester has to deal with trees grown in regular forests which have been carefully tended. The average contents of trees of different dimensions are, therefore, fairly uniform. But in this country where the forests are very irregular, and the conditions which influence the form and contents of trees differ greatly, local rather than general volume tables should be used.

Volume Tables for Trees of Different Diameters.—The simplest volume tables show the average contents of trees of different diameters, differences in height being disregarded. These are the tables in most common use in estimating the merchantable contents of standing timber. They are extremely convenient, because it is only necessary to obtain an enumeration and measurement of the diameters of the trees for the calculation of volume, the measurements of heights not being required. The steps in the construction of these tables are as follows:

A large number of trees are cut and measurements of volume taken. It is the common custom to follow lumbermen who are cutting for the market. Care is required in the selection of the trees for measurement. It is the rule to measure only sound trees, because volume tables show the full contents of sound trees. It may be claimed that the tables would be more practical if based on average trees, including those partially defective. A table made up in this way would be extremely unreliable. It is well known that the defects of trees differ greatly in different situations. A table based partly on defective trees could not be used where the defects are different from those of the trees used in constructing the volume table. Factors, like injury by fire, insects, disease, wind and ice, would make entirely useless a table which is constructed for trees showing other defects, but unaffected in this particular way. A table based on sound trees may be reduced in any given case, just as log rules are reduced for unsoundness in logs. Care should further be exercised to select for measurement trees representative in form. It is usually a temptation to measure only the best trees. It must be remembered that the figures will represent the average tree of different diameters, regardless of differences in the number of logs, total height, or tree class. Therefore, each tree should be a good representative of its class, that is, not abnormal in height, size of crown, form of trunk, etc. In selecting material for volume measurement, the different classes of trees should be represented about as they occur in the forest. That is, there should be about the same percentage of one-log trees, two-log trees, three-log trees, etc., as ordinarily occur in the particular forest being studied. This point is to be observed especially if the number of trees measured is limited. If 1000 trees are to be measured, it is ordinarily sufficient to measure trees as they are cut by the lumbermen, taking care that the diameters are well distributed and the trees are not abnormal. Abnormal trees are those with forked trunks, those with swollen butts, and diseased or distorted trees.

Before undertaking the field work of collecting material for volume tables, it is desirable to examine the forest where they are to be used in estimating, in order to determine the character of the trees which ought to be used in constructing the tables. A determination is then made of how many trees it is necessary to fell and measure, and in general how they should be distributed among the different diameters. Ordinarily the aim is to secure at least 1000 trees as a basis for volume tables; where the timber is very uniform, as with most conifers, 500 trees give exceedingly good results. If the tables are to be used in careful cruising, at least 500 trees should be measured. In reconnaissance work and rough cruising, or where the trees are extremely regular in form, 100 trees may suffice.

The required measurements on each tree are:

Diameter at breast height.
Diameter at each cross section, inside and outside the bark.
Length of each log.
Length of the top above last cut.
Height of stump.
Length of the crown.
Width of the crown.

With these measurements the merchantable or full contents of the stem, with and without bark may be computed. The measurements of the length and width of crown serve as an excellent description of the tree. In addition, it is desirable to add for each tree a descriptive note regarding the form of the trunk, soundness, general thrift, approximate age, the form of the stand, the trees in mixture, and soil and situation. Where a volume table is constructed for diameters alone, the tree and forest description is not so essential as where the trees are further grouped by height or tree class.

The first work of computation is the calculation of volume of each tree measured. The work can be done most rapidly by two persons, one handling the data collected in the field and the other the log tables, tables of areas or other tables necessary in cubing the logs in the unit chosen. The computing work may be divided between the two, resulting in economy of time and mental effort.

The trees measured are grouped according to breast-height diameters in inch classes. Thus all trees are thrown into the 6 inch class which have a diameter between 5.6 and 6.5 inches. In judging the diameter class, the five-tenths goes to the lower rather than the higher number. That is, a tree 12.5 inches diameter is counted as a 12-inch tree, not a 13-inch tree.

The volumes of all trees that are in a single diameter class are averaged together and the exact average diameter also determined, the last being usually not a whole inch but a few tenths above or below the whole number. The data may then be arranged in five columns, as in the example following, which shows the results of the measurement of 101 chestnut trees at Milford, Penn. The first column shows the inch diameter classes, the second column the exact average diameters of the trees in each diameter class, the third column the number of trees used, the fourth column the average volume of the trees in each diameter class, and the fifth column the results of the fourth column made regular by graphic interpolation. To construct the curve used in obtaining the values in column five, the volumes from column four are plotted on cross-section paper as ordinates, with the average diameters in column two as abscissæ. The values in column three are used to assist in constructing the curve. For the final results in column five, the values for the whole inches are read from the curve.

CHESTNUT

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS

Based on the measurement of 101 trees at Milford, Pa.

Diam. Class Breast high	*Ave. diam. of trees measured breast high*	*No. of trees measured*	*Ave. volume of trees measured*	*Ave. volume {Results of column 4 evened off by curve}*
Inches	*Inches*		*Cubic feet*	*Cubic feet*
6	6.25	2	4.7	4.5
7	7	10	5.4	5.4
8	8.1	13	7.2	7
9	9	16	9.4	9.3
10	10	15	11.7	11.7
11	11	14	14.9	14.4
12	12	18	16.2	17.1
13	12.9	9	20.2	20.2
14	14.1	3	23.6	23.4
15	14.9	1	27	27

Another method of averaging together the volumes for different diameters is as follows :

The volumes of all trees are plotted on cross-section paper as ordinates, the abscissæ being the diameters breast high. After the volumes of all trees have been plotted, an average curve is drawn through the points. From this curve are read the average volume for the different diameters.

Volume tables are, then, used to compute the contents of stands, for example, sample plots on which the trees have been calipered. The method of using a volume table is shown in the following example, in which the first column shows the diameters, the second column the number of calipered trees of each diameter, the third column the volume of each diameter from the volume table, and the fourth column the total volume of each diameter class, obtained by multiplying the values in the second and third columns.

CONTENTS OF CHESTNUT ON A SAMPLE PLOT AT MILFORD, PENN.

Diameter breast high	*No. of trees*	*Contents from vol. tables*	*Total contents*
Inches		*Cubic feet*	*Cubic feet*
6	2	4.7	5.4
7	10	5.4	54.0
8	13	6.9	91.0
9	16	9.3	148.8
10	15	11.7	175.5
11	14	14.4	201.6
12	18	17.1	307.0
13	9	20.2	181.8
14	3	23.4	70.2
15	1	27.0	27.0
		Total	1273.9

Volume Tables for Trees Grouped by Diameters and Number of Logs.—In the method just described all trees are averaged by diameters regardless of heights or lengths of merchantable timber. Thus one-log trees are averaged with three-log trees, or even five-log trees, if such occur. It is obvious that tables which show the contents of trees of different numbers of logs, merchantable lengths or total heights, as well as diameters, would be more accurate in estimating standing timber than the tables described above. Tables based on diameters and number of logs are in actual use in estimating standing timber in board feet. They are practical in tall timber where a standard log length, as, for example, 16 feet, may be used in the estimate of the number of logs. These tables are useful in Pine, Red Fir, and other tall species.

The principles of the selection of trees for the construction of a table is simpler than in the previous method. In this method it is only necessary to select trees of different diameters and number of logs, seeing to it that each is a representative of its class. In the other method one must constantly watch that the proportion of trees of different classes is about the same as occurs in the forest, which is an exceedingly difficult thing. In a given forest having fairly uniform forest types, the trees of a given diameter and number of merchantable logs have relatively uniform volumes.

When the measurements have been taken, the work of constructing volume tables is the same as previously described, except that instead of a single column of figures evened off by a curve, there are several. Each column is treated as if it were an independent volume table. A curve is made for the average volumes of all one-log trees of different diameters, then of two-log trees, of three-log trees, etc. The results from these curves are tabulated in the following form :

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS AND NUMBER OF 16-FOOT LOGS

Based on the Measurement of ______Trees

Diameter breast high	*Volume of One-log trees*	*Volume of Two-log trees*	*Volume of Three-log trees*	*Volume of Four log trees*
Inches	*Board feet*	*Board feet*	*Board feet*	*Board feet*

When the trees in a given stand are calipered for computation of contents by the use of this kind of a volume table, they are grouped by diameters and number of logs. The field record is taken on a form like the following :

Diameter breast high	WHITE PINE				HEMLOCK		ETC.
	One log trees	*Two-log trees*	*Three-log trees*	*Four-log trees*	*One-log trees*	*Two-log trees*	
Inches							

The contents of the trees measured may be determined by multiplying the number of trees of each diameter and number of logs by the value given in the volume table for that class.

Volume Tables for Trees of Different Diameters and Lengths of Merchantable Log.—This is a very useful and accurate kind of volume table. The field work follows the principles already described for the previous type of tables. The logs are, of course, cut in such a way as to scale the highest possible number of board feet. The sum of the lengths of the logs represents the merchantable length of the tree. The following groups may be recognized for the merchantable lengths: 10, 12, 14, 16, 18, 20, 24, 28, 32, 36, 40 feet and so on. A volume curve is made for the trees of different diameters which have a merchantable length of 10 feet, then a curve for all trees having a merchantable length of 12 feet, and so on. A table is then made from these curves like the following:

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS AND MERCHANTABLE LENGTHS

Based on the Measurement of ______ Trees

Diam breast high	LENGTH OF MERCHANTABLE LOG IN FEET								
	10	*12*	*14*	*16*	*18*	*20*	*24*	*28*	*32*
	Board feet								
Inches									

It will be found that this first table, while its values run regularly in the vertical columns, will show irregularities when read in the other direction. Thus the values of 12-inch trees probably would show an irregular increase in volume with increase in merchantable length. It is, therefore, necessary to construct a second series of curves for the different diameters on a basis of merchantable length. These series of curves are constructed on one sheet of cross section paper, and are harmonized. The values read from these curves are then entered in the above form as the final volume table.

To use this volume table, the trees on a sample plot or other area are calipered, and at the same time grouped by merchantable length classes. The form for the field record would be:

Diam breast high	WHITE PINE										
	Merchantable Length in Feet										
	10	*12*	*14*	*16*	*18*	*20*	*24*	*28*	*32*	*36*	*40*
Inches											

The computation of the volume from volume tables is then merely a matter of multiplication, as described for the other methods.

Another method would be to classify the trees by diameters, as ordinarily, and then determine the average merchantable length of trees of different diameters.

Volume Tables for Trees of Different Diameters and Tree Classes.—The volumes of trees depend largely upon the development of crowns. In a good deal of forest work it is desirable to classify the trees not by diameters and height or merchantable length, but by diameters and development of crown. This is the case especially in measuring trees for cord wood in second growth hardwoods. Experience in New England has shown that volume tables based on diameters alone are not satisfactory, but that very fair results are obtained if hardwood trees, within certain age limits, *e. g.*, 40–70 years, of the same diameter and general class of crown are averaged together. Five classes may be recognized:

1. Trees in the open.
2. Large-crowned forest trees (maximum in stand).
3. Trees in crowded stand, crowns narrow and about 15–20% the length of stem.
4. Overtopped and partially suppressed trees.
5. Badly suppressed trees.

Other systems of classification could be used for special investigations, but for second growth hardwoods the above classification is the most useful.

In selecting the trees for volume measurement, much greater stress is placed on the description of the tree than with the other kind of volume tables. It is particularly important to describe the conditions of density, form of surrounding stand, and shape and dimensions of the crown, because these are the factors which determine the class to which a particular tree is assigned. After computing the contents of the trees, they are separated into classes and then for each class a table is constructed in the ordinary manner, showing the volume of trees of different diameters. These separate tables are then combined in the following form :

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS AND TREE CLASSES

Based on the Measurement of ______ Trees

Diam. breast high	TREE CLASS				
	I	*II*	*III*	*IV*	*V*
Inches	*Cords*				

Just as in the previously described method, the trees on a specified sample plot must be grouped, when calipered, in the proper tree classes. The field records may be taken on a form like the following :

Diam. breast high	WHITE OAK					CHESTNUT		
	Class I	*Class II*	*Class III*	*Class IV*	*Class V*	*Class I*	*Class II*	*Etc.*
Inches								

The contents of the stand may then be obtained from the volume table by multiplication, as in the previous methods.

Volume Tables for Trees of Different Diameters and Heights.—Volume tables for trees grouped by height as well as diameter, are very practical and accurate when used in fairly regular forests. In irregular forests they give good results when there are separate tables for different tree classes. The European volume tables are based on diameters and heights, and are satisfactory in practice because the forests are regular, having been under management for many years. But even in Europe separate tables are made for different ages, for example for trees 60 to 90 years, 90 to 120 years, etc.

There are two methods of constructing a volume table for trees of different diameters and heights, first by arranging together the volumes of the trees measured in the woods, and second by making a table of form factors and then converting this into a volume table. The second method is used only with cubic measure because no satisfactory form figure has been found for board measure. But, as shown later, a cubic foot table may be converted into board measure.

Suppose that a volume table is to be made for Chestnut cordwood. A large number of trees are felled and measurements for volume taken. The cubic contents of the merchantable portion is calculated in the ordinary way. Then a regular table is made for all the 20-foot trees of different diameters, then a table for 25-foot trees, then for 30-foot trees and so on. The values taken from these tables combined in a single table of the form on page 238, would be regular in its vertical columns, but irregular when read on the horizontal lines. The whole table must be made regular by a series of harmonized diameter curves, made for the heights, just as described before. Such a table may be constructed with ease and confidence if 500 or 1000 trees have been measured. Where a smaller number is used, so much interpolation is necessary that the results cannot be thoroughly relied on.

The table following was constructed in this way by the Juniors at the Yale Forest School. The values for the middle of the table are reliable, but the extremes are less so because the lack of the largest and smallest sizes did not enable the certain establishment of the ends of the curves. Nevertheless this table proved very accurate when tested in the field.

TABLE A

CHESTNUT

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETER AND HEIGHTS

Based on 99 trees measured at Milford, Pa.

Diam. breast high	HEIGHT IN FEET				
	40	*45*	*50*	*55*	*60*
	Merchantable Cubic Feet				
Inches					
6	3.9	4.2	4.6		
7	4.8	5.1	5.7		
8	6.2	6.6	7.3	8.1	
9	7.8	8.3	9.0	10.0	
10	9.7	10.2	11.1	12.2	
11	12.0	12.6	13.6	14.8	16.3
12		15.1	16.1	17.4	18.9
13		17.8	18.9	20.2	21.7
14		20.9	22.0	23.4	25.0
15					28.8

The second method of constructing a volume table for trees of different heights and diameters is to make a table of breast height form factors, and then convert the values into cubic feet. Volume tables in Europe are constructed by the form factor method. A large number of trees are felled and measured as in the preceding methods. The cubic contents of each tree are computed. Then the breast height form factor is obtained by the formula $F = \frac{V}{B\ H}$, in which F is the form factor, B the area of the circle corresponding to the diameter breast high, H the total height of the tree, and V its volume. Three kinds of form factors are distinguished :—Tree form factor, derived from the formula in which V is the total volume of the tree, including branches and spray ; Stem form factor, derived from the formula giving V the volume of the whole stem, without branches : and Merchantable form factor, based on the merchantable volume of the tree. In this country the stem and merchantable form factors are the only ones considered.

In determining the stem form factor, the whole volume of the stem is used, including the stump cubed as a cylinder, and the top above last cut cubed as a cone, the logs being cubed as truncated paraboloids. The reason why the whole stem is used and volume tables constructed on this basis is that the form factors are much more regular than for the merchantable volume, and hence it is possible to make the final tables more confidently. If the merchantable form factors of an American tree, for example the Chestnut, are used there will be considerable variation in form factors and volumes due to the varying height of stump, as well as that due to the influences which always affect these values. The purpose of studying the volume of whole stems is to eliminate the question of stump-heights and, by including the tip, to eliminate also the slightly disturbing factor of possible differences in the diameter of the last merchantable stick. In Europe this last mentioned disturbing influence is avoided by always measuring to seven centimeters in the crown. In this country it is the custom not to take the top diameter measurement where it is exactly a certain diameter, as for example, seven centimeters, but at the top of the last merchantable stick. The purpose is to obtain the exact merchantable contents.

When the form factors have been determined for all trees, they are averaged together in diameter and height groups. Thus the form factors of all trees rounding to six inches and twenty-five feet are averaged together, the form factors of the trees seven inches by twenty-five feet, those eight inches by twenty-five feet, and so on. A convenient form for averaging the values is the following, in which the number in the center of each square is the average form factor ; the number in the upper left hand corner is the average diameter of the trees used, the number in the upper right hand corner the number of trees averaged, and the number in the lower right hand corner the average height of the trees used.

Diam. breast high	HEIGHT IN FEET			
	40	45	50	55
	Average Form Factors			
Inches				
6	6 1 .470 40	6.2 1 .465 45.7	6.3 1 .468 49	
7	7.3 2 .451 39.5	7 5 .410 44.8	6.8 2 .451 51.2	7 2 .430 55
8				

The next step is to inspect the values of this preliminary table to see how the form factors vary. The stem form factors of mature conifers usually show a distinct decrease of form factor with increase in diameter, but no regular change with increase in height. Usually there is a distinct change in form factor with increase in diameter and increase in height. Then it is necessary to make a table of form factors for both diameters and heights. If the form factors vary with diameters alone, a table is made for the average form factors of different diameters, disregarding heights. Where there is a small amount of data, say not over 100 trees, the values in the first table are apt to be very irregular. This is particularly true of the merchantable form factors. In this case the form factors for the same diameters and then the form factors for the different heights should be averaged. Usually this average shows whether the form factors vary by diameters, heights, or both.

The writer at different times has experimented in making tables of form factors where the data is meagre, in order to see whether the results can be used at all in constructing a volume table. An example is a table for second growth Chestnut. One hundred dominant sprouts, 40–60 years old, were felled and analyzed. Their merchantable form factors were computed and averaged, and arranged in a preliminary table by diameters and heights. The values were so irregular that it seemed impossible to use them at all. They were then averaged by diameters and and also by heights. The results of this average are shown in the following table :

FORM FACTORS OF CHESTNUT FOR TREES OF DIFFERENT DIAMETERS

DIAMETER AT BREAST HEIGHT INCHES									
6	7	8	9	10	11	12	13	14	15
Merchantable Form Factors									
.438	.435	.431	.426	.421	.414	.408	.401	.393	.384

FORM FACTORS OF CHESTNUT FOR TREES OF DIFFERENT HEIGHTS

HEIGHT IN FEET				
40	45	50	55	60
Merchantable Form Factors				
.446	.429	.420	.411	.404

These tables show that the form factors drop off with increase of height and diameter. The values in the original table are so irregular that it is impossible to even off the irregularities even by harmonized curves. Therefore to construct a volume table, either the form factors averaged by diameters or those averaged by heights, must be used, or the figures be discarded altogether. As an illustration, two volume tables were constructed, one by use of the form factors averaged by heights, and the other by use of the form factors averaged by diameters. In the first table (B), the same form factor was used to compute the volume of

TABLE B

CHESTNUT

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS AND HEIGHTS

Based on 99 trees measured in Milford, Pa.

Diam. breast high	HEIGHT IN FEET				
	40	*45*	*50*	*55*	*60*
	Merchantable Cubic Feet				
Inches					
6	3.4	3.8	4.1		
7	4.7	5.2	5.6	6.0	
8	6.1	6.7	7.3	7.9	
9	7.8	8.5	9.3	10.0	
10	9.6	10.5	11.4	12.3	
11	11.6	12.7	13.9	14.9	15.9
12		15.2	16.5	17.7	19.0
13		17.8	19.4	20.9	22.3
14		20.6	22.3	24.2	25.9
15			25.8	27.7	29.7

all 40-foot trees, then a single form factor for all 45-foot trees, and so on. In the same way in the second table (C), a single form factor was used in computing the contents of all seven inch trees, then another form factor for all eight inch trees, and so on.

TABLE C

CHESTNUT

VOLUME TABLE FOR TREES OF DIFFERENT DIAMETERS AND HEIGHTS

Based on 99 trees measured in Milford, Pa.

Diam. breast high	HEIGHT IN FEET				
	40	*45*	*50*	*55*	*60*
	Merchantable Cubic Feet				
Inches					
6	3.4	3.9	4.3		
7	4.6	5.2	5.8	6.4	
8	6.0	6.8	7.5	8.3	
9	7.5	8.5	9.4	10.4	11.3
10	9.2	10.3	11.5	12.6	13.8
11		12.6	13.7	15.0	16.0
12		14.4	16.0	17.6	19.2
13		16.6	18.5	20.3	22.2
14		18.9	21.0	23.1	25.2
15			23.6	25.9	28.3

This table may be converted into cords by dividing each value by 89.6, on the principle that a cord of wood contains, on an average, 70% of solid wood.

The tables are almost identical, and also very close to the table shown on page 238, which was made in another way. The three tables were then used to compute the contents of the 99 trees on which they were based. These 99 trees were averaged by diameters like the enumeration of a sample plot, a table of average heights was made ; and the total contents determined separately from the three volume tables. Table A gave a total yield of 1242, Table B a yield of 1265, and Table C a yield of 1262, cubic feet. The actual yield determined by adding together the separate volumes of the 99 trees was 1243.

To convert a cubic foot table to board feet, the procedure is as follows : The volume of each of the trees measured is computed in cubic feet and also in board feet, and the relation between the units obtained. The cubic feet in each tree are multiplied by 12, the board feet divided by this product represents an artificial but convenient ratio between the cubic and board feet of each tree. A table of ratios is then constructed for trees grouped by diameters and heights or by diameters.

Each value in the cubic foot table is then multiplied by the proper factor in the ratio table, and the result multiplied by 12 in order to convert back to board feet. This method has the advantage that existing tables of cubic feet may be used as a basis of new tables of board feet. In some circumstances the data at hand may be of such a character as to make a more reliable basis table of cubic feet than of board feet. It must always be remembered that the basis table should be thoroughly reliable, because a slight error in a converting factor is less important than one in the basis table.

Volume tables for trees of different diameters and heights are used in the following way : After the trees on a given sample area have been calipered, the heights of a limited number of trees of different diameters, including small, medium and large trees, are measured. When a height is taken, the diameter is also noted. From this data a curve is made for heights on a basis of diameters, and from the curve may be read the height of any desired diameter. The contents of the stand is then obtained from the volume tables. Arrange the data in a form like the following, in which the diameters are placed in the first column, the number of trees in the next, the average heights (from the curve) in the third, the volume from the volume tables in the fourth, and the total volumes in the fifth column.

Diameter breast high	*No. of trees*	*Average height*	*Volume from volume table*	*Total volume*
Inches		*Feet*	*Cubic Feet*	*Cubic Feet*

Another way to use the tables is to group the trees by heights as they are calipered in this way.

Diam. breast high	WHITE PINE			
	Heights			
Inches	*20–30*	*30–40*	*40–50*	*Etc.*

It is then a simple matter to compute the contents from the volume tables.

HENRY S. GRAVES.

METHODS OF SCALING LOGS.

Instruments for Scaling Logs.—The measurement of logs to ascertain their contents is called scaling. The instrument which is used for measuring logs is called a scale stick, scale rule or log rule. A number of different types are manufactured. The most common type of scale rule consists of a stick, square or flat, which may be placed on the end of a log and shows, by two sets of figures on its face, both the diameter of the log and its actual contents in board feet. It is usually a square stick graduated to measure 36 inches. At each inch mark is placed the contents in board feet, by the Maine Rule, of a log of that diameter. Each line of figures represents the results for one length of log, the lengths being indicated at the left-hand end of the stick. It is exactly as if a printed log rule were wrapped about the stick. The flat type of stick is most commonly used throughout the country. These rules are generally made of hickory and tipped with a plain binding of brass or by a head of iron. There are in use a variety of such heads for the measurement of logs of different forms and designed to satisfy the taste of different scalers. The advantage of a head is that the rule may be placed quickly and accurately on the end of the log. If there is no such guide, inaccuracies are frequent through carelessness in placing the end of the rule exactly at the edge. This type of rule, however, is applicable only where the log has been peeled. Where logs are scaled with the bark on, the plain rule with no guide-head must be used, or a reduction in the measure made for the thickness of the bark. Sometimes logs are "nosed," that is, the sharp edges are rounded off with the axe to prevent splitting ("brooming") of the ends in transportation. In scaling such logs a long guide-head on the scale stick is needed. Occasionally scale sticks are made hexagonal instead of flat or square. The old Cary and Parsons scales of Maine were formerly constructed in this way. Where scaling in the woods consists merely in measuring the diameters of the logs, a flat rule, graduated in inches and half inches, is used. These rules are often made by the scalers themselves, or for them by the camp blacksmith. A common type consists of a flat steel rule one inch wide, attached to a wooden handle.

Several firms manufacture a caliper scale for the Scribner rule. The caliper is also used where the diameter is measured at the middle or at one-third from the end. The New Hampshire rule requires a measurement at the middle of the log. Therefore, a caliper rule is used. The most common form is one in which there is a depression on the inside of each arm, so that the recorded diameter is less than the real diameter. This is the allowance for bark. These calipers are constructed for use with Spruce, and an allowance is made on the caliper equivalent to the average thickness of Spruce bark at the middle of the average log. The scaler is thus saved the trouble of chipping off the bark or of measuring its thickness. It is, of course, a rough method to assume that on all logs the thickness of bark is the same.

For measuring the lengths of logs a wheel measure is used. It consists of ten spokes, each tipped with a spike, mounted on a small hub which is attached to the caliper scale. The spokes are all painted black except one which is yellow, and this one is weighted with a band of lead, so that when at rest it always points downward. When the wheel is placed on a log, the yellow spoke touches the log first. The construction is such that the tips of the spokes are six inches apart. When the wheel is run along the log, each revolution, easily counted by the yellow spoke, measures five feet and the distance between the spokes six inches, so that the length of a log may quickly be determined to within six inches.

Method of Measuring the Diameters and Lengths.—The methods of scaling logs differ in using different rules and according to local differences in the character of timber, in the market requirements, in the habit of the individual scalers, etc. In regions where the logs are cut into short lengths and piled on skidways for winter hauling, as in the Adirondacks, the scaling is done in the following way: Ordinarily two men constitute the scaling crew. They are provided with a rule for measuring the diameters of the logs, a note book, tally sheets or a "scale paddle," for recording the measurements, a special marking hammer, and crayons for marking the logs. One scaler measures the diameters of the logs inside the bark at the small end; the other records the results. Only the smallest diameter is recorded, since the log tables are based on length and on diameter at the small end of the log. It is not necessary to measure separately the length of each log, for there are usually only a few standard lengths, as for example, 10, 12, 13, 14 and 16 feet. The scaler can tell at a glance the correct length. If a log is slightly longer than the standard, the extra length is disregarded. For example, a log 16.5 feet long is scaled as a 16-foot log. If 18 feet is the next standard length, a log 17.9 feet long is scaled as a 16-foot log. Therefore, a log may be slightly longer than the specified length, but never shorter. If a log is shorter than the length of the shortest specification (ordinarily 8 or 10 feet) it is discarded entirely. A great deal of waste is caused by choppers through careless measurement of log lengths.

In measuring the ends of logs, the diameters are rounded to whole inches. If a diameter is nearer 7 than 6 inches, the log is tallied as 7 inches. If the diameter is exactly between two whole inches, as for example 9.5 inches, the scaler usually tallies it under the lower inch class, in this case 9. Sometimes scalers endeavor to throw about half of such logs into the inch class below, and half into the class above. Very conservative scalers record all diameters falling between two whole inches to the lower inch class, even if it is within 1 tenth of an inch of the next class (for example 6.9 inches would be a 6 inch log).

When logs are evidently not round, the rule is usually placed on the cross section at a point where the diameter is about an average between the largest and smallest dimensions. Some scalers always take the smallest diameters, a precaution necessary in measuring veneer logs.

The field records are taken on special forms prepared by the company owning or buying the logs. Often the scalers use a blank book or wooden scale paddle in the woods, and then transfer the figures to regular forms at the camp.

There are two methods of recording the measurements. The most common way is to tally the logs by diameter and length, and then afterwards compute the volume in the office. The other way is to record the board contents of each log, as shown by the scale stick.

When a log has been scaled, the end is chalked to prevent its measurement a second time. Logs which are to be discarded receive a special chalk mark. At this time or later the logs are stamped with the special marking hammer of the purchaser of the logs. It is customary in many places to blaze a tree near each skidway, and mark the number of the skidway and number of logs tallied. Thus $\frac{23}{460}$ would mean that there are 460 logs on skidway number 23.

The description of scaling given in the previous pages, applies to the northern regions where logs are cut short and where roads are used for hauling. The principles of scaling are practically the same in other sections where short logs are cut. When the logs are loaded on cars in the woods, the scaling is generally done on the cars after loading. Where logs are to be driven, they may be scaled on the bank before rolling into the river, or, where slides are used, at the side of the slide before they are started. Naturally the accuracy of the different scalers varies tremendously. Some guess at the dimensions of many of the logs without measuring them, and even estimate the total run of a pile without bothering to measure any of the logs in it.

In Maine and also in some parts of New Hampshire, Spruce is cut in long logs, that is, the entire merchantable part of the tree is taken out in one log. The scaling is sometimes done as the logs are hauled to the skidways or yards, and sometimes at the landing if they are to be driven. If the Maine Log Rule is used, the scaler's outfit consists of the ordinary Maine scale stick, a measuring pole or tape, marking hammer and chalk, and note book. The small end of the log and its length are measured. The results in board feet are read directly from the stick, and recorded on special tally blanks or in a note book.

The Maine Rule gives figures for lengths only up to 30 feet, so that if a log is longer than that, it must be scaled as two logs. Ordinarily the diameter at the small end alone is measured, the scaler estimating the diameter at the middle. Thus if a log is 36 feet long, the small diameter 7 inches, and the diameter at the center estimated at 9 inches, the contents of two 18-foot logs, respectively 9 and 7 inches in diameter, are read from the stick as the contents of the whole log. The scaler guesses at the middle diameter of the log after measuring the tip. The increase in size from tip to center (called the "rise") may be estimated very accurately by experienced scalers. Sometimes a scale-stick is used which gives the contents of whole logs over 28 feet long, constructed on the principle that logs 28 to 32 feet long have a rise from tip to center of 1 inch, those 32 to 36 feet long a rise of 2 inches, those 36 to 40 feet long a rise of 3 inches. The rise of logs over 40 feet long is left to the scaler's judgment. The rule stick thus constructed is called the regular five-line rule.

Deductions for crooks and other defects are made according to the judgment of the scaler. There are no rules, the discounting being entirely a matter of experience. In common practice it is mostly customary to reduce the total scale of a lot of logs by a certain percentage as a factor of safety. This is particularly the case where the quality of logs is extremely poor. For example, the disease of Cypress called "peckiness" is so difficult to discover from external signs, that a general reduction for safety is necessary.

The growth of the pulp industry in Maine has introduced a new factor in the scaling of Spruce. Inasmuch as the whole log is used in making pulp, a solid measure is more appropriate than board measure. For this reason, many operators are now using the Blodgett Rule. This requires the measurement of the middle diameter of a log instead of the end diameter. The measurement is taken with calipers of the type described before. The length of the log is measured and the middle point located by a wheel. The diameter is taken outside the bark, the calipers being constructed to allow for an average bark width. The contents of the log is read directly from the beam of the caliper. The deduction for defects is made as with the Maine Rule.

Method of Making Discounts for Defects.—If all the logs on a skidway were sound and straight, the operation of scaling would be largely mechanical, and would not require much skill. But many logs are cut and piled which are partly rotten, crooked or seamy. They must be entirely discarded or reductions must be made for imperfections when the contents are calculated. Skill is required in deciding what logs should be thrown out. The obviously rotten logs are not piled on the skidway at all. The contractors include many which are doubtful, and which they think may be accepted by the purchaser. The final decision rests with the scalers. There are many logs having center rot or rot only on one side, seamy, shaky and crooked logs, which contain enough good lumber to pay for the hauling, but cannot be given a scale equivalent to straight sound logs of equal dimensions. When such a log is measured, a deduction is made to compensate for the loss through the imperfection. If the scaler is recording only the diameters and lengths of the logs, discount for defects in a specified log is usually made by reducing the measured diameter sufficiently to cover the loss. Sometimes, chiefly in the south, the allowance for defect is made by reducing the log's length. If the contents of the logs are reduced in the woods, the discount in board feet is made when the log is measured. The experienced scaler, who has worked at a saw-mill, is able to estimate the loss through certain imperfections merely by inspecting the log. It requires skill and experience to recognize defects and to know how much they affect the quality of the timber. It also requires good judgment to determine how much the dimensions of a defective log should be reduced to scale what can actually be manufactured from it. The best scalers have this experience and judgment. Many, however, make deductions for defects largely by guess work. The writer has encountered a few rules for special cases, but there is apparently no uniformity in practice among different scalers. This lack of uniformity is unfortunate, and while it is impossible to lay down rules which are universally applicable, it is possible to classify the principal problems met by scalers. It would be entirely practicable for lumbermen to follow a uniform system of handling these problems, making modifications as required in special cases.

Discount for Center Rot.—If a log has a rotten spot at the center, and there is enough good wood to pay for hauling, a discount for the defect is made in the scale. Several incorrect methods for computing this discount are in use. One method requires the subtraction of the diameter of the rotten core from the diameter of the log, for the required diameter. Thus if a 12-foot log were 20 inches in diameter, and the rotten core had a diameter of 6 inches, this method would make the new diameter 14 inches. The loss (using the Champlain Rule) would be 122 board feet, which is ridiculous. Another method is to scale the log as sound, compute the contents of a log the size of the core, and subtract this from the scale of the log. In case of the 20-inch log with a 6-inch center rot, the loss would be 17 board feet. Another scheme is to add 3 inches to the diameter of the rotten core, square this and deduct from the gross measurement. The result, if the method be applied to the example above, would show a loss of 81 feet. The actual loss, as shown by a diagram, would be 33 board feet. This shows that some of the methods of scaling in practice are thoroughly incorrect.

The writer has for some time considered the possibility of "CULL TABLES" to assist scalers in making discounts for specified sorts of defects in logs. In pursuance of the idea of basing such CULL TABLES on diagrams, the writer secured the services of Mr. H. D. Tiemann, of the U. S. Forest Service, to experiment with the construction of the tables. In the first place Mr. Tiemann constructed a series of diagrams representing the cross-sections of logs of different diameters, and calculated the actual loss occasioned by center holes of different sizes. In constructing the diagrams, ¼ inch was allowed for saw kerf and 4 inches as the width of the narrowest board. It was assumed that the logs would be sawed so as to yield the greatest possible output. Experiment showed that the most is obtained by "sawing through and through" up to a certain point where the holes are large enough to make "sawing around" necessary. It was recognized also that in sawing through and through there might be a difference whether the log is cut so as to have an inch board from the center, or to have the saw pass exactly through the center. In every case the maximum yield was used.

Mr. Tiemann's study established the fact that *in logs of the same length, the loss due to holes of any specified size is practically uniform, regardless of the diameter of the log.* This law is clearly shown in the table given below. It happens that for 12 foot logs this loss is almost exactly expressed by the formula $\frac{\pi}{5}(D+1)^2$, where D is the diameter of the hole.

LOSS BY CENTER-ROT IN TWELVE FOOT LOGS OF SELECTED DIAMETERS AS SHOWN IN DIAGRAMS

Diam. of hole	*12-inch log loss when sawed*		*16-inch log loss when sawed*		*24-inch log loss when sawed*		*36-inch log loss when sawed*		*48-inch log loss when sawed*	
	Through	*Around*	*Through*	*Around*	*Through*	*Around*	*Through*	*Around*	*Through*	*Around*
Inches	*Board Feet*		*Board Feet*		*Board Feet*		*Board Feet*		*Board Feet*	
2	6	14	6	12	4	12	2	16		
3	9	14	9	12	9	12	9	26		
4	28	14	13	20	11	12	12	26	11	
6	53	34	29	30	27	32	27	44	—	
8	69	50	76	52	45	54	47	70	51	
10			112	82	70	92	65	80	—	
12			132	120	106	132	110	132	108	
16					221	186	173	194	175	
20					314	306	276	306	272	

NOTE.—The double lines are drawn at the points where the loss is greater by sawing through than by sawing around.

In practice, logs which have holes are apt to have more loss from hidden defects than others. Therefore, it is wise to allow a further loss of 5%. This gives the very simple formula of loss in board feet due to center holes:

$$\text{Loss} = \tfrac{2}{3}\,(D + 1)^2.$$

A table, showing the loss in board feet for logs of different sizes and holes of different diameters, has been constructed by this formula, first for 12 foot logs and then for 10, 13, 14, 16, 18 and 20 foot logs.

This table is applicable to all center defects, such as holes, cup shake, rot, etc., *which are not nearer the bark than four inches.*

CULL TABLE

Loss by Holes or Rot of Different Diameters near the Center of Logs
[*Good for defects more than 4 inches from the bark*]

Diam. of hole	LENGTH OF LOGS IN FEET						
	10	*12*	*13*	*14*	*16*	*18*	*20*
Inches	*Board Feet*						
2	5	6	6.5	7	8	9	10
3	9	11	12	13	15	16.5	18
4	14	17	18	20	23	25.5	28
5	20	24	26	28	32	36	40
6	27.5	33	36	38.5	44	49.5	55
7	36	43	47	50	57	65	72
8	45	54	58.5	63	72	81	90
9	5[illegible]	67	74	78	89	100	112
10	67	81	87	93	107	120	133
11	80	96	104	112	128	144	160
12	94	113	122	132	151	169.5	188
13	109	131	142	153	175	196.5	218
14	125	150	162.5	175	200	225	250
15	142	171	184	218	226	255	283

Discounts for Defects near the Edge of the Log.—Under this head may be included rot near the edge, defects on butt logs due to fire scars, splits on butt logs due to careless felling, and any other defect which requires a heavy slab to be taken from one side. Just as in the case of discounting for center-rot, there appears to be no uniformity among scalers in calculating the loss through defects near the edge. The writer has in preparation a cull table which will show the actual loss in board feet by slabs of different widths. With this table in hand, the scaler may measure the distance from the bark to the sound wood and determine at once the amount in board measure which should be deducted from the gross scale of the log. The cull rule for center-rot is applicable to all defects more than 4 inches from the bark. The cull rule for side defects applies to every imperfection whose edge is nearer the bark than 4 inches.

If there are two defects on opposite sides of the log, the discount is determined from the cull rule. If the two defects require a squaring of the log on adjacent sides, the cull rule does not apply. A good method is to measure the sides of the squared piece which can be cut from the sound piece, multiply the product of these sides by the length and then deduct $\frac{1}{5}$ for saw kerf.

Discount for Crooks.—Usually logs are supposed to be straight, and the scaler does not make any discount for crooks when he measures the logs. When logs are piled on skidways, it is obviously impossible to take crooks into consideration. Often, however, a small percentage is deducted from the total scale to allow for this imperfection. To make allowance for the loss by crooks in a specified log, the scaler sights over the surface and calculates how much the small end must be reduced to circumscribe the square piece which really can be cut from the log.

Discount for Wormy or Rotten Sap.—The diameter measurement is taken inside the sap, that is, the heartwood alone is scaled.

Discounts for Seams and Shakes.—Seamy and shaky logs are usually culled altogether. Sometimes in a tree with straight grain, a seam causes only the loss of one plank in the center. This loss may be calculated by the rule: Multiply the thickness of the plank to be discarded by the diameter of the log, multiply by the length and divide by 12. Usually the grain of the log is not straight and it has to be discarded altogether.

Shaky logs are usually valueless. If the shake is confined to the center, the cull rule for center-rot may be used.

HENRY S. GRAVES.

FOREST TERMINOLOGY.

Two publications have appeared during the year which record, or intend to record, the terms in use in the English and American forestry literature.* The one, the well-known French-German Dictionary of Professor J. Gerschel, appeared in its fourth edition, which was briefly noticed on page 160 of this volume, with an English addition, and later the U. S. Bureau of Forestry issued a bulletin of "Terms Used in Forestry and Logging," which is to mould American usage.

The first-mentioned publication covers a wider field and has a different aim from the latter, namely, to record for dictionary use the terms employed in the three languages in forestry and allied subjects; while the American publication is a statement of the terminology which the Bureau of Forestry "will closely follow in all its work." It is, therefore, less inclusive, but to us of more direct interest.

It is a very useful and timely publication, of much more import, we believe, than the practical forester may realize. For, we hold that any science or art progresses very much more readily if it is supplied with a recognized terminology which permits ready expression and discussion. We believe that one reason why the Germans have taken such a prominent place in the development of sciences may lie, even though only to a small degree, in the fact that their language lends itself readily to word-making; the permissibility and facility of compounding words renders it possible, as soon as a new idea presents itself, to coin a word, which, without further explanation, conveys the idea. The English and French languages have much less facility in that respect. Take, for instance, the cumbersome translations into French of self-explanatory terms like *Stammformzahl*, *Nachhaltsbetrieb*,

* *Terms Used in Forestry and Logging*, Prepared in Co-operation with the Society of American Foresters. U. S. Department of Agriculture, Bureau of Forestry. Bulletin No. 61, pp. 53. 8mo.

J. GERSCHEL, *Vocabulaire Forestière Français-Anglais-Allemand*. 4th edition. Paris, 1905. pp. 203. 12mo.

Femelschlagbetrieb, *Ueberhaltbetrieb*, *Flächenfachwerk* into *coefficient de forme de la tige*, *exploitation à rendement soutenu*, *méthode par coupes successives*, *traitement en futaie avec réserve sur coupe définitive*, *méthode par compartiments et superficie*—and one gets soon tired of talking or writing on these subjects.

The English language, being generally shorter in words and diction, is somewhat more facile, yet its aversion to compounding is a hindrance, and it has recourse to either attaching new meanings to old terms, or perchance invents new words, in either case making explanations needful. In forest terminology the English of the Britons appears to us particularly unfortunate, perhaps for historic reasons: the science and art of forestry were introduced into English literature from Germany and through Germans, who, probably better foresters than linguists, deprived of their favorite method of compounding words, found difficulty in expressing themselves and established a verbiage which, to the American ear at least, sounds cumbersome.

The American, perhaps because more frequently thrown with foreigners on equal terms, is more ready to adapt new words to new ideas and perhaps to reduce the rigor of his language sense by permitting compounding more readily, hence he is more likely to be successful in forming an acceptable terminology.

The publication before us does not, as is stated in the Introduction, "comprise the English forest terminology used in this country," if thereby is meant that it includes all the terms that have been, and have been freely used. A glance through this, or any number of the FORESTRY QUARTERLY, will show that many terms have not found record, or even equivalents in the list. Historic truth would, therefore, require modification of this language.

We do not know upon what principles the terminology of this publication was selected. Except in regard to logging terms, it is not a mere record of actually used terms, but, on the contrary, it attempts not only to introduce new terms, but to replace long accepted ones. Language in general is subject to evolution, like all other growing things, although new creation and invention are here not infrequent, and in technical language necessary. But, although through such powerful influence as the Bureau of

Forestry can at present exert, new language, even if not desirable, might be forced into our forestry literature, it would be a pity and most undemocratic to do this; such attempts should at least be made with great caution; it would be as unfortunate to crush natural development and evolution in the literary field as in the practical application of the art. That this is evidently not intended, appears from the introductory note, which invites "suggestions for the correction or enlargement of the present list."

It is in this spirit of improvement and because the FORESTRY QUARTERLY, being filled with technical writing, is naturally greatly concerned in terminology that we propose to review at length the new (or comparatively new) terms as to their acceptability, and to suggest such additions and substitutes as occur to us.

We must confess at the outset that even in the use of common language, personal preferences, growing out of familiarity, render certain verbiage more natural and acceptable to us than other verbiage just as good but not familiar; we must also admit that we share the common objection to innovations, unless they are absolutely necessary or very desirable indeed. But, aside from these personal elements in selecting phraseology, it is possible to formulate certain standards to which a terminology should aspire and by which its permanent acceptability may be tested.

We will first try to formulate such standards, positive or negative characteristics and principles, and then test by these some of the proposed terms. We hold that technical terms are merely conveniences for quick and precise speech and should be first of all tested by that object. To attain it, they should conform as much as practicable to at least the following four requirements, important in the order of their sequence:

(a) A term should be necessary. As long as common language is sufficient to precisely state the idea, special terminology is superfluous, except, perhaps, for special cases or special writings. A corollary is that, as long as an accepted term employed in other sciences or arts expresses precisely the conditions or ideas to be expressed, there is no gain in coining a new word.

(b) Words which are current with well established meanings should not be employed as terms in another sense, especially where it is likely that ambiguity would be introduced by the simultaneous use of the ordinary sense and the term meaning.

(c) Age is a virtue : a long-established, sufficiently well defined and understood term should not be lightly discarded or supplanted unless very considerable improvement were gained. Convenience, we repeat, is the object of language, and it is more convenient to use established language than to fish for new words.

(d) Terms should be as short and as nearly as possible self-explanatory. It is, of course, well nigh impossible, nor is it necessary, that a term explain all that is implied in it : it is the very impossibility of doing so that leads to the use of special terms which to the initiated at once convey the full explanation. But, if the term suggests its own explanation, it will be the more acceptable.

(e) Finally, the word or word combination should have a *term-quality*. This is, perhaps, the most difficult requirement to define or to discover : it is like taste in art, it requires a language sense which by instinct or intuitively rejects the unsuitable. A word infrequently used in common language has thereby more term quality, than one in common use ; a Roman word more than a Saxon ; a brief combination more than a long one ; a compound more than a phrase ; an unusual compound more than a common one.

If the term fulfills all these conditions, it is perfect ; by so much as it fails, it is deficient and open to criticism, calling for improvement.

Going through the list systematically, we shall omit those terms which do not call for comment, but we will mention with our approval such new terms as appear to us well chosen.

Accident yield appears useful and acceptable.

Accretion. The reservation of this term for diameter and height as against *Increment* for volume may be useful.

Advance growth, in contra-distinction of *volunteer growth*, the former to express natural regeneration in the forest without man's assistance, the latter on fields and openings, is acceptable.

Clean cutting and *Clean cutting method.* We do not see an advantage in replacing *Clear* by *Clean,* the former being well established, perfectly plain in meaning, with satisfactory term-quality, indeed more so than *Clean*, the first and ordinary sense of which is well employed in the combination *Clean logging*, and later on is, indeed, properly applied in *cleaning* for *weeding* (which would be better used as the same term in horticulture), while nothing is better known than a *Clearing* as a place from which the timber has been entirely removed.

How the making of a clearing can be defined as a "method of conservative lumbering" we fail to see, the conservatism being in the planting rather than in the lumbering.

Conservative lumbering. Indeed, to define this first approach to forestry methods which is implied in the term as "practical forestry," and apply it to all silvicultural methods which have *reproduction* in view, seems to us most illogical. Lumbering is to cut logs, as defined in the logging terms; conservation lies in leaving some logs uncut and in not destroying young growth unnecessarily; it is a negative measure, designed not to prevent the possibility of continued crops—a very meritorious "first aid" to forestry, but as far removed from the positive measures for securing reproduction, which "practical forestry" attempts, as extinguishing a fire to prevent the total destruction of a house is different from building one. It has as little truth in it as that other perversion of meaning which defines "forestry is anything we do in the forest." While it is a very proper thing to use every possible means for bringing forestry within the lumberman's sphere, it is not needful or proper to twist the terminology for that purpose.

Crown class. We think this term well chosen, but do not look favorably on the term *intermediate* for the second class instead of *co-dominant*, which describes well the fact that the crowns of this class still participate in the upper crown cover. The new term is vague while the term proposed, which we have hitherto used, precisely expresses the idea and, perhaps written without a hyphen, appears to have as little objectionable in it as the term *dominant*.

Cutting area and *Cutting series*. We do not see why the use of *felling* for *cutting* is not preferable. Although this term does not appear even in the synonymy, it has been long used, especially in the combination *felling budget*, which is absent in the terminology. It has a term-quality superior to "cutting," which even in its ordinary sense, is less definite.

We find fault with the definition of *felling series* in so far as uniform difference of ages is not a necessity of the definition ; a felling series is a matter of plan, not yet necessarily a condition of stands.

Expectation value. We prefer *expectancy* for its better term-quality.

Fail spot. We prefer *fail place* because *spot* seems to suggest limitation to a very confined or small space.

Forest. v. We welcome this innovation.

Forest. n. Further descriptive differentiation is desirable.

Forest management. Here we find the principal stumbling block in the definition. Having delivered a course on "Forest Management" before the Yale Forest School, by which was meant according to our notion what, in the terminology is well defined as *forest organization*, we were rejoiced to find here the proper definition and limitation of the term, namely, "the practical application of the principles of forestry to a forest area." *i. e.*, the actual practice of forestry, the conduct of the forestry business. This is the common-place, self-evident meaning of the word, which anybody, not a forester, would at once give to it. But we were further on disappointed in finding that *silviculture* was *not* included in forest management—the practical application of the principles of forestry—as one of its enumerated branches ; and then to find cited as the "three great systems of forest management" all the *silvicultural* methods and systems, and none of the systems of forest organization. Indeed, one looks in vain through the terminology for most of the terms of forest organization and forest finance.

Again we were rudely disturbed in our satisfaction over the definition of *forest management* by finding it under *forestry* as one of the main branches, and *forest organization* not mentioned. This confusion, we suspect, is in part imbibed from the French literature in which these subjects are frequently curiously mixed. We have been in the habit of dividing, with continued satisfaction, the subject matter of forestry into three logically separable branches, namely : *Silviculture*, which is based on natural history knowledge, the art of producing the crop, including its protection and its harvest ; *Forest Organization*, which is based on and embraces all the mathematical and economic knowledge, the art of regulating the felling budget and conducting the business according to certain principles ; *Forest Politics*, which is based upon knowledge of political economy and statesmanship and such parts of the other two branches as are necessary to formulate the attitude and policies of the State towards forests and forestry.

Forest Policy, the term used for the more correct *Forest Politics* in the terminology is decidedly wrongly defined, if it is supposed, as it seems, to cover the German *Forstpolitik* ; "Politik" being politics or statescraft. The definition given is not that of the term but the ordinary meaning.

Forest type, a very good term, the German for which, *Bestandsform*, *Waldform*, is not given.

Forest replacement seems an unnecessarily long and cumbersome term for the well established *Reforestation*, which is not even given as a synonym.

Future yield table, for which the synonyms G. *Ertragstafel*, *Erfahrungstafel* and F. *table de production* are omitted, seems to be unnecessarily and undesirably lengthened by the addition of "future", in order to make the antithesis to *Present yield*. Why the good English word *Stock* (on hand) which precisely expresses the idea and is used in the same sense in every other business, precisely corresponding to the German term *Vorrat*, should be replaced by *Present yield* is not visible, especially as yield at once suggests to the mind : result, some futurity, somewhat like interest on capital stock.

The term *growing stock* has been allowed as a synonym for *stand* for which a synonym is hardly needed. Of course, stock is made up of stands; to our mind the difference lies merely in the point of view as to which of these two terms to use, *stand* being the term in forest description, *stock* or *growing stock* in forest mensuration.

Index and *Index forest*=the highest average actually found upon a given locality (site). This definition needs some modification to make its meaning quite clear and to make it cover its German and French equivalent "normal." We would also take exception to the combination *index forest*, when only "index stand" can be meant. Moreover we would call attention to the fact that the definition of index forest, which fits an index stand very well, does not cover the idea of the long used "normal forest"=*Normalwald*.

Normal forest has for the last hundred years meant not at all an actual forest, but an idea, a conception, a norm, a scheme as a standard for forest organization, the main condition of it besides normal increment, being a proper gradation of age classes and normal stock as a consequence of these two conditions. Whatever an "index forest" is, it certainly is not synonymous with normal forest.

Index is a verbatim translation of the German *Weiser*, a word which was first used in forestry literature a hundred years ago by Huber in the combination *Weiserbestand*, exactly like the definition, and by Pressler, some fifty years ago, in the combination *Weiserprozent*, a growth per cent for the determination of which he caused the accretion borer to be constructed; this per cent., a financial, not volume, per cent., was then compared with a standard, the chosen business per cent. when by its falling short or exceeding the standard per cent. it would INDICATE the financial ripeness or unripeness of the stand. It is a term we need in discussing forest finance.

The terms *Weiserbestand* and *Weiserbaum* (index stand and index tree) were used by Huber and later by Th. and R. Hartig in forest mensuration and construction of growth or yield tables, mainly to solve the problem of ranging stands properly into site classes. The terms designated older, mature stands and trees, which could be utilized by stem analysis as an index of conditions of younger stands, on the supposition that the stems of the mature stand represented the dominant stand of the earlier periods on the same site class.

We would favor, therefore, the substitution of "index" wherever the idea of local standard in measurement is involved, which the Germans unfortunately call also normal, but the retention of "normal", wherever as in forest organization an ideal or scheme is conceived as in normal forest, normal felling age, normal age-classes, etc.

Intermediate. See Crown class.

Locality. We prefer *site* for its brevity and superior term quality, locality being often needed in its ordinary sense.

Many-aged forest and *All-aged forest*, to replace *selection forest* seem to us as unfortunate selections as *Single tree method* for *Selection method.* We agree that it is not proper to use, as has been done, the term *selection forest* to describe a forest in which many age-classes happen to occur (we cannot conceive of an *All-aged forest*) and for this purpose *many-aged forest* may do. *Selection method* is so long and well established and so descriptive a term, namely of the taking here and there a tree, usually of certain diameter limits, that we would plead for its retention as one of old age and greater term-quality than the proposed substitute.

Mature forest. Cessation of height growth as a criterion is a good limitation, if "physically" were added, for we shall need to talk and write of a financial maturity which does not fall under the definition.

Patch method and *Patch sowing.* We do not like these terms which suggest patch work. Gershel's dictionary gives *gap-felling* for the first, which is rather neat and *plat sowing* for the latter term seems to us also more elegant and perfectly descriptive.

Present yield and *Present yield table* (=Enumeration of stock). See Future yield.

Regular forest and *Irregular forest.* Although *even-aged* and *uneven-aged forest* appear to us cumbersome, we do not think that *Regular* and *Irregular* are sufficiently definite. The French *uniform* would fit better for the first.

Is there ever an *even-aged* FOREST or may this condition occur only in stands, *i. e.*, parts of the forest?

Reserve seed method is cumbersome and the word *seed* unnecessary except as antithesis to "sprout". We would be inclined to simply translate the self-explanatory German term into *Hold-over method* since it consists in holding over trees for a second rotation.

Reserve sprout forest and *method.* Wherein this differs from *Composite system* and *Composite forest*, both of which are accepted in the terminology, we do not see. We could be satisfied with either *composite forest* or *standard coppice.*

Root sucker. We are referred to *sprout*; but, while *root sucker* is a sprout, it is a very special sprout and the term is needed, besides being well established in horticulture and botany.

Rotation. We regret to see in the definition the common mistake of mixing up *actual felling age*, the time when a stand is ACTUALLY cut or to be cut, and *normal felling age* (rotation), the time when in a scheme of continued management it is PROPOSED to have it cut again and again—a mere standard time. Few stands are cut in the age of the rotation determined for the forest as a whole.

Row planting. Why the distance between the rows must be greater than the distance between the young trees in the row, in order to fall under this term, we fail to see. What shall we call it when this condition is not fulfilled?

Scattered seed method. We do not warm to this term, which is cumbersome, lacking term quality, and does not describe the specific feature of the idea, namely, a scattering of TREES not of SEEDS, for in all natural regeneration seed is scattered. We suggest instead *seed tree method*, which, although also relying on a feature common to all regeneration methods, accentuates the fact that the trees left are merely for seed and do not, as in all other methods, serve also another purpose, or are distributed in a special manner, which should be indicated in the term referring to them.

Second growth. A meaning, different from the definition given, is the current one among lumbermen and should be stated, namely, the increment on small trees left in the logging.

Seed forest and *Seed system* are good innovations.

Seed spot. This term has been so long used to describe the method of "spotting seeds", *i. e.*, scratching the surface of small spots for sowing the seed into, that it would be a pity to disturb it in its well fitting place, especially as it is needed there, while for the rare occasion of the changed meaning, namely a small area sown with tree seed, a technical term is hardly needed, a seeded or sown area or plot or place being all-sufficient.

Semimature forest. We have no objection to the term, but believe a hyphen in the adjective indispensable.

Severance cutting. See Cutting Area.

Silvics, We consider this one of the best terms invented for the cumbersome "silvicultural characteristics."

Single tree method. We have before (see "many-aged forest") recorded our desire to retain *selection method* for this purpose, pleading its antiquity, term quality and sufficiency of descriptive character, in all of which the new term is deficient. In the definition of this regeneration method alone do we consider the use of the term "conservative lumbering" fitting; indeed, it might almost be substituted for selection forest, so well does it express the spirit and actual object of the operation; namely lumbering without destroying the possibility of future crops. We consider it a mistake to use in the definition the words "under the shelter of the old stand," for that implies that this shelter is SOUGHT while really it is mostly an unavoidable evil, which ranks this method on the lowest level of all seed forest methods and only applicable where special reasons, physical or economical, make it desirable.

Sprout forest and *sprout system*. The same reasons as those adduced for retention of "selection forest" make it desirable to retain *coppice*.

Stand class is a good innovation.

Stand method and *strip stand method*. The essential feature of these old silvicultural methods defined under these new terms is that the old growth is left for some time and only gradually removed in order to protect the young growth. This idea seems to us admirably covered by the long established, self explanatory term "shelterwood method." The addition of "compartment," which has probably suggested the substitution of "stand", is quite irrelevant; that usually a compartment or definite stand is taken into operation is not essential and the same thing is done in a clearing system or any other system when the forest is divided into compartments.

For "strip stand method" we would suggest "progressive shelterwood method" which describes the process exactly, while strip suggests the strip method of clearing strips.

Stand table is a good term.

Stem and *Stem density*. We hope to accustom ourselves to the use of these terms, but would point out, that there are slight differences of meaning suggested in the different synonyms, and that according to the point of view from which they are used, the different terms seem of different appropriateness. "Stem" suggests to us one of many trees, a numerical aspect; "trunk" a part of the tree in merely botanical description; "bole" and "shaft" a technical or silvicultural aspect, an antithesis to other useful woody parts, branches, etc. For "stem density" we would be inclined to retain the synonym "stock density", when speaking not from the point of view of silvicultural but from that of economic or financial operations.

Suppressed. The definition suggests "oppressed", rather than "suppressed", which latter suggests entire and accomplished smothering—the dead and dying, while "oppressed" suggests the possibility of regaining position. We would refer to the classification of crown classes given on p. 62 of this volume as the best we have seen, with the terms: dominant, codominant, laggards, oppressed, suppressed.

Valuation area and *Valuation survey*. We regret that this opportunity was not used to replace these unfortunate terms, which we have inherited from the English, by terms more truthfully descriptive of the ideas involved. It is really not a valuation, a determining of values, which is made, but a mere descriptive survey and measurement, which to be sure, could serve the purposes of a valuation by addition of other matter, values, etc. "Forest survey", or if that is adjudged too general, "stock survey", would appear to us quite satisfactory. The untruthful terms have been used so long and persistently that it is perhaps too much to ask that they be replaced, although the almighty Bureau could do so successfully.

Working. We are glad to see this term adopted for the German *Betrieb* and for the too general term "management", although this latter covers the idea as fully and should still be allowed in the synonymy.

If we have succeeded in convincing our readers and the authorities that, while the effort to secure a uniform terminology, must be appreciated, there is still room for improvement before it is time to force the selected one, we shall feel that the discussion has been useful. We would invite those who have flaws to find with our own strictures and who have additional suggestions to make, to use the pages of the QUARTERLY for that purpose freely. We know that we have by no means exhausted the subject, and there is especially a long list of terms which is omitted in this terminology, to which we may refer at some future time.

We may only add a few remarks on Gershel's dictionary. The English terminology in it has been supplied by Prof. Fisher of Coopers Hill, a forester of note. In the German-English-French part we find very nearly 500 terms which may be called purely forestry terms (the "Terms" contains somewhat over 400 words), but it is not to be inferred that the English equivalents are all terms; they are in very many cases merely explanations of the German term or translations, and sometimes not accurate ones.

The reason is, of course, that forestry in England or India is by no means so developed as to have call for the discussion of phases of forestry which a more intensive development requires. The same condition exists, also in our own country, except that, our floral, climatic, and economic conditions being much more like those of Europe than of India, where alone the British practice forestry to any extent, we shall sooner come to the necessity of discussing the same subjects that the Germans do, and shall need a more extended terminology.

Even before that time, it behooves a well educated forester of University training, to be able to follow at least the discussions of any phase of his subject in any part of the world, even if he may have no call to apply it in his own narrow sphere. If "American" forestry is ever to amount to anything, it cannot afford not to have within its reach all the knowledge that the world affords, any more, than the American chemist would think of shutting himself out from the development of his science in other countries. To do this we must have developed our terminology beyond the needs of every day practical application.

To do justice, we should in this connection not omit to mention an earlier attempt to secure an English terminology, namely that of Oberförster Karl Phillip, which he published about five years ago, after a short visit to the United States. It is like the French dictionary, often merely translation and often unfortunate in its vocabulary.

B. E. Fernow.

FOREST LEGISLATION IN CALIFORNIA.

On March 20, 1905, Governor Pardee, of California, signed Senate Bill No. 638, which provides for the protection and management of the forests of the State, and creates a State Board of Forestry and certain technical and administrative offices.

The passage of this bill marks the beginning of a new era in the forest movement in California and places on the statute books a forest law which in many respects is not equaled in any of the States. Its working efficiency is yet to be determined, but regardless of the local influences which may hinder or favor its application, it remains, according to the Secretary of Agriculture, the most comprehensive and carefully prepared State forest law yet enacted, and if backed in the future by the favorable public sentiment now existing, should give results fully in keeping with the local requirements.

Historically the present attainments in forest legislation in California represent the revival of a movement which had its rise and fall during the decade prior to 1894. Both in achievement and point of time California ranks as one of the pioneer states in the matter of legislation tending toward the establishment of State forest policies. A State Board of Forestry was created in 1885, and it published several reports, mainly of a botanical nature. In 1887 the powers of the Board were increased, forest experiment stations were established at Chico and Santa Monica, and an appropriation of $29,500 was made for salaries and expenses. In 1893 the Act creating the State Board of Forestry was repealed, and the experiment stations were given into the care of the Agricultural Department of the State University at Berkeley.

The failure of this Act followed mainly because it was premature, the time was not yet ripe for applied forestry in California; in fact, forestry as now practiced was then practically unknown in the United States, and men capable of applying its principles or studying the subject intelligently were few or wanting. Another prime factor in the case was the failure of the Board to make satisfactory use of the appropriations, and consequently the whole movement fell into disrepute. During the ten years from 1893 to 1903 forestry progress in California was practically at a standstill.

The revival of the forestry interest and the direction of the activities into the proper channels was due to the public-spirited action of the several bodies who work unselfishly for the commercial and esthetic upbuilding of California, and finally to the unswerving fidelity of a few individuals in these bodies. The main exponents of the new movement were the officers of the Water and Forest Association, and of the Sierra Club. The press of the State did notable propaganda work, and has given unvarying assistance from the beginning.

The opposition came almost entirely from those who imagined that reform in forestry matters would interfere with certain private interests, and from those who were too ignorant of existing conditions in their own State to see any necessity for action. One unexpected form of opposition arose from those who claimed to favor forest protection, yet who argued that a frequent burning of the forest floor to destroy the "brush" (often valuable reproduction) was beneficial. This class was the most difficult of all to combat, for they were deaf to argument and persisted in holding views which had neither a scientific nor a practical basis.

The action of the State in delaying legislation until a careful study had been made of the forest resources and conditions, and a stable forest policy had been recommended by the representatives of the Forest Service who made the investigations, was fortunate in that it prevented the passage of incomplete and inapplicable forest laws.

The arrangement whereby the Forest Service carried on cooperative forest investigations in California during the past two years is familiar to all. It will suffice to say that part of this investigation was a study of fire conditions and protective measures, and that all lines ot study were drawn upon for data which would serve as a basis for a future State forest policy.

In its original form the bill provided in detail for the protection and management of the private and State forest lands, and for the machinery to carry out the provisions of the Act, the active field force to consist of firewardens and technical forest officers of higher rank. It was based on a thorough field study, and was revised in the hands of special committees appointed for the purpose from the Water and Forest Association, and Sierra Club of California, and from the Forest Service. Its legal, technical, and administrative aspects were carefully considered until there seemed no doubt as to its practical working value. As submitted to the Legislature it was without doubt the most complete and comprehensive State forest code ever drawn, and was a model of its kind. Its very completeness was perhaps its greatest weakness, as it was early demonstrated that anything approaching so nearly to an ideal was too much for a State Legislature to accept on short notice, and without modification.

Although considerably amended in the legislative committees, to accord with the State's finances and the demands of the opposition, the more important fundamental principles were retained.

As passed, the bill provides, in brief, for a technically trained State Forester and two assistants, whose duties shall be the prevention and extinguishment of fires, and the management of State parks and forest lands ; for the division of the State into fire districts and the appointment of voluntary firewardens with power to arrest ; for coöperation with counties, corporations, and individuals in matters of forest management and protection ; for restrictions in the use of fire with penalties for violations, and a fixing of the responsibility ; and for the acquirement of forest lands by the State. To carry out its provisions an annual appropriation of $17,600 is made, while all moneys received as penalties go into a Forestry Fund to be used only for forestry purposes.

Other legislation having a bearing on the general forestry bill, was an appropriation of $76,000 for a continuation of the coöperative water and forest investigations, of which sum forestry gets $10,000 ; a new section in the county government act, authorizing counties to appropriate sums up to $20,000 for the protection and reforestation of forests upon public lands ; and an

Act appropriating for forestry purposes $100,000 from the monies received in the settlement of Civil War claims. It is doubtful if there will be any money available from this last source, but should there be, it will add greatly to the working efficiency of the general forest law.

The more important changes made in the original bill were: the elimination of the district firewardens, and the failure to make provision for the payment of voluntary firewardens, and of citizens warned out to fight a fire; and the exemption of railroad companies from clearing up along their rights of way and providing suitable spark arresters on their locomotives.

Even with its modifications, the Act in the form in which it became a law is a decided step forward, and offers excellent opportunity for the organization and development of an indispensable State forest system in California. Few, if any of the States, offer such splendid opportunity for the practice of forestry, and in no region of the United States will the economic results of applied forestry have more prompt and certain bearing on the paramount industries.

The forests themselves, from the commercial aspect, are peculiarly essential to the welfare of the State; while their general silvicultural characteristics are such that improved methods of management will be promptly justified. Not only do they serve as a source of timber supply, which is always an important consideration, but, by their location, protect the drainage basins adjacent to the fertile valleys where successful agriculture is dependent upon irrigation water, and thus they perform another function of the highest utility. The high productive value of the land in the famous fruit belt of southern California, and in the San Joaquin valley, is practically all secured by irrigation, and the future development of this southern section, and of the great central valley of the State, some 400 miles long and comprising an area of 58,000 square miles, is largely dependent upon the water supplied by the adjacent forest- and brush-covered mountains. With water, agricultural land attains values as high as $2,000 per acre; without water, desert conditions prevail and the land is practically worthless.

The value of the forests as timber producers is appreciated when we learn that the lumber industry is third in importance in the State, and that the annual value of the output exceeds $20,000,000. Large virgin supplies are still available, but at the present rate of exploitation the end is in sight. Situated on the coast, where advantage can be taken of the export trade, and with a growing domestic and local demand for timber, the opportunity for profitable, long-continued forest management is excellent.

The bearing the forests of California have on a variety of commercial interests is a subject which would bear lengthy discussion, but the necessity for wise forest legislation is obvious without such a discussion. Coupled with the high value of the forests is the fact that the timbered areas, in general, occupy rough, mountainous land which can never be utilized for agricultural purposes, and hence its highest productive value will accrue from maintaining it under forest cover. Moreover, there are extensive barren and brush-covered areas which should be reforested, in order that they may be made productive.

The man who organizes and directs the State forest policy under the provisions of the new law, will be called upon to exercise the highest technical and administrative judgment. He will encounter opposition on the part of individuals and corporations who misunderstand his motives and question his authority and judgment, and he will find technical problems of the most difficult nature. On the other hand, he will have the general encouragement of a favorable and helpful public sentiment, and unless he goes far astray the press and the more influential citizens will heartily back him. There is the advantage, too, that the forests he will manage, while always in danger from fire, will respond readily to treatment, the rate of growth of most of the species being fairly rapid and the tendency to natural reproduction strong. His first and his greatest duty will be the perfecting of methods of protection from fire.

One of the greatest possibilities lies in coöperation. State funds are not available for extensive field operations, but lumber companies are accepting with increasing readiness the advice and assistance of professional men, and counties and cities may be depended upon to contribute funds for purposes of planting and protection.

To sum up, we find that the recently enacted forest legislation in California is the nearest approach to a model forest code yet made, and furnishes a foundation for a more perfect system than has been inaugurated in any State. The people are appreciative of their forest resources, they are loyal to their State and anxious for its highest development, and in general there is a very favorable combination of circumstances, all tending towards the better use and more thorough protection of the forest lands of California.

E. A. STERLING.

CURRENT LITERATURE

HENRY S. GRAVES, *in Charge*

The Use of the National Forest Reserves. Regulations and Instructions. Issued by the Secretary of Agriculture. To take effect July 1, 1905. 141 pp., 12 mo.

The year 1905 will always remain memorable in the history of forestry in the United States as the starting point of an administration of the National Forest Reserves under a bureau with a technically educated staff. This was brought about by Act of Congress of February 1, which transferred the forest reserves to the Department of Agriculture, and by the subsequent fiscal legislation which changed the Bureau of Forestry into the Forest Service.

The booklet of regulations and instructions which is to serve as a guide to this service marks the beginning of this new era. It is prefaced by a brief rehearsal of the historic development which led up to the present organization and a brief statement of the object of the reserves. The general functions of the service are stated, "to protect the reserves against fire, to assist the people in their use, and to see that they are properly used." It is evident that for the first not much more than police duties will fall to the care of the field officers; the regulations are, therefore, mainly of administrative character. Whatever of technical character is contained in them may be found under the chapter "Sale of Timber." The silvicultural policy is here simply expressed: "All timber on forest reserves which can be cut safely and for which there is actual need is for sale. Applications to purchase are invited. Green timber may be sold except where its removal makes a second crop doubtful, reduces the timber supply below the point of safety, or injures the streams. All dead timber is for sale."

To prevent overcutting and to reserve supplies mainly for local use is, for the present, the principal aim. Reproduction must be largely left to nature and good luck. To make reasonable assurance of such production, the tracts of timber for which applications to cut are made are to be examined by an officer who is to decide whether the timber can be spared, "whether another growth of timber will replace the one removed or whether the land will become waste; whether the water supply will suffer; and whether the timber is more urgently needed for some other purpose." He is to study the chances for reproduction of the forest, and decide on the best method of cutting; "whether all the trees below a certain diameter shall be left to form the next crop or only selected seed trees; whether the surrounding timber will furnish enough and the right kind of wood; whether the cutting may be unrestricted or must be confined to strips; or, in other words, what system will be surest to bring about satisfactory reproduction."

The examination and report includes the making of a map on any scale, an estimate of timber to be cut, possibly after subdivision into compartments (not over 160 acres), a forest description, and recommendations as to valuation and other matters throwing light upon the conditions of the sale, manner of logging, etc.

Sales of timber not exceeding $100 are made directly by local officers, those over $100 must be by bids after advertising for 30 days (60 days in California) upon approval of the Washington office.

Besides the sales, there are also free use privileges given for home consumption to settlers, farmers, proprietors or "similar persons who may not reasonably be required to purchase" or have not sufficient supply of their own, also to school and road districts; the free permits are for limited time (6 months) and limited amounts (not to exceed $20 in value, or $100 for school and road districts), being issued by the ranger.

The desire to make the existence of the forest reserve acceptable to the resident population, certain classes of which had been, for natural reasons, antagonistic, crops out in many places, and quite properly also in the rule to employ as far as possible local officers from the State in which the reserve is situated.

That administrative rather than technical questions are the prominent ones in the new service appears also in the organization. The supervisors, or head officials, in charge of reserves (corresponding to the German *Oberförster*) are to be able to handle men and deal with all classes of persons, rather than possess forestry knowledge. "Knowledge of technical forestry is desirable but not essential." The technical men are the "forest assistants", who are placed under the supervisor, receiving their orders from and reporting to him, and making the technical examinations. This relation, which is perhaps wise so long as only the youngest and mostly inexperienced men possess such technical knowledge, will necessarily, we predict, create much friction, and in time the technical men who have the proper qualifications will rise to the supervisorships.

In passing we may note the repetition of history in this arrangement, which existed in Germany one hundred or more years ago, when the direction of affairs was in the hands of jurists or huntsmen from the nobility, and the foresters, the technical men, then, to be sure, poorly educated and ignorant, had small influence.

The qualifications desired in the rangers, the real woodsmen, also remind us of the *Holzgerechten*: they "must be able to build trails and cabins and to pack in provisions without assistance;" "must know something of surveying, estimating and scaling timber, lumbering and the live stock business;" "experience, not book education, is sought." This is as it ought to be, and it is only to be hoped that it will be possible to secure the kind of men demanded for this service. Besides deputy forest supervisors, deputy forest rangers and assistant forest rangers there are also provided forest guards with temporary employment, to assist in protective service.

Forest Inspectors, evidently to be selected from the ranks of the supervisors, without any authority and only with advisory powers, seem designed to act merely as informants to the Forester, at the head of the service,—a feature borrowed from other departments of the government. In this feature, we expect, it will soon be found that more definiteness and increased responsibility with subdivision of labor is desirable. The inspecting service of the United States government generally is not based on proper principles, and is deficient, as past and recent revelations of misconduct in departments attest.

It is evident that the organization of the service is not yet perfected, as appears from the disproportionate number in the various grades, given in the Field Program of the Forest Service for August. The Field Service for the 82 reserves of over 60 million acres was at that time composed of only 114, namely, 12 Forest Inspectors, 50 Forest Supervisors, 19 Forest Assistants and 33 Forest Rangers, 9 of these being in charge of reserves. A very irregular distribution of the reserve officials with reference to reserve areas is noticeable, probably because of greater or less need of superintendence. There are, in addition to the reserve service, not less than 140 persons employed, continuously or temporarily, to carry on other work of the Forest Service, besides the clerical staff.

Chapters on private and State rights in the reserves, on the jurisdiction in special cases, an extensive set of regulations of grazing, of special occupancy of reserves including canals, ditches, reservoirs, railroads, etc., and of business routine, besides an appendix giving in full the laws referring to the forest reserves, fill the 133 pages of the compact little volume.

Perhaps we should make special mention of the chapter on Protection against Fire, in which a well-directed appeal is made for co-operation by citizens' fire brigades, and reliance is placed on the co-operation of all interested persons.

There is nothing radical attempted in any part of the instructions; evolution rather than revolution and simple common sense characterize this beginning of an American Forest Administration.

We congratulate the Forester on his success in having attained this long-hoped-for consummation of reform which has been a decade in coming.

B. E. F.

Report of the Chief of the Bureau of Forestry of the Philippine Islands for the year beginning Sept. 1, 1903, and ending Aug. 31, 1904. By Capt. George P. Ahern, Manila, 1905, pp. 94.

This report shows that marked progress has been made in the organization of the forest work of the Islands. During the year covered by the report the Forest Act was established, a law whose provisions are sufficient to safeguard in the future the proper use of the forest resources. This Act together with a set of Regulations has been published in a handy form for the use of forest officers and lumbermen. The law replaces the military act which was really an extension of the old Spanish laws. One of the important changes in the law was the reduction of the charges on timber, taken from Government land, of from thirty-five to sixty per cent. This was done to stimulate the the demand for timber. Events since Aug. 31, 1904, seem to show that the expected increased demand has not taken place.

The report shows that the plan of organization outlined by Mr. Pinchot during the previous year has already been put into effect at least in part. Divisions of Inspection, Forest Management, and Accounts have already been established and it is only a step to the organization of a Division of Forest Products, the work of testing timbers and studying economic products now being under the chief of the Division of Forest Management. The report describes the first attempt to introduce American methods of lumbering in the Islands, and the difficulties in transportation of machinery and product, in obtaining good labor and so on are clearly shown. This description together with the tables of prices of Philippine and imported lumber are discouraging to the average lumberman seeking possible investment. The prices for native lumber in Manila average from $50 to over $160 per thousand. Oregon Pine is laid down in Manila for $40 to $50 per thousand. The Pacific lumber is cheaper for general construction and it is lighter, more easily worked and more cheaply handled than native wood. The popularity and cheapness of American lumber is bound to effect the problem of lumbering native woods.

The report of the timber testing laboratory is of especial interest. A large number of tests of strength have been made which show the value of some of the species hitherto not highly prized. The Bureau work-shop has done a great deal to show the value of native wood for cabinet work.

The new law provides for the establishment of forest reserves. Already one reserve has been set aside, in the province of Bataan. The primary purpose of this reserve is for experimental research. The work so far done has been largely botanical, but the plans of the Bureau include extensive silvical investigations.

One of the interesting features of the report is the individual annual reports of the field officers. These contain detailed descriptions of the forest conditions of different provinces, and enable the outsider to obtain an excellent idea of the forests of the islands. The Forest Act provides for the registration in the Bureau of Forestry of private lands. There are 132 private tracts aggregating 106,877 hectares, the largest being 13,202 hectares. During the year of the report the amount of timber cut on the public land was 4,916,562 cubic feet, in addition to 230,417 cubic feet of fire wood. The financial showing is excellent, the receipts from forest products being $599,480.58 (Mex.) The report is illustrated by twenty-five excellent photographs and a map showing the distribution of the forests.

H. S. G.

Proceedings of the American Forest Congress. Held at Washington D. C. January 2 to 6, 1905, under the auspices of the American Forestry Association. 1905. 474 pp. 8°. Price $1.25.

This volume records the papers and addresses delivered at one of the most notable, if not the most notable, propagandist meetings which have been organized to promote the subject of forestry in this country, notable especially for the participation in it of the President of the United States, of the Ambassador from France, and of a number of leading railroad and business men.

It reminded us very much of the first American Forestry Congress at Cincinnati in 1882, although the character of the participants and of the presentation of the subject marked the progress which has been made in the 23 years of propaganda since that first beginning of associated effort. The economic importance and pressing need for active restorative measures had brought out representatives of the various forest interests, lumbermen and wood manufacturers, railroad presidents and managers, also timberland owners, engineers and professional men, as well as congressmen and other representative public men.

It is natural that much laudatory oratory as well as deprecatory harangue should swell the speeches at such occasions, nor is it to be expected that much that is new to professional men should appear in such addresses. The important feature is the attitude of the speakers and the commitment of leading men of business to an expression in favor of conservative forest policies.

In the 60 papers and addresses every phase of the subject which appeals to public interest is touched upon, and here and there also crumbs of valuable information of technical character may be gathered.

The subject matter is divided into seven parts: Forestry as a national question; Importance of the public forest lands to irrigation; The Lumber Industry and the Forests; Importance of the public forest lands to grazing; Railroads in relation to the forest; Importance of public forest lands to mining; National and State forest policy.

If we were to point out the particular address which was of most interest to us, it is that of Mr. C. D. Walcott, which gives, although with important omissions, a bit of detail history, hitherto unpublished, of the origin and early troubles of the National reserve policy. Altogether as a historic document the volume will retain its value.

B. E. F.

The Maple Sugar Industry. By Wiliam F. Fox and William F. Hubbard, Sc.Pol.D., with a discussion of the adulterations of Maple Products, by H. W. Wiley. Bull. No. 59, Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1905, pp. 56.

The first part of this bulletin comprises an historical sketch of the maple sugar industry and a statement, illustrated by maps, of the production of sugar and syrup in different regions up to 1900. Then follows a general description, botanical and silvical of the different native maples. The most interesting part of the paper is that dealing with the requirements of a properly managed sugar grove. Rules are given for making improvement cuttings in groves which are too dense or contain undesirable species, and simple instructions are given for planting new groves. These recommendations show the hand of a trained forester who studied the problem on the ground, the diagrams and photographs add a great deal to the effectiveness of the discussion of handling groves. These suggestions and the description of the methods of manufacture should be of value to all producers and manufacturers of maple sugar and sirup.

H. S. G.

Improvement Thinning. By Alfred Akerman, M.F. Bull. No. 2. Issued from the State Forester's Office. Boston, Mass., 1905. pp. 14.

An admirable paper on the subject of improvement thinning, with particular reference to the small owners of Massachusetts. In the introduction the writer shows clearly that improvement thinnings are practical when properly carried out, at least in most parts of Massachusetts; then the theory of thinnings is explained; then the practice and finally the results of the work are discussed. Though the pamphlet is designed for the popular reader, foresters will find a great deal of profit in a careful study of it.

H. S. G.

Insect Injuries to Forest Products. By Dr. A. D. Hopkins. Yearbook of the U. S. Department of Agriculture for 1904.

This article deals with those insects that do such damage to commercial products as to be the cause of serious losses. The classes of material to which the author gives consideration in his discussion of insect injuries are round timber, rough lumber and other crude products, seasoned rough and dressed lumber, construction timbers, stored oak and hemlock bark, and medicinal bark, roots and leaves.

After giving an estimate of the financial loss resulting from insect damage, Dr. Hopkins then presents some valuable suggestions for preventing wastes of this nature. The "distinctive character of insect injuries" is carefully discussed in detail, the nature of the injuries being illustrated by excellent cuts. "Conditions favorable for insect injury" receives comprehensive treatment and gives careful thought to some of the requisites necessary to prevent the damage caused by the class of insects which are dealt with in this article.

The paper is an exceedingly interesting one from the view point of the entomologist and the information which it contains is particularly valuable to all lumber dealers and others who handle the products of the forest, such as pulp-wood, tan-bark and the like. The treatise is one which should also be in the hands of every thoroughly informed forester.

G. E. T.

The Nut Weevils. By F. H. Chittenden. Yearbook of the U. S. Department of Agriculture for 1904.

The production of nuts for commercial purposes is an industry in many respects allied to forestry and somewhat closely associated with that profession. Moreover, in the U. S., it is a productive activity of growing importance and increasing magnitude and especially is this true of chestnut culture in recent years.

In the opening remarks of the article appears the statement that "nut-growing in the U. S. would be a much more profitable industry were it not for the insects which inhabit the kernels, rendering them unfit for food." Dr. Chittenden limits his discussion to a consideration of chestnut, pecan and hazelnut weevils. Each of the weevils is described and the life histories given of the two species of chestnut weevil. The remedies and preventatives for controling the weevils receive comprehensive treatment.

The article, while of interest to the entomologist, is particularly valuable to all those engaged in the growing of nuts for market, especially the chestnut and pecan, and is worthy of the attention of all who are engaged in forestry work.

G. E. T.

Forest Planting and Farm Management. By George L. Clothier. Yearbook of the U. S. Department of Agriculture for 1904.

The subject of forest planting in its relation to the economy of the State is one of great breadth. This phase of forestry has, therefore, been given every consideration and a prominent place in the Government work, and several of the States, some corporations and not a few private owners have deemed it worthy of attention. Even though a keen interest is being taken in the planting of trees the immensity of the field is such that the work can as yet be considered only as merely having begun.

In the opening remarks of this article on forest planting there appear two statements of a leading character which give the reader an idea of what he is to expect in the discussion of the subject. The writer states that "one of the ways in which present methods of farm management may be greatly improved, is by a better recognition of what may be called farm engineering, or farm designing ; and this in turn must give an important place to the consideration of farm forestry." Further, "economical management may be attained by a scientific adjustment of the parts of a farm, just as the utility of a great building may be increased by the careful planning of a qualified architect."

The " need of forest planting" is briefly considered yet clearly set forth. The mistakes that have been made in the past receive just treatment. What these mistakes have been are undoubtedly more familiar to Mr. Clothier than to any other one person in the country for the reason that so many of them have come under his personal observation. The major discussion, however, deals with "what should be considered in the preparation of a planting plan." A concrete example and an ideal plan for a model prairie farm are each discussed, amplified in both cases by diagrams. A scheme for planting and a list of species to plant are also included. The value of planting about the homestead is an interesting consideration well treated and is illustrated by a diagram.

The importance of windbreak belts and the necessity for the protection which they afford is emphasized in the discussion. The furnishing of material for fuel, fence posts and other like uses, is a further economic consideration presented for the reader's benefit. The principles set forth and the suggestions made are particularly applicable in the states of the Middle West but are not without practical value for other portions of the country.

G. E. T.

Attitude of Lumbermen toward Forest Fires. By E. A. Sterling. Yearbook of the U. S. Department of Agriculture for 1904.

Those agencies which, like fungi, insects, etc., cause damage to the forest and are the source of greater or less loss, take a secondary place when compared with the damage inflicted and the losses incurred by forest fires. But "certain as it is that fire is the greatest of forest evils, there exists comparatively little accurate knowledge on which to base an estimate of the total loss from this source." Mr. Sterling gives some monetary estimates of the waste caused by fire, discusses briefly those damages which are not usually given due consideration as for example the destruction of young growth, and in discussing all these fire losses brings out the point that the region in which the lumbering operation is conducted affects the extent of the damage done.

A consideration of the erroneous ideas entertained in respect to the effect of fires carries the reader along to the views held by lumbermen in regard to the fire evil, his attitude in the past having been one of indifference. The "needs and possibilities of forestry," "the end of the virgin timber supply" and "the improved tone of the lumber market" are modifying past conditions and "these changes are making it profitable for timber owners to cut more conservatively and to hold their land for future timber production." The lumbermen have, therefore, become more favorably disposed toward fire protection. The writer next sets forth the primary considerations to be taken into account in a scheme for fire protection and discusses these under the following heads:

1.—Burning slash.

2.—Plan for protecting mature timber.

3.—The question of second growth.

In the summary remarks the statement is made that "it may be said that economic conditions produced by an overestimated abundance of timber have been mainly responsible for the hopeless inactive attitude of lumbermen toward forest fires. They have been tolerant of, rather than aggressive toward, this greatest of forest evils." Again, "adequate forest fire protection is a big and difficult undertaking at best, but if approached as such and if serious, systematic action is taken by individual lumbermen, the solution will be found."

G. E. T.

Jahresbericht über Veröffentlichungen und wichtigere Ereignisse im Gebiete des Forstwesens, der forstlichen Zoologie, der Agrikulturchemie, der Meteorologie und der forstlichen Botanik für das Jahr, 1904. Herausgegeben von Dr. Karl Wimmenauer, Frankfurt, 1905. Mk 3.60

This most useful annual record and survey of forestry literature is published as a supplement of the monthly Allgemeine Forst-u. Jagdzeitung.

It contains on 87 double pages in most condensed form all that has been discussed in the magazine literature of the world during the year which may be considered of permanent interest, and also records the book literature. The information is classified in nine chapters, each one prepared by an expert in the particular line, and each with varying sub-classes, the eye is further assisted by differentiation of type, so that one can quickly find the subject discussed.

An index is, as in so many German publications absent, reducing the value of the otherwise excellent performance. A summary index comprising the last ten years is under contemplation, but it is hoped that the ease with which such a

"Gesammtregister" could be compiled if each number were indexed will be recognized and the present deficiency remedied.

B. E. F.

Holzproduktion und Holzhandel von Europa, Afrika und Nordamerika. Von Julius Marchet, I Band. Wien 1904. Price 12 K.

This is a very painstaking compilation of the export and import conditions of wood in the various European countries, the second volume to include North America and Africa. The compilation is made officially by a competent man, Professor at the Hochschule für Bodenkultur at Vienna, and besides the dry tables, analysis of the peculiarities and special conditions of the wood trade is made, and the various movements of wood traffic explained.

With the completion of this work it is expected that an important contribution will have been made towards the important question of conifer supplies for the world.

B. E. F.

Festschrift zur Feier des 75 jährigen Bestehens der Grossherzogl. sächsischen Forstlehranstalt Eisenach. Herausgegeben vom Lehrerkollegium. Eisenach, 1905. Price, k. 3.

Contains, besides historical data, three articles deserving general attention, namely by Dr. Stoetzer, *Sturmschaden und Forsteinrichtung*; by Dr. Matthes, *Der Plenterbetrieb*, an historical study; by Pfeifer, *Die Ziele und Aufgaben der Forsteinrichtung in der Gegenwart.*

B. E. F.

Le Bois. Par J. Beauverie. 2 vols., 1402 pp., 16 plates, 485 illustrations. Paris, 1905.

Attempts to bring together all knowledge regarding production, anatomy, chemistry, physics, pathology, preservation, prices, exports and imports, industrial uses, etc., of wood. As far as possible the work of all authors is cited without judicial selection.

B. E. F.

Report on an Examination of a Forest Tract in Western North Carolina. By Franklin W. Reed. Bull. No. 60. Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1905. pp. 32.

A description, and general recommendations for the management of a tract of 16,000 acres in Western North Carolina owned by the Linnville Improvement Company. The bulletin is of special interest to foresters because of the excellent description of the various types of forest represented on the tract. The description is accompanied by tables showing the average number of trees of different diameters for separate species and the yield per acre in merchantable timber. The general reader would be more interested in the recommendations for handling the forest, as illustrating how forestry is applied to a large tract of wild land which is held chiefly as a pleasure park. We heartily commend the publication of the work done by the Government for private owners.

H. S. G.

Practical Results of the Cup and Gutter System of Turpentining. By Charles H. Herty, Ph.D. Circular No. 34, Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1905. pp. 7.

An important circular showing the practical results of three years experimental work of gathering turpentine by the new system of cups. The experiment was conducted on the turpentine farm of Powell, Bullard & Co., at Ocilla, Ga. The results show that the trees treated under the new system yielded in three years 30% more than those boxed by the old method. The circular explains certain improvements in the implements used and in their application.

H. S. G.

OTHER RECENT LITERATURE.

Laws of Vermont Regarding Forestry. Regulations of Commissioner as to Tree Planting. Suggestions as to Forest Fires. Bull. No. 1. Issued by the Vermont State Forest Commissioner. Pittsford Vt., March, 1905. Pp. 16.

Messages from the President of the United States, submitting the Preliminary and Second Partial Reports of the Public Lands Commission, appointed Oct. 22, 1903, to Report upon the Condition, Operation, and Effect of the Present Laws, and to Recommend such changes as are needed. Senate Documents, No. 188, Fifty-eighth Congress, Second Session, and No. 154, Fifty-eighth Congress, Third Session.

Recommendations of State Game Commissioners and Wardens for 1905. Circular No. 47, Division of Biological Survey, U. S. Dept. of Agriculture, Washington, April 15, 1905. Pp. 12.

The Red Gum. By Alfred K. Chittenden, M.F., with a Discussion of the Mechanical Properties of Red Gum Wood, by W. Kendrick Hatt, Ph.D. Bull. No. 58, Bureau of Forestry, U. S. Dept. of Agriculture, Washington, 1905. Pp. 56.

Research in Ecology. By Frederick Edward Clements, Ph.D. The University Publishing Co., Lincoln, Nebraska, 1905. Pp. 334.

The Determination of Timber Values. By Edward A. Braniff. Yearbook of the U. S. Department of Agriculture for 1904.

Connecticut Laws Relating to Forests. Compiled by Austin F. Hawes, State Forester, Hartford, Conn., 1905. Pp. 12.

PERIODICAL LITERATURE.

In Charge :

Botanical Journals---------------------R. T. FISHER
Foreign Journals--B. E. FERNOW, R. ZON, F. DUNLAP
Propagandist Journals-----------------H. P. BAKER
Trade Journals-------------F. ROTH and J. F. BOND

FOREST GEOGRAPHY AND DESCRIPTION.

Forest Practices in Bohemia

In the latest of his comparisons of the more important practices and policies found in the forests he has visited, Dr. Martin gives an insight into the forestry of the large private estates of Bohemia. In most respects, in the method of subdividing the forest into lots, in the laying out of the roads, in the serial arrangement of the annual felling areas and in determining the felling budget, in the rotation, in the kind of material produced, and in many of the practices of silviculture the methods are markedly similar to those current in Germany. It is the existing differences which are most instructive and to them we will direct our attention.

The forest service at Gratzen exemplifies the practice of having the periodic revision of the working plan made by a permanent bureau and not, as is the custom in Germany with the "taxation" as it is called, by a special board chosen for each district as the time for this revision arrives. In so far as this revision consists in determining what part of the forest is to be cut over in the next decennial period and in calipering the stands to assure the proper volume of cut, the German method is good enough. But this is the immediate, not the final aim of the regulation work. Beyond this is the broader field in which the forest property is considered as a whole. Simultaneously with the usual work of forest, survey measurements are made and statistics gathered for fixing upon the yield and rotation and for determining the increment both of volume and value. These calculations occupy the bureau of regulation indoors. That a permanent bureau would acquire a higher degree of efficiency in this work and devise improved methods of procedure as to details is to be expected. A tendency to make this change is also noticeable in Germany.

Studious attention to the possibilities of the soil at Gratzen has resulted in the growing of a variety of species to best utilize the sites. There are stands of Spruce, Pine, Fir, Oak and Beech in various parts of the forest and grown and reproduced in different fashions. Old stands of beech and oak are reproduced with special regard for the oak. Where no adverse conditions are met regeneration is secured by the regular shelterwood method; where differences in soil or exposure occur or where for any reason seeding is rendered less certain under this plan, the group method is applied ahead of the regular regeneration.

For Spruce clear cutting with artificial reforestation is the usual practice. In higher altitudes plants transplanted twice or even oftener are used, while to a less extent other methods, even natural regeneration, are used in restricted areas where conditions favor.

Underplanting of promising stands of Scotch Pine with Fir and Beech when 60 years old is practiced in Gratzen much as in the more advanced parts of Germany. Where conditions of stand warrant it and there is no reason to expect a volunteer undergrowth, this is a practice to be recommended. Compared with similar German practice the planting here is made a decade or two later than desirable. By the earlier underplanting more valuable material is produced in the underwood by the time the main harvest is ready for the axe. The hardwood species are either planted separately or in mixed groups, or else are regenerated naturally.

In group regeneration the small areas opened up have at once an immediate and permanent advantage over the adjacent untouched portions of the stand, in the direct exposure to the rains, in the insolation, which while not direct is greater than under the shelterwood, in the more rapid humification of soil cover, and in the protection against frost and heat and drought. After these groups have been started to oak or whatever species is used, the main stand is then regenerated for pine. This method of securing group mixture by natural regeneration has of late years been quite successful, though recognized as more uncertain and risky than the artificial planting which is the general practice in North Germany.

The doctrine has often been advanced that two kinds of forestry exist, one for the state and one for individual practice. To show how little this difference obtains in such *large* private holdings nothing is more conclusive than the practices here found. The theory of production is the same and soils yield their highest under certain courses of management regardless of whether such are carried out by the state or privately.

Kritische Vergleichung der wichtigsten forsttechnischen und forstpolitischen Massnahmen deutscher und ausserdeutscher Forstverwaltungen. Zeitschrift für Forst- und Jagdwesen, February, 1905. pp. 82–96.

England

A note on forest conditions of England points out that while the country is well studded with trees, it lacks real forest areas, the total acreage of these representing less than five per cent. of the land area. The home production is about 2 million tons of building material, as against 11 million tons import, the latter having more than doubled in the last 30 years. During the years from 1897 to 1903 the imports, including wood manufactures, rose in value from 130 million dollars to over 140 million, with a maximum of 143 million dollars in 1900.

Englische Forstwirtschaft. Allgemeine Forst und Jagdzeitung, May, 1905, p. 183.

Forest Conditions in Sweden

As a result of an extended journey by the Austrian Forestry Association to Sweden a very full report of conditions in Sweden is printed through four issues of the Centralblatt. Forty-four members, mostly professional foresters or owners of forest estates, traveled for several weeks through the country from south to north, under the guidance of forest officers delegated for the occasion, and the report naturally touches on all questions from forest geography and history to forest exploitation and management.

The distribution of species is explained by the history of plant evolution as exhibited in the layers of the moors. In Quarternary times forests of Birch (*Betula alba*) covered the belt which to the north limited the Arctic flora, to the south the Pine (*Pinus silvestris*) forest. The latter expanded and forms to-day the most prominent feature. The Spruce (*Picea excelsa*), imigrating later from Finland, occupies largely the northern section, and is gaining ground as against the Pine. Oak and Beech came from the south and were stopped by climatic conditions at the lower reaches of the Dalelf (river). Only in middle Sweden do Spruce, Pine, Oak, and Beech meet.

The southern part of Sweden is largely farm land and only when more profitable is forest growing justified. The market for fuelwood, in spite of the extensive use of turf, is so good that even the brushwood can be sold; the price for fuelwood stumpage (Beech) is $3.00 to $7.00 a cord, and in one place is reported (incredibly) at 20 cents per cubic foot, which is nearer the price of workwood. An intensive Beech forest management for fuel with 120-year rotation at Skabersjö pays $2.00 to $2.40 per acre per annum (elsewhere over $3.00), cutting, as in Denmark, 8,400 cubic feet in the final harvest and 11,000 cubic feet (?) in thinnings, which are made early (20-30 years), often (every 3 years), and severe. For regeneration the soil is either hoed or worked with a harrow to secure a seedbed (sometimes also without such preparation). Sometimes Pine and Larch are planted first and the regeneration secured under their light shade, the Pines and Larch being cut out when 30 to 50 years old, since they are attacked by fungus.

In another part of this section some Oak plantations were visited, the remarks on which it may be useful to repeat for the benefit of our forest planters. Since about 1830 old fields and pastures were planted and sown to Oak, not more than 600 to the acre. This open stand soon necessitated admixture of other species, for *Oak needs dense stand in its youth.* Therefore Larch, Pine, and Spruce were used for underplanting, together with sowings of Birch to secure clear boles. If the open spacing of the Oak was a mistake, the choice of these species was not more fortunate. Due to the very rapid height growth of these, they soon began to crowd the Oak, and they had to be cut out or pollarded. In this way again open Oak stands with small crowns had been created, which were underplanted with Spruce, Fir, and Beech. With Spruce the experience was poor, as was to be expected; the Spruce soon crowded the Oaks as did the Fir, but Beech did good service. As a result of these mistaken measures the 70-year-old stands of Oak, with 160 trees to the acre, show hardly 2,000 cubic feet to the acre.

Forty or fifty years ago considerable planting of mixed Spruce and Fir was done with great success on the granite soil of the Omberg Mountain, where in 30 years 2,000 to 2,500, and in 40 years 3,200 to 3,800 cubic feet are grown. In a 41-year-old stand of Spruce the average height was 43 feet, average diameter, 5.3 inches, number per acre 1,480, total cross section area, 184 square feet, contents, 4,400 cubic feet; the average increment per year, therefore, was 107 cubic feet, an excellent performance. Yet, in another 45-year-old Spruce stand the average production was as high as 182 cubic feet. And similar increments were recorded from Fir plantations and from mixed growths.

North of Upsala is found the limit of the Oak, and the Pine becomes prominent, with Spruce subordinate in mixture, and Birch interspersed. Silviculturally of interest is that, contrary to the experiences in northern Germany, where only clearing with planting is practised, the natural regeneration of the Pine is a decided success, and that it develops favorably in mixture with the Spruce. For seed-trees 12 to 20 trees with high crowns are left and the ground is burned over soon after the snow melts. It is stated, however, that no difference of success was noticeable on the burned and unburned areas. Seed years occur only every 7 to 8 years. The seedtrees are either left to grow into the second rotation or removed a few years after the seeding. Frequently Spruce is introduced by sowing seed-spots, the Spruce assisting in the clearing process. Stumpage in the well located forest district of Elfkarleö is still only 7.5 cents per cubic foot up to 11 cents for the finest grades of Pine; for Spruce about 20% less.

One of the largest sawmills at Bornhus, employing 1,400 men, is described as with 12 double and 18 single gangsaws, 9 slabsaws, 35 electrically driven trimmers, 875 horse power engines and all sorts of finishing machines cutting 1,300,000 (rather small) logs representing about 660,000 trees or about 13 million cubic feet (75 million board feet), two thirds Pine (redwood), one third Spruce (whitewood). The exceedingly fine-ringed material justifies the high reputation of Swedish ware. It takes one to two years to get the material by water to mill, but being then at seaport it competes favorably on the world market.

There are 10 per cent firsts and seconds, 15, 35, and 40 per cent falling to the other grades, bringing, respectively, 95, 85, 62, and 60 dollars per standard (165 cubic feet) on board ship at Gefle, or about half these prices per M board feet.

North of Elfdalen the true forest country begins with a forest cover still sometimes exceeding 75 per cent of the land. A survey of over 200,000 acres of virgin forest in the Kronapark showed only 33 trees per acre over 8 inches in diameter, mostly Pine. To make a tree 13 inches in diameter takes 160 to 200 years. Applying this diameter limit of 8 inches, 112,000 acres were culled, the auction price for the stumpage being $1,200,000. This cut left only 88 trees over 4 inches per acre. The regeneration is to be natural, but hopes are by no means fulfilled, fire making an additional difficulty. As is evident from the enumeration, the original stand is remarkably open, even sunny, and this is characteristic of the northern forest, as well as small crowns and thin foliage. According to Wiesner, the light requirements of trees grow with the latitudes and in the Artic zone are at a maximum, light and temperature being vicarious in their effect upon assimilation; hence the pyramidal form and loose structure of the crowns. The height growth is equivalent only to that of the 4th site class in North Germany. Diameter growth, at first rather rapid, sinks rapidly, so that in the sixth year it sinks below one-tenth of one inch, and after 150 years is rarely above one-twentieth.

The selection system practised shows itself detrimental in soil deterioration with weed growth which prevents regeneration, besides forest fires which appear to be a usual phenomenon. At present fire watch towers with telephone connections are erected to reduce the danger. The description of these maltreated forests reminds us very much of our own typical forest wastes.

As with us, only lately has a beginning been made towards improvement. (See Quarterly, Vol. II, No. 4, p. 272.)

Die Studienreise des Oesterreichischen Reichsforstvereines nach Schweden im Sommer 1904. Centralblatt für das gesammte Forstwesen, April and May, 1905, pp. 124–135, 176–187 and 219-226.

Forestry in New Zealand

The annual report of the Chief Forester for New Zealand for the year ending March 31, 1904, contains some interesting data in reference to the forest work on these islands.

The first appropriation for plantation purposes was made in September 1896, and up to the 31st of March 1904, 18,293,682 trees had been raised in nurseries, of which number 6,644,259 seedlings were raised in 1903 and 1904. The total area now planted is 2,479 acres, on which are 5,359,307 trees. Of this area 10,040½ acres containing 2,451,151 trees were planted in 1903 and 1904. The total expense from September, 1896, to the close of March, 1904, was $272,164.82, and the total value of the investment on March 31, 1904, was $397,591.67. There are at present six nurseries and ten plantations. The government authorizes 5,000,000 trees to be grown annually; but it is difficult to order the exact quantity of seed to produce this number, as weather influences and variations in the seed make the estimate uncertain. The cost of planting trees by free labor on the plantations varies from about $2.80 to $5.00 per thousand.

The Forestry Department was successful in propagating "totara" and "puriri" from seed. Both of these are very valuable and durable native trees. Several Gums, Cork Oak, and Hardy Catalpa were successfully raised from seed. Prison labor has been utilized in preparing the land and transplanting trees at a number of the plantations with quite satisfactory results. There is considerable agitation for the creation of extensive reserves for the growth of timber for the future.

Forest Leaves, June, 1905, pp. 40 and 41.

FOREST BOTANY AND ZOOLOGY.

Douglas Spruce in Germany

Attracted by the frequent plantations of Douglas Spruce which one finds throughout the length and breadth of Germany, Dr. Schwappach has measured the stands of some of those most accessible to him and made a small number of tests with such specimens of the wood as he could readily obtain in order to get some basis for an opinion as to what this introduction was doing in Germany, what was to be expected of it in the future, and with what favor its further spread was to be looked upon. The report is favorable. On account of the small size and number of the sample plots and of the small number of test pieces at disposal, his recommendations are temperate. He limits himself to stating that the species has fully justified the hopes put in it, and there is no reason to believe it will not continue to do so.

In detail a comparison of a 22-year-old stand of Douglas Spruce of average annual increment, 134 cubic feet per acre, with a 28-year-old stand of Norway Spruce, showing growth of 126 cubic feet, is quite favorable to the newcomer, and when the difference in age is considered, there is every reason to look for a more marked difference a decade hence. The number of trees per acre is greater in the Norway; the Douglas already exceeds in height. The Norway shows more cylindric stems and greater basal area, but the difference in age at this period (six years) accounts for much.

Wachtumsleistungen und Holz von Pseudotsuga Douglasii in Deutschland. Zeitschrift für Forst- und Jadgwesen, May, 1905. pp. 282–287.

American Trees in Great Britain

The publication of Evelyn's work in 1664 gave the first impetus to the planting of American trees in Great Britain. Some few trees were introduced into England in the seventeenth century, and many more during the last two centuries, when Michaux and others did much by their writings to arouse interest in the trees of the United States. Menzies, Douglas, and others brought seeds of the Pacific Coast conifers to England before these trees were well known in their native country. The climate of England is extremely varied, but is on the average more like that of Oregon than that of New England or the Middle or Southern States, and in consequence most of the Pacific Coast conifers are more common and succeed better in England than our eastern trees.

It is an interesting fact that some of the common trees of the Eastern States will not grow at all in England, while others succeed admirably. Black Locust grows to even a greater size than in its native habitat. Black Walnut succeeds the best of all of our timber trees, but only on good land in the south of England, where it often attains a height of one hundred feet in one hundred years. Red Oak grows well and ripens acorns freely, but White Oak refuses to grow at all. Pin Oak and Willow Oak succeed to a certain extent, but the black oaks are failures. Our native Beech and Sycamore are not satisfactory, and hence have almost entirely disappeared. Sassafras, Thorny Locust, Black Gum, Coffeetree, and Persimmon all grow in favorable soils in the south of England, but not to any size. Hickories are seldom seen and never equal in dimensions those found in the United States. English summers are not warm enough for *Catalpa speciosa*, though it will exist in very favorable places. The American maples seem to demand colder winters and rarely live long or attain large size. The same is true of Boxelder and Birches. Of our eastern conifers, those that succeed best are White Pine, which has attained heights of over one hundred feet, and Bald Cypress, which becomes almost as tall but never ripens seed.

The success of some of the Pacific conifers in Great Britain has certainly been astonishing. Douglas Spruce, Sitka Spruce, and Western Red Cedar have so far succeeded as well as in Oregon and Washington. Several of the western cypresses and Western and Lyalls Larch also have been tried with success. A very fine avenue of Redwoods is growing upon the estate of the Duke of Wellington. These trees are exceptionally fine specimens, sixty to eighty feet high. It is thought by some that this tree will take rank as a timber tree, although the wood is almost too soft to be much liked and the persistent lower branches which droop and lie on the ground make it better suited for ornament.

American Trees in Great Britain. Arboriculture, May, 1905, pp. 83–85.

SOIL, WATER, AND CLIMATE.

Irrigation and Forestry

A further report on the Austrian experiments on the effect of irrigation (see Quarterly, Vol. III, p. 172) is made by Dr. Cieslar. This report refers to young plantations. After referring to the law of the minimum the author attributes to water supply an importance greater than any other factor, both in its excess and deficiency as in its optimum.

With regard to maximum production the water requirements of plants are very considerably influenced by temperature and humidity of the air, and by physical conditions of the soil.

To secure the maximum production the less water is necessary, the less the soil retains it. Soils of coarser grain and containing fewer colloidal substances, like sand, produce a maximum yield with less water than clay and humus soils, which require more.

In a series of experiments of older date (1893) the author had shown that watering in the nursery increased the production of Spruce by 15 per cent.

The present experiments were made on a soil of only 20 inches to an impermeable conglomerate in a region poor in winter humidity and only 12 inch rainfall during the four months May to August.

White Pine (4-year-old) and Spruce (3-year-old) were planted, 400 plants each, irrigated and not irrigated, and later (1903) *Pinus divaricata* was used to replace failing plants of White Pine. The irrigation was accomplished by open ditches flooding between the rows of plants, and at each watering the water was allowed to flood from 8 to 15 minutes. After two or three rainless days, and in longer drouths every third day, from May to September the water was applied.

Omitting the detailed observations, the curious negative behavior of the White Pine is notable in the table which refers to conditions in the third year of the experiment:

	SPRUCE		*WHITE PINE*		*BANKSIAN PINE*	
	watered	*not watered*	*watered*	*not watered*	*watered*	*not watered*
Loss of plants since start, %	5.7	10	51	33	1.1	1.6
Height growth in 3d year *cm.*	12.5	7.5	4.8	9.4	6.7	3.6

The main ditch exerted the most powerful influence, the first three rows of Spruce showing average heights of 11, 6.9, 5.4 cm. respectively.

The year 1904, the fourth year, was very drouthy, hence observations in this year are of special interest.

	SPRUCE		*WHITE PINE*		*BANKSIAN PINE*	
	watered	*not watered*	*watered*	*not watered*	*watered*	*not watered*
Loss since start, per cent	6	68.7	57.7	70.2	1.1	60.6
Loss in last year, per cent	.3	58.7	.7	37.2	—	59
Height growth 4th year, cm	13.1	7.6	6.	11.1	10.3	11.1

The inability of the Banksian Pine to resist the drouth is notable but is explained by the fact that the plants were younger. Only the neighborhood of the main ditch saved the plantings and non-irrigated plots. The flooding, to be sure, improved the heightgrowth, but it also favored still more the growth of weeds making a close sod and mat of roots in the upper layers. On the other hand, where, as along the main ditch on the non-irrigated plots, the water had benefited the trees by capillary action, weedgrowth was not developed, showing that sub-irrigation is preferable. On the non-irrigated plots the influence of the ditch was effective in preventing loss from drouth; in White Pine this extended to the 9th row, *i. e.* 22 feet, in Banksian Pine to the

8th, in Spruce only to the 6th row. Similar relations were seen in the heightgrowth; the two American species showing more independence of moisture.

Another experiment with Spruce from Sweden and Spruce from various elevations in the Sudetes mountains showed that the loss from drouth was not only in relation to the size of the plants but also to elevation and latitude of their home, the smaller, those from higher altitudes and latitudes suffering the most.

Bewässerungsversuche im Walde Centralblatt für das gesammte Forstwesen, May, 1905, pp. 195–211

Forest Meteorology

A review of the weather for 1904 as recorded at the meteorological station at Eberswalde has been prepared by Dr. Schubert. The usual data, showing the temperature and absolute and relative humidity at two hours of the day, 8 A. M. and 2 P. M., instead of once as is customary with us, the hours of sunshine and the precipitation per month, and the frequency of the wind of each month from eight points of the compass are stated in concise and readily interpretable form. In addition to the total precipitation, within each month there are also given the maximum and minimum within 24 hours and the number of days showing more than 2 mm., figures which give some idea of the intensity and distribution of the rainfall.

In conclusion, observations made during the year on variations in temperature and humidity in the lower strata of the atmosphere and the soil beneath are appended. These go to show that while there is only a slight but constant variation in the temperature at a height of 2.2 meters within and without the forest in summer, that within being the lower both at 8 A. M. and 2 P. M., the differences at a height of 0.2 m. are very considerable, on sunny days as much as 2° C., and even a greater difference being not unusual. Inside the forest the difference for the two levels is small, while in the open field it averages about 1° C., so that at the upper level the open station shows still a difference of nearly one degree of higher temperature.

Other experiments go to show that the temperature of the surface of the ground and of the lower strata of air directly overlying it may vary independently, hoar-frost being formed when atmospheric temperatures have not fallen below zero centigrade and dew being deposited during nights when lower temperatures were recorded. No attempt is made to close the discussion ; too much remains to be done in the future.

Die Witterung in Eberswalde im Jahre, 1904. Zeitschrift für Forst-und Jagdwesen, May, 1905, pp. 277–282.

SILVICULTURE, PROTECTION, AND EXTENSION.

Silvicultural Notes

Oberförster Dr. Heck continues and concludes his critical remarks on a journey through South Germany and Austria, which contain not only valuable hints to professional travelers but also notes of general interest.

A visit to the exemplary forest management of the private estate of Kogl in Upper Austria, under the efficient direction of Forstmeister Vogl, some 25,000 acres, is pointed out as most instructive in regard to open stand and intensive finance management ; and the very efficient conduct of the Austrian Experiment Station at Mariabrunn is highly praised.

An experiment near Vienna to determine the influence of removal of litter in Austrian Pine (79 years old) on thin soil, with moss and lichen cover, conducted through 20 years, curiously enough shows practically as yet no deterioration in the stands ; indeed the area which has been annually robbed of its litter showed, after 20 years, the best height growth and with 233 cubic meter timberwood, the largest contents against 200 cubic meter for the area raked every 5 years, and 219 cubic meter on the untouched area.

Reference is made to the pot method employed for gathering turpentine from Austrian Pine, which seems to be much like that now under trial in our pineries.

A note on prices shows that Spruce logs of over 6-inch middle diameter, in the woods not far from Vienna (Forest Kogl), bring 6 to 10 cents per cubic foot, according to diameters (up to 24 inch). Pine logs and Beech bring about 1 cent less; Larch logs 5% higher. Oak and Ash over 12-inch diameter bring up to 23 cents per cubic foot, which may be equivalent to $35 per M ft. B. M.

In the open stand management at Kogl half the number of trees in a 50 to 70 year-old stand, regularly thinned before, is removed in 5 to 10 year intervals, cutting out the poorly growing, altogether about 120 trees, with 1400 to 2800 cubic feet contents. The remaining 120 trees, with 2800 to 5600 cubic feet, are left for 20 years. The increment in this open position is doubled, so that at harvest quantities, sizes, and money values are obtained which usually exceed those obtained from closed stands two decades later. In two larger fellings of 70-year-old Spruce the total average annual increment during the open position for 23 and 21 years had been 218 and 198 cubic feet and the value increment 3.9 and 3.6% respectively. Briefly summarizing the results of his journeyings the following points of interest are made.

1. The pure stands of spruce, which are found in great extent, are condemned as a silvicultural as well as economic mistake, even if temporarily advantageous. The rarity of Ash and Larch, in spite of their great value is to be regretted; the former would have prevented many snow breakages; the latter, if planted in proper places where the fungus disease could be avoided, would have added much value.

2. The use of exotics in group or single mixture with the best native species is to be encouraged. But while Sitka Spruce, Douglas Fir and Lawson Cedar are said to be thoroughly acclimated, White Pine is stated as frequently dying sooner or later in plantations. The native Silver Poplar is recommended together with our Cottonwood, as the most rapid in diameter and volume growth.

3. Mixed forest is best for natural regeneration, and natural regeneration is best for mountain forest. While even without lack of skill natural regeneration may fail here and there, when planting may be resorted to, the planted Spruce forests of Thuringia and other parts of middle Germany must be deprecated.

4. The backwardness in the practice of thinnings and the old-fashioned schematic prescriptions of the same in working plans is severely criticized and the thinning in the dominant with a selected harvest crop and free movement for the manager is advocated. Improvement thinnings (Reinigungshiebe, Nutzholzfreihiebe) are to be made even if the resulting material does not pay for the operation.

5. Of utmost importance and a necessity for the future is the transition to *Lichtungs-* and *Ueberhaltbetrieb.* (Open stand system and reserve of hold-overs) with or without underplanting, as developed in 40 years of experience in the Kogl forest (See "Aus der Praxis 25 jähriger Forstfinanzwirthschaft" von J. Vogl in Oesterreichische Vierteljahrsschrift, 1887); or at least the use of severest thinnings to secure the highest rate of increment, a single tree management after the 50th to 60th year.

6. The significance of form of shaft or bole has hardly yet been appreciated. Not passive but active favoring of the best stems, freeing them from neighbors for the purpose of increasing their rate of accretion! the best formed shafts make the largest accretions. This will lead to lower "financial" rotations. Even pruning to bring these best forms to perfection (at a cost of 20 cents to $2.40, average 80 cents per acre) will pay.

7. A proposition for uniform grading of logs has no interest for us except to call our own deficiencies in that direction to mind.

8. The remarkable lack of uniformity in holding out long or short logs, which prevails in the different parts of Germany is pointed out.

9. The increasing expenditure in the Würtemberg State forests for good roads (in 1902, 20 cents per acre or 2 cents per cubic foot of wood) with certainty of the profitableness of the investment furnishes a text for recommending such. Several more points we pass by as of more local interest. The very suggestive

article closes with the recommendation to divorce the forest experiment stations, as now mostly conducted, from the academic influence and merely coöperative conduct, pleading for independent organization with specially fitted experimenters not otherwise burdened with work, an institution such as is found in Mariabrunn.

Deutsche Reisebilder. Allgemeine Forst- und Jagd Zeitung, May and June, 1905, pp. 145–154, and 187–200.

Biology and Silviculture

In his inaugural lecture at the Hochschule für Bodenkultur in Vienna, Dr. Adolf Cieslar, the new professor of silviculture, gave a rapid survey of some of the biological basis of forest production, laying stress upon the need of testing all practice in the forest by the laws of plant physiology and of biology. German writers narrow —desirably so—the latter term to comprise only the broad phenomena of the life history of plants, and especially ecology and phaenology.

The first point raised is that the actual geographic range of plants does not always indicate fully their requirements of the site, and may lead to wrong conclusions: the struggle of species at the periphery of their field with other species, or mechanical barriers like waters and mountains have prevented them to exist beyond their limit where conditions are entirely favorable to their existence. Examples are found in the absence of Fir in the Scandinavian peninsula, where it thrives perfectly when planted; the natural extension of the field of the Spruce during historic times observed in that region; the success of alpine species, like the Larch, in lower altitudes.

Closer study of biological requirements (silvics?) is needed, than the rapid conclusion from the range of species.

The questions are raised and affirmatively answered whether not the biological characteristics of the stands of the same species grown in different climatic conditions differ, and whether not special qualities of value in silviculture are developed in species occurring under widely different climates, the species being in a manner biologically the product of the climates. A spruce stand on an alpine or a northern site develops entirely differently from a spruce stand at lower elevations or in a more southern range, where temperature conditions, light intensity, transpiration are entirely different. With the elevation sites become generally poorer, conditioning a retardation of differentiation into tree classes, hence increasing density, but this influence is counteracted by the necessity of more open position in higher elevations, because lower temperatures increase the need for light, as has been shown by Wiesner. But so far this knowledge is but scantily developed and hardly applied.

The question of heredity and transmission of acquired characteristics is answered by the correlation between site and form of plant; which often shows decided adaptations, leading to what systematists call species, but which often are merely climatic adaptations, like *Juniperus communis* and *nana* (and we could cite a large number of such climatic forms in the United States!). Follow carefully the changes of form in a species of wide range from north to south or from low to high altitudes and the variation of the extremes is found to be produced by gradual steps. The author adduces the Norway Spruce. The tree in the Alps grows exceedingly slowly, makes a bushy rounded form, densely branched, inclined to fork; in the extreme north it makes a small pyramidal crown with a slender long drawn-out spindling top. Even when transplanted or grown from seed into mild valley situations they show at least during the juvenile period, the same characteristics of rate of growth and form.

The amount of foliage of the Spruce near timberline is larger in proportion to its woody parts, in other words the tree of the valley produces with the same amount of foliage and chloroplasts a larger amount of wood than the alpine tree, a weight relation of 1: 1.8 for the former as against 1: .9 for the latter between foliage and wood was ascertained for 9 year spruce. The chlorophyll of the alpine form appears, therefore, less active, a highly important biological characteristic, due to climatic influence, and as this difference continues with plants grown from seed derived from the different sites, the ability to transmit such characteristics is demonstrated.

The author, who has worked on these biological lines, proposes the term "biological races" for such differences in substitution for his former name "physiological varieties."

The practical importance of realizing these distinctions appears from the observation, tbat in a concrete case a 9-year old plantation of alpine and northern spruce was only 20 to 32 inches high while one of low-land Spruce under the same conditions was 64 to 76 inches, more than double ; the crowns in the latter close up much earlier, hence a smaller number may be planted reducing cost, and the probability of continued larger production of wood is great. Even if the superiority were to last only 20 years, the difference would be important enough merely by the rapidity of growing out of the dangerous infantile period.

For the Scotch Pine similar biological races have been demonstrated, some of which were found resisting the "Schütte," the most insidious fungus disease of young plantations and nurseries. This latter experience is of great public importance and similar experience has led the Swedish government for its own plantations to order the exclusive use of plant material of Swedish origin, which has proved superior.

The paramount importance of light among biological conditions, and the need of minutest observance of its influence in every silvicultural operation in pure a swell as mixed growths, and especially in the measures for regeneration are accentuated. New knowledge of greatest interest regarding the relation of light requirements and site has been lately developed and still more is needed.

The increase of light requirement with altitude and latitude, due to temperature changes, indicates the advantage of more open stands for cold north exposures and for alpine situations, for severe opening for regeneration in such situations, and for denser position on warm south exposures and more southern climates. On good soil trees get along with less light, hence can grow more densely than on poor soil, hence from the point of view of assimilation more crownspace is required.

More knowledge is needed regarding the relation of soil humidity and light requirement, upon which to base rules for thinning; of the requirements at various ages to influence the rapidity of regeneration. Only the general statement, that in their youth trees need less light seems admitted.

With regard to the influence of root development, the value of symbiosis, periodicity of root growth as influencing planting operations, we are also still poorly informed.

Beziehungen zwischen Biologie der Pflanzen und dem Waldbaue. Centralblatt für das gesammte Forstwesen, June, 1905, pp. 244–250.

A Larch Forest

In the Lesnoj Journal of St. Petersburg measurements of an interesting forest of Siberian Larch, 45 acres, are given, which was planted by order of Peter the Great at various times since 1738.

The oldest stand, 164 years old at time of measurement, originating from sowing in furrows and broadcast, shows still, with 176 trees to the acre, a density of .5 to 1, with a dense undergrowth of Spruce (volunteer growth), 112 feet average height, 14.5 inches diameter and 9640 cubic feet contents.

The other stands, resulting mainly from plantings with wildlings taken from the first sowings, spaced 12 feet, which, varying in age from 80 to 160 years, still show the artificial regularity of the spacing, show the Spruce undergrowth only on eastern exposures, the western slopes and hills being without it. Here in stands of 130 to 160 years of age, with about 132 trees per acre, the height is practically the same, but the diameters are better, namely 15.5 to 16.5, and the volumes from 7700 to 8400 cubic feet.

The culmination of the increment was found to be in direct relation to the depth of soil to a hard clay subsoil or watertable, the depth in centimeters very nearly giving the age of culmination. On the poorest sand soil the culmination had occurred in the 80th year and all factors of increment except the diameters of these dominant trees decrease or increase with the poorer or better site, the diameters of the dominant behaving alike in the first and second, and again in the fourth and fifth siteclass.

In comparison with Pine the yield in the 130th year is larger for Larch, that on the fourth site for the latter not falling much short below the yield on first site for the Pine. Even at 164 years the Larch seems not yet to have reached culmination, and with the current accretion in the dominant still at .6 to .9% the financial (value) felling age seems not yet attained. The density is satisfactory, no special damage or dying of even oppressed trees and only very occasional windfalls are recorded.

Leistungsfähigkeit der Sibirischen Lärche. Centralblatt für das gesammte Forstwesen, June, 1905, pp. 251.

Protection against Fires

The latest formulation of measures to protect forest areas against fires from locomotives was made by Dr. Kienitz in the German Forstwirtschaftsrath in February.

Recognizing that the railroad companies can reduce, but by no means avoid entirely, the escape from the locomotives of glowing coals (the small sparks are not dangerous), and that with increased traffic an efficient patrol system becomes practically impossible, the necessity of safety appliances along the right of way is argued.

The cost of these appliances must, of course, be kept in proportion to the result, and the more endangered forests (conifers on dry soils) call for greater care. These appliances may be merely woven wire-fences or light metal fences (applicable only near civilization) or else cleared or planted safety-strips.

The best safety-strips are not open but wooded strips of moderate width with trees dense enough and high enough to prevent the passage of glowing coals and in such a condition that a fire if started goes out of itself.

Open safety-strips even if the ground is kept plowed, which is the best means of preventing fires are less desirable, because, to be effective, they must be broader than is usually practicable—100 feet on each side is still insufficient—and if not fit for farm use constitute a great waste.

The construction of such safety strips is based on the observation of the manner in which fires originate and propagate. All fires originate on the ground, stem and top fires included which run up from the ground if inflammable material intervenes and go out when the ground fire is stopped.

The ground fire in its incipiency goes out by itself when meeting small impediments of non-inflammable material, a plough-furrow, a trail ; it becomes more dangerous as it increases in circumference. Hence excessive breadth of the wooded safety-strip may become a source of danger.

The safety against fires is not to be sought so much in the non-inflammability of the green leaves as in the absence of dry branches and the presence of non-inflammable bark. The thick bark of a pine may make it the most resistant species ; but the soil cover is, of course, the main source of danger.

Upon the basis of these general principles the Prussian Ministry of Agriculture and Forests has issued specific instructions for the construction and maintenance of safety-strips. These are to have a breadth of 40 to 50 feet with a plowed strip or trail or road or ditch or otherwise open ground of 3 feet width along the embankment, and another such strip of 4 to 5 feet on the opposite side of the wooded strip ; the first to prevent fires to run into, the latter to prevent fires from running out of the safety-strip. Within the latter all easily inflammable material is to be removed and trees are to be trimmed up to within 4.5 feet. Only the green branches on the side toward the railroad are never to be removed.

The two plowstrips are to be connected every 75 to 100 feet by cross-strips, to confine eventual fires still further. In moorlands sanding over these strips may be necessary.

In new railroad constructions the opening through the forest is to be made no wider than the absolute necessity of safe railroading requires. Where danger from windfalls are to be anticipated the opening is to be widened as far as necessary, to be at once reforested.

For this reforestation on sandy soils especially the Scotch Pine yearlings or three-year old transplants (4 x 4 feet) are to be used, and Spruce for better sites. Until the plants are about 3 feet high, the ground is annually in the spring cultivated. When the lower branches begin to die they are trimmed off, and all dead plants are removed ; but every green twig is preserved.

Massnahmen zur Verhütung von Waldbränden durch Funkenauswurf der Eisenbahnen. Centralblatt für das gesammte Forstwesen. June, 1905, pp. 271–274.

Forest Fire Insurance

According to a note in Centralblatt für das gesammte Forstwesen (June 1905, p. 265) the Gladbach Fire Insurance Company had in 1903 about 340,000 acres insured, of which nearly two-thirds conifers, and in the last 8 years had paid around $150,000 insurance for a little less than 5,000 acres burned. The premium varies according to the danger class from .45 to 4 per 1000. All calculations are made with a 3 per cent interest rate.

Spreading Habit and Spacing

On page 181 of this volume of the *Quarterly* were briefed the observations by Hauch on the spreading habit of different species and the influence which this should have on the density of plantations. Especially for spruce the absence of this habit suggests the use of a smaller number of plants, which Hauch states as 3200–3600 per acre. Oberförster Augst points out that this reduction in numbers is still too small ; that the market for spruce does not make high demands on clearness of bole and the price is little improved by clearness or grain. In Saxony, the land of spruce experts, the number per acre has for decades been 2400, and on fertile soils even down to 1800 plants, and the Saxons wonder why elsewhere larger numbers are still thought indispensable.

Zum sogenannten Ausbreitungsvermögen unserer Holzarten. Allgemeine Forst- und Jagdzeitung, August, 1905, p. 272.

Ball Planting of Spruce

In a note on Spruce planting an unnamed writer points out that, since the cost of nursery grown material is becoming more and more expensive through various reasons, mainly through increased labor cost, it becomes desirable to return to sowing, and then transplanting surplus from these sowings into failplaces and portions not fit for sowing, using plants with the ball of earth when three years old. These plants are superior to nursery grown, being more resistent to all dangers, the planting can be done independently of the weather and requires less skilful labor.

While the cost of these ball plants on account of transportation charges may equal that of nursery plants, their success seems more assured.

Ueber Fichtenpflanzung. Allgemeine Forst- und Jagdzeitung, May, 1905, p. 175.

The Farm Woodlot in Pennsylvania

It is probable that in Pennsylvania no portion of the farm is given as little attention and thought as is the woodlot, and it is certain that no other would continue to produce crops year after year regardless of abuse and neglect.

The low prices which prevailed for many years made it cheaper for the farmer to buy his lumber than to cut it, and the advent of cheap coal made cordwood scarcely worth cutting. Time has altered conditions somewhat, and the price of lumber has doubled in the last fifteen years. When Hemlock lumber sold for $9 and less per M board feet, it was perhaps best to allow the sawmill-man to strip the land of the mature trees. Now, however, it seems best to go back to the plan in vogue before the railroads came, and cut on the farms the lumber necessary for home use, endeavoring at the same time to sell the surplus to the best advantage. Most farmers in the State live near enough to sawmills to get logs sawed without much labor.

The use of wooden fences is a tremendous drain on the woodlot. The modern woven-wire fence costs no more than the old rail and board fences and is stronger and more durable. The farmer is now advised to sell the Chestnut trees that will make telegraph poles, buy wire fences, and cut the tops of the trees into posts. By this plan many more rods of fence can be built than if the trees are split into posts and rails.

Great aid can be given the natural development of the existing groves by cleaning out the forest weeds and such broken, crooked, or hollow trees of no value as are taking the places of younger, more valuable growth. Also the trees of little use, such as Beech, Gum, Dogwood, and Ironwood should be removed. Under no conditions should cattle be allowed to roam at will through the woods. They destroy the young seedlings and so pack the earth that it will not absorb the rain.

The trees on steep, stony hillsides, thin ridges, and swampy meadows should be cut in such a manner that erosion will not take place. Where poor open stands or clearings occur much can be done by underplanting. For general planting, some of the best species are Chestnut, Black Walnut, Oak, Black Locust, Mulberry, White Pine, and Hemlock ; in the swampy places, Willow, Black Cypress, and Sycamore.

Lastly, if trees of various kinds exist in the woodlot, do not cut everything at one time. Different trees have different rates of growth, and the cutting of the entire forest when one species is ripe probably harvests others which are not ready for the ax. Select with care those trees that are ripe or are encumbering the ground as forest weeds and thus aid the development of the younger and better individuals.

The Farm Woodlot. Forest Leaves, April, 1905, p. 25,

MENSURATION, FINANCE, AND MANAGEMENT

Simplified Volume Determination

For rapid calculation of tree volumes with a view of checking ocular estimates, Hersche finds that for Spruce (Norway) the squared diameter, breasthigh, multiplied by one-third the height increased by one, $v=d^2\left(\frac{h}{3}+1\right)$, gives very nearly the true volume, except for trees below 50 and above 115 feet, when the added height is only a fraction to zero. For Fir the needed addition was found to be 1.5. With volume tables for different species it would be possible to determine the required addition for eventual use. [For rougher calculation the simple squaring of the radius will give good approximations for trees from 80 to 100 feet in height and a form factor of .48 (the majority)].

Vereinfachte Berechnung stehender Stämme Schweizerische Zeitschrift für Forstwesen, June, 1905, p. 149.

Influence of Planting Cost on Profits

In an elaborate essay Dr. H. Weber discusses with greatest detail the financial aspect of the cost of plantings compared with the results. The discussion is based upon a collection of data from many forest districts of Hesse giving cost of planting Oak and Pine by various methods and upon the money yield tables prepared for the two species by Dr. Wimmenauer. The profitableness is investigated by the method of the soilrent or soil expectancy value, and by the interest rate on the expenditure. Finally the profitableness of underplanting is discussed.

Foresters in Germany have often made plantations at great expense, $30 to $40 for Pine, and up to $60 and more for Oak, without realizing that, especially with the advocated long rotations (180 years for Oak), even at 2½%, the planting cost grows to over 85 times.

From the 39 tabulated reports on Oak plantations, we find that they varied from $3.60 to $67.50 per acre, the first for sowing in spots, the last figure for sowing in subsoiled furrows and spotting between the rows; including in all cases the necessary repair planting. Between these extremes we find a great variety of figures; in the majority of cases the cost seems to lie between $25 and $40, including some planting of Oak and other species between the rows of Oak sowings.

Scotch Pine which formerly was the cheapest and easiest to reproduce, experiences to-day, especially in the large pineries, such setbacks by insects, fungi, drouth, etc., that repairs are always and re-plantings not infrequently necessary. Hence the cheap methods of planting with yearlings are being replaced by expensive ones with transplants, etc., to the detriment of profitableness, inviting to a careful study possibly of better protection against the ills, and return to the cheaper methods. Some 50 records are tabulated showing the planting cost to vary between $6.80 and $36.80 per acre, the last for planting in subsoiled furrows, the first figure for sowing in simple furrows. Sowing cost lies mostly between $8 and $15, while planting on hoed spots can be done for $6.50 to $12.00, and $17 to $30 are mostly required for planting in hoed furrows.

In the profit calculations, the figuring has been done for oak with planting cost of 15, 30, 45 and 60 dollars, for pine with allowances of 6, 12, 18, 24, 30, 36 dollars. The interest rate used is 2.5 per cent. Cost of administration is taken from Dr. Wimmenauer's compilations of the difference of actual gross and net soil rents determined for Hessian districts, the cost being variously apportioned to the different siteclasses, the best siteclass, just as in the levying of taxes, being charged the most. This cost for Oak is found for site I as $1.24, for site II as 84 cents, site III as 52 cents, site IV as 24 cents per acre. The calculations of the soil expectancy value show that for Oak costs of $30 or more produce on site IV negative results, and with $15 cost produce a maximum of only $23 with a rotation of 90 years. Negative values occur also on site III with a cost of $60, and under rotations of 140 years with a planting cost of $45, as also on the other sites with the higher rotations. The culmination of the soil rent value occurs always with a planting cost of $15, on site I under a rotation of 60 years with $116 per acre, on site II under a rotation of 70 years with $78, on site III under rotation of 80 years with $47.

With Pine the results are even more discouraging, for a planting cost of $24 produces only negative results on site III and on site IV with rotations higher than 90 years, while the culmination of soil rent value is attained with $6 planting cost in 60 and 70 year rotations on site II and III, the values being $31 and $18 respectively. Similar relations appear, of course, by the method of interest rates, the culminations occurring with 2.5% as in the soil rent calculations.

The author recognizes, to be sure, that the soil improvement in planting up wastes should not be charged against the first rotation, but must be considered as an increase in soil cost, this increased soil cost to enter into the calculations of interest or soil expectancy value.

Interesting statements are also made regarding profitableness in the conversion from one to another species, which have so far been rarely subjected to strict financial investigation.

Various other phases, which it would lead us too far, to detail, are discussed in this highly suggestive article.

Ueber den Einfluss der Kulturkosten auf die Rentabilität des forstlichen Betriebs. Allgemeine Forst- und Jagdzeitung, July and August, 1905, pp. 221–232 and 261–272.

Simplified Forest Organization

Those, who are acquainted with German methods of forest organization only from the reading of text books or from lecture courses will learn from the exposition of the actual practice by Oberforstrat Frey, that all the fine and complicated methods of forest mensuration which are taught, are by no means applied.

Speaking to be sure, of forests which have been surveyed and subdivided, in which the regulation of yield is merely to consist in showing that the budgets determined for the next ten years correspond to the capacity of the forest, *i. e.*, can be derived continuously, it is only necessary to ascertain the stock and increment. The stock is ascertained by estimate. In mixed forest the species are stated in decimals or, if in larger groups by area, ascertained by stepping, or they may even be left out of consideration, both stock and increment being based on the leading species. The age is not determined by the true arithmetic average but by counting the rings on a few typical trees.

Similarly the height which is used for siteclass determination is found by merely measuring that of a few trees of estimated average height. The stock density is also estimated in decimals. All these factors being by necessity only close approximations, the calculations of stock and increment may also be only approximations. If, therefore, general normal yield tables are in existence, as they are in Germany, these may be freely used, although theoretically they would not be permissible. The lacking ages in the yield table are interpolated. The actual stock and increment for each stand is then found by multiplying the normal stock and increment per acre corresponding to the respective ages with the estimated stock density factor and the acreage of the stands. Summing up, the total stock and the total annual increment are found under the assumption that for the next ten years the increment will not change, and by multiplying with 10, the felling budget for the next ten years is determined. Then follows the selection of the stands which from silvicultural, financial or other reasons it is desirable to cut, making a closer calculation for these, in order to assure us that the determined felling budget does not exceed their stock and increment. The poorest growing and oldest stands are taken first, to be replaced by better stands etc. After ten years a new survey is made and the felling budget corrected accordingly.

To further learn what the condition of the whole forest is with reference to continuity of the determined felling budget the average age of the entire forest is found by dividing the stock by the increment $\left(\frac{S}{I} = a\right)$. This should be equal to one-half the rotation; if it turns out to be much less, then it may be an indication that it is desirable not to cut the entire increment during the decade or *vice versa*, in order to come nearer to normal age.

Vereinfachung des Waldertragsregelungs- verfahrens. Allgemeine Forst- und Jagdzeitung, July, 1905, pp. 232–236.

Rotation and Forest Finance

The knotty question of the proper basis for determining the rotation, the ripeness of our crop, so important and so far from a rational solution, is further ventilated by Schiffel; refuting the strictures of Vogl, briefed in the last number of the QUARTERLY (p. 200). Schiffel reiterates his position as follows: Value increment furnishes the only basis independent of interest rates and expectancy values, to calculate the most advantageous rotation for a working block. The time of maximum of the value increment determined by average yields on average sites for equal time periods indicates the desirable rotation. If several maxima are calculated the rotation is chosen which corresponds most nearly to the existing age class conditions, or else the felling budget may be regulated so as to approach the conditions of the other rotation. As long as the value increment of a stand still rises, it is not mature, leaving out of consideration the cost of production; no mistake will be made in cutting it, if the value increment is falling. It is quite irrelevant to the forest manager to know at what rate his capital is producing, provided he is convinced that it is the *highest* possible rate he can work out. In not too high rotations it is possible and probable that the rotation of the highest *current* value increment secures this aim. The possibility is proved in an example based on Schwappach's yield tables for Spruce, in which the culmination of the current value increment coincides with the culmination of the average annual increment in the 90th year. The highest interest rate on the forest capital in this example occurs in the 70th year, while the value increment continues to rise somewhat to the 80th and 90th year. The rotation should then be chosen within these time limits according to the "interior and exterior forest conditions" (age class conditions, market, desire of owner, etc.).

Time calculations are to be as much as possible avoided, since the basis for calculation is too uncertain.

In an appendix to the article Dr. Wimmenauer clearly points out the difference in attitude to both soil rent and forest rent theories, which Schiffel occupies, which it may be useful to brief:

The doctrine of the *forest* rent (*Wald* reinertragslehre) declares that forest management as most advantageous, which—without regard to the forest capital and interest on it—promises the largest continued surplus of annual revenues over annual cash expenses. The doctrine of the *soil* rent (Reinertragslehre, then *Boden* reinertragslehre—soil net yield) demands a satisfactory interest rate on all the capital of production, soil, stock, expenses, as result of the management; the soil rent being the excess of the forest rent over the interest on the forest capital. [The difference is similar to the renting of a house for the best rent one can get, no matter what the cost of the house was, and the desire to have the rent in a predetermined relation to the cost *i. e.*, the capital invested. ED.]

A very important point which is mostly overlooked by the opponents of the soil rent doctrine, is that in determining a rotation by its calculations, not *absolute*, but *relative* values are involved; that the calculations are for static or comparative use only, hence the uncertainty of data like interest rate and prices in the, future, etc., which is charged against soil rent calculations, is after all of little moment, for the same data are used in the two or three comparative calculations.

Waldrente und Bodenrente. Allgemeine Forst- und Jagdzeitung, August, 1905, pp. 273-277.

UTILIZATION, MARKET, AND TECHNOLOGY.

The New York El Comercio of July 15 says that German chemists in Bavaria have been making experiments recently looking to the production of cotton from pine wood. It is claimed that this artificial cotton is produced as cheaply as the real cotton.

New Paper-making Material

Consul Griffith, writing from Matamoras, Mexico, says:

Interest has been created in this district by the suggestion that the fiber of the papaya, commonly known as the Mexican papaw, would probably afford an admirable material for the manufacture of high-grade paper.

The fiber in question is the full length of the tree trunk and appears to be quite strong and rather silky in texture. With the exception of the bark and a small pithy heart, the trunk is composed entirely of this fibrous material. Some samples of the fiber have been sent to an American paper expert and manufacturer with the purpose of having it tested with reference to adaptability for the manufacture of the higher grades of paper.

The plant grows rapidly, attaining a diameter of from 2 to 3 inches when 1 year old. It requires no special care nor cultivation and grows luxuriantly on either the sandy or black waxy soil of this region.

Although known as the Mexican papaw, it is claimed that the papaya is not indigenous to Mexico, but was brought to this country originally from the Moluccas by the Spaniards, a fact well worth noting, for if it proves to be anything like as good a paper maker as its friends urge, it might be tried in Florida and California.

To judge from its appearance, it seems probable that no decorticating machinery would be required in its treatment, as the fibrous material is devoid of woody elements to all appearances.

Consular and Trade Reports, August, 1905.

Steel versus Wood

From an article by R. V. Norris on steel to replace timbering, it appears that rather extensive use of steel structures is made by the coal companies of the Pennsylvania Railroad, two types of rolled shape supports being employed; the one with posts constructed of two channels connected by pins and wedges, the other consisting of simple I-beams for both caps and posts, the latter standing on cast-iron shoes or bases. Cap and posts are pinned together, and the pins being the weak points the heaviest channel-iron must be used, in order to reduce the size of the pin required. Such "timbering" costs about three times as much as oak timber, but its life is very much greater; 24-inch oak timber lasted less than ten months, failing by the gradual crushing of the posts with the caps, while the steel structure remained in excellent condition after eight years.

The strength of the structure is compared with timber supports as follows:

STRENGTH OF MINE TIMBER AND STEEL SUPPORTS

	Ultimate strength—Pounds per square inch		
Material	*Tension*	*End compression*	*Compression across grain*
Hemlock	8,700	5,300	1,100
Chestnut	10,500	5,300	1,600
White Pine	11,500	5,400	1,200
White Oak	14,800	7,000	1,600
Southern Pine	15,900	8,500	2,600
Steel, safe load, factor 4	16,000	12,000	17,100

Tables are also given for beams and posts of varying sizes and spans.

Steel to Replace Timbering. Engineering and Mining Journal, July 14, 1904, p. 60.

Rüping Process of Impregnation

The adoption of the Rüping process of impregnation by some of the leading railroads of the country calls special attention to this importation, which differs from previous processes in that its use of compressed air makes commercially practicable the treatment of timber with preservative materials which are of the highest efficiency, but which have been used to only a limited extent on account of their high cost. Tar-oil or creosote is the material used.

The seasoned wood is subjected for almost half an hour to an air pressure of 60–65 pounds, so that all cells must be filled with compressed air. This is the principal difference between the old and the new methods; the former removed the air from the wood cells, while the latter fills the cells with compressed air.

The remainder of the process is thus outlined:

"Without reducing the pressure in the impregnating cylinder, the warmed impregnating fluid is then forced from the tar reservoir into the impregnating cylinder by means of a somewhat higher pressure, say of about 65 to 75 pounds. In proportion to the quantity of tar entering the impregnating cylinder, air is permitted to escape through a valve, in order to make room for an equivalent volume of impregnating fluid. At the same time it must be borne in mind to allow only such a quantity of air to escape as cannot impair the maintenance of the pressure of 60 to 65 pounds. When the wood in the cylinder is completely covered with the impregnating fluid the pressure, according to the dimensions and qualities of the material, is to be increased to 105 to 225 pounds. Under this increased pressure the impregnating fluid will penetrate into the cells of the wood.

It might appear that through the forcible advance of the fluid the compressed air contained in the wood would be forced to the interior and these form a kind of cushion or piston which would render an impregnation of this sort impossible. But, owing to the high pressure, the tar-oil, in consequence of the capillary action of wood and its adhesive properties, moves along the cell walls into the innermost parts of the wood, soaking them entirely, by which the compressed air contained in the cells will be still more compressed and at the same time entirely kept in suspension and inclosed by the advancing tar-oil.

When the material is sufficiently impregnated the pressure, with great energy, through its expansion, will force as much of the impregnating fluid out of the wood as does not adhere to the cell walls, and this surplus is thus made to flow back into the creosote tank. This is the distinctive feature of the Rüping process.

Accordingly, no more fluid can remain in the wood than is necessary for impregnating, coating or saturating the cell walls, etc., and this is the only important object in view for the preservation of the wood. In each case the pressure can be regulated in such a way that only a minimum quantity of fluid (or larger quantities, as required) remain in the cells of the impregnated wood. The oozing of the superfluous tar-oil may be increased and accelerated by exposing the impregnated wood to a vacuum for some time. By this means a further quantity of from 5 to 10 per cent. of the impregnating fluid left in the wood may be regained."

Review in Canada Lumberman, March, 1905, p. 19.

Timber Preservation

The remarkable development of the timber-preserving industry in the United States during the past five years is to be seen in a list of such plants published in the St. Louis Lumberman; no less than twelve out of a total of thirty, erected since 1848, having been built after 1899.

Year of building	*Number of plants*	*Location*	*Process*	*Estimated annual capacity Ties*
1848	1	Mass.	Kyanizing	150,000
1876	1	La.	Creosoting	400,000
1878	2	N. Y.	Creosoting	1,600,000
1881	1	Va.	Creosoting	. . . .
1885	1	N. Mex.	Burnettizing	500,000
1886	1	Ill.	Zinc-tannin	500,000
1889	1	Cal.	Creos. and Bur.	1,000,000
1890	1	N. J.	Creosoting Resin	1,200,000
1891	1	Tex.	Bur. and Creos.	1,500,000
1892	1	La.	Creosoting	750,000
1894	1	Cal. and Ore.	Burnettizing	1,000,000
1896	1	Va.	Creosoting	900.000
1897	2	Tex.	Bur.; Various	3,000,000
1898	1	Ariz.	Burnettizing	350,000
1899	2	Ill.; Wyo.	Zinc-tannin; Various	700,000
1901	2	Mont.; Tex.	Zinc; Zinc-tannin	2,100,000
1902	8	N. Mex.; Ill.; La.; Tex.; Colo.	Zinc-tannin; Various; Creos.; Bur., and Creos.	7,500,000
1903	2	Miss.; Mich.	Various; Zinc-tannin	1,700,000

St. Louis Lumberman, January 15, 1905, p. 89.

STATISTICS AND HISTORY.

Lumber Trade in Belgium

Consul McNally says that recent statistics indicate a continued increase in the importation of woods into Belgium, while export figures show a decrease. In 1903 the importations exceeded 1902 by about $1,110,329, while at present the imports are $27,395,771, without including the importation of bark and wood pulp. This increase is chiefly attributed to the demand for its use in the mines.

The exports of wood fell from $9,770,525 to $2,726,704. The inland Belgian production is estimated at about $2,895,000 and is considered of first importance among the industries of Belgium. For the past fifteen years the consumption of wood in Belgium has been increasing at the rate of about $965,000 yearly. The principal exporter of wood into Belgium is Sweden and Norway. Russia is coming to the front rapidly. The importations from Scandinavia decreased by $1,073,852 in 1903, while those from Russia increased by $1,760,932. It is thought that in a few years Russia will be in the lead. The imports from the Kongo have increased from $7,913 in 1902 to $22,002 in 1903. These are exclusively cabinet woods other than oak and walnut. Belgian woods go mostly to England and the Netherlands. The Kongo takes about $24,318.

Consular and Trade Reports, August, 1905.

Bavaria

From the budget of the Bavarian forest department for 1904–5 we learn the interesting fact that, in the total income from wood of $9,320,000, three-tenths is for fuel wood. Minor products add about $300,000 and the chase $60,000 to the revenue, sundry other items bringing the total to around $10,000,000, while the expenditures are figured at $4,285,000, or, since the area involved is 2.5 millions acres, a net result of $2.30 per acre is anticipated. Twenty-five years ago the net income was just about one-half of what it is to-day—a striking change.

Following a period of rapid deforestation by private owners, for the last three or four years a reverse policy is noted, some 5,000 acres of waste land have been replanted in 1903. The student of forest history and forest politics will find much of interest in the pages cited below.

Kammerverhandlungen über den bayrischen Forstetat. Allgemeine Forst und Jagdzeitung, May, June, and July, 1905, pp. 167–174, 203–209, and 247–250.

Russia According to the annual report for 1898, lately published, the Russian State forest area comprises over 700 million acres, of which, however, less than one-half is productive forest, namely, 235 million acres in Europe (62% of the total forest area) and 103 million in Asia (13% of the supposed total). Of the European area 34% is in Spruce, 30% in Pine, 23% mixed conifer forest. In Siberia 75% is mixed conifers and 8% Pine.

The administration of this vast property, divided into 1014 districts, occupies nearly 3400 persons, 81% of whom are educated. In the last 33 years the cut has more than doubled, being estimated at now 1253 million cubic feet, more than half of which secured under a clearing system.

Forest improvement is still at a low stage on account of the moderate means allowed for it; yet in the 33 years preceding nearly 5 million dollars were spent on surveys, over 20 million acres were brought under working plans and 2.5 million acres were planted at an expense of from 30 to 90 cents per acre.

The great difference of conditions north and south in the European territory appears from the fact, that in the northern districts, where the State forests occupy 52% of the land area (24 acres per capita) the net money result of the administration was only about one-quarter cent per acre, while in the southern districts, where the government owns only 6% of the land area ($\frac{2}{5}$ acre per capita), the net income was 36 cents, the average of the two being 6 cents. In 1903 the receipts were $600,000.

Centralblatt für das gesammte Forstwesen, June, 1905, p. 275.

Saxony The following data of the budget of the forest administration of Saxony, one of most successful State administrations, which is based on financial principles, are of interest.

The 420,000 acres are this year expected to produce a net income of 1.9 million dollars with a cut of 30.4 million cubic feet at an average price (for the last three years) of 10.3 cents per cubic foot. Of the expenditures of 1.3 million dollars, $510,000 is the cost of administration, \$460,000 the wood choppers' bill (1.5 cents per cubic foot of timber), and only \$240,000 is devoted to forest improvement, although Saxony relies largely on planting.

POLITICS AND LEGISLATION.

Coöperative Forest Management

It has long been recognized that for best economic results in forest management large areas under the same working plan are necessary and hence coöperative management of small farmers' woodlots is encouraged by legislation in Germany. This legislation is based on the recognition that public interests are subserved by such unit management, experience having shown that the small woodlots are usually mismanaged, creating unproductive lands.

For Austria, Dr. Trurig proposes coöperative organization on an even more extensive plan, indeed the formation of trusts, from which he expects not only more rational technical management of the wood lots but by coöperative marketing the possibility of using hitherto unused materials, securing higher prices, lower freight rates, and altogether producing greater values. Forest properties under 1200 acres each form 44 per cent of the Austrian forest area with over 10 million acres, so that the opportunities are large. By combining 75,000 to 100,000 acres in an organized association there is also created a property on which loans can be secured for improvements, etc., for which the small parcels would not serve.

Moreover these smaller associations might for some purposes form a wider union, in which large owners might also be represented and a powerful educational as well as commercial organization with a central bureau for the whole country might be effected to advance forestry interests in general, regulate and distribute the fellings and secure advantageous conditions.

"The conservative nature of forest property and the extreme modesty of forest owners removes the fear of such a trust being conducted on improper lines ; should this nevertheless occur, the State as the largest forest owner (10.7%) will be in condition to correct the evil, its own property preventing monopoly." The trust being built up by small, more or less isolated properties of individual owners can never lead to the annihilation of small owners, as in the industrial field, but merely strengthens the small owners by the associated organization.

The fact that the forest producer is not forced as the farmer is, to sell the year's production more or less at once, and that his production is less fitful, less dependent on weather, renders the formation of such a trust and the regulation of production much more feasible than for farm production. In no other industry does the product when not used produce interest, as it does in forestry.

The difficulty of organizing such a trust, which the author declares a social-political necessity, lies in the first step of bringing small owners to the realization of its advantages, and next in developing a plan, which from the start can be profitably set in operation without paying too much in education.

Years ago the reviewer argued [1] that rational forest management could in the United States even for large private properties be best and most quickly secured by the formation of trusts, which on account of the size of the properties could distribute their fellings and could afford to work for continuity.

The organization of the small owners should be even more readily accomplished and the advantages be relatively greater. While in Austria the first idea would be that the association could improve technical management, in the United States it should be to secure commercial benefit, when the technical improvement would more readily follow. Here is a field for State foresters to work who have the opportunity of stimulating woodlot owners into activity.

Genossenschaftliche Organisation der Forstwirtschaft. Centralblatt für das gesammte Forstwesen, June, 1905, pp. 237–243.

[1] Address before Baltimore Lumber Exchange by B. E. Fernow, 1895.

NEWS AND NOTES

E. A. Sterling, *in Charge.*

An interesting fact is that the oldest son of Germany's greatest poet, Karl von Schiller, was an Oberförster in Würtemberg. In Laurop's forest magazine, *Sylvan*, for 1814, the following story is related of the great poet, which we deem worthy of recalling to the present generation: "Schiller, some time ago, seeking recreation at Ilmenau, accidentally met a forester who was just making a working plan for the very much mismanaged Ilmenau forest. The stock map was spread out, on which the fellings for the next twice one hundred and twenty years were projected and noted with their year number; by its side lay the plan of the ideal of a perfect conifer forest, which was to have materialized in the year 2050. Attentively and quietly the great poet contemplated the telling means of forest organization and especially the numbers of such distant years. He quickly realized, after short explanation, the object of the work, and gave vent to his astonishment: 'By Jove, I had considered you hunters very common people, who did little else than kill game. But you are great: you work unknown, unrecompensed, free from the tyranny of egotism, and the fruit of your quiet work ripens for a late posterity. Hero and poet attain vain glory. By Jove, I would like to be a forester.' "

Die Beziehungen Schiller's zum Forstwesen. Allgemeine Forst- und Jagdzeitung, August, 1905, p. 295.

The city of Helena, Montana, has recently set an example in municipal improvement which other cities of the country might profitably follow. It is perfecting plans for a city forest park in which the æsthetic effect is to be obtained by a true forest plantation, without recourse to the usual landscape work of city parks. The site of the proposed park comprises the varied slopes of Mount Helena, which rises from the western outskirts of the city to a height of some 1,400 feet above the main street and to an absolute elevation of 5,200 feet. Considerable western Yellow

Pine (*Pinus ponderosa*) and Red Fir (*Pseudotsuga taxifolia*) are found in the draws near the summit and on the western slopes, most of it of small size. In the gullies and more protected situations they show a tendency to extend down the slopes, but unfortunately a number of Angora goats which were allowed to range over the mountains destroyed all seedlings and injured many of the small trees. The lower slopes are entirely bare of trees, and it is on these and in the open spots in the natural growth that planting will be undertaken.

At the request of the Helena Improvement Society, which is acting on behalf of the city, the Forest Service has prepared a detailed planting plan for the forest park under the usual coöperative arrangement of the Service. Mr. F. G. Miller has been in charge of the work and during August supervised the making of a map and drew up the details of the plan. The total area of the proposed park is about 1,000 acres, of which the larger part must be planted. The species mainly to be used are *Pinus ponderosa* and *Pseudotsuga taxifolia*, though small areas will be planted to *Pinus coulteri*, *Pinus flexilis*, *Populus tremuloides*, and certain other species that promise to grow in the region. The slopes which are in plain view of the two trans-continental railroads will be reforested first, and the establishment of a forest growth on the mountain will be a striking object lesson of the forest-planting possibilities in that part of Montana.

F. W. Reed of the Section of Reserve Boundaries in the Forest Service has recently gone to Elko, Nevada, to examine the Ruby Mountains as to their suitability for forest reserve purposes. During the earlier part of the summer Mr. Reed was in Southern Idaho examining lands at the headwaters of the Palouse and Coeur d'Alene Rivers, the source of the water for the Palouse irrigation project of the Reclamation Service.

The 13th National Irrigation Congress convened in Portland, Oregon, August 21st to 24th, inclusive. Two general sessions were held, at which various topics were discussed, new officers elected, and resolutions offered. The technical papers as usual were read before the Sections of Engineering and Mechanics, Forestry, Climatology, Rural Settlement, and Production by Irrigation. The several hundred delegates in attendance were from 40 different States and Territories, and include many men prominent along various civic and economic lines. Among them were: F. H. Newell, Chief Engineer of the U. S. Reclamation Service, Gifford Pinchot, Forester and chief of the Forest Service, Gov. Pardee of California, Ex.-Gov. Prince of New Mexico, Senator Carter of Montana, C. B. Boothe of California, C. W. Eberlein of the Southern Pacific Railroad, and many others equally well known. One of the main points of discussion was regarding the size of farm units on land reclaimed by government irrigation systems, and the best way to compel non-resident landowners to comply with the provisions of the irrigation law which limits the size of the individual farms. The desire of speculators and large owners to profit by government irrigation works to the exclusion and injury of the small settler, is vigorously opposed by the Reclamation Service. The questions of immigration and colonization in relation to the lands newly opened by irrigation came in for heated, inconclusive arguments. A resolution was passed stating that the National Irrigation Congress is not in any way affiliated with the National Irrigation Association.

Gov. Pardee of California was re-elected President of the Congress and Boise City, Idaho was selected as the next meeting place.

At the Lewis and Clarke Exposition there are two exhibits of logging machinery which are of interest to the forester. One is that of the Lidgerwood Company in the Oregon Forestry Building. It consists of a large model showing in miniature the several Lidgerwood logging systems. In the foreground is a logging railroad which furnishes transportation to the timber brought down by wire cables from a cut-over slope at the back of the model. Steam loaders, overhead and ground wire-rope systems, skidding engines and other time and labor-saving machinery are represented. The whole is a working model and, from logging trains to overhead wire log-conveyors, can be put into actual operation; the visitor can see the 3-inch sticks representing logs brought down from the mountain side and loaded on the cars. On the whole it is as complete an example of the practical application of modern engineering genius to logging operations as has ever been seen on exhibition. A less elaborate exhibit is that of the Williamette Iron and Steel Works in the Transportation Building. Their booth shows two machines of particular interest: a steam log loader and turner, and a portable sawing machine. This latter machine is especially adapted for operating drag saws and eliminating hand-power in cutting logs, shingle bolts, cordwood, etc. It can be operated by either steam or compressed air, and if driven by air generated in a traction engine can be used as a cross-cut saw wherever the land is smooth enough for the traction engine.

In connection with the above portable saw it is interesting to note that the McCloud River Lumber Company in California use compressed air "bucking up" saws in cutting practically all of their logs. They operate in Siskiyou County near Mt. Shasta in rather open stands of Western Yellow and Sugar Pines and the ground is smooth enough to permit the use of a traction engine in furnishing motive power for the saws. Two machines are run by each traction engine, and connected to the air tank by rubber hose. One saw suffices for both machines, as one frame is moved and attached while the saw is being used in the other. The machine consists of merely a frame which can be moved readily and attached to logs of any size, and into which the saw fits. The air supplied from the lines of hose works a piston to which the saw is connected, the cylinder and connections being set in the portable frame. Nine men are required to run the traction engine and two machines. Tbe average cut per day of 16-foot logs is about 125,000 board feet, at a cost for labor and fuel of about $25. The economy of such an apparatus is obvious, since two men at $1.75 each with a cross-cut saw will not cut on an average more than 4,000 feet per day. The daily output of the two McCloud mills is about 400,000 board feet; hence the practical utility of this portable compressed air saw under the conditions in which it is used is apparent.

E. T. Allen, formerly a Forest Inspector in the Forest Service, has received an appointment as State Forester for California under the law passed at the last session of the Legislature. Mr. Allen went from Washington to Sacramento about the first of July to take up his new duties. In addition to serving as State Forester he will act as inspector of forest reserves in California for the Forest Service. His first work consisted of the organization of the office, the publication of the new forest code and of fire warning notices, and the appointment of fire wardens.

By the death of William F. Hubbard by drowning on July 17th, the Forest Service lost one of its most capable and accomplished men. Trained by five years' study of economics and forestry abroad, Mr. Hubbard brought to his work a technical knowledge and a wide experience and mature judgment which placed him in the very first rank as an American forester. He was the author of a well-known bulletin on "The Basket Willow," and just prior to his death his second bulletin on the "Maple Sugar Industry" came from the press. His sincere interest in his profession and his broad view point was clearly shown by various contributions to papers and magazines and by his thorough understanding of world affairs and of the economic relation of forestry to other commercial interests. His keen interest in his work and associates, his ability to promote good fellowship, and his frank, lovable nature won for him a host of friends to whom his death is an irreparable loss.

The summer term of the Yale Forest School in Milford, Penn. began on July fifth with an attendance in the Junior class of thirty-one students. The work of the term comprised the courses in Forest Mensuration and Surveying. The former was conducted by Prof. H. S. Graves, assisted by Mr. G. E. Tower. The course in Surveying was carried by Prof. J. C. Tracy of the Sheffield Scientific School who was assisted by Mr. C. H. Farnham and W. L. Ulrich, also of the Sheffield Scientific School. Last year the course in surveying was given in the fall term and Silviculture in the summer. This year Silviculture will be given through the year in New Haven and the course will be considerably extended.

The popular course in Forestry, known as the Yale Summer School of Forestry, was conducted as usual at Milford, Penn. The course opened on July fifth and ended August twenty-third. Eighteen students were in attendance. The summer school was conducted under the direction of Prof. J. W. Toumey, assisted by Mr. S. H. Graves and G. E. Tower.

Mr. G. E. Tower has been appointed Professor of Forestry at the University of Maine. Mr. Tower is a graduate of the Yale Forest School. He had considerable experience in the Bureau of Forestry before entering Yale in 1903.

Mr. George H. Myers has recently returned from a sojourn of two months in the forests of Japan. He is the first American after Dr. C. S. Sargent to make an extended study of the forest conditions of Japan. Mr. Myers also visited with Prof. Graves, the forests of India and the Philippines.

The Pennsylvania State College is contemplating the establishment of a four years' course in Forestry.

The Yale Forest School had in its class at Milford this summer two students from South Africa, Mr. G. A. Wilmot and Mr. C. C. Robertson, and one student from Norway.

For seven years there has existed, besides the German Forestry Association, a German "*Forstwirthschaftsrat*," which may be translated into Council on Forest Policy, composed of 48 members, namely, 19 delegates of the governments of different States, 16 delegates of forestry associations, 3 representatives of forestry science, and 10 representatives of large forest estates. The object of the Council is in general to unify as much as possible conditions of administration and policy in the different

States. The questions coming before this Council are largely administrative ones, although such questions as the significance of the humus discussed at the last sessions show that other fields may be considered.

In discussing the question, "What measures shall be adopted to prevent forest fires from locomotives," to which last year's drought had given increased importance, the efficacy of ditches with safety strips, if properly watched and kept clear, was attested. The width of such strips in Alsace is 45 feet, and they are annually hoed over two to three times.

During the last three years the City of Zürich, noted for the masterly management of its "Sihlwald," has bought 746 acres of forest property for $164,000, or about $220 per acre. The intention is, while managing the city property for revenue, to give special attention to its use for park pleasure purposes.

XYLOMETER FOR CROSS TIES.

See Article p. 335

FORESTRY QUARTERLY

VOL. III] NOVEMBER, 1905 [No. 4

A PRACTICAL XYLOMETER FOR CROSS-TIES.

In the course of recent seasoning experiments on railroad cross-ties in coöperation with the Atchison, Topeka and Santa Fe Railroad, it became necessary, just as the work was closing, to obtain a considerable number of measurements of the volumes of the ties with which the work had been concerned. A few such determinations of volume had already been made, but the briefest inspection of the method employed showed that great improvements must be made, and especially the time required must be shortened. In the earlier work the ties were submerged horizontally in a trough, which was filled to the overflow with water before the operation was begun. The ties were submerged very slowly, to avoid as much as possible disturbances of the surface which are readily set up in a long shallow trough and which seriously affect the water level when the tie is finally submerged. The water displaced by the tie flowed out and was caught from the spout in tubs, and weighed. The relative weight, that is, the weight of the tie divided by the weight of water displaced, gives the specific gravity of the wood compared with water at that density. Here was one error in accuracy, to which should also be counted the error due to absorption of water as the tie was being submerged, a proceeding which took some thirty minutes. But the drawback which rendered this method out of question for a longer series of measurements was the time, the determination of the volume of six ties being an afternoon's work at Rociada, N. M., where this method was put in operation.

From what has been said, the suggestion of an upright tank comes naturally; but any such change, while promising the desired celerity of operation, necessitates radical changes in the handling of ties to and from the tank.

Considerable thought was given to this phase of the problem, and while numerous improvements readily suggest themselves, a description of the final apparatus actually employed and a statement of results obtained as showing what can be accomplished with the given equipment, may be of practical value.

The figure on the frontispiece gives an idea of the xylometer when ready for work. The upright tank shown at the right is built of 1½ inch quarter-sawn oak, and is a foot square and ten feet deep, inside measurements. Iron bands bind the top and bottom, the corners are rabbeted, and it was found necessary to further support the tank against internal pressure by iron bolts passing through 2x8 blocks 20 inches long, these being so placed around the tank as to hold the rabbets more snugly in place. An opening five feet long and three inches wide runs from the top half-way, down the middle of one side, and carries a quarter-inch thickness of plate glass. Against this, a tape graduated to tenths and hundredths of a foot is placed, which allows the reading of the water level accurately to hundredths of a foot, though greater accuracy in this respect is readily attainable. The tank is set in a platform built over an arroyo so that only the upper four feet protrude above the floor. A step is provided for reading the low point on the scale, as this is usually about the level of the floor, too low for convenient reading, but desirable for the more important item of ease in handling the tie in and out of the tank.

Some four feet to the left is the crane used for swinging the ties from the pushcar, on which they are brought along the track from the yard, around over the tank. This distance is so gauged that the tie comes directly over the tank, when it can be lowered into the water rapidly and smoothly ; at the same time, when the empty tongs are hanging ready for another tie, they are conveniently at one side of the pushcar. A single loose block is used as shown, and this arrangement required two or three Mexicans to raise a tie.

For ordinary operation two men with six helpers are the proper working force. The ties were brought to the xylometer on push-cars 25 to 30 at a load. Two cars were used, one coming from the yard loaded, the other empty to return them. The ties were set upon end at the side toward the platform, and the tongs firmly imbedded into the upper end ; those at the rope then raised it to the proper height, and a man on the platform swung it over the tank into which it was carefully lowered. While it was held submerged by an assistant the "high" reading was taken. Then the tie was allowed to rise out of the tank, the tongs were re-attached and it was swung onto the empty pushcar, while the "low" reading was taken. Three men were found necessary at the rope to move the tie with the desired speed. One man attached and released the tongs at the pushcars and placed the ties in position at the side of the car for attachment of the tongs. He had to receive occasional assistance from one of the men at the rope. Two men received the ties after submergence and piled them on the empty car for carrying back to the yard. Twenty ties were readily measured per hour of actual operation, but owing to delay in handling and selection of ties in the yard and further delays in moving the cars to the platform, a hundred measurements represented a very good day's work.

It is evident, this gives the volume of the submerged tie directly ; such errors as arise are the constant for which the tank can be calibrated and the error due to absorption and adhesion, for the ties were dry when brought from the yard. The constant error in calibration was found to average less than .02 cu. ft. and varies nowhere greatly, while the absorption error was quite regularly .03 cu. ft.

Beside the variations inherent in the nature of the material, these errors were inconsiderable, and as the results did not allow of calculation into the first decimal of pounds per cubic foot, the first was entirely neglected, and the average of the low reading before and after submerging the tie was used.

The following form of record was found convenient:

VOLUME DETERMINATIONS AT LAS VEGAS, N. M.

MAY 9, 1905.

Red Pine from Pecos—November Cut.

Stack. No.	*Tie. No.*	*Wt. lbs.*	*Wt. per cu. ft.*	*Vol. cu. ft.*	*Low.*	*High.*	*Low.*	*Remarks.*
53	2	86.5	29.4	2.94	2.07	5.00	2.04	
47	30	80	27.8	2.88	2.04	4.90	2.01	
53	14	115	30.6	3.76	2.01	5.76	1.98	
53	30	146	29.8	4.90	1.98	6.00	1.10	Spill.
34	27	120	31	3.77	1.10	4.80	1.08	
47	18	85	28.4	2.99	2.40	5.37	2.37	Water in.

The first two columns were in this case necessary in order to find from the records the weights given in the third column.

FREDERICK DUNLAP.

THE MEASUREMENT OF SAW LOGS AND ROUND TIMBER.

For very many years the only way of determining the amount of lumber in board feet which a sawlog should yield has been to employ certain so-called "log rules"– arbitrary scales which profess to give the amounts based on the length of the log in feet and on the diameter measured in inches. These rules differ widely one from the other, are crudely constructed, and give mostly such astonishingly low figures as to cause great injustice to the sellers and to furnish them a certain pretext for recrimination and fraud in a vain attempt to get even with the buyers. It would seem to be high time that this "school for scandal" should be closed.

At the outset it should be stated that two of the old rules are indeed mathematically correct, but they are not calculated to show the number of feet of boards in a log. The Constantine rule, (Vol. $= 0.7854D^2$,) gives the solid contents in board feet of a log 12 feet long and D inches in diameter, but with no allowance for sawkerf or slab, — and the Humphrey or Vermont rule, (Vol. $= 0.5\ D^2$) which gives the volume of the squared timber in board feet. This last rule is sometimes employed as a log rule under the false impression that the loss in saw kerf will be made up by the boards obtained from the slabs. As a matter of fact, the slabs very much more than counterbalance the sawkerf, especially in large logs.

Now a rule-maker who is desirous of making a rule that shall be at once scientific, just, and acceptable, will, as he advances in his investigations, encounter the following leading difficulties and considerations.

First, the criterion of the correctness of the log rule is furnished by the board rule.

Second, the amounts actually secured from logs whose diameters measure alike to the tenth of an inch are not necessarily the same, but may differ by as much as three feet in a 12 inch log. This is caused by the circumstance that in "through and through" or "live" sawing, the slabs on the opposite sides are not always of equal thickness as they should be to secure the same maximum amount. The variation is increased to about 14 feet when we neglect fractions of an inch and class as a 12 inch log one whose diameter lies between 12 and 13 inches.

A third source of uncertainty is the shrinkage under the board rule. This shrinkage is due to the custom of disregarding fractions when surveying boards with the board rule. It is a matter of chance whether the boards from a given log all happen to run just over the mark and so count full, or whether they all fall just under the mark so that on each board there is a sacrifice of nearly a foot. There are still other minor sources of variation, some of them depending on the degree of skill and care employed, but perhaps enough has been said to show a total extreme variation of more than 20 feet in a 12 inch (12 to 13 inch) log, and to exhibit the extreme difficulty of arriving at great exactness by the empirical method at the mill without basing the averages on very numerous, and probably costly, experiments conducted with some degree of scientific caution.

Finally there enters into consideration what may be called the buyer's psychology. In view of the above-mentioned uncertainties as to the output and the difficulty of fixing upon an average with anything like authority and exactness, the buyer will always expect all doubts to be decided in his favor, or he will not use the rule, and no statute can compel him to do so.

In view of these facts it seems advisable to travel the "high priori road" as far as it will take us, and for the rest, to rely on our best experience and judgment; for the rule, to be successful, must be not only just and fairly accurate but acceptable also. Absolute accuracy is out of the question. We must be satisfied with a scientific approximation that shall not leave out of account the psychology.

In making a rule, the following conditions must be kept in view:—thickness of the planks; thickness of the saw; the amount of crooks and blemishes it is proposed to allow for, that is, the quality of the timber; the method of sawing, whether through and through, or slab sawing; and, lastly, whether the boards are to be of the same width throughout. We shall assume :—1, boards one inch thick ; 2, one-quarter inch sawkerf ; 3, first class timber ; 4, logs sawed through and through ; 5, boards of the same width at both ends.

Now the total contents of a first class log, 12 feet long and D inches in diameter is, $0.7854\ D^2$ cubic feet. The loss in sawdust will be one-fifth, leaving $0.62832\ D^2$ cubic feet. It only remains to make the proper allowance for slabs and edging, or surface waste. The assumption will generally be easily admitted that the slabs and edgings encroach to the same average depth below the surface of the log all around, whether the log is small or great. This makes the surface waste proportional to the amount of surface, or what is the same thing, proportional to the diameter. Just what this proportion should be is now the main question left to be answered. This proportion or factor is the same for all diameters, and it is therefore only necessary to examine a log of any one diameter, and to divide the sawed log into three portions, one being the sawdust, the second the average amount of trimmed boards, and the third, the surface waste. Suppose the log to be an average 12 inch, that is 12.5 inches in diameter. We shall then have—

Volume without allowances	**122.66 feet.**
The saw kerf is one-fifth of this or 24.53, leaving	**98.13 feet.**
The board rule shrinkage is 4.5, leaving	**93.63 feet.**

So far the reckoning has been strictly accurate. If we assume for argument's sake that 78 feet for this log appears judicious and acceptable to both parties to the business, it will still remain for us to show how we account for the difference of 15.63 feet. This quantity consists, first of the average actual surface waste, which is subject to unavoidable and uncertain fluctuations, very much like those mentioned above ; second, allowance for the small, obscure and uncontrollable sources above mentioned, and also a small margin of safety which shall draw the figures down a trifle below our probable average amounts. Now there is a certain convenience in taking for the surface waste as many feet of boards as there are inches in the diameter,—in this case 12.5, leaving 3.13 feet as the margin of safety for the buyer.

Whatever figures one may decide upon for this "12 inch" log, the method has this advantage, that, after the scale is computed, the practical tests at the mill need not be confined to any one diameter, it will only be necessary to keep a record of all the lengths and diameters of logs entering the mill, and of the quantities of finished boards leaving it. The totals by the log rule can be compared from time to time with the totals by the board rule, and the degree of accuracy of the former gradually ascertained. In other words, with a rule constructed on this plan, the ordinary sawyers' tallies should furnish a good test every day. So far, a few millers and scalers of experience have examined the rule which we have developed, and pronounced the figures safe but very close. They therefore advise all who use the rule to make full allowance for all crooks and blemishes. The convenience mentioned of estimating the surface waste at as many feet as there are inches in the diameter appears when we compare this, which I call The Champlain rule, with the Constantine rule. This latter rule is computed for whole inches; By the Constantine rule a log 12 feet long and having a diameter of just 12 inches (not 12.5) has, without allowances—

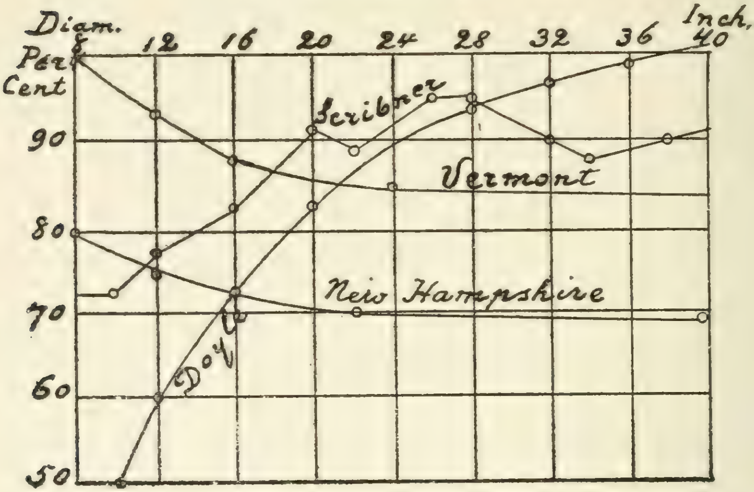
A volume of	113 feet
One-fifth out for sawkerf leaves	90 "
One diameter out for surface waste leaves	78 "

here the allowance for board rule shrinkage and buyers' margin is contained in the neglected fraction of an inch in the diameter.

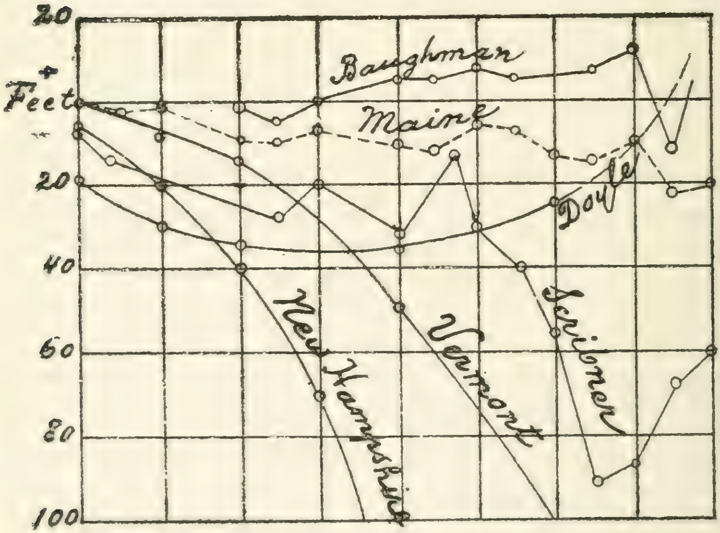
The Champlain log rule has been computed on this latter basis of whole inches, since thereby the same end is reached in a simpler manner and the rule better adapted to the understanding and convenience of a wider public. Any one who can do simple ciphering can square the diameter given in whole inches, multiply by 0.6283, and subtract the diameter, and thus have the quantity sought. This will be the quantity for a 12-foot log; for other lengths, multiply by that length and divide by 12. The formula for this new rule will then read—$Vol. = 0.6283\ D^2 - D.$

THE CHAMPLAIN LOG RULES COMPARED WITH OTHER RULES.

BY PERCENTAGES.



BY QUANTITIES.



To compare it with some of the more familiar rules the figures for a 12 foot log are subjoined.

Diameters.	*6*	*8*	*12*	*16*	*20*	*30*	*40*	*60*
Champlain rule	17	32	78	145	231	535	965	2202
Vermont	18	32	72	128	200	450	800	1800
New Hampshire	14	26	58	104	163	367	652	1471
Baughman	13	31	79	145	233	542	971	2174
Doyle	3	12	48	108	192	507	972	2352
Carey	18	33	78	143	227	536	---	----
Scribner	14	23	59	119	200	493	903	----

Comment upon these figures would seem to be unnecessary.

In order to make a skeleton rule, adapted to any thickness of plank as n inches, and any thickness of saw as s, where s will be a fraction of an inch, we notice that s parts are lost and n parts saved in every $n + s$ parts. The surface waste will be the greater the thicker the planks, but it will always be properly represented by the diameter multiplied by a factor which will be the same for all diameters; we may call this factor k provisionally, and the formula will read :—

$$Vol. = \frac{n}{n+s} \frac{3.1416}{4} D^2 - kD.$$

Thus, for two inch plank, $n = 2$, if $s = 0.25$ the formula reduces to $Vol. = 0.7\,D^2 - k\,D.$; the fraction being rounded off to 0.7 from 0.6981, as being near enough. For a band saw if $s = 0.125$, the formula for one inch boards is $Vol. = 0.7392, D^2 - k\,D$, which may also be rounded off to 0.7. The value of k in each case should be determined by experience, but would seldom differ much from n.

When we come to the measurement of long timber, other considerations make necessary a different method of procedure. The writer believes it impossible to construct a general formula that shall apply equally to all lengths and diameters. It might perhaps be possible if the lengths of long timbers were always a multiple of twelve feet.

We may assume first that the timber is to be cut into 12 and 16 foot lengths as far as possible, and otherwise into even-numbered lengths as near to 12 and 16 feet as may be. For example, a timber 28 feet long would make one 12- and one 16-foot log. It will now be found that more lumber can be secured by taking the long log at the top than the other way. The difference becomes of importance when the butt is a good deal larger than the top. All timber lengths above 24 feet which are divisible by 4 can be divided into 12- and 16-foot lengths. Altogether it appears necessary to treat each length as a separate problem.

The simplifying assumption may be made that the timbers taper uniformly. In case a stick expands suddenly near the butt, it will be the duty of the scaler to determine what the butt diameter would be if the taper above were continued uniformly down to the butt. This estimate will in some cases call for very careful judgment—the danger being of getting the figures too large, but it seems to be the only way, if we wish to avoid the necessity of using the calipers. We have thus to measure butt diameter, top diameter, and length, which requires only a tape line.

Under these assumptions tables are constructed by taking a certain top diameter, butt diameter and length, and calculating by proportion the upper diameters of all saw logs in the timber, and then getting the corresponding quantities from the Champlain log rule, and adding them up to find the contents of that stick. Intermediate sizes are found by interpolation. Such tables are now being computed by the writer.

Some scalers take the diameter of a long timber at the middle as an average diameter, but this will be found to give too large figures. A better approximation, as I find from my tables by inspection, is to subtract from the middle diameter one inch when the taper is not over two inches in 12 feet, two inches if the taper is 2 to 4, and three inches if the taper is 4 or more inches in 12 feet, and to use this reduced figure as the average diameter. It is not meant that this is an accurate rule, but it will not often vary from the true amount by more than 5% to 10%.

Those interested in finding the total contents of a long timber with a uniform flare and without allowance for sawkerf, can use the formula :

$$Vol. = \frac{\pi L}{144}\left[D^2 + D_1^2 + DD_1 \right],$$

where D is the top diameter, D_1 is the butt diameter, L is the length in feet, $\pi = 3.1416$, *Vol. = board feet.* If sawed, and boards are merely trimmed and left wider at one end, we have—

$$T = \frac{\pi}{15}\left[D^2 + D_1^2 + DD\right] - \left.\frac{D + D_1}{2}\right\}\frac{L}{12}$$

which may perhaps stand as a curiosity,

The Champlain Log Rule has been copyrighted by the author, and the printed rule as well as measuring sticks based on it are to be had in the trade, or by addressing the author.

A. L. Daniels.

NOTE ON INCREMENT OF SPRUCE IN WEST VIRGINIA AND FIRE LOSSES.

In devising plans for protecting a certain forest property, in West Virginia it became necessary to determine how much money could be reasonably spent in reducing or obviating the fire loss. It is a property of about 75,000 acres; the annual felling area being 3,000 acres, hence the old timber may be worked for 25 years.

The annual felling areas, as soon as cut over, have hitherto been burned, and practically everything living left on them has been destroyed.

To determine the fire loss approximately as an argument for expenditures in carrying out preventive measures it was needful to ascertain how much the small spruce, which was thus systematically destroyed, would have produced towards some future harvest.

It is not often that an opportunity is afforded in a newly opened district to measure such production on areas on which no fire, or other accident, or else damaging shade or careless removal of old timber has interfered. It may, therefore, be of interest to record the result of measurements of a stand which offered this opportunity.

Over a considerable area the old timber had some years ago been destroyed, the destruction according to testimony of a native, taking place gradually within 7 to 8 years, having begun in the year 1877—the year after the Centennial Exposition, hence easily remembered. The cause of the destruction was ascribed to a "worm or fly", probably a bark beetle.

In analyzing the growth of a number of trees of various sizes, it was found that in no case was a response to changed conditions noticeable until 8 to 10 years after the year in which the old timber had begun to die. This may have been due to one of three causes, or all three causes combined, namely, either the particular spot which came under observation had been reached by the pest toward the end of its period of spread, or the timber died only gradually, keeping up root competition and shade, or else the theory of Kienitz found expression according to which the shade-foliage of the young spruces had to change to light-foliage before the increased increment could take place.

Whatever the cause, here was a growth of young or rather *small* spruce—for 6-inch trees, before the new lease of life began, were here over 80 and 100 years, 8-inch trees over 150 years old—of all sizes from 2- to 12-inch, which had grown from 18 to 20 years at the accelerated rate resulting from the killing of the old timber.

Not enough trees were analyzed to make regular growth tables, but a sufficient number of the various size classes to permit the statement that the diameter accretion varied from ¾ to 1¼ inch in five-year periods, so that in 25 years a 2-inch tree would have grown into the 5- to 6-inch class, and the latter size would have grown into 11- to 12-inch trees. In volume, these latter had grown at the average rate of little less than one-half cubic foot per year, so that in 25 years ten of them would have produced at least 1¼ cord of new growth and would cut 1½ cord, while 7- to 8-inch trees had grown at the rate of one-third cubic foot, ten of hem cutting nearly one cord, and ten 5- to 6-inch trees, growing at the rate of one-tenth cubic foot, would cut one-third of a cord.

Two sample areas, averaging 1469 trees per acre, gave the following counts, averaged, and rounded off in the lower diameter classes ;

Diameter,	2	3	4	5	6	7	8	9	10
Number,	500	300	270	160	120	55	44	12	8

Larger diameters were considered as not belonging to a future but to present harvest. Applying the above figures for annual production, the 399 trees of 5 to 10 inch diameter will have made on the average nearly $\frac{4}{5}$ cord per year and acre. In other words, in 25 years, a harvest of at least 20 cords of pulpwood per acre, from trees 5 to 16 inch in diameter could be cut, leaving some thousand trees of 4 inch and less for succession.

This calculation, to be sure, refers only to the better spruce areas, where spruce is almost pure. Sample areas in the poorest stands of the mixed hardwood and spruce forest, developed only 200 small spruces to the acre, of which, however, a larger proportion, namely 90, belonged to the diameter classes above 5 inch. These, if placed under similar conditions as the above area—which would be nearly the case if the old spruce were logged—would produce at the rate of one-third of a cord per acre, or would cut at the end of 25 years about 8 cords.

To complete the rough calculation of the fire loss we could assume that only one-third of the property was of the better type, one-third of the poorer, and the last third negligible as regards new growth. Under such assumption, by the burning over of the year's felling area over 1000 cords of prospective harvest, or one-third of a cord for every acre burnt, is being lost every year. If the fire could be kept out, after 25 years when the virgin timber has been cut over, an annual harvest of 28,000 cords, worth then, probably, far over $100,000, could be secured for at least 25 years, if not continuously.

The present capital value of such a prospective revenue, if discounted even at the high rate of 5 per cent, would not be far from $500,000.

Even if we halved this conservative figure and assumed that only half the area could be saved from destruction, the margin left would still be large enough to warrant an expenditure of several thousand dollars for reasonable protection against fires, which in this particular case could be attained with a few hundred dollars.

It is rarely realized how large the loss in the destruction of young growth is, and such a rough calculation, which can be made without expensive surveys, may stimulate closer inquiry into the possibilities of saving the loss.

B. E. Fernow.

NOTES ON THE RATE OF GROWTH OF RED CEDAR, RED OAK AND CHESTNUT.

A knowledge of the rate of growth of trees is necessary to determine whether it will pay to practice forestry. One reason why more farmers and other owners have not attempted to establish plantations and to do other forestry work is the lack of knowledge of the results of such work. A case in point is the problem whether a farmer in southern New England should allow an abandoned pasture to grow up to Red Cedar and Birch or should undertake the trouble and expense of planting Pine or hardwoods. Some might at first consider it most profitable to let the ground grow up to Cedar because this is a valuable species and because nature does the sowing. Others would urge that Red Cedar in southern New England grows so slowly that it would be better to plant Chestnut or Pine which grow rapidly and yield, when fully stocked, at least one cord per acre per annum. A study of growth would definitely answer this question. Such investigations are now in progress. Until their completion the data given below will be only suggestive to foresters.

RED CEDAR, *Juniperus virginiana*, LINN. This species grows much more slowly and produces less valuable wood in New England than in the South. Its chief use in the north is for posts, though a small amount is used for chests and novelty wood. It occupies abandoned fields, sometimes to the exclusion of other species. When it does not grow in dense stands, other species, such as Chestnut, Maple, Birch and Oak gradually creep in. These species grow more rapidly than Cedar and soon overtop it. On old clearings Cedar may be found growing under four conditions: Trees in the open with full crowns; trees in crowded stand, with crowns reduced but not overtopped; trees which in youth were in full enjoyment of light but later were suppressed by Chestnut or other species; trees crowded and overtopped from youth.

A study of 23 trees cut near New Haven, Conn. showed that a tree growing in the open requires 30 years to yield a post six feet long and four inches in diamater at the top end; that by scant measurement two such posts can be obtained in 40 years; that at 50 years one post ten feet by five inches and one post six feet by four inches can be obtained.

The study showed further that a tree growing in crowded stands (but not overtopped) yields in 30 years one post six feet by scant four inches; in 40 years still only one post six feet by four inches, in 50 years one post ten feet by four and one half inches, and one post six feet by scant four inches; in 60 years one post seven feet by six inches and one post six feet by four inches. Suppressed trees require fully fifty years to yield one four inch post. This is certainly a discouraging outlook for the species in New England. The results of the study are given in the following table:

RED CEDAR.

Based on the measurement of 23 trees near New Haven, Conn.

A. TREES IN THE OPEN.

Age	*Diam. Inside Bark on Stump*	*Diam. Inside Bark at 6 ft. Above Stump*	*Diam. Inside Bark at 12 ft. Above Stump*	*Diam. Inside Bark at 18 ft. Above Stump*
Years	*Inches*	*Inches*	*Inches*	*Inches*
30	5.5	4.0	2.3	1.6
40	6.8	5.1	3.5	2.6
50	7.8	5.9	4.5	3.6
B. TREES CROWDED, BUT NOT OVERTOPPED.				
30	4.8	3.7	2.3	1.3
40	5.9	5.0	3.3	2.1
50	6.8	6.0	4.1	2.6
60	7.4	6.6	4.6	2.8
C. TREES FREE IN GROWTH, BUT LATER ON OVERTOPPED.				
40	4.4	3.7	2.7	1.4
50	5 1	4.5	3.4	2.2
60	5.5	4.8	3 7	3.0

RED OAK, *Quercus rubra*, LINN. This species is of interest on account of its rapid growth in height and diameter and the excellent character of its timber. The following table shows the average rate of growth in diameter, and height of the maximum trees in a sprout stand growing in good soil near New Haven.

RED OAK.

MAXIMUM GROWTH OF TREES IN A SPROUT STAND.

Based on the Measurement of 53 Trees near New Haven, Conn.

Age	*Diameter Breasthigh Outside Bark*	*Height*
Years	*Inches*	*Feet*
20	3.5	36
30	5.4	47
40	7.3	57
50	8 8	65
60	10.4	70
70	11.2	--

CHESTNUT, *Castanea dentata*, (MARSH.) BORKH. This species does not reproduce well by seed in most sections on account of the repeated fires, although where fires are kept out for a number of years, seedlings are plentiful. Most trees in the forest are sprouts. Therefore the rate of growth of sprouts is more immediately important than of trees from the seed.

The average stand of Chestnut sprouts contains many crooked trees. The natural tendency of the species is to grow straight, but where there are several sprouts in a clump, each one is apt to have one or more crooks, and the crowns are irregular and contracted. There is no reason why straight trees should not be produced if the stand is properly thinned in youth. There is also no reason why nearly all the dominant trees in a stand should not grow as rapidly as the maximum trees in an unthinned stand. We are, therefore, most interested in the rate of growth of the maximum trees in ordinary stands and not so much in the average rate of growth of all trees including the subordinate part of the stand. Two tables of growth are given for average conditions obtaining at New Haven, Conn., on fairly good soil.

These tables show that a pole 30 feet long and six inches in diameter may be grown in the open in 30 years, but in the forest even the maximum trees require 40 years. The trees grown in the open are very limby and therefore less desirable than the forest grown trees. On the other hand it is probable that the growth of the forest grown trees can be increased through thinning without effecting their quality. It is probable that in 50 years 100 to 150 trees per acre at least 13.7 inches in diameter at breast height, can be produced. If by thinnings 125 trees straight enough for poles could be secured in 50 years a stumpage value, in poles alone, of $125, according to New Haven prices would be attained. Under present practice it is rare that more than 10% of the trees are fit for poles or piles.

CHESTNUT SPROUTS

Based on the Measurement of 39 and 29 Trees near New Haven, Conn.

A. DOMINANT TREES IN THE FOREST.

Age	*Diameter on Stump Inside Bark*	*Diameter Breast-high Outside Bark*	*Diameter at 10 ft. Above Stump Inside Bark*	*Diameter at 20 ft. Above Stump Inside Bark*	*Diameter at 30 ft. Above Stump Inside Bark*	*Diameter at 35 ft. Above Stump Inside Bark*
Years	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
10	2.1	2.1	1.35	0.3		
20	5.4	5.1	4.3	3.4	0 9	
30	8.7	7.8	6.9	6.1	3.7	2.9
40	11.45	9.7	8.9	8.0	5.8	5.0
50	13.7	11.3	10.6	9.5	7.25	6 5
60	----	12.5	11.9	10.7	8.55	7.8

B. TREES IN THE OPEN.

10	3.0	3.0	2.2			
20	7.8	7.4	5.9	4.5	2.5	
30	13.2	11.5	9.8	8 0	6.0	
40	18 5	15.3	13.2	11.0	7.9	
50	23.4	18 5	15.9	13.4	11.2	

It is interesting to compare with this table the results of the measurement of 100 trees at Milford, Pa. These trees grew on a plateau at an elevation of about 800 feet above sea-level and 300 feet above the Delaware river. The soil here is second-class hardwood land.

CHESTNUT SPROUTS

Based on measurements of 100 Trees at Milford, Pike County, Pa.

A. AVERAGE GROWTH OF DOMINANT TREES.

Age	*Diam. Inside Bark on Stump*	*Diam. Outside Bark at Breast Height*	*Diam. Inside Bark at 10 ft. Above Stump*	*Diam. Inside Bark at 20 ft. Above Stump*	*Diam. Inside Bark at 30 ft. Above Stump*
Years	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
10	2		.5		
20	4		2.25	1.95	
30	5.96		4.1	2.85	1.35
40	7.86	7.7	6	4.7	2.85
50	9.68	9.6	7.95	6.35	4.4

B. MAXIMUM GROWTH OF DOMINANT TREES.

10	3.3		1.9		
20	6.2		4		1.6
30	8.9		6		3.3
40	11.0	10.9	7.9		5
50	13.0	12.8	9.8		6.2

H. S. GRAVES.

METHODS OF MAKING DISCOUNTS FOR DEFECTS IN SCALING LOGS.

In the last number of the FORESTRY QUARTERLY an article by Professor H. S. Graves, on the Methods of Scaling Logs, discussed the methods of making discounts for visible defects. A table was given for losses caused by defects near the centre of logs, and it was shown that such losses would be expressed very closely by the simple formula :

Loss in Board Feet $= \frac{2}{3}(D+1)^2 \times \frac{L}{12}, = \frac{L}{18}(D+1)^2$, where D is the diameter of the hole or defect and L the length of the log. This was found to be independent of the diameter of the log.

There remains yet to be considered the problem of discounting for defects near the surface of the log, or which extend inwardly from the surface. Through the courtesy of Professor Graves, to whom belongs the credit of originating these cull rules, I am enabled to present here the completion of this subject.

The case of the defects just mentioned is not so simple as the previous one, for the defects may be of a great many shapes and conditions, each one giving raise to losses of different kind. It is necessary to classify them in some way before any rule whatever can be applied. The simplest way is to throw these into two general groups ; first, those which could be removed most economically by cutting off a straight slab from the side of the log ; and second, those which run in towards the centre and could be removed with less loss by cutting out a V-shaped wedge (sector) from the bark inwardly, with the point at the center. The latter description, however, does not imply that the log would be sawed in this manner, but refers only to the conception of measuring the defect.

When the shape renders it uncertain as to which group a defect belongs, both of the following rules for these two cases may be applied, and the one showing the least loss chosen.

The accompanying tables, B and C, which are here presented for the first time, were constructed from diagrams, similarly to the one presented in the former article, and the results harmonized graphically by curves. In these diagrams a saw kerf of ¼ inch was assumed and 4 inches taken for the minimum width of board, the logs being assumed to be slash-sawed. The fact that the relative position of the cuts in the circle influences the output was taken into consideration, and the results were figured in this way:—the greatest possible output was measured and from this was subtracted the maximum output which could be obtained with the slab or sector removed, the difference being taken as the loss. It is thought inadvisable to make an additional discount of 5%, as was done in case A discussed by Professor Graves on p. 253, inasmuch as the irregularity of the imperfection would generally allow a slight saving from the loss occasioned by removal of the entire area indicated.

To sum up the whole subject of discounting for defects, there are the following three cases:

Case A. Discussed in the former article by Professor Graves; being the loss due to defects not less than 4 inches from the bark, of a more or less circular form.

Case B. Loss due to irregular defects, such as could be removed with less loss by cutting out a V-shaped wedge (sector), with its point at the centre of the log.

Case C. Loss due to defects within four inches from the surface, such as could be removed by a slab from the side of the log.

The tables are to be used in the following manner: If the defect can best be removed by cutting off a wide slab, measure the greatest thickness of the necessary slab and apply table B. If the removal of a slab would cause more loss than sawing through, measure the fractional portion of the circumference covered by a V-shaped wedge containing the imperfection, and apply Table C. When in doubt, try both tables and use the one giving the least loss.

Figures for other log lengths than those given in the tables may be supplied by interpolation.

For sake of comparison we repeat the table applying to case A. from p. 253 of the QUARTERLY slightly changed and enlarged.

HARRY D. TIEMANN.

CULL-RULE.

Case A—Loss in Board Feet by holes near the center of Logs.
[*Good for defects more than 4 inches from bark.*]

Diam. of hole.	LENGTH OF LOG IN FEET.							
	10	*12*	*14*	*16*	*18*	*20*	*22*	*24*
Inches.	*Board Feet.*							
2	5	6	7	8	9	10	11	12
3	9	11	13	15	17	18	20	21
4	14	17	20	23	26	28	31	33
5	20	24	28	32	36	40	44	48
6	28	33	39	44	50	55	60	65
7	36	43	50	57	65	72	78	85
8	45	54	63	72	81	90	99	108
9	56	67	78	89	100	112	122	133
10	67	81	93	107	120	133	148	161
11	80	96	112	128	144	160	176	192
12	94	113	132	151	170	188	207	225
13	109	131	153	175	197	218	240	261
14	125	150	175	200	225	250	275	300
15	142	171	218	226	255	283	313	341

Case B.—*Loss in board feet by irregular holes, removeable by a V-shaped wedge (sector).*

Part of Circle Removed.	DIAMETER OF LOG IN INCHES.										
	12-foot logs.										
	6	8	10	12	14	16	18	20	22	24	26
1–16	2	4	6	8	10	13	17	20	25	30	36
1–8	5	7	10	13	17	21	27	33	40	49	59
1–4	9	13	18	24	30	39	48	59	73	90	108
3–8	9	17	27	36	47	59	75	93	113	136	160
1–2	9	17	27	39	55	73	93	117	142	170	200
	16-foot logs.										
1–16	3	5	7	10	13	17	23	27	33	39	48
1–8	7	9	13	17	22	28	35	44	53	65	79
1–4	11	17	23	31	40	51	64	79	97	120	144
3–8	11	22	35	47	62	79	99	123	151	181	213
1–2	11	22	35	52	73	97	123	155	189	226	268
	20-foot logs.										
1–16	3	6	9	13	17	22	28	33	41	49	60
1–8	8	12	17	22	28	35	44	55	67	82	98
1–4	14	21	29	39	50	64	80	98	121	150	180
3–8	14	28	44	59	78	98	124	154	188	227	267
1–2	14	28	44	65	91	121	154	194	237	282	334
	24-foot logs.										
1–16	4	7	11	15	20	26	34	40	49	59	72
1–8	10	14	20	26	33	42	53	66	80	98	118
1–4	17	25	35	47	60	77	96	118	145	180	216
3–8	17	33	53	71	93	118	149	185	226	272	320
1–2	17	33	53	78	109	145	185	233	284	339	401

CULL RULE.

CASE C. *Loss by irregular holes, removeable by slabbing.*

Depth of Slab from Surface	DIAMETER OF LOG IN INCHES										
	6	*8*	*10*	*12*	*14*	*16*	*18*	*20*	*22*	*24*	*26*
Inches	*12-Foot Logs,*					*Board Feet*					
1	0	1	1	2	2	3	3	4	4	5	5
2	4	5	6	7	7	8	9	10	11	11	12
3	9	10	11	13	14	15	16	18	19	20	21
4	----	17	19	21	23	24	26	28	30	31	33
5	----	----	27	29	32	34	37	39	42	44	47
6	----	----	----	39	43	46	49	52	56	59	62
7	----	----	----	----	55	59	63	67	71	75	79
8	----	----	----	----	----	73	78	82	87	92	97
9	----	----	----	----	----	----	93	98	104	110	115
10	----	----	----	----	----	----	----	117	123	129	135
11	----	----	----	----	----	----	----	----	142	149	155
12	----	----	----	----	----	----	----	----	----	170	178
13	----	----	----	----	----	----	----	----	----	----	200
						16-Foot Logs.					
1	0	1	1	2	3	3	4	5	5	6	7
2	5	6	7	9	10	11	12	13	14	15	16
3	11	13	15	17	18	20	21	23	25	26	28
4	----	22	25	27	30	32	35	37	39	41	44
5	----	----	35	39	42	45	49	52	55	59	62
6	----	----	----	52	57	61	65	69	74	78	83
7	----	----	----	----	73	78	83	89	94	99	105
8	----	----	----	----	----	97	103	109	116	122	128
9	----	----	----	----	----	----	123	131	138	146	153
10	----	----	----	----	----	----	----	155	163	171	179
11	----	----	----	----	----	----	----	----	189	198	207
12	----	----	----	----	----	----	----	----	----	226	237
13	----	----	----	----	----	----	----	----	----	----	268
						20-Foot Logs.					
1	0	1	2	3	3	4	5	6	7	8	8
2	6	8	9	11	12	13	15	17	18	19	20
3	14	17	18	21	23	25	27	29	31	33	35
4	----	28	31	34	38	40	43	46	49	52	55
5	----	----	44	48	53	57	61	65	69	73	78
6	----	----	----	65	71	76	82	87	93	98	103
7	----	----	----	----	91	98	104	111	118	124	131
8	----	----	----	----	----	121	129	137	145	153	161
9	----	----	----	----	----	----	154	163	173	183	192
10	----	----	----	----	----	----	----	194	204	214	224
11	----	----	----	----	----	----	----	----	237	247	259
12	----	----	----	----	----	----	----	----	----	282	296
13	----	----	----	----	----	----	----	----	----	----	334
						24-Foot Logs.					
1	0	1	2	3	4	5	6	7	8	9	10
2	7	9	11	13	14	16	18	20	21	22	24
3	17	20	22	25	27	30	32	35	37	39	42
4	----	33	37	41	45	48	52	55	59	62	66
5	----	----	53	58	63	68	73	78	83	88	93
6	----	----	----	78	85	91	98	104	111	117	124
7	----	----	----	----	109	117	125	133	141	149	157
8	----	----	----	----	----	145	155	164	174	183	193
9	----	----	----	----	----	----	185	196	207	219	230
10	----	----	----	----	----	----	----	233	245	257	269
11	----	----	----	----	----	----	----	----	284	297	310
12	----	----	----	----	----	----	----	----	----	339	355
13	----	----	----	----	----	----	----	----	----	----	401

CATALPA CRAZE.

More than one hundred years ago when the fear of a timber famine agitated the people of Germany, we find among the many suggestions of relief offered a pamphlet entitled : "The Catalpa, a sure means of avoiding the wood famine." History seems to repeat itself, and we seem destined to pass through the same phases of development as other nations, even in this particular.

The wood of Catalpa has been credited with possessing great durability in contact with the ground, combined with rapid growth, and on that account the planting of this tree for the production of railroad ties, fence posts, and like material, has been frequently, and in some cases persistently, advocated. Like all things which possess numerous good qualities, Catalpa has added to the ranks of her ardent admirers many persons, who, on account of their superficial knowledge of this tree and its real value, are carried away with the striking good qualities possessed by the wood and have entirely overlooked its limitations, advising its use for certain purposes to which it is but little adapted.

Within the past five or six years Catalpa has been quite extensively planted by several railroads for the purpose of producing tie material. That they will not meet with the expected success seems certain, for almost the entire basis of the many and varied statements made concerning Catalpa raised in plantations, and its value for railroad ties, is founded on theory rather than on fact.

In support of the statements that the wood is well adapted to the above purpose we are asked to look at this or that cross-tie which was in continuous use in some road bed for twenty years or more. Though this tie may be badly cut by a rail, such cutting, it is stated, can be quite eliminated by the use of proper tie plates ; but such a statement can be made only theoretically, since no actual tests of Catalpa have been made under such conditions.

Upon examining farther into the history of this cross-tie we find that its past is somewhat clothed in doubt, and probably the actual number of years it remained the part of some railroad track cannot be accurately stated. Further, it should be remembered that in the earlier days when Catalpa ties were used the rolling stock of railroads was much lighter and the weight of the trains far less than at the present time. Can we, then, safely judge from the action of Catalpa ties having an uncertain past and used under conditions much less severe than are prevalent today, what the present value of such a tie will be, even using a tie plate, when the road bed is subject to the wear and tear of engines weighing 110 tons and large freight cars carrying 50 tons burden?

Catalpa enthusiasts in some cases state that a planter may expect to harvest every fifteen years, on various kinds of soils, five ties per tree besides fence posts and other material; but strangely enough, though there are Catalpa plantations of an age of 30 years or more, and owned by railroads, no ties have so far been cut from such plantations, nor are there records that any plantations so far have produced material in sufficient quantity and of a size suitable for this purpose.

The rapid growth of Catalpa into material suitable for cross-ties has been greatly overestimated, and it is questionable if under ordinary conditions it will ever prove to be of as great value for railroad ties and similar materials as many other woods, especially if the latter are impregnated.

Catalpa has a mission to fulfill, and an important one, but it is doubtful if the production of material for cross-ties can be considered as one of its chief attributes. Throughout the Middle West and in other regions where natural timber is scarce and fence posts are expensive, the planting of Catalpa on deep, rich, moist, well drained soils will prove profitable if thorough cultivation can be given for some years. It is one of the most fastidious of trees so far as soil requirements are concerned, and satisfactory results are to be obtained only on the best soils and with good care. B.

NOTES ON FOREST TERMINOLOGY.

Newly coined technical terms should have due regard to the laws of language. Where a badly formed word has already obtained wide-spread acceptance, it may be proper enough to sanction it, for usage is the only final criterion of good speech; but deliberately to invent a barbarism is the reverse of praiseworthy.

On the strength of this principle I wish to protest against some of the terms inserted in the Bureau list.

"Forestral" should be "forestal". The adjective is derived from the Low-Latin *forestalis*, and the *r* is a mere intruder. There may have been a notion that it should be inserted in analogy to "forestry". But the latter word is formed in analogy to the German "*Foersterei*", not a supposed Latin "*forestria*", which does not exist. If an analogous term had existed in Latin, it would have been "*forestalia*". Besides, forestral is decidedly cacophonous, while forestal, with the stress on the first syllable, sounds quite well.

"Silvics" is an entirely impossible word. There is a Low-Latin adjective "*silvaticus*", (see DuCange's Glossary), and from this the word "silvatics" might properly be formed. To leave out the syllable *at* makes it appear as if an ending derived from the Greek had been attached to a Latin root, which is an abomination.

On other grounds I would like to add a few suggestions to those of Dr. Fernow in the October number of the QUARTERLY.

"Dominant" is used in different senses by foresters and botanists. The latter give that predicate to a species or group of species which, by greater number or otherwise, imparts to a plant association its distinctive character. Perhaps the difficulty could be obviated if foresters would say "dominating", leaving "dominant" to the botanists.

A term not included in the list, but needing definition, is that of "forest economics". In the sense in which it is used in

Fernow's "Economics of Forestry", it evidently means so much of forestry as is not included in silviculture, utilization, or protection. In this sense it is a branch of, or rather a group of branches, of forestry, including mensuration, valuation, welfare effects (*Wolfarts-Wirkungen*, another subject that needs a technical term), and policy. But the word forest economics may also be used for a branch of political economy, designating the part played by forests and forest products in economic life—evidently something very different though closely allied. I wish somebody would invent a new term for the latter, I confess that I am unable to do so.

ERNEST BRUNCKEN.

[Mr. Bruncken has evidently misunderstood me in my use of the term *economics*. In choosing the title for my book it was certainly not my intention—as will appear from the first sentence of the preface—to include in its definition anything but what concerns the political economist, the student of economics, which is "the science of the utilities or useful application of wealth and material resources". Whatever of technical forestry, such as mensuration, valuation, silviculture, etc., appears incidentally, was introduced merely to make clear to the economist the nature of the forestry business. I recognize as a synonym the term *forest politics*, which includes *forest policy*, the application of its teachings and I have so used the term on p. 261 of the QUARTERLY.

In my book I have also used the term *forest economy*, keeping in mind the strict meaning of the word *economy*, namely the regulation of household affairs, the purely business arrangements of forestry, for which in a somewhat more restricted meaning, I use as a synonym the term *forest organization*.

It seems to me that the term *forest influences*, suffices to cover the idea of the (welfare) effects of forest cover on its surroundings.

B. E. FERNOW.]

CURRENT LITERATURE.

HENRY S. GRAVES, *in Charge*

Economie forestière. Par G. Huffel, Tome premier, Lucien Laveur, Editeur, 1904. 422 pp. Price, F 10.

The appearance of this work—the second volume of which has been published—was briefly noticed on p. 140 and 159 of the FORESTRY QUARTERLY; but its importance in the French literature and its valuable contents render a fuller review desirable.

It is a book for the professor of forestry rather than for the practical forester; a book for the student rather than a book for the graduate. It comprises some 422 pages, and is divided into four studies:—the first on the utility of the forests; the second on property and forest legislation; the third on forest politics; the fourth on French forests and statistics. The summaries given before each study are of value as they give in a concise manner a synopsis of each topic that is treated. In addition to the regular reading matter there are numerous interesting foot notes.

This volume covers in a brief way much that is usually included in an introduction to forestry. The history of the uses and prices of wood are treated from the historical standpoint. We learn that up to the beginning of the nineteenth century the forest was valued chiefly for fire wood, grazing and hunting. In some forests grazing was so valuable that the value of the forest was rated by the number of hogs which its mast would feed.

Monsieur Huffel believes that the value of rights of user in the forest keeps the laboring people from being congested in large towns, and thus bears upon the welfare of the nation.

One cannot help wondering what would have happened had coal never been found to take the place of firewood. As it now stands, in France, firewood is only for the rich and those who are distant from the towns. Had no coal been discovered, M. Huffel estimates, that France would need sixteen or seventeen times the amount of the present forests in order to supply the annual consumption.

Without iron the lumber supply would also have been insufficient. As far back as 1669 the French naval authorities were anxious about the future supply of oak suitable for ship building, and at various periods they reserved private and public forests to secure this public need. In 1843 the French marine commenced to use iron. Yet even with these eliminations the author shows that there exists an enormous demand for lumber for which supplies have to be found; for carpentry, mining props, railroad ties, paper, as well as for many minor uses.

In regard to the effect of the forest on climate and rainfall it is interesting to learn that the first systematic observations along these lines took place at Nancy in 1866. It is generally admitted now that forests have an important local and general effect upon the climate of a country.

In regard to the relation of forest to springs the author says: "The forest soil receives more water than the agricultural soil or the bare land. The forest, in diminishing local evaporation and in lessening the run off, certainly favors the saving of the springs in hot climates and on sloping soil, that is to say, in the great majority of cases. On level ground the actual result of the actions of the forest is still uncertain. It is probably variable according to circumstances." The recent investigations of Professor Henry, of the National School of Forestry at Nancy in 1899, made in the forest of Mondon, have shown in a preliminary way that the depth of the water table is usually lower in the forest than outside the forest, and a fact less generally known, that this difference is greater during the season of rest than during that of vegetation. Up to this time no conclusive explanation of this phenomenon is known.

The chapter on "Protection Forests" is perhaps the most interesting of the whole volume, as it deals with the two activities of French foresters with which every forester it most familiar; namely, the correction of the torrents, and the reforestation of the dunes.

In prefacing his remarks on torrents he says that heavy rain during short periods, easy erosion, and steep slopes are the chief factors in torrential action. We learn that France has two-thirds of the torrents of Europe, comprising some three-quarters of a million acres, of drainage mostly in the Alps. The terrible devastation experienced within this area was due chiefly to overcutting and overgrazing, which created numberless torrents. The work of restoration was begun in 1862 under methods that were originated by the well known engineer, Prosper Demontzey. In 1893, of 1462 torrents, 654 were under a course of treatment, 168 were cured and 31 were classed as incurable. Within the past two years there has been a revulsion of feeling regarding the methods that were first employed. Some of the best foresters in France now believe that the famous method of building expensive "barrages" is incorrect for many eroded districts, and that a bad torrent is not corrected by this means, without incuring immense expenditures.* It is significant that even now the inspector in charge of the works of reforestation in the Maritime Alps has modified the old methods, and emphatically disapproves of the enormous masonry dams or "barrages" which were formerly so popular. He believes that so far as possible the correction should be secured by living works rather than dead.

Probably the work of the French forest department in the reforestation of the dunes is more widely quoted than any other achievement. It is certainly remarkable to realize that where 100 years ago one could secure as much land for $5 as the voice would carry, now this same land is worth more than $100 per acre. A calamity was turned into a gold mine.

The first work of restoration took place near Arcachon in 1786, when Brémontier began the work. In reality this was not the first work of improvement, as the villagers of Teste are reported to have begun the sowing as early as 1717. The methods best employed are quoted below:

"The intolerant maritime pine grows under a glaring sun, even in the seedling stage. It grows more rapidly, especially at first, than any other important species of our Flora. Moreover, on ac-

*See under "Description," etc., in Periodical Literature.

count of its great fertility, one can always easily secure seed in large quantities at cheap rates." "One sows broadcast on each hectare a mixture of 25 kilograms of pine seed, 8 kilograms of broom (*Sarothamnus vulgaris*) and 5 kilograms of 'gourbet' (*Psamma arenaria*). The seed establishes itself on the sand, without any preparation of the ground. Then the sown areas are covered with pine branches, laid flat on the sand, after having lopped them in order to make them as flat and as fan-shaped as possible. The rows should be placed pointing north and south, the large end (of the branch) turned towards the west, stuck lightly in the sand, covered by the last branches of the preceding row, all the branches overlapping like the tiles of a roof. In order to anchor them it is sufficient to throw here and there a shovelful of sand.

The young seedlings, once up, are protected against the average wind by palisades built in the following manner :

Pine planks are driven vertically into the sand so as to form, west of the sown areas, a barrier running north and south and projecting about three feet above the ground. The planks are not put close together ; there should be a space of about two inches between them. When the sand has piled itself up to the top the barrier is raised by means of a lever and chain. It should be raised two or three times until the seedlings are strong enough to protect themselves and hold the soil."

An artificial littoral dune is formed close to the sea to prevent the sand from advancing landward by the following method : "A wattle work or palisade is established, parallel to the shore of the ocean and at a distance of 90 to 150 feet from this line. As fast as the sand accumulates before this barricade, part of it passes through the cracks between the planks or the wattles and backs up from behind. Little by little the sand rises and covers the barrier ; the barrier is then drawn up to the top of the mound, and the operation repeated in the same way until the dune has the proper height." The most convenient height has been found to be 40 to 50 feet. A cross section cut through a correct littoral dune would show a trapezoid with a top of 195 to 225 feet and with a base of 355 to 410 feet.

In France, the formation of a littoral dune costs only \$126.00 per mile; to sow an acre to maritime pine costs in France \$15.50; in Prussia it costs \$200 per acre (?) for their plantations of "mountain pine," and in Roumania, along the Danube, an acre planted with *Robinia pseudacacia* costs but \$2.50.

Considerable space is devoted to description of the forests of olden and present time.

One of the most noteworthy forests of France in early days was that of Ardenne; another the Sylva Vernensis, now the forest of Villers-Côtterets. In the last two centuries many of the forests were overcut, particularly where the cutting was for wood of large dimensions. An English agriculturist, named Young, found in 1790 that there existed only 17,565,000 acres of forest, or 14.3% of the total land area. In 1892 the area of the forest had increased to 23,628,041 acres, or 18.02%. The details of the present French forests are of more interest than those of former times, especially for those who contemplate a trip to France, but unfortunately the descriptive matter in the volume is not complete.

Mr. Huffel has divided the forests of France into six regions, namely: 1. North East. 2. Valley of the Seine and Loire. 3. North West and Central. 4. South West and the Pyrenees. 5. Mediterranean and "Pre-Alps." 6. Alps. To make the detailed material concerning some of the most typical and famous state and communal forests readily available for reference, the reviewer has reduced the notes to tabular form, which gives the forest region and department, in which they are situated, method of treatment, chief species, and rotation; where the notes are incomplete the details are lacking in the book. By a reference to the volume one can in addition usually find for each forest district its area, soil, yield in wood and money, and find a short review of its former history and treatment. Unfortunately the forests mentioned by the author are not always the most instructive, and the forests marked with the asterisk have been added by the reviewer as being worthy of a visit.

Department	*Forest*	*Principal species*	*Method of treatment*	*Rotation*	*See Huffel page No.*	*Remarks*
1. North East.						
Meurthe et Moselle	Pont a Mousson	Oak	Coppice under standards	30	347	
"	*Nancy (Haye and Champenoux)	Oak, beech	Conversion coppice under standards			
Vosges	Senones	Silver fir	Regular high forest and selection	140	349	
"	*Fraize Gerardiner		Same			
Doubs	Levier	Silver fir	High forest	140	351	Richer than the Vosges and probably the best silver fir in Europe
Jura	La Joux	Silver fir	High forest	140	351	
"	Chaux	Hard woods	Coppice under standards and conversions	30	355	Formerly mismanaged
Saône et Loire	Pourlans	Hardwoods	Conversion		357	
"	Saint Prix	Hard woods, especially beech	Conversion with introduction of soft woods	120	359	In 17th Cen. treated on selection coppice system, "furetage"
2. Valley of the Seine and Loire						
*L'Aisne	Villers-Côtterets	Beech, oak	High forest	150	362	
L'Eure & Seine-Inferieure	Lyons La forêt	Beech, oak	High forest	150*	364	
"	Fontainebleau	Oak, beech	High forest with æsthetic reserves		363	
"	Bellème	Oak, beech, Scotch pine	High forest	200	365	Most beautiful forest of Normandy
Sarthe	Bercé	Oak, beech, Scotch pine	High forest	216	369	Recent thinnings well executed
"	Blois	Oak, beech	High forest	220	375	
"	Troncais	Oak, beech	High forest	180	377	
"	D'Orleans	Oak, Scotch pine	Conversion coppice and plantations of Scotch pine		380	A good example of former bad management

Department	*Forest*	*Principal species*	*Method of treatment*	*Rotation*	*See Huffel page No.*	*Remarks*
3. North west and Central						
Bretagne	Rennes and Gavre	Oak, beech, Scotch pine	High forest		381	Poor soil
Cantal	Pinatelle	Scotch pine	High forest and grazing		383	
4. South west and Pyrenees						
Haute Garonne	Montauban	Silver fir	High forest		386	
Ariege	Laurento	Silver fir	High forest		386	Fir forest of high altitudes
	Bouconne	Hard woods	Coppice under standards	20	386	
Landes	*Mimizan	Maritime pine	High forest; tapping for resin			
5. Mediterranen and "Prealps"	Herault near Gignac	Cork, oak	Coppice	20	387	
	Luberon near Avignon	Cork, oak, Aleppo pine	Coppice	25	388	
Var	l'Esterel	Aleppo pine and moline (cork), oak			388	Most elaborate fire protection in France
"	Bedoin	Moline (cork), oak, beech		3	389	Mushrooms and grazing are important products
6. Alps						
Hautes Alps	Mont Genevre	Larch	High forest	180	393	
Haute Dauphiné	Grande Chartreuse	Silver fir, spruce, beech	Selection high forest	162 to 225	394	
Haute Savoie	Vailly near Thonon	Spruce, beech	Selection high forest and improvement cuttings		396	Only region in France where spruce is the chief species
Drôme	Luc				397	The earliest and best plantation in the eroded Alps

There are 20 departments with a percentage of forest area of 3.5 to 10, 25 with a per cent. of from 10 to 17.8, 24 with a per cent. of from 18.2 to 25, and 18 with a per cent. of from 25 to 56. Of all the departments in France that of Landes has the highest percentage of wood area (namely 56) where at one period there was mostly a waste of sand. The state owns 12% of the forests, or a little over 17,200,000 acres. Of the entire area of forests under state management 23% are coniferous, and 77% are broad-leaf. In the state forests over 30% are managed by the coppice system, or by coppice under standards, 16.8% are in conversion, and 51.5% high forests.

The conditions of yield per acre and year are stated as follows :

Net yield	$2.34
Cost of control	.07
Cost of management	.17
Works of maintenance	.13
Additional costs	.17
Gross yield	$2.88

The French foresters are always complaining about the inadequacy of their pay, and this would appear justified by the relation between expense of administration and the gross revenue.

In France it costs but 25 cents per acre for administration or 8.3% of the gross revenue. In other European countries it costs for administration from 55 cents to $1.05, from13.1 to 18.3 per cent. of the gross revenue.

T. S. W., Jr.

Les forêts de plaine et les eaux souterraines. (Extrait des. Annales de la Science Agronomique française et étrangère, 2e Série, 8e année. 1902–'03. Tome I.)

This is a pamphlet made up of two articles bearing upon the same subject : one is by A. Tolsky, the other is by E Henry. Both describe their experiments with measuring the water level under forest and denuded land and the conclusions which they were forced to make by these observations. The observations made independently in France, near Nancy, and those made in the Russian Steppes in 1895 and in the neighborhood of St. Petersburg in 1897 and later—all agreed in the following, at least as far as Europe is concerned.

1. The water level is never higher under a forest cover than under bare soil.

2. The surface of the groundwater is always found to be farther removed from the surface of the ground under forest than outside of the forest or under a cut over forest, this being true for both winter and summer.

3. The fluctuations in the groundwater are smaller in the forest than outside of it.

4. The water level is lower in old forests than under young stands.

5. The depression of the water level is greater in dry climates than in places where it is raining frequently, in the later case this depression may not exceed several decimeters.

The articles are accompanied by curves, showing the seasonal fluctuations of the water level under forest and outside, and by detailed description of the experiments, which show the forest in a new light as a desiccator and drainer of moist or swampy soils.

R. Z.

Are Swamps Regulators of Waterflow and Should they be Drained? By E. V. Oppokov and H. Schreiber. Publ. by the "Khoziau." 1904, pp. 52.

The pamphlet consists of two parts of an article by H. Schreiber, the editor of the "Oesterreichische Moorzeitschrift" and the head of the Austrian Swamp Experiment Station in Sebastianberg, translated into Russian by E. V. Oppokov, and of additional notes made by the latter.

To the swamp as to the forest was attributed in a large measure the rôle of feeding streams and rivers. Since Visozky, Morozov, Wollny, and Ebermayer have demonstrated the greater dryness of the soil within the area of root extension, and Otozky and Henry have proven, independently of each other, by actual measurements the water level to be lower under forest cover than under any other plant growth, the rôle of the forest in directly feeding streams became rather doubtful.

Schreiber and Oppokov try to prove the same regarding the swamps.

The theory is that swamps absorb moisture in rainy season and retain it in the same manner as a sponge does, gradually giving it off later to the surrounding soil when the latter becomes dry. Schreiber's experiments in Sebastianberg swamp demonstrated the extreme "unwillingness" of the swamp to give off its surplus water to the neighboring areas.

Ditches dug in the Swamp lowered to some extent the water level in it, but only within a distance of 5 meters from the ditch.

During cold weather, especially in the spring at the time of thawing, swamps give off more water than in summer. For this reason in Bohemia during spring floods the swamps not only do not regulate the flow of water, but help in its unproductive waste.

In summer, swamps evaporate more water than any other soil, not giving any of it to the neighboring soil and frequently robbing the surrounding areas of their moisture. The claim that swamps have beneficial effect upon increase of precipitation is very problematic.

If to this be added that swamps have a bad effect upon climate (causing sudden changes of temperature near the surface and in the lower layers of the air) and are bad hygienically, the advisability of draining the swamps becomes self evident. E. Oppokov thinks that if the importance of the moss swamps in the mountains, where they could check destructive torrents, is very limited, this importance must be still less in the plains. He agrees with our known soil physicist, King, that not forests or swamps, but *sandy soils* are the true reservoirs of plentiful ground water important in feeding rivers. This, he thinks, follows from the qualities of the soil, known as the maximum or full absorptive capacity, and the minimum or the absolute capacity. Under the former is understood that amount of water which a certain soil contains in the state of fullest saturation. Under the latter is meant the minimum amount of water which is held by the soil in its capillary spaces, and which can be removed only by drying. The difference between the maximum and minimum absorptive capacity is the amount of water which the soil spends in the form of percolation or gives off to the surrounding territory. The greater this amount, the more useful is a given soil as source of ground water. Let us suppose, says Oppokov, that we have two soils: one is a sand with grains from 0.3 to 0.9 mm. in diameter and a maximum absorptive capacity of 49% (of the volume of the soil) and a minimum one of 13.7%; the other is a turf of the meadow character, (consequently far from being the most water-absorptive soil), with a full absorptive capacity of 80% and a minimum of 60%. It is easy to see that in case of precipitation sufficient to saturate 1 cu.m. of a turfy soil (0.8 cu.m.), the latter will absorb $0.8-0.6=0.2$ cu.m. of water, and 0.6 cu.m. will be held by it in the capillary spaces. The same amount of water (0.8 cu.-m.) would be sufficient to saturate $\frac{0.80}{0.49}$ of sandy soil and the latter would be capable of giving off for feeding streams not 0.2 cu. m. as the turf does, but $\frac{0.80}{0.49}(0.49-0.137)=0.58$ cu.m. *i.e.*, three times more than swamp. It is natural therefore to consider a sandy soil at least 3 times more favorable to the formation of ground water, the real feeder of streams and rivers, than the swampy soil, even overlooking the fact that sandy soil evaporates, according to Wollny's experiments, much less water than a swampy soil does. Thus the deduction one must make from the data supplied by Schreiber and Oppokov is that sandy soils and groundwater, and not forests and swamps, play the main rôle in feeding streams and rivers.

R. Z.

Biltmore Lectures on Silviculture. By C. A. Schenck, Ph. D. The University Press, Sewanee Tenn. 1905. pp. 71.

In calling attention to this volume it is fair to note that it is not published, but printed for the use of the students at the Biltmore Forest School. If American forestry possessed a text book on silviculture, Dr. Schenck would probably not have printed this. In our present need, however, it is distinctly valuable, notwithstanding its many faults—faults that the author no doubt recognizes better than any other. The lectures are made up from all available sources, and the book aims to be little more than a collection of notes. These notes embrace the essential points of European silviculture, with a commentary on the application of its principles to American conditions. They also include the only statement in English, with which the writer is familiar, of Dr. Heinrich Mayr's principles of universal silviculture. All these things are of the greatest value, since the matter is unavailable anywhere else. There are also many important statements relative to processes in this country—gathering seeds, cost of raising young plants, etc.—that one often wants to know.

The section devoted to the American forests (North American Silva) is distinctly faulty and one must regret that many of the statements are printed. It is apparent that Dr. Mayr is responsible for some of them, yet Dr. Schenck should find an early opportunity to make the necessary corrections. The division of the country into forest regions which agree neither with Professor Sargent, nor with the commonly accepted map published by the Forest Service is unfortunate. The chief fault is that the Rocky Mountain forest as a unit is not recognized at all.

It is a matter for much regret that in two points Dr. Schenck has worked on an independent line, when he could as well help to establish a uniform practice. In the first place he describes many tree species by names different from those recommended in Sudworth's Check List. This is unfortunate, since only by concerted action can the confusion in the common names of our trees be overcome. The use of terms in forestry differing from those adopted by the Forest Service is, perhaps, less objectionable, because the nomenclature recommended in Bulletin No. 61, is not yet fully accepted; nevertheless, there seems to be no reason whatever for using *chesthigh* for *breasthigh*, nor for introducing such terms as forest *pedagogy* or *tendance*. Silvicultural *types* for silvicultural methods is also an unhappy innovation.

In reading a book of this kind one inevitably picks out the faults, and is apt to ignore the mass of valuable matter it contains. In this publication, it must be repeated, that there is much material to which every forester is glad to have access. The faults can easily be forgiven for the time being, especially since there is no doubt that Dr. Schenck will eventually rewrite the book and make it a really valuable manual. A. G.

The Determination of Timber Values. By Edward A. Braniff. Reprint from the Year Book of the U. S. Department of Agriculture, 1904.

This article describes one of the important investigations which have been undertaken by the Forest Service. During the last two years investigations have been in progress, to determine the actual product, in graded lumber, of logs and trees of different dimensions. The purpose of the work is to provide a basis for the determination of the true value of standing timber. Hitherto it has been customary to base volume tables on the average merchantable contents of trees of different sizes. These tables show the amount of lumber which may be manufactured from trees, but do not indicate their real value because trees of different sizes produce lumber of different grades and value. The Forest Service is now preparing a series of graded volume tables which show the average yield of trees, of different diameters, in graded lumber. The method of investigation is to select trees in the forest, scale each log and number it for later indentification, and then determine at the mill its exact product in lumber. The results of these measurements are averaged in tables of convenient form. An illustration is given, in Mr. Braniff's article, of a graded volume table of Yellow Birch, showing the contents in board feet of the following grades: firsts and seconds red, firsts and seconds, No. 1 common, shipping culls (No. 2 common), mill culls (No. 3 common), and sound 7″ by 8″ railroad ties. With this table, and with a knowledge of the prices per thousand feet of the different grades and the cost of lumbering, the actual value of standing timber can be determined.

These studies are not only of practical value to lumbermen, but they are of great importance to the forester in the preparation of working plans.

H. S. G.

Forest Reserves in Idaho. Bulletin, No. 67, Forest Service, U. S. Department of Agriculture, Washington, 1905. 90 pp.

This bulletin contains extensive correspondence between the President, Senator Heyburn, Senator Du Bois, the Secretary of the Interior, the Commissioner of the General Land Office, Mr. Gifford Pinchot and others, respecting the forest reserves in Idaho. It forms an exceedingly interesting history of the controversy about the reserves of Idaho and shows how the effective opposition to the federal forest reserve policy is gradually melting away.

H. S. G.

Johnson's Guide to the Government Land of the United States. Wm. H. Johnson, Springfield, Mo., Publisher. 152 pp. Price $1.

This is a detailed description by states, territories and counties of the government lands remaining unreserved on July 1, 1904. The physiography, climate, irrigation projects, agricultural and mineral possibilities of each state as a whole, are set forth in rather attractive form, and the amount of unreserved land remaining in each county is stated and briefly described with references for further information. The sketch of the progress of irrigation in the United States and the projects now under way is good. Part II gives careful and detailed information in regard to making entries under the Homestead, Desert Land, Mineral Land and the United States Public Land Acts, including the law concerning the use of timber under each class of entry. The book is of real value to the home seeker.

T. E. A.

Report of the Superintendent of Forestry for the Dominion of Canada, 1904. Ottawa, Government Printing Bureau, 1905.

The work of the Canadian Federal Government along forestry lines is confined to the Province of Manitoba and the new provinces of Saskatchewan and Alberta, which up to September last constituted the districts of Assiniboia, Saskatchewan and Alberta. The other provinces are left to conduct their own forestry work along their own lines. The work, up to the present, has consisted almost entirely in the distribution of trees to settlers in these provinces. In 1904 a total of 1,800,000 trees were distributed to 2,218 applicants. The consolidation of the two nurseries at Brandon, Man., and Indian Head, Sas., into one at the latter place was effected, a quarter section of land having been set apart here as a site for a nursery. It is intended not only to make this a nursery for raising seedlings for distribution, but also a model forest. The number of hardwood seedlings in the nurseries in 1904 was about four and a half million, two thirds of which were available for distribution, and of conifers a quarter of a million. The varieties distributed were native maple, ash, elm, willow, Russian poplar and cottonwood ; all were raised in the nurseries but the last, which were imported from Dakota ; the Russian poplar was found to be somewhat unsuitable, and its distribution has been abandoned. The conifers in the nursery included Scotch, Lodgepole, Banksian and Stone pines, Larch, Blue Spruce and Douglas Fir, but these were too small for distribution. On the Spruce Woods reserve, in Manitoba, a reclamation experiment on sand hills similar to that on the Dismal River reserve was being made ; seedlings of Scotch Pine were set out ; the one-year-old seedlings all died, while of the two-year-old seedlings 35 to 45 per cent. lived. The need of exploration of forest land is strongly urged. The year was a bad one for fires, but through the efforts of the rangers all but one were kept from assuming serious proportions.

F. W. H. J.

Type Studies from United States Geography. By Charles A. McMurray, Ph.D. The Macmillan Company, New York, 1905. 288 pp.

This book contains a series of twenty-five simple type studies designed as an introduction to the geography of the United States. In its rich descriptive content and stimulating interest the value of the type is strikingly exemplified. It is significant that, despite the wide diversity of topics, two of these studies are on subjects akin to forestry.

The first, entitled "The Pineries and Lumbering," is a short account of a typical lumbering operation in the Great Lake region. The author follows the progress of the logs from the lumber camps through the sawmills and clearly points out the interdependence of lumbering and other industries.

The other study bearing on forestry is "The Hardwood Forest Region of the Ohio Valley," After describing how the early settlers had to contend with the virgin forest and how, later, the lumber interests developed, the author concludes with a virtual resumé of the whole forestry problem, which is all the more remarkable in view of the elementary nature of the book. "In our day the question is not how to get rid of the forests—but how to save them. The forests have been cut down too much, not only destroying much valuable lumber, but changing the climate and causing the rivers to flood their banks in spring. The forests no longer hold the water back, but it runs off too quickly in the springtime. The question of the future is therefore largely to protect the forests, to plant in trees, and to provide for an extension of the forest area." The value, to the cause of forestry, of such a teaching in our elementary schools can not well be overemphasized.

The volume is very attractive in appearance and profusely illustrated by maps and photographs ; there is even a map showing the different timber regions.

A. B. R.

Some Trees Suitable to Plant for Posts, Poles and Ties, with Cultural Suggestions and Financial Possibilities. By W. J. Green and C. W. Waid. Forestry Investigations I, Bulletin 158, Ohio Agricultural Experiment Station, Wooster, Ohio, Jan. 1905.

There has been much public interest in Ohio during the past few years in growing post, pole and tie timber.

The above bulletin briefly considers several of the more popular species recommended for planting and the results already attained in a few scattered plantations throughout the state. General cultural suggestions are made for growing Catalpa, Black Locust, Mulberry and Osage Orange. Their cultivation is briefly described and the best distances at which the trees should be spaced is pointed out.

Those who intend growing Catalpa are cautioned against planting seeds of the species *Catalpa Catalpa* because its habit of growth is much more crooked and is more inclined to branch near the ground than *Catalpa speciosa.* The Black Locust grows naturally in many parts of Ohio, but the serious drawback to the growing of this species is its susceptibility to attacks of the Locust borer, it is nevertheless recommended for planting even though no remedy is known.

An attempt is made to show the financial possibilities of growing Catalpa and Locust for fence posts from investigation of several plantations. The publication is well illustrated with photographs showing the behavior of Catalpa and Locust when grown in pure stand. C. H. F.

The Tree Doctor. By John Davey. The Saalfield Pub. Co., Akron, Ohio, 1904. pp. 87, Price $1.00.

A practical book of 90 pages and 170 photographic illustrations devoted especially to the care of shade, fruit and ornamental trees. There are a few pages also dealing with ornamental pruning, landscaping and floriculture. The chief interest of the book, however, lies in the author's forceful treatment of the effects of "tree butchery" as practiced by untrained persons in contrast to "tree surgery" as practiced by trained "tree doctors." The purpose of the book is to educate all people in the art of pruning a tree in such a way that the wounds may heal rather than expose the tree to fungus attack, decay and premature death. The chapters on the planting of fruit trees, especially those dealing with the soil and moisture requirements of different species, are instructive to farmers.

The book is very practical in that the essential difficulties and reasons for general failure in each subject are clearly pointed out and the proper method set forth. J. A. H., Jr.

"*Dulichium Spathaceum Pers, eine nordamerikanische Cyperacee in dänischen interglacialen Torfmooren.*" By N. Hartz. Botanische Jahrbücher, von Engler. B. 36 Heft I, 1905, p. 78–81.

This is a small note of considerable interest, because the author tells of his discovery of numerous fruits of the North American species *Dulichium spathaceum* Pers. of the *Cyperaceae* family in the Danish interglacial peat-bogs, in the outskirts of Brörup in Southern Jutland; a plant which occurs now only in the eastern part of North America.

This is the second discovery of a North American species in the peat bogs of the interglacial epoch in northern Europe. The first one was *Brasenia purpurea*, Mich., which is found not only in North America alone, as is the case with *Dulichium*, but in all other parts of the world, except Europe.

The author thinks that *Dulichium spathaceum* as well as *Brasenia purpurea* are ancient circumpolar tertiary species. Both species had died out in Europe, but survived in northern America. They are the only representatives of the genera *Dulichium* and *Brasenia* which closely resemble other tertiary monotypical genera like Gingko, Taxodium, etc., that had existed in Europe during the tertiary epoch, but now remaining only in North America. The author mentions also the few other North American species which are now found in Europe.

Thus in Ireland are growing *Eriocaulon septangulare*, With.; *Sisyrinchium angustifolium*, Mill.; *Spiranphes Romanzowiana*, Cham.; and in northwestern Norway—*Carex scirpoidea*, Mich.: *Draba crassifolia*, Grah.; *Platonthera obtusata*, Lindl. After making the discovery of *Dulichium* the author is inclined to think these six North American species are also relics of the last interglacial period and not newcomers to the European flora.

R. Z.

Species and Varieties, Their Origin by Mutation. By Hugo de Vries. The Open Court Publishing Co., 1322 Wabash Avenue, Chicago, 1905. 830 pp. Price $5.00.

The belief has prevailed for more than half a century that species are changed into new types very slowly and that thousands of years were necessary for the development of a new type of animal or plant. After twenty years of arduous investigation Professor de Vries has announced that he has found that new species originated by sudden jumps, or by "mutations", and in conjuction with this discovery he offers an explanation of the qualities of living organisms on the basis of the conception of unit-characters. Important modifications are also proposed as to the conceptions of species and varieties as well as of variability, inheritance, atavism, selection and descent in general.

The announcement of the results in question has excited more interest among naturalists than any publication since the appearance of Darwin's Origin of Species, and marks the beginning of a new epoch in the history of evolution. Professor de Vries was invited to deliver a series of lectures upon the subject at the University of California during the summer of 1904, and these lectures are offered to a public now thoroughly interested in modern ideas of evolution.

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Trade Journals------------F. ROTH and J. F. BOND

FOREST BOTANY AND ZOOLOGY.

Light Requirements of Plants

On p. 167 of this volume we have briefed account of the photometric experiments of Dr. Cieslar on the "shade coefficient." A note by Dr. Wiesner adds further interesting material to the discussion of the light requirements of plants. His observations were made in the Yellowstone Park and other regions of North America, especially on the relation of light requirement to northern latitudes and to altitude. With increase of altitude there is experienced not only increased intensity of light in general, but of direct radiation. The parallelism between change of altitude and change of latitude as regards light requirements exists, however, only up to certain altitudes. Beyond this limit the relative light requirement becomes constant and the absolute mimimum also becomes more or less constant. In other words, the plants of the Arctic region try to secure for themselves more and more of the total light supply, the nearer we approach the pole the stand becomes more and more open. Ascending to altitudes, the same relation obtains to a certain height; beyond this, plants utilize less and less of the light at their disposal, which is indicated by a change in the crown form, as in *Pinus Murrayana* and other conifers, which assume a form (cypress-like) calculated to reduce the light intensity in the interior of the crown. The damaging effect of high intensity of the direct sunlight in high altitudes is also shown by the loss of foliage due to heat in plants which in lower altitudes are not subject to this loss.

The Arctic limit for the existence of a plant will be where the maximum and minimum of its light requirement are one, *e. g.*, *Betula nana* on Spitzenbergen.

Wiesner from these and other observations concludes that the plants reduce their light requirement and that maximum and minimum requirement have the tendency to approach each other with altitude.

Centralblatt für das gesammte Forstwesen. Oct. 1905, p. 442.

Introduction of Exotics

A long article of controversial character by John Booth discusses the question of which species have proved themselves desirable for introduction into Germany. Since many or most of those discussed are natives of the United States, the stray notes which are interspersed through the general discussion and the references in footnotes are of interest.

John Booth, the owner of a large nursery near Hamburg was instrumental through the influence of Bismark in inducing the German forest departments to make extensive trials of exotics for forest purposes, which date back to the eighties. His present writing is directed against the assertions made by Prof. Mayr as referee regarding the availability of certain species, at the meeting of the International Forest Experiment Stations at Mariabrunn in 1903, which we have briefed and commented upon in vol. II, p. 92 ff. The author scores the referee for the unsubstantiated generalizations, for which, he declares the data are still lacking.

Especially such general, easily refuted statements, that "of exotic species no advantage is to be expected in comparison with native species," "to expect the advantageous use of North American species on a large scale is chimerical", arouse his justified opposition. *Pinus Strobus* and *Robinia pseudacacia* are cited as cases to refute these ideas.

A number of contradictions in Prof. Mayr's own statements are uncovered.

Die Exotenfrage auf der vierten internationalen Versuchsanstalten zu Mariabrunn. Allgemeine Forst- und Jagdzeitung, Sept., Oct. 1905, pp 307-312, 329-336.

Black Locust

From a monograph on *Robinia* by Vardas, director of the Hungarian forest experiment station we glean this statement, specially interesting in view of the native mountain home of this tree: For the plain, the celebrated *puszta*, the *Robinia* is extraordinarily adapted, and we have no tree, which on this extensive territory could even approximately replace it. More than 100,000 acres of Black Locust have been planted in Hungary, mainly for vineyard stakes.

Ceutralblatt für das gesammte Forstwesen, Aug., Sept. 1905, p. 381.

Seed Vitality

A series of experiments on the germinating capacity of seeds, among them those of *Quercus rubra*, *Thuja occidentalis*, and *Juglans nigra*, have been described by W. J. Beal. The seeds were tested at intervals of 5 years. All acorns were dead at the end of two years. A subsequent trial with the oak and walnut seeds, planted at depths varying from a few inches to two feet, showed at the end of two years that all those planted over 8 inches deep had decayed, except a few young plants of the oak which were still alive 2½ feet from the surface.

The Vitality of Seeds. Botanical Gazette, August, 1905, pp. 140-143.

Large Sizes of Small Trees

Records of some surprising developments of species not usually considered arborescent have been made by Roland M. Harper. During a collecting trip in Georgia he found *Rhus copallina* 11 inches in diameter near the base and 30 feet in height; *Rhus glabra*—quite a number of them—7 inches in diameter and 30 feet in height; *Ilex myrtifolia*—also in some numbers—a foot in diameter and about 30 feet in height; and one specimen of *Staphylea trifoliata* with a trunk 5 or 6 inches in diameter and its lowest branches 6 feet from the ground.

Some Large Specimens of Small Trees in Georgia. Torreya, September, 1905, pp. 162 164.

Seaside Plant Succession

M. A. Chrysler has described very interestingly and in great detail the gradual conversion (begun over 50 years ago) of the marine shore at Wood's Hole, Mass., from a heath to a forest. The writer's "attempt to show that the agency of man may accelerate the process called succession" is very instructive to those engaged in the reclamation of seaside barrens.

Reforestation at Wood's Hole, Mass. Rhodora, July, 1905, pp. 121-129.

Key to Woody Plants

Mr. John Schaeffner in the Ohio Naturalist gives a rather complete key to the genera of woody plants both native and introduced found in the Ohio Valley. The shape of the foliage with arrangement of the leaves and branches is used as the main basis for distinction. The marks upon leaves and twigs are also brought into the classification although this feature is so variable that it cannot be relied upon. Considerable attention is paid to the shape and physical condition of the pith of young branches, which is of more importance than foresters usually consider. For instance, in the oaks the pith of young branches is usually five-angled, while in the Persimmon the pith is filled with small irregular cavities. In the Elder the pith is three-angled, and in the Black Gum the pith although solid has permanent diaphrams. Since several common species, such as the poplars and hickories, have a five-angled pith, it is necessary to add other characteristics for recognition in winter, the matter of appearance and shape and size of fruit.

SOIL, WATER, AND CLIMATE.

Fertilizers for Sand Soils

It is now somewhat generally recognized that in many instances in Germany forest soils are deteriorating, in face of the frugality of forest growth as compared with farm crops. As this idea has spread, various attempts have been made to remedy this state of affairs by the application of such fertilizers as the market offered, that is, such as were adapted to agricultural crops. As Dr. Albert points out, there are very obvious reasons, the greatest being the very much longer time required for the development of the crops as compared with the annuals and biennials of agriculture, which make the standard fertilizers of doubtful use or even harmful, while their high cost is out of proportion to the brief stimulus gven the trees.

Comparison of the amount of minerals present in the loose, sandy soil of northern Germany with the amounts annually taken up by trees from this soil indicates which constituents are present in proportionally least amounts and so what direction artificial fertilization must follow. Potash and phosphoric acid are present in this poor soil in excess of needs. It is lime and magnesia the sand needs most. But applied in such forms as find use in farm lands the result is too temporary, and too costly in the first instance as well as in the doubtful or negative results.

Lime is best applied to forest crops in the form of marl, and, as such, is widely distributed in shaly beds through the region where it is most needed. Where, however, these marl beds do not occur, the needful lime and magnesia may be procured in the desired combination in the screenings that collect in such heaps about rock crushers as where material is prepared for mending roads. As it comes from the machine it will be found fine enough for this use.

Nitrogenous matter is supplied most favorably in the form of muck. The practical application and results as well as the expense attached are dealt with in some detail on the basis of what has been done in reforesting of sandy areas in East Prussia. The expense is not regarded as excessive and the results are evident and satisfactory.

Welche Erfahrungen liegen bis jetzt über den Einfluss künstlicher Düngung und Bodenbearbeitung im forstlichen Grossbetriebe vor? In welcher Weise und nach welcher Richtung hin sind Versuche hierüber fernerhin anzustellen? Zeitschrift für Forst- und Jadgwesen. March, 1905. pp. 139-152.

SILVICULTURE, PROTECTION, AND EXTENSION.

Variety in Clearing System

In a meeting of the Prussian Forestry Association it was pointed out by Dr. König, that a clearing system could be carried out in many different ways and consequently with very different results. The evil consequences of the clearing, soil deterioration, increase of insects, does not belong to the clearing system as such, but to improper size of clearings joined to each other. The area is too large when it is deprived of side protection. The maximum width in pineries should not be over 100 yards, without limit to the length, when the drying effects of sun and wind on soil and young crops are abated. Such abatement of sun effect reaches about $1\frac{1}{2}$ tree lengths, for an old stand casts at noon on June 21, (the longest day) a shadow of somewhat over half the tree length, and on March 21, and September 23, (equinox) of about $\frac{5}{4}$ the length. The protecting old stand should not be removed until 5 to 10 years later, or until the young crop on the clearing is safe.

The objection to these narrow clearings is that, due to root competition of the old stand, prevention of dew in its neighborhood and interception of light rains, a strip of from 5 to 10 or more yards is apt to run to grass and to dry out; hence, is best left unplanted. The need of protection against the *curculio* requires ditches for catching them.

Such a clearing system in narrow strips of 15 to 20 acres requires many felling areas properly distributed, which must be provided for in the working plan. Neither strips in echelons nor checker board arrangement are satisfactory, but a more or less irregular groupwise location is advocated which, where young volunteer growth is found may become a transition to groupwise selection cutting.

Ueber Schlagführung in Kiefern. Allgemeine Forst- und Jagdzeitung, Oct. 1905, pp. 357-359.

Reforestation in High Alps

The detail of the present planting practice in the Austrian Alps is discussed by Forstrath Berufus, In an introduction the condition of the practice, as it was 50 years ago, is briefly described, when outside of the show plantations near foresters' houses or near roads frequented by notabilities, here and there some clearing was sowed to spruce, but usually it was left to nature to re-seed the large felling areas. At present every practitioner is proud of his fine plantations of pure spruce and mixed growth, having overcome all difficulties.

Naturally the plantations are mainly coniferous. Both, sowing and planting is practised.

Broadcast sowing is done in connection with a farm crop after burning the litter slowly by forking it into the fire. Two or three graincrops (rye or oats) can be grown, the tree seed (spruce), 10 to 12 lbs per acre, being sown with the grain. To insure even sowing, area and seed is best divided into parts. In the upper parts of the slope, where the soil is usually shallower and seed is apt to be washed out, the sowing is made denser, than in the deeper, low levels. Usually the seed is not covered, but where practicable a brush harrow should be employed. There is no danger of loss by birds in the Alps.

The sowing in rows or furrows is not favored because they lead to washing. Where this is not to be feared, the rows are of course made horizontal, 1 to 2 feet wide, the litter is raked to one side of the row, and the topsoil hoed, the seed is sown superficially and pressed into the soil with the foot. To avoid the running of water in the furrows, these are frequently interrupted, leaving a balk of unopened soil between the parts.

More satisfactory is the sowing in plats of 10 to 20 inch square, from which litter and grass is removed and the soil loosened, the seed being placed in the middle of the plat in order to keep the seedlings as long as possible from competition with the encroaching grass. The success is better on elevated plats than those in depressions where the 2 to 3 year old seedlings are apt to be heaved by frost.

Sowing in spots, namely in the corners of old stumps or rocks, on mossy places, etc., has been used with great success, where cattle is to be feared; the open stand is more resistent than the denser sowings and, if mature stands are in the neighborhood, is filled out by volunteer growth. This method is especially employed with *Pinus Cembra*, dibbling 3 to 5 seeds into holes $\frac{3}{4}$ to 1 inch deep.

Sowing on snow has been found uncertain of success as it depends on the more or less rapid thawing of the snow, when in the latter case the seeds are washed together and into undesirable spots. The cheapness of this method recommends this practice and frequently success attends it.

Altogether the main advantage of sowing lies in the relative cheapness, and the ease and rapidily of its execution by unskillful labor, otherwise it has many disadvantages. On south and east slopes frost kills many young seedlings and the stand becomes very uneven. At the foot of slopes and in depressions the seeds are washed together and the stand becomes too dense, which in the absence of the possibility of thinning becomes detrimental in the yield. Broadcast sowing presupposes burning, which on shallow limestone soils is most detrimental, as it leads to denudation and erosion. Here planting is the only method. Yet, where labor is scanty and cash short, sowing is better than leaving it merely to nature to cover the clearings.

The planting practice is very fully discussed. Wildlings, seedlings and transplants are used. For the growing of seedlings either flying or temporary camps which last for 8 to 10 years without fertilizer, or standing or permanent nurseries are used. In the nursery practice the seeds are sown in 2 to 4 inch drills, not too dense, so that the seeds do not touch, when an open stand results which produces more quickly stout material. Eventual dense stands are thinned soon after germination. Transplanting is done after one year, the plants remaining two, more rarely three years in nursery. The use of three-year-olds is safer, being more easily handled. Transplants are used in exposed positions and where grass growth interferes, but since the cost is three to four times that of untransplanted material, their use is sparingly extended. Absolutely sure material and cheaper are plants secured from natural or artificial sowings in the field, taken up with a ball of earth.

As to time of planting both spring and fall are used, but spring planting is preferable and more frequent because of easier labor conditions, although interrupting snow falls may interfere. The operations are begun in the valleys when the frost is cut of the ground and then proceed upwards, first on south and east slopes, the north and west slopes opening last. This variation of season in different localities is an argument for the use of flying camps to secure plant material, so that it be at the right time in condition for use.

Regarding the spacing it is pointed out that the character of the planting area in the mountains prevents any regular spacing except over small areas, hence most discussions of the subject based on conditions in the plain became irrelevant. The favorable humidity conditions of the Alps, the unfavorable labor conditions, and lack of market for thinnings make the use of a smaller number of plants possible and desirable, than are customary in the plain. Besides, assistance by natural seeding is expected. Hence the general practice is under normal conditions to set not more than 1600 to 1800 plants per acre, corresponding to a spacing of 4.5 to 5 feet. On south and east slopes the number will have to be increased to 2000 or even 3000, while on the dry dolomitic lime soils up to 3600 were set and had in 25 years not yet closed up. Again, in Carinthia extensive stands, planted with 1200 to 1600 spruces, showed a most phenomal volume increment, namely 25-year-old stands containing over 6000 cubic feet and a 45-year-old stand containing near 8000 cubic feet. Especially the resistance of the open stands to snow pressure makes the small number of trees desirable.

A number of planting methods are in vogue. The planting with a ball, which is the surest, is not much practiced because of the expense, although under circumstances this need not be so great. The planting into dug holes is often a failure because of lack of care in placing the roots into the plant hole. When properly done this is, of course, the best method, but also expensive. The use of a pyramidal iron dibble reduces the expense. Bunch-planting has proved a failure because of the growing together of two or more plants in the bunch to undesirable forms.

Where a strip system with natural regeneration is practiced it has sometimes been found desirable, in order not to be hindered in the progress of fellings, to set out 400 to 600 plants into the corners of stumps and other protected places as seed spots, the completing of the stand being left to the natural seeding.

After discussing without prejudice, advantages and disadvantage of planting and sowing the author concludes: Exposed positions, those liable to frost, south slopes, wet places, repairs of fail places and of frost holes are the places for planting; west and north slopes can be reforested by sowing; and if properly done and assisted at the right time with the right means, the object may be attained in either way, growing well-closed stands of valuable timber without loss of increment or soil rent.

In discussing the propriety of mixed forest, and the availability of different species for different exposures, the following significant statement is made: "The times of the unregulated selection forest, in the Alps, in which such shade-loving species as beech and fir could maintain themselves, are past. We do not find full satisfaction in the selection forest, hence, one may object as one will, it was lucky for the mountain forest to have introduced the clearing system with its variations."

In mixing in oak, ash and maple with the intolerant spruce, it is reccommended to plant groups or troops of them and surround them with a belt of larch for protection against the spruce. The usual practice has been to mix spruce and larch in the proportion of 8 to 2; the larch assisting not only in wood production but by its leafless open condition reducing the snow break danger.

For reforesting very steep slopes, any species with a profuse root system, especially shrubs, are useful, which can be planted as root cuttings. Alder, Serviceberry, Viburnum, Boxelder, etc., are used for this purpose.

Das Aufforstungswesen im Hochgebirge. Centralblatt für das gesammte Forstwesen. Aug.–Sept. 1905, pp. 325–345. 5

Combined Farming and Silviculture

In an out-of-the-way corner of Germany, just off from the busy manufacturing centers of the Rhine, an interesting system of forest management has persisted through all the times of which record exists; and today historians generally recognize in this system known as "hauberg" the primitive form under which this land was held and cropped by the early Teutonic "markers". Under hauberg is understood a cropping of the soil alternately with forest and agricultural crops. Coppice growth in open stand is carried through a rotation of 15–20 years, to be followed by rye or wheat, and this in turn by coppice again.

In a sociological and economic study of some depth, Forstrat Müller lays before his readers a detailed account of the influences under which the hauberg has assumed its present form, the factors which work to keep it up in face of its disadvantages, and the prospects of change to high forest as permitting a more economic use of the soil. As showing the various social and political aspects of the problems which come up for consideration when any radical change in soil management is contemplated in a community so entirely dependent on the harvests of its fields, and as indicating the method of treating this sort of data, the article has its greatest value to American foresters.

Vergangenheit, Gegenwart und Zukunft der Hauberge im Dillkreise. Ein Beitrag zur Beantwortung der Umwandlungsfrage. Zeitschrift für Forst- und Jadgwesen. Feb.–March, 1905. Pp. 96–107; 156–172

Recuperation of Dwarf Growth

The question of the applicability and result of more intensive methods of culture is more and more frequently discussed in German journals, and experiments are multiplying. Such were made by Oberförster Hofman in the Black Forest on areas of dwarfed pine growth, the dwarfing being due to formation of bog-iron ore and overgrowing by moss and heath, so that in many places the heath was higher than the 20-year-old pines. The brief history of the forest district, preceding the account of the experiments, is most interesting even to American readers in showing how opinions regarding forest management change with observation of results. Under the working plans of 1844 and 1854, all pine stands were to be changed to spruce and fir. After 1860, the pine came again into favor, but the losses by snow breaks had by 1886 dampened this favor. The dwarfed stands resulted from the severe thinnings, by which the increment was to be forced, and from the deterioration consequent to the openings.

The changes *i.e.*, deterioration of forest conditions due to changes of treatment are briefly and interestingly stated, especially the changes in the soil cover and the appearance of the heath, which resulted.

On the experimental area in question, after a severe thinning in the mixed stand of pine, spruce and fir, (on southwest slope, sandstone) of medium to good site class in 1855 to 1860, spruce and fir were sowed in furrows, later, after much of this sowing had failed, as the old stand was cleared away, pine, mostly pure, in some cases mixed with spruce, fir, and white pine, was planted. Enough plant material was used during the 26 years of this plan, to plant three times the area, and the cost was not less than $12 per acre, not counting the plant material.

The result was, that wherever the mixture was planted, satisfactory conditions prevail. "The later the clearing of the old pine growth and the planting took place, *i.e.*, the more the soil had time to deteriorate under the open pine, and the fewer plants of other species were admixed, the worse is the stand". At any rate 25 acres of pronounced dwarf growth gave opportunity for the experiments, which were begun in 1901. These contemplated to determine the influence of

a) removing of the heath and sphagnum cover,

b) cultivating the soil in the older cultures,

c) applying artificial fertilizers, (kainite, superphosphate, slag),

d) introducing leguminous crops,

e) planting in broadleaf trees and other conifers.

The tentatively stated results show :—

a) that the mere removal of the undesirable soil cover, and stirring the soil, even without fertilizer, will revive the growth. Entire removal is more effective than removal of strips only;

b) that fertilizing with Thomas slag produced extraordinary increase of increment; the addition of kainit being without effect; lime also seems to produce satisfactory results.

The effect of fertilizers is hardly visible in the first two years, but becomes striking in the third and fourth year. Tables are given showing the height growth as more than doubling in the third year, and again the fourth year, both in the newly planted and in the 20-year-old dwarf growths.

The cost of fertilizing, varying very much according to material used and manner of application, are so small, that the author feels justified in recommending the operation for larger areas. The total cost was less than $4.00 per acre, one-half for the material, one-half for bringing it under—an expense which compares favorably with that of repair planting.

After some instructive observations on the behavior of other stands and the formulation of pointers for the practice, the author concludes that mixed plantation and fertilizers are the means of making success on such poor sites; the bog-iron ore under such treatment, he thinks, will vanish of itself.

Bodenbearbeitung und Künstliche Düngung in Forchen-Krüppelbeständen des Württemberg. Schwarzwaldes. Allgemeine Forst- und Jagdzeitung, Sept. 1905, pp. 297-307.

Time for Thinnings

Forstmeister Dr. Meister, the well known manager of the Zurich city forest, contributes towards the discussion of thinnings, which occupies now so much space in the German journals. It is well to note the declaration of this highly experienced man, that in practicing thinnings "doubts and disappointments have not been lacking, and hastily formed conclusions have led us, like many others, astray". "But one principle has in the last three decades become unalterably established in my mind, namely, that the modern practice of intensive thinnings increases the volume and value increment of the total stand until its final harvest, much more than the practice antedating 1870''.

Referring to Dr. Schwappach's failure to find proof of this proposition in his measurements on spruce, he points out that the experimental areas had only been thinned after the 35th year, ''a period in which according to our observations the desirable influence on forming the stand cannot any more be fully realized ; the thinnings must be begun at an earlier age, from the 18th to 20th year''. Especially in mixed forest is this true. The existing experiments are still quite inconclusive, but the author is convinced that they will finally prove not merely an increased increment percent, but an actual increased total volume production.

Meeting the objection that thinnings are in danger of anticipating final harvest, the author explains. Final harvest stand and intermediate stand and their increment are complementary factors, and the budget must be so gauged as not to exceed the two together, although it may be secured now from this, now from that part of the stand.

Until about the 70th year the differentiation of main harvest and thinnings is usually easily made. With the 67th year in the Sihlwald (beech) the increment of the intermediate stand has reached its maximum, with 76 cubic feet, just when the maximum occurs in the *current* increment of the main stand. After that the differentiation in the intermediate stand proceeds more slowly and into two classes, namely those individuals which naturally fall behind or have reached their technical felling age, and those which, though capable to live, are impediments to the desired development of the main stand. The increment on these, although used before the final harvest, belongs really to the main budget and is so booked, namely, (a) final harvest, 79 cu. ft, ; (b) anticipated budget, in period 70 to *r*, 12 cu. ft.; (c) thinnings, in period 1 to 70, 30 cu. ft.

If *b* becomes larger than the budget prescribes, then to that amount *a* is reduced, and there is no violation of sustained yield management.

Zum Kapitel der Durchforstungsfrage. Schweizerische Zeitschrift für Forstwesen. Oct., 1905, pp. 241 248.

Silvicultural Studies in Hungary

For seven years the Hungarian forest experiment station has published a Quarterly, giving account of its work. In the first two numbers of this year there appears an article on the anatomical structure of *Robinia*, and another study on this tree in general, which is an important one in Hungary. An article on the influence of farm crops in combination with silviculture shows the results of experiments on good heavy oak soil on three areas, one without farm crop, another on which Indian corn was grown and the cultivation thoroughly done between and in the rows of corn and trees, the third on which cultivation was confined to the rows. The thoroughly cultivated area gave always the stoutest (heaviest) plants, the uncultivated the lightest; but the height growth was in reverse order for two years; in the third year, however, the uncultivated area fell behind even in height, and lost 50% of its plants; the thoroughly cultivated area was ahead in all respects. In the fifth year the uncultivated trees had perished, those on the best cultivated area were 85% better than on the less cultivated.

The measurements of six *Sequoia gigantea* in the botanical garden of the Mining and Forest school are of sufficient interest to reprint, these trees growing at about 2000 feet above sea level in an interior country where the temperature sinks regularly to —4° F.

No.	*Age, years.*	*Height, feet.*	*Diam. inch.*	*Volume.*	*Form factor.*
1	31	52	20	45.9	.344
2	28	46	28	56.5	.263
3	31	40	17	25	.349
4	31	39	13	14	.335
5	31	39	14	19.4	.380
6	19	30	10	8.5	.468

Erdészeti Kisérlétek. Centralblatt für das gesammte Forstwesen. Aug., Sept., 1905, pp. 381–384.

Fire protection in France.

A picture of reform work in France, namely in the Estérel mountains of the southeast corner, not far from Cannes, is given by Barbey. The territory by about 1860, had been turned into a real desert by forest fires, the dry climate assisting. Rains are here confined to the fall, winters are mild, the summer long and almost rainless. To stop the fires was the main necessity. The forest growth consists to the extent of 70 per cent. of *Pinus maritima*, cork-oak 20 per cent., the balance of Aleppo Pine and Oak, with undergrowth of various shrubs almost impenetrable and 2 to 3 m. high, which gives the best food for fires. The growth of the pine is miserable, not over 60 feet high and rarely over 20 inch diameter.

The working plan for the 14,000 acres of State forest divides the district into six felling series and determines by count the contents of four of these. The 3 million cubic feet, or 33 cubic feet per acre, are to be cut in selection forest method with a 16 year return, which is determined with regard to the fire danger. No planting is done, but much expense is incurred to get rid of the underbrush, which is cut every 8 years. Until two or three years ago the underbrush was being burned off, but too much damage resulted from this practice. The fires run over from the private forests, where they are started either by carelessness or intentionally to obstruct the forest regulations. The State forest is cut by fire lanes, 20 to 50 yards wide, which, except for a few oaks, are kept clear. Thereby it was possible to localize the fires. Private owners are obligated to kept up fire lines on their boundaries. Telephones permit a rapid call for assistance. Ten patrols are constantly on watch during the four dangerous summer months and by these means, it has become possible to secure immunity.

Eine forstliche Excursion im Estérel. Schweizerische Zeitschrift für Forstwesen, Oct., 1905, pp. 253-258.

Protection against Insects.

Throughout Germany the large brown weevil (*Hylobius abietis*) preying so disastrously on young plantations is generally combatted by placing large chips or billets of pine through the cleared area and regularly collecting the insects attached to these traps. The question has arisen as to the effectiveness of this work, and in some parts of Germany the practice has been discontinued, at least for a time.

Every year trap-blocks are set over the cleared area, every year a pretty constant number of beetles are caught and a pretty constant number of seedlings succumb to the inroads of the pest.

Dr. Eckstein contributes an answer based on experiment.

In the demonstration forest maintained in connection with the academy of forestry at Eberswalde experiments have recently been made to determine the practices under which these trap blocks most efficiently accomplish the results expected of them, and especially to answer the two questions, where is the weevil caught most abundantly? when ought the trap-blocks be first put out, how often renewed, and how often and how long should the weevils be collected? The experiments extending through two seasons show that the pests were caught quite as effectively in the adjacent mature stand as in the cleared area itself.

In addition it is recommended, that the use of furrows or ditches by itself is not sufficient; trap-blocks must be employed in connection; these must be in place by April first and the weevils collected daily thereafter until October; and the blocks must be renewed as soon as they begin to show signs of drying out, that is, somewhat short of four weeks.

Regarding the practice itself it is not only to be recommended strongly, but should be much more intensely and thoroughly carried out. Careful and well-directed effort sustained through a few years should so far reduce the trouble as to render its ravages the exception rather than the rule, and remove the necessity of the preventative measures being carried on year in year out, as they now are in most districts.

Über die Anwendung von Fangkloben. Zeitschrift für Forst- und Jagdwesen. Apr., 1905. Pp. 207, 226.

UTILIZATION, MARKET, AND TECHNOLOGY.

Durability Influenced by Position

Karl Havelik points out that the position in which wood is placed has much to do with its durability. Vertical position predicates greater duration; shingled roofs last longer the steeper they are, the cross-pieces of telegraph poles a shorter time than the poles. Generally steepness of the angle increases the durability, simply because the rain water and dew runs off faster and the favorable conditions for rot fungi are lessened. In railroad ties season splits expedite their decay and their effect can by proper manufacture and position be lessened. Where two ties are made from one log the tangential side of the annual rings is usually placed in the upper face, the radial side on the ground. Due to greater tangential shrinkage season splits form from the top surface inward. In these water collects and cannot drain off. If the ties were reversed, the water would drain off readily and the season checks would partially close up.

Ueber den Einfluss der Lage des Holzes auf seine Dauer. Allgemeine Forst- und Jagdzeitung, Oct., 1905, p. 360.

DESCRIPTION, STATISTICS, HISTORY.

Reboisement Cost and Effect

The extravagance in the reboisement work of France, which is of world-wide renown, finds a severe critic in Briot, the author of the epoch making work, *Les Alpes françaises, Etudes sur l'économie alpestre*, who, with intimate knowledge, discusses at length the various methods used, and questions the value of the existing policy.

The law of 1860 charged the forest administration with the reforesting of denuded mountain slopes, in which private owners were to co-operate by re-paying the cost or by ceding half of the reforested ground. This did not work. The law of 1882 provided that the State should expropriate the territory to be reforested. Under these laws 20 million dollars have been spent, six million for forest planting, eight million for revetments and other engineering works to quiet the torrents, six million for land purchases and a few thousand for improvement of pastures. Conscientious estimates show that the local damage per torrent each year is a few hundred francs and in the worst cases may reach a thousand francs, except in very sporadic cases when cloudbursts occur. Another thousand francs would represent the more general damage at a distance from the source. The engineering works which consist in drainage channels and in barriers to change the rushing streams into quiet waters, if they were to cost one hundred thousand francs would represent an interest charge of three thousand francs. Yet for many projects 500,000 to 1,000,000 francs ($100,000 to $200,000) have been expended. At first, cheap constructions were used, which were simply destroyed in short order, reconstructed and lost again, bootless sacrifices. Altogether the cost for these works has been in no relation to the result. Over 30 examples of actual works are given in detail to show this disproportion.

The author points out that extravagantly pessimistic views are advanced to secure the funds for these works ; to substantiate the charge several examples are adduced. It is even charged that some of the magnificent works have not abated but increased the dangers.

The expressions of local authorities are given to show what the people think about these works : organized squander! One of the forest officials, not afraid to express his opinion is reported as having said : In this manner, reboisement becomes the art of turning unproductive soil into a productive field for continuous expense. Even Demontzey, has lost all illusions regarding the application of the formerly recommended methods. Three years after the withdrawal from service he declared : "The only remedy for quieting torrential nature lies in an energetic restocking of the denuded slopes. Give up the great engineering works and be satisfied with planting to forest those areas which are denuded and yet quiet. In this way the object is more quickly and cheaply attained." The rest may be left to natural re-establishment. In Tirol and Austria generally, cheaper constructions, dry walls and wood structures, are satisfactorily made, the State paying only one-half the cost, which leads to economy. Where masonry walls are necessary, the work had better be left alone.

Hence, the author proposes, that the State buy at open sale what it can for reforestation, but make the execution of extensive works dependent on participation of the adjoiners. If they do not accede to that proposition, the undertaking is questionable. Especially lands that are damaged or are endangered and adjacent to waters are proper objects of such purchases. Instead of utopian reconstructions only the practically feasible work should be undertaken.

The present budget for reboisement has crept up to over $600,-00c, of which he wants $100,000 reserved for protecting existing structures, half of the rest for land purchase, the other half for planting, which if $20 per acre is taken as a unit cost would permit reforesting 25,000 acres annually.

Les Torrents des Alpes. Revue des eaux et forêts, 1905, pp. 202-215, 257-271.

Servia — A longer article by Markowitsch gives with much detail information regarding forest conditions and forest management of this small, out-of-the-way, inland country, which still boasts of nearly 4 million acres of forest, mostly deciduous. Six species of oaks used to be the principal timbers, but this class of wood has been largely exploited and beech has become more prominent. The State owns over 36 per cent. of the forest area, which is placed under a forest division of the Department of Agriculture, the organization being similar to any of the German ones. The districts have a size of 70,000 acres in the average, many of the district managers having but little education; the only silviculture school, founded in 1900, having merely a one-year course.

From the statement of the character of management, it can be seen that matters are not highly developed and that exploitation is still largely the rule.

Forst- und Jagdbetrieb in Serbien. Centralblatt für das gesammte Forstwesen, Oct., 1905, pp. 401-415.

Algeria

From a commentary by Gugot, on the new forest law for Algeria, promulgated in 1903, we learn that the forest area of this French dependency comprises about 7 million acres. Before the French occupation this was all communal property of the mussulmans; in 1851, it became nearly all State property, much encumbered by rights of user; 1.5 million acres being privately owned and about 160,000 acres is in the hands of corporations. The new law places the latter under government supervision as well as such of the private property whose maintenance or recuperation is needed for the public welfare; in these, clearing for other uses requires permission by the governor-general. For the administration of these forests the State receives 10 per cent. of the gross yield. Reforested hilltops or slopes or dunes are free from taxes for 30 years, burnt areas for 10 years.

Commentaire de la loi forestière Algérienne. Centralblatt für das gesammte Forstwesen, Oct., 1905, p. 416, 418.

Forest Restoration in California

A few years ago the United States Geological Survey selected a water shed in the State of Washington and one in Arizona, each covering an area of 142 square miles. Their purpose was to ascertain the comparative value of forested and non-forested areas in the regulating of stream flow. The area in Washington, Cedar Creek, was completely forested and the annual precipitation was from 93 to 150 inches, with a maximum run off of 6321 cubic feet per second. The maximum run off from Queen Creek in Arizona, with a precipitation of but 15 inches annually, was 9000 cubic feet per second.

These facts, Mr. Lukens declares, establish so clearly the great benefit of forest cover on mountain slopes that a determined effort is being made in California to reclothe the barren mountain slopes with tree growth. Experiments to determine the most economic method of re-forestation have been carried on for several years. A large proportion of the expense in the planting of rough mountain slopes in this state is the preparation of the areas to be planted so as to exclude fires or at least to reduce the danger to the minimum. This has been done by clearing the ridges of brush so as to confine the fire to narrow limits and enable men to reach quickly points of advantage for fighting fire.

As the principal growth on these mountains is of a coniferous nature this class of trees is mainly used in planting. Along water courses success is being attained in the growing of ash and walnut trees. Seedlings of the native conifers and a few exotics are grown under lath screens, and at the end of the first year are transplanted in nursery rows so as to harden them and cause the formation of a larger root system. At two or three years of age the seedlings are transplanted to the permanent location. Care is taken to grow the young trees in the same character of soil as that in which they will finally stand. The planting is done by loosening a small space with a mattock and setting the tree so that the soil is firm about the rootlets. Unlike tree planting in the east the work must be done during the rainy season, which is between November and April, that the trees may become established before dry weather sets in. As is usual in other semi-arid regions the roots of the native conifers in southern California make a remarkable growth. Trees of the Big Cone Spruce when but 6 inches high and of but one summer's growth are often found with a tap root 30 to 40 inches long. Old trees have been found having a root system equal in bulk and in many cases greater than its growth above ground. The value of this extraordinarily large root system is readily seen when it is known that the wet season is short, and the dry season long and very trying to tree growth.

Water and Forest. July, 1905.

Forest Reserves of Ontario. The number and location of Canadian Forest Reserves is not at all well known by foresters in the United States. The forest reserves of Ontario lie largely along the higher water sheds, and amount in all to 11,032 square miles or 7,060,992 acres. About twelve per cent of the whole is water in the form of lakes, streams and rivers. Following is the list of the reserves showing extent and date of proclamation:

NAME.	AREA.	DATE
Algonquin Park Reservation,	1466 square miles,	January, 1892.
Rondeau Park Reservation,	7 4-5 square miles,	1894.
Eastern Reservation,	125 square miles,	April, 1899.
Sibly Reservation,	70 square miles,	February, 1900
Timagami Reservation,	5,900 " "	January, 1901.
Mississagua Reservation,	3,000 " "	February, 1904.

In the northern part of what is now generally known as New Ontario there are millions of acres of land which can never be of any value for agriculture, but upon which there are large tracts of valuable timber. Forests of great value in various sections of the country were laid waste by fire during the construction of the Canadian Pacific Railroad. This wholesale destruction could easily have been prevented had reasonable precautions been taken·

The primary object in view when these reservations were set apart was the preservation of the forests from destruction by fire, thereby securing a more regular and heavier rain-fall, bringing about a larger flow of water in the streams and rivers, and also providing a harbor of refuge where the many valuable game and fur animals could live and increase in nnmber.

Rod and Gun. June, 1905

The history of the oldest forest school, which has continued its activity for 110 years, is briefly told by its director, Neumeister. It is the school which Heinrich Cotta began in 1795 at Zillbach, and transferred to Tharand in 1811. In 1816 it became a State institution, and since then has given an education to nearly 6000 students. Of the men who have made this school known beyond the confines of the little Kingdom of Saxony, and beyond the narrow circle of foresters, may be mentioned, Stöckhardt, v. Schröder, Wislicenus, whom every chemist knows, Rossmäsler, Willkomm and Nobbe, leading botanists. Cotta and Judeich have always been leaders of the forestry world, and Pressler, who stirred up the strife of soil rent vs. forest rent, worked here for over forty years.

Die Forstakademie Tharand von 1811 bis 1904. Centralblatt für das gesammte Forstwesen, Aug.–Sept. 1905, pp. 384–389.

NEWS AND NOTES.

E. A. Sterling, *in Charge.*

CORRECTION.—On page 278 of this volume a statement is made regarding the number of forest rangers employed on the National Forest Reserves, which needs correction. The number given, namely 33, was taken from the Field Program, which in this particular was incomplete, the number of rangers being over 500 and sometimes nearer 600. The area of forest reserves has now also grown to over 102,000,000 acres.

Broadcast seeding, as a method of artificial reforestation, has on the whole met with little success in the United States. It has been tried in the mountains of Southern California, the sand-hill country of Nebraska, the Adirondacks, and elsewhere, but for various reasons has not given the desired results. At the suggestion of Secretary Wilson, the Forest Service started experiments along this line in the Black Hills Forest Reserve in South Dakota this spring. The results are at present very promising. The region selected was the Custer Peak burn in the southern hills, an area of about 20,000 acres burned 12 years ago and now barren save for second-growth of aspen and bearberry thickets. The growth prior to the fire was young Western Yellow Pine from 10 to 15 feet high.

Broadcasting was tried on 31 acres, and planting in hills 2 by 2 feet apart with a corn planter on 8 acres. Western Yellow Pine was the only species tried, from 5 to 12 pounds per acre being used in broadcasting, and an average of 4 pounds per acre with the corn planter. The average cost of broadcasting was $1.16 per acre, of planting in hills, $4.06.

In late September the seedlings on 27 sample plots were counted. On the 31 acres sown broadcast an average of 12,600 seedlings from 1½ to 2 inches high and in thrifty condition were found per acre. They were least abundant on sod and in the aspen and bearberry thickets, and most plentiful on dry knolls.

where the soil was exposed. Where the corn planter was used from 1 to 3 seedlings were found in each hill.

The promising showing this fall is most encouraging and indicates a cheap and simple method of reforesting burns in the Black Hills. The feasibility of such methods elsewhere, however, is as uncertain as ever, and a promising field for systematic experimental work.

Railroad companies have been concerned for some time about the future source of cross-ties and construction timber. Coal companies are now beginning to realize that they, too, are on dangerous ground and that a not-far-distant shortage of mine timbers may occur. True, they are able to use very inferior material for mine props and ties, and thus can draw largely on the cheap hardwoods which are still abundant in the Pennsylvania mining districts and adjacent territory. On the ground of good business management, however, it is not satisfactory to invest so largely in material of such temporary value. For this reason the question of treating the timbers used or growing more durable species is being considered. Coal companies have a great advantage over railroads in that they own immense areas over coal veins, which are of little value save for forest purposes. The Philadelphia and Reading Coal Company, for example, uses about $100,000 worth of timber a month. Their land holdings, consisting of poor woodlands and unproductive fields, aggregate several hundred thousand acres. Obviously, it would be good business policy to manage these woodlots properly and devote the open lands to forest planting, a use for all kinds of timber products being found in their own mines- It is just such a plan as this that they are at present considering. In western Pennsylvania the Forest Service has already made planting plans for the Frick Coke Company and the Keystone Coal and Coke Company.

An investigation of the possibilities of forest planting in the coal region of southwestern Pennsylvania and adjacent portions of West Virginia was made by the Forest Service this past summer. Special attention was given to Black Locust, since this tree, owing to its rapid growth, and supposed suitability for railroad ties, is much favored for planting. It was found that several insects are causing such serious damage that the planting of Locust is not advisable. The stem and twig borers are causing exceptional injury locally in two counties, and the leaf miner, *Odontata sontellaris* Olivier, is killing the locust throughout nearly all the region studied. Its work appears in July as a blister on the leaf, which on being opened reveals a flattened, whitish worm. The adults emerge from the leaf in August and feed upon its upper surface. When numerous, these insects so reduce the working leaf surface that the life and growth of the tree gradually decline, until death ensues.

Another insect, a geometrid of an unidentified species, is attacking all kinds of broadleaf trees. Its range of exceptional injury is at present largely confined to Chestnut Ridge and Laurel Hill, the two westernmost ridges of the Alleghenies in Pennsylvania. It is gradually spreading eastward, however, causing severe damage to local areas in Westmoreland, Fayette, Armstrong, Butler, Allegheny, and Washington counties. The presence of this goemetrid jeopardizes the existing woodlands, as well as making planting, save of conifers, inadvisable.

Other special factors influencing forest planting in this region are the injurious effects of smoke from the coke ovens and the change in the level of the water table due to the cracking or falling in of the surface when the coal underneath has been removed. The gases from the ovens kill all the vegetation in the direct draft of the smoke, but the hilly character of the country is a protection against damage at a greater distance. In this connection the local position of the planting site needs special consideration. The breaking of the surface in spots occurs when the coal vein lies at slight depth, and such lands then become waste. The water level is dropped to the floor of the mine and consequently wells and springs become dry. The changed conditions must be carefully considered in choosing species for various sites, but do not prevent forest planting entirely.

The planting of such lands by coal companies is a profitable investment, since it makes lands productive which are now lying idle, and will give a much higher sale value to the land after the coal veins are worked out.

Throughout the northeastern Spruce belt of New York, Vermont, New Hampshire, and Maine, this has proved to be a very abundant seed year for the Red Spruce. Trees both scattered through hardwoods and in thick "black growth" are alike heavily crowned with cones. In many localities the cones hang so numerously as to give a strong brownish appearance to the trees as if blighted. This seed abundance should be a source of great satisfaction to those operating with a view of securing natural reproduction.

At the meeting of the National Federation of Horticultural Societies, held in Washington early in November, a resolution was passed requesting Congress to appropriate funds for instruction in the general principles of forestry in the land-grant colleges. It is not desired that complete courses leading to the graduation of professional foresters be attempted, but that the knowledge necessary to enable farmers to appreciate the significance and possibilities of their woodlots, which in the aggregate form the country's main forest wealth, be imparted.

Recent additions to those teaching forestry in this country are Austin Cary and R. C. Hawley, who will lecture on lumbering and forest measurements, respectively, at Harvard; G. L. Clothier, who is now Professor of Plant Breeding and Forestry in the Mississippi Agricultural and Mechanical College; J. Fred Baker, who is instructor in mathematics and forest measurements at the Mont Alto, Pennsylvania, ranger school; and E. G. Cheyney, who is assisting Prof. Green at the University of Minnesota.

Pennsylvania State College has organized a department of forestry, with Prof. Buckhout in charge.

Mr. William H. Wetmore of New York City has given this fall a course of eight lectures at the Yale Forest School on The Marketing of Lumber. Mr. Wetmore formerly lectured on lumbering at the Cornell College of Forestry.

The Yale Forest School has established a Graduate Advisory Board to assist the Faculty to keep in touch with the alumni and with the practical needs of the profession. This board consists of Mr. George H. Myers and Mr. J. G. Peters, appointed by the Governing Board of the School, and Mr. W. B. Greeley, elected by the alumni.

The department of forestry, University of Nebraska, reports an increased enrolment over any previous year. About fifty students are taking work in the department this semester, and the courses in farm forestry to be given next semester will bring the total enrolment up to ninety or better for the year. About twenty-five men are specializing in forestry, and the department will graduate three men next June. The University Forest Club organized last year, which meets every two weeks for the discussion of questions pertaining to forestry, is doing aggressive work.

The timber-testing station of the Forest Service, operated during the summer at the Lewis and Clark Centennial Exposition has been moved to the laboratory of the University of Oregon, located at Eugene, where a study will be made of the strength of large beams cut from various woods grown in the State of Oregon. The station will be in charge of J. B. Knapp. Preparations are being made for the establishing of a laboratory at the University of Washington to make a similar study of the woods native to the State of Washington.

Geo. K. Smith, Secretary of the National Lumber Manufacturers' Association, recently visited Washington and made arrangements for the co-operation of his association with the

Forest Service in securing annual statistics of forest products. Many conferences have been held with leading lumbermen and the secretaries of lumber manufacturers' associations throughout the country, and, in addition to heartily approving the work, these gentlemen have given valuable suggestions for rendering it more efficient. The names of sawmill operators, pulp manufacturers, and the owners of other establishments for which logs furnish the raw material will soon be procured from the Bureau of the Census, and preliminary forms of the question cards which will be sent to them January 1st are being printed. The Geological Survey will co-operate with the Service in procuring data on the amount of timber used in the mines of the country, and preliminary correspondence indicates that the railroad companies will gladly report the number of ties used by them annually.

The study of the woods used in the cooperage industry undertaken by the Forest Service is being carried on in the Northern States by J. J. Levison, and in the Southern States by H. M. Hale. Owing to the natural conditions in these regions, Mr. Levison's work has been largely on slack cooperage stock and Mr. Hale's on tight cooperage. They have found excellent opportunities for experimental work, and are making some instructive tests at various plants to determine the number and grade of staves produced from logs of different diameters.

An examination of the injury to vegetation by sulphur fumes from the copper smelters in the vicinity of Ducktown, Tennessee, has been completed. The work was carried on by the Forest Service in co-operation with the Bureau of Entomology and the Bureau of Chemistry. It was found that the fumes were doing damage to vegetation within a radius of 20 miles of the smelters. Suit has been filed by the State of Georgia against the copper companies, and will come up for hearing in the Supreme Court of the United States on December 4th.

During the summer S. J. Record, of the Forest Service, made examinations of 55 woodlots in Indiana, Ohio, and Michigan. In addition, several preliminary examinations were made of timber tracts in this region.

Working plans are being prepared for proposed sales aggregating over 5 million board feet of timber in the Sierra Forest Reserve in California. Forest Inspector W. B. Greeley is in charge of the work, with a party of seven men. Preliminary work in looking up timber suitable for cutting is being carried on in the Santa Barbara Reserve in California, and working plans will be prepared during the winter for proposed sales.

The preliminary reconnaissance made by the Forest Service in the Salt Lake Forest Reserve to locate planting sites has been finished, and work on the establishment of a nursery is under way. An area of about 15,000 acres at the headwaters of Big Cottonwood Creek is in urgent need of reforestation, and a favorable nursery site has been located about half way up the canyon and the construction of the lath house begun. The waters of this stream are of particularly high value, 80 per cent. being used by Salt Lake City and the remainder for power and irrigation.

An application has been received by the Forest Service for a planting plan for about 200 acres of denuded land near Saranac Lake in the Adirondacks, Strangely enough the applicant desires trees which can be utilized for cord wood, and in his opinion there is liable to be a scarcity of this form of wood material as well as of pulpwood and timber trees.

During November the Forest Service began a working plan survey on the Wassamasaw lands of the E. P. Burton Lumber Company, in Berkley County, South Carolina. The tract consists of 27,000 acres of Longleaf and Loblolly pines, which it is intended to manage with the thoroughness devoted to the execution of the working plan previously made in coöperation with the company for its Cooper River holdings. Five men are assigned to the work, under E. A. Braniff. C. S. Chapman, forester for the company and collaborator in the service, will have direct supervision of the execution of the completed plan.

An examination of the timber lands of the Union Pacific Railroad in Colorado and Utah is being made with a view to coöperation in the protection of Government and railroad lands.

W. W. Clark, whose return to the United States on a vacation from the Philippine Bureau of Forestry as noted before, has entered the Forest Service and been assigned as technical assistant to the Supervisor of the Black Mesa Forest Reserve in Arizona.

William Klemme, who left the Philippines on leave of absence about the same time as Mr. Clark, sailed for Manilla, on the Coptic from San Francisco, Oct. 21. Mr. Klemme came from Manilla by the eastern route and spent most of his time in Switzerland. He was accompanied on his return to the Philippines by H. M. Curran, who has transferred from the Forest Service to the Philippine Division of Forestry.

Mr. Curran takes with him an extended acquaintance with American forest conditions which should be of value in his new field. He was graduated B. S. by the University of North Carolina in 1898, and was a Special in the New York State College of Forestry during the fall and winter of 1899–1900. His forest work has been in connection with a study of Loblolly Pine in North Carolina in 1898-99; working plans for the Black Hills Forest Reserve in South Dakota and Wyoming and the Deering Harvester Company in Missouri in 1900, for the Whitney Estate in Massachusetts and for Grand Island, Michigan, in 1901, and for the Houston Oil Company in Texas in 1902-3-4. In 1901 and 1902 he investigated forest conditions in Maryland, and his reports on Cecil and Garret counties were published in the report of the State Geologist. In 1902 Mr. Curran had charge of the collection of data on White Oak and Chestnut Oak, in Kentucky, and in 1904 he studied Western Yellow Pine throughout its range.

The deliberations of the International Botanical Congress at Vienna in June of this year centered mainly in an attempt to unify the nomenclature. The deliberations were based upon a very comprehensive statement by Dr. J. Briquet of Geneva. The most important decision, adopted by large majorities, was the acceptance of a list of names for genera, to be adhered to rigorously.

In connection with the Congress a botanical exposition was held, the contents of which are very fully described in Centralblatt für das gesammte Forstwesen, Aug.-Sept. 1905, pp. 356-373. Of exhibits of special interest to foresters may be mentioned those of the forest experiment station at Mariabrunn. An increment autograph by Friedrich, which records the daily growth of diameter, shows that this is dependent on the weather in such a way that, as actually proved, calipering in dark wet weather would show a smaller cross section area that the measurements made in sunny weather. By an electric contrivance the record can be registered at a distance.

An instrument by the same fertile investigator measures the energy expended in diameter accretion. Precision calipers, permitting exact measurements of diameters at any height, and precision xylometers with automatic zero and measuring device, all by the same author, were also shown.

A section of an Austrian Pine, 600 years old, with a diameter of only 60 cm. (24 inch) or an average annual ring width of .5 mm, from the Schneeberg region exemplified the persistence of Alpine growth.

Experiments on the transmission of acquired characters, especially of the rate of growth of the mother plant were exhibited by Dr. Cieslar. The eight 9-year-old spruces exhibited showed a difference of height growth from .50 to 2.40 m. corresponding to the relative rate of their mother trees. The same author showed other results of the derivation of seed from various sources and studies on the composition of the soil-cover in stands of different density.

A collection of photographs of the crowns of groups in more or less severely thinned areas, before and after the first and second thinning, showed the changes taking place due to the operation.

A method of nature print of cross sections, in which the springwood is reduced by acids, and a number of exhibits of timber physics material should also be mentioned; among the latter especially, exhibits showing the influence of site on quality.

Prof. Dr. R. Weber, well known for having first attempted to formulate comprehensively the mathematical laws of tree growth, Professor at the University of Munich since 1883, died on Oct. 12.

The graduates of the Hochschule für Bodenkultur at Vienna which is also the Austrian forest school, who hitherto had no degree conferred, are now after a four years' course to be entitled to the degree of Doctor of Soilculture.