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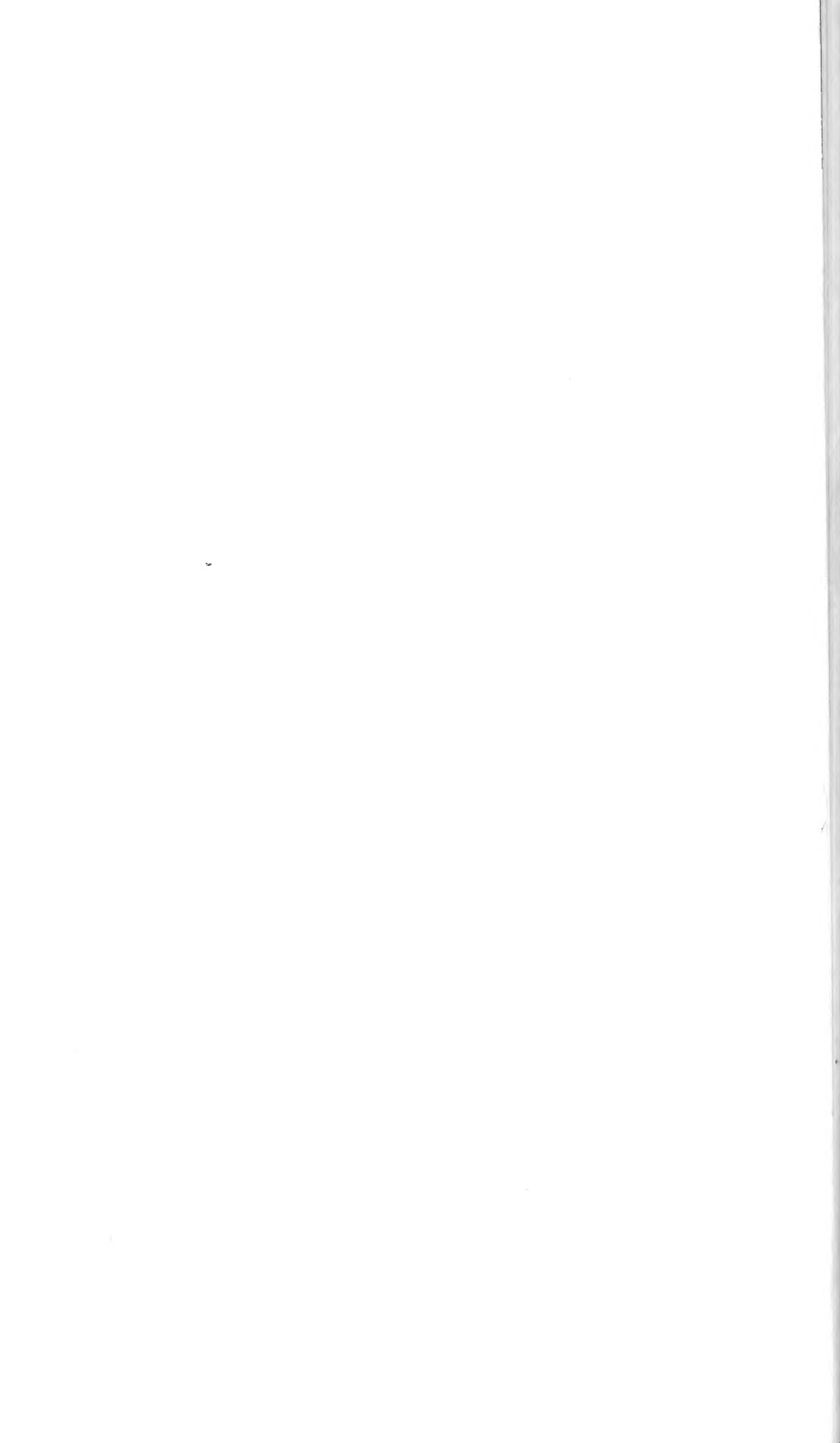


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DEPARTMENT OF AGRICULTURE.

Miscellaneous.

Special Report No. I.

Library, U. S. Department of Agriculture,
Washington, D. C.

Ag 84 Sm ADDRESS

OF THE

HON. GEO. B. LORING,

U. S. COMMISSIONER OF AGRICULTURE,

BEFORE THE

AMERICAN FORESTRY CONGRESS,

SAINT PAUL, MINNESOTA,

AUGUST 8, 1883.

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ADDRESS

BEFORE

THE AMERICAN FORESTRY CONGRESS.

GENTLEMEN: When I had the honor of addressing an assembly of those interested in promoting the cultivation and preservation of forests in this country, and in ornamenting our cities and towns by the planting of trees in their parks and along the highways, now a year ago, I dwelt largely on the value and importance of providing in every way for the gratification of our refined tastes and for increasing the popular sense of beauty. I did this as preliminary to the more practical work which called that assembly together, and as an appeal to the strongest motive man has to engage in the business of providing for his wants and surrounding himself with the comforts and luxuries which prosperity secures. At this time I propose to confine myself strictly to the condition of forests in this country, and to such suggestions as may occur to me with regard to their increase, preservation, and economical use.

And first as to the increase of our forests. In this work both nature and art are engaged. The "forests primeval" meet man wherever he advances to the occupation of new lands best adapted to feed and clothe him and best fitted for agricultural labor and production. His primary work is to remove this great vegetable growth, whose condition indicates the quality of the soil he proposes to cultivate. If he pauses in his work the forests return to their accustomed place. In the older States many acres which half a century ago were used for pasturage or tillage are now covered with forest growths, and many timber lands which have once supplied the forest products are now hastening to supply a new crop. The acreage of woodland is undoubtedly increasing in those sections where farming has become unprofitable either through exhaustion of the soil or through a change in the locality and demands of the markets. In the strictly lumbering States this is also true. While the deserted, remote, and mountain farms in Massachusetts are rapidly "growing up to wood," the woodlands of Maine and Michigan and many another lumbering State are growing a new crop, which in a quarter of a century will be more valuable than the original growth, although much reduced in size. The young pine and spruce forests of the north, covering acres of land once occupied by their sturdy progenitors, are full of promise and beauty. In other sections of the country,

lands, which have for ages been bare of trees while exposed to annual prairie fires, are, under the protection of man, producing rapid growths of wood. As the settler guards his fields against fires and cattle, trees spring up, and especially along the water-courses may be seen forest belts where an entire absence of trees had been the law for many generations of men. Wherever the land is protected, therefore, whether it be the location of old forests, or bare spots adapted to tree-growing where forests have been hitherto unknown, nature is busily engaged in producing wood and in bringing back the forest growth which welcomes advancing man as he goes on in his work of civilization.

In addition to this natural increase, much has been done in many of the States in tree-planting, and much more ought to be done. The establishment of "arbor days" and the inducements held out by legislation have operated very favorably on the work of what is called village improvement, and on an agricultural attention to the cultivation of trees as a crop. And this business has increased with very considerable rapidity in some of our best farming States. In Minnesota, for instance, the number of acres planted on "arbor day" in 1878 was 811; in 1882 the number was 1,184; and the whole number of acres planted increased from 18,029 in 1878, to 38,458 in 1882. Work similar to this is done in Iowa, Nebraska, and Dakota, as well as in Ohio, Michigan, Illinois, and Kansas. In Nebraska, the number of acres of cultivated woodland has reached 107,438, as against 19,695 acres of natural increase. These are small beginnings, it is true, but they are entitled to our most careful consideration as the commencement of an enterprise which, when properly conducted, will undoubtedly constitute an important branch of American agriculture.

Tree-culture ought now to receive our most careful attention. It is time that the skill which has been applied to the cultivation of our great cereal crops, to cotton, rice, tobacco, and all the profitable products of the soil, such as grass and vegetables and fruits of every description, should be applied also to the growing of wood as a farm product. To the choice of forest trees adapted to each locality; to the selection of land which can most properly be devoted to trees, considering its fitness or unfitness for any other crop on account of quality and situation, whether near to or remote from the farm buildings, whether useful or not for pasturage and tillage; to the best methods of cultivation, whether by seeding or planting from nurseries; to the best method of securing a speedy return—to all these points the attention of practical and investigating farmers should be carefully and systematically turned. The profit of the crop can, I presume, be no longer questioned. Waste lands inclosed and left to nature have produced in wood a very large return for the investment. Why should not land subjected to the well-directed art of the cultivator produce just as good a result? For the purpose of encouraging this enterprise it is important that Government should lend its aid in every legitimate way until the wood crop is recog-

nized exactly as are the great staple crops of the country. If a bounty is legitimate and useful in any case, it certainly would be in this. The protection against lawless invasion thrown around our grain fields and gardens should also be extended to our woodlands, protection against depredation, wanton fires, and stray cattle. The rifling of a forest should be as penal an offense as the rifling of an orchard. Over forest-covered public lands and over forest plantations, against the careless destruction of the settler on the one, and the trespass of the outlaw on the other, should the strong arm of the law be constantly and vigorously extended.

THE VALUE OF THE INDUSTRY.

In order that I may impress upon you the value of this industry I will ask your attention to its extent in our country, which covers such a vast area. I do this in order to impress upon your minds not only the value but the great importance of husbanding our resources in this direction in view of the constantly increasing demand for our forest products in all their variety. The forest lands of the United States amount to less than one-fourth of the entire area. The proportion of wooded area is less than in Eastern, Northern, and Central Europe, and is very unequally distributed. Norway has two-thirds of its area wooded, Sweden six-tenths, Russia nearly one-third, and Germany nearly one-fourth. The countries having less forest areas, arranged in order of proportion, from 18 down to 5 per cent., are Belgium, France, Switzerland, Sardinia, Naples, Holland, Spain, Denmark, Great Britain, and Portugal.

Originally the Southern, Middle, and Eastern States were entirely wooded, except a large portion of Texas and a few small prairies in the Southwest. Small areas of mountain glades among the Alleghenies might also be excepted. Ohio and Eastern and Southern Indiana were wooded, and the northern portions of the Lake States.

West of the line of prairies, running southwest through Indiana, Illinois, Missouri, to the Indian Territory, the central prairies, the drier plains, and much of the southern belt of the Pacific slope are destitute of wood. The streams in all the great region are more or less fringed with trees of some sort, and the higher mountains on the protected sides have a thin covering of forest. In the deep valleys of the western slope of the Sierra Nevadas are forests of extraordinary density filled with soft-wooded evergreen trees of enormous size, the wonder and admiration of the practical woodman. Here the *Sequoia gigantea*, or big tree, flourishes in isolated patches, while the coast range is the home of the *Sequoia sempervirens* or redwood.

From North Carolina to Louisiana nearly six-tenths of the farm area is wooded, though much of the area thinly, and part of it has been culled and is in second growth. Including unoccupied areas not in farms

which are in forest, something like three-fourths of the entire South is wooded.

There are counties in the South that were ten years ago almost unbroken forest. More than nine-tenths of the area of Brunswick, North Carolina, were then wooded, and almost as large a proportion of Beaufort, Craven, Onslow, New Hanover, and Bladen. A similar preponderance obtained in Williamsburg, Georgetown, and Lexington, South Carolina: and in Camden, Charlton, Clinch, and others in Georgia. In all of the Gulf States such districts were found. Less than 2 per cent. of Newton County, in Eastern Texas, was cleared. To-day the proportion of woodland is but little less. On the farm areas of Georgia the percentage of forests has increased from 55 to 59 on account of taking two or three millions of primitive forests into the farm area. In Florida, from the same cause, it has increased from 60 to 66 per cent. The decline has been from 61 to 58 in Mississippi; from 57 to 55 in Louisiana. It has increased from 42 to 44 in Texas; and nearly one hundred counties show from 10 to 80 per cent. in wood. The wealth of forest growth is scarcely appreciated in large districts of the South. There are districts where clearings are yet made yearly by girdling the trees in the summer for planting among the boles standing bare and blackened. Every winter a log-rolling disposes of the trunks that fall, until decay and fire have cleared the field. And it is not long since a sprinkling of black walnut rails could be seen in the worm fences which still surrounds fields of corn and cotton, and probably a few can yet be found.

Comparing the census returns of 1870 and 1880 we find a decrease of woodlands in farm areas in Michigan from 41 to 32 per cent.; in Minnesota from 21 to 15, and in Iowa from 16 to 11 per cent. In Nebraska, tree-planting has changed the record from 3 to 10 per cent. From the increase of farms in the wooded area, Wisconsin has 31 instead of 29 per cent. The comparison is thus tabulated:

States.	1880.			1870.		
	Acres in farms.	Acres in woodland.	Per cent. of farm lands.	Acres in farms.	Acres in woodland.	Per cent. of farm lands.
Michigan	13, 807, 240	4, 452, 265	32	10, 019, 142	4, 080, 146	41
Wisconsin	15, 353, 118	4, 768, 046	31	11, 715, 321	3, 437, 442	29
Minnesota	13, 403, 019	2, 030, 726	15	6, 483, 828	1, 336, 299	21
Iowa	24, 752, 700	2, 755, 290	11	15, 541, 793	2, 524, 793	16
Nebraska	9, 944, 826	321, 566	3	2, 073, 781	213, 374	10
Total	77, 260, 903	14, 327, 893	18	45, 833, 865	11, 592, 054	25

The belt including latitudes 37° to 41° through which runs the Ohio River extended westward across the Mississippi River, shows a decrease from 34 to 26 per cent.; greatest in Ohio and Indiana, as follows:

States.	1880.			1870.		
	Acres in farms.	Acres in woodland.	Per cent. of farm lands.	Acres in farms.	Acres in woodland.	Per cent. of farm lands.
Kentucky	21, 495, 240	10, 106, 072	47	18, 660, 106	9, 134, 658	49
Ohio	24, 529, 226	5, 982, 507	24	21, 712, 420	6, 883, 575	32
Indiana	20, 420, 983	5, 935, 308	29	18, 119, 648	7, 189, 334	40
Illinois	31, 673, 645	4, 935, 575	16	25, 882, 861	5, 061, 578	20
Missouri	27, 879, 276	10, 137, 790	36	21, 707, 220	8, 965, 229	41
Kansas	21, 417, 468	991, 187	5	5, 656, 879	635, 419	11
Total.....	147, 415, 838	38, 088, 439	26	111, 739, 134	37, 869, 793	34

In the eastern section, Maine shows an increase from new farms in Aroostook County and other northern counties, but it has been denuded of heavy timber and left for new growths, and therefore makes a deceptive showing. New York shows a decrease from 26 to 22 per cent., and Pennsylvania from 32 to 29, as follows:

States.	1880.			1870.		
	Acres in farms.	Acres in woodland.	Per cent. of farm lands.	Acres in farms.	Acres in woodland.	Per cent. of farm lands.
Maine	6, 552, 578	2, 682, 296	41	5, 838, 658	2, 224, 740	38
New Hampshire	3, 721, 173	1, 296, 529	35	3, 605, 994	1, 047, 090	29
Vermont	4, 882, 588	1, 503, 467	31	4, 528, 804	1, 386, 934	31
New York	23, 780, 754	5, 195, 795	22	22, 190, 810	5, 679, 870	26
Pennsylvania	19, 791, 341	5, 810, 331	29	17, 994, 200	5, 740, 864	32
Total.....	58, 728, 434	16, 488, 418	28	54, 157, 866	16, 079, 498	30

Taking the States by groups the inequality of forest distribution is strikingly shown. The following statement divides the woodlands reported on farm areas as follows:

States.	Acres in farms.	Acres in woodland.	Per cent. of farm land.
New England	21, 483, 772	7, 315, 730	34
Middle	47, 592, 113	11, 993, 317	25
South Atlantic	90, 117, 393	49, 339, 653	55
Gulf and Southern	112, 004, 983	59, 078, 032	53
Ohio Valley and Lake	137, 473, 231	42, 360, 123	31
Trans-Mississippi	97, 397, 289	16, 236, 559	17
Pacific	21, 339, 316	3, 115, 924	15
Rocky Mountain	8, 673, 738	816, 406	09
Total.....	596, 081, 835	190, 255, 744	35

CHANGES BY YEARS.

The following tables give a list of the States showing changes of ten years both in farm and woodland areas:

States and Territories.	Acres of woodland.	Per cent. of farm lands.
Maine.....	2, 682, 296	41
New Hampshire.....	1, 296, 569	35
Vermont.....	1, 503, 467	31
Massachusetts.....	1, 004, 099	30
Rhode Island.....	182, 666	35
Connecticut.....	646, 673	26
New England.....	7, 315, 730	34
New York.....	5, 195, 795	22
New Jersey.....	708, 092	24
Pennsylvania.....	5, 810, 331	29
Delaware.....	279, 099	26
Middle.....	11, 993, 317	25
Maryland.....	1, 634, 019	32
Virginia.....	9, 126, 601	46
North Carolina.....	13, 868, 086	62
South Carolina.....	7, 255, 121	54
Georgia.....	15, 269, 225	59
Florida.....	2, 186, 601	66
South Atlantic.....	49, 339, 653	55
Alabama.....	10, 430, 727	55
Mississippi.....	9, 144, 323	58
Louisiana.....	4, 557, 332	55
Texas.....	15, 851, 365	44
Arkansas.....	7, 861, 409	65
Tennessee.....	11, 232, 876	54
Gulf and Southern.....	59, 078, 032	53
West Virginia.....	6, 180, 350	61
Kentucky.....	10, 106, 072	47
Ohio.....	5, 982, 507	24
Michigan.....	4, 452, 265	32
Indiana.....	5, 935, 308	29
Illinois.....	4, 935, 575	16
Wisconsin.....	4, 768, 046	31
Ohio Valley and Lake.....	42, 360, 123	31
Minnesota.....	2, 030, 726	15
Iowa.....	2, 755, 290	11
Missouri.....	10, 137, 790	36
Kansas.....	991, 187	5
Nebraska.....	321, 566	3
Trans-Mississippi.....	16, 236, 559	17
Colorado.....	44, 117	4
Arizona.....	13, 399	10
Dakota.....	80, 264	2
Idaho.....	11, 892	4
Montana.....	3, 673	1
New Mexico.....	219, 224	35
Utah.....	2, 305	0. 4
Washington.....	437, 696	31
Wyoming.....	510	0. 4
Indian.....	3, 321	18
Rocky Mountain.....	816, 466	9
California.....	1, 672, 810	10
Oregon.....	1, 424, 417	34
Nevada.....	18, 697	4
Pacific Coast.....	3, 115, 924	15
United States.....	190, 255, 744	35

Of the value and importance of the forests covering these areas let me say: Next to the white pine of the northern forests, the most valuable tree is undoubtedly the *Pinus australis*, or long-leaved pine of the southern coast lands, forming a belt of varying breadth, up to 100 and 150 miles from the Atlantic and Gulf shores. It is the Georgia pine of builders, preferred for flooring and heavy frame-work, and is still found in pristine vigor and abundance over a large area from Norfolk to Galveston. These pine lands are now eagerly sought for by American and English capitalists, are rapidly taken up for manufacturing operations or on speculative account, and are rising in value. They have been held for many years by the General Government at prices ranging from 12½ cents to \$1.25 per acre, the former being for lands that had been opened to market for a certain period. This is the turpentine pine of North Carolina, where the business of distilling turpentine and making tar and rosin has long been profitable. It is also carried on, though in isolated enterprises, in other portions of this coast belt.

TURPENTINE PINE.

The products of the year ending April, 1880, are thus estimated by Mr. A. H. Van Bokkelen:

States.	Turpentine.	Rosin.
	Gallons.	Barrels.
North Carolina	6, 279, 200	663, 907
South Carolina	4, 593, 200	333, 940
Georgia	3, 151, 500	277, 500
Florida	1, 036, 350	68, 281
Alabama	2, 005, 000	158, 482
Mississippi	250, 000	20, 000
Louisiana	250, 000	20, 000
Total United States	17, 560, 300	1, 542, 110

The Southern pine will come into still greater prominence as railroad and steamboat lines extend facilities for transportation, which is now being done with great rapidity.

The condition of the pine-lumber supply of the United States in connection with the statements I have made is interesting. The destruction of this tree by fire and the ax of the settler and the lumberman is very great. Together with the spruce it is being rapidly consumed, and I think the following figures will show that the supply is to be obtained hereafter by allowing an exhausted region time to recuperate, while the comparatively uncut sections are resorted to for filling the demands of the market. Investigations recently made show that the supply of pine in New Hampshire and Vermont is exhausted, and that the spruce lumber, at the rate the cutting is now going on, will last in the former State but 7 years, and in the latter but 4. In the State of Maine the pine will last 4 years and spruce 15 years. In South Carolina the pine forests will last 50 years at the present rate of cutting; in California, 150 years; in Arkansas, 300 years; in Pennsylvania, 15 years; in

Georgia, 80 years; in Louisiana, 100 years; in North Carolina, 50 years; in Wisconsin, 20 years; in Michigan, 10 years; in Minnesota, 10 years; in Mississippi, 150 years; in Alabama, 90 years; in Florida, 30 years; in Texas, 250 years. That the exhausted forests in this list of States can be restored in time there is no doubt; and every means of cultivation and protection should be applied by the people and the Government, both State and Federal, each in accordance with its own jurisdiction.

FEARS OF A TIMBER FAMINE UNFOUNDED.

We should not forget, however, that while the demand for timber is imperative and increasing with increase of population, requiring the fostering care of the Government and the enlightened enterprise of timber-growers in promoting the progress of forest culture, there may be danger of assuming too hastily a prospective timber famine, and fabulous prices for fuel, even with the foregoing striking estimates before us.

It should be remembered that thus far the exhaustion of lumber relates mainly to the white pine. It may be found, when the great pineries shall be cut over, that the outcome is greater than was assumed, and that isolated patches of pine in mixed forests, and the second growths and remnants from first cuttings, may suffice to delay the threatened famine.

The black-walnut, culled from western forests to meet a limited though important demand, is really becoming scarce on the northern side of the Ohio Valley; but on the southern, along the foot-hills and in the valleys of the Appalachian range, it is abundant and almost untouched. It grows rapidly in the Western States even beyond the Missouri, and is destined to be the source of wealth to the future tree-grower.

The millions of acres of existing forests on this great eastern chain of mountains have not yet been considered in the statistics of forestry here presented. Their resources have never been measured, are yet comparatively unknown, and almost untouched by the axe of the woodman. As railroads penetrate these mountain fastnesses in the Virginias, the Carolinas, Kentucky and Tennessee, bonanzas of forest production will respond to the call of enterprise, and enrich the proprietor-woodsman and manufacturer. In addition to this, the white pine of Minnesota is estimated at 6,100,000,000 feet exclusive of isolated timber in birch lands and amidst other hard-wood growth. In Michigan the estimates for the lower peninsula cover 7,000,000,000 feet in the Saginaw district, 8,000,000,000 on the streams flowing into Lake Huron, and 14,000,000,000 on those flowing into Lake Michigan. The upper peninsula contains 6,000,000,000 more, making 35,000,000,000 feet in the principal pine districts of Michigan.

The great pine forests of Wisconsin are estimated to contain 41,000,000,000 feet of lumber, the largest proportion in the Chippewa and Wisconsin districts. They cover an area of 22,500,000 acres. The northern

border of the pine area is less productive than the areas of lower latitudes. The cedar swamps of Wisconsin scattered through the pine belt are estimated to cover 1,365,000 acres, and to contain 62,800,000 posts, telegraph poles, and railroad ties. There are also large supplies of tamarack, and spruce, and valuable oak timber, especially in Dunn, Pierce, and Saint Croix Counties, and other hard woods are abundant through the southern border of the wooded districts.

The united area of the States south of Maryland and the Ohio River is more than 500,000,000 acres, containing nearly 400,000,000 acres of forest lands. The farm area of these States is 228,000,000 acres, containing 123,000,000 acres of woodland. Denude any portion of this forest surface, and trees spring up spontaneously and grow rapidly. There are millions of acres of young forests in the South in which the corn-hills are almost as prominent as when the waving corn occupied the surface. Nature abhors a vacuum of broom-sedge, the first growth of abandoned fields, and speedily replaces it with a forest of pines. Intelligent land-owners of this region have estimated an average growth of a cord of wood per acre each year, or twenty cords of wood per acre in twenty years.

Is there immediate danger then of scarcity of fuel in a country where more than two-thirds of the entire area is wooded; and when nature is so kind and so prolific in forest farms, cannot the supplementary hand of man aid in providing even a sufficiency of timber for the wants of coming generations?

PRESERVATION OF FORESTS.

But notwithstanding this somewhat encouraging view, much remains to be done for the preservation of our forests. The waste by careless cutting, by fires, by settlers clearing the land for agricultural purposes, is enormous. Thus far this has not been checked to any great degree. Local and federal legislation, diffusion of knowledge, the manifest destruction of valuable property have not yet been able to bring the forests within the pale of well protected possessions under the law. Often has the remedy been pronounced by those who have devoted their lives to the study of this industry, and often have laws been passed which seemed to afford a remedy for the existing evil. But still the work of destruction goes on. It now remains, as it seems to me, for the public mind to be brought to a true understanding of the value of the property itself and of the disaster which would attend its destruction. That protection can be secured in the States by associations like this, by practical men engaged in planting trees and preserving their woodlands, by bounties for successful tree-culture, by the distribution broadcast of bulletins and pamphlets, there can be no doubt. On the best method of legislation it is not easy to decide. Bounties based on exemption from taxation have not had the desired effect, the tree-planting having served more as a mode of evading taxation than as a means of developing an industry

under the stimulus of protection. And of one county in Iowa it is said "the experience of the board of supervisors justifies them in the opinion that forest culture in our county would advance as rapidly without as with the exemption laws." On the other hand the State auditor declares that: "there can be no question but that this law of our State has gratefully stimulated the planting of forest trees and orchards too;" and that "if advantage could be taken of its popularity by inducing planter to set out a better class of trees, such as ash, walnut, &c., more good would thereby be accomplished." Connecticut, Dakota, Nevada, Pennsylvania, Rhode Island, Texas, and other States, have all passed acts encouraging tree-planting, either by bounty or exemption. Encouragement has also been largely offered by agricultural associations in most of the States, and great attention has been given to the proper selection of trees for each locality. The introduction of new varieties of forest-trees has been carefully considered also; and the habits of trees, native and foreign, have been made matters of the most diligent study, both by those who are governed by scientific zeal and those who are engaged in developing a practical industry. Of the efforts of the Federal Government to preserve and develop the forests on the public lands of the United States much has been said.

THE TIMBER-CULTURE ACT.

On the working of the timber-culture act it is unnecessary for me to dwell. But I think I can, with profit, submit some suggestions, made by the Land Office, with regard to "timber depredations" and the laws to prevent them. On this point the Land Commissioner, in his report of 1882, says:

While much has been accomplished in the direction of suppressing the unlawful cutting and removing of timbers from the public lands, I am of the opinion that better results can be obtained in the future; particularly so if some general and comprehensive law could be passed clearly defining who may take timber from the public lands, the purposes for which it may be cut and removed, and prescribing the punishment for unlawfully cutting, removing, or in any way wantonly destroying or injuring any timber growing, or being upon any of the public lands, or in any way causing or inciting such trespass. Such law should also establish the terms and conditions upon which any compromise or settlement should be authorized. A law of this nature would be more generally understood and comprehended than the several different enactments relating to this subject now in force, and could be more easily and evenly administered.

This is recommended because it is difficult to get competent and reliable special timber agents under the existing laws, and because the offenses are committed too often under cover of the homestead entries fraudulently made for the purpose of securing the timber on the lands. I think the difficulty in this matter lies in the fact that no value is set upon the timber itself as a piece of Government property. It has been assumed that Government does not desire to make the timber a source of revenue or profit, and that in the survey of lands no discrimina-

tion should be made on the score of existing resources. This policy may be wise and necessary, but it is not thrifty. Early in the history of the Government public lands were sold, as in the case of the sale to the Ohio Company, in 1787, for the purpose of replenishing the public treasury. And while Congress has exercised great liberality in the donation of lands for various enterprises, still the fact remains that this landed possession is of great financial importance. The time is gone by when the standing timber of the country, either on public or private domain, can be considered an obstruction to be removed by the ax and fire to make way for crops of another description. There is a value attached to it equal to that of any crop known—a value which should in some way be considered in the transfer of public lands to settlers and purchasers. Whenever in any way a recognized value is attached to the timber itself, be it large or small, its protection and preservation by the Government becomes a natural consequence, and wanton destruction by the ax and fires may be prevented. Government now offers a bounty for planting trees by its timber act, and makes no adequate provision for the preservation of the valuable forests standing on unoccupied lands. It seems as if this case might be met by some form of legislation.

The timber-culture act was passed March 3, 1873, amended March 13, 1874, and again June 14, 1878, since which date 75,045 entries have been made, of the aggregate of 93,246, since the first passage of the act. The area covered by these entries is 13,677,146 acres, of which 4,890,802 are in Dakota, 3,594,775 in Kansas, and 2,338,155 in Nebraska. In 1882 the entries amounted to 2,566,686 acres, more than half of which were in Dakota. The distribution of the aggregate entries is as follows:

States and Territories.	Entries.	Acres.
Arizona.....	88	11,866.08
Arkansas.....	3	231.92
California.....	1,245	168,413.53
Colorado.....	1,101	153,373.87
Dakota.....	31,178	4,890,802.15
Idaho.....	1,089	141,903.25
Iowa.....	640	55,151.51
Kansas.....	24,854	3,594,775.49
Louisiana.....	28	3,417.85
Minnesota.....	10,866	1,510,382.56
Montana.....	497	63,273.25
Nebraska.....	16,403	2,338,155.60
Nevada.....	30	4,120.00
New Mexico.....	87	11,619.13
Oregon.....	1,570	232,954.86
Utah.....	137	16,144.59
Washington.....	3,332	476,841.52
Wisconsin.....	1	40.00
Wyoming.....	37	3,679.21
Total.....	93,246	13,677,146.37

THE NECESSITY OF PRESERVING AND REPLANTING FORESTS.

In the report of R. W. Phipps, esq., of Toronto, on "The necessity of preserving and replanting forests," I find a sketch of forests and their

management in other countries, to which I call your attention as one of the most comprehensive statements we have had on this subject. His sketch, which is here abridged, is taken from an extensive report of Captain Walker, a gentleman who passed nine months on the continent, by direction of the English Government, for that purpose.

From Mr. Phipps I learn that in Hanover there are 900,000 acres of forest, under government or state management, belonging to the church and to municipalities. The care and working of these forests costs about \$650,000 annually. The receipts therefrom are \$1,500,000, and the profit is about \$850,000, about \$1.50 per acre per annum. The officers in charge are a forest director, an over-forest master, 20 forest masters, 112 over-foresters having charge of districts of seven or eight thousand acres each, 403 assistant foresters. A systematic plan for the management of the forest is adopted.

After a forest has, by thinning, planting, and so forth, been gradually got into perfect order, the system of natural reproduction forms a great part of the German method. It is as follows:

The rotation and periods are fixed in the working plan. For beech it is, in Hanover, 120 years, divided into six periods of 20 years each—that is to say, when the forest has been brought into order there should be nearly equal areas under crop of trees in each of the six periods, from one year to twenty, from twenty to forty, and so on. When a block arrives in the last period, felling is commenced by what is called a preparatory clearing, followed by a "clearing for light" in the first year after seed has fallen, with the object of (1) preparing the ground for the seed, (2) allowing it to germinate, (3) affording light to the young seedlings. If there is a good seed year and sufficient rain, the ground should be covered with seedlings in two or three years after the first clearing; but it is better generally to wait for a second year, and aid nature by hand-sowing, transplanting from patches of many to the barer spots, and turning up the turf to give the seeds a better chance of germinating.

When the ground is well covered, the old trees are felled and carefully removed, so as to do as little damage as possible to the new crop, and the block recommences life, so to speak, nothing further being done till the first thinning. The time allowed between the first and final clearings is from eight to fifteen years. * * * In these forests can be seen all the periods of growth—nurseries and schools for seedlings.

In Prussia there are twenty millions of acres of forests, ten millions of which are private, and the remainder, with which we have more to do, state, communal, and ecclesiastical. Of these the income is \$14,000,000, and the expenses \$7,500,000, leaving \$6,500,000 clear. The forests in Prussia as in Hanover form part of the finance department, and are presided over by an overland-forest-master and ministerial director, aided by a revenue councillor and joint ministerial director, and a numerous council or board. There are two forest academies, one near Berlin and one in Hanover.

There are 12 provinces in Prussia, divided into 30 circles, each having an over-forest master. These represent the forest department in local administrations, which as a board represents the forest interests in the government.

In order to be a forest-master, the lowest of the gazetted appoint-

ments, 5 years without pay are required to be given in study, with but meager pay when employed, yet candidates are numerous.

In some provinces the Prussian Government has certain rights concerning the management of private forests; in others, none.

In Saxony the state forests are nearly 400,000 acres, worked at an expense of \$500,000, receiving \$1,750,000, leaving a clear rental of \$3 per acre. The expenditure is planting, draining, roads, improvement of inferior woods, felling, transport, killing insects, &c. About 5,000 are planted yearly, at an average cost of \$7.50 per acre. The official establishment resembles that of Hanover. There is a forest academy at Tharandt with a separate staff of professors.

In Bavaria the state forests cover 3,000,000 acres. They return, after paying all expenses, about \$1.50 per acre per annum. About 30,000 acres are planted or sown annually, taking 35,000,000 plants and 1,000,000 pounds of seed. Persons found guilty of breach of forest rules have been punished by enforced labor in the woods. Private forest rights are being bought up by the government. The system of management is much the same as that previously described.

In Austria the state forests have been largely sold to meet state necessities, but there still remain nearly 2,000,000 productive acres, which yield, however, after expenses are paid, little over twenty-five cents per acre. The existing establishments of forestry are not uniform, but there are about 1,200 employes, of whom 22 are forest-masters. Scientific forestry is not so far advanced here as in Germany, but officials are busily introducing a reorganization, by means of which, there is no doubt, it will be on a par with other states. The Austrian crown forests have been neglected. There has been till now no attempt at rotation of blocks, or working in periods. The present director is trying hard to change matters for the better. He is planting up many bare or ill-covered tracts, where natural reproduction is impossible, owing to the absence of standard trees.

In the Grand Duchy of Baden there is a most interesting private forest belonging to the Prince of Furstenburgh, in the Black Forest. There are about 72,000 acres in charge of 18 foresters and over-foresters, who have many subordinates.

The administration of forests in France is intrusted to the ministry of finance, and the head of the department is the director-general, assisted by two administrators, one charged with the management of the forests and the sale of the products, the other with the police of the forests and the forest laws. The forests under the management of the bureau (state or commerce) are about 7,500,000 acres. Also, there are in France 15,000,000 acres of private forests. The saw-mills in the forests are usually owned by the government, and hired at a certain rate to the wood merchants, who buy the cuttings. The school of forestry at Nancy is said to be one of the best in the world. The French Government have, at great expense, replanted vast and almost barren dis-

tricts; they have also established great forests along the seashore where formerly the sand threatened to destroy whole departments, and have averted the evil.

In Russia, the government own about 330,000,000 acres of woods, and other parties 150,000,000. About 40 per cent. of the country (Russia in Europe) is timbered. The immense government woods have been placed under the care of the minister of public domains, who has a director of the forest department, and the organization of the service is very complete. Two special schools of agriculture and forestry have been established; one at St. Petersburg, and one near Moscow.

Italy has over 5,000,000 acres of communal forests, over 6,000,000 of private forests, and only 500,000 acres of state forests. One-fifth of the land is in forest.

In Switzerland, the waste of forests has been more rapid and destructive than any other country in Europe, and in none, perhaps, has this been followed by more disastrous results. Public attention has, however, been thoroughly awakened, and active measures are in progress to remedy, as far as may be, these evils. The cantons which have charge of these operations have for some time, at great expense, been constructing works to control the streams, and planting trees wherever practicable.

The description of the forests in the British Isles, as given by Captain Walker, from whom Mr. Phipps obtained his facts, is most interesting, and shows, as do those to which I have already referred, that the business of forestry is entitled to the most careful consideration of states and individuals.

VARIETY AND AGE.

In the practical work of planting forest trees there would seem to be a propriety in following the example of nature and giving variety, mixing trees of early maturity with those of great longevity, that the former may be cut when the great size of the latter should command an ampler space. Thus after the usual consecutive thinnings for hoop-poles, fence posts, railroad ties, or other purposes, the mature trees of the genus of least longevity could be taken out, leaving the veterans of the plantation to mature their more valuable crop of heavy timber.

In this connection the consideration of the proper age for cutting with profit is important. Mr. Michie reports his recent observation of a plantation in Great Britain sixty-five years old, partly cut down, in which 85 per cent. of a growth of mixed hard woods was deceased from over-ripeness. The plantation should have been cut at fifty years. The proprietor all this time was losing a part of the value of his wood, and losing the growth of fifteen years of young trees. He cites an example of an ash growth the root cuts of which were "tough as whalebone" at fifty-five years, while at seventy-five all toughness had disappeared and more than half its value lost. It should have been cut down and replanted at the age first named. The ash should have a clean and straight stem, and be cut while yet in rapid growth and full vitality.

In England, the larch, ash, and poplar, are ripe at fifty to sixty years, while the oaks planted among them may continue to grow one hundred to one hundred and fifty years, and a second crop of the earlier maturing species be matured among the oaks. Mr. Michie places the mature age of the elm at eighty to one hundred years.

METEOROLOGICAL INFLUENCES.

The influence of forests on rainfall has been so frequently and exhaustively discussed that little of value can here be added. From ten thousand observations made in Parana the mean annual temperature of the forest soil was found to be 21° lower than in the open field, and the mean annual temperature of the atmosphere of the forest 10° lower than in the open field. Relative moisture was found to be 6 per cent. greater than in the open field, 9 per cent. in summer and 5 in the other seasons. In the mountain regions the difference was greater than at lower elevations.

It is not necessary to assume that forests induce a heavier rainfall, or even to show that they influence locally the distribution of rain, to prove their beneficence in regulating the moisture available for the use of agriculture. The foliage of forests resists the violence of storms, breaks the force of the rainfall which percolates through the covering of leaves and moss, and is absorbed by the humus beneath to be given out by the slow process of retarded evaporation, the surplus finding its way to the springs deep in the earth. In an open field the storm beats with unbroken violence upon a surface impacted and hardened under the rays of the sun, fails to penetrate the soil, and rushes on in turbid streams down the slopes to swell the brooks and rivers, and instead of refreshing the earth scarifying and wasting it.

The world is full of examples of once verdant and productive areas which have become burned and blackened deserts. The gradual desiccation of the once green and productive islands of the West Indies, Santa Cruz and Saint Thomas, which has been progressive for many years, is the result of the destruction of primitive forests. The little island of Curaçoa, where rich plantations, beautiful villas, and terraced gardens have given place to aridity and desolation because of the export of its valuable timber, is a striking illustration of the changes wrought by forest destruction. The entire coast of the Mediterranean, once the garden of the world, has been blighted into comparative barrenness by the denudation of the forest areas. A portion of this territory, the Karst region of Southern Austria, bordering on the Adriatic, has been the scene of extensive reforestation work by the Austrian Government. Centuries ago it was covered with magnificent oak forests, and furnished piles and ship-building timber to Venice during her brilliant maritime career. So dense was the forest upon the Istrian coast that a squirrel could traverse it for miles on the branches of the trees. It was plundered systematically by Venetian spoilers till the whole region was reduced to barrenness and poverty. For a score of

miles north of Trieste the soil itself was washed away by the floods after the exportation of timber had been followed by relentless fires, leaving the bare rock in rugged masses as the sole covering of the surface. The work of restoration, commenced nearly twenty years ago, was one of exceeding difficulty. Exposure to sun and rain had exhausted the fertility of any remaining forest humus; the underlying masses of chalk were seamed and honeycombed with cavities requiring a mixture of underlying clay to sprout either grass-seed or tree-seed. Millions of trees were annually supplied by the Government nurseries of Austrian pine, ash, larch, and other varieties, and year after year the slow and patient effort has been continued with results that promise the ultimate renovation of a vast area of several hundred thousand trees, though the blasted district is yet a scene of comparative desolation, requiring millions of treasure and years of patient labor to restore a tithe of its profusion of forest wealth.

The productive capacity of the United States is due not alone to the great fertility of its central areas but, in a large measure, to the amount and reasonable distribution of the rainfall. The lower latitudes, the Southern States, where high temperatures prevail and evaporation is greatest, have a rainfall of 40, 50, and 60 inches annually, with a liberal distribution through the summer months. The lake region and the Ohio basin have less, yet a good supply, suited to more temperate conditions, a lower temperature and less evaporation. Yet the droughts that occasionally prevail, and which are most severe on the borders of the wooded belt, as in Texas, Kansas, Missouri, and Illinois, should admonish us to avail ourselves of the local benefits of forests in the equalization and conservation of the rainfall actually received.

Some of the States have less than the rule of the Duke of Burgundy requires: "One-third to the hunter, two-thirds to the husbandman." The rule of William Penn, one acre in woods for five acres cleared for agricultural lands, exclusive of the wooded hills and mountain forests, was not materially less. Yet Vermont, Massachusetts, and Connecticut in New England have less than a third of the farm lands in forest; New York, 22 per cent.; New Jersey, 24; Pennsylvania, 29; Delaware, 26; Ohio but 24 per cent.; Michigan, 32; Indiana, 29; Illinois, 16. These are originally wooded States, except a part of Indiana and Illinois.

The necessity of a careful and accurate cultivation and restoration of our forests is now recognized by all. For three-quarters of a century we have been busily engaged in the business of lumbering; the time has now come when we must turn our attention to the business of forestry. The great wood crop, which nature lavished on our ancestors, has been so diligently gathered that all our ingenuity will be taxed to continue the necessary supply for the growing wants of a rapidly increasing population. It is to this point that this association should especially turn its attention. It is to this point that I have directed the work of the Forestry Division in the United States Department of Agriculture for the development of the forest industry of this country.

APPENDIX.

THE FORESTS AND THEIR MANAGEMENT IN OTHER COUNTRIES.

[From the report of R. W. PHIPPS, Esq., Toronto.]

HANOVER.

Its forests under State management amount to 900,000 acres. Some are Government, some church, some belong to municipalities or communes. Government manages the forests by officers appointed, while the community pay four cents per acre towards the pay of the officers. The method appears to be that of giving the owners as much wood, pasture, or litter-for manure as their original right to the forest entitled them to; but to give it at the hands of Government officials. If the forest is of sufficient extent to employ a special officer, the commune, instead of the four cents, are charged his pay and allowances, as well as other working charges.

The Government forests are about 600,000 acres of the above, and the cost of working and all expenses is about \$650,000 annually, the receipts being \$1,500,000 and the profit therefore \$850,000, or, taking the actual figures, about \$1.50 per acre per annum. This, of course, takes no account of the value of the land, or what it might rent or sell for if cleared.

Hanover is a province of Prussia. The head office is therefore in Berlin. The forest establishment of Hanover consists of 1 forest director and over-forest master, who is also a councillor; 20 forest-masters in charge of circles or divisions, forming also a board of management in all forest matters; 112 over-foresters in charge of forest districts (*revier*), averaging seven or eight thousand acres each; 403 foresters who assist the over-foresters, and have charge of portions of a district; 343 overseers, under-foresters, &c., employed in watching and protecting the forest, and supervising the work which is executed by hired weekly or daily labor, or on contract under supervision of the fixed establishments. A cash-keeper is attached to each over-forester, who receives and disburses all moneys out of the forest cash chest, with which the over-forester has nothing to do, although his accounts should, of course, tally with those of the cash-keeper. For payment of laborers, &c., he gives orders on the cash-keeper, whose books are examined by the forest-master in charge of the division, and accounts rendered to the head office in Hanover and thence to Berlin.

All the forests have been surveyed, valued, and divided into blocks in this manner: Besides those already enumerated, there is, for the sole purpose of measuring, valuing, and framing working plans for the forest, a superintendent, draughtsman, and clerks, generally practical foresters, and a staff of surveyors and forest valuator, who are generally candidates for the position of over-forester.

When a forest was about to be taken in hand and worked systematically, a surveyor and valuator were dispatched to the spot, the former working under the directions of the latter, who placed himself in communication with the local forest officer and the inhabitants interested, and obtained from them all the information in his power. The surveyor first surveyed the whole district, then the different divisions as pointed out by the valuator, who defined them according to the description of the timber standing, and any conditions affecting the nature of the trees to be grown in future.

While the surveyor did this, the valuator valued the trees, formed a register of rights with a view to commutation, considered the best plan of working the forest, the roads, in fact, all which enabled him to form a plan for the head office, and a subordinate plan to be handed over to the executive officer as his "standing orders."

The valuator and surveyor return to headquarters, and prepare the maps and plans, which are submitted to the board of forest-masters, the forest-director, and other councillors of the finance department, who are thus prepared to listen to any objections made by communities or individuals, which are very rarely made now, as the people have learned that the action of the officers is not adverse to their interests, and are willing to allow them to settle matters.

The executive officer has thus in his hands maps showing each division of the forest tract in his charge, and instructions—the quantity to be felled yearly, the extent to be planted, the state in which the forest should be ten, twenty, or a hundred years after the plans were made, all calculated—so that the over-forester has only to carry out the instructions given him, allowance being made for unavoidable difficulties—failure of seed, occurrence of storms, and the like.

The forest-masters have no executive work, but control four to six over-foresters, of whose labors they make frequent reports to the director (both in forest and office work). The over-foresters give annual reports of operations. They spend most of their time in the forest, supervising the felling, planting, sowing, thinning, carting, and selling of timber. The laying down of roads is done by a forest officer, but the actual work is carried out by the local officer, who has also much office work, giving grazing licenses, etc., and preparations of returns; but his work is out of doors compared to that of the forest-master, who has more office work, comparing operations and rates in the districts, collecting statistics, settling disputes, and as a member of the forest committee, revising working plans.

The main object aimed at in any scientific forestry is to convert the natural forest, consisting of trees, young and old, good and bad, too thick and too thin, into blocks of trees of the better description, of the same age, and capable of being worked—that is, thinned out, felled, and reproduced, or replanted, in succession, a block being taken in hand each year. In carrying out such a system, considerations must be attended to, such as the relation of the block to the whole forest system; the needs of the people in timber, firewood, leaves for manure, and pasturage; the soil, the situation as regards winds (which must be attended to in felling to lessen damage), and precautions against insects, fire, trespass, or theft.

The plans need revising every twenty years, though it is marvelous to notice to what an extent the original scheme has generally answered.

After a forest has (to give some idea of management), by thinning, planting, and so forth, been gradually got into perfect order as described, the system of natural reproduction forms great part of the German method. It is as follows:

The rotation and periods are fixed in the working plan. For beech "hochwald" it is in Hanover one hundred and twenty years, divided into six periods of twenty years each; that is to say, when the forest has been brought into order there should be nearly equal areas under crop of trees in each of the six periods—that is, from one year to twenty; from twenty years to forty, and so on. When a block arrives in the last period, felling is commenced by what is called a preparatory clearing, followed by a "clearing for light" in the first year after seed has fallen (the beech seeds every fourth or fifth year), with the object of, (1), preparing the ground for the seed; (2), allowing it to germinate; (3), affording light to the young seedlings. If there is a good seed-year and sufficient rain, the ground should be covered with seedlings in two or three years after the first clearing; but it is better generally to wait for a second seed-year, and aid nature by hand-sowing, transplanting from patches of many to the barer spots, and turning up the turf to give the seeds a better chance of germinating.

When the ground is well covered the old trees are felled and carefully removed, so

as to do as little damage as possible to the new crop, and the block recommences life, so to speak, nothing further being done till the first thinning. The time allowed between the first and final clearings is from eight to fifteen years. But in many provinces they do away with this system, and remove the old trees so gradually that there can hardly be said to be any clearing at all, the new crop of trees being well advanced before the last of the old trees is removed.

In these forests can be seen all the periods of growth—nurseries and schools for seedlings, which are transferred thither, at the age of two to four years, from the seed beds, and are pruned and transplanted as often as seems required till finally planted out, sometimes not till twelve or fourteen years old. There are many methods of planting adopted here. The steepest and most rocky sides of the hills are covered with forests, which have been created by the labors of the forest department. In many such places, where even the few handfuls of soil placed round the young tree had to be carried some distance, it is not contended that the first plantations will yield a pecuniary profit, but the improvement in climate by the retention of the moisture and reclamation of large tracts formerly barren and unproductive is taken into account; besides which the dropping of leaves and needles from the trees will ere long create a soil and vegetation, and insure the success of plantations in future years and consequent surplus.

PRUSSIA.

Prussia has 20,000,000 of acres of forests, 10,000,000 of which are private, and the remainder, with which we have more to do, state, commercial, and ecclesiastical. Of these the income is \$14,000,000, and the expenses \$7,500,000, leaving \$6,500,000 clear. This will not show much, in fact not more than 65 cents per acre, but there are other returns of more than mere yearly revenue importance. When it is considered that this result is arrived at without trenching on the capital or stock of timber in the forests which, on the contrary, is being increased and improved in every province of the kingdom, and that the indirect value to the people of many forest privileges, which they exercise free of charge, must be very great, not to mention the benefit to all in the shape of public recreation grounds and an improved climate, some idea may be arrived at of the enormous value and benefit such a system of state forests must confer on Prussia.

The forests, as already stated concerning Hanover, form part of the finance department, and are presided over by an overland-forest-master and ministerial director, aided by a revenue councillor and joint ministerial director, and a numerous council or board.

There are two forest academies, one near Berlin and one in Hanover. The overland-forest-master is curator of the academies, and at the head of each is an over-forest-master, who is aided by a numerous staff of professors and assistant professors.

There are twelve provinces in Prussia, divided into thirty circles, and to each an over-forest-master, who is appointed to represent the forest department in the council of local administration, and is aided by councillors and by the forest-masters as a board, to represent forest interests in the Government. Next in order come the forest-masters, numbering 108, in charge of divisions with an average area of 60,000 acres, and then the executive officers, 706 over-foresters, to each of whom is 7,000 acres, and to each of whom is attached a cash-keeper, and 3,646 foresters, or overseers with ranges of 1,000 to 3,000 acres.

At the academy near Berlin are seven professors with assistants. There is an experimental garden attached, with an over-forester in charge of the technical portion, and professors for the meteorological, zoological, and chemical sections. The number of students averages sixty-five. The varied apparatus includes a building where the seed is dried and separated from the cones, large seed-beds of spruce, fir, and willow, full opportunities of transplanting seedlings, and examples of every kind of trees for botanical study.

There is here a museum, rich in specimens of all sorts of birds, animals, and insects found in the forests. In cases where the animal or insect does damage to trees, specimens of the branch, bark, leaf, or cone, in a healthy state, and after being attacked, are exhibited close to each, so that the students can see at a glance the nature of the damage and connect it with the animal which causes it. Thus we have squirrels, rats, beavers, mice, set up gnawing the barks, grubbing at the roots, &c. Insects are shown in the several stages of their existence—larvæ, chrysalis, caterpillar, moth, with their ramifications in the stem or branches of the tree. These, with specimen blocks of almost all descriptions of timber, form a most instructive collection. There is a forest district attached, remarkable for the growth of Scotch fir and spruce on a poor sandy soil, and in spite of repeated attacks by insects.

Nothing is more remarkable than the extent of study required from forest candidates, and the number of years they are content to spend in studying or waiting an appointment. The would-be over-forester, which is the lowest of the gazetted appointments, must pass certain terms at a Government school, a year in a district with an over-forester, an examination as forest-pupil, two years at a forest academy, an examination in scientific forestry and land surveying. He is then a forest-candidate. Then two years' practical study, nine months of it doing duty as an actual forester; then another examination. He is now an over-forester candidate. The first examination tests his theory; the second his practice. Then he will be occasionally employed in the academies, or in charge of a district, only then getting allowances. After five years of this he may look for steady employment.

Thus five years without pay are given in study; five in probation with but meager pay when employed, and the time is often longer, before regularly installed. Yet so great is the desire for Government—especially forest—service, that there are numerous candidates.

The qualifications for admission into the subordinate grades—forester, sub-forester, overseer—have a military tendency. Candidates, after two years in the forest, enter a jager battalion, and bind themselves for twelve years' service. After three years they obtain leave, and are employed in the forest as huntsmen or gamekeepers. After eight years they must have passed the forester's test, which consists in six months' charge of a district, and an examination. At the end of twelve years they are discharged with a certificate entitling them to employment in the forest establishments. The appointments are much sought after, and in 1867 there were two hundred and twenty-one applicants for one hundred and forty-five vacancies; but many are absorbed by communal and private forests.

In some provinces the Prussian Government has certain rights concerning the management of even private forests; in others none.

While on the subject of Prussia, it may be well here to insert some extracts from a letter received from Baron Von Steuben, a Prussian nobleman, now royal chief forester of the German Empire, by the Forestry Congress, at Cincinnati, in April of last year. He remarks:

"There can be no doubt that every country requires a certain quantity of well-stocked woods, not only to supply the demands for building material and fuel, but more especially to secure suitable meteorological conditions, to preserve the fertility of the soil, and out of sanitary considerations. The ratio of the minimum quantity and judicious local distribution of the indispensable forest to the aggregate area cannot be expressed by a universal rule, but the same can only be approximated by scientific investigation. Above all things, it is essential to prevent forest destruction where such would injuriously affect the fertility of the soil. It is important, then, to preserve and to cultivate judiciously those forests which stand at the head-waters and on the banks of the larger streams, because, through their indiscriminate destruction, fluctuations in the stage of water, sand-bars, and inundations of arable lands are occasioned. It appears also necessary to preserve and properly to cultivate

woods in quicksands, or the summits and ridges, as well as on the steep sides of mountains, along the sea-coasts, and other exposed localities.

"In Germany, and especially in my more narrow-bounded Fatherland, Prussia, it is regarded as of the greatest importance, not only to preserve the forests already there, but to extend them as much as possible.

"In the national appropriation bill large sums are set apart for the purchase of such lands as are unfit for cultivation, and for utilizing the same by planting trees.

"With reference to forests owned by private individuals, they are not restrained in the use of their forests, and may, according to their own judgment, clear the same and till the soil, in short, do what they like, and yet there may be certain restrictions placed on the free use of the same as soon as danger to the common welfare is feared; these restrictions are prescribed by the law of July 5, 1875, relative to forest protection.

"This law is applicable in cases—

"1. Where, by reason of the sandy nature of the soil, adjoining lands, or public grounds, natural or artificial courses, are in danger of being covered with sand.

"2. Where, through the washing away of the soil, or through the formation of cascades in open places on the ridges of hills and on hillsides, the arable lands, streets, or buildings lying below are in danger of being covered with earth or stone, or of being flooded; or the lands-or public grounds or buildings lying above are in danger of sliding.

"3. Where, through the destruction of the forests along the banks of canals or natural streams, riparian lands are in danger of caving, or buildings hitherto protected by the woods are in danger of iceflows.

"4. Where, through the destruction of forests, rivers are in danger of a diminution of the stage of the water.

"5. Where, through the destruction of forests in open places and near the lakes, neighboring fields are seriously exposed to the detrimental influences of winds.

"In the cases above mentioned, which have been copied verbatim from the statute book, the manner of use as well as the culture of forests may be legally ordered, in order to prevent those dangers where the dangers to be averted are considerably in excess of the damages which would result to the owner by reason of the restrictions."

SAXONY.

The state forests are nearly 400,000 acres, worked at an expense of \$500,000, receiving \$1,750,000, leaving a clear rental of \$3 per acre. The expenditure is planting, draining, roads, improvement of inferior woods, felling, transport, killing insects, &c. About 5,000 acres are planted yearly, at an average cost of \$7.50 per acre.

The fixed establishment is 1 inspector, 15 over-forest-masters, 120 district foresters, 16 cash-keepers, 13 engineers, 27 foresters, and 83 sub-foresters.

There is a forest academy at Tharandt, with a separate staff of professors.

The system of planting now principally experimented on is much the same as that previously described, the young trees being several feet high before the old trees are all removed. One operation is noticeable. It was decided to convert a mixed hardwood forest, patchy and irregular, with impoverished soil, in 1820, into a coniferous forest, and maps were drawn showing what it would be in eighty years. Private intersecting lands have been bought up, and by 1900 the ideal chart will be actual. Already, in place of a straggling wood, irregularly covered with timber trees of inferior growth, we have now a compact close forest, regularly wooded in sections of different ages, principally spruce and Scotch fir, but containing also fine oak, ash, and beech, with straight and clean stems. In many cases the young oaks have been left where pines were planted, and the introduction of the latter has had a wonderfully good effect on the oaks.

All private rights were abolished and compensated in these forests by a bill passed in 1832.

BAVARIA.

The state forests are 3,000,000 acres. They return, after paying all expenses, about \$1.50 per acre per annum. About 30,000 acres are planted or sown annually, taking 35,000,000 plants and 1,000,000 pounds seed. Persons found guilty of breach of forest rules have been punished by enforced labor in the woods. Private forest rights are being bought up by the Government.

The system of management is much the same as that previously described. There is a forest academy at Aschaffenburg, with one hundred and sixty-five students.

It will be interesting to notice the injury and process of repair in the fine forests of the Spessart in Bavaria. The deterioration was caused by felling the forest trees as soon as, or before, they were mature, the impoverishment of the soil by the removal of leaves and litter, and the allowing dense underwood to grow unchecked. Inferior trees got the upper hand and prevented the growth of good, while they drained the already impoverished soil and gave nothing in return. Early in the present century the matter attracted attention, and every means have since been adopted to grow oaks, beech, and coniferae. The result is, though not yet equal to the uniformity of other forests, nowhere can one find finer clumps and individual trees. Inferior trees will soon be rare in the whole forest. In remote portions where the humus had not been destroyed, the growth of beech and oak is truly magnificent, tracts of 120-year old beech and 300-year old oaks being common, the latter with clear trunks running up to a hundred feet high. When we compare these with other portions where the crippled and stunted appearance of the trees shows the effect of unregulated grazing and loss of litter, burning of the decayed wood, and forest theft and mischief, or the soil and vegetation, the result is marked. The circumstances, says the Indian commissioner, are analogous with what has gone on in India for centuries, and is still more or less permitted. The vast extent of forests, which once clothed the hillsides and extended far out on the plains, and the luxuriant growth of the tropics, have hitherto, or until the last two years, prevented the gradual deterioration of our forests being marked or felt, but the subject has now attracted attention, and none too soon. If any have doubts in the matter, let them visit the Spessart, study the history of its forests, and judge for themselves.

The forests are sharply protected by law, the average number of prosecutions annually being thirty per thousand acres. The crimes are mischief to wood, pasture, grass, straw, and miscellaneous.

AUSTRIA.

Scientific forestry is not so far advanced as in Germany, but officials are busily introducing a reorganization, by means of which, there is no doubt, it will soon be on a par with other states.

The state forests have been largely sold to meet state necessities, but there still remain nearly 2,000,000 productive acres, which yield, however, after expenses are paid, little over twenty-five cents per acre.

The existing establishments of forestry are not uniform, but there are about 1,200 employes, of whom 22 are forest masters. Some of these have almost sinecures, while others have six times too much to do, and it is the same with those in the subordinate ranks. The forest academy is at Mariabrunn, near Vienna. There are about 35 students.

The collections are fine, possessing specimens of all instruments and appliances made use of in felling, squaring, sawing, carting, and preparing timber, models of saw-mills and machinery of all descriptions, plans of river beds improved and embanked for floating, sluices of all sorts, dams and piers for directing rafts in their course and catching fire-wood, models of rafts, and specimens of home and foreign timber of all kinds. The damage done by animals and insects is also exhibited here comprehensively. There is also a forest garden attached to the academy for the instruction of the students.

The staff of the academy consists of the director, 13 professors and assistant professors, with subordinates in the account office, laboratory, &c. There is also a forest school at Bruhl, for training young men (of whom 8 were there) as practical foresters.

The greater number of those trained here are intended for private and not for Government service, their expenses for board and lodging being paid by noblemen and large proprietors, from whose estates they come and to whom they return as forest officers and workmen. The state maintains the schools and pays the professors' salaries, and there are no extra fees. This cannot fail to assist the intelligent management of the private forests of the empire, which are very extensive. The absence of numerous candidates for the Government forest service and the preference for private employment are noteworthy when compared with the opposite state of things in Prussia. The irregular promotion, lack of system, and low salaries in the Austrian forest service are the explanation.

The Austrian crown forests have been neglected; they are patchy, with a low and decreasing yield per acre. There has been till now no attempt at rotation of blocks or working in periods. As is found in India, a glance at the outskirts of the forest would lead one to suppose it fairly stocked with timber, but a more careful inspection proves that this is not the case, and that only in the valleys and more remote portions, where the soil is particularly good and the ax has not been so frequent in its inroads, is there a fair and regular crop.

Herr Schuppitch, the present director, is trying hard to change matters, and is changing the hard wood crop, which has exhausted the soil for that class, with pine growths, which, besides, grow quicker and pay better. He is also dividing into blocks and periods, and planting up many bare or ill-covered tracts, where natural reproduction is impossible owing to the absence of standard trees.

GRAND DUCHY OF BADEN.

We shall now notice a private forest, that of the Prince of Furstenburgh, in the Black Forest. The receipts and expenditures are not obtainable, as are the public ones, but we are informed that the forests are economically worked, and that the liberal sums expended on road-making, fitting rivers for floating, housing foresters, &c., were well repaid by the facilities secured and contentment and zeal of the employés. In the case of this, as of other private forests, it is evident that a private individual is not burdened with considerations of policy and public good as in a state. The forests are, therefore, worked with the best profit compatible with their retention as capital.

There are about 72,000 acres, in charge of eighteen foresters and over-foresters, who of course have many subordinates. The method employed is the slow felling and continual reproduction before mentioned, a block being after forty years in clearing before all the old are replaced by new trees. Attention and intelligence are necessary, for the seed will not grow nor the seedlings flourish without enough light, and the forest officer must watch that they get it; and again much greater care is needed in felling and hauling away when the trees are surrounded by lofty saplings and young trees than when the seedlings of the next crop are not more than a foot or two high. In this the axmen of the Black Forest are adepts, and the damage very slight to what it would be in other hands.

It may be useful to describe their manner of bringing timber down the rivers. It cannot here be done when the stream is in flood; in fact, the less water in it the better so long as sufficient is stored up above to float the rafts. Reservoirs are made, and the water poured into the river bed when the raft is ready. The streams are often small, of only fifteen or twenty feet in width, and have to be prepared for floating, by being cleared of any large rocks or bowlders, and "sleepered," if we may use the expression, by pieces of wood firmly fixed in the bed of the stream every few yards. These prevent the formation of holes in the bed, and serve for the raft to slide on if it touches the bottom. The first impression of the Indian commissioner when he saw

the float, composed of stems from twenty to sixty feet in length tied together with withes at the ends and lying zigzag in the bed of a mountain stream, up and down which they extended sixteen hundred feet, was that it was simply impossible they ever could be floated down the stream, with all its windings, and over the locks and rocks which occurred pretty frequently. It contained eight hundred and eighty stems, eight or ten of which abreast formed as it were a link in the raft. There were thirty links, not fastened laterally, but only at both ends to the next link. The breadth is greatest about two-thirds from the prow, which is narrow and consists of only three stems abreast, with, in front of all, a piece formed of old wood and raised out of water like the bow of a whale-boat, so as to lead the raft, and the largest and heaviest stems placed in the broadest part and towards the stern or hinder part, which does not taper at all. There are two or three brakes, by which the speed is slackened or the raft stopped if needed. When all is ready, the water from above is let loose, and the raft, perhaps not now lying in more than a foot of water, begins to float a little but is not let go till two-thirds of the water is passed, as it is a curious fact that when let go, if there is much descent, it travels faster than the water, and has to be stopped to let the water get ahead again. The raft has eight or ten men and boys, one or two of whom stand by the master at the chief brake, on which the safety of all depends.

When let go it is exceedingly curious to see the forward part dart off at the rate of five miles an hour, and the several links which have been lying zigzag and perhaps high and dry uncoil themselves and follow in its wake till the whole dashes along at great speed and apparently uncontrolled. Accidents are rare, as they are well trained (lads of six or eight can be seen going down in miniature floats); but for one not accustomed to it, it is nearly impossible to stay on the raft at all, as it literally springs out of water on touching a rock, dashes round a rapid turn, or jumps a weir with a fall of several feet. Forty or fifty miles can be got over in a day if stoppages to let the water ahead are not too frequent or the stream is not swollen by rains.

REMARKS ON GERMANY.

The Indian commissioner proceeds to remark on the German system of forestry. Perhaps it will be here admissible that I make one myself. Let me say that, when we consider the immense extent and rapid growth of forests in India, the vast amount in Government hands, and yet find that they are so rapidly deteriorating as to necessitate the dispatch of commissioners to Europe to learn the methods of preserving the forest, it is likely that Canada has just as much reason to bestir herself in the matter. Let us notice also, by some of the valuable tables Captain Walker has furnished, that in Germany and Prussia alone there are nearly 250,000,000 of acres of forests. We will well have already understood, by the foregoing pages, how different the great mass of these forests, with their great reserves of growing and well cared for trees, planned and prepared for many years, so that the forest can be depended on to give its regular and annual yield of valuable timber in perpetuity, are from our Canadian reserves, which are cut without regard to the future, and are fast disappearing before the combined assault of the settler and the lumberman. On asking where are we to look for a model or precedent on which to work, he replies:

"To Germany, where the management of forests by the state has been carried on for hundreds of years. Not the mere planting of a few hundred acres here, or reserving a few thousand acres there, but a general system of forest management, commencing by a careful survey, stock-taking, definition and commutation of all rights and servitudes, careful experiments in the rate of growth, the best soil for each description of tree; in fact in every branch of the subject, and resulting in what we find to-day, hundreds of thousands of acres mapped, divided into periods and blocks, and worked to the best advantage both with regard to present and future, and the annual yield of which now, and for many years to come, is known and fixed to within a few hundred cubic feet."

"The great difference," says the commissioner, "in climate and local conditions be-

tween India and Germany would, doubtless, necessitate important modifications; but I can see no reason why the broad principles of organization and forest management should not be applied with success to our Indian forests, that is, gradually feeling our way as regards the best mode for the forest and the wishes and interests of the people and the state."

I would here remark that this is still more applicable to Canada, as our climate presents no difference of moment.

"I do not think," he continues, "that we have much to learn from the Germans with regard to the planting and rearing of young trees; but it is with regard to the best method of managing groups or plantations that I consider we may with advantage take a leaf out of their book. For instance, I would certainly introduce, in an experimental manner and on a very small scale, their system of rotation, clearing, and periods, and endeavor to bring forward a second crop before the first is off the ground, encourage the growth of the better descriptions, and keep down the least valuable, so as gradually to arrive at groups of trees of the same age, description, and class, and eventually at blocks worked in rotation, and containing always a sufficient stock of crop coming on to meet the requirements of future years. To arrive at all this the most careful observations and experiments will have to be made as to the rate of growth and yield per acre of each description of forest, the conditions under which trees grow best and form the most timber, some requiring close and some open planting, some nurses and some not; some, like the oak, requiring a great deal of light, while some, like the beech, do best for many years in the shade. All these points, and many more, demand attention, and till they are settled we shall be merely groping in the dark. In fact, I think it may be taken for granted that all we will do in the way of forestry in the Madras Presidency, during the present century at least, will, after all, be but experimentalizing, which fact, however, need in no way delay the demarkation, survey, and settlement of the forests."

It may be said here that, if it be necessary to commence at once in India, it is probably more necessary in Canada, where the process of growth is so much less rapid.

Concerning the capabilities of German foresters, the Captain says:

"An over-forester, and even many of the foresters and overseers, can tell the name, local and botanical, of any tree, shrub, and plant, classify it, and state its uses; name and classify every beetle and insect in the forest, and know whether they are harmless or destructive to trees, in what shape they do damage, and what are the best known preventive measures; inform you of the nature of the soil, and to what period the formation belongs; what trees will grow best, and why. All this is known thoroughly, theoretically and practically.

"Then as to the district, the exact yield, rate of growth, and annual increase in value of each block is thoroughly known and can be put down in figures at each moment by the over-forester, who can tell at the commencement of each year how much timber he is going to cut and sell, and from what parts of the forest it is to come, how many acres have to be partially cleared for natural reproduction, how many to be planted, sown, thinned, or planted up. The mere details of all this are left, as a rule, entirely to the subordinates, who thoroughly understand them.

"The forest-masters in charge of divisions possess not only the theoretical and scientific knowledge acquired in the forest academy, and the practical experience gained while they were over-foresters in charge of a district, but the more extended knowledge and wider views from their larger field for observation and comparison of causes and results. They are then qualified to decide most points, revise working plans, and supervise operations generally whilst settling complaints and complications in connection with the forest administration, advising the local head of the department, and compiling valuable reports and statistical information."

THE BRITISH ISLES.

There are many forests, both Crown and private, in the British Islands, concerning which, as they appear to be managed on different systems, I shall merely state such

points as seen to have some bearing on possible operations in Canada, or may show the progress made in late years in planting and foresting operations.

In the New Forest, Hampshire, containing 91,000 acres, much has been planted with Scotch fir and larch in 1853, and with oak in 1857. What is noticeable is that the first, planted as nurses, are planted here so much before the others (both are elsewhere frequently planted at once). It is done to establish the nurses, and give shelter from the cutting winds prevalent here. They transplant here from the first nursery to another—the last one near the ultimate destination of the trees.

The Dean Forest, in Gloucestershire, has 22,000 acres in all. The commissioner visited twelve plantations here, ranging from 1844 to the present year. Nurses and hardwood are put out together.

In Scotland, the nurseries of Lawson & Sons, near Edinburgh, are noticed. They contain 270 acres. There were 30,000,000 coniferæ seedlings in the beds. The *pinus pinaster* is largely used for planting on light sandy soils near the sea.

Before sowing or forming the nursery bed the land is trenched to fourteen inches, and a crop of potatoes taken off to clean it. In the following spring the seed beds are laid out, and the upper soil carefully prepared to suit the nature of the trees which are to be sown. Most of the coniferæ prefer a light dry soil with a considerable proportion of sand, and this has the advantage that the seedlings are easily shaken out and freed from each other for transplanting. In the case of Scotch fir and larch, the seed is sown in May or June, and left in the seed bed for two seasons. The seedlings are then planted out in lines fourteen inches apart and three inches between each plant, are left thus for sometimes two years, and then planted out for good. It is thought better, if the frost can be prevented from killing the seedlings, to sow in April, and transplant one year after, or even the same autumn, as soon as the leaf bud is hard. The spruce requires two years in the seed beds, as its growth is slower than that of larch. The *pinus pinaster*, *austriaca*, and *laricio* are sown in May or June, and transplanted the same autumn into rows six inches apart, the plants close together. Hence they are transplanted the following autumn, into rows fourteen inches apart, where they are left one or two years before being planted out. It is considered an object to shorten tap-roots and encourage laterals. (This last idea, it will be noticed, may assist the tree; but not that main object of forest preservation, the connection between the upper and lower strata.)

The Earl of Seafield's woods, in Strathspey, give an instance of the rapidity with which planting is going on in Scotland. There 60,000 acres, of which half are in timber, yet so young that the commissioner saw little large wood ready to cut, but plenty of thinnings. The overseer intends gradually to plant the whole, so that, in course of time, a thousand acres could be cut annually and a thousand planted out, which could not, it is said, fail to bring in a large revenue without trenching on the capital of timber. Three lines of Scotch fir the commissioner saw lifted and tied in bundles for planting out. This was done expeditiously by the five-pronged fork, two men digging out the young trees, which are then lifted by women, the earth shaken off, and tied in bundles for planting. This list will give some idea of the progress on only one estate: Duthil Hill, 700 acres, planted six years; Deshar, 1,100 acres, within seven years; Slenmore, 600 acres, five years; Revoek, 700 acres, four years; Bengalupin, 1,200 acres, six years; Advie, 300 acres, one year.

A point here presents itself which, though it seems vague and not according with Canadian experience, it might be well to examine and find the meaning of. The Strathspey overseer considers that "in Strathspey, at least, the land should be left barren and untouched, after it is cleared of trees, until the natural herbage, whether heather, grass, or moss, which existed before the trees grew, recovers; and that if planted before this takes place, failure will result."

It may be remarked that oak is now little planted here, its use for ship-building being much less than formerly: while even for backing for iron-clads it is abandoned in favor of teak, which has not the injurious effect on the iron produced by the con-

tract of oak. Scotch fir and larch are much planted, and are rapid in natural production. Whenever the natural vegetation has sprung up in places formerly covered with coniferous trees, the seeds germinate. This is then protected by wire fences with great success. In a large tract of self-sown forest in the Grantown district, inclosed six years ago, the Scotch firs average six feet high, while individual trees run up to ten feet.

Wire fence, tarred, three feet eight inches high, can be constructed for seventeen cents per yard, posts and all, and is much used. After ten years, or when the trees have grown out of harm's way, pasture is sometimes let. Inclosed plantations for this purpose command 2s. 6d. per acre, while ordinary hill side pasture gets but 6d.

The Earl of Mansfield's woods, in Perthshire. These are about 10,000 acres. Planting is going on constantly. There are nine district foresters and a large staff of woodmen. A large plantation of Douglas pine is mentioned as doing remarkably well. They were planted in pits fifteen feet apart, fifteen inches square, and ten inches deep, with larch and Scotch fir nurses at four feet apart. The pines average twenty-five feet in height. The nurses are being removed. The overseer disagrees with the Strathspey statement as to leaving the land bare, and considers that it is only the insects (the beetle) which hinder the growth of seedlings on land cleared of conifers. He succeeds well by excluding cattle for one year, letting the grass, &c., grow, then burning it when dry, and planting out.

The Duke of Athol's woods, in Perthshire, comprise 10,000 acres, and were commenced in 1728, principally with larch, which has done well in places, but is now undergoing the substitution of Scotch fir, which pays better. Oak coppice cut at intervals of twenty years yields \$60 per acre.

FORESTS OF LUSS AND THE HARZ.

Another gentleman, M. Gustav Mann, Conservator of Forests in Bengal, has proceeded to Germany for the same purpose as Captain Walker, and gives some further important information relative to the German forests.

In the plain of North Germany the Scotch fir is the principal forest tree, and better suited for deep, loose, sandy, than for heavy loaming soil.

The great "Luneberg Heath" is mentioned as having been covered with wood, but the indifference of the inhabitants to the existence of forests, originating in the common belief that they will continue to exist no matter how recklessly treated, the desire of the villagers to get grazing ground for their cattle by burning the forests, the indiscriminate usage of the wood and method of felling in vogue, have destroyed hundreds of miles of forest, and have left the greater part of the Luneberg Heath barren, covered almost exclusively with heather, and of little use to any one. Now the evils are seen, and with a view of restoring these forests large sums of money and much skill and labor are being expended.

I will quote here a short description of the method used in planting the Scotch fir in such localities. The land is first plowed, after which a man proceeds along the bed making holes at distances three feet by five, with a wedge spade (one quite straight, made all of wood except the edge, which is shod some inches high with iron, and is two inches thick at the top of the blade). This he forces into the ground, withdraws it, and passes on, while two women follow him, who plant by holding the seedling against the side of the hole, while with one foot they press the opposite earth against the plant. The material for planting consists of one-year old seedlings of Scotch fir, and occasionally a two-year old seedling of spruce, which are raised in the ordinary way by sowing in furrows. The Scotch fir requires more light and air than any other, and does not thrive at all in the shade of other forest trees. For the same reason natural reproduction (in forests) is very difficult and not attempted here. As a tree affording some shade to other trees which require it, the Scotch fir is well suited. If sown or planted very close, early attention to thinning out also is necessary, as plants early stunted never fully recover their strength. The soil not being rich, the trees

are not allowed to grow older than sixty to eighty years, this being the age at which the comparative yield of wood is best. Spruce is planted in small numbers with the Scotch fir, and even where the soil is not good enough for it to grow up into large trees with the fir it becomes beneficial by the cover of its dense foliage, which facilitates decomposition of the soil and keeps it moister and cooler than the fir alone could do.

It will, perhaps, be as well here to give Mr. Mann's very lucid description of beech culture :

Seed beds for beech are prepared in the ordinary way, and the seed is sown in autumn as well as in spring. If the former time is preferred, care has to be taken that the seed does not germinate too early, so as to be exposed to spring frosts. This is prevented by covering over the beds after the surface gets slightly frozen, and by removing the covering in spring so late that the young seedlings have nothing more to fear from frost. If sown in spring, the seed has to be carefully stowed during the winter. Steaming, as well as excessive drying, must be guarded against. The first is avoided by turning over the seed or even keeping it spread out; the second by slightly watering it and turning it over afterwards, so as to distribute the moisture equally. A cool, moist room on the ground floor is preferable to a warm and dry one.

From the seed beds the plants are either removed at once into the forest, or into other nurseries for transplanting and keeping until they reach a height of three or four feet. If they are to be planted in open ground, without the protection of old trees, they are sometimes kept in the nursery until they reach a height of ten or twelve feet, which however is a very expensive measure. In this care is taken that the young shoots are not removed from the stem, as the bark of the beech is very easily burnt by the sun and otherwise apt to be damaged by the weather. Unnecessary exposure of the roots of the young beech is carefully avoided, as they are very sensitive, and demand special care during the removal of the plants. Where it can be done some of the soil is left on the roots for the same reason.

Ordinarily the beech forest trees get re-established by natural production, *i. e.*, the shedding of seed from old trees. When the beech gets mixed with other kinds, as in the coppice with standard, its regeneration is furthered or checked according to circumstances, but planting is seldom resorted to.

In the pure, high forests of beech the natural reproduction is brought about by gradual and well-considered fellings, which tend to affect this as completely as possible. In hilly or mountainous localities fellings are commenced at the top of the hill. These fellings take place when the trees have reached maturity, and are three to four in number, and distinguished according to the immediate effect they are intended to have on the forest.

The first felling, called in Germany the preparatory cutting, is intended to facilitate the decomposition of the dry leaves and branches which cover the surface, and thus prepare it for the reception of the seed, which latter, without this precaution, frequently germinates without being able to penetrate with its roots the comparatively hard and leathery leaves lying on the surface, and often dies in consequence, while weeds and scrub easily get up in it and cover the surface soon, thus adding to the difficulties to be overcome by the young plants. It is commenced several years before the intended regeneration and carried out gradually; but where the air and light thus admitted are not sufficient to render the surface fit for the reception of the seed, a timely permission to villagers to remove some of the dead leaves is resorted to. Besides the preparing of the soil, this opening out of the forest induces the tree to flower and bear seed more frequently than when standing very close.

The second felling—the so-called seed-cutting—is carried out as soon as the bearing of seed becomes probable, which can be judged of beforehand by the appearance and shape of the buds during the preceding winter. An abundant seed-bearing season generally occurs with the seed after longer or shorter intervals, but sufficient seed for the regeneration of the forest may be reckoned on every second or third year. Precaution

is used not to remove too many trees at once, as in case of the flowers being destroyed by spring frosts or other causes, the restocking of the ground with young plants does not succeed. Too much light would dry up the surface of the soil, and induce the weeds to overrun the ground, both circumstances seriously interfering with the germination of the seed at a future season. Where at this time the suitability of the soil remains doubtful, a timely loosening and preparing of it in strips and patches is resorted to to insure success.

When the expected seeding of the trees turns out a failure, further clearing is carefully avoided to prevent the deterioration of the soil or overgrowing with weeds. If, however, the season is a favorable one, and produces sufficient seed, and the young plants germinate, this felling is soon extended to a greater number of trees, to admit more light and dew to strengthen the young plants.

For the purpose of getting the seed worked into the ground, herds of swine, cattle, &c., are often driven through the forest with good effect.

Seed beds are sometimes established in the neighborhood of a forest at the same time, to furnish young plants for the filling up of vacancies, which, however, are also obtained nearly as good out of the forest itself from places where the plants stand thick enough. Altogether the aiding of the natural reproduction by artificial means, either sowing or planting, is at the present time generally resorted to at once, as such measures always lead to a more satisfactory accomplishment of the desired regeneration, and save time.

The third felling is called cutting for light, as its chief purpose is to admit light and air in greater abundance as the young plants require it. This is generally commenced when the seedlings are two years old. It is also regulated very much by circumstances, and while in the one case the forest trees may be required longer on account of the spring frosts, so very injurious to the young beech, in others their early removal is necessary, even if an increase in size be sacrificed, for the establishment of the young trees. Neither do partial failures prevent the removal of the old trees, but are resorted to at once by sowing or planting as the safest and quickest mode of securing the establishment of the young forest.

After the third or light felling follows the gradual removal of the old trees, or final clearing, which is regulated in the first instance also by the requirements of the young trees, and after this by the fixed yearly out-turn, as laid down in the working plan. As a general rule, all these fellings are carried out gradually, without causing sudden changes in the forest. The aiding of natural reproduction is either accomplished by sowing, if failures are perceptibly early, such as non-germination of the seed or death of the seedlings; or by planting, if the seedlings get destroyed later by spring frosts, or are choked by weeds. The sowing is carried out in the forest in strips two feet wide, in furrows, or in patches two to three feet square, prepared by hoeing for the purpose, and by loosening and leveling of the soil, while planting is done by seedlings two to three feet in height taken from adjoining nursery beds, or from spots in the forest where there are more than are necessary.

"It is evident," says Mr. Mann, "that if, with all this care and attention to aid natural reproduction, still occasional failures occur, how unreasonable it is to expect forests in India to keep in an equally rich and thriving condition if left to themselves or worked only with a view of extracting the timber from them." I would also apply the remark to Canada, and observe also that Captain Clarke respecting India, and Hon. M. Joly concerning Canada, make precisely the same statement, to the effect that the forests in both countries, cut over and carelessly managed, are often, so far as any available supply of good timber is concerned, only forests in appearance.

It may be noticed that the beech, of all other trees, is said to improve the land, forming a rich vegetable mold, to gain the benefit of which other trees—oak, ash, maple, larch, Scotch fir—are planted among the beeches and do well. I may notice here that in Canada, while clearing the forest, this did not appear to me. I generally found the maple on the richest land, and where beech were intermixed a lighter loam.

One description of forest much used in Germany is called "Middle Forest." It contains a number of high trees cut at long intervals for timber, and below them a coppice (smaller trees growing from roots of previously existing trees, and which will themselves, when cut, be succeeded by similar ones) cut at much shorter periods for firewood. In cutting the coppice, young trees are left to replace the tall ones when cut.

A method of planting used here should be noticed. A small spade of solid iron, about twenty pounds in weight, fourteen inches long, seven inches broad at top, five at bottom, with a handle four inches long, is driven into the ground, and bent to all sides, then drawn out. The plant, three to four years old, of beech, spruce, or oak, &c., is dipped into a thin mixture of loam and water, which adheres easily. In this state it is pushed with its roots into the hole as far as possible, and with continual shaking, by which the roots get straight down into the hole, drawn up to the level at which the plant should stand. Here it is held by one man, while another drives in the spade a second time, about three inches from the first hole and parallel with it, and first presses with its point towards the first hole, and then with the broader part, by which means the plant gets very firmly pressed into the soil. If necessary the spade is driven in a third time, to close up the second hole slightly. The soil is then beaten firm with a mallet all round the plant, but not striking closer than three inches. This mode is very successful; it is carried on without preparing the soil, and answers in stony ground, on account of the strength of the spade.

On the Harz Mountains (the scene of many a supernatural legend) are vast forests of spruce, kept with much care. One remarkable point in the management is the Government seed-drying kiln at Westerhof, for getting the spruce seed out of the cones and cleaning it of wings, which is carried on here extensively, the spruce being plentiful, of excellent growth, and producing exceptionally good seed. The cones are collected by contract work, and varies according to the seasons, if plentiful or otherwise; and generally enables the workman to earn 50 cents to 75 cents per day. After all the Government stores are filled, private persons are allowed to collect, for which the person has to pay a small sum per season. In the cones the seed remains good from seven to eight years. The Government kiln turns out about 180 cwts. per season, while private parties in good seasons have turned out as much as 1,600 cwts. besides. The cones, when first brought in, are stored in large rooms with perforated walls, so as to admit a free current of air through them.

The kiln itself consists of three rooms, the center one of which is heated by means of a large oven, from which large iron pipes, six inches in diameter, pass twice through the room before they enter the chimney. This room is separated by walls, in which there are holes of nine inches, from the two outer rooms, in which the cones are being dried. By means of these holes, which can be closed at pleasure, the temperature in the drying-room is regulated and kept between 122° and 128° Fah. The drying is done in large wire drums, out of which the seed falls on the floor of the room. There are twelve in each room, and are turned from the outside of the room, where it is cooler. They are filled in the evening, the temperature got up, and so left for the night. The next morning the fire is lit again and, the drums being turned every half hour, by night the cones are empty. Half the cones are used to heat the kiln; the rest sold for fuel. It costs Government about six cents per pound. What is not needed is sold at nine.

It is noticeable that the spruce wood, among other uses, is ground into pulp for paper manufacture, several mills in the Harz Mountains being employed in this manner. It might be worth consideration whether, under an improved system of forestry, the waste wood left in such quantities in hewing and score-hacking could be, in our great Canadian spruce forests, so employed.

It will be well to give an account of the method of reproducing and caring for spruce forests, both because our own forests will soon need replanting and to give some idea of the care taken in maintaining woodland property in foreign lands.

Natural reproduction of the spruce is seldom attempted, as too slow and uncertain; but if there are thriving naturally some clumps of any extent they are kept up. Almost all spruce forests are regulated high forests, with complete clearings either resown, which is still preferred by some, or planted, which is by far the most general mode of establishing or re-establishing spruce forests. If sown, lines about two feet in width are prepared by clearing the weeds, &c., off the ground, and placing this at the edge of the lines to prevent the wind blowing among the seed or rain washing them off. The soil on these strips is sometimes loosened and left as it is if the seed is to be sown broadcast. If the seed is sown in rows small furrows are made. Between the strips ground twice as wide is left. For plantations the seed is sown in seed-beds, which are good, even, and sheltered pieces of land, about half an acre in size and well dug up, afterwards leveled and occasionally slightly manured by the ashes of the weeds, remains of wood, &c., collected on the surface, brought together and burned, and afterwards mixed with the soil. These seed-beds are usually in the immediate neighborhood of the ground to be planted and have to be fenced in. If the seedlings, after they are three or four years old, have to be removed from here at once to the spot where they are to remain, the seed-beds have to be larger, especially if the young plants are to be planted out in numbers, *i. e.*, three or four in one hole. In the latter case the seed is sown generally in furrows, one foot apart, as being more convenient, and requiring here in the hills about seventy-five pounds of seed for half an acre, which is sufficient to plant fifty acres of forest. The better plan, however, is to have the plants from seed-beds, after they are two years old, transplanted singly into a nursery at about seven inches distance, where they remain until they are four or five years old; this, however, requires as much space again for the nursery as for the seed camp. Not unfrequently four to six year old seedlings are taken from the adjoining forest, where they are generally so close as to permit of the removal of many of them; and this is the most inexpensive way of procuring seedlings in limited numbers. Where there is a demand for thinnings the planting of three or four plants in one hole recommends itself. If it is likely that the ground get run over rapidly with weeds, or the soil dried up by the sun, the replanting is done as soon after the removal of the old forest as possible, whilst where the danger from insects, especially the small beetle, is great, the ground is let lie two or three years first. Planting is done in autumn as well as in spring, but the latter is preferred. Spruce is planted four or five feet apart.

To protect the spruce forest against damage from insects the forester has to be constantly on the alert, as they are many, and if not checked in time great damage is done by them. The most destructive noticed was the ordinary spruce bark beetle, which attacks the bark of living trees, and had, in some of the localities visited by the commissioner, destroyed so many trees that, when the diseased were removed the forest had become so open that the wind would soon have removed the rest had they not been felled. Experienced men are told off to guard against this danger by going through the forest to search for the trees attacked by the beetle and fell and bark them to prevent the spreading of the insects. In most cases they are quite able to hold the insects in check. These generally attack trees loosened in the roots by wind, known after the beetle gets in by their foliage turning yellow. In spring, when they are worst, healthy living trees are felled at the southern margin of the forest in sunny spots, for the purpose of attracting the beetle. Such trees are often full of them three or four days after being felled. The trees attacked are barked, which destroys the larvæ if not too far advanced; if so, the bark is burned. To prevent any escaping while barking a cloth is spread under the stem. The timber beetle, which attacks new felled trees, going deep into the wood, is also common there and is watched for closely. For the young plantation of spruce the first mentioned is the most dangerous as it eats off the bark above the roots and kills the tree. Fresh pieces of bark a foot square, inner side down, are laid around before or after planting. The beetles go under and are caught and killed. The bark is examined every morning.

SILVER FIR AND SPRUCE IN THE BLACK FOREST.

The Black Forest mountains are the home of the silver fir. The winters are severe—five to eight feet of snow on the hills from November till April; three feet in the valleys from December till March. They are partly regulated forest, in which, however, a gradual felling for their reproduction is carried on over one-third or one-fourth of the whole area at once, from which every year during thirty or forty years the largest trees are removed, while the rest are allowed to grow larger during the remaining years. This is done, as the price these large trees fetch is much higher in proportion than that of the smaller ones, and all are felled and removed in one piece if possible. Natural reproduction is chiefly resorted to in these forests, which, in consequence of the young plant growing well in the shade of the old trees, is very easily accomplished, even though it is extended over such a long period as thirty or forty years. To be able to keep as many trees as possible growing on the lands on which the regeneration of the forest is going on, the branches up to one or two-thirds of the height of the tree are sawn off to admit air and light to the young plants below, which does no harm to the silver fir, but, on the contrary, is said to aid the more rapid increase of the trunk, while the branches are used for litter. This sawing off of the branches is commenced from above by men who earn about forty-five cents a day. Regular seed-bearing seasons occur at longer or shorter intervals, but nearly every year there is sufficient seed to increase the number of young plants where it is wanted. Moss cover is very favorable for the germination of the seed, whilst in such places as get covered with grass or weeds, or where for other reasons the seed does not germinate freely, the soil is at once prepared, by clearing and slightly loosening it in strips and patches, for the reception of the seed, the germination of which is thus facilitated. If the open space in the forest is so large that the seed from the old trees does not reach the whole of it, sowing by hand is resorted to early, so as to let the young plants be as nearly as possible of the same age. If, by the time the old trees are nearly all removed, there are still some parts not covered with young trees, planting is resorted to. For the better growth of such planted trees the existing groups are somewhat rounded off, to avoid the young trees planted having to struggle with the others, perhaps already twenty to thirty years old; and where, on incompletely stocked spaces, which have to be filled up by planting, there are single trees of some twenty or thirty years, they are cut down altogether; or, if they are standing in numbers, and are not quite so large, some of the lower branches are lopped off the outer ones, so as not to interfere with those planted. These plants are either taken from nurseries or out of the forest, if the latter have not grown in too deep shade, which would render them liable to suffer on being removed to open places.

The seed is collected with some risk from the trees in October, before the cones open and it falls out. As the seeds are very oily, they are best kept in the cones or sown at once. The sowing is done in prepared beds in rows four inches apart, and after germination the ground is covered with moss to keep in the moisture. The seedlings one year old are transplanted into rows six or seven inches apart, and three inches between the plants in the rows, after which the soil between them is also covered with moss. Here they have to remain for two or three years before they are fit for transplanting. Shade from the side is very beneficial for the seed beds as well as for the nursery. Plants from the nursery are preferable to those out of the forest; and the latter, when used, are as a rule removed with some of the soil adhering to the roots. Planting is better done in spring than in autumn, and in the usual way, the roots of the young plants being cut as may be necessary. They have to be sheltered as far as possible against sun, dryness, or spring frosts, and the plants as a rule thrive better on the cool northerly and easterly slopes of the mountains than anywhere else. The silver fir grows very slowly at first, and does not get much higher than six inches in the first four or five years. At the age of twenty-five years it begins to grow very fast, and increases most between the ages of eighty and a hundred and twenty years.

It likes best a deep, cool, moist, and loamy soil with a covering of moss, and sends its roots deeper than the spruce, in consequence of which it suffers less from wind and storm than the latter. There are many spruce intermixed, used when natural reproduction of the silver fir fails. Thinnings are necessary in the thirtieth year, and have then to be repeated every tenth year, till the gradual felling of the largest trees commences. These fellings are regulated by the needs of the young seedlings, and are carried out only sufficiently to admit light to the young plants, leaving as many of the old trees to stand as can be permitted.

Moorpan.—In Hanover and elsewhere, where the Government are bringing up thousands of acres of heath for the purpose of planting forests, great difficulty is found in penetrating and converting into good soil a hard layer called "moorpan." This is broken by plough and pickaxe, and Scotch firs planted, whose deep tap-root passes down into the layer of better soil below. The Government pay about \$11 an acre for the land.

FRANCE.

The administration of forests in France is intrusted to the ministry of finance, and the head of the Department is the director-general, assisted by two administrators, one charged with the management of the forests and the sale of the products, the other with the police of the forests and the forest laws. In the departments there are thirty-two conservators, each in charge of one or more departments, according to the extent of forests in each. The immediate supervision is intrusted to inspectors, who are assisted by sub-inspectors and *gardes-generaux*, who live near, and personally superintend all operations and work of the forest guards. The brigadiers and forest guards live in houses in the forest and serve as a police over a certain range. They are required to be present at all operations, and to go round their ranges at least once a day to report any violations of forest law that may take place.

The saw-mills in the forests are usually owned by the Government and hired at a certain rate to the wood merchants, who buy the cuttings. The timber is allowed to be sawn up before it is inspected and marked by the forest guard under the superintendence of an inspector.

The forests under the management of the bureau are (State and Commune) about 7,500,000 acres. There were nearly a million more, which went with Alsace and Lorraine to Germany. Also, there are in France 15,000,000 acres of private forests.

Of schools of forestry, the French have, at Nancy, one of the best in the world, where pupils are instructed both experimentally and theoretically in all forest learning, the collegiate home studies being constantly varied by excursions of parties of pupils, under charge of professors, to those forests where, at the time, most can be learned. Proficiency in these school forms, of course, a strong recommendation to future advancement in the Government or private forests service. For admission to the school candidates must bring a letter of authorization from the director-general of forests, which can only be obtained by those from nineteen to twenty-two, without infirmities, and having a diploma of bachelor of letters, or attainments in classical studies to warrant such diploma. They must also have an income of \$300 per annum, or a pledge from friends to provide it and \$120 afterwards till employed as garde-general on active duty.

In the difficulties which have hindered the efforts being made, especially in America, to preserve a due amount of forest, one of the most formidable has been the disinclination to interfere with private rights. It will be of service in Canada in this matter to notice how summarily, in France, this matter has been managed. I will therefore quote the principles of law upon which the forest code of France is founded, as stated with great precision by Professor Macarel (a writer deservedly of the highest estimation) in his "*Cours de Droit Administratif*." As they embrace views applicable in other countries under like necessities—being, in fact, an extension of the right of eminent domain, or that maxim of Roman law, *salus populi suprema est lex*—they will be especially germane to our purpose. He says:

"Restrictions implied in the free enjoyment of the soil.

"As to the woods and forests:

"The preservation of forests is one of the first interests of society, and consequently one of the first duties of government. It is not alone from the wealth which they offer that we may judge. Their existence is of itself of incalculable benefit, as well in the protection and feeding of the springs and rivers as in their prevention of the washing away of the soil from mountains, and in the beneficial influence which they exert upon the atmosphere.

"Large forests deaden and break the force of heavy winds that beat out the seeds and injure the growth of plants; they form reservoirs of moisture; they shelter the growth of the fields; and upon hill-sides, where the rain-waters, checked in their descent by the thousand obstacles they present by their roots and by the trunks of trees, have time to filter into the soil, and only find their way by slow degrees to the rivers. They regulate, in a certain degree, the flow of the waters and the hygrometrical condition of the atmosphere, and their destruction accordingly increases the duration of droughts and gives rise to the injuries of inundations, which denude the face of the mountains.

"Penetrated with these truths, legislators have in all ages made the preservation of forests an object of special solicitude.

"Unfortunately, private interests—that is to say, the action of those who do not directly feel the power of the Government—are often opposed to this great national interest, and the laws framed for protection are often powerless.

"In France, the ordinances prior to the revolution carried too far the restrictions imposed on private owners. The new regulations fell into the opposite extreme, and allowed the proprietors free and absolute liberty to dispose of their woods.

"A large destruction followed this imprudent translation from excess of restraint to excess of liberty. The proprietors abused this unwonted freedom, and clearings multiplied indefinitely, without distinction as to the places where they were made, so that in many localities the rushing down of the denuded soil and the deforesting of mountains caused the soil needed for vegetation to disappear and left the rocks naked. The rise in the price of wood and the easy and certain resource offered to proprietors in the clearing of a planted tract, when compared with the remote and eventual advantages offered in their preservation; the hope of compensation, and, beyond this, the advantages, in one way and another, of cultivation, may be recognized as among the causes which sufficiently explain the inducements offered to many of these proprietors, which led them to undertake these clearings."

I would here notice that this is precisely what we have been doing in Canada, and that the ill effects which followed in France will surely in no long time be felt in Ontario. They are already felt; we have not the climate we had, nor the favoring moisture when most needed. Yet we could get along as we are. But that is just what is impossible. We must, while there is time, use some means of averting the evil, or we shall certainly become much worse off than we are. M. Macarel goes on:

"At length, this progressive deforesting of the soil of France, joined with the incessant need of firewood, and the demand for wood by manufactories and ships, have, during forty years, made sad havoc with our forest wealth.

"A renewal of the ancient prohibitions by the law of 9 Floreal, year XI, was deemed necessary to oppose this excessive clearing of woods by private owners. It was accordingly decreed that, during the twenty-five years dating from the date of the promulgation, no wood should be cut or carried off unless six months' notice had been given by the proprietor to the forest conservator of the arrondissement of the district in which the wood was located. Within this time the forest administration might object to the clearing off of the wood, and was charged to refer the question before the end of this time to the minister of finance, upon whose report the Government might definitely decide within the same time. It therefore resulted in this, that to make a clearing an authorization precedent by the administration was necessary, and

that if the administration thought proper not to grant this, the proprietor was restrained against cutting.

"Thus, according to this branch of agricultural industry, the general law of France is, that owners are free to vary, within certain limits, the cultivation and working of their lands; but as to woods and forests, the public interests demand that individuals shall not be free to clear them from the soil whenever they please. From hence it follows, that the administration has a right to pronounce its prohibition against clearing whenever it is deemed that the public interests require that this be done."

The penalties for clearing when forbidden are, I may state, a fine of about \$200 per acre, and compulsory replanting within three years. This law was, I conceive, in full force in 1874, as this quotation forms part of a report to the United States Congress of that year. It probably is in force still, and justly so. The voice of the people, not of solitary citizens, should decide in so important a matter as deforesting a country.

The French Government have, at great expense, replanted vast and almost barren districts; they have also established great forests along the sea-shore, where formerly the sand threatened to destroy whole departments, and have averted the evil. But the chief means is the prohibition of clearing; for it is the interest of an owner who does not clear to plant and improve his forest, so as to receive an increased income from the trees arriving at maturity in increased numbers yearly.

SWITZERLAND.

In no country in Europe has the waste of forests been more rapid or destructive than in Switzerland, and in none, perhaps, has this improvidence been followed by more disastrous result. The woods, being considered common property, were uprooted; and the soil on the mountains being exposed to the wash of the rains, was rapidly carried away, leaving broad areas of naked rock, from which the water would at once sweep down the valleys in sudden and destructive inundations. The autumn of 1868 is memorable on account of these floods.

Public attention has, however, been thoroughly awakened, and active measures are in progress to remedy, as far as may be, these evils. The cantons which have charge of these operations have for some time, at great expense, been constructing works to control the streams, and planting trees wherever practicable.

I would here remark that this is a very difficult matter compared with what it might have been. It is easy to preserve a forest on a hill-side, but the soil once washed to the rock, it is another matter. I could point out places in Ontario where splendid forests stood, and yet might have stood, now for many miles.

"White rock and gray rock,
Barren and bare."

The matter is now in Switzerland taken into the hands of the national Government, and the following article gives the idea:

"ART. XXII. The Federal Union of Switzerland has the right of supervising structures for the protection of water courses, and of the forest police in mountain regions. It will assist in protective structures for water courses, and in the planting of forests at their sources. It will enact the requisite regulations for maintaining these works and the forests now existing."

ITALY.

Soon after the present Kingdom of Italy was established, a central forest school was organized near Florence, under the direction of A. di Berenger, formerly in the Austrian forest service of Venezia, and author of an excellent work on the history of forest management in Italy. The school is located in the splendid silver fir forest of Vallombrosa. We all remember

"Thick as autumnal leaves that strew the brooks,
In Vallombrosa."

This is below the crest of the Apennines, on their western slope, about twenty miles east of Florence. In winter it is transferred to a lower station at Paterno, in the region of the olive. Italian forest literature of direct practical application is comparatively modern, but of late the publications of the ministry of agriculture, to which sylviculture is entrusted, contain much that is valuable. The two most important of these give the statistics of forests and the forest law of Italy. There are over 5,000,000 acres of communal forests, over 6,000,000 of private forests, and only 500,000 acres of State forests. One-fifth of the land is in forest. This is scant enough, apparently, or the nominal forests have been culled to depreciation, for we are told that—

“Projects of a general forest law for the whole of Italy have been repeatedly submitted to the Italian Parliament. The evil effects of denudation have been severely felt in many parts of the country, and the aim of these proposed legislative enactments has hitherto been to guard against further mischief by determining beforehand which lands shall, in the public interest, be clothed with forest or kept under forest, and then to place the whole of these lands under the supervision or control of the public forest officers without distinction, whether they belonged to state, village, commune, or private persons. From a report with which the minister of agriculture submitted the project of a general forest law in 1870, it appears that the financial exigencies of the country had rendered imperative the alienation of the greater part of the forests at the disposal of the State, and that it was only intended to retain a limited area of State forests, mainly with the view of supplying the timber required by the navy, and the forests required for this purpose the bill proposed to declare inalienable.

“Thus, with regard to forest matters,” says Captain Walker, “it seems probable that Italy will pursue a policy different from that which has of late years been initiated in most provinces of India. In those provinces we acknowledge the necessity of maintaining certain areas under forest, or of clothing them with forest when they are bare; but we do not expect any satisfactory success in those attempts, unless the forests to be thus maintained or created are under the entire control of the State, and we entertain no serious hopes of effecting any real good by the supervision of private forests, or by any general kind of control over communal forests, unless the administration or management of such communal forests can be vested entirely in the hands of the public forest officers.

“In those provinces, therefore, of the Indian Empire, to which I now refer, our principal aim is, in the first place, to consolidate the State forests wherever the State has suitable forest lands at its disposal; and we hope that eventually, when the majority of public forest officers shall have acquired that professional knowledge, skill, and experience which is necessary for a satisfactory management of forest land, that they may be found competent not only to manage the State forests entrusted to their charge, but also to induce large landed proprietors to follow their example in the management of their own estates, and, if such should ever be found necessary and expedient, to exercise an efficient supervision over private and communal forest lands; but we think that any attempt to exercise supervision and control over private and communal forest lands through the agency of forest officers who have not actually charge of public forests entirely under their own control, and who cannot point to the management of their own forests as an example to be followed in the management of the private or communal forests, would lead to unsatisfactory results. The further development of the general forest policy in Italy will doubtless be followed with great interest by Indian foresters, and on this account it appeared to me right to add the present remarks.”

It may be valuable here to notice that in this, as in other points, the practical ideas of the Indian commissioner might well be applied in Canada. There is good reason to fear over-denudation here; there is also reason to believe that we shall have an interval in which to take measures for avoiding the evil. In that interval the course

stated by the commissioner as likely to be followed in India might, it appears to me, profitably be pursued here, namely, the taking in hand by Government of any amount of forest fit for the purpose, and which could be spared from the operation of the system at present pursued, and preserving them on the European plan. This will further on be more fully treated.

RUSSIA.

In this vast empire, where, as in the United States, we have been accustomed, to believe the forest is interminable, and where, in fact, the amount of woodland in the northern two-thirds is more than twice as great in proportion to its area as in the United States, the Government has turned its attention energetically to the subject of forestry, and has undertaken to establish by regulation conservative measures. As yet, private persons and establishments owning forests enjoy the absolute right to cut and clear at will. But these do not own nearly so much as the Government, which has about 330,000,000 acres of woods; the others holding about 150,000,000. About 40 per cent. of the country (Russia in Europe) is timbered. I must remark that this amount, after so long an occupation, shows that the timber has been taken some care of already. For the immense Government woods, they have been placed under the care of the minister of public domains, who has a director of the forest department, and the organization of the service is very complete. For the purpose of fitting young men for the duties of forest agents and agriculturists, either for the Government service or upon private estates, two special schools of agriculture and forestry have been established—one at Saint Petersburg and one near Moscow. The course of instruction extends through three or four years, and the schools are placed near forests, where every detail is illustrated. There is also another forest school at Lissino, of the second grade, where the course is very practical.

SWEDEN.

In 1859 a bureau of forest administration was created. Forest regulations, however, extend back to 1647, and even before that private owners were required to plant and protect from cattle two trees for each one cut.

In 1868 a commission was appointed, under the direction of Mr. E. V. Alinquist, to inquire into the need of further legislation, and in December, 1870, he submitted a report with a bill, making 392 pages, besides numerous tables.

One clause in the reported bill is a compulsory feature, which, though less stringent, is in the spirit of the enactments now in force in most of the countries of continental Europe, namely, forbidding trees to be cut for sale smaller than eleven inches at the butt, or eight inches, sixteen Swedish feet therefrom.

INDIA.

The necessity of preserving tropical forests has, fortunately, attracted the attention of Government in British India, where the importance of maintaining an equilibrium of temperature and humidity is of much immediate consequence to the social welfare; and the growing demands of railroad use, and the various applications of the arts, render it a subject of direct practical utility.

The matter has been agitated since 1850, and in 1864 Government laid the foundation of an improved general system of forest administration for the whole Indian Empire, having for its object the conservation of state forests, and the development of this source of national wealth. The experience acquired in the forest schools of France and Germany has been brought to apply in this great national undertaking. Among the more important general principles laid down for the execution of this measure is that all superior Government forests are reserved and made inalienable, and their boundaries marked out to distinguish them from waste lands available for the public. The act of 1864, defining the nature of forest rules and penalties, has been adopted by most of the local governments, and the executive arrangements are

left to the local administrations. Various surveys have been made to obtain accurate data concerning the geographical and botanical characteristics of the reserved tracts, and the kind of timber best adapted for various localities has been carefully ascertained.

In 1866, the Government resolved upon sending out five young men, duly qualified by education in the forest schools of France and Germany, for the forest department of India. An arrangement was made the same year by which forest officers in the India service, who might choose to come to Europe on furlough, would be able to increase their professional knowledge by studying forest management and other subjects connected with forests in Great Britain and on the continent. A number of officers have availed themselves of these arrangements, and some of their reports have been published.

Of these, that by Captain Walker and that of M. Gustav Mann I have largely used elsewhere, as the reader will have observed.

"At the moment of our writings," says the author of a report from which I have obtained much, presented to the United States Congress in 1874, "the public journals are giving most painful accounts of the distress in India from famine. From a careful study of this subject, we cannot doubt that this calamity is due to the fact that the forests have, of late years, been swept off by demand for railroad and other uses much more rapidly than formerly, and that the exposure to winds and sun thus occasioned may have largely contributed to these painful results. The remedies are to be sought in the restoration of that due proportion of forest-shade upon which agriculture depends for success. If the officers to whom the opportunities for European observation fall, improve them as well as some reported by Captain Walker, we may reasonably hope for a radical, though not an immediate, restoration of abundant harvests throughout the vast countries of India."

Now, since this was written, we have Sir Richard Temple's valuable book, "India in 1880," which I have noticed before. This gives us some idea of what has been commenced by the gentlemen who have been writing the reports we have used. He says:

"The Government of India has enacted a law regulating all matters connected with forest conservancy, and the provisions of this law are being carried into effect by the several local governments. The forests are divided into two categories: first, those which are 'reserved' being preserved and worked through state agency, in a most complete manner; secondly, those which are 'protected' being preserved less thoroughly. The best timber markets are mainly supplied from the 'reserved' forests. Care has been taken to determine what tracts shall be 'reserved' and 'protected,' and to mark off their boundaries. The area thus defined in the several provinces already, or likely to be defined ere long, will prove to be hardly less than eighty thousand square miles for the whole empire. The primary object of the administration is to preserve the forests for the sake of the country. Due attention is also given to the financial out-turn; much income is already secured. The expenditure is over £500,000 annually, but the receipts amount to nearly £700,000, and in time the forest department will have a prosperous revenue.

"The superior officers of the department are for the most part British, trained in the forest schools of France and Germany. The inspector-general of forests with the Government of India is Dr. D. Brandis, whose services to the empire have been conspicuous in organizing a system of forestry which is sound and scientific, and is yet adapted to the circumstances of the country. Instruction in forestry is afforded to natives also; forest schools are established for them, and in time they will take a large share of the administrative work.

"As might be expected, the system of forest conservancy, though generally accepted by the natives who dwell near the 'reserved' and the 'protected' tracts, is sometimes opposed by them. There must always be some danger lest the foresters should, in their zeal for conservancy, infringe upon the prescriptive rights of the inhabitants. The local civil authorities are vigilant and prompt in asserting and vindicating the

rights of the people in this respect; for the recognition of which rights, indeed, ample provision is made by the law. They should, however, be careful to support the forest officers in the execution of duties which are of the utmost consequence to the welfare of the country. Many of the hill tribes habitually burn patches of valuable forest, in order that the ashes may so fertilize the virgin soil as to render it capable of producing a crop without tillage. Having reaped one harvest, they leave the spot marked by charred stumps of timber trees and move on to repeat the same ravage elsewhere. This barbarous and wastefully destructive practice is gradually and cautiously checked by reclaiming these people from agricultural savagery, and inducing them to plow lands and raise yearly crops by ordinary husbandry.

“According to the latest returns there appear to be 29,600 square miles of demarcated reserve forests, 3,500 square miles of protected areas, and 35,000 square miles of unreserved forests, or 68,000 square miles in all. This appears a comparatively small area for so large an empire, especially when it is remembered that of this not more than one-half is effectually preserved. Some extensive forest tracts exist, however, in the Madras Presidency, of which a return remains to be rendered. There are, further, 31,000 acres of plantations in various districts.”

These plantations, I may remark, are those commenced by the foresters under Dr. Brandis, and are being every year added to at the rate of some thousands of acres. It may be noticed that the forest officers trained in Europe for India, and at work there now, number forty-six out of a staff of ninety-three, who have, of course, an immense number of subordinates.

Concerning other countries, it may be generally remarked that all the nations of continental Europe are moving in forestry matters, and that there are many schools besides those I have mentioned.



