

Vol. 4

1916

THE AMES FORESTER

Published Annually By

The Forestry Club

of the

Iowa State College

Ames, Iowa

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Credit for the financial success of the publication is
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Doctor Louis Hermann Pammel

To
Louis H. Pammel,
who with untiring de-
votion inspires in the
student a desire for an
intimate knowledge of the
plantworld and who thru his
genial personality and zealous
interest in forestry has won
the high esteem of the stu-
dents, we, the Forestry
Club of Iowa State Col-
lege, respectfully ded-
icate this publica-
tion.

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"HOME SONG OF THE WEST"

Anonymous

It came over me on Broadway, in the splatter and the mud
And the blasted office-building seemed to mock me where I stood,
For I saw the Sapphire Mountains girdling round the valley plain,
And I heard the cattle lowing on the ranges once again,
Heard the far coyote's cry,
Saw the tumbling weed blow by,
And the light upon the ledges where the sunning rattlers lie,
It was clear before my eye
As the daylight in the sky
And I swore to see the mountains once again before I die.

You may talk of quiet homesteads in the Immemorial East,
And the still New England village, where the weary years have ceased
Footing up the bills of trouble; but the only place for me
Is below the naked mountains, where the lupines used to be,
Oh! it is far away to seek
By the banks of Sweet Grass Creek
With the shadows falling purple down the slopes of grassy Peak
Where the little roses bloom
In a passion of perfume,
And a man has light and air, and a man has rest and room.

I can see the brown stock saddle, I can hear the punchers swear
At the raving staying pony rising end-wise in the air;
I can see the tough flank reddened, where the iron rowels score,
And the strong brown fingers plucking at the choking hackamore.
I can see each stroke that's struck
As the brute begins to buck
And the buster settles to it, and sets in to ride amuck,
Crack! comes the downward slashing quirt;
Thud! the bunched hoofs hit the dirt;
But the boy's still sticking to him like a shirt-tail to a shirt.

Oh! I'll swing away to the westward on the new Milwaukee mail,
And they'll drop me off at Two Dot, and I'll hit the open trail.
And I'll cleanse my soul of cities, as they cleanse a sword of rust,
And the watch-word of my venture shall be "open air or bust!"
Oh! my heart will be a feather
When we are riding home together!
Oh! the hot rejoicing horses! Oh! the smell of sweaty leather!
Oh! its home we'll ride again
O'er the God-created plain
To the snows that are forever, to the summit that remains.

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Max Geisler '16, Editor

Geo. B. Hartman '17, Business Manager

A. S. Henry, '17, Associate Editor E. L. Loy '17, Asst. Business Manager

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The Forestry Club of Iowa State College.

Progress of Land Classification in the National Forests

E. A. SHERMAN, '96

Assistant Forester, in charge of Lands, U. S. Forest Service.

The growth of the National Forests in the public land states of the west was largely a spasmodic mushroom growth. The first Forests were created under the authority of the Act of 1891, which provided merely for reservation without administration. A sudden increase in these areas, through Presidential proclamation, was at first set aside by Congress but resulted in the passage of the Act of June 4, 1897, which provided for the administration and protection of the areas reserved. The great body of timber land under Government ownership today was withdrawn during the ten years following the passage of that Act, the National Forest area, inclusive of Alaska, reaching its maximum April 20, 1910, with a total of 167,710,956 acres, gross.

This vast acreage represented approximately 160 Forests which had been carved out of the public domain with a full free hand. Many of the earlier Forests created in the Northwest were established without field examination. These, however, did not represent in the aggregate more than about 30,000,000 acres, and embraced the first Forest reserves created under the administration of the General Land Office of the Department of the Interior. Afterwards all areas were examined in the field by officers from the Bureau of Forestry, then in the Department of Agriculture, and, excepting for the work of boundary examinations at that time, in no way connected with the administration of the Government's Forests. The work was done quickly. The examiners were young, energetic, honest, and thorough. What they lacked in field experience they made up in enthusiasm and earnestness. Each examiner was expected to cover about a township a day while in the field, and for several years these boundarymen waged a strenuous campaign of cruising and exploration, having for

its object the control and ownership of the Nation's forests. On the other side, was a large number of lumbermen, with their cruisers and dummy entrymen, who were seeking to secure timber to furnish a future supply of lumber for the future big sawmills of the Northwest. In other places big cattlemen employed dummy entrymen in order to secure ownership and control of timber, water, and range. The matter was terminated by the issuance of a series of proclamations March 14, 1907, inclusive, at which time approximately 17,000,000 acres of the most valuable timberland in the Northwest was added to the National Forests.

This boundary work was the first rude attempt at classifying public lands for National Forest purposes. It was followed by the Forest Homestead Act, which was passed June 11, 1906, and provided for the listing and opening to homestead entry of all lands within the exterior boundaries of the National Forests found to be chiefly valuable for agriculture. This law authorized and empowered the Secretary of Agriculture, upon application or otherwise, to examine and list with the Department of the Interior for homestead entry in tracts not exceeding 160 acres in area and not more than one mile in length, lands in the National Forests which in his opinion are chiefly valuable for agriculture and not needed for public purposes, and the listing of which will not injure the National Forest interests.

This law was a boon to the mountaineer of the west, in that it provided a means whereby land might be filed upon and patent secured in advance of the extension of the regular public land surveys. It had another feature particularly adapted to rough, mountain regions in that it provided for metes and bounds surveys, thereby making it possible to secure the good land, where conformity to 40 acre legal subdivisions might throw considerable poor, rough land into the 160 acre total.

The first applicants under the Forest Homestead law were usually "squatters", or settlers who had taken up land before the forests had been set aside for public use. These naturally divided themselves into two classes: (1) Those who had settled for farm purposes; (2) Those who were after the timber. They were at the two extremes. The agriculturist had the best farm land in the Forest, since he was early on the ground



By courtesy of U. S. Forest Service.
A ranch established under the Forest Homestead Act on the Payette River in Western Idaho. The homesteader is living in a tent during the construction of a log house. It is 30 miles from the railroad.



By courtesy of U. S. Forest Service.
A ranch situated in central Idaho near the mouth of a creek emptying into the Salmon River. It is about 75 miles from a railroad and was established under the Forest Homestead Act.

and took his pick. It was easy to handle his case, for his land was really farm land. The timber speculator had the most valuable tract of timber, for the same reason, because he had his pick. His land could not be classified as "chiefly valuable for agriculture", and he has consequently remained dissatisfied with the workings of the law.

The applications from outsiders have, in the main, been from people who were honest in their desire for farm land. For a time the belief was cherished that this represented a form of timber homestead, another opportunity to get a stake at Uncle Sam's expense, but that misapprehension was soon disposed of, and only in exceptional cases are heavily timbered lands now applied for.

The classification of land which has been done by the Forest Service in carrying out the provisions of the Forest Homestead Act has been exceedingly interesting because of its infinite variety and the elements of human interest which it involves. Every forest has been searched from foothill to timberline for areas suitable for farm purposes. Up to June 30, 1915, the last date for which total figures are available, a total of 18,010 individual tracts, involving a grand total of 1,907,608 acres, had been listed by this procedure and made available for agricultural use. These special areas may be considered "hand picked", and represent the cream of possible farm lands in the National Forests. During the fiscal year ending as above 2,336 individual areas were listed, involving a total of 238,525 acres. On a great many forests it is becoming apparent that the limit of land at all fitted for agriculture has been reached, and that there will soon be a falling off in the number of areas listed annually.

Reaching the limit of available land on many of the forests will have little present influence on the advance of agricultural development. This is due to the fact that upon many of the National Forests listing has been in excess of actual demand for settlement. The result has been that although the land has been listed it has not always been filed upon, and still less frequently has filing been followed by improvement and cultivation.

When the land has been listed but not filed upon there is some chance for real public service by bringing the land and real home-builders together. The records in each Supervisor's office are open to the public, and these records show what land has not been listed. Similarly, the records in the local land office are available and show, what land has not been filed upon. Inquiries addressed to Washington can not bring results for the reasons that filings may be made in the local land office at any time, and advice concerning available lands, which may be accurate today may be in error tomorrow. It is, therefore, almost a foregone conclusion that any land which is open to settlement will be secured by local people, if at all desirable.

Following the classification work thus done by the piecemeal examination of area applied for under the Forest Homestead Act, the Forest Service, in 1909, undertook a wholesale overhauling of the National Forest boundaries for the purpose of determining what areas had in the great haste of boundary examination been improperly included within the forest, and should therefore be eliminated, and also what areas were omitted which should properly be added. The work begun in the spring of 1909 is not yet completed, and probably will not be for several years to come. This is due, first, to the magnitude of the area requiring examination; second, to the manifold difficulties of the task; third, to the great care necessary to give all interests due consideration for the purpose of invariably taking uniform action under uniform conditions.

As a result of this boundary campaign the gross area of the National Forests, inclusive of Alaska, and not including the purchase areas in the Appalachians, was reduced by January 1, 1916, to a gross total of 156,446,486 acres, a total net reduction of 11,264,470 acres from the high tide total of April 30, 1910. This gross total, however, includes over twenty-one million acres of alienated land, the actual net area of National Forests of the United States, exclusive of Alaska and the Appalachian purchases of the East, being reduced at this time to 135,389,328 acres. As a matter of fact, the total area eliminated has been much greater than this figure, which represents the total decrease over and above two additions made by a



By courtesy of U. S. Forest Service.
Part of an area included in a National Forest for protective purposes, located on the northern border of Nevada. The cabin is a sheep herder's abandoned camping place.

special Act of Congress and a number of additional areas added by Presidential proclamation.

The work of the boundary examination, which is in reality one form of land classification, has undergone a very great change during the last three or four years. The Act of August 10, 1912, appropriating funds for the Department of Agriculture, carried for the first time, among its other provisions, a fund for the classification and segregation of land in the National Forests chiefly valuable for agricultural purposes. Successive appropriation Acts increased this fund until it is now uniformly one hundred thousand dollars a year. This money is being expended for the purpose of making available for farm use lands in the National Forests which are found to be suitable and chiefly valuable for that purpose. The work which was inaugurated under this Act is of a more permanent and final nature than the classification work carried on by the boundary and settlement examinations already described. Necessarily, boundary work can not deal with small interior areas. Examinations based upon the applications of individual land seekers must necessarily be widely scattered. But the work of classification under the special appropriation for that purpose has been thorough and systematic. Attention was given first to projects which are most likely to yield a considerable percentage of land suitable for farm purposes, but when a project was once begun, ordinarily it was continued until the entire area was covered, in order that there might be no necessity of going over the area again in the future.

The land classification work as now carried on within existing National Forests is conducted in two operations, one supplemental to the other. The preliminary stage is known as "extensive" classification work. In reality this is a classification reconnaissance. It covers in a broad way, usually by units of approximately a township in area, the lands which are very apparently not chiefly valuable for agriculture. While the so-called "extensive" classification work does not deal intimately with the various factors affecting each area in such a unit report, it does deal conclusively with the non-listable character of that land, for the reason that such reports do not attempt to pass upon the final classification of any areas which are at

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all doubtful in character. If a given area appears to present any agricultural characteristics sufficient to warrant a homesteeker in giving it serious consideration for homestead purposes, it is left for the more detailed study and closer scrutiny, such as is given to all land classified by the "intensive" method.

Up to January 1, 1916, a total of about 56,000,000 acres of land within National Forests had been covered by such so-called "extensive" reports, and the classification had been approved by the Secretary of Agriculture. This work resulted in about 6,000,000 acres of land being eliminated from the National Forests. About 45,000,000 acres were classified as non-agricultural and non-listable under the Forest Homestead Act. The remaining 5,000,000 acres were patented lands, or lands otherwise alienated, and were therefore not affected by the classification or included in it. The reconnaissance classification has worked both ways. It has resulted in retaining within forests, under a specific non-listable classification, all areas most clearly chiefly valuable for that purpose. It has also brought out very clearly the location of the areas of doubtful forest value or possible agricultural value. When a forest has once been entirely covered by such reconnaissance or extensive classification, the areas of doubtful forest value or of probable agricultural value are all definitely and accurately determined. In a great many instances the result has been to clearly demonstrate that the only serious objection against retaining practically the entire area for National Forest purposes is the fact that certain errors have been made in running the boundary lines, whereby limited areas of land unsuited for forest purposes, or desirable for farm purposes, have been improperly included. In a number of instances such reconnaissance classification has been followed by boundary readjustments excluding the agricultural land and leaving only a few areas within the forest of possible value for homestead use. Such areas are then carefully examined and classified accordingly.

The classification problem, however, is not always so easily solved. In some instances, such as the Harney and Black Hills National Forests in South Dakota, it will be necessary to cover practically the entire forest with timber and soil survey, accurate in details down to each $2\frac{1}{2}$ acre subdivision. Such work



By courtesy of U. S. Forest Service.
Head of Six Mile Canyon, Manti National Forest, central Utah, elevation 10,000 feet. This tract was included within a National Forest for protective purposes. The notable erosion shown by this picture is due in large part to unregulated grazing by sheep and cattle. A mountainous watershed in this condition is very liable to send destructive floods to the agricultural valley below.

is painstaking and expensive, but up to December 31, 1915, a total of 450,000 acres had been covered in South Dakota by this method.

Usually, however, reconnaissance examinations, and the boundary revisions which are based upon such examinations, have resulted in a permanent classification of over 90 per cent of the area in each National Forest. The classification has in many cases been governed by some one controlling factor. For example, it is not necessary to secure an accurate timber cruise of a township located at such an altitude that the weather reports show killing frosts every month in the year. Obviously, such land could not be used for farm purposes even if the stand of timber should be found to be very light. Again, it is unnecessary to consider questions of timber valuations when dealing with a tract of land having a topography utterly unfitted for farm purposes. By taking such facts into consideration it has been possible to carry on the work with great rapidity and at a low average cost. While some of the classification work done by the most intensive methods has cost as high as 10 cents an acre for the area covered, the average classification cost has been less than half a cent per acre.

The field work has already been finished on over one hundred million acres of National Forest land, but the mere mechanical labor of typewriting reports, and preparing and duplicating maps to cover such a vast area is in itself a stupendous task, and work now under way will not be put in final shape for official action before the close of another year. Meanwhile, however, the Forest Service, already has located very definitely practically all the areas of land of any considerable acreage having any material or prospective value for agricultural purposes, and by January 1, 1917, will have completed most of the reconnaissance classification surveys and will have accurate figures showing the total acreage remaining for final classification.

In the progress of this work the Forest Service has learned many things. The study of farm values in their relation to land in each National Forest and the investigations which have been made to determine the ultimate highest use of each tract of land in the existing National Forests, has brought out the

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importance of taking into consideration the influence of local economic factors. The ancient expression that "what is one man's meat is another man's poison" has its truthful parallel in classification work in *what is one country's forest is another country's farm*.

In one locality where market conditions are unusually favorable as the result of a certain combination of conditions—as in the vicinity of Telluride, Colorado, where a large mining town is located at some distance from any important agricultural districts, and into which horse feed and dairy products can be shipped only upon payment of a heavy freight rate—aspens land at an altitude of 8,500 feet may be chiefly valuable for agriculture. Because of such unusual market conditions, which conditions appear to be as permanent as the mining camp itself, it may actually pay to clear such land of its timber and put it to such agricultural use. Even though the only crop it is practicable to raise is a crop of grain hay, the barrier of mountain gives such an advantage over outside produce that the price received offsets the disadvantages of soil, topography, and climate. And yet, less than 200 miles away exactly the same kind of land may be very valuable for its timber and for watershed protection and utterly valueless for farm purposes. Its location upon an important watershed, where water is of great value for irrigation purposes, and its nearness to a large agricultural region where great areas of alfalfa land are producing several crops a year, and where, in consequence, farm produce brings only an average price, while lumber, posts, and fencing are in great demand, so influences permanent values as to absolutely control the classification.

Because economic conditions differ as widely in the different States as topographical and other physical conditions, it has been found necessary to work out the problem in each region independently, taking into consideration the general factor of interdependence, which constitutes the economic sympathetic nervous system of the Nation. In the Black Hills region it is found that there is very little timber land suited for farm purposes or which, if cleared, would yield an agricultural return sufficient to justify the destruction of the forest, and that the local public understands this fact as clearly as it is understood



By courtesy of U. S. Forest Service.
A site too rough to be used for agriculture included within a National Forest in Oregon. This tract was applied for as a homestead. The application was refused on the ground that lands of this character are too steep and rough for farming purposes.

by the Forest Service. On the other hand, in parts of Arizona and New Mexico, where there are vast areas of grazing land and but little hay land, the clearing of timber land even in a relatively non-timbered region may be good economics if water for irrigation is available and the hay produced on the area has a special value as a form of livestock insurance, being accumulated from year to year during the good years and kept to carry through the occasional bad winter a large herd of cattle that ordinarily run on the range satisfactorily the year long. But the timber land that may justify an agricultural classification under irrigation may be valuable only for its timber if water for irrigation is not available. In the first instance it may represent an annual production of 4 to 8 tons of alfalfa per acre, while on a dry farm basis it may represent an annual production of from half a ton to a ton of grain hay per acre, a return so scanty in comparison with the labor and expense of cultivation, seed, etc., that it is undertaken only where the crop has unusual value on account of its location and the land does not require any expensive preparation such as clearing.

In this way it has been necessary in every region to make a thorough study of the fundamentals of farm and forest economics peculiar to the region preliminary to the actual approval of any classification. Based upon such study, certain broad rules have been formulated as a general guide to be observed in that region. Perhaps the best known example of such a rule was the rule put into effect on certain lands along the Kootenai River in Montana, where under given conditions National Forest land was classified as chiefly valuable for agriculture and opened to settlement under the Forest Homestead Act if it did not carry a stand to exceed 4,000 feet B. M. of merchantable saw timber per acre. This rule was merely the concrete expression of the result of a very careful study of economic conditions in that particular region which showed such a relation existing between farm and forest values that in this given region land having certain characteristics of soil, climate, topography, and accessibility, would usually be developed for agricultural purposes if it had less than 4,000 feet B. M. of merchantable saw timber per acre, while if it had more than that amount the odds were in favor of it being held

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for its timber value. This rule was given publicity out of all proportion to the region of its applicability, and it took some time to give equally widespread vogue to the fact that this rule applied only where all the physical and economic factors were the same as in the special region for which it was intended. Since then rules have been worked out for other regions; sometimes fixing the minimum of farm value which in a given region justifies cutting into a forest unit; sometimes naming the altitude in a given region above which, with a given slope and exposure, agricultural success cannot be expected; sometimes, for a given soil and precipitation, giving the maximum slope on which permanent agricultural success may reasonably be expected and beyond which the clearing of the slope will probably result in a gullied hillside of little value for either forest or farm. In short, all rules have been restricted in their application to a limited region within which the relation of the determining economic factors are found to be fairly constant. Yet, even with this restriction, it has been found necessary to provide for exceptions to take care of any special cases where some economic factor, because of some special condition, has changed the equation for a particular tract. Economic principles have been given precedence over all rules. In fact, each rule has been only the expression of the application of economic principles under certain fixed conditions. Therefore, whenever a rule is found to be inapplicable, the policy has been to fall back upon the original economic principle and be governed accordingly. In this way it has been possible to make rapid progress and to be both consistent and just.

The classification study and work of the Forest Service is constantly bringing out more and more clearly the importance of community influence as a factor in agricultural development. Probably no other economic factor has greater power in determining the future and highest use of land than the fact of the necessary relation of the land to the development of community life. *Pioneering played such a large and necessary part in the development of our Nation that we have not always viewed it with the right perspective. The first settlements in every community have necessarily encountered pioneer conditions. Therefore, when a homesteader goes back into some re-*



By courtesy of U. S. Forest Service.
A site which has been listed as agricultural land on the Boise National Forest, Idaho. Not a very extensive farm, but the owners want it and seem to be able to make a living. Altitude 8,000 feet. The snowfall covers the fences here in winter.



By courtesy U. S. Forest Service.
This land is heavily timbered, but is a level tract along the river bottom and suitable for agriculture. It has been listed as agricultural land and is located in central Idaho, Boise National Forest.

mote gulch where he has found perhaps 100 acres that could be farmed if cleared of its timber, he has been inclined to think that, although the place may be ten miles from the nearest house, he is no worse off in that respect than his father or grandfather was when he settled on river bottom land along the Missouri. He overlooks the fact that his father's or grandfather's place was surrounded by equally suitable farm land extending for miles in practically every direction, so that the isolation of pioneer life was only an incident of his younger *manhood, and that settlement followed rapidly, resulting in community development and the establishment of the community institutions* which are usually incident to civilized life, such as roads, schools, churches, physicians, newspapers, mercantile establishments, etc. Such community development cannot follow the settler into the hills, because no power can push back the mountains no matter how desirable it may be to replace them with farms. Consequently the landseeker is at last beginning to realize that in anticipating pioneer conditions the most important consideration is whether those conditions are probably only transitory or whether topography makes them permanent. A full realization of the importance of community institutions and their influence on farm values has resulted in very much liberalizing the application of classification principles as applied to land adjacent to or intermingled with established growing rural communities. It is realized that such land may be very desirable for individual use in connection with established farms, although land exactly similar in character, situated at a distance from farm development, and not intermingled with more valuable farming land, may be practically valueless for farm use. The proper appreciation of the importance of community influence has, in consequence, resulted in the elimination of many small areas of National Forest land having relatively low value for either farm or forest purposes, but so located that their logical highest use was use under private ownership in connection with other farming activities. Conversely, it has resulted in retaining for forest purposes small patches of land topographically suited for farm purposes, but so located as to be of no real economic value for that purpose on account of permanent isolation, while at the same

time of real value for forest purposes on account of the interdependence of other parts of a large and important forest unit.

The question arises, when will this work of National Forest land classification be completed? The answer is hard to give. The total area will be covered in a very few years, but there will be occasional re-examinations to make from time to time. Even in older countries, where forestry and agriculture have been established for centuries, the work is still going on. In some places one-time farm land is being planted to forests, while parts of the forests are being cleared for farms, these changes representing the results of experience and not the vagaries of a shifting policy. So may we also expect to do in the future.

The sophomore forestry students of Iowa State College, accompanied by three members of the faculty, will make a 4000-mile trip this summer to study at first hand lumbering methods, reforestation, marketing, fire protection, and other forestry operations. A camp lasting three weeks will be established on the St. Joe National Forest, Idaho, and four weeks will be spent on the Columbia National Forest, Washington. Other National Forests to be visited are the Pike and Holy Cross in Colorado, Uinta, Utah, Plumas and Shasta in California, Snoqualine in Washington, Lolo and Deerlodge in Montana, and the Nebraska National Forest. An intensive timber reconnaissance of several townships will occupy the main part of the work in one of the camps. The class will leave for the West on June 2 and will return approximately September 10.

Iowa State College has the largest and oldest extension department in the middle west. The addition of a forestry expert and landscape architect last fall is a step in advance in the development of Iowa homesteads. Mr. R. J. Pearse devotes his entire time to the planning and planting of farmsteads, school grounds and the development of other public and private properties. The great aim is to stimulate interest for good forestry and landscape work in all parts of the state.

Possible Remedies for Monopolistic Conditions in the Lumber Industry

JOHN ISE, Ph.D., L.L.B.
Associate Professor of Economics, Iowa State College

In a previous issue of the *Forester* the writer traced the early history of the United States forestry policy. In a monograph which is now in the publisher's hands the history of that forest policy has been brought down to the present time, and the results have been analyzed in detail. In that monograph the writer has indicated how as a result of the unwise policy pursued by Congress most of the timberlands of the country have gravitated into the hands of a few holders, and how, upon the basis of this concentration in the ownership of the standing timber, there have developed certain monopolistic conditions in the lumber manufacturing industry. It is the purpose of the present article to consider the various ways of dealing with this so-called "lumber trust".

Before proceeding with the question of remedies for the situation which faces us, it will be wise to note briefly just what the situation is, first, in regard to the ownership of standing timber, and second, in regard to the lumber manufacturing industry.

The privately owned standing timber of the United States, according to the best estimates, amounts to some 2,197 billion feet, worth at least \$6,000,000,000. Of this total amount about four-fifths were included in the area investigated by the Commissioner of Corporations; and of the amount in the investigation area nearly half was owned by holders of one billion feet or over; 32.2 per cent by holders of $3\frac{1}{2}$ billion feet or over; 26 per cent by holders of 5 billion feet or over; and 19 per cent, nearly one-fifth, by holders of 13 billion feet or over. Over 69 per cent of the unreserved timber in the investigation area is owned by holders of 60,000,000 feet or over.

To illustrate the magnitude of some of these figures, it may

be stated that a billion feet of lumber would load a freight train 417 miles long, or would build about 65,000 ordinary five or six-room houses.

Concentration of ownership in terms of board feet is sufficiently startling, but perhaps nearly as significant are the figures in terms of acreage. The three largest timber holdings in the United States, those of the Southern Pacific, the Weyerhaeuser Timber Company and the Northern Pacific, aggregate about 9,000,000 acres of timberland, some of it among the finest in the world. The five largest holdings in the country include 12,794,000 acres, an average of 2,560,000 acres each. Among holdings smaller than these are 9 of from 500,000 to 1,500,000 acres, averaging almost 1,000,000 acres each; 27 holdings of from 300,000 to 500,000 acres each; 48 holdings of from 150,000 to 300,000 acres; 124 of from 75,000 to 150,000 acres; and 520 holdings of between 18,000 and 75,000 acres. Thus 733 holders own in fee a total of 71,521,000 acres of timberland and land owned in connection with or in the vicinity of this timberland, an average of nearly 100,000 acres each. Nor is this all. There are 961 smaller holders owning a total of 6,731,000 acres, an average for each of 7,000 acres, the equivalent of 40 homesteads. This makes a total of over 78,000,000 acres owned in fee by 1,694 holders, over one-twentieth of the land area of the United States, from the Canadian to the Mexican border.

Several factors make the power of these large timber holders really much greater than any figures as to acreage or lumber feet would indicate. In the first place, large timber holdings are proportionately more valuable than small holdings, even when the timber is of only equal quality, because large holdings can be so much more economically managed in every way. In the second place, the large holdings in many places have the smaller holdings "blocked in" in such a way as to practically control them. In the third place, the large timber holdings everywhere include the most valuable timber,—the heaviest stands and the most valuable species. In the fourth place, many of the various large holders are bound together by various interrelations of interests in such a way as to make possible common policies. Furthermore many of the large tim-

ber owners are not cutting their timber, but are holding their estates intact and perhaps buying up smaller tracts for immediate cutting. Finally, it is of course evident that with the rise in timber values the power of the holders of the remaining supply will be greatly augmented.

Now upon the basis of this concentration in the ownership of standing timber, a monopolistic situation has developed in the manufacturing industry. Associations of manufacturers have been formed and have grown strong enough to manipulate prices to their own profit, sometimes by concerted curtailment of output, sometimes by adherence to a price list, sometimes by other means.

The evidence presented in the Missouri Ouster Suit and likewise much other evidence that is available, indicates clearly that the lumber manufacturers are strongly organized and that they have often raised prices by illegal concerted efforts.

The question now arises as to what remedy is proposed for such a situation as has been here briefly outlined.¹ Four different methods of attack might be suggested. First, the Government may attack all unlawful combinations among lumbermen or lumber dealers under the anti-trust laws, Federal and State, and in that way try to secure competitive prices for consumers. In the second place, the Government might recognize the lumber business as a natural monopoly based on the possession of a natural resource, and regulate prices through a commission. In the third place, since monopolistic conditions in the manufacture and distribution of lumber are in general based upon a monopoly of the standing timber, the Government might perhaps strike at the root of the problem by imposing a graduated tax on timber holdings and in that way break up the large estates. In the fourth place the Government may simply extend the system of National Forests as rapidly

¹For excellent recent discussions of the trust problem, see articles by Prof. E. Dana Durand in the *Quarterly Journal of Economics* for May and August, 1914; and by Prof. W. H. S. Stevens in the *Political Science Quarterly* for June and September, 1914. Among other works on the same subject are: (1) John Bates Clark, *The Control of Trusts*; (2) Richard T. Ely, *Monopolies and Trusts*; (3) Charles R. Van Hise, *Concentration and Control*; (4) Bruce Wyman, *Control of the Market*; and a great number of other contributions of importance. The amount of trust literature is altogether too great to be given consideration here.

as possible, and thus try to secure a large enough proportion of the timberland so that it can set prices for the public.

The "trust-busting" policy was naturally the first one to be tried in this country, and since about 1906 the Federal Government and some of the state governments have been very active in their efforts to break up lumber combinations. In considering this government activity two questions arose: first, is it desirable to break up such combinations; and second, is it possible to do so.

The problem of breaking up combinations in the lumber industry brings with it the whole question as to the advantages or economics of large-scale organization. It is impossible to go into a minute analysis of this question here, but it will be pertinent to suggest that many of the advantages claimed for large-scale organization in general are not of great importance in the manufacturing of lumber, because the most efficient unit in the business is comparatively small. "To enlarge a mill beyond a capacity of 20 or 25 million feet a year is to duplicate mechanical units, with small or doubtful advantage in manufacture, and with certain disadvantage in the cost of transporting logs. It is a matter of dispute among lumbermen whether a mill of 20 million feet capacity, under the usual conditions of transportation in the southern pine territory, is not more economical than a larger one."²

There is without a doubt considerable economy in the so-called "integration of industry," that is, in the union of various successive related processes under the same management. In certain regions it may frequently be in the interest of efficiency and economy that a single organization should control the standing timber, own and operate all the logging equipment, the saw-mill and perhaps even wholesale and retail establishments. It is almost everywhere desirable that mill owners should own their own standing timber because in this way they can eliminate much of the element of uncertainty in the securing of timber supplies, and so insure the most economical use of milling capital. The contests between the loggers and the mill men on the Pacific coast, often resulting in very severe losses to those concerned, indicate that logging and mill-

²Report of the Commissioner of Corporations on the Lumber Industry, I, 35, 36.

ing should if possible be carried on by the same organization.

Now while the most efficient sawmill is not a very large unit in itself, if with it are included the various other items which may be effectively combined, a rather large initial investment is indicated,—in some regions an investment of millions of dollars. The purchase of several thousand acres of valuable timberland,—enough to guarantee a timber supply for the reasonable life of an efficient mill, in itself involves a very heavy outlay; and in some regions, as for instance in the cypress fields, logging equipment represents a large expense. The cost of drying kilns, the capital tied up in drying woods, and the advances to loggers and mill hands amount to considerable sums.

It may be stated at this point, however, that it has not been the policy of the Government to attack such integrated organizations as have been suggested. The Government has made no objection to the combination of timber ownership, lumber manufacturing and all other processes under one management, but has merely tried to prevent the combination of a number of these large units into one association for the purpose of manipulating prices. It is clear that this latter sort of combination, the combination of similar units performing similar functions, the so-called "horizontal" combination, is an entirely different proposition. It not only represents vastly more power, but it certainly does not effect the same economies.

Some economies there may easily be, however, even in this latter type of combination. Doubtless it may secure cheaper distribution of the product, through a reduction in advertising and selling expenses, and a saving in cross freights. Perhaps it may prevent some needless duplication of plants,—an important consideration in the lumber industry where there is always a considerable amount of capital tied up in useless milling and logging equipment. It might even permit some specialization among the various mills, although this is not certain. Experience has already shown that combination can do much in adjusting the supply of lumber to the demand, thus securing more stable conditions in the industry. This is a consideration of great importance because of the fact that the lumber industry is peculiarly sensitive to changes in the general

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business situation. Whether combination among lumber operators would result in the adoption of more efficient accounting methods or better machinery is perhaps not quite certain, but there might be some gain here.

There is thus something to be said for the economies of combination even in the lumber business. It should of course be noted that while the lumber industry presents examples of a great many different kinds of combination, most of the lumber associations are not closely knit organizations, many of them not strong enough to secure all of the advantages possible to effective combination.

Even if we admit the desirability of breaking up these combinations, there still remains the question as to the possibility of doing it. As indicated in the preceding chapter monopolistic combinations have existed in most fields of the lumber industry, often strong enough to raise prices materially; and in spite of the activity of Federal and State prosecuting agents, many of these combinations still exist. Most of them have altered their form of organization or their scheme of operations; others have been weakened; but many are still strong enough to manipulate prices to their own profit, and, from evidence at hand, are doing it. The Government has certainly not been entirely successful in its policy of breaking up lumber combinations, and there is no reason to believe that it will be in the immediate future.

Some success, however, has certainly been achieved. No student of the recent history of the lumber business can fail to concede that the vigilance of the Federal and State governments has broken up some of the worst forms of monopoly activity; has driven some illegal combinations to cover; and, perhaps more impotent than all, has to some extent prevented the formation of others. Monopolistic activities have been, to say the least, more difficult since 1906; and some that were possible before that date, have been impossible since. It is doubtful whether the lumber industry as a whole is as strongly organized now (1915), as it was ten years ago. The decision in the Missouri oyster suit for instance, was a crushing blow to the yellow pine ring; and the provisions of the verdict rendered

would seem to promise something for the effectiveness of Government control.

To what extent the attitude of the Government has prevented the formation of new lumber combinations, it is of course difficult to judge intelligently. It is perhaps significant, however, that nearly all of the powerful lumber associations had their inception before the time of Government anti-trust activity, which dates from about 1906. The National Lumber Manufacturers' Association was organized in 1902. The Missouri and Arkansas Lumber Association, perhaps the earliest of the yellow pine associations, dates from 1883; and the Southern Lumber Association, later to become the Yellow Pine Manufacturers' Association, was organized in 1890. The Georgia Saw Mill Association, the predecessor of the Georgia-Florida Saw Mill Association, was formed in 1899. The first organization in the field of North Carolina pine dates from 1888, and the present North Carolina Pine Association was formed in 1905, by the union of the old North Carolina Pine Association and the South Carolina Pine Association, both of which had been organized some years previously.

In the Douglas fir territory as elsewhere, lumbermen's organizations run back to the period previous to 1906. The loggers of Puget Sound organized the Puget Sound Timbermen's Association as early as 1899, and this organization has persisted under various names. The Washington Logging and Brokerage Company, since 1907 known as the Washington Log Brokerage Company, was formed in 1904. The three associations among the mill men of this region; the Southwestern Washington Lumber Manufacturers' Association, the Pacific Coast Lumber Manufacturers' Association and the Oregon and Washington Lumber Manufacturers' Association, were organized in 1900 and 1901. The combination of these three into the West Coast Lumber Manufacturers' Association was, however, not effected until 1911; and some subsidiary price regulating organizations in this region have also been formed in very recent years.

In other fields of the lumber industry, as in those mentioned, most of the present lumber combinations were formed previous to 1906, although some consolidations and reorganizations have been effected more recently. In this connection it must

be pointed out that most fields of the lumber business were fairly well organized before the Government began its anti-monopoly campaign, and that therefore there has been no great occasion for the formation of new organizations since; nevertheless, bearing all the evidence in mind, we can scarcely escape the conclusion that the number of such monopolistic organizations is now less than it would have been but for the hostile attitude of the Government. The abandonment of the proposed North Carolina Pine merger is a case in point.

Finally then, as to the effectiveness of Government efforts to break up lumber combinations, the most definite conclusion that the information at hand will justify, is that, while the lumber industry is still strongly organized, part of it perhaps entirely beyond the reach of anti-trust prosecution, nevertheless the Government has accomplished something, has even achieved some notable success. Some students of the question may feel that with further experience, with improvement in the anti-trust laws and in the machinery for their enforcement, with the elimination of various unfair practices, with increasing publicity of corporate affairs, and with the development of supplementary legislation, such as for instance, Federal incorporation laws, the Government will be able to handle the lumber situation successfully, without departing from its present policy. Other students of the question will view the situation more pessimistically, will feel that it is impossible to break up combinations in this way, that as fast as the Government devises new methods of attack, the lumber organizations will invent new means of evasion, and that in the end, the Government will be driven to direct regulation of prices.

The possible advantages of combination in the lumber industry have been indicated above, and certainly they must be given due consideration. Whether these advantages are so great, however, and whether their preservation is a matter of much importance as to justify the Government in abandoning its present policy, to embark upon a wholly untried scheme of price regulation, is quite another question.

The idea of price regulation by means of a commission seems attractive in many ways.³ It has a directness, a finality, an

³Van Hise, *Concentration and Control*, 238-242.

apparent simplicity even, which presents a strong appeal to certain minds. It is perfectly conceivable too that if the Government is to engage in the regulation of prices at all, lumber prices might seem as good a point of attack as any. The industry is based on a natural monopoly, is fairly well centralized, the product simple and generally well standardized. Furthermore the cost of production, as far as that might enter into the fixing of price, could be as easily determined for lumber as for almost any product.

It will be profitable, however, to point out certain objections to this scheme, to indicate briefly some of the difficulties involved. Immediately questions arise as to the personnel and manner of appointing such a commission, and the scope of its powers. To be effective, it must, of course, have broad powers, and this would make its personnel a matter of the greatest importance. Clearly if the lumber interests were to have a strong representation on the commission its work might amount to little or nothing. It is scarcely to be doubted that any representatives of other lines of business on this commission would line up with the lumber representatives in most events, because once the Government embarked on a policy of price regulation, most lines of big business would cooperate in common self-defense. Experience with minimum wage commissions points to the possibility of difficulties of this nature.

It would perhaps be fairly easy to conceive of an ideal commission, with a majority of highly trained men who could handle the business with intelligence, but it is easier to conceive of a commission created according to canons of political expediency, the fruit of political debates and trades and compromises rather than of intelligent and judicious planning. Experience with the Interstate Commerce Commission indicates that it would take many years of experimenting to develop any degree of efficiency in the regulation of prices.

The price regulating commission would presumably be a Federal institution, and the definition of its powers and jurisdiction would present certain difficulties. It could get jurisdiction only under the interstate commerce clause of the constitution, and so would be unable to reach lumber which did not enter into interstate commerce, unless effective cooperation were se-

cured with state commissions of similar nature. The difficulty of securing such cooperation with some of the states, and the tangle that would result from a failure to secure it can easily be understood. Some states might feel that Federal prices were too high; others, where lumber interests were strong, might feel that they were too low. A situation might even conceivably arise in which consumers in a lumber producing state would have to pay a high price, fixed by the organized lumbermen of the state, or by a commission under their influence, while consumers across the state line were getting the same lumber at a low price, fixed by the Federal commission. A host of unforeseen complications would certainly arise in connection with the mere question of jurisdiction. Of course amendment of the constitution of the United States would clear away some of these difficulties, but amendment could be secured only after a long and energetic campaign, if at all; and even if it were accomplished, state constitutions might still interpose obstacles to effective price regulation.

The most serious difficulties connected with the whole scheme would of course enter with the matter of price determination; and the first question would be as to the basis upon which prices should be determined. A vast number of items would clearly have to be considered: cost of labor; logging and milling equipment, original cost, interest charge and depreciation; more remote items, such as fire protection and taxes, (in the first instance these would have to be reckoned for years previous); and perhaps more important than all, the value of the standing timber.

A very careful system of cost accounting would be needed here, and it is probable that the Government would have to prescribe a uniform system for all lumber manufacturers. Many of the mills have had no effective system in the past, and it might be many years before the Commission would have enough comparative data to proceed with intelligence.

The value of the standing timber would have to be considered. In most cases a price has been paid for it, and to fix a uniform price schedule without considering this price at all would be confiscation; whether the manufacturers themselves own the timber or whether they buy from timber owners. This

is not to assume that the original price, or even any subsequent price paid, is an accurate index to the value of the timber, for it may have no significance whatever. For instance the \$6.00 per acre paid in the great Weyerhaeuser purchase of 1900 has no significance as to the present value of the land. In order to get any idea of present values it might be necessary to institute an extensive and thorough cruise of all the timberlands in the country.

Unfortunately, however, it appears at this point that the whole idea of considering present values in the fixing of a price schedule involves a logical absurdity, a "vicious circle" in reasoning. How can any price be fixed on the basis of the present value of standing timber, when the value of the standing timber is directly determined by the price fixed? The value of standing timber depends upon the price at which it is anticipated, the lumber can finally be sold; and how can it serve as the basis for determining the price at which it is to be sold? How can timber values and lumber prices each be in turn cause and effect?

In the case of joint products special complications would arise. For instance the yellow pine forests of the South produce turpentine and lumber. Hemlock is valuable for its bark as well as for its wood. How shall the price of the lumber be determined with relation to the other products? Some mills produce different kinds of products, lumber of many kinds and grades, shingles or lath, and perhaps excelsior. How much of the fixed charges and how much of the operating expenses shall be attributed to each product?

It might sometimes be difficult to adjust the price of different kinds of woods so as to do justice to each section of the country. As long as there is competition between different sections of the country this matter is regulated, but if once this competition were eliminated it might be very difficult to find a satisfactory basis for the determination of relative values in the various markets of the country.

Under the present regime, to a considerable extent competitive, most lumber prices tend to fluctuate greatly, because of the fact that the demand for lumber is extremely variable, while the supply responds only tardily. Now it is clear that

no commission would be able to change the price schedule with any degree of facility; and the establishment of fixed prices would bring in unprecedented conditions which can scarcely be more than guessed at. In times of business activity excessively large amounts of lumber would be demanded, because there would be no rise in prices to discourage its use; in times of depression very little would be called for because there would be no lowering of prices to stimulate demand. How could the supply be adjusted to such a widely varying demand? Even under present conditions, there is a great waste in the industry, because so much capital is idle during slack seasons, and it seems that this waste would be much greater under the circumstances suggested.

It might be suggested that the commission could vary prices according to changing industrial conditions, but even if this were possible, it is very doubtful if it would be a wise policy because of the uncertainty and uneasiness it would bring into the situation. It seems that prices fixed by the commission would tend to remain the same for considerable periods, perhaps even for years, somewhat like the rates fixed by the Interstate Commerce Commission.

Lumber prices will certainly show a strong upward tendency for a long time, and as prices gradually rise consumption will decline and waste will be reduced. The higher prices will have a conserving tendency. It is interesting to speculate as to what would happen if a Government commission were regulating prices. As stated above, there would be a strong tendency for such a commission to fix a certain level of prices and adhere to it, perhaps for years. The changing relations of supply and demand would present no just ground for altering the schedule unless there were also increasing costs of some kind. Now with the growth in the population of the country the demand for timber will certainly increase; and if prices were to remain about the same, might not our timber supply be very speedily exhausted? Would there be any incentive for timber owners to preserve their timber for the future? Certainly the expectation of a future rise in stumpage values is the chief reason why many timber owners are not clearing their land now; and if this hope of future profit were taken away, if holders

felt that prices would remain the same for a long period, they would cut their timber as fast as the market would absorb the product, unless the Government also in some way taxed or regulated the output.

If the commission were to follow a policy of permitting lumbermen to raise prices merely because the supply of timber was decreasing, when there was no increase in the cost of production, it seems that it would to some extent fail in its avowed purpose, which is to protect consumers from unreasonably high prices.

Advocates of Government regulation of prices sometimes point to the experience of the Interstate Commerce Commission as an example of success in Government regulation. Without entering into any discussion of the Interstate Commerce Commission and its work, it may be said that it is not very significant as to the desirability or feasibility of regulating general commodity prices. In the first place it was absolutely necessary that interstate commerce rates be regulated; and this cannot be said of lumber prices. In the second place, perhaps it cannot be said that the Interstate Commerce Commission has been so successful in its work up to the present date as to throw a particularly favorable light upon the general policy of Government regulation. The commission has been mainly interested in preventing unjust discrimination between persons, localities or kinds of freight, and has done very little, if anything, in the fixing of specific schedules. The general rate structure for the country as a whole has been determined almost entirely by the railroads themselves. There is little probability that the commission itself could ever have made out entire rate schedules for the railroads, and applied them successfully. The work now done by the Interstate Commerce Commission is very different in many ways from that which would be required of a commission for the regulation of lumber prices.

It might of course be argued that the lumber commission could follow out a policy similar to that of the Interstate Commerce Commission, simply adopt the present price schedules of the lumber companies and permit no advances except upon proof that such advances were reasonable. Since lumber

prices will for a long time tend to rise, the commission might thus reduce its work to merely "sitting tight", allowing few advances, and meantime regulating such matters as unjust discrimination and unfair practices.

It seems probable that the price regulating commission would adopt a policy somewhat similar to this; and possibly it would prove successful. It may be well to point out, however, that many of the difficulties urged above to the general scheme of price regulation would be encountered in this procedure as well. The questions of personnel, manner of appointment, and jurisdiction would not be simplified. A careful accounting system would be needed, although perhaps it would not be so important as if price schedules were to be fixed immediately by the commission.

The questions regarding joint products and the relation of prices of different woods might be largely solved by the lumber companies themselves without much interference from the commission. The problem of adjusting supply to demand would not be simplified; low prices would in any case stimulate forest destruction; and if the value of standing timber were to be reckoned in the determination of prices, it would involve the same circle of reasoning that was pointed out above.

One objection which is sometimes urged against price regulation in general, is that it leads to Government ownership and socialism; but this objection has very little force when applied to the lumber industry, for Government ownership is the ideal toward which we should be working.

Perhaps it may seem that since monopoly conditions in the manufacture and distribution of lumber are dependent on ownership of the standing timber, the logical procedure would be to attack the question there, to break up in some way the monopolistic control of standing timber, break up the large holdings.⁴

There are several reasons why the present situation in regard to the ownership of standing timber would seem to demand some kind of a remedy; some reasons why, as a matter of equity

⁴See E. Dana Durand, *The Trust Problem*, in the *Quarterly Journal of Economics*; August, 1914, 672-674.

and justice if nothing more, the large holders might be shorn of some of their power. In the first place we must recognize that no labor is required to discover standing timber, as contrasted with such natural resources as iron ore, coal, or petroleum. The search for minerals is a real public service; but timber is conspicuous upon the surface, and could never fail of being turned to account for lack of knowledge of its existence.

Not only have timber owners as a class rendered no particular service in "finding" and appropriating timber lands, but many of them have given no equivalent in any other way for the valuable resource they now hold; many of them have merely stolen their lands. As indicated in previous chapters, many of the railway grants were not really earned; the two great timber owning railroads, the Northern Pacific and the Southern Pacific, presenting notable examples of bad faith in their disposition of their grants. Various other railroads furnish examples quite as bad on a smaller scale. Swamp lands were often, perhaps usually, acquired fraudulently, and the terms of such grants were not often complied with. Most timber lands acquired under the Timber and Stone Act, the Commutation Homestead Act, the Preemption Act, and the Desert Land Act, were acquired fraudulently; indeed there was about one general public land law under which large holdings could be honestly taken up, and that was the Cash Sale Law, and even under that law the payment for the lands was of course grossly inadequate.

Since so much of the timberland was stolen in the first place, there might seem to be special reason why a few holders should not own it all, special reason why the Government might try to regain control over more of this resource, or might try to secure a more equal division, perhaps break up some of the large estates in some way. In judging of the wisdom of any such plan of procedure it will of course be proper to consider that a vested wrong may in time become a vested right; that much of this land is not now in the hands of the original holders; that some of it is now owned by holders who have paid full value; and that the proportion of such holders will grow from year to year as more of this land changes hands.

If we were to go so far as to advocate breaking up of some of these great timber estates in some way, the most obvious method would of course be taxation, perhaps a progressive tax, somewhat after the Australian or New Zealand plan, imposing an especially heavy burden on the very large holdings. It might be argued that this would tend to encourage the division of these holdings into moderate sized tracts; or that even if it did not have any decided tendency that way, it would at any rate be equitable as a system of taxation, apportioning burdens according to ability, since the real wealth, power, or "ability" of these large holders is more than proportionate to the size of their holdings. If furthermore, it saddled a special burden upon a class of large-scale land thieves, so much the better.

It is not the purpose of this chapter to enter into an exhaustive discussion of the progressive tax, or of the general question of remedies for our timber situation; but it will be worth while to consider briefly a few very weighty objections to any scheme of breaking up the large holdings by means of a graduated tax on timberlands.

In the first place, aside from all questions of constitutionality or conflict of jurisdictions, such a scheme may seem unfair to some holders, for some who have purchased a recent years, have paid full value for their land.

In the second place, any tax graduated sufficiently to be effective would promote a rapid forest destruction which is exactly what conservationists should wish to avoid. It has everywhere been observed that heavy taxation of forest land results in premature cutting of the timber.

The decisive argument against the taxation scheme suggested is, however, that it is not desirable to break up these large holdings. The Australian and New Zealand taxes apply to agricultural land, and are probably justified by social considerations.⁵ It is not desirable to have agricultural lands in large states; but the situation in regard to forest land is quite different. A large holding of timber land is proportionately easier to protect from fire and from trespass, and is more economically managed in every way. The cost of fire protection is a very important item in the timber business, and for the

⁵Seligman, *Essays in Taxation*. Eighth edition, 459-466, 516-522.

large holdings this cost is proportionately much lower than for the small holdings and protective measures are far more effective; indeed it is almost impossible to afford adequate protection to a number of scattered small lots. The holder of any such lot is very much at the mercy of his neighbors, any one of whom may by carelessness jeopardize all the timber in the community. The breaking up of timberlands into small holdings would thus increase the cost and decrease the effectiveness of fire protection and of management in almost every way.

Perhaps the best thing that could be said for a progressive tax is that it would not really be effective because it would be evaded. Many large holders would doubtless pretend to break up their holdings, but would retain control through gentlemen's agreements and through various other subterfuges so common in the general field of monopoly. If in this way the tax could be rendered ineffective it would perhaps do little harm, but of course it would then yield no revenue and would have no excuse for existence.

No doubt some scheme of taxing the annual cut would be better than a tax on the land, and tax legislation is turning to this more and more in recent years. It is difficult, however, to see how this tax could be graduated in such a way as to break up large estates. It might of course be graduated so as to bear heavier upon those establishments having the larger output, or it might be imposed only on the larger organizations, (those larger than the unit of maximum efficiency); but it is not easy to see how this would improve upon the policy of breaking up trusts, except that it would tend better to conserve the timber supply.

The reasons why forests should be owned by the Government have been discussed in various connections, in fact, the wisdom, perhaps we may even say the necessity of Government ownership, is the great outstanding lesson to be gained from the study of the United States forest policy as outlined in the preceding chapters. Almost all the advanced countries of the world have found it necessary to take over the management of their forests; and the United States must eventually enlarge her field of activities along this line.

Our National Forests will of course play a more important

part in the future than they do now. At the present time they are of course much less important than their area would indicate, because only part of the land is timbered, and the timber included is of poor quality and inaccessible. The Forest Service is handling the timber very conservatively, however, cutting less than the annual growth, so that the amount of Government timber is even increasing; while the privately owned timber is being cut at a very rapid rate. Furthermore the Government is slowly taking over tracts of denuded land under the Weeks Law, and is again planting it with trees. Thus the relative importance of the publicly owned timber is bound to increase greatly in the future, and this will tend to prevent the large private holders from too gross abuse of their power.

In conclusion then, it appears that of the several remedies suggested for our lumber and timber situation, the only one worthy of unqualified approval is the last,—the extension of Government ownership and control. The scheme of breaking up large timber holdings by means of a progressive tax has been as unqualifiedly rejected. In regard to the two other remedies considered, it has seemed wise to take no stand, but merely to point out the various advantages and disadvantages that might be claimed for each plan of procedure. It is hoped that this caution and conservatism will not lay the writer open to criticism on the ground of having avoided or glossed over vital issues. Much has been written about trusts and monopolies in general, about the Standard Oil Company and the United States Steel Corporation, and various other monopolistic combinations; but comparatively little is generally known about the lumber industry. The report of the Commissioner of Corporations contains a vast amount of valuable information; but this report is about the only ready source of information, it has been given little general publicity, and it is not at all concerned with the question of remedies.

Thus the writer is exploring new fields, and abundant caution would seem to be fully justified. If the above suggestions as to remedies have any effect in arousing interest in the matter, in stimulating others to follow up with fuller knowledge and more careful analysis, their inclusion here will perhaps be justified.

University Extension Work in Forestry

SHIRLEY W. ALLEN, '09

Assistant Professor of Forest Extension New York State College of Forestry

The wag who said he had no use for forestry because "Posterity has never done anything for me" was fairly well informed and very honest. The man who waxed warm on the wastefulness of the lumberman and the timeliness of forestry and then pastured his woods and kept them full of dead and down timber was also well informed but not so honest. The County Fair visitor who asked the man in the forestry booth whether he was an organizer for the Ancient Order of Foresters or a Tree Surgery expert was honest enough but in sore need of information. These men represent very well the attitude of the average citizen who has any idea of forestry at all. They also stand as an eloquent indication of the great opportunity in educational work for the general public along forestry lines.

This kind of educational work as in the case of any economic question can best be accomplished by what has come to be known as University Extension Work. The latter is defined in the New Standard Dictionary as "A system for extending the advantages of University instruction beyond the limit of Universities, by the establishment of lecture courses and classes in or near populous centers."

I think I am safe in saying that New York State through her College of Forestry at Syracuse University is a pioneer in this Extension work in Forestry. As early as 1912 lecturers from the Faculty of the College were sent out over the State to talk before Granges, Men's Clubs, High Schools and other organizations. Since that time the work has been prosecuted with great vigor until at present it is organized as a definite Department in the College. Four men are kept busy with lectures, demonstrations and the various other lines of work now falling properly under University Extension.

The visiting of over two hundred communities in one sea-

son and the giving of as many illustrated lectures is only a part of the extension activities. The worker who visits a high school is always ready for a field excursion with the biology classes or with some of the older pupils. The man who goes into a county to help the local farm bureau or a number of granges expects to conduct a demonstration for some neighborhood in timber estimating, marking, planting or timber treating. The forester in charge of an exhibit at the state fair or county fair must be prepared to answer questions ranging from "How do you control the elm leaf miner?" to "How expensive may my land be to guarantee a fair return from planting red pine?" In the office a forester in this department may find himself called upon to outline a season's reading course with suggestive questions for a Woman's Club, to get out material for a high school debate on some angle of the forestry question, to get up an exhibit for an agricultural high school or to write a magazine article or a press bulletin on some producing or marketing phase of the business.

Some of the more interesting extension activities outside of lecture work are the maintenance of a wood utilization service whereby the users of timber and mill waste are brought into communication with the producers by means of a monthly bulletin made up from inquiries sent in to the College; the supervision on Arbor Day of the planting of a thousand or more trees by various high schools on city watersheds or pieces of waste land secured for the purpose of a school forest, the placing of a wood collection of some 30 hand specimens of commercial species, in the schools of the state, the management of a few small libraries of forestry books and bulletins gotten together for lending to schools and public libraries throughout the state, and the conducting of a correspondence course in "Lumber and Its Uses."

A certain amount of help along the line of improvement of shade tree conditions and so-called "City Forestry" has been demanded of the college and one man gives all of his time to extension work in this line. A good many cities and villages have been stirred to action by means of a survey of shade tree conditions, a tree census by the school children and a public

meeting. Notable among these is the city of Mt. Vernon, where the college gave valuable aid in the drafting of a shade tree commission calling for the permanent services of a trained man.

The question of financing the extension work in Forestry is taken care of through a direct appropriation from the state for this purpose. The college agrees to send its men into any given neighborhood for a week of lectures (three communities or more) without cost to the requesting agency, and requires only that a crowd of more than 50 people be guaranteed and that consistent local effort be put forth to advertise the meetings. Where a forester goes out for only one lecture or demonstration, the requesting agency is required to pay his traveling and subsistence expenses. The appropriation also takes care of the other activities except that libraries which borrow sets of books are required to pay transportation charges each way and correspondents registered for the course in "Lumber and Its Uses" are charged a fee of \$5.00 to cover books and material used. A small wood collection is put into schools and other organizations at actual cost, which is 50 cents.

There are two big organization problems in extension along forestry lines at present. The first one is the gathering and distribution of the best and most usable information. That is, the problem of keeping the workers properly "loaded" and at the same time out of the rut where a proper "load" will tend to keep them. To explain my rather clumsy figure further, I may say that extension foresters must not generalize so much that they merely entertain and they must not be so "technical" that their talks go over the heads of their audiences. A peculiar type of man must be developed for the ideal worker would combine wide knowledge and experience with broad sympathies, keen interests and ability to meet people in a friendly way. The greatest lack at the present time among men available for this work is actual knowledge and experience in forestry.

The second problem is that of following up the work which has been started by means of lectures, demonstrations and study courses in various centers. If the eternal remark "Forestry is a very important subject" is the only result of a visit to a community further lecture and demonstration work is necessary. On the other hand if some local man resolves to

manage his farm woods according to forestry principles, or a school wants to plant some idle land next spring, or the people of the village want to make their idle watershed pay, some local organization such as the County Farm Bureau, the Boy Scouts or the local Chamber of Commerce must be interested and led to cooperate. Cordial relations are not always easy to establish, but careful study of any given community and prompt attention to resulting correspondence will accomplish much in this direction.

Forestry stands coordinate with agriculture as a solution for the problems involving the use of land. As such it offers an unlimited field for the creation of public sentiment which when crystallized into action is the mightiest force which man can summon. This year the foresters from the college will probably reach from 50,000 to 75,000 people in one way or another. I know of one forester who, when it is all over, will scratch his head and wonder just where the results will show. He will probably be able to say that as a direct result 50,000 trees have been planted by schools and land owners, thirty or forty people have been sufficiently interested to join either the State or the American Forestry Association, fifteen woodlot owners have found a market for their dead and down timber, a dozen boy scouts have passed their tests for a forestry merit badge, three villages have passed shade tree ordinances and two clubs have taken up forestry for their next year's study subject and then as he goes home and saws up some of his six dollars a cord fire-place wood which came from a piece of farm woods blown down by a hard wind last summer, he will begin to figure the further results. He will know that five or ten years from now a couple of thousand citizens of New York State will be voting right on the initiative measures calling upon the state to do telling reforestation work on its idle lands, calling for tax reform that will allow the practice of forestry on private lands at a larger profit. That some twenty or thirty farmers will then be saying "By George, I've got to plant me some trees. Look at the ones Neighbor Jones put out ten years ago." That the citizens of _____ will be looking at their avenues of Oriental planes and calling their "City Dads" blessed for not planting Carolina poplar. That the State Forestry Association has a

membership of ten thousand and that the 14,000,000 acres of land better suited to forestry than to agriculture are gradually becoming busy at their one best job.

New York and other states need men for this work. Men who are up on the best modern forestry thought who are as versatile as possible, endowed with vision and enthusiasm and who will not be sunk by any brand of pessimism afloat.

The annual convention of the Iowa Forestry and Conservation Association was held in Ames February 2, 1916. The principal topics for discussion were:

- The Proposed National Park for Iowa;*
- The Conservation of the Iowa Lakes;*
- County and State Parks and Forests;*
- The Conservation of the Beauty Spots of the State.*

The movement for the establishment of a National Park in northeastern Iowa, the Switzerland of the State, as Senator W. S. Kenyon has called it, was given hearty support.

The Forestry Section of the Iowa Experiment Station issued two bulletins written by G. B. MacDonald during the last year. The two publications give the results of a very comprehensive study of the preservative treatment of farm timber and the renewal of windbreaks. The Experiment Station has undertaken the reforestation of the sandy lands adjacent to the Mississippi River in Allamakee County. Eight species of conifers are being tried out in plantations. In the same region a large amount of cottonwood is planted in the overflowed island lands. Cottonwood makes sawlogs in from twenty-five to thirty years.

Carolina poplars put out on the College farm at Ames in the spring of 1910 have yielded fenceposts in five years. Five hundred and forty posts with a diameter of $3\frac{1}{2}$ inches and 720 posts with a diameter from $2\frac{1}{2}$ - $3\frac{1}{2}$ inches were produced on one acre. If given a good creosote treatment costing from 10-20 cents apiece, the posts will last from 20-25 years.

The Woodlot in Relation to Farm Management

E. R. HODSON, '98
U. S. Forest Service

When one thinks of forestry, lumbering, and kindred subjects there come to mind pictures of a wild and distant region, pioneer conditions and things done on a huge, rough scale. The idea of forests and their utilization seems inseparable from that of vast tracts of timber, remote from settlement and cultivation. Particularly does this seem true to dwellers of the prairie who are not usually familiar with timbered regions. In fact it is true to a large degree, for many extensive forest areas are wildernesses, rough and mountainous and most of the lumbering is done under pioneer conditions. In other places lumbering is the forerunner of cultivation as in the central hardwoods and southern pine belt where the topographic and climatic conditions are favorable.

While this is true, that many forests are in wild places and lumbering most frequently carried on remote from cultivation and settlement, yet there are also many thousands of small bodies of timber distributed among the farms in the cultivated districts which are in eastern sections called "woodlots." These tracts of timber are intimately connected with the farm and its management and are usually remnants of more extensive forest which has been gradually cleared away to make the farms. On the prairies they are, for the most part, planted.

These small tracts of timber are a part of the forest wealth of the country and their disposal and treatment is of both public and private concern. On account of their location and distribution the utilization of the woodlots is different from the use of large lumbering tracts, as a rule, and is closely related to the general system of management of the entire farm in their respective localities.

In the aggregate those small woodlot holdings are end

mous and have until recent years received insufficient consideration. Lately attention has been directed to their importance and value and a number of publications by the states and Federal Government have been published or are now in the course of preparation. Most of these publications deal with the marketing of the timber products as this is the feature in which the owners are most keenly interested at the present time. It is the feature whose realization is forced by the practical necessities of the present moment while the care and management of the woodlot as a permanent source of income and general advantage to the farm, is overlooked. The latter feature is of equal importance and is primary where the woodlot is to be maintained as a permanent part of the farm and not regarded as a stage in its improvement by clearing, and consequent extension of the cultivated area. To secure reliable practicable information on all sides of the subject its study has been followed in a number of directions.

The phase under discussion in this paper has been designated woodlot economics, and seeks directly to correlate the practical economic management of the woodlot with that of the farm to which it belongs and indirectly to the general community. It was inaugurated at the beginning of the field season in 1915 by the Forest Service and the Office of Farm Management of the Department of Agriculture as a co-operative project. So far the study has been confined to the general eastern half of the country, extending as far west as the prairie states. As stated before this work deals mainly with the economics of the woodlot and is a carefully planned attempt to secure definite figures and basic facts on woodlot and farm management conditions from the field and on a number of selected representative localities and to correlate and compare the information obtained.

The method of doing the work was developed from a number of conferences between the two offices directly concerned in which the lack of essential data of this character was shown, the points needed and means of securing them gradually worked out. Some forty or fifty questions designed to bring out information along specific lines were framed up and placed on a set of cards for use in the field. Answers to the

same questions will be obtained from 50 to 75 farmers in each selected locality and the results tabulated.

While it is perhaps not necessary here to give each question, they cover the following points: size and value of farm, distance to market, description of soils and topography of farm and woodland, different kinds, size and age, density of stocking, and an estimate of its value, also an estimate of the value of the woodlot for windbreak and shade purposes. Questions are asked on the pasture value of the woodlot, how many mature animals it will support through the pasture season and the proportion this amount is of those pastured on the entire farm. Another point to complete the survey of the woodlot value is the amount of land in it which can be cleared and make good farm land.

A classification of land on the farm is made as to acreage and value: plowland, permanent meadow, permanent meadow not in pasture, woodland pastured, woodland not pastured, and waste land.

In addition to the indirect advantages and values enumerated, a careful canvass is made of the average quantity and value of the woodlot products used and sold annually, such as firewood, fenceposts, poles, railroad ties, lumber, maple sugar products, etc.

In a line of inquiry to develop the advantage of the woodlot in furnishing labor to the farm at slack times, information is requested as to the number of days work obtained annually in harvesting and marketing woodlot products for man and team, the season at which the work is done, the kinds of winter work available on the farm and whether they serve to keep the farm force occupied through the winter.

Information in regard to the amount and character of the annual expense in keeping up the woodlot is asked. This includes usually taxes, fences, supervision, etc.

Three questions are asked which are designed to bring out the permanency of the woodlot; the number of acres of woodlot actually needed to supply the needs of the farm for woodlot products, whether the present woodland is preferred left in woods or cleared and used for other purposes, as for pasture if not suitable for cultivation, and how many acres now clear



Chestnut and mixed hardwood woodlot. Well protected. Litchfield County, Conn. By courtesy U. S. Forest Service.



Beech woodlot, not properly protected or handled. Henry County, Indiana. By courtesy U. S. Forest Service.

on the farm and in pasture or crops which the owner believes should be in woods. The foregoing questions comprise practically all the information requested.

Of the sixteen areas selected for field work, seven were completed the past field season. They are as follows: northeastern Connecticut, northern Vermont, southeastern Pennsylvania, central Indiana, central Piedmont region in North Carolina, the coastal plain at the junction of the fall line in northern South Carolina, and central Tennessee. The nine areas which remain are distributed as follows: northern Alabama, northern Louisiana, southern Missouri, southern Indiana, northern Indiana, northern Wisconsin, southern Minnesota, eastern Iowa, and southeastern Nebraska.

These areas are confined to a county and are carefully selected for soil, topography, timber conditions, type of farming, and general economic conditions. The Connecticut locality, Windham County, is in the heart of a manufacturing district whose power is largely furnished by waterfalls along the stream courses. The population of the county is 48,361 and markets are good, both local and distant. According to the census 37.6 per cent of the area is wooded and the present survey of a portion shows the percentage of wooded area as 35.3. For the entire State of Connecticut the percentage of farm homes to total homes is 10.6 per cent and is decreasing slightly; 31.2 per cent of the owned farm homes in the county are encumbered, and 13.4 per cent of the farm homes are rented. The land is generally rough and stony with many granite ledges. The usual northern hardwoods are found, of which chestnut forms a large proportion. White pine occurs in the northern part. Fuel wood, lumber, ties, fenceposts, and poles are the principal products. Dairying is one of the important farm industries and pasture is in demand near the towns.

The Vermont locality, Franklin County, is much the same general type as the Connecticut, with the exception that there is very little manufacturing. Dairying is one of the principal industries and maple sugar making furnishes work in the early spring. In the part of the county where the information was collected the farm land is about the average for the

county as it is located between the best farming part and the hilly timbered part. The population of the county is 29,866 and decreased 1.1 per cent during the decade from 1900 to 1910. The census gives 21.1 per cent of the county wooded and the present survey gives 25.4 per cent. The percentage of farm homes to total homes for the entire State is 36.6 and 47.4 of the farm homes of the county are encumbered. 24.9 per cent of the farm homes are rented. Much of the land is ledgy but on the whole is much better than the locality in Connecticut.

The northern half of Chester County, which is the locality chosen in southeastern Pennsylvania, is in a highly developed farming region where progressive methods are followed and the population frugal and industrious. It is a dairy and grain raising region with hay and cattle growing to some extent. Since the county is near Philadelphia and well cultivated, the population is large, 109,213. For the entire State the per cent of farm homes to total homes is 13.1 and has decreased slightly since 1890. The per cent of farm homes encumbered in the county is 55.7 and 29.1 per cent of the farm homes are rented. The per cent of wooded area is given by the census as 12.2 and by this survey as 17. The greater part of the land in the valleys is tillable but the ridges are usually timbered and not capable of cultivation. The forest is hardwood with large home consumption and ready sale in most of the locality.

Madison County in central Indiana is the locality chosen to represent the best farming part of the State. It is a flat, fairly fertile region originally solid forest with much wet ground. The census shows now 11 per cent of the area wooded and the present survey shows practically the same 10.9 per cent. The population of the county is 65,224. For the entire state the percentage of farm homes to total homes is 32 per cent and has decreased from 44 per cent in 1890. In the county 35.5 per cent of the farm homes are encumbered. 36.1 per cent of the farm homes are rented. The timber is all hardwood and belongs to the general oak-hickory formation, with many species of hardwoods associated, as beech, ash, and maple. While the markets are good as a rule for imple-



By courtesy U. S. Forest Service.
Sugar maple grove, Orange County, Vermont.



Photo by W. R. Mattoon.
Badly eroding, clear cut, steep slope. Protective work with brush not entirely successful. East Tennessee.

ment and handle stock, there is practically no market for fuel wood and little use for it on the farms as coal and gas are generally used. This county is in a gas region and had a boom about 20 or 25 years ago and considerable local natural gas is still used for fuel on the farms. A pipe line from West Virginia supplies the towns with gas and some of the farms. Where gas is not available coal is used, which leaves little room for wood fuel, cutting off the opportunity to dispose of waste wood in the woodlot. Another important point is the character and high price of the land on which the woodlot is situated which greatly increases the carrying charge for taxes and makes it necessary for the woodlot to compete with cultivated land in returns. The tendency here is to clear out all the land for cultivation in order to secure the greater returns yielded by annual crops.

The locality which is chosen for the Piedmont Region on the Atlantic coast is Randolph County in central North Carolina. It is in rather a remote region of rolling and hilly land fairly typical of a certain section of the Piedmont. The census gives 60.7 per cent of the area as wooded and the present survey 58 per cent. The population of the county is 29,491 and is increasing slightly. The percentage of farm homes in the entire State is 55.5 per cent and has decreased but slightly in the last census decade. The percentage of farm homes encumbered is 19.3 per cent for the county, and 21 per cent of the farm homes are rented. There is very little stock raised in the county except that needed for home use. The wild pastures are not of great value and most of them are not fenced. As there is a stock law in force the unfenced pastures can not be utilized. Agriculture in general is in somewhat primitive state. The home consumption of fuel wood is large, as most of the farms as well as many of the town residences have fireplaces. A market exists for fuel wood, implement and vehicle material, but in many cases the hauling distance is too great.

Marlboro County in northern South Carolina at the edge of the "Fall line" is the locality selected for the Coastal Plain. It is in the cotton belt and with very fertile land for the most part. The county was once covered with longleaf and loblolly pines, with hardwoods in the wetter parts. Cot-

ton growing is the chief industry although some corn and other crops are grown. Most of the holdings are large plantations and worked by tenants. The population is 31,189, showing an increase in the last census decade of 12.8 per cent. The census gives 32.3 per cent of the area wooded while the present survey shows 42.2 per cent. The percentage of farm homes to total homes is 53.4 per cent, and 17.6 per cent of the farm homes are encumbered. 81.5 per cent of the farm homes are rented. The markets are not particularly good except for lumber but there is a large use of fuel wood on the plantations. Most of this land will be cleared up in time except the swamps which are difficult to drain.

Rutherford County in central Tennessee represents the southern extension of the central hardwood forest. Red cedar is also a well developed type and figures prominently in the use made of the woodlots. The locality is in the limestone district and the soil is fairly fertile, except where the bed rock is near the surface, where occurs what is known as "glade" land. Phosphate deposits occur in the extreme western edge of the county. The surface is mostly rolling with some of the land quite hilly around the edges of the county. There is some cotton raised in parts of the county but the most general industry is the production of grain, hay and live stock. Some dairying is done and is likely to increase. The population of the county is 33,199. For the entire State the per cent of farm homes is 51.1 per cent; 12.1 per cent of the farm homes are encumbered and 42.3 per cent of the total are rented. The wood market is fairly good and large quantities of red cedar posts and poles and hardwood material are used. There is a strong tendency to clear off the land for cultivation and pasture, for the latter purpose even when of the most rough and stony character.

Of the localities remaining, from which data has not been obtained, the one in northern Alabama represents the hill section along the Tennessee in Morgan County, with a certain type of soil and methods of farming. Ouachita County in northern Louisiana represents the western extension of the southern pine belt with associated swamp hardwoods. A county in southern Missouri is chosen to represent the general



Photo by W. R. Mattoon.
Farm buildings and woodlot of a progressive farmer, East Tennessee.



Photo by W. R. Mattoon.
Six hundred cords of chestnut acid wood in the yard of extracting plant, Carter County, Tennessee.



Photo by W. R. Mattoon.
Hauling red and white oak logs to railroad, Jonesboro, Washington County, Tenn.

Ozark region of Missouri and Arkansas. There are two counties selected for Indiana, one in the southern hill portion and the other in the northern part. These counties are in addition to the one already canvassed for the central belt and all three represent belts which extend outside the State. One locality is chosen in northern Wisconsin to represent the timber and farming conditions of both northern Minnesota and Wisconsin and one for the southern part of Minnesota. The two remaining localities represent conditions in the prairie region and will be selected in eastern Iowa and southeastern Nebraska.

One of the main objects of the study is to show the capitalized value of the woodlot land based on net returns from the products and an interest rate of 5 per cent compared with the actual sale value of woodland. In arriving at this value the gross value of all woodlot products, used on the farm and sold, is found and from this amount is deducted the cost of maintaining the woodlot and the labor cost of getting out and marketing the products. For the Connecticut locality the estimated value of woodlot land average \$8.13 per acre and the capitalized value of \$10.80, leaving a balance of \$2.67 per acre in favor of the woodlot business. This is due to the fact that the land is rough and ledgy with low farming values. In the central belt of Indiana the farming values are high with level fertile land easily cultivated which makes the showing decidedly against the woodlot on a strict financial basis. Here the average estimated value of woodlot land per acre is \$128.31, and the economic value \$26.20, leaving a balance against the woodlot of \$102.11. In other words, land which will sell for \$128 per acre is used for woodlot purposes giving returns on a \$26 per acre valuation only. The character of the land and its suitability for farming determines largely the value of the woodlot business. In Chester County, southeastern Pennsylvania, there is good farmland but the woodland is usually on the rougher parts. Here the values are more nearly equal as the estimated value per acre is \$18.16 and the economic value \$28.40, leaving a balance in favor of the woodlot of \$10.24. In central North Carolina the economic value is low—\$5.80 per acre—and the balance

against woodlot is \$6.40. This is mainly due to lack of market and low value of fuel wood.

If the direct returns included all the values and advantages of a woodlot on a farm, the showing would be good for the timbered districts where the land is not agricultural in character. But there are other advantages to the farm as a whole, such as shade for stock, protection from storms, pasture value, prevention of erosion on steep slopes and utilization of inferior land of little or no value for other purposes.

Where the woodlot is perhaps related most closely to the welfare of the farm in its intelligent and systematic management is in furnishing work for men and teams through the slack period, usually the winter. Even where the returns are only sufficient to pay the expenses or part of the expenses of the labor in getting out the material it raises the total income of the farm as the expenses of carrying necessary work stock, and help through the winter are eliminated or reduced.

The convenience of a ready supply of wood material at wholesale cost for repairs on the farm is no small item, particularly in the rush season.

The following are important points relating to the management of the farm and woodlot:

1. Region where located, whether generally timbered or untimbered.
2. Agricultural value of the land—its fertility and ease of cultivation.
3. Whether there are home needs for woodlot products and a steady market value for the surplus.
4. Value of direct returns including wood products used at home and sold.
5. Protection value, i. e., windbreak, shade and erosion.
6. Grazing value.
7. As a means of fully utilizing inferior land on the farm.
8. As a means of furnishing labor for idle help and work stock through the winter or other slack period.

The Des Moines Sawmill Co., Iowa, it is reported, manufactures more gunstocks than any other factory in the world.

Grazing Resources and their Utilization on the Wallowa National Forest

E. H. STEFFEN, '18
U. S. Forest Service

It had always been the custom for settlers to graze their stock on the vacant public lands near the settlement without supervision or restraint, and it naturally followed that when National Forests were created and the areas closed to certain classes of stock and the grazing of all stock restricted, much opposition arose. Prior to 1897, all National Forests were closed to sheep grazing, on the supposition that this class of stock was injurious to the forest cover. This was true to a certain extent, but the damage in most cases was due to the method of handling the stock. In 1897, the forests in Oregon and Washington, and later the other National Forests, were opened to sheep, and since the advent of the regulated use of forage, there has been very little material damage to the forest cover, and the almost depleted ranges are gradually returning to their normal vegetative cover.

It is true that we must have trees and lumber, but we must also be fed and clothed, and the meat and wool producing powers of the forage on the National Forest lands is too great to be lost sight of. According to the Forester's report there are at present some 7,280,000 sheep and goats, and 1,725,000 cattle and horses and their additional increase, which range on the National Forests. Grazing should, therefore, not be considered as an accident to National Forest administration, but as a legitimate aid in capitalizing an enormous forage resource, and an important adjunct in the proper control of fires.

Up to the present time, the utilization of the grazing resources has been the major activity on the Wallowa National Forest. While there are some fairly large bodies of good timber here, there has heretofore been no call for it except a

limited amount for local consumption. Now, however, a timber sale of approximately 120,000 M. B. F. is under way. The larger portion of the area of this Forest is chiefly valuable for watershed protection and the forage over the entire area.

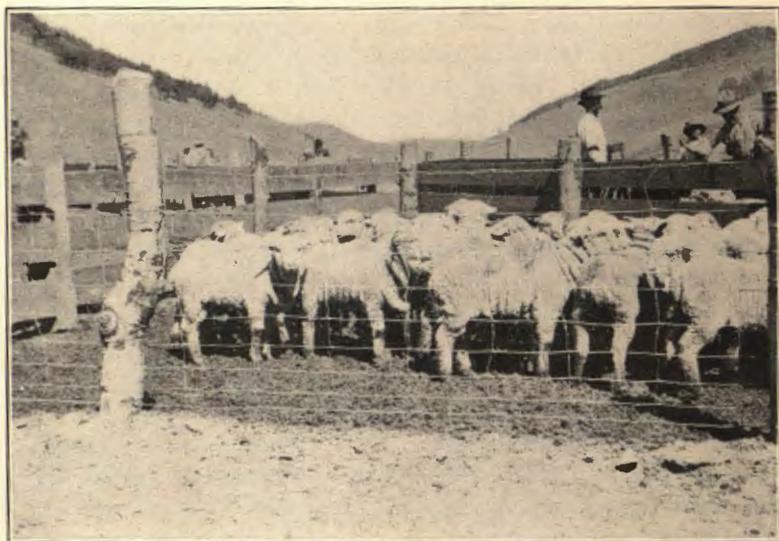
The geological formation and consequent topographic conditions of this region are in a large measure responsible for the value of this Forest from a grazing standpoint.

The entire Forest is part of that great lava flow known as the Columbia River plateau which covers 250,000 square miles of this northwest territory. This great lava flow surrounds several prominent mountain ridges which stand out boldly. Of these mountain ranges, the Wallowa mountains are mostly within the boundaries of this Forest.

The entire Forest lies within the Snake River drainage area—Snake River itself forming the 70 miles of eastern boundary. Along the boundary the river has a comparatively low elevation of from 900 to 1600 feet above sea level. From Snake River the elevation rises by successive stages to about 10,000 feet in the Wallowa mountains with a consequent variation in climate. It is this variation in climate that makes this Forest of particular value from a grazing standpoint.

The precipitation of the region varies from 12 inches at the lower altitudes to 30 inches or more on the high mountains, and either dry farming methods or irrigation are resorted to on the ranches within or adjacent to the Forest.

While the timber values of this region are great, it is probable that the community and its development are more dependent on the stock-raising industry than on any other one thing, and the forage on the National Forest lands is the greatest item in the stock-raising industry of this region, comprising, as they do, a large percent of the available range. Previous to the creation of this Forest there was a mad scramble for the range, without system or regulation. This state of affairs continued for years with a consequent depletion of ranges and a gradual diminution of the forage resources on which the community development is dependent. It is safe to say, that had not the National Forest been established and grazing regulated, much of the available range would have been ruined.



A valuable product of the National Forests. A flock of young sheep ready for shipment.

Photo by E. W. Nelson.

The grazing plan for this Forest for the coming year recommends that 19,000 cattle and horses, 105,000 sheep and 100 swine be allowed to utilize the ranges on this Forest, which in itself is an indication of its forage resources.

The range as a whole may be roughly divided as follows:

Summer, cattle and mutual, (includes spring and fall sheep range	380,000 A.
Summer sheep range	320,000 A.
Winter cattle range	150,000 A.
Winter sheep range and lambing grounds.....	160,000 A.

The northern portion of the Forest, comprising about 13 townships, is mainly a plateau area, from which the drainage flows southerly into the Wallowa valley, or northerly into the Snake River. This plateau area has been only slightly dissected by erosion, and only a few deep and prominent canyons are to be found in this region, and these do not grow deep until they near the northern boundary of the Forest. It is on this area that the accessible merchantable timber is to be found.

To the east and south of this plateau area lies Snake River and its tributary canyons. This area is geologically similar to the northern plateau, but is more deeply dissected, and while some fairly large flats occur in the region, it as a whole consists of long narrow ridges and deep canyons, with narrow valley floors. From Snake River the walls of the canyon rise more or less precipitously to a height of from 5000 feet to 7100 feet above sea level. Numerous bench areas are to be found in the canyons, parts of which are suitable for agriculture. This deeply dissected plateau area leads up to the Wallowa mountains which are very rugged and large areas are barren or at best support but a scanty plant growth.

Roughly, the Forest lies in the shape of a horseshoe surrounding the Wallowa valley and the rolling hills to the east of it, to which the major portion of the settlement of this region is confined.

The summer cattle and mutual ranges, parts of which are used as spring and fall sheep ranges, are confined to the more accessible timbered northern plateau area, and the larger of the flats in the more deeply dissected region lying to the

east and south. Some of the larger flats are also used as summer sheep range.

The types on the summer cattle range may be divided into three broad classes, grass, browse and weed types, in order of importance, all being timbered types. On the northern plateau area the larger percent of the area consists of an almost pure stand of pine grass, and in point of area, it is also probably the most important type on the Forest. The composition of a typical pine grass type is about as follows:

PINE GRASS

		Per Cent
Surface supporting vegetation.....		90
Average density		80
Palatability		60
Timber, yellow pine, Douglas fir and larch.		
GRASSES 70%	WEEDS 15%	BROWSE 15%
	%	%
Pine grass	Alum root	Chaparral
Koeleria	Arnica	Large huckleberry...20
	Bluebell	Spiraea
	Yarrow	Willow
	Everlasting	Kinnikinnick
	Clover	
	Lupine	
	Geranium	

Of the browse types the large huckleberry and small huckleberry are by far of greatest importance on the summer cattle range and spring and fall sheep range, though the browse types along the creeks are in the aggregate quite important, and help to make up a proper balance of the different classes of forage on any allotment.

The following may be taken as typical browse types:

LARGE HUCKLEBERRY

		Per Cent
Surface supporting vegetation.....		70
Density		90
Palatability		60
Timber: Lodgepole pine.		
GRASSES 5%	WEEDS 5%	SHRUBS 90%
Pine grass	Clover	Large huckleberry
Sedge	Strawberry	Willow
	Potentilla	Sevenbark
	Arnica	

BROWSE (Along Creeks)

	Per Cent
Surface supporting vegetation.....	90
Density	70
Palatability	30

GRASSES 15%

WEEDS 15%

SHRUBS 70%

		%
Pine grass	Aster	Thimbleberry10
Sedges	Potentilla	Currant10
Bromus	Senecia	Mock orange20
	Clover	Gooseberry10
	Arnica	Spiraea 5
		Serviceberry10
		Willow10
		Maple10
		Rose 5
		Alder10

SMALL HUCKLEBERRY

	Per Cent
Surface supporting vegetation.....	60
Density	40
Palatability	30
Timber: Lodge pole pine.	

GRASSES 10%

WEEDS 15%

BROWSE 75%

Pine grass	Lupine	Small huckleberry
	Fireweed	
	Anophilus	
	Arnica	

It may be said of the small huckleberry type, that it is practically worthless from a grazing standpoint, and it occurs principally on the higher spring and fall and some of the summer sheep ranges in the neighborhood of the high mountains.

In the spring and early summer, as soon as the forage on the respective ranges has attained a sufficient growth to prevent excessive injury by grazing and trampling, the stocks are allowed to drift or are driven from the low winter ranges onto the higher ranges. This generally takes place during April and May for cattle, and the sheep go on the summer range in late June or early July. The type of forage on this class of range necessitates that it be used as early as possible, since pine grass in its early stages of growth is quite palatable and succulent, but later on as the dry summer weather continues, pine grass becomes more harsh and loses its palatability and forage value to a large extent, and while the stock do not relish it under these conditions, they will graze

it when forced to do so. Supplementing the pine grass type and adding much to the forage value of the entire area are the different shrubs and weeds which are found in mixture with the pine grass in the pine grass types and the more or less pure types of browse and weeds, the composition of which have been previously given. These supplemental types are to a large extent responsible for the value of this class of range, since they maintain a proper balance between the different classes of forage, and increase the value considerably.

It has been noted on this Forest in two widely separated areas that where pine grass has been heavily overgrazed, a species of small clover supplants the original pine grass type to a large extent. This condition has increased the carrying capacity of these ranges to a considerable extent, since the clover type which has come in is much more palatable than the original pine grass type, and remains palatable for a greater period of time, and grows up again in a short time after being grazed, if moisture is to be had in sufficient quantities. This case is practically the only one where it is known that overgrazing in any form is beneficial in any way. Generally, overgrazing causes a diminution of the more valuable forage plants, and an increase in the percentage of less valuable species.

Cattle and horses occupy the summer range from about May 1 to October 31, and the efficient use of the range by this class of stock depends upon the method of handling. Horses and cattle, not being under constant supervision as are sheep, naturally occupy the areas easiest to graze. In the beginning they are distributed over the range as evenly as possible and their future movements are regulated as much as possible by drift fences supplemented by occasional riders, and to a larger extent by watering facilities and the proper location of salting places in relation to available water. During the summer season cattle require about 10 pounds of salt per head, and should they receive an inadequate amount they will not do their best, and become uneasy and travel too much and will not put on fat, nor will they use the range to the best advantage. It is possible by correct location of salting grounds to force the cattle traveling between salting and watering places to

utilize much range that they would not go over if salting grounds were not correctly located. The development of watering places is also a great asset in the proper utilization of the range in this respect.

Sheep using the summer cattle and mutual ranges use their allotted portions first early in the spring, shortly after lambing, thus supplying the tender feed much needed to keep the ewes in good milk-giving condition, and to supply the lambs with succulent forage which is necessary during the first few months of their existence. On the supply of tender forage at this period depends to a large extent the growth and development of the lambs. When the snows have melted on the high mountain sheep ranges and the areas at the foot of the mountains, the ewe bands with lambs leave the summer mutual ranges for the high summer ranges, where they continue to have an abundance of tender palatable forage.

In the fall when the sheep have been driven off the high summer ranges by the snow, the ewes and the remaining lambs (some of the lambs having been cut out and sold) are driven back onto the mutual ranges to utilize such portions of the range as have not been fed off by the cattle and horses.

Though sheep utilize, during the summer months, much of the range previously described, the typical summer sheep range is confined to the high mountains whose difficulty of access and ruggedness precludes the use of the area by other classes of stock, though, there are areas—especially the basin areas at the head of streams—which are covered with excellent forage, and which could be easily utilized by cattle.

The sheep are driven to the high summer ranges about July 1, utilizing first the lower slopes and canyon bottoms, and progressing upward as the heavy winter snows melt, and the forage develops.

It is rather difficult to make a general classification of the types in this region, but a few of the more important ones will be outlined. First in importance from a forage value standpoint comes the mountain bunch grass type, the principal forage plant of which is mountain bunch grass (*Festuca viridula*).

MOUNTAIN BUNCH GRASS TYPE

	Per Cent
Surface covered	60
Density	80
Palatability	80
Timber: Scattered white-bark pine, lodgepole pine and alpine fir.	

GRASSES 70%	WEEDS 15%	SHRUBS 15%
Festuca	Everlasting	Sage
	Yarrow	
	False alum root	

GRASS-WEED TYPE (Found along some streams)

	Per Cent
Surface cover	90
Density	90
Palatability	80
Timber: Scattered mature Douglas fir, western larch, Engelmann spruce, and seedlings, saplings and poles of lodgepole pine, western larch, Douglas fir and Engelmann spruce.	

GRASSES 70%	WEEDS 30%
Wheat grass	Hellebore
Cheat	Giant larkspur
Blue grass	Mallow
Tickle grass	Strawberry
	Bluebell
	Sego lily
	Hydrophyllum
	Antenecia
	Anophilus
	Drymocalis
	Nettle
	Niggerhead
	Meadow rue
	Dandelion
	Geranium
	Yarrow
	Fire weed

GRASS (Timbered)

	Per Cent
Surface covered	80
Density	80
Forage plants	80
Timber: Lodge-pole pine, white and Douglas fir.	

GRASSES 60%	WEEDS 40%
Fescue	Pentstemon
Pine grass	Wooly weed
Blue grass	Alum root
Sedges	

MEADOW TYPE (no timber)

	Per Cent
Surface covered	100
Density	100
Palatability	70

GRASSES 35%	SEDGES 35%	WEEDS 25%	SHRUBS 5%
Poa	Various species	Drymocalis	Mountain heath
Agrostis		Gentian	
Others		Strawberry	
		Others	

BROWSE TYPE

	Per Cent
Surface covered	100
Density	90
Palatability	50
No timber. (Scattered Douglas fir saplings.)	

GRASSES 35%	WEEDS 25%	SHRUBS 40%
Pine grass	Columbine	Aspen
Bromus	Sego lily	Willow
Rye grass	Geranium	Ceanothus
Fescue	Yarrow	Buckbrush
	Senecio	Large huckleberry
	Peavine	
	Paint brush	
	Valerian	
	Strawberry	

WEED TYPE

	Per Cent
Surface covered	60
Density	70
Palatability	50
Timber: White fir, lodge-pole pine, Engelmann spruce.	

GRASSES 20%	WEEDS 60%	SHRUBS 20%
Blue grass	Meadow rue	Small huckleberry
	Monkshood	Currant
	Valerian	Spiraea
	Saxifrage	Serviceberry
	Strawberry	

The return from the lamb crop is largely dependent on the handling of the ewe bands with lambs on the summer ranges. It has been noted on this Forest that lambs from two different bands of the same breed of ewes having equal chances on like ranges have in the fall differed in average weights as much as 17.7 pounds. This difference in weight can therefore be due to one thing, that is, faulty handling of the sheep. It might also be said here that lambs grazed outside the Forest weighed 64 pounds, while those grazed inside the Forest on like range weighed 67½ pounds at selling time. From the summer ranges the sheep are driven back to the lower fall sheep and mutual ranges, and in this way are able to utilize the forage not touched by cattle during the summer. Neither the ewes nor the remaining lambs are, at this time, so much dependent on succulent forage for proper growth and development, and can therefore utilize the left-over areas to good advantage. Here they remain until the snow forces them to seek the open winter ranges at the lower altitudes.

A large percent of the winter range of this region is within the Forest boundary, and lies along Snake River and the deeper of its tributary canyons. The small amount of precipitation at the lower elevations at which the winter range lies precludes the growth of much timber, and consequently the range is all of an open bunch grass type, the composition of which is in the main largely as follows, varying to a certain extent on account of the directions of the slope which it occupies:

OPEN BUNCH GRASS TYPE

	Per Cent	
Surface cover	90	
Density	90	
Palatability	80	
GRASSES 70% WEEDS 20% SHRUBS 10%		
Wheat grass	False alum root	Serviceberry
Koeleria	Yarrow	Rose
Carex	Lupine	Tassel bush
	Club moss	Maple
	Potentilla	

The value of the winter range, as far as the forage value of the types is concerned, is all in all nearly equal, but the direction of the slope is the one salient feature about the winter range that must be taken into consideration in allotting the range and the handling of the stock thereon. Slopes having a northerly exposure are naturally cold, freeze up early and remain frozen during the colder winter months, which prevents the new growth of grass to a very large extent. It is a peculiar fact that the grasses on the north slopes have a carrying capacity of not more than half that of the south slopes; while no investigation has been made to determine the truth of this statement, it is well known to stockmen that the slopes with a northerly exposure being frozen are dangerous for stock to encroach upon, because of the danger of sliding and consequent loss. On the winter range each band of sheep have an individual allotment, as they also do on the summer ranges.

The method of handling cattle on the winter range differs widely from the method used on the summer range. In allotting the summer range, allotments are large and are used jointly by a group or an association of permittees. The winter

cattle allotments are individual; that is, each permittee is allotted a piece of winter range as near his home ranch as possible, so as to enable him to look after his stock during the dangerous winter months, and develop his range to the best advantage, and so that he may eliminate to a large extent any loss by sliding, by fencing off the slopes where loss by such accident is liable to occur. By having his stock confined to an area near the home ranch during the winter months, it is a simple matter for him to collect the animals and feed them hay or other forage crops raised on the ranch, should occasion demand.

The amount of winter range being inadequate in proportion to the summer range, it is necessary that a large part of the stock grazing the summer ranges be driven to the ranches in the valley and surrounding foothills to be fed during the winter.

To illustrate some points of management and utilization and some of the results obtained for Forest Service administration, there is inserted here what Ranger Winniford has written about the Snake River Live Stock Association.

"A particularly good example of the beneficial results of stockmen working under the Forest Service administration, is on the Snake River range. Formerly there was very great uncertainty in the livestock industry on this range, regarding both summer and winter feed, and the effect was almost as bad on one range as on the other. This condition was due to two causes: first, the use of the winter range during summer. There were few, if any, drift fences, and the cattle were left on the range in the spring until they drifted back up the mountain side on to the summer range. There was very little incentive for a man to drive his stock out on the summer range, for his neighbors might object to the added expense and labor of keeping his stock on the mountain, or he might fear too great a loss, so that he would keep them around his ranch all summer, and let them drift back and forth over and ruin the range which should have been saved for winter. Fencing on the public domain was not allowed by law, and was therefore not resorted to. The range was therefore used just as it happened, without regard to when it was ready to use, or

economically most valuable. Second, on the summer range there was sharp competition between sheep and cattle, and the cattle were never able to put on fat. Then when they came down on to the winter range they were poor, and the range was bad, and many of them died from poverty, or slid off the steep hills and were crushed to death. No one expected to get any beef off the range. The administration of the Forest legalized drift fences, and this made it possible, not only to protect the winter range against destructive summer grazing, but to allow each permittee to protect his own winter allotment and build within it such drift fences as were necessary to keep the stock off dangerous sliding ground, and to so handle his stock as to secure the greatest amount of good from the use of the range. It also eliminated competition, protected the summer range for the stockman, insured the continuity of his business, and the fruitfulness of it. For some years each permittee was busy improving and developing his winter range. His stock now leave the winter range in good shape, but it was noticed that big steers, and in some cases, dry cows, did not put on enough fat during the summer to tempt the cattle buyer. Something had to be done. The Service encouraged the building of big drift fences which would separate the beef cattle from the stock cattle during the summer, and more uniform salting. It was a community matter, for the range was used in common by all the stock, and one permittee could not do the necessary work. An association was formed, and authorized the construction of the fence, which was built, and this served the purpose well, but it had to be paid for, and this disrupted the association, for the people were hardly ready for the progressive by-laws of the association. The association was pretty thoroughly dead, but the drift fence was working right along, and its good effects were so evident that as time went on the minds of all became more and more impressed with the good that it was doing, and at length the fence began to assume the form of a public necessity. Then came a time when it needed repairing. Everybody said so, and there were corrals to be built and repaired, business had been prosperous, so why not put up a good cabin at the head camp? The psychological moment had ar-

rived for the revival of the stock association, and the improvement of the summer range, if only the lid could be held down. The service encouraged the unenthusiastic, plead with the tight wads, and checked the radicals, and tried to harmonize the various elements. They were told that a permit for any special use would have to be held by the stock association if it was to be located on the summer range. The Stock Association was dead, it is true, but why not revive it? They did. They provided for more salt for the cattle, they planned water troughs, and made yearly programs for handling stock and using the range. They were all ready for the by-laws of the Association, and they felt at this time, with a recognized Advisory Board, the Stock Association could take a hand in grazing affairs. This gave the permittees a feeling of confidence. It began to look as if the beef cattle would always be of a quality that would demand a good price. Then why not further increase the price by breeding the stock up to a better standard, since better stock brought in better profits, and greater profits brought greater enthusiasm in the business. Now they are vieing with each other in suggesting improvements that can be made to benefit the range, and make the work of riding easier, so that still more time can be spent in improving conditions on the range. Prices are better now, and while this may be due entirely to market changes, no one hesitates about buying Snake River Stock, because they are a better grade than formerly. They are fatter than they used to be, they were never poor or hungry in their lives, their ranges are protected winter and summer, and their owners have confidence enough in their quality to demand the highest market price. Snake River steers sold as tops on the Portland market this fall. Conditions are still a long ways from ideal, but to deny that the administration of the Forest contributed anything to their betterment would be to deny that they have changed for the better at all."

The Forest Service administration of grazing lands has made it possible for the various sheepmen as well as cattlemen to plan definitely for the future, with the assurance that they will be allowed the more or less continuous use of the same range from year to year. This has stimulated the im-

provement of the range by the permittees themselves in the building of trails, and the development of watering places in co-operation with the Forest Service to open new and formerly unused range. Due to regulation, the former waste in the use of forage has been stopped. By assigning permittees to definite allotments, and by regulating the time that each camp on an allotment is to be used, the greatest good compatible with economic results is now obtained from all the range.

The educational features of the Forest Service administration should not be lost sight of. By experiment and by co-operation with the stockmen in all parts of the west, various problems in methods of handling stock on the range have been worked out, and are being brought to the attention of the users of the range. Among these problems may be mentioned:

1. Water development.
2. Salting; amount required, and best location for salting places in relation to watering facilities and forage.
3. Deferred and rotation system of grazing.
4. Bedding-out system of handling sheep.
5. Poisonous plant studies.
6. Forest Service influence in the destruction of predatory animals.

The regulation of cattle and horses on the various ranges by drift fences built through the co-operation of the members of the various live stock associations, has resulted in a great saving of time, money and forage, and in a considerable gain in beef.

The following figures taken from the Annual Grazing Report for this Forest will show approximately the value of the forage resources of the Forest to the community:

“The Forest will carry 6000 head of cattle yearlong. At 3 years of age they will be worth at the present market price, \$60 per head, or \$20 per year for the three years. This would amount to \$120,000 for the cattle under year-long permit. 12,000 additional cattle can be cared for during the period from April 1 to November 30. As it would cost about \$15 per head to carry them through each of 2 winter seasons, this would leave \$10 yearly value through each of 3 years,

for the National Forest forage consumed, or an annual revenue of \$120,000. There is range for 34,000 head of sheep yearlong, and for 66,000 additional sheep during the season from June 1 to October 31. It will cost \$1 per head to feed these sheep during the remainder of the year. At two years of age each sheep would be worth, using present prices as a basis, \$5 per head, and would have sheared 15 pounds of wool at 20c per pound. This would make each sheep yield \$8 at two years of age, or \$136,000 for the yearlong sheep, and \$462,000 for the sheep grazed part of the season, or \$299,000 for one year. The grazing resources then will produce beef, mutton and wool valued as follows:

Cattle grazed yearlong	\$120,000
Cattle grazed during part of year, less amount re- quired to carry them balance of year.....	120,000
Sheep grazed yearlong, including 7½ lbs. wool each	68,000
Sheep grazed during summer, less amount to carry them balance of year	231,000
	<hr/>
	\$539,000''

The Wallowa Forest and its adjoining agricultural lands in Wallowa County may then be described as an excellently balanced grazing unit, capable of supporting, when fully developed and utilized, 120,000 head of sheep and 25,000 head of cattle and horses. The farm lands depend upon the Forest ranges for the profitable utilization of their products, and without these products the stock could not so profitably utilize the forest ranges. There is enough hay raised to supplement the winter range and feed the farm stock, so there is practically a continuous balance in farm and forest during the entire year.

In 1915 the Forestry Club of Iowa State College became a member of the Inter-Collegiate Association of Forestry Clubs. T. W. Rehmann, who was elected local vice-president of the national organization, will represent Ames at the next convention of the association to be held at Seattle, Wash., in November, 1916.

Reforestation on the Minnesota National Forest

H. H. RICHMOND, '12
U. S. Forest Service

The Minnesota National Forest was created by an Act of Congress in 1902. It comprises a net area of 197,000 acres. The tract is located at the headwaters of the Mississippi River and aside from an economic standpoint, is valuable as a protection forest and also as a public recreation ground. It is known throughout the middle west and even on the Atlantic Coast as the playground of Minnesota. Its many lakes, its excellent beaches and bathing facilities, combined with a stand of virgin white and norway pine, such as can be found nowhere else in the United States, attract many tourists. As a result, during the past four years, two summer hotels have been constructed. In addition, thirty-five summer homes have been built along the lake shores by people from Minnesota, Iowa, North and South Dakota, Nebraska, Missouri, Illinois and even New York.

From an economic standpoint, the Forest is entirely accessible either by water or railroad. The Mississippi River flows through the center, while two railroads cross the Forest from East to West. It is bounded both North and South by waterways. The market for timber is unlimited and the quality of the stumpage is unsurpassed. No substitute can be found for white pine and as for norway, it is second only to the first named species.

The silvicultural system in vogue on the Forest consists of clear cutting with scattered seed trees. Until 1908, 5% of the entire stand was left as scattered seed trees, but after careful observations it was found that 5% was insufficient to restock the area. As a result a bill was passed which required 10% of the stand to be left instead of 5% as formerly. The scattered seed tree system has not proven an entire success on the Minnesota National Forest. It has had many oppon-

ents among the lumberman who could not understand such a system of management. It was necessary in marking the seed trees to leave many that were mature and over mature and of little value as seed producers. Many of the seed trees have blown down. After ten years of close observation, it has been found that the seed trees have been practically valueless. On the other hand, the policy should not be condemned because it has been one step—a great stride—toward the advancement of Forest management. It is needless to quote statistics or dwell upon the causes and results of the failure.

In July, 1915, the writer spent several days with Mr. Raphael Zon in examining cutover 5% and 10% areas. Not a single instance could be found where reproduction could be attributed to the seed trees. A good seed year occurred in 1910 and accordingly, examinations were made upon areas that were logged in 1909, 1910 and 1911. On one particular area where the logging had been done in the winter of 1910 and 1911, a fine stand of reproduction covers the ground. The entire stand produced the seed and it cannot be attributed to the 10% left as seed trees. The seed was on the ground at the time of logging and the same results would have been accomplished had the area been clear cut. Examinations of all other areas proved the seed trees valueless. Under present conditions, there is little or no chance for the seed trees to restock the area. The ground cover has grown up very dense and in addition there is a tremendous amount of litter that effectively keeps the seed from reaching the mineral soil and precludes all chance of reproduction. Cultivating the soil with the advent of a logging operation seems to be the only method by which natural reproduction has been obtained. In that case, the 10% left has had no more influence in the reproduction than the 90% that was logged. The seed was produced by the entire stand and was on the ground at the time of the lumbering.

Ten sections of the Minnesota National Forest were not included in the timber sale and have been set aside to be maintained on a sustained annual or periodical yield basis. The cutover area produced 500 million B. F. which have been removed in the past 13 years. Had this area been handled on a

sustained annual or periodic yield basis the Forest would have been perpetuated and today we would not be worrying about the reforestation of 85,000 acres of land. In addition, there would have been a permanent industry in our midst drawn directly from the economic resources of the Forest. As it is, the business has moved to new fields.

Natural regeneration has proven unsuccessful, and it will be necessary to restock the area artificially. Planting is far more economical than the scattered seed trees, even if they had been a success in starting a new stand. Reforestation by planting falls under two lines of work, namely nursery operations and field planting.

NURSERY OPERATIONS

The Forest Service recognizes the value of reforestation work. White pine and norway pine, the two most important economic species, are represented in the nursery, because they have the highest market value. They are fairly rapid growing trees and combined with favorable soil, site and moisture conditions such as are found in Northern Minnesota make field planting a proposition that will bring a fair rate of interest on a long time investment. In 1913, a small ranger nursery existed at Cass Lake. At that time it was authorized at 200,000 capacity. In the same year it was enlarged and authorized at 500,000 capacity, with 300,000 white pines and 200,000 norway pines. Fifty per cent of the output is 2-1 stock, 20% 3-0 stock and 15% 1-1 and 2-0 respectively.

The nursery is located on National Forest land bordering the townsite of Cass Lake. The location is a particularly favorable one. In locating a nursery, the following factors are taken into consideration.

1. It should be located favorably in regard to the distribution of its products.
2. A well drained sandy loam soil is preferable.
3. It should be situated so as to escape frost and other injuries and should never be located in low, damp surroundings where it is highly susceptible to damping off.
4. An adequate water supply should be at hand.
5. Labor should be available at all times.

The Cass Lake Nursery has all of these peculiarly de-

sirable points except soil, which is for the most part sand and must be subjected to a building up process. It represents the one big factor with which the nurseryman has to contend. It is being overcome by the application of large quantities of well rotted manure that is stratified in manure receptacles. In addition, every square foot of available surface is sown to a cover crop, such as cow peas and rye. Commercial fertilizer applied directly to the beds during the growing season proved to be of great value in 1914. Because of the absence of a subsoil or even substrata, the plant food leaches away very quickly, but there can be no doubt that commercial fertilizer or immediately available plant food applied at the proper time and in the proper manner will stimulate plant growth.

The nursery is situated between two rather large bodies of water which, during times of low temperatures, prevent injuries from frost. Its close proximity to the town of Cass Lake eliminates the labor question and no mess or bunk house is required. The stock may be distributed either by rail or water. The freight or express depot is only one-half mile from the nursery, while a three-quarter mile haul will place the young trees at the dock. The latter combined with a government owned motor boat and barge affords a low distribution cost.

A pressure system supplies the water which is pumped into a tank installed on the top of a tower 30 feet high. The nursery proper, upon the installation of the water system, was divided into 100 foot squares and at the center of each a hydrant was erected.

Few nurseries have advantages such as this one. In fact, the writer does not believe there is another nursery in the United States where the supply and demand is entirely taken care of by the local forest. The seed is obtained from the Minnesota National Forest area. Everything necessary in nursery operations is obtained from the Forest and all of the stock raised is planted back on it, so it may be truthfully said that the Cass Lake Nursery exists through and for the Minnesota National Forest. Even the moss—such an essential factor

which is hard to procure for some of our nurseries—is found in great abundance not forty rods from the nursery site.

SEEDLINGS

Nursery work does not differ materially from many other agricultural pursuits. It is only a few steps in advance toward what we might call intensive farming. With that idea in mind, the ground is worked both fall and spring and placed in a mellow, friable condition. The beds are laid off 4' x 12' over which a seed bed cage is placed. Two foot paths are left between the beds while at regular intervals 4' paths are left. This is done to facilitate the work of watering and cleaning up.

Equal amounts of seed are sown both fall and spring. One half of the beds are sown broadcast and the other half drilled. In drilling, the beds are prepared the same as for broadcasting. They are then marked off into drills 4" apart. A board 4' long and 2' wide, with six V shaped markers is used in making the drill. By exerting pressure on it, the drills are made $\frac{1}{4}$ " deep. The quickest and most economical method of drilling seed is to take an empty shot gun shell and cut it off until it holds the amount required for sowing one half row. It is easier to work around the bed and sow one half row at a time. The cost of drilling exceeds that of broadcasting but it is not excessive. The beds are sown with the idea of growing 100 seedlings per square foot. It has been demonstrated conclusively that the beds have been overcrowded with the result that the seedling stock, whether used for transplanting or field planting was small, spindling and lacking in general appearance and suffered enormous losses. One hundred seedlings per square foot allows sufficient root and growing space and produces, stocky, sturdy plants that are able to withstand the shock of transplanting or field planting.

The one great danger, especially with norway pine, is the damping-off fungus. Each year we have suffered great losses. No practice, such as the manipulation of shade frames or the application of sand, seems to check it. The Bureau of Plant Industry is now working on prophylactic measures to control the disease.

A comparison of spring and fall sown seed brings out the

fact that the seedlings in the norway pine fall-sown beds are a little larger but there is not such an appreciable difference as is seen in the white pine. The white pine seedlings are one-fourth larger in the fall sown beds and while the same amount of seed is sown per square foot there are many more seedlings probably 25% more than from spring sowing.

During the early part of the season, while the seed is still germinating the beds are watered daily. It is thought that frequent light waterings are more beneficial than flooding of the beds. At the end of the germination period the water is gradually reduced until at the end of the growing season, the beds are watered but once a week. The older class of seedling stock receives water but twice a week during the early part of the growing season and but once every ten days toward the end. More water is applied to this class of seedling stock but at no time are the beds in a flooded condition.

TRANSPLANTS

Transplanting requires very close supervision. Under poor management, the transplanting is done at a very high cost and in the majority of cases results in large losses of stock. These losses may be due either to subjecting the plants to the sun and wind or it may be due to improper methods of placing the plants in the transplant bed, or a combination of the two. The personnel of the transplant crew may vary according to conditions and methods, but on the whole it has been found that the trencher method is the most satisfactory and has produced the best results at lowest expense and with less loss of stock. The transplanting crew as used here consists of seven men, namely: one trencher, two tampers and four threaders. Two crews are worked under the supervision of one man.

Five or six beds are laid out and worked as a unit, carrying forward a continuous front. Each threading table is provided with at least three planting boards. The boards are constructed so that the plants are spaced $1\frac{1}{2}$ " apart and in rows six inches apart. The threading table is covered with canvas, only one side remaining open allowing men freedom for work. It was found in using 2-0' stock that two men at

a threading table are more than enough to form a well balanced crew. There is always a little time intervening between boards so that in using 2-0 stock of good quality, three men at two tables, the odd man alternating between tables, will be the most economical crew. The small 1-0 stock requires two men at each threading table to keep the tampers busy. The soil on the newly made beds is raked down at the close of each day and flooded to firm it about the roots and thus eliminate air pockets and the consequent drying of the roots and loss of plants. Previous to transplanting the soil should be wetted down so that the trencher leaves the trench in good condition for the plants. Trench slits must be left perpendicular since small "cave-ins" of dry soil will keep plants from being properly transplanted.

Transplants as a rule, depending upon the nature and the texture of the soil, require an application of water at least every ten days during the early part of the growing season. Light sprinklings while beneficial do not fill the needs, a thorough soaking and even at times a flooded condition seems to bring the best results. Cultivating aside from hand weeding should be avoided as much as possible. Mechanical cultivation, unless accomplished in a very conservative and careful manner results in great destruction of young trees. Transplants must be spaced as closely as is compatible with growing conditions. Mechanical cultivation is very apt to sever lateral roots which results in dead, weak or spindling plants that have to be culled before being planted in the field. Transplants, while not so exacting as seedlings in regard to soil and moisture conditions must have for the very best results a soil that is rich and well drained. Every effort should be put forth to bring the soil up to the condition necessary for seedlings.

FIELD PLANTING

The stock is dug with a spade and placed in the packing box with the roots to the center. A small amount of soil is left on the roots which are securely packed in sphagnum moss. When the packing boxes are filled, they are placed in a cool, damp situation to await their immediate distribution to the field. The cost of digging and packing transplants and

seedlings amounts to \$.39 and \$.13 per M respectively. This cost could be materially lessened by the use of some mechanical device such the the Smith tree digger now in use at the Halsey Nursery.

The planting area on the Minnesota National Forest represents two types of soil—clayey loam and sand. These respectively represent white pine and norway pine situations. These sites are again divided into three different planting areas representing burned and cutover land. Some of the area is very open with very little ground cover. This condition signifies a hard burn. Other portions of the area are similar but in many places a dense growth of grass and low bushes has sprung up, while other parts of the area are entirely brush land.

These situations represent individual problems which must be solved by constant attention and a diversity of planting stock. It would seem that the open, barren soil, where there is no competition with grass or other undergrowth would afford an ideal planting site. Certain classes of stock, the older and hardier, do survive on such sites, but the smaller classes cannot live unless they are planted during a year when the precipitation is above normal and comes at the proper time. The roots of the smaller classes, such as the 1-1 are very short, compact and well developed but they do not penetrate the ground to a sufficient depth to survive a drought. This same stock with the same seasonal conditions planted in the brushy type or on the shady side of a log or stump does very well. Observations have proven that the smaller stock during the fore part of the growing season will appear healthy and produce strong growing shoots but upon the advent of a drought during midsummer, the survival percentage will materially decrease. The matted sod and low bush type is the most difficult with which we have to contend. None of the stock seems to be able to cope successfully with it. It is necessary, in extreme cases, to remove a certain portion of the sod in the immediate vicinity of the plant. This is done with a spade, but in cases where the country is open and there are few stumps, or old windfalls, logs or other debris that may be left on the ground at the

completion of a logging operation, it is advisable to plow a furrow and plant in it.

The slit method is used in planting which requires a crew of two spaders and one planter. The spader opens the slit, the planter puts in the tree and the spader completes the operation by inserting the spade and forcing the soil against the tree. The soil is then firmly pressed around the tree by tamping with the foot. Five of these crews work together and form a solid front under the supervision of one man or crew foreman who constantly walks back and forth behind the line to see that plants are set properly. The stock is wrapped in moss and burlap and carried under the arm. A thousand trees per man per day is an average day's work.

Some apprehension was felt as to whether the slit method would prove practical in the clay loam soil. It was found that by planting before the frost was out of the ground the work progresses even faster than in the sand.

The work of reforestation on the Minnesota National Forest has been firmly established. There is no doubt about the practicability of it, nor the success of the plantations already made, and it is only a question of time before the entire area will be covered with a tree growth that will be perpetuated.

If the twenty-five million posts required each year for Iowa fence-posts were set in one line and spaced a rod apart, they would build a fence three times around the earth at the equator. Their cost is nearly four million dollars.

A clearing house for fence-posts has been established by the Forestry Department at Iowa State College for the benefit of the farmers. "Many farmers in Iowa want to buy native grown fence-posts, but do not know where to buy them", says Prof. G. B. MacDonald. "Other farmers have fence-posts to sell, but do not know where to sell them". Several carloads of Osage Orange posts have been listed.