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State of Montana

Fifth Biennial Report

— OF THE —

State Forester



— TO —

Hon. Samuel V. Stewart
GOVERNOR

1917-1918

INDEPENDENT PUBLISHING CO.
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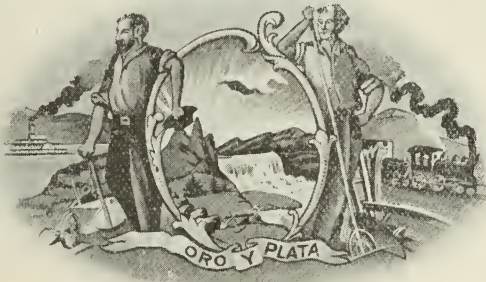
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1917-1918

LETTER OF TRANSMITTAL.

December 1, 1918.

To His Excellency,
Honorable Samuel V. Stewart,
Governor of Montana.

Dear Sir:

In accordance with the provisions of Section 10, Chapter 147, Laws of 1909, I have the honor to transmit herewith the Fifth Biennial Report of State Forester for the years 1917 and 1918.

Also have included, through the courtesy of the National Forest Officials, of Missoula, Montana, an ably prepared contribution, entitled, "ECONOMIC USE OF THE FORESTS OF MONTANA" by Mr. JOHN F. PRESTON, Assistant District Forester, United States Forest Service; District One.

Very respectfully
JOHN C. VAN HOOK,
State Forester.

STATE FORESTRY BOARD:

SIDNEY MILLER.....Register of State Lands, Chairman
CHAS. A. WHIPPLE.....State Land Agent
JOHN C. VAN HOOK.....State Forester

STATE FORESTER'S OFFICE:

JOHN C. VAN HOOK.....State Forester
H. L. SHERLOCK.....Assistant State Forester
Chas. S. Cairncross.....Field Representative



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TIMBER CRUISED

TIMBER CRUISED

For the two year period since my last biennial report the Department has examined, appraised and cruised, state lands, and timber, as follows:

Fiscal Year	Land—Acres	Timber—Feet
1916-1917	24,888	69,255,000
1917-1918	27,160	131,030,000
Totals	52,048	200,285,000

PERMITS ISSUED—(CLASS B).

This class of permits are issued for dead down timber, for domestic purposes, in limited quantities, free of charge:

Fiscal Year	Number Permits	Amount Cords
1916-1917	151	1,510
1917-1918	103	788
Totals	254	2,298

PERMITS ISSUED—(CLASS A)

Issued for green and dead timber, in limited quantities, for domestic purposes, and for fire killed and damaged timber, for commercial purposes, at such prices as may be designated by the State Board of Land Commissioners:

Fiscal Year	Quantity	Average Price Each
1916-1917	10,900 *Posts	1 1/3c
1916-1917	6,363 ‡Posts	2 1/3c
1916-1917	1,645 ‡Poles	2 1/3c

*(Dead)

‡(Green)

Fiscal Year	Quantity	Average Price
1916-1917	1,881 cords (dead)	32c per cord
1916-1917	832 cords (green)	53c per cord
1916-1917	171,350 feet (green)	\$2.22 1/2 per M
1916-1917	106,875 feet (dead)	1.50 per M
1917-1918	650,000 feet (green)	1.80 per M
1917-1918	326,330 feet (dama'd)	1.00 per M
1917-1918	358,420 feet (dama'd)	2.00 per M
1917-1918	1,179 cords (dead)	40c per cord
1917-1918	95 cords (green)	60c per cord
1917-1918	3,428 posts (green)	3 1/2c each
1917-1918	900 poles (green)	4 1/3c each
1917-1918	2,105 ties (dama'ed)	5c each

Making a total of 263 (Class A Permits) issued during the two year period, for an aggregate amount of timber, as follows:

Feet (Board Measure)	Posts	Poles	Wood Cords	Ties
1,612,975	21,591	2,545	3,987	2,105

TIE TIMBER

Live merchantable timber, advertised and sold under contract:

Fiscal Year	Number	Price
1917-1918	25,582 No. 1 ties	10c each
1917-1918	6,544 No. 2 ties	7 1/2c each
1917-1918	4,340 No. 1 ties	12c each

Total 36,466

MERCHANTABLE TIMBER

Live merchantable timber, advertised and sold under contract.

Fiscal Year	Feet (Board Measure)	Average Price
1916-1917	6,071,620	\$3.12 per M.
1917-1918	7,236,120	3.00 per M.
1917-1918	62,828	3.50 per M.
1917-1918	4,918	3.05 per M.
1917-1918	4,000	3.75 per M.
1917-1918	1,437	4.00 per M.
Total	13,380,923	\$3.062+

At the close of the fiscal year, November 30th, 1918. There is in operation, 32 Contracts for the sale of timber, in an estimated amount of 32,215,890 feet, and 111,000 ties, for the aggregate sum of \$110,964.00.

This evidences an increasing demand for timber.

FINANCIAL STATEMENT.

The receipts and expenditures for the past six years are as follows:

Receipts:

1913	\$ 4,688.44
1914	22,689.88
1915	20,079.62
1916	19,938.33
1917	20,922.97
1918	30,139.32

Expenditures:

1913	\$ 8,693.02
1914	11,537.10
1915	13,481.08
1916	12,251.71
1917	24,614.95
1918	18,962.05

Expenditures in detail for the fiscal year ending November 30th, 1917.

General Expense:

Salary	\$ 7,535.00
Travel	407.00
Office	551.20
Field	1,215.30
Total General Expense	<u>\$ 9,708.50</u>

Fire:

Salary (Patrolmen) Weeks Law	\$ 1,756.74
Transportation, Weeks Law	11.80
Regular Assessment, N. Mont. Forestry Asso.....	1,275.17
Special Assessment, N. Mont. Forestry Asso.....	3,825.51
Prorated Expense, Seely Lake Fire	702.09
Wages, Fire Fighters	4,484.04
Transportation	1,062.25

Equipment	245.20
Groceries and Supplies	1,042.63
Meals and Lodging	406.40
Telephone and Telegraph	30.90
Publicity	63.72
Total Fire Expense	\$14,906.45
Total Expense for the Year 1917	24,614.95

Expenditures in detail for the fiscal year ending November 30th, 1918.

General Expense:

Salary	\$ 7,337.46
Travel	593.75
Office	775.31
Field	3,439.15
Total General Expense	\$12,145.67

Fire:

Salary (Patrolmen) Weeks Law	\$ 2,830.31
Regular Assessment, N. Mont. Forestry Asso.....	1,786.18
Cooperative Fire Expense, Flathead Indian Reservation	78.40
Prorated Share, Valley, Foster, Deep Creek, Coleman Fires	555.04
Wages (Fire Fighters)	662.65
Groceries and Supplies	107.94
Transportation	333.18
Equipment	40.23
Telephone and Telegraph	24.11
Publicity (Printing, Distribution Fire Notices, etc.)	398.34
Total Fire Expense	\$ 6,816.38
Total Expense for the Year 1918	18,962.05

Receipts in detail for the fiscal year ending November 30th, 1917.

Timber sold for commercial purposes	\$12,996.72
Timber sold for domestic purposes	741.50
Timber sold under Certificate Purchase	7,152.50
Collection made for trespass	32.25
Total Receipts for the Year 1917	\$20,922.97

Receipts in detail for the fiscal year ending November 30th, 1918.

Live timber sold for commercial purposes	\$18,800.42
Fire damaged timber sold for commercial purposes	1,148.42
Timber sold for domestic purposes	1,700.06
Timber sold under Certificate of Purchase	6,883.99
Unexpended Bal. Forest Cooperative Work	311.37
Collection for trespass	10.05
Collection for timber lease	15.00
Collections made for extinguishing forest fires originating on privately owned lands	1,087.93
Rebate for exchange mileage books	182.08
Total Receipts for the Year 1918	\$30,139.32

As a matter of general public interest, the following information is submitted:

Twenty-five per cent of the receipts of the National Forests is devoted to the support of the Common Schools.

For the fiscal year ending June 30th, 1918, the proportion to which Montana is entitled, is as follows:

National Forests	Amount
Absaroka	\$ 2,232.59
Beartooth	3,472.88
Beaverhead	7,989.60
Bitter Root	5,633.12
Blackfeet	1,182.62
Cabinet	1,129.45
Custer	3,882.66
Deer Lodge	6,655.18
Flathead	9,608.00
Gallatin	1,874.48
Helena	5,225.72
Jefferson	5,686.86
Kootenai	1,504.66
Lewis and Clark	1,324.73
Lolo	5,028.70
Madison	8,112.10
Missoula	4,626.21
Sioux	1,428.00
	<hr/>
	\$76,597.56

Distribution of Forest Reserve Fund, by Counties for the Year 1918

County	Amount
Beaverhead	\$ 8,682.55
Blaine .....	.11
Broadwater	1,151.95
Carbon	1,615.69
Carter	1,428.00
Cascade	2,197.16
Chouteau	165.76
Custer	3,031.54
Deer Lodge	2,087.82
Fallon	17.38
Fergus	1,021.99
Flathead	8,277.25
Gallatin	2,892.78
Granite	3,217.31
Jefferson	3,714.16
Lewis and Clark	3,165.36
Lincoln	2,030.62
Meagher	2,465.78
Madison	6,320.60
Mineral	3,541.64
Missoula	2,882.68
Musselshell	130.64
Park	2,344.68
Phillips	157.82
Powell	3,122.91
Ravalli	5,638.87
Rosebud	906.94
Sanders .....	.00
Silver Bow	1,390.63
Stillwater	464.27
Sweet Grass	1,572.52
Teton	648.64
Wheatland	310.51
Total	\$76,597.56

In addition to the foregoing 25 per cent distributed to the common school fund of the counties, 10 per cent of the receipts from National Forests Service is devoted to road building in the counties from which the receipts are derived.

MONTANA

Area in Square Miles 147.387

Area in Acres 94,196,480

Being the third largest state in the Union.

The whole area of the State may be roughly estimated and classified as one-third forest, one-third grazing, and one-third agricultural lands.

Eighteen (18) National Forest Reserves have been created in Montana, embracing a gross acreage of 19,400,000 and a net forest area of 16,027,000 acres.

TIMBER RESOURCES

From the most reliable data now available, Montana's present stand of living timber, of merchantable size, is estimated as 58 billion board feet, log scale.

This vast body of timber is made up of the following species in approximately the proportions given: Douglas Fir 22 per cent; Western Yellow Pine, 21 per cent; Lodgepole Pine, 20 per cent; Western Larch, 11 per cent; Englemann Spruce, 8 per cent; Cedar, 3 per cent; White Pine, 2 per cent; Miscellaneous, 13 per cent.

It is estimated that 29 per cent of this timber is privately owned, 4 per cent is held by the State, and the remaining 67 per cent is the property of the Federal Government.

Conservative estimates by the Forest Service indicate that the business of lumber manufacture in Montana represents an investment of about 22 million dollars. This great industry is second only to agriculture and mining. With the proper handling of the forest resources, the lumber business of Montana will always be one of its greatest industries.

The annual cut of timber in Montana has reached a volume of about 400,000,000 feet.

From June 30th, 1917 to June 30th, 1918, the following cut has been reported:

	Feet
United States Forest Service	82,771,000
Indian Reservations	17,000,000
State and Private	250,000,000
	<hr/>
Total	349,771,000

Summing up, the commercial value of the forests of the State, in all ownerships represents an aggregate community wealth of approximately \$1,400,000,000.

To a state whose greatest resources is its agricultural lands, the value of such a body of timber is incalculable. In developing the great agricultural possibilities, enormous quantities of timber are needed for building purposes.

FOREST FIRE COOPERATION

For the protection of the forests of Montana, all interests work in co-operation for the prevention and extinguishment of forest fires.

Under agreement with the State of Montana, and the United States Department of Agriculture, forest fires occurring within the boundaries of the National Forest Reserves, or within one to three miles outside of said boundaries, shall be extinguished by the National Forest Service, under the jurisdiction of the Supervisors of the several forest reserves.

The Forest Supervisor shall divide the expense of each fire, in accordance with a pro rata basis, determined by outlining the exterior boundaries of the area endangered by such fire, and computing the ratio of the acreage of lands owned or claimed by the State, the Government, and other cooperating owners, within such endangered area, making a full statement in duplicate of the total cost of such fire; shall certify the amount to be paid by the State, together with a full statement showing the total cost of the fire, and a map showing its location, the exterior boundaries of the endangered area, and the holdings of the State, the Forest Service, and cooperating owners, upon which the prorating of the expense is based, and upon verification, the amount is paid by the State.

Under the "WEEKS LAW" Agreement, between the State and the Federal Government, a fire patrol system is maintained in Montana.

The Weeks Law, by act of Congress of March the 1st, 1911, provides a fund to be expended in cooperation with the states, for the protection of forested watersheds of navigable streams.

The allotment to the State of Montana from said fund has been not to exceed \$3,500, provided the State would expend a like amount. This has made available an annual sum of \$7,000 for the prevention of fires by patrol work.

Under this agreement there is now being maintained in Montana, a patrol of twenty-one (21) men during the summer months. These patrolmen are placed in localities where the greatest danger from forest fires exist.

The Northern Montana Forestry Association, was organized in 1911, being a mutual association of timber owners in Flathead and Lincoln Counties. An annual assessment is levied for fire protection.

The area embraced within the boundaries of said association is 2,500,000 acres; the State of Montana being the owner of 123,861 acres. The State is a member of the association, and cooperates by paying its assessments, the State Forester being a member of the Board of Directors.

The regular assessment for the current year, 1918, is one and one-half ($1\frac{1}{2}$) cents per acre. To meet emergencies a special assessment may be levied. Last year, 1917, was the worst fire season of record in Montana, necessitating a total levy of four (4) cents per acre by the association for patrol and fire extinguishment.

For the present year, 1918, the association is employing a force of fifty-four (54) patrolmen.

Agencies such as the Northern Montana Forestry Association, are reducing the fire risk, and seems the best method of protecting our forests from destruction.

The affairs of the Northern Montana Forestry Association are ably managed by the Chief Fire Warden, Mr. A. E. Boorman, of Kalispell, Montana. In his seventh annual report he quotes from a recent publication by the United States Forest Service: "Forest fires in the United States have caused an average annual loss of about 70 human lives, the destruction of trees worth at the very least \$25,000,000 and the loss of stock, crops, buildings and other improvements to the amount of many millions more," and adds, "This annual loss of human lives and the destruction of property valued at millions of dollars can be reduced to a minimum through well organized association efforts, if properly supported by the public."

In addition to the foregoing cooperating agencies, the State Forester, Assistant State Forester, and two Field Representatives, as Fire Wardens; every Sheriff, Under Sheriff, Deputy Sheriff, Game Warden, and Deputy Game Warden, are Ex-Officio Fire Wardens. Public spirited citizens are also appointed "Volunteer Fire Wardens," one hundred and ninety-six (196) being so appointed last year, valuable services being rendered by them.

Publicity of the great danger of forest fires is given by posting notices throughout the State; also in the theatres, lantern slides, depicting forest fire scenes are used.

The Montana Council of Defense, at a meeting held June 24th, 1918, issued an order prohibiting the setting on fire of slashings, underbrush, timber, stumps, straw, grass, weeds, or waste matter of any kind, whether located upon lands belonging to the State of Montana, the Government of the United States, Railway Rights of Way, public roads, or private property; said prohibition being for the months of June, July, August and September, of each year, during the continuance of the present war. The penalty for the violation of said order is a fine not to exceed One Thousand Dollars, or by imprisonment in the county jail not to exceed one year, or both such fine and imprisonment.

This order has since been modified by permitting (under rules and regulations prescribed by the county councils of defense) the burning of stubble and weeds in non-timbered areas.

Said order further provided that all campers, shall, before leaving camp, even temporarily, see to it that all camp fires are completely extinguished, and the ground around such fire saturated with water, or the ashes and coals covered with dirt to a sufficient depth to insure the complete extinguishment of the fire, and the safety of adjacent timber or grass.

All agencies interested in the preservation of the forests of Montana, have heartily endorsed this order, and the results so far observed indicate a great reduction of forest fires by reason of its prohibition for the four months' period of the dry summer season, and it can be fairly said that the people generally approve and welcome the protection afforded by the order.

The State Forester has for years urged the enactment of a law defining a closed season for brush burning, and is greatly pleased with the protection afforded by said Order No. 9, Montana Council of Defense.

FOREST FIRE FIGHTING EQUIPMENT

Telephone building, trail building, fire-breaks, and lookout stations are of first importance, providing a means

of detecting, locating and promptly reaching the fire. Quick action avoids the expense and wanton waste that follows in the wake of big fires.

The fire fighting crew should be provided with shovels, mattock, axes, saws and water bags.

Upon reaching the fire, organize the crew, and select a fire boss.

Attack most fires from the rear, and work along the flanks to the head.

Clear a trail two to three feet wide around the fire and remove from it all inflammable material to the mineral soil.

Do not leave a fire until it is out.

Food for the crew should be immediately arranged for, and camp equipment when necessary.

The equipment, number of men required, method of attack and other features is governed wholly by the location of the fire, the character of the surrounding country, its slope, the direction of the prevailing wind, etc.

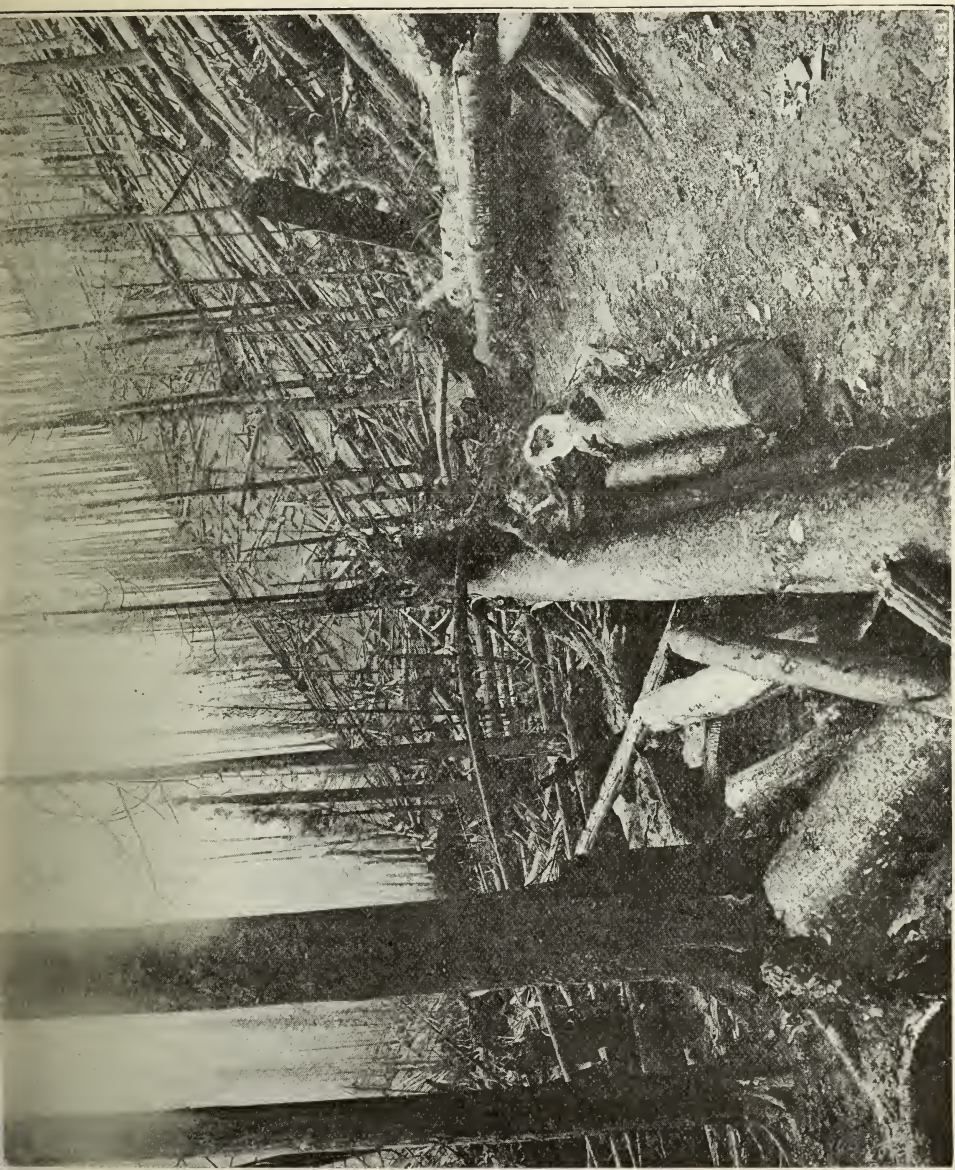
The United States Forest Service has in operation, in Montana, Two Thousand, Six Hundred (2,600) miles of telephone line, which is constantly being extended, aiding greatly in forest fire suppression.

FOREST FIRES

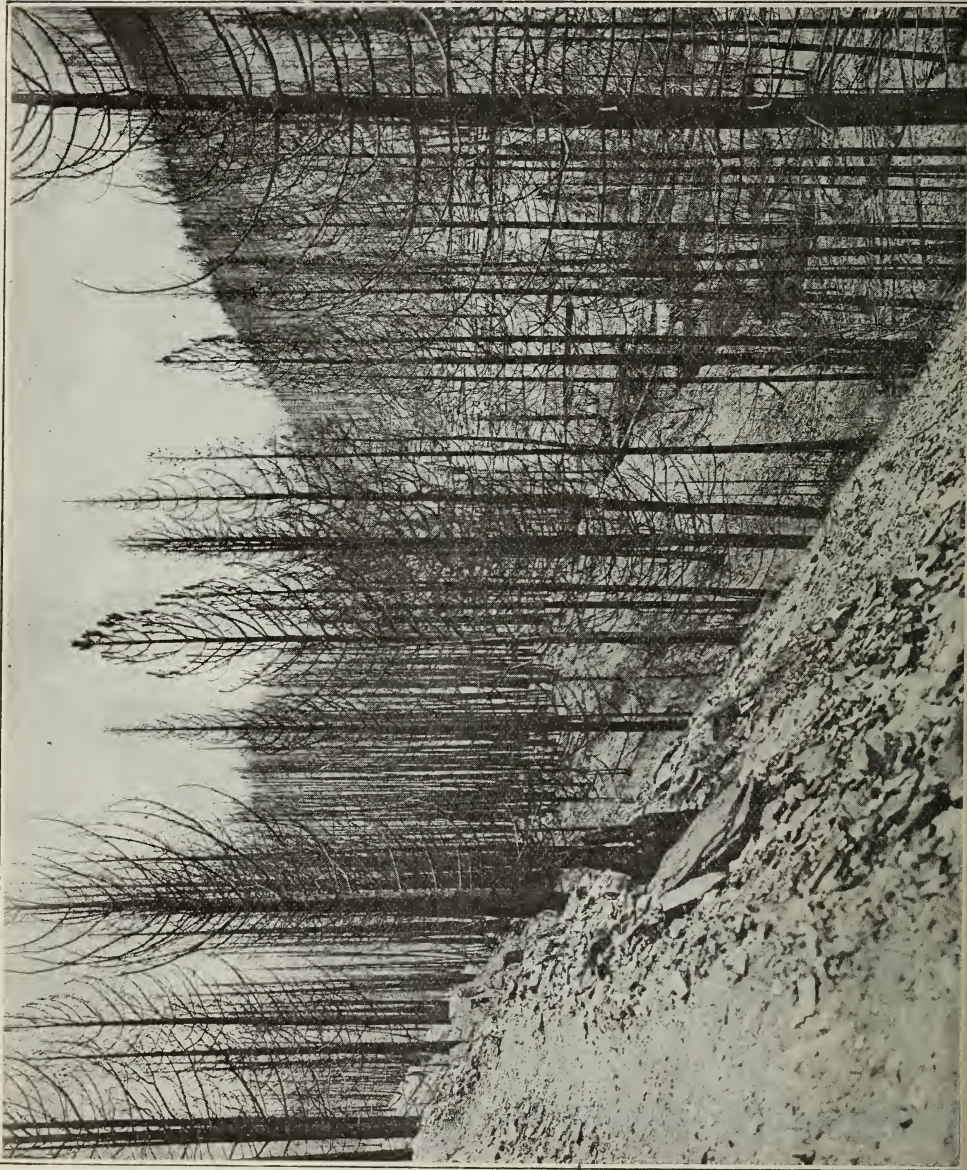
Owing to the extremely hot dry summer of 1917, forest fires were the most serious in the history of Montana, requiring, at great cost, the united Effort of all agencies engaged in their suppression and control; however, the system of cooperation and patrol employed, held the damage done to a minimum.

The following summary is made of the agencies reporting for the years 1917 and 1918.

Agency	No. Fires	Cost	Area Burned	
			Acres	Damage
State of Montana.....	43	\$ 14,906.45	7,576	\$ 12,650
Northern Mont. For'try Asso.	63	35,916.89	2,474	2,000
National Forest Service	1,046	428,454.00	180,902	276,000
Totals for 1917.....	1,152	\$479,277.34	190,952	\$290,650
State of Montana	35	\$ 6,816.38	9,158	\$ 4,775
Northern Mont. For'try Asso.	55	14,208.71	1,931	1,000
National Forest Service	573	82,603.37	19,596	32,624
Totals for 1918.....	663	\$103,628.46	30,685	\$ 38,399



DESTRUCTION BY FIRE AND HURRICANE. WHITE PINE FOREST.



PROTECTION OF PROPERTY AGAINST SLASH FIRES IN WESTERN MONTANA

Damage Caused by Uncontrolled Burning

Western Montana is distinctly a forested region. Rich agricultural valleys are found between the mountain ranges. An ever increasing population is converting the wild lands into productive farms. The non-timbered farm lands were mostly settled years ago and the homesteader of today in this region is a stump land or a timbered land farmer. The removal of the small timber, the brush, or debris left from logging is his greatest problem. Fire is the quickest, surest and cheapest known method of land clearing; but it is a dangerous weapon. If not properly controlled it sweeps far beyond the bounds of the agricultural areas and burns valuable timber lands.

The third most important industry in Montana is the lumber business. The mountains of Western Montana are clothed with valuable stands of timber, most of it on lands entirely unsuited for agriculture. The prosperity of the whole state depends upon keeping these lands productive for timber. Fire, the greatest aid to the new settler, is also the greatest menace to the forest. How can the slash fires of the settler and the irresponsible logger be controlled, without interfering with the legitimate use of this valuable aid?

During the five year period, 1913 to 1917 inclusive, for which records are available, there were 4,000 fires reported in the State of Montana. It is estimated that these fires burned over 200,000 acres of land, doing damage estimated at \$480,000 and costing the State, Protective Associations, Private Owners and the U. S. Forest Service \$700,000 to control. The State Forestry Department estimates that forty per cent (40%) of all fires are caused by BRUSH BURNING.

Fire Is an Important Agent in Clearing Land

There exists no more worthy or proper use of fire than burning of slash to clear land. The broadcast burning of the debris is most essential in order to prepare the land for the plough. Unfortunately, however, the very time when such burning can be done most successfully and



Forest Homesteads in Montana

economically is also the time of greatest danger to adjoining forest lands. During the months of June, July, August and September, the forests are extremely dry and a slash fire easily spreads and becomes a devastating forest fire destroying hundreds and thousands of dollars worth of standing timber. However, there are many periods during this time when it is perfectly safe, with a few precautions, to burn slash with little or no risk of damage to the forest wealth of the State. Recognizing the great value of fire in converting waste land into productive farms but also recognizing that the use of fire for this purpose during the dry season threatens other resources even more valuable to the people of the state, it seems obvious that some control of slash burning is imperative.

A Method of Control

Experience in this and other northwestern states points the remedy—a state law establishing a closed season during the dry period during which it will be unlawful to set fires without a permit from an officer of the state or federal government. Individuals can not be depended upon to set fires only when it is safe and to properly safeguard the burning. The great majority can be depended upon, of course, as in all other matters, to handle their private affairs with due regard to the safety and well-being of the community. There is always a minority, however, who either through ignorance, indifference or maliciousness, disregard absolutely the property rights of others. Long experience in combating forest fires is needed in order to determine under what conditions it is safe to burn slash and when the risk of spread of the flames is too great to balance the gains to the individual. The federal and state officers who would be vested with authority to issue burning permits have the experience necessary to enable them to determine when and under what conditions it is safe to burn slash. The average rancher can not be expected to know. At least experience has shown that the present system of uncontrolled privilege or license results in enormous losses of forest wealth which must be stopped.

What Other States Are Doing

Montana is falling sadly behind in progressive forest legislation. Idaho, Washington and Oregon have long since

recognized the danger and have established closed seasons with burning only under permit. They have gone much further than that, and provided for adequate patrol of forest lands, compulsory burning of debris left from logging before and after the closed season and taken other steps which may or may not be advisable in Montana. The closed season and permit law has been thoroughly tried and found workable. It reduces the damage to a minimum. Such a law is based on the fundamental principle of cooperation between the state and the individual. The forestry organization, to get results, must help the farmers clear the land, by issuing permits when conditions are right and supervising the work to a large extent. During the closed season, at least half and often more than half the time, burning of slash can be accomplished effectively and safely, but during the remaining period no reasonable man would be willing to take the risk of destroying one of the great natural resources.

How the Permit System Works

The State Forester in cooperation with the U. S. Forest Service now maintains adequate administrative machinery to enforce the law and to make it serve both the interests of the farmers and the public welfare. Scattered over Western Montana during the dry season is a small army of forest officers—Forest Supervisors, Forest Rangers, Forest Guards, State Agents and state and federal patrolmen. One of these officers is within easy reach of every homesteader and farmer. It will be an easy matter to get in touch with a local forest officer who is authorized to issue permits. If it is safe to burn he will issue the permit and specify the precautions (if any) which must be taken to prevent the spread of the fire. There will be no delay in reaching an authorized state agent and every forest officer will have authority to take action directly. Mistakes will undoubtedly occur. Permits will be issued when it is unsafe to burn and refused at times when it appears perfectly safe, but mistakes will always occur where laws must be administered by human beings. Unquestionably, however, as already proven in other states, the net result will be far better than unregulated burning. The farm lands will be cleared in the most economical way and the

damage to forest property will be reduced to a minimum. Every fire lookout in the region will be notified promptly of every permit issued and they will recognize the smoke as a legitimate smoke which will decrease the expense now incurred in fruitless "smoke chasing."

Action of State Legislature and State Council of Defense in 1918

In February, 1918, while the State Legislature was in extra session, the Governor asked for an adequate law to meet the problem, and the State Forester was instrumental in having one introduced. It was met with opposition by a few and was regarded as of minor importance by others, with the result that while a new law was enacted, it was wholly adequate to meet the need. A closed season and the permit system was not provided for in this new law. In the summer of 1918, a prolonged dry period resulted in an early and more critical fire situation than has been previously known in the fire protection history of Western Montana. With the labor shortage beginning to be felt and the necessity for reduction to a minimum of non-productive labor, the Montana Council of Defense realized the seriousness of the situation and promulgated Order No. 9, making the period July 1 to October 1 as absolute closed season for the burning of all forest refuse. To those who were directly connected with fire suppression work, the result was apparent almost at once and very gratifying. This order was a factor—one of the largest—in keeping the fire loss and expense of 1918 from reaching a figure far in excess of the actual total, but effective as it was from a forest standpoint it worked a hardship on quite a large number of farmers. On September 9, the State Council of Defense issued Order No. 14, which provided a permit system in connection with the closed season.

The Montana Council of Defense saw the threatened crisis and took action to avert it. However, this is not entirely a war problem but one in which the State is vitally interested and in which it must assume the responsibility.

State Law Proposed for Consideration of Legislature of 1919

After a careful consideration of the forest fire laws of Washington, Oregon and Idaho with reference to Mon-

tana conditions, the followig proposed fire law for this State has been drawn up for the consideration of the next legislative assembly. It provides for all proper use of fire, with only such safeguards as the interest of the whole people demand. It is hoped that it will secure the support of the legislature and of all patriotic citizens. It incorporates into law nothing which has not been thoroughly tried and tested in neighboring states.

This is a question for the people of the whole State to decide. Do we want to continue the present system or lack of system of unregulated use of fire and constantly endanger one of the greatest natural resources in the State? Will Montana be content to be the only state in the northwest which has not made reasonable effort to protect its forest property?

PROPOSED FOREST FIRE LAW

Section 1. In this act, unless the context or subject matter otherwise requires, the word "forester" shall mean the State Forester, or any of his subordinate officers; "warden" shall be held to mean "Fire Warden;" "ranger" to mean "Forest Ranger" or any duly appointed forest officer of the U. S. Forest Service; "rangers" shall be held to mean "Forest Rangers;" "one" shall be held to mean "person, firm or corporation" and "forest material" shall be held to mean "forest, slashing, stumpland, chopping, woodland or brushland;" "camp fire" shall be held to mean "any fire set for any purpose other than the disposal of forest material."

Section 2. All duly appointed Forest officers of the United States Forest Service, the Northern Montana Forestry Association, and the U. S. Indian Service, are hereby made ex-officio fire wardens and shall have authority to enforce and carry out the provisions of this act. Said officers are to serve without compensation from the State.

Section 3. No one shall burn any forest material within the State of Montana during the period from June 1 to September 30 inclusive of each year, which period is hereby designated as the closed season, without first obtaining permission in writing from the forester, a warden

or a ranger, and afterward complying with the terms of said permit; said permit shall fix the time for setting out fires on any three consecutive days therein named, and no fire shall be set out later than ten days from date of said permit, and no such fires shall be set at a time when the wind is blowing to such an extent as to cause danger of same spreading beyond the control of the person setting said fire, and without sufficient help and tools present at time of setting and thereafter until out, to control the same, and the said fire shall be watched by the person setting the fire until the same is out; and any one violating any provisions contained in the preceding portions of this section shall, upon conviction thereof, be fined not less than twenty-five dollars (\$25.00) nor more than five hundred dollars (\$500.00), or be imprisoned in the county jail not exceeding thirty (30) days, or by both such fine and imprisonment.

The Forester, any of his assistants, any warden or ranger may, at his discretion, refuse, revoke or postpone the use of permits to burn when such action is clearly necessary for the safety of adjacent property.

Section 4. Any person who shall upon any land within this State set and leave any fire that shall spread or damage or destroy property of any kind not his own, shall upon conviction, be punished by a fine of not less than ten dollars (\$10.00) nor more than five hundred dollars (\$500.00). If such fire be set maliciously, whether on his own or on another's land, with intent to destroy property not his own, he shall be punished by a fine of not less than one hundred dollars (\$100.00) nor more than one thousand dollars (\$1,000.00), or imprisonment in the county jail for not less than thirty (30) days, nor more than one year, or by both such fine and imprisonment, and shall be liable for all damages in a civil suit.

During the closed season, any person who shall kindle, a camp fire on land not his own, in or dangerously near any forest material and leave same unquenched, or who shall be a party thereto, or who shall by throwing away any lighted cigar, cigarette, matches or by the use of fire-arms, or in any other manner, start a fire in forest material not his own, and leave same unquenched, shall upon con-

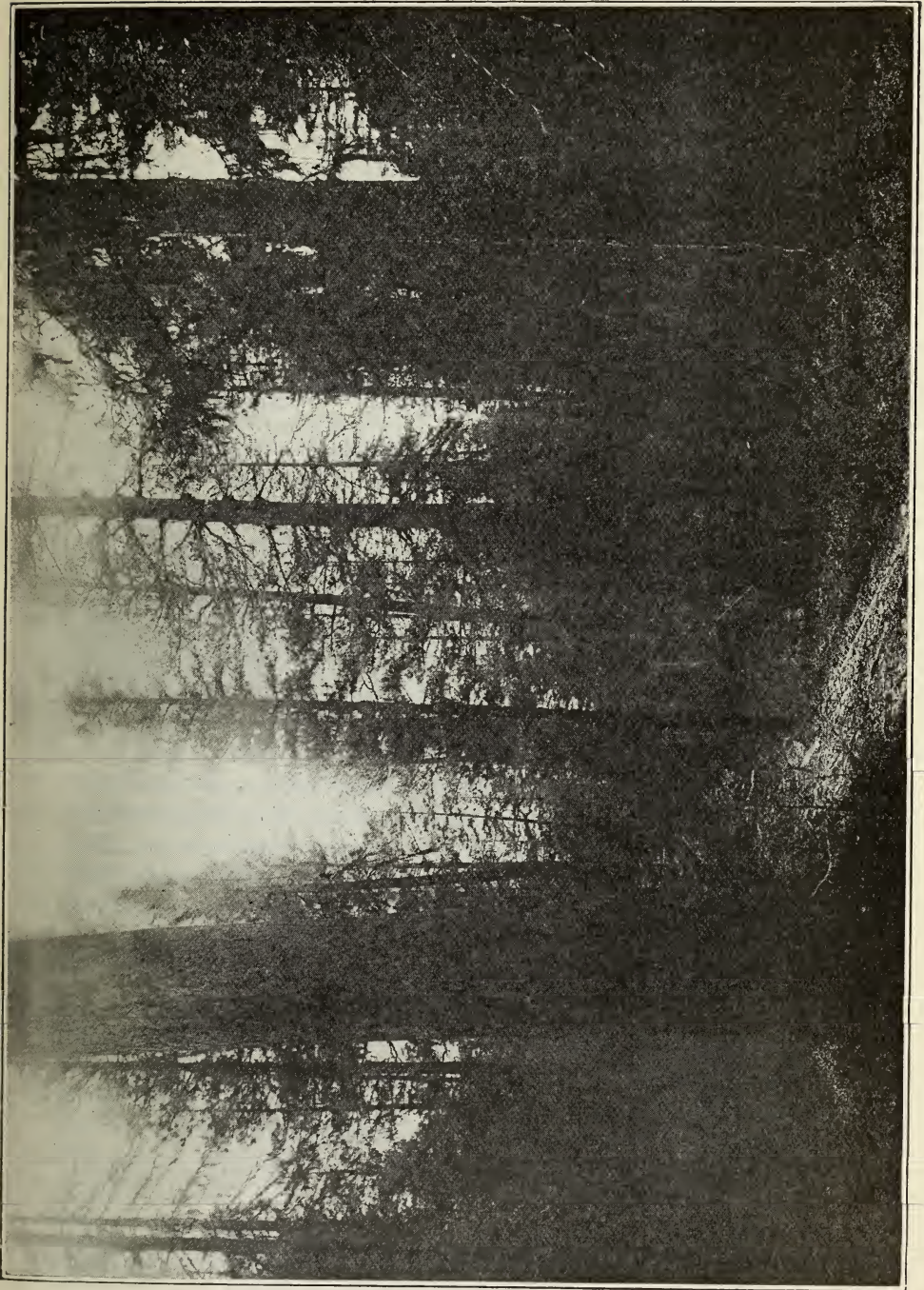
viction, be fined not less than ten dollars (\$10.00) nor more than one hundred dollars (\$100.00), or be imprisoned in the county jail not exceeding sixty (60) days.

Section 5. The forester, his assistants, wardens, rangers and all police officers are hereby empowered to make arrests without warrant of persons violating this act.

Section 6. Whenever an arrest shall have been made for a violation of any of the provisions of this act or whenever information of such violation shall have been lodged with him, the prosecuting attorney of the county in which the criminal act was committed, shall prosecute the offender or offenders, with all diligence and energy. If any prosecuting attorney shall fail to comply with the provisions of this section, he shall be guilty of a misdemeanor and shall be punished by a fine of not less than fifty dollars (\$50.00) nor more than five hundred dollars (\$500.00), or by imprisonment of not less than thirty (30) days, nor more than one year in the county jail. The penalties of this section shall apply to any magistrate, with proper authority, who refuses or neglects to cause the arrest and prosecution of any person or persons when complaint under oath of violation of any provisions of this act has been lodged with him.

Section 7. All fines collected under this act shall be paid into the county treasury of the county in which the offense was committed.

Section 8. All acts or parts of acts inconsistent with this act are hereby repealed.



NATURAL FOREST SCENE,

THE WHITE-PINE BLISTER RUST

By PERLEY SPAULDING

Pathologist, Farmers Bulletin No. 742, United States
Department of Agriculture, Washington, D. C.

A destructive disease of white pines known as the white-pine blister rust has been introduced from Europe and seriously threatens our white pines. It also attacks the leaves of wild and cultivated currants and gooseberries and spreads for long distances on them. Look for it on pines in May and early June on currants and gooseberries from June until the leaves are shed.

Danger to the Western States

The white-pine blister rust, however, also threatens two of the most important lumber species of the western forests, namely, sugar pine and western white pine. The mature stand of these two is estimated to be worth \$240,000,000. Both of these trees have been seriously attacked by this disease in Europe. They are little grown in the Eastern States where this disease is present; hence, we have absolutely no experience to show what the disease may do in this country to them. Aside from the consideration of the total valuation, these two species reproduce readily, and the prospects are good that they will form a very important part of the future forests of their regions. Any reforestation which may be done within their range is likely to consist largely of these two species.

The limber pine, which is distributed throughout the Rocky Mountain region, is known to take this disease in Europe. It, together with the two above-mentioned pines, would furnish a means for the spread of this disease over the entire Pacific coast and Rocky Mountain regions.

There can be no doubt regarding the danger from this disease if it once reached the Pacific coast or the Rocky Mountain regions, as it has been found by experiment that the wild currants and gooseberries of these sections are susceptible to the disease. Conditions in the natural for-

ests are such that if the native forest once becomes infected there is practically no hope of controlling the disease there; hence the outlook is especially grave.

The writer has no positive evidence that the white-pine blister rust has ever been west of Indiana. Imported white pines of suspicious origin are known to have been shipped as far west as Illinois and Minnesota, but not beyond the natural range of the eastern white pine.

The western forests are so separated from the eastern forests by the Great Plains that the white-pine blister rust can reach the former only through the shipment of diseased nursery stock from the East! consequently, the supreme importance of preventing such shipments. All 5-needle pine stock should be grown from seed in the general locality where the trees are to be planted. Each state west of the Mississippi River should immediately enforce an absolute prohibition of the shipment of 5-needle pines or of currants or gooseberries from the section east of the Mississippi River. Seed may be shipped with entire safety, so far as this disease is concerned. The importance of such State quarantines can not be too strongly urged.

Efforts Already Made to Control the White-Pine Blister Rust

In Europe this disease was firmly established before any eradication of plant diseases was attempted, and the only effort there exerted is merely to keep it in check. There has never been, previously, either in Europe or America, any serious attempt to eradicate a disease of trees of this type; that is, we have had no earlier experience with a disease of this sort by which to guide our attempts at controlling this one. It was in 1909 believed feasible to remove all of the diseased trees from an infected lot of pines during the course of two or three years by repeated annual inspections in the spring when the fruiting bodies of the parasite are most conspicuous on pines. The work then attempted was done with this end in view. It has become increasingly evident since that time that such annual inspections would have to be repeated for an indefinite period, as it has been found that the parasite apparently may lie dormant in an infected tree for six or more years before becoming eternally visible. This means

that inspection is not efficient. The alternative seems to be that of the total destruction of the entire lot of pines known to be infected. In the work done upto the present time, special emphasis has been given to the removal of all wild and cultivated currants and gooseberries from dangerous proximity to lots of pines known to be infected with the white-pine blister rust.

It has been found, however, in these investigations that the various State officials, who necessarily must perform this work, do not have power to destroy such currants and gooseberries as may seem necessary in order to completely control this disease. The work for this reason has been greatly hampered and in many cases has not been carried out as it should have been. Many people have not realized the seriousness of this trouble, and unanimous action could not be secured. It is absolutely necessary that the State officers have complete power to enforce such measures as are needful for the control of this disease or their work will fail, just as it has failed up to this time.

Present Status of the White-Pine Blister Rust

During the years 1909 to 1914, inclusive, the white-pine blister rust has been held well in control, considering the circumstances under which the work was carried on. In this period eleven distinct outbreaks of this disease occurred; that is, there were eleven different places where the disease spread from pines to adjacent currants or gooseberries. In these places the disease has been nearly or entirely eradicated. In 1915 the weather conditions were so favorable for the growth of the parasite that it spread very readily on currants and gooseberries for relatively long distances. In 1915 alone twelve distinct new outbreaks occurred. The areas infected vary in extent from only a few currant or gooseberry bushes up to a single area of some 400 or 500 square miles. Unless very energetic action is taken to control the disease at once, it will shortly become impossible to do so.

Need for Adequate State Laws

As above indicated, there are a number of areas where this disease has spread upon wild and cultivated currants and gooseberries. It is entirely possible to stop its further spread by the mere removal of all wild and cultivated cur-

rants and gooseberries within the infected areas. The actual carrying out of this work is not as difficult as is much of the work which is being done in the effort to hinder the spread of other diseases and pests. In carrying on this removal of currants and gooseberries, however, it is absolutely necessary that unanimous action be taken throughout the infected areas. Federal officers have no power to destroy private property in any State. This power is given solely to certain State officers, usually known as State horticultural inspectors. In most cases these State officers do not have power sufficient to compel unanimous action in such removal of currants and gooseberries. This power is one which every State should give to her proper officer at once if this work is to be efficiently done, and if such power is not thus given this serious disease of white pines is certain to escape beyond any possible control and cause irreparable damage.

Committee on the Suppression of the Pine Blister Rust in North America: The Committee is composed of four members from each State and Province where Five-Needle Pines grow, and includes Foresters, Agriculturists, Horticulturists, Pathologists, Entomologists, Lumbermen, and representatives of Agricultural Experiment Stations, Forestry and Lumbermen's Associations.

The FEDERAL HORTICULTURAL BOARD of Washington, D. C., granted the above COMMITTEE a hearing for the purpose of discussing and receiving recommendations in order to prevent the introduction of Foreign Insects and Fungus Diseases, including the PINE BLISTER RUST.

The hearing was called for May 28th, 1918, at Washington, D. C. The meeting was attended by delegates from the following States: Montana, Minnesota, Michigan, Wisconsin, Massachusetts, Maryland, Delaware, Vermont, Virginia, Illinois, Alabama, New Hampshire, North Carolina, Pennsylvania and New Jersey; other States were represented by their Congressmen; also the Nurserymen and Importers were will represented.

I had the honor of representing our State at the conference, and the discussions and matters presented impressed upon me the very serious character of the problem,

particularly that of the "PINE BLISTER RUST" and the necessity of making a strong effort to keep our Western Forests free from this very destructive fungi.

The committee presented the matter to the Board on the broad grounds of "Shall the Consumers and Producers of Food and Wood be Protected from loss Caused by Foreign Insects and Fungi." At this meeting the opinion prevailed unanimously that immediate exclusion of plants from the Orient and other little explored parts of the world—except Japanese lily bulbs and sacred lily bulbs from Amoy, China, be urged at this time.

It was further agreed to urge the exclusion of all ornamental and forestry nursery stock, not heretofore mentioned, on and after July 1, 1919, and that fruit stock also be excluded as soon as economically practicable.

It being understood that for the purpose of securing new varieties the Department of Agriculture should bring in for propagation purposes such plants under such rules and regulations as it may devise.

It is believed that the Federal Horticultural Board not only has all the facts of the case but that it is cognizant of the country wide public sentiment in favor of the exclusion of plant materials which are liable to introduce injurious pests.

Its power as well as its responsibility in this matter is very great, and its decision will be awaited with general interest.

A REPORT ON THE RED BELT INJURY OF FOREST
TREES OCCURRING IN THE VICINITY OF
HELENA, MONTANA

Office of Forest Pathology, Missoula, Montana,*

July 24, 1918

Several reports coming from the Helena and Deer Lodge Forests and describing a peculiar injury to forest trees in these regions have been received by the Office of Forest Pathology this season. As a result of the earlier reports, Mr. Lenthall Wyman, in charge of insect control for District 1, investigated the Helena area, and found no evidence to point to insects as the cause of the trouble. He reported that the injury apparently affected the trees within an irregularly defined strip running almost parallel with the contours along the east side of the Continental Divide. This and other facts led to the belief that weather conditions may have been responsible for the damage. Later, requests were made to this office for an examination of the areas in question and Mr. E. E. Hubert was detailed for the work. His report of this work is herewith submitted.

The areas inspected are principally those in the vicinity of Helena, Montana, including the drainage areas near Park Creek, Three Mile Creek, the Marysville region, Mt. Helena and vicinity, Colorado Creek, Priest Pass region, Rimini-Red Mountain-Lee Mountain and Jericho Mountain. By observations the zone of injury was found to extend along the Northern Pacific right-of-way through Austin, Montana, up to the Continental Divide on the east slope. On the west slope it was noted from Blossburg to a point east of Elliston. From these observations it is apparent that the injury is wide-spread and occurs on both sides of the Continental Divide at least for the regions noted. Throughout these regions the injury bore the characteristic banding peculiar to the red belt injury. This injury is

*James R. Weir in charge.

attributable to adverse weather conditions and has been reported from District 1 by Hedgcock (1) and from District 2 by Hartley (2). Speaking of the red belt injury

(1)

Hedgcock, G. G. Winter-killing and smelter injury in the forests of Montana.

Torrey 12:25-30. Feb., 1912.

(2)

Hartley, C. P. Notes on winter-killing of forest trees. Forest club annual.

Neb. 4:39-50. 1912.

Hedgcock (1) states that "During the past three years (1909-1911), in all, about 40,000 acres of coniferous trees have died from its effects in Montana."

The strip of affected timber is very pronounced and has the appearance of a rusty streak running parallel with the valley floor and winding in and out of the depressions along the slopes. Its width varies from a quarter to half a mile, and scattered injured trees are more frequently found below the lower demarkation of the zone. The trees on the most exposed portions of the topography were the ones most heavily affected. Slopes and ridges having Eastern, Southeastern, Southern, and Southwestern exposures were harder hit than the others. All trees within the zone were not equally affected, nor did the injury react uniformly upon the various species in the stand. In the Park Creek region very few of the trees were killed outright, but every tree in the zone bore evidence of some degree of injury. The yellow pines at first appeared to be the ones most seriously damaged, but this was afterward found to be otherwise. The older needles on these trees were killed, turned brown and remained attached to the tree. The youngest needles were affected in part and in some cases only the tips turned brown. New needles appeared in 1918 at the tips on many of the branches, giving the tree a peculiar appearance. In contrast to this the Douglas firs at a short distance appeared to have little or no injury, as very little browning of needles was observed at this time (July). Upon closer inspection it was found that those trees suffered considerable damage. The older needles behind the 1916 and 1917 needles were found to

have been killed and had all fallen from the branches. A majority of the buds had been either killed outright or were only able to produce a very few needles, these often abortive and not able to free themselves from the bud scales. Exposed trees and parts of trees exposed above the general forest cover were noticeably more damaged than those protected by their neighbors. The zone in the Park Creek region occupied a position approximately between 5,000 and 6,000 feet elevation, and was not so distinctly outlined as the zone in the Rimini region.

A peculiar phase of the injury was noted in the case of young Douglas firs and yellow pines whose lower branches came close to the ground. The lowermost branches up to a point 2 feet from the ground were in a healthy condition and the 1918 needles had developed normally. From inquiries made and from the Weather Bureau records it was found that a 2-foot covering of snow on December 13th preceded a rapid rise in temperature, accompanied by chinook winds from the Southwest. The snow in this case apparently formed a protective layer for such branches as were imbedded in it. Many of the Douglas firs had dropped nearly all the leaves from above a point approximately 2 feet from the ground, and some of the lowermost uninjured branches bore several healthy normal cones. No cones were found on the upper portion of any of the trees on this area. Mr. Swensen, a rancher on Park Creek, stated that during the chinook period mentioned above the snow covering ranging from 2 to 3 feet in depth melted completely away within 18 to 20 hours. The species on this area found affected are Douglas fir, yellow pine, lodgepole pine, juniper and white bark pine. The latter species was but slightly affected. Increment borings made of the first three species given show that very little or no growth, according to the degree of injury, is being made by the affected trees.

This type of winter-killing shows a uniform difference in susceptibility to injury between needles of different ages. The greatest damage was found to occur to the older needles. Where the damage extended to only a portion of the needles and where only a few needles survived, these were found to be the youngest. Where parts of

needles only were killed the basal portions always remained healthy. These observations are similar to those made by Hartley (2), who says, "Assuming that the cause of death was transpiration during the sudden warm periods indicated in the weather records quoted, it might follow that the younger needles have a stronger pull on the water supply than the older ones." This is undoubtedly a correct explanation and accords with the weather data for the region covered by this report, and presented later.

The other regions visited disclosed practically the same conditions as those given for the Park Creek area. The Rimini-Red Mountain-Lee Mountain area suffered the heaviest damage. Approximately 30 per cent of the trees in the zone on this area are either dead or dying. The species affected are lodgepole pine, yellow pine, Douglas fir, Alpine fir, juniper and spruce. The lodgepole pine consists of about 80 per cent of the stand, and suffered heavily. Spruce branches in many instances were killed outright, and entirely defoliated. A peculiar effect of the injury upon the mistletoe infected trees was to kill the parasitic infection. On such trees no mistletoe plants appeared, although the trees were still alive and capable of full recovery. Nearby trees below the zone and not affected by the red belt injury and infected with mistletoe bore normal plants of the parasite.

In tracing the cause of this disorder, the U. S. Weather Bureau at Helena furnished the meteorological data for the region, and from these data a chart of the weather conditions during the cold snap and chinook period from December 11 to 15, 1917 was furnished. This period exhibited the greatest range in temperature for the entire winter, and fits in with statements made by local residents as to the probable cause of the red belt injury. The cold spell commenced on December 11th, reaching a minimum temperature of -23° at 8 A. M. on December 12th. This cold spell, with a slight rise in temperature on December 13th, continued up to noon of December 14th. A sharp rise in temperature reaching 44° above zero at 4 P. M. December 14, is recorded. This was accompanied by a warm southwest (chinook) wind which continued almost uninterrupted through December 15th. During most of this time

the sky was clear, the sun adding its influence. In 56 hours a rise of 67 degrees in temperature is recorded, and on the slopes in the vicinity of the red belt zone (Park Creek) nearly all the snow covering melted in one and one-half to two days. The Helena record shows only a 6-inch reduction in the height of the snow for this period. It is possible that this particular cold spell and chinook was not alone responsible for the injury, as similar periods with smaller extreme temperatures followed during the winter. The injury may be cumulative and due to the effects of all of these periods.

The outstanding peculiarity of the injury is the limited area in which it occurs. Checking the observations made during the investigation of the areas it is found that near the heads of streams tributary to the main and larger valleys the band is found between 6,000 and 7,000 feet. Where the injury occurs on the slopes near the main valleys the band is found at a lower elevation, between 5,000 and 6,000 feet. Apparently the zone runs parallel with the general level of the valley floor.

Apparently, the red belt injury is caused by excessive transpiration of the needles during the period when the chinook winds are blowing. Usually these winds are preceded by a cold spell where the temperature drops below zero, and the ground, the roots and the entire tree are frozen. A sharp rise in temperature, accompanied by warm drying winds and sunshine, rapidly thaws the needles, causes excessive loss of water—which, due to the frozen condition of most of the tree can not be immediately replaced—and eventually the needles or parts of needles most seriously affected, turn brown or red and die. Discussing winter-killing, Hartig (3) states "In my opinion

(3)

Hartig, R. Text book of the diseases of trees.

English edition. Pg. 290: 1894

these phenomena can only be explained by the circumstances that repeated thawing and accelerated transpiration are induced in the leaves by the direct action of the sun during the bright wintry weather * * *, or by the warm south winds, as the case may be, and that the leaves wither because they are unable to obtain any water

from the stems which have been frozen under the influence of long-continued and severe cold."

Mr. J. F. Preston's report of March 5, 1910, on the effects of weather on timber in Montana, gives some very good data on the 1908-1909 damage. Attention is drawn to the elevation in which the red belt occurred (5,000-5,500 feet) and the statement made that the zone ran more or less parallel with the valley floor. It is also noted that needles protected by the snow covering were uninjured.

In closing it should be stated that samples of the dead needles of yellow pine and Douglas fir submitted by Mr. Wyman, when placed in damp chambers for a period of one week developed no indications that fungi were the cause of the damage. No signs of fungus injury were to be found upon the affected needles of the various species examined in the field.

FARM AND CITY TREES

Windbreaks

Value of Windbreaks. As the farming section of Montana becomes more and more settled, the need for protection from winter winds becomes constantly more evident, and it will only be a matter of a comparatively few years before windbreaks will have their place on every ranch throughout this region. As the trees grow they will protect dwelling houses, barns and stock, later yielding fence posts and firewood, and finally even rough lumber for building purposes. A windbreak properly planted at this time can not fail to add to the value of the ranch, it being well-known that a farm having a windbreak on it always sells at a higher rate than the same land barren of tree growth.

Before planting is commenced the following essentials should be carefully considered:

Essentials in Planting. 1. What are the directions from which the cold winds blow? If they come from the North and West, the windbreaks should be placed in an L-shape on the north and west sides of the building; if from the South and West, place the break on these sides. In some cases it may be advisable to plant on three sides, but it is usually not desirable to completely surround the buildings with trees.

2. Never place the trees closer than 100 feet from the principal buildings, otherwise snow—which accumulates in drifts on the inner side of the break—will tend to block up the yard. If feasible, the windbreak may be 200 or even 300 feet from the buildings, and still afford ample shelter.

3. In order to have a windbreak which will effectually stop the wind, it should not be less than 40 feet in width, and may be advantageously as wide as 100 feet. The wider it is (within limits) the greater the protective value. Its length will depend on the number of buildings to be protected, the ordinary length of a windbreak being 300 to 500 feet.

4. Plow the area on which the trees are to be planted, and allow it to lie fallow or planted to a cultivated crop for one year. This is absolutely essential under conditions prevailing in Eastern Montana. Plant the trees the spring after plowing, as soon as native vegetation starts.

QUALITIES AND USES OF THE MORE IMPORTANT MONTANA WOODS

Western Pine (*pinus ponderosa*) is the chief lumber producing tree of Montana. The wood is light and resinous, the grain fine but often twisted, and the growth variable. It is not especially durable when in contact with the soil, lasting on the average about five or six years. Forest Service strength tests made of small clear specimens cut from trees collected in Montana gave a modulus of rupture of 4950 pounds per square inch and crushing strength of 2370 pounds per square inch.

The tree produces an average of about 13 per cent select grades, 12 per cent shop lumber and 75 per cent common grades. The wood is very extensively used in the mines at Butte and has a large variety of other uses, ranging from the coarsest construction to the high finished product. A large part of the total amount produced in Montana is consumed within the State, but quite an amount is also shipped out.

Western Larch (*larix occidentalis*) produces very nearly as much lumber in Montana as does Western pine. The wood is heavy, of fine growth, but is not very durable when placed in conditions subjecting it to decay. Forest Service strength tests of small clear specimens cut from trees collected in Washington gave a modulus of rupture of 7250 pounds per square inch, and a crushing strength of 3700 pounds per square inch. The tree does not produce much select lumber, 92 per cent going into the common grades and eight per cent into the select. The wood is used to quite an extent by the Butte mines and also for general building and construction purposes, for ties and for paving blocks. A considerable quantity is shipped out of the State to the prairie states of the Middle West.

Douglas Fir (*pseudotsuga taxifolia*) is one of the smaller lumbering producing trees of Montana. The wood is considerably lighter than larch but heavier than the Western pine in the dry condition. The fir grown in Montana is rather knotty and coarse grained, but is slightly more durable in contact with the soil than either larch or pine. Forest Service strength tests of small clear specimens cut from trees collected in Wyoming gave a modulus of rupture of

6340 pounds per square inch, and a crushing strength of 2920 pounds per square inch. The tree cuts out a very small percentage of selects, 98 per cent going to common lumber and only 2 per cent in the select grades. In Montana, fir and larch are graded and sold together owing to the very small percentage of selects in each of these species. The wood is used in the Butte mines and for general rough construction purposes and ties. Most of the output is consumed within the State.

Lodgepole Pine (*pinus contorta*) is one of the minor lumber producing species of Montana. The wood is rather light, of slow growth, and not durable when placed in conditions subjecting it to decay. The Forest Service strength tests of small clear specimens cut from trees collected in Wyoming gave a modulus of rupture of 5170 pounds per square inch, and a crushing strength of 2400 pounds per square inch. Only a small percentage is manufactured into lumber and if so manufactured yields mostly common lumber, only 7 per cent going into the selects, while 93 per cent goes into common grades.

This wood is the chief source of stulls, lagging and converter poles for the Butte mines where enormous quantities are consumed annually. It is also used for ties and fuel and to a slight extent for fence posts and telephone poles. Practically the whole output is consumed within the State.

PROPOSED TIMBER LAND EXCHANGE

AN AGREEMENT was made and entered into the 23rd day of December, A. D. 1912, between the Department of Agriculture, of the United States, and the STATE OF MONTANA, looking toward a settlement and adjustment of all matters relative to the unsurveyed school lands within the National Forests in the State of Montana: This agreement provides that all unsurveyed school sections included within the boundaries of the National Forests shall be relinquished by the State and that said unsurveyed school sections be used as a basis for the selection by the State in lieu thereof other lands equivalent in acreage and value, in one or more compact bodies, lying along and within the boundaries of the National Forests, in such position that when eliminated therefrom all will lie outside boundaries.

In pursuance of said agreement the State and National Forest Service caused to be examined and cruised a great many of said unsurveyed school sections, and tentatively selected two areas, one located in the Stillwater and Whitefish Districts, comprising 69,180 acres, and one in the Swan River Valley of 37,180 acres, a total of 106,360 acres, being in Flathead and Lincoln Counties.

Lists have been prepared and approved, equalizing as near as possible, acreage and timber value, both the tracts to be relinquished and the areas selected.

Under date of November 27th, 1918, the President of the United States of America, WOODROW WILSON, under and in conformity with said agreement of December 23rd, 1912, duly issued a Proclamation excluding the said selected areas from the National Forests, and granting the State ninety days from the date of the Proclamation within which to file its selections for all surveyed lands eliminated, and ninety days from the approval of the official plat of survey of any unsurveyed lands embraced within the areas excluded.

In conjunction with the State Board of Land Commissioners, action will be immediately taken to comply with the terms of the Proclamation.

The early consummation of this timber land exchanged affords this Department very much satisfaction. It will give the State compact and very valuable timber tracts making their preservation and administration more economical and satisfactory. And it is to be hoped the area may be further enlarged by selections based on other isolated school sections.

ECONOMIC USE OF THE FORESTS OF MONTANA*

By John F. Preston, Assistant District Forester, United States Forest Service. District One.

INTRODUCTION

The value of forests as a national asset and the importance of their preservation and development has been very strongly brought to the attention of the world during the great war. To the far-sighted and forward-looking forest policy of France in no small measure is the successful termination of the world war due. Years ago France undertook to preserve, extend, and develop her forest resources. The result was that France, when the great emergency came, was ready and the cause of Democracy did not suffer for a lack of wood. The great importance of this resource can be appreciated only by those closely in touch with the military needs of the allied armies in France.

The great war brings home to us many truths, not the least of which is the necessity of making the highest use of timber resources, not for the present only but for all time. Mineral and forest wealth are Montana's two great natural resources. The state is already dotted with deserted mining towns and abandoned mines. Mineral wealth can not last forever and little that we can do will enlarge the quantity or extend the period of use. Forest wealth, on the other hand, if properly handled, will increase in quantity and the industries built around this resource will be

*This article is the work of the Office of Silviculture, United States Forest Service, at Missoula, Montana. J. W. Girard, Lenthal Wyman, and C. N. Whitney contributed largely the data used.

Reference is also made to the following list of references from which information was secured:

Dept. of Agricultural Bulletin 506—Production Lumber, Lath and Shingles in 1915 and Lumber in 1916. J. C. NELLIS.

United States Bureau of Census Abstracts.
Montana 1917 Bulletin, State Board of Agriculture and Publicity Montana Secondary Wood Using Industries. J. B. KNAPP.

Products Studies
U-2 Report of Consumption of Forest Production by the Butte Mines in 1914 and 1916 H. N. KNOWLTON.

U-3 Statistics of Production
U-4 Lumber Consumption in 1916. C. N. WHITNEY.

U-2 Market Study of Gallatin Valley. S. V. FULLAWAY, JR.
U-2 Market Study of Sun River Valley. H. G. ADE.

permanent. Michigan, Minnesota, Wisconsin and other eastern states are dotted with sawdust piles and abandoned lumber towns and thousands of acres of land unsuited for agriculture and which formerly supported magnificent forests are now only waste lands, contributing nothing to the wealth of the states and adding to their burden of taxation.

Montana's forest industry is in its infancy. The population is rapidly growing and the demands for lumber are increasing. We have the choice now of saying whether we want a permanent forest industry or only sawdust piles and waste land to remind us of past prosperity. The federal government is doing a big work in preserving vast areas of mountain forest land and in regulating the cut. If allowed to continue, Montana will never be in the predicament of the Lake states, but there is a great deal to be done by the state if the full value of the forest resources is to be realized. Thirty per cent (which includes the best timber) of the forest resources are in the hands of private owners. The control and proper use of this land and timber are entirely matters for the state to undertake. It means not only some degree of control but active assistance to the industry which manufactures finished products from the forests.

The purpose of this report is to show the extent and value of the forests of the state, the lumber industry which they support, the wealth created and the people dependent on it for a livelihood, the present and future needs of the people of the state for forest products and, lastly and most important, to point out some of the things the state must do to develop and make permanent the wealth and industry which comes from well regulated forests. We must not wait until our forests are depleted with axe and fire before taking steps to insure the permanency of the forest industry. Montana should take steps now to strengthen the State Forestry organization so that it will be able not only to look after the state lands and forests but to point the way step by step to a forest policy which will insure Montana's place as a progressive, prosperous, and wholly productive state.

Forestry, like other good things, will not come about without active effort. The people must be educated to the point where they understand what it is all about and when

once they do understand, there will be no question as to the action which will be taken.

In a rapidly growing state like Montana, the natural resources of the state regulate to a large extent the rate of growth. Of these assets timber, mines, and available farming land are the most important. Although the eastern half of the state is nearly devoid of forested areas, in the mountainous western part lumbering comes to its own and vies with mining and agriculture for first place in importance. As the population increases and the demands for lumber increase in proportion, the value of having an adequate supply of timber to draw upon for the natural development bound to ensue will be more and more appreciated.

Forest Wealth of the State

Distribution. In considering the location and distribution of the timber stands of Montana the state has been divided into seven regions or districts. The territory covered by each is shown graphically on a map accompanying this report.

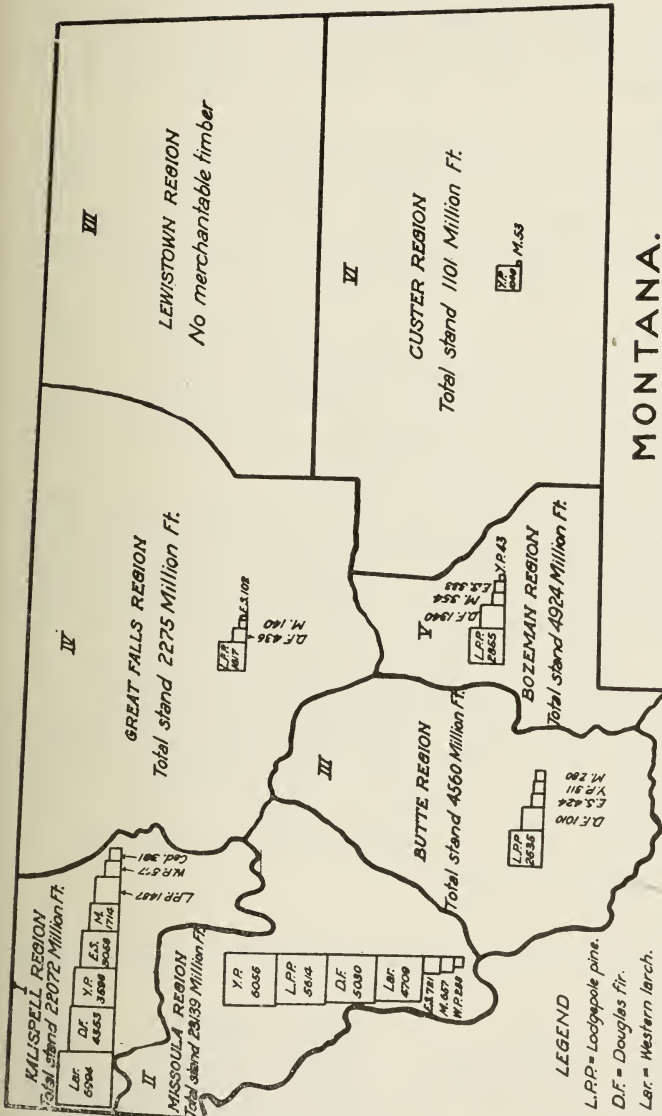
Region 1, the **Kalispell District**, includes Lincoln and Flathead Counties, the Kootenai, Flathead, and Blackfoot National Forests and Glacier National Park, together with included or closely adjacent forested land.

Region II comprises all the territory tributary to Missoula and is designated, for convenience, as the **Missoula District**. The Cabinet, Missoula, Lolo and Bitterroot Forests and the Flathead Indian Reservation are in this region. It includes Missoula, Ravalli, Sanders, Mineral, and a part of Granite and Powell Counties.

Region III is the **Butte District**. It takes in the Deerlodge, Beaverhead, Helena, and Madison Forests and all the territory which may be considered tributary to the cities of Butte and Helena.

Region IV, or the **Great Falls District**, occupies the north central part of the state, east of the Continental Divide. The Lewis and Clark, and Jefferson Forests and the Blackfoot and Fort Belknap Indian Reservations are included.

Region V is known as the **Bozeman** region as all the forested area tributary to that city falls into this district.



MONTANA.

TIMBER STAND. All classes of ownership. (Exclusive of protection forest)

Total stand by Species and Regions,

~in~

Million feet board measure.

March - 1918.

LEGEND

- L.P.R. = Lodgepole pine.
- DF. = Douglas fir.
- Lar. = Western larch.
- Y.P. = Western yellow pine.
- ES. = Engelmann spruce.
- W.P. = Western white pine.
- Ced. = Western cedar.
- M. = Miscellaneous

The Gallatin, Absaroka and Beartooth Forests are within the exterior boundaries of the Bozeman region.

Region VI takes in the southeastern corner of the state and is called the **Custer** region. The Sioux and Custer National Forests and the Crow and Tongue River Indian Reservations are the only large timbered areas included.

Region VII, the so-called **Lewistown** region, constitutes the northeastern corner of the state and contains practically no timber.

The heaviest stands lie to the west of the Continental Divide in the Kalispell and Missoula Districts; four-fifths of all the timber of the state is in these two regions. The eastern slope of the Rockies and outlying ranges included in the Great Falls, Butte, and Bozeman regions have a lighter stand and the trees are for the most part shorter, not yielding as high a percentage of lumber of the better grades as the stands farther west.

The altitudinal distribution of the forests ranges from 1800 feet (the lowest elevation in the state) on the west slope to between 10,000 and 11,000 feet, which represents about the upper limits of the growth in Montana, commonly known as "timber line."

East of the Rockies, because of the decreased rainfall, the lower limit of the timber rarely goes below 3,500 feet; 14 inches of rain are apparently necessary for tree growth at this altitude under the usual conditions of wind and topography. The elevation at which subalpine and protection forests occur of course varies greatly with the aspect and degree of slope.

Kinds of Trees:

The timber stand is composed of the following commercial species:

Lodgepole pine	Pinus contorta
Western yellow pine	Pinus ponderosa
Western white pine	Pinus monticola
Douglas fir	Pseudotsuga taxifolia
Western larch	Larix occidentalis
Englemann spruce	Picea engelmanni
Western hemlock	Tsuga heterophylla
Western red cedar	Juniperus occidentalis
White fir	Abies grandis

In addition there are present the following subalpine specie or species of inconsiderable importance; Alpine fir (*Abies Lasiocarpa*), limber pine (*Pinus flexilis*), and white bark pine (*Pinus albicaulis*), besides several species of junipers and a few broad-leaf trees such as ash, cottonwood, and birch.

Larch and western white pine are confined to and reach their optimum development in the Kalispell and Missoula regions and adjacent parts of Idaho; lodgepole pine finds its optimum habitat in the Butte region; yellow pine, Douglas fir, and spruce are found in nearly all parts of the state.

Timber Estimates:

As may be seen in Table I, the stand on the permanent productive commercial timber land for the state is about 58 billion feet. The figures submitted in this report do not include the timber on land suitable for agriculture when the timber is removed and the land cleared. For that reason the estimates are considerably lower in some instances than would be the case if the timber on the possible agricultural land was included. This is particularly true of the Kalispell region which contains the largest areas of agricultural timbered lands in the state.

Lodgepole pine, with a little more than 14 million feet, comprises 24 per cent of the total stand. The complete list is as follows:

TABLE I.
Rough Estimate of Volume by Species in Million Feet (Board Measure)

REGION	OWNERSHIP	Yellow Pine	White Pine	Douglas Fir	Engelmann Spruce	Larch	Lodgepole Pine	Cedar	White Fir	Hemlock	Miscellaneous	All Species
I KALISPELL	Forest Service.....	692	396	2,292	1,941	3,315	753	121	.....	.....	1,445	10,955
	National Park.....	140	40	340	160	420	520	20	.....	.....	60	1,700
	Public Domain.....	.....	.....	5	5	8	.....	.....	.....	.....	6	24
	Total Federal.....	832	436	2,637	2,106	3,743	1,273	141	.....	.....	1,511	12,679
	State Private.....	206	105	316	210	251	214	0	160	3	195	1,500
Total.....	2,560	26	1,400	742	3,000	0	160	.....	.....	.....	5	7,893
	Total.....	3,598	567	4,353	3,058	6,994	1,487	301	3	.....	1,711	22,072
II MISSOULA	Forest Service.....	2,295	170	2,552	531	1,051	5,376	44	16	46	365	12,446
	Indian.....	1,074	.....	358	358	.....	.....	.....	.....	.....	.....	1,790
	Total Federal.....	3,369	170	2,910	531	1,409	5,376	44	16	46	365	14,236
	State Private.....	116	30	160	40	200	206	21	27	53	.....	800
	Total.....	2,570	88	1,960	150	3,100	32	21	53	55	95	8,103
	Total.....	6,055	288	5,030	721	4,709	5,614	65	96	101	460	23,139
III BUTTE	Forest Service.....	27	.....	816	399	.....	2,510	.....	.....	.....	276	4,028
	State and Private.....	284	.....	194	25	.....	25	.....	4	.....	.....	532
	Total.....	311	.....	1,010	424	.....	2,535	.....	4	.....	276	4,560

IV GREAT FALLS		Forest Service	Indian	Public Domain	Total Federal	State and Private	Total	1,428	7	31	1,958
		42	371	86	1,477	140	1,617	47	.....	4	118
		35	24	8	396	40	436	2	.....	.....	3
		77	.....	94	.....	.....	.....	.....	.....	35	2,079
		5	40	8	.....	.....	.....	.....	.....	3	196
		82	486	102	.....	.....	.....	.....	.....	38	2,275
V BOZEMAN		Forest Service	Indian	Public Domain	Total Federal	State and Private	Total	2,278	7	325	3,928
		3	1,057	261	.....	.....	.....	177	.....	21	306
		40	83	22	.....	.....	.....	400	.....	.....	690
		43	200	50	.....	.....	.....	.....	.....	.....	.....
		462	1,340	333	.....	.....	.....	2,855	7	346	4,924
		506	.....	.....	.....	.....	.....	.....	.....	.....	.....
		968	9	6	.....	.....	.....	20	.....	2	497
		80	.....	7	.....	.....	.....	2	.....	.....	517
		1,048	9	13	.....	.....	.....	22	.....	2	1,014
		.....	2	1	.....	.....	.....	4	.....	.....	87
		.....	11	14	.....	.....	.....	26	.....	2	1,101

NO TIMBER

VII LEWISTOWN		Forest Service	Indian	Public Domain	Total Federal	State and Private	Total	12,365	165	2,511	33,812
		3,518	7,097	3,224	4,366	.....	.....	697	.....	81	2,006
		143	40	182	420	.....	.....	20	.....	6	27
		1,615	.....	5	8	.....	.....	2	.....	.....	.....
		5,276	606	7,908	3,425	5,152	13,113	49	.....	6	2,425
		392	135	476	250	451	420	601	.....	.....	.....
		5,539	114	3,796	976	6,100	160	.....	.....	225	2,300
		11,137	855	12,180	4,652	11,703	14,134	.....	.....	215	17,501
	
		19	12	21	8	20	24	1	.....	5	100

WHOLE STATE

Per Cent

TABLE II.
(Areas in 1,000 acres; Volume in million feet, b. m.)

REGION	OWNERSHIP	Protection Forest Area	Productive Area	Mature Stand Area	Poles and Reproduction Area	Total Annual Growth Volume	Mature and Overmature Stand Vol.	Immature Stand Volume	Total Stand Volume
I KALISPELL	Forest Service	1,245	2,549	1,622	927	199	8,232	2,723	10,955
	National Park	200	660	560	100	50	1,500	200	1,700
	Public Domain .....	.....	7	2	5	.....	16	8	24
	Total Federal	1,445	3,216	2,184	1,032	249	9,748	2,931	12,679
	State .....	.....	208	160	48	.....	14	1,300	200
Private	110	1,073	645	428	83	.....	6,000	1,893	7,893
Total	1,555	4,497	2,989	1,508	346	.....	17,048	5,024	22,072
II MISSOULA	Forest Service	403	2,997	1,247	1,750	178	9,446	3,000	12,446
	Indian	40	140	100	40	8	1,000	790	1,790
	Total Federal	443	3,137	1,347	1,790	186	10,446	3,790	14,236
	State .....	.....	118	78	40	.....	5	600	200
	Private	961	322	639	60	4,900	3,203	8,103
Total	443	4,216	1,747	2,469	251	.....	15,946	7,193	23,139
III BUTTE	Forest Service	703	2,538	1,075	1,463	104	2,354	1,674	4,028
	State and Private .....	.....	93	44	49	3	340	192	532
	Total	703	2,631	1,119	1,512	107	.....	2,894	4,560
IV GREAT FALLS	Forest Service	241	1,056	211	845	48	1,134	824	1,958
	Indian	30	69	28	41	8	81	37	118
	Public Domain .....	.....	10	2	8	.....	2	1	3
	Total Federal	271	1,135	241	894	51	1,217	862	2,079
	State and Private	145	50	95	4	150	46	196
Total	271	1,280	291	989	55	.....	1,367	908	2,275

V BOZEMAN	Forest Service	509	784	500	284	48	2,532	1,396	3,928
	National Park	28	92	43	49	4	206	100	306
	State and Private .....	.....	168	83	85	5	425	265	690
	Total	537	1,044	626	428	57	3,163	1,761	4,924
VI CUSTER	Forest Service	68	303	253	50	4	287	210	497
	Indian .....	.....	85	40	45	2	367	150	517
	Total Federal	68	388	293	95	6	654	360	1,014
	Private .....	.....	70	40	30	.....	60	27	87
Total	68	458	333	125	6	714	387	1,101	
NO TIMBER									
VII LEWISTOWN	Forest Service	3,169	10,227	4,908	5,319	581	23,985	9,827	33,812
	National Park	228	752	603	149	54	1,706	300	2,006
	Public Domain .....	.....	77	4	13	.....	18	9	27
	Indian	70	294	168	126	13	1,448	977	2,425
Total Federal	3,467	11,290	5,683	5,607	648	27,157	11,113	38,270	
State .....	.....	326	88	88	19	1,900	400	2,300	
Private	110	2,510	1,184	1,326	155	11,875	5,626	17,501	
Total	3,577	14,126	7,105	7,021	822	40,932	17,139	58,071	
WHOLE STATE									

I. Includes about 80,000 Acres State Land in units IV, V and VI.
 Source of Information: D. S. Forest Plans
 D. T. Mason's Report, Lumber Industry
 Dept. Interior Commissioner Indian Affairs
 S. V. Fullaway's Lincoln and Flathead Co. Report
 Correspondence with Indian Agents., general information.

TABLE III.
ROUGH ESTIMATE OF VOLUME IN MILLION FEET, (BOARD MEASURE)
AND PER CENT OF SPECIES BY REGIONS.

		SPECIES								
REGION		Yellow Pine	Western Pine	Douglas Fir	Englemann Spruce	Larch	Lodgepole Pine	Cedar	Miscellaneous	All Species
I KALISPELL	Vol. %	3,598 16	567 2	4,353 20	3,058 14	6,994 32	1,487 7	301 1	1,714 8	22,072 100
II MISSOULA	Vol. %	6,055 26	288 1	5,030 22	731 3	4,709 21	5,614 24	65 *	657 3	23,139 100
III BUTTE	Vol. %	311 7	.....	1,010 22	424 9	.....	2,535 56	.....	280 6	4,560 100
IV GREAT FALLS	Vol. %	82 4	.....	436 19	102 4	.....	1,617 71	.....	38 2	2,275 100
V BOZEMAN	Vol. %	43 1	.....	1,340 27	333 7	.....	2,855 58	.....	354 7	4,924 100
VI CUSTER	Vol. %	1,048 96	.....	11 1	14 1	.....	26 2	.....	2 *	1,101 100
VII LEWISTOWN		NO TIMBER								

*Less than ½%.

		Per Cent
Lodgepole pine.....	14,134	24
Douglas fir.....	12,180	21
Larch	11,703	20
Yellow pine.....	11,137	19
Engelmann spruce....	4,652	8
White pine.....	855	2
Cedar	366	1
Miscellaneous	3,045	5
	<hr/>	<hr/>
	58,071	100

By regions the most important species are:

Kalispell—larch, Douglas fir and yellow pine.
and larch.

Missoula—yellow pine, lodgepole pine, Douglas fir and larch.

Butte—lodgepole and Douglas fir.

Great Falls—lodgepole.

Bozeman—lodgepole and Douglas fir.

Custer—yellow pine.

Lewistown—no timber.

Tables I, II, and III shows the estimates in detail.

Ownership

The total productive commercial timbered area is 14,126,000 acres, half of which is covered with mature timber and half, covered with reproduction and young growth. These figures are shown in Table II. In the same table it will be seen that there are 3,577,000 acres of protection forest important from an erosion and water supply standpoint. Practically all of the protection forest is owned by the federal government. It is composed largely of limber and white bark pine and alpine fir, averaging possibly 2,000 feet to the acre and making a total of 7 billion feet for the whole state. This, of course, should not be considered with the merchantable timber as it may be only lightly cut, and then only in especially favored districts because of the inaccessibility of the stands and the necessity for maintaining an almost unbroken forest cover.

The merchantable timber is separated by ownership into five classes, as follows:

	Per cent
Forest Service.....	58
National Park.....	4
Indian Reservations.....	4
State	4
Private	30

Practically all of the lodgepole is held in federal ownership and 74 per cent of the spruce is also owned by the government and 66 per cent of the Douglas fir. About one-half of the larch is in private hands and the proportion is about the same for yellow pine.

Productive Capacity

Only very rough data is available from which to determine the annual cut permissible without injuring the forests. Much more accurate data will be required before any final answer can be given. Several different methods of figuring the yield, well known to Foresters, were used which gave results varying from 768 million feet to 2,250 million feet. The latter figure can probably be reached in practice only after years of care and development. In the present primeval conditions, without endangering either their permanence or the continuity of the cut, about 900 million feet is believed to be a conservative estimate of the allowable annual cut of forest products from Montana forests. The forests of the Kalispell and Missoula regions where all of the big sawmills are located will sustain a cut, under present conditions, of about 700 million feet. The present annual cut is less than 400 million feet. Some of the calculations by which these figures were obtained are given in footnote *.

* The current annual growth for all species on the productive commercial timber land (exclusive of Park land and protection forest) for the whole state, as determined very roughly, is 768 million feet. By regions the figures are:

	Million Feet
Kalispell	296
Missoula	251
Butte	107
Great Falls.....	55
Bozeman	53
Custer	6
Lewistown	0

768

These growth figures are probably lower than they would be were the stands in their most productive state with no overmature timber and all areas properly stocked. With the removal of the present overmature stands the annual growth will increase as these cut-over areas will be in a better growing condition and increment will not be offset by decay, windfall, and other losses as it is to a great extent at present.

The proper lodgepole rotation (the age at which the timber is ripe for cutting) appears to be about 140 years and this figure is used in this report. For all other species 120 years is taken as the age at which saw-timber size will be reached. White pine, cedar and white fir might profitably be handed on a 100 year rotation but since these species are of relatively very small importance in Montana they are thrown into the 120 year class. These are the rotations used in securing the limitation of cut for a sustained annual yield.

So many factors come in that it is very difficult, with no accurate information on site quality, acreage of stands now over-mature, and degree of stocking, to more than hazard a guess as to the possible future growth. However, using such yield tables as are applicable to this region for site quality II normal stands and applying them to the total acreage of the various types, the annual growth would be 2,250 million, but since the average stands are six-tenths normally stocked, it is estimated that the best that could be expected would be 1,350 million. The mean annual growth figures per acre used in the above computation are:

	Board Feet
White pine.....	275
Douglas fir.....	210
Spruce	200
Yellow pine.....	175
Larch	165
Lodgepole	110

This possible annual growth of 1,350 million obtains only when there are no over-mature stands, and when reproduction comes in immediately after logging. Loss by fire or other causes is not taken into account.

With the rather incomplete data at hand the limitation of cut figures must necessarily be only approximate. The best method of securing it seems to be to spread the cut in the present total mature timber stand over one-half the rotation since the mature stands occupy about one-half the total acreage which gives a very rough area check. "This is a well known method."

13,430 million	=	192 million feet per year
70 years		
42,355 million	=	706 million feet per year
60 years		
		898 million feet per year, all species.

The mature commercial lodgepole stand amounts to 13,430 million feet and all other species constitute 42,335 million feet.
Annual regulation of cut:

If it is planned to make the mature and over-mature stand last until the present pole stands reach the rotation stage, there would be 9,360 million feet of lodgepole to cut in 50 years or 187 million feet cut annually, and 28,623 million feet of all other species cut in 40 years which gives 716 million feet to cut annually. This makes a total of 903 million possible annual cut.

These figures do not take into account possible loss by fire, insects, fungi and other causes nor do they take into consideration the increment on the mature and over-mature stands for half the cutting period. These factors tend to affect each other but on the whole the 900 million feet is probably low rather than high and with proper care and management should increase materially.

A sustained annual yield of at least a billion and a quarter can reasonably be expected when the present over-mature stands have been logged.

PRODUCTION OF FOREST PRODUCTS

Number and Size of Sawmills

There were 103 sawmills in operation in the state during the year 1916, each producing an annual cut of 50,000 board feet or more. The following tabulation shows the number of different sized mills included in the above 103 mills from which complete and reliable data has been secured.

Annual Cut	No. of Mills
10,000 M or more.....	8
5,000 M to 10,000 M.....	4
1,000 M to 5,000 M.....	8
500 M to 1,000 M.....	10
50 M to 500 M.....	73
Total	<u>103</u>

In addition to these mills, there were in operation during 1916 probably from 20 to 30 mills cutting less than 50 M per year. Most of these mills are located east of the Continental Divide.

Annual Lumber Production

The best available statistics on the annual production of lumber in the state during the last ten years up to and including 1915 vary from about 337 million feet b. m. as the maximum to about 228 million feet b. m. as the minimum. The average is 312 million per year. This information is based upon data compiled from reports from operators who manufacture more than 50,000 feet b. m. per year. Small mills not included in the above figures produce probably from 500,000 feet b. m. to 3,000,000 feet b. m. per year. It would appear then that the average production of lumber during the past ten years ranges from 313 to 315 million feet b. m.

The cut for 1916 is considerably above the average for the past ten years. For the purpose of this article, however, the production of lumber for 1916 is assumed as being representative of what may be expected for a normal year in the future—for several years at least. The total lumber cut for 1916, based upon mill cutting 50,000 feet b. m. or more per year is 383,884,000 feet b. m. If the small mills cutting less than 50,000 feet b. m. per year

are included, it is believed to be conservative to assume that the total cut for 1916 was in round numbers at least 385,000,000 feet b. m.

There are several reasons for this great increase in lumber production during 1916. These reasons are as follows:

1. Stimulation in building and increase in lumber values.

2. More complete information on the physical and mechanical properties of Montana woods and the wide range of uses to which these woods are particularly adapted.

3. Better quality of manufacture.

4. More efficiently organized operations and selling methods.

5. Increased demand because of war requirements.

6. Pressure from taxation and carrying charges.

7. Agricultural development and activity in other industries requiring lumber.

The lumber production by species is as follows:

	Board Feet Measure
Yellow pine.....	138,206,000
Douglas fir.....	56,845,000
White pine.....	10,497,000
Larch	163,829,000
Spruce	6,790,000
Cedar	2,612,000
White fir.....	3,408,000
Lodgepole Pine	1,631,000
Cottonwood	66,000
	<hr/>
Total reported.....	383,884,000

There was no hemlock reported, but it is known that a small amount was manufactured in the western part of the state. The total hemlock cut was probably from 2 to 3 million feet. This species was largely sold with the larch and Douglas fir.

Total Cut All Forest Products

In addition to the lumber produced, there were 25,522,000 pieces of lath and 16,266,000 shingles. Figuring that 7,000 lath is equal to 1,000 feet b. m. and 10,000 shingles is equal to 1,000 feet b. m. of lumber, the lath and shingles produced are equal in round numbers to 5,200,000 feet b. m.

The stulls, lagging, converter poles, cordwood, ties, posts and poles produced are estimated to be equivalent to approximately 204 million feet b. m.

The following table shows the total estimated amount of forest products manufactured during 1916, in terms of feet b. m.

	Feet Board Measure
Lumber	385,000,000
Stulls	75,000,000
Lagging	1,000,000
Converter poles.....	1,500,000
Cordwood	100,000,000
Ties (not included in lumber)	20,000,000
Posts	5,000,000
Poles, pilings, etc.....	2,000,000
Shingles	1,600,000
Lath	3,640,000
	<hr/>
Total Forest Products.....	594,740,000

The total figures are rounded off to 595,000,000 feet b. m.

The total cost of handling these products from stump to final place (as given in detail later) is estimated to average about \$40.00 per M, which includes the freight. It is estimated that the amount of money expended in labor, freight, etc. for each thousand feet of fuel wood used is about one-fourth as much per M as for lumber. One reason for this is that a large proportion of the wood is used on ranches and is not shipped over any railroad.

The figures for the production of lumber, lath, and shingles are considered very reliable, because they are based upon authoritative data. The figures for the other Forest Products may be slightly in error for the reason that they are partly based upon estimates, but in most cases the estimates are believed to be conservative; possibly estimates of stulls may be too high.

Relation of Logging and Milling Costs to f. o. b Prices at Mill

This varies greatly for different regions, different species, and between different operators. Nothing more than general averages can be given. During the last ten years the margin between total costs from the stump to

f. o. b. cars and the selling prices has been very small. In many cases the two have been about the same and sometimes the selling price has been less than the cost of production.

Lumber manufacturers have not made 10 per cent net on their investment during the past ten years, if the cost of carrying charges on their holdings, such as protection, taxes and insurance, is charge to the annual cut. During 1917 the manufacturers probably made from 10 per cent to 20 per cent on their investment, excepting operators who were tied up a large part of the year by strikes, shortage of labor, et cetera. Any one familiar with logging and lumbering operations, realizes that this is a very risky and hazardous business and is entitled to a higher margin, to insure a fair industrial return, than almost any other line of business.

The following tabulations show the estimated relation between manufacturing costs and the selling prices f. o. b. mill for a representative plant during 1917. This mill cuts from 15 to 22 million feet per year. It is an up-to-date band mill. The cut is about 75 per cent yellow pine. The timber was sound and the quality good.

Kind of Mill	Daily Capacity	Estimated Investment in Mill	Estimated Investment in Operating Capital, Logging equipment, etc.	Estimated Investment in Stock Carried in Yard	Total Average Profit bearing Investment
Band	60,000	\$80,000	\$80,000	\$200,000	\$360,000

The following tabulation shows an analysis of the operation and the relation between the operating costs and the f. o. b. mill selling prices.

Logging	Manufacturing Lumber Tally	Over Run, Per Cent	Manufacturing Log Scale	Stumpage	Total Cost Stump to Car Log Scale	Selling Price f. o. b. Mill, Lumber Tally	Selling Price Log Scale	Margin Per Thousand	Amount Cut	Total Margin
\$11.00	\$6.50	20	\$7.80	\$3.25	\$22.05	\$22.00	\$26.40	\$4.35	15000M	\$65,250

On this basis, and for this particular operation, the gross profit on the investment is about 18.1 per cent. Assuming that money in this region is worth at least 8 per cent, and including interest as a cost, the net profit on the investment is 10.1 per cent. This does not allow anything for taxes and carrying charges on standing timber. It is believed that the average mill in Montana during 1917 did not earn more than 10 to 15 per cent on the investment, from which interest, taxes, and carrying charges on stumpage must be paid.

Freight Rates to Eastern Montana Points

The freight rate per M feet b. m. varies greatly, of course, for different species and for different kinds of material. It is estimated that the freight rate per M for all Montana lumber, from origin to destination varies from about \$2.50 to \$7.00 per M with an average of probably \$5.00 per M. The rate per M for the material shipped in from the Coast varies from about \$2.45 per M for the lightest material (cedar bevel siding) to about \$10.00 per M for timbers with an estimated average of not less than \$8.00 per M for all material shipped.

The freight rates per 100 pounds of lumber are uniform for all grades.

For car-load shipments the approximate rates per 100 pounds to several Montana points are as follows:

FROM	TO				
	Bozeman	Billings	Miles City	Havre	Glasgow
Missoula, Mont.	12½c	20c	25c		
Eureka, Mont.				13c	21c
Sandpoint, Ida.	25½c	33c			
St. Maries, Ida.			33c		
Pacific Coast Points (Seattle, Portland)	35c	35c	35c	35c	40c

The freight per M from these different points varies considerably for different species and different classes of product. The following table gives the freight rates per M feet of lumber by producing regions to the Gallatin Valley or the Bozeman region:

Species	Producing Region	Boards	Dimension	Planks Timbers	Rustic	Shiplap	Drop Siding	Flooring	Ceiling
Coast Fir.....	Coast.....	8.75	9.28	10.15	8.40	8.75	7.00	7.00	4.90
Larch and Douglas Fir.....	Missoula.....	2.75	3.00	3.75	2.38	2.50	2.50	2.50	2.50
	St. Regis.....	3.63	3.96	4.95	3.14	3.30	3.30	3.30	3.30
	Idaho.....	5.61	6.12	7.66	4.85	5.10	5.10	5.10	5.10
Western Yellow Fir.....	Missoula.....	2.50	2.75	3.63	2.25	2.38	2.38	2.38	2.38
	St. Regis.....	3.30	3.63	4.79	2.97	3.14	3.14	3.14	3.14
	Idaho.....	5.10	5.61	7.40	4.59	4.85	4.85	4.85	4.85
Western White Pine.....	Missoula.....	2.38	2.63	3.63	2.25	2.25	2.25	2.25	2.25
	St. Regis.....	3.14	3.47	4.79	2.97	2.97	2.97	2.97	2.97
	Idaho.....	4.85	5.36	7.40	4.59	4.59	4.59	4.59	4.59

THESE RATES PER M ARE FOR AIR-DRIED LUMBER

Factors of Competition With Mills Further West

The factors which determine competition are: the cost of stumpage, cost of logging, cost of manufacturing, quality of lumber, grades, sizes, strength, durability, adaptability to certain uses, weight, freight rates, etc. If it were possible to make a detailed analysis of all the factors enumerated, it would then be possible to show diagrammatically the possibilities of each timbered locality. Theoretically, the factor which determines the economical competition with mills further West in distance, which in turn greatly affect the freight rates. This one factor, however, does not determine the limit of competition with the mills further West.

The Coast mills can log cheaper and the timber is of better quality and is better suited to certain sizes and grades. The mills in this state can compete with the Coast mills to a certain distance, for certain kinds and sizes of material.

The freight rate from Missoula, Montana, to Bozeman, Montana, is 12.5 cents per hundred pounds. From Bellingham, Washington, to Bozeman, the rate is 35 cents per hundred, or 22.5 cents per hundred more. In this case, assuming 2x4 dimension to weigh 2,400 pounds per M feet b. m., the Coast mill shipping to Bozeman must pay \$5.40 per M more for freight than the mills at Missoula or Bonner, Montana. If there is no difference in the quality

of the lumber, and the logging on the Coast is not more than \$5.40 per M cheaper than the Montana logging, the Coast mills, theoretically, should not get any of the business in Bozeman for this particular class of material, provided that Montana has sufficient timber to supply all such markets within the state. There are, however, certain classes of material which probably cannot be supplied for the entire state from Montana mills because of the quality of the timber. There are more Douglas fir clears, such as flooring, ceiling and the like, used in the state than could be supplied from the Douglas fir which is cut annually within the state. It is believed that there is a big field for larch in this particular line if it is rift or vertical grain sawed and properly dried. It should be investigated, and I believe that it is financially feasible and practically possible to replace a large portion of the Coast fir clears with Montana larch.

A complete and detailed analysis of the factors affecting competition would require complete knowledge of lumber consumption, by grades and sizes; complete knowledge of logging and manufacturing costs; complete knowledge on available timber, its quality and condition and a complete diagram of freight rates. This kind of study, to be of greatest value to the producer and the consumer would necessarily cover, not only the state of Montana, but the entire United States. This should be one of the ultimate aims of the Forest Service and the State Forestry Departments. It will then be possible to formulate working plans and regulate the cut on the basis of sustained annual yield for all timber producing areas, but varied locally to meet demands from an economic point of view. Such a study as this would make it possible to divide the country into zones showing the following information:

1. Population and consumption of forest products.
2. Amount and quality of available timber.
3. Present source of supply.
4. Most economical source of supply.
5. Where competition should be encouraged.
6. Zone lines for different grades of material.

It would be found by a study of this kind that certain market zones would be overlapped by other zones

for certain grades. If a certain zone could be most economically supplied from a certain body of timber, based upon distance and logging conditions, it might be found that the quality of timber was such that certain grades and sizes could not be produced in sufficient quantity to supply the demand. In that case, that particular zone would necessarily have to be overlapped by the zone which could most economically supply the special product.

Shipping lumber long distances has two disadvantages:

1. It reduces the manufacturer's margin, and
2. It increases the cost of the lumber to the consumer.

The two most important features in connection with the lumber industry are (1) the business should be on a sufficiently sound basis to yield a fair industrial return on the investment and (2) it should be so organized relative to competition, cooperation and distribution, that the consumer could secure lumber at the lowest practicable rate.

Market Limitations of Montana Mills and Relation to Number and Size of Mills and Accessibility of Stumpage

The market limitations of Montana mills are determined by practically the same factors as outlined under "factors of competition with mills further west." The size and quality of the timber, accessibility, logging conditions, logging costs and manufacturing costs, primarily determine the limitation of Montana mills but the amount of timber, quality of timber, logging costs, etc., in adjacent states also materially affect the limitation.

Assuming that the total cut of Montana mills for 1916 was 385 million feet 'b. m. of lumber, which includes the sawed ties and timbers, and that 80 per cent of the cut was sold in Montana, the total consumption from Montana mills would be 308 million feet b. m. The best information available shows that the Idaho mills sold 80,000,000 feet b. m. in Montana, the Pacific Coast mills sold 213,000,000 feet b. m. and approximately 1,000,000 feet b. m. of of hardwoods were shipped in from various eastern states. The material which was cut under free use and commercial sales up to \$100 and Forest Service sales to settlers at cost, are eliminated from the above figures. On this basis the Montana mills supply only about 52 per

cent of the lumber consumed in Montana. The annual growth of timber in the state is figured conservatively to be not less than 900 million feet b. m. This indicates that the state has sufficient timber to supply the present annual consumption indefinitely, and have a considerable surplus to dispose of elsewhere or in the form of other products, provided that the forest lands are protected and properly managed.

Theoretically, the Montana market should be supplied by Montana mills but there is a certain amount of white pine, cedar, and probably some Douglas fir clears and large timbers which could not be furnished by Montana mills. Without more detailed study, it is not possible to determine with any degree of accuracy what percentage of the total consumption of lumber in Montana could be most economically supplied by Montana mills, but it is roughly estimated that from 75 to 90 per cent should be so supplied.

Assuming that 75 per cent (the more conservative figure) could and should be supplied by Montana mills: this means that the cut would have to be increased from 385 million to 450 million, an increase of only 65 million. The present mill capacity of the state is ample to take care of this amount. This would mean a decrease in the amounts shipped into the state from the coast, and from Idaho of approximately 140 million feet and a decrease in the amount shipped to other markets of about 75 million feet. Of the 140 million feet decrease in shipments from points outside the state, it is reasonable to assume that 120 million would be from Coast mills and 20 millions from Idaho mills. This would represent a saving to the consumer of about \$3.00 in freight on the Coast lumber and \$1.00 on the Idaho lumber, or a total reduction in the price of lumber paid by the consumer of \$380,000 annually, or an annual saving per capita of 76 cents.

The only way to get at the actual figures is by a comprehensive study of the demands of the consumer, correlated with the sizes, grades, and kinds of lumber produced in the state. Is it not a problem worth studying? Are not both producer and consumer entitled to know the

facts and should not the state undertake to bring about a more satisfactory condition of affairs?

One factor which affects the possibility of this development is the fact that owners of Pacific Coast timber and mills operate a large number of retail yards in the state and naturally they are most concerned about a market for their own stumpage. This may affect to some extent the possibility of supplying some of the markets in the eastern part of the state with native timber.

The data at hand indicates that several more small mills and a number of medium sized band mills could be profitably operated in this state. Probably the biggest field for increased business and better utilization of forest products is in the development of the pulp industry. It is believed that this state can supply at least one and possibly two good sized pulp mills indefinitely. This phase of timber development should be thoroughly investigated.

Distribution of the Total Cut

There is not sufficient data available to accurately show the distribution of the entire cut. Reliable data is available for about 359 million feet b. m. This is about 85 per cent of the total cut and it is believed to be representative for the distribution of the entire cut. The amount or percentage of the entire cut sold in Montana does not check with figures which have previously been worked up because more complete data has been obtained since these figures were compiled. The following tabulation shows where the lumber was sold, the amount, and the percentage each amount is of the total sold, also the total cut for all mills included in the tabulation, the amount of stock on hand and the percentage this is of the total cut.

Distribution of Montana Lumber, 1916 Cut

WHERE SOLD	Amount M	Approximate Per Cent of	Amount Cut M	Amount in Yard M	Per Cent of Total Cut in Yard
Montana	288,940	80.50			
Nevada, Utah, Oregon, Colorado, Wyoming and New Mexico	4,803	1.34			
North Dakota, South Dakota, Kansas and Oklahoma	17,596	4.92			
Minnesota, Wisconsin, Iowa, Illinois, Missouri, Michigan and Indiana	23,725	6.54			
Atlantic States	8,282	2.30			
Canada	618	0.20			
Other States	15,101	4.20			
Totals	359,065	100.	377,912	191,599	51

The above figures indicate that, when the lumber market is good and the demand is above normal, not more than 50 to 60 per cent of the annual cut is carried in stock. If the stock on hand for large mills is averaged over a period of five to ten years, it usually amounts to from 60 to 80 per cent of the total annual production, but as small mills usually sell a large portion of their cut in the rough, much less lumber is carried in stock by these mills. It is believed that for the entire state 60 per cent of the annual production of lumber would be a safe figure to use for normal conditions, including all types and sizes of mills in the state. In order, however, to be on the safe side in figuring investment in lumber, 70 per cent of the annual cut is usually assumed to be a conservative figure.

Approximately 20 per cent of the total cut of lumber in Montana is shipped out of the state. This would be from 60 to 80 million per year. This is largely the better grades of yellow pine and white pine and a small amount of Douglas fir and larch. Common grades of the interior

species cannot be shipped long distances because of the weight and low mill run value.

Number of Retail Yards

There are, according to the 1917 "Blue Book," *Vol. 28, 456 retail yards within the state. These yards deal in lumber as their principal business, but most of them handle other products in connection with lumber.

There are 143 other concerns which retail lumber but are not listed in the "Blue Book" as retail yards. This makes a total of 599 concerns which retail lumber, either as a principal business or as a side issue. There are probably a few small yards in the country which are not listed, but the amount of material handled by such yards, if there are any, is such a small percentage of the total business in the state that they need not be considered.

Cost and Selling Prices

Considerable data has been collected concerning the cost prices f. o. b. cars at retail yards and the selling prices. The figures, without detailed analysis, indicate that there is a wide margin between cost and selling prices. One would naturally conclude that the retailer was making an unusually high profit at the consumer's expense. This, however, upon close analysis, is found to be not the case. The retailer in this region usually makes from 12 to 25 per cent on the average investment. During 1917 the margin on the investment was probably a little greater than usual or an average of about 20 per cent.

It is often thought by the consumer when he was to pay from \$30 to \$40 per M on an average for his lumber that the price is unreasonable and some one is making a big profit. An analysis of the retail business, if carried no farther than the class of material handled, the freight rates and the margin between cost and selling prices, indicates that the retailer is making an unreasonable profit. However, if the retail business is probably analyzed, it will be seen that the prices charged for lumber are not unreasonable, but a good profit is made on the investment. There is detailed data available from about 123 retail yards, showing the number of men employed, the average investment per yard for real estate, sheds, office furniture, yard equipment, lumber carried in stock, and the cost per

*Issued by the National Lumber Manufacturers' Association.

M for handling lumber from the cars to the consumer. This data was collected for 1917. The following table shows the analysis of the retail business in these yards, which is based partly upon data submitted by retailers and partly upon estimates.

No. of Yards Included	Average Investment Per Yard	Average Amount of Lbr. Handled Per Yard	Average Cost Price Per M Including Freight	Average Selling Price Per M	Gross Margin Per M	Cost of Handling in Yards, Delivering, etc.	Net Profit Per M	Per Cent of Profit on Average Investment
123	\$14,000	600M	\$26.00	\$38.00	\$12.00	\$ 7.00	\$ 5.00	19.2

It has been shown elsewhere in this report that the manufacturer does not make an unreasonably high profit on the investment. The figures in this table indicate that the retailer makes a fair profit but it is not considered exorbitant. The cost of handling lumber from the car to the consumer includes taxes, insurance, depreciation, maintenance of equipment and all overhead. This item ranges from about \$4.00 per M as the minimum to about \$8.50 as the maximum.

The investment per yard is not believed to be representative for the average yard for the entire state. There are several large yards located in towns where real estate is very valuable and the investment would be much greater. It is believed that \$18,000 per yard would be a good average investment for the entire state, and from \$6.00 to \$6.50 per M for handling charges.

These 123 yards were selected because they were so nearly the same for the investment per yard, the amount of lumbr handled, and the cost per M for handling it.

It seems perfectly evident that the consumer has to pay for too many retail yards. One yard for every 1,000 people in the state is really more than is necessary. In one locality in Eastern Montana eight yards supply 14,000 people; in another locality twenty-one retail yards supply 15,000 people. Numerous cases can be found of duplication of effort in this field. Obviously if the number of

retail yards was more nearly commensurate with the population, the cost of lumber to the consumer could be reduced several dollars per M feet. This may or may not be a field for investigation and action by the state government.

Principal Lumber Trees of the State

The available supply, distribution of supply, and production have already been discussed for the commercially important species which grow within the state. It is here intended to summarize in a general way information concerning the characteristics of the different woods, grades of lumber made, and uses to which the material is adapted.

Western Yellow Pine (*Pinus ponderosa*)

In total value of the product, western yellow pine is the chief lumber producing tree of Montana. In this state it reaches its best development in the Bitter Root and St. Regis Valleys. The wood is light, soft, and resinous, and has a fine even grain. The sapwood is nearly white, usually varying from three to six inches in thickness. The heartwood varies in color from light yellow to reddish brown. The wood is not strong as compared to larch or Douglas fir, but its even grain, smooth finish, easy working properties, and resistance to warping and checking enhance its value for uses of the trades. In its general serviceability for secondary manufacturing plants requiring soft woods, it is excelled only by white pine for which it is often mistaken and substituted.

The following statistics show some of the physical and mechanical properties of western yellow pine (or western pine and western white pine, as it is commonly called in the lumber trade.)

Average weight of oven-dry wood, 26.5 pounds per cubic feet (Sargent).

The green weight is about 46 pounds per cubic feet. Specific gravity (dry) 0.42.

Fuel value 63 per cent that of white oak (Sargent).

Average breaking strength (Modulus of rupture) of small, clear pieces green, 5200; air-dry, 9800 pounds per square inch. (Forest Service strength tests).

Average factor of stiffness (Modulus of elasticity) of small clear pieces, green, 1,010,000; air-dry,

1,340,000 pounds per square inch (Forest Service strength tests).

The strength under varying conditions of service varies from about 60 to 70 per cent of that of Douglas fir.

Weight of 1,000 feet b. m. of rough green lumber, from 3,500 to 3,700 pounds.

Shipping weight of 1,000 feet (b. m.), of 1-inch rough air-dry lumber, 2,600 pounds; of 1-inch lumber, air-dry and planed, 2,100 pounds.

Utilization

The major product of the yellow pine forests is lumber in its various forms. Western yellow pine lumber is used for almost every purpose to which any pine lumber is put. It has uses ranging from the coarsest construction to highly finished products. House frames, beams, joists, rafters, sills, sheathing, and studding are cut in all workable dimensions. Thick finish from $1\frac{3}{4}$ to 2 inches inch finish, siding, flooring, factory plank or shop common, factory selects, thick common lumber, common boards, ship lap, groved roofing, dressed and matched material, dimension, fencing, and lath are the principal products into which western yellow pine is separated when it leaves the yard or planer. Many of these products are shipped in the rough as they come from the sawmills, but the bulk of the material is run through the planer and either surfaced or re-manufactured into some of the finished forms.

The uses of the wood and the basis for the grades of sawed products are very similar to those of white pine. The tree produces an average of about 13 per cent select, 12 per cent shop, and 75 per cent common lumber, as graded at the larger mills. The proportion of the various grades produced depends not only upon the quality of the timber, but also upon the efficiency of the operation, the size of the mill and the facilities for marketing lumber. Inefficient operations do not cut as high a proportion of the better grades, and small mills without a marketing organization do not take as much care in separating grades.

Western yellow pine is well suited for flooring, although considerably softer than its chief competitors, Douglas fir and western larch. Its even grain and wear-

ing qualities commend its use for flooring and it shrinks or warps comparatively little after proper seasoning. The wood makes excellent fuel for which both the green and dead timber is used. In addition to being sawed for lumber and used for fuel, it is extensively used in the mines of Butte for stulls; also to some extent in the round for house logs and frames, fence rails and posts in the agricultural districts, but for these purposes is inferior to Douglas fir and lodgepole pine. The wood of the yellow pine is not very durable in contact with the soil and as a rule should be treated with a preservative before being used for ties, telegraph poles, or fence posts. The butt logs of dead trees thoroughly impregnated with pitch, however, make excellent fence posts.

It has never been used commercially for paper, but experiments made at the Forest Product Laboratory, Madison, Wisconsin, indicate that it has possibilities for this purpose. With the soda process it yielded pulp with a strong fiber of brown color which would probably make a good grade of wrapping paper. By the mechanical process it yielded pulp which had long fibers and was creamy in color, but coarse, and suitable only for making manila and other papers where color and coarseness are of no importance.

Western Larch (*Larix occidentalis*)

Montana has about 46 per cent of the total supply of this species in the United States. In 1916 more than 50 per cent of the total output of larch was cut in this state. The total cut reported by Montana sawmills in 1916 was 16 per cent greater than that of western yellow pine, but fell off from 164 million board feet in 1916 to about 138 million feet in 1917, which was 4 per cent less than that of the yellow pine. The heaviest stands of larch are located in the northwestern part of the state.

Description of the Wood

The heartwood is reddish-brown in color, while the sapwood, which is usually from $\frac{1}{2}$ to $1\frac{1}{2}$ inches thick, is yellowish-brown. Western larch lumber is practically all heart-wood, because the sapwood is so thin that it is generally cut off with the slab in sawing the log. The annual rings are clearly marked, each showing two distinct bands,

one of light-colored wood grown in the spring, and the other of darker, harder and stronger wood grown in the summer. The grain of the wood is straight and very close. The fiber is hard and tough; holds nails firmly. Knots are generally sound, tight, and not over 1½ inches in diameter. The wood is very durable under conditions where it is exposed to the weather, even when not painted. The average weight of western larch grown in Missoula County, as shown by tests at the Forest Products Laboratory, Madison, Wisconsin, is 51 pounds per cubic foot, green; air-dry weight (at 12% to 15% moisture) 39 pounds; kiln-dry weight (at about 8% moisture) 37 pounds; oven-dry weight, 31 pounds.

Forest Service strength tests of western larch show that it ranks high with other American woods as a structural material. The following average values for small clear pieces tested green were obtained from material grown in Montana and Washington:

Specific gravity oven-dry, based on Volume when tested 0.48.

	Pounds Per Square Inch
Specific gravity oven-dry based on vol. when tested	0.48
Av. breaking strength (Modulus of rupture	7,500
Av. factor of stiffness (Modulus of elasticity	1,350,000
Crushing strength (compression paral- lel to grain	3,800
Fiber stress at elastic limit (Compres- sion perpendicular to grain.....	560
Shearing strength parallel to grain.....	920

Utilization

The bulk of the larch is cut into dimension, common lumber, and timbers for structural purposes, since the stiffness, strength, hardness, and other qualities particularly adapt it for that class of work. It is, however, used for a great variety of purposes ranging from the heaviest construction to the finest interior finish. The tree produces an average of about 8 per cent select lumber and 92 per cent of the common grades.

Owing to its beautiful grain, larch is an excellent wood for interior finish. It does not mar or dent easily and readily

takes and holds stains, varnishes, oil finishes and paints. When cut with the grain vertical and properly seasons, the wood makes an excellent flooring material which wears evenly and keeps a smooth surface.

One of the chief objections often made to western larch is that interior finish often shrinks after placing in a building. This is due to the wood being manufactured into finished product before it is thoroughly dry. Forest Service tests show that the volumetric shrinkage of larch is somewhat greater than that of most other western woods, which emphasizes the importance of careful attention to the matter of seasoning. Excellent results have been secured in kiln drying larch green from the saw in the Forest Service humidity regulated kiln. Wide clear boards one inch thick were dried successfully, and it was demonstrated that the losses which ordinarily occur in seasoning larch can be greatly reduced.

Larch is one of the best cross tie woods in Montana and large numbers are used annually. The wood has sufficient strength in side bearing to withstand rail wear well. It can be easily treated with preservative, and about two-thirds of the larch ties used in Montana are treated either with creosote or zinc chloride. As a material for wood-block paving, larch is very serviceable because of its hardness and resistance to wear. In Spokane treated larch paving blocks have been quite extensively used. In addition to the large amount consumed locally, a considerable quantity of western larch cut by Montana mills is shipped out of the state to the prairie states of the Middle West.

Pulp

Forest Service paper making tests on western larch indicate that although the wood in the mechanical process produces a pulp which can not be manufactured into papers of good color and strength, nevertheless, in the sulphate process the wood produces a pulp which can be manufactured into natural colored kraft wrapping paper of very good strength. The wood is not well suited for the manufacture of pulp in the sulphite process.

Douglas Fir (*Pseudotsuga taxfolia*)

Douglas fir holds third place in Montana in total output from the sawmills and in the total value of its products. The

annual cut represents from 10 to 15 per cent of the total lumber production of all species in the state.

The wood is considerably lighter than larch but heavier than the western yellow pine in the dry condition. The Douglas fir grown in Montana is rather knotty and coarse grained. The spring and summer wood vary greatly in density. The spring growth is soft and spongy and almost white in color, while the summerwood is hard and flinty and very dark. The growth is more variable than that of larch and the yearly rings may be narrow with very little of the brown summerwood, or broad with nearly as much summerwood as springwood. The proportion of heartwood is usually less than that of larch, but greater than that of yellow pine. The wood is neither as straight grained nor as easily worked as that of the coast fir, but it is highly valued for its strength and durability. Forest Service strength tests of small clear pieces in the green condition show the following average values for material grown in Montana and Wyoming:

	Pounds Per Square Inch
Specific gravity overn-dry based on vol. when green	0.40
Av. breaking strength (Modulus of rupture)	6,400
Av. factor of stiffness (Modulus of elasticity)	1,180,000
Crushing strength (compression paral- lel to grain)	3,000
Fiber stress at elastic limit (Compres- sion perpendicular to grain)	450
Shearing strength parallel to grain.....	880

In pure stands the Rocky Mountain form of Douglas fir does not produce such dense stands nor clear straight boles as the coast fir, and because of its slower growth it forms at a given age a forest of much smaller trees than does the coast fir. Because of its smaller size and absence of clear length the Douglas fir cut in Montana does not furnish as high a quality of lumber as that grown in Oregon and Washington. Some of the Montana fir is used for flooring and finish, but the tree cuts a very small percentage of selects, 98 per cent going into common lumber and only 2 per cent in the select grades. At the sawmills most of the fir is cut into rough lumber, timbers and dimension stuff for mining and

construction purposes. Its strength and comparative lightness fit it for joists, floor beams, rafters, and other timbers which must carry loads. The greater part of the output is consumed within the state, a large quantity being used by the Butte mines. Both square and round timbers are in some cases crosoted or treated with other preservatives when used in permanent mine work. The round timber is more easily treated because of the soft sapwood which readily absorbs the fluids. In the square form the density of the heartwood hinders the penetration of the preservative. Large numbers of railway cross ties are used annually in an untreated condition throughout the state.

Pulp

To a limited extent paper mills in the Pacific Coast region use Douglas fir for pulp, but it is usually combined with that of other woods. The density of the summerwood of Douglas fir and difficulty of bleaching the pulp make it unsuitable for the finer grades of paper, but good wrapping paper can be produced. The wood may be reduced by either the mechanical or the soda process.

Lodge Pole Pine (*Pinus contorta*)

Most of the lodgepole pine produced in the state is consumed in the round or hewed form or as fuel wood. The lumber census figures which are for lumber cut only do not indicate the importance of the species. It contributes less than one per cent to the lumber cut of the state, but should be classed as the fourth species of importance in point of production and value on the basis of the total output of mining timbers, posts, poles, ties, and fuel. The total supply of standing timber exceeds that of any other species and in many districts the wood is the most important in its general uses.

The wood of lodgepole pine is straight grained, with narrow rings in which the resinous band of summerwood are conspicuous, though relatively small when compared with the the springwood. It is more resinous than eastern white pine, but less so than the yellow pines of the South and West. In color it varies from almost white to a light yellow or yellow-brown with a tinge of red in the heartwood. Its specific gravity (oven-dry) based on volume when green is about 0.38. The green weight varies from about 39 pounds to 47 pounds

per cubic foot. The air-dry weight averages about 28 pounds and the kiln-dry weight 27 pounds per cubic foot. The wood is fairly soft, and is easily worked. Though not so strong as Douglas fir of the Pacific Coast, a heavier wood, tests made by the Forest Service show it to be practically as strong as western yellow pine and stronger than Engelmann spruce and alpine fir, three woods of more nearly its weight. Tests made on lodgepole pine and western red cedar telephone poles cut green and seasoned show lodgepole pine to be the stronger, both in cross bending and in compression parallel and perpendicular to the grain.

Average strength value for green lodgepole material grown in Montana, Colorado, and Wyoming, tested in the form of small clear pieces are as follows:

	Pounds Per Square Inch
Average breaking strength (Modulus of rupture)	5,500
Average factor of stiffness (Modulus of elasticity)	1,080,000
Crushing strength (compression parallel to grain)	2,610
Fiber stress at elastic limit (compression perpendicular to grain).....	310
Shearing strength parallel to grain	690

Lodgepole is one of the smallest of the commercially important pines. In well developed stands approximately 140 years old, at which age the tree may be considered mature, most of the merchantable trees are from 8 to 14 inches in diameter breast high and from 60 to 80 feet in height. Trees up to 20 inches in diameter and 85 feet in height are commonly found, however. Even in mature stands only about 20 per cent of the material is large enough for saw timber and the logs taken out run from 20 to 30 per thousand board feet. Such sizes do not yield wide lumber and are more expensive to log than larger stuff. Owing to the small size of the timber and various other causes the use of lodgepole in lumber has been comparatively small, forming less than 0.1 per cent of the total lumber cut of the United States.

When carefully manufactured lodgepole produces better lumber than is commonly assumed. In quality it ranks between western yellow pine and western white pine and

is often mixed with these species. While the sound knots which are characteristic of lodgepole make it difficult to turn out any large quantity of clear lumber, they do not prevent a high percentage from going into No. 1 and No. 2 common of the narrow widths. When manufactured into lumber the tree produces about 7 per cent selects, 93 per cent going into the common grades. At present most of the lodgepole pine lumber is used locally for rough construction and repairs, though in some places where other species are not available it is also used for flooring, siding, and finish.

Figures on the total cut of lodgepole for all purposes in Montana have not been compiled recently, but in 1913 the total amount including that cut from private as well as from National Forest lands was about 30.5 millions board feet. This cut was distributed among the different products as follows:

	Board Feet	Per Cent
Mine timbers	14,632,000	48
Cordwood	8,554,000	28
Fencing	4,083,000	13.4
Saw timber	2,805,000	9.2
Miscellaneous	315,000	1.1
Railroad ties	108,000	0.3
	<hr/>	<hr/>
Total	30,497,000	100.

The annual cut has probably increased somewhat during the past five years, but it is estimated that the percentages used for different purposes have not been greatly changed.

The wood is the chief source of stulls, lagging, and converter poles for the Butte mines and Butte affords the greatest single market for this species to be found anywhere. Lodgepole stands supply large quantities of house logs and straight slender poles used for building corrals and fences and it is an ideal timber for ranch purposes.

The wood is not durable in contact with the soil, but is easily treated with preservatives. It yields a ground wood pulp of good quality suitable for the manufacture of news print paper. It can also be made into pulp by the sulphite process.

Western yellow pine, western larch, Douglas fir and lodgepole pine furnish over 90 per cent of the forest products

cut within the state. The remaining 10 per cent is made up principally of Engelmann spruce, western white pine, and white fir. The Engelmann spruce forms extensive stands at high elevations, but has been little exploited thus far. The quantity of western white pine manufactured in Montana sawmills is small compared with the amount of this species manufactured in Idaho. White fir is found in small quantities in mixture with other species in the mountains of western Montana.

Consumption of Forest Products

The lumber consumption in the state in 1916 was computed to be 604 million feet and of all other forest products, such as cordwood, hewn ties, posts, poles, lath, and shingles, 196 million board feet, a total of 800 million feet.

Dwellings

The 1915 census abstract states that there is one dwelling for every 4.5 people in Montana, and at the present estimated rate of increase in population of 15,000 per year, about 3350 new dwellings are required to house the people. This would take 67 million board feet of lumber. There are in the neighborhood of 110,000 dwellings in the state at present requiring an annual amount of 22 million feet of lumber for repairs. Furthermore, lath and shingles amounting to 33 million feet board measure are needed, this making 122 million feet used for dwellings alone.

Farm Improvements

Each year 1700 new farms are established in Montana requiring barns, hay sheds, carriage houses, and various out-buildings. It takes 38 M feet of lumber per farm for these improvements or 65 million feet in the state. At present there are 50,000 ranches: and repairs on these at the rate of 300 board feet per year per ranch would be 15 million feet. It is estimated that one million fence posts are needed on ranches, or 5 million feet, reduced to board measure.

Office and Factory Buildings

No very close check was possible on the amount of lumber used in office and factory buildings but it is estimated at 150 million feet.

Mining

The mining industry is centered at Butte, which takes

a large percentage of the total amount of lumber demanded by the industry. Very close figures are available for the Butte consumption as a result of a study of that market by the Forest Service. Adding 10 per cent of the Butte consumption for the rest of the state, the mining companies annually need

132,000 M board feet of lumber

32,000 M board feet of stulls

2,000 M board feet of lagging, and converter poles.

Thus the total consumption of the mines is 167 million feet per year.

Railroads

According to the 1917 valuation survey of the Board of Assessors, there are 7254 miles of railroads in Montana, of which about 1450 miles are side tracks, spurs, and yards, and 5,804 miles in main line tracks. The average annual cross tie replacements were figured at 300 per mile for main line track and 250 per mile for the side tracks, or 2,104,000 ties and another 100,000 is used on the 270 miles of electric road (exclusive of the C. M. & St. P. main line, which is included in the previous figures). Reduced to board feet, 80 million feet are required by the railroads for cross ties; of these, 60 million board feet are sawn ties and 20 million are hewn ties.

Stations and other railroad buildings are included under the heading "Factory and Office Buildings" previously discussed. 200 M. B. M. of poles are used by the various electric railroads but this figure has been combined with the pole figure for telephone and telegraph companies. For repairs on platforms, bridges, trestles, crossing, etc. 20 million feet are consumed annually, bringing the total consumption for railroads in the state up to 100 million feet.

Irrigation

It is estimated that there is needed for the repair of flumes, gates, etc., on irrigation works, not to exceed 6 million feet.

Telephone, Telegraph, and Power Companies Use One Million board feet of cross arms and 42,000 poles which when reduced to board measure give 3 million feet, a total of 4 million feet of all forest products.

The Fuel Consumption has been estimated at 200,000 cords or 100 million board feet.

The Wood Using Industries of the state in 1912 took 6 million feet and for the present year, the amount is placed at 8 million.

Miscellaneous

All other needs in Montana are estimated at 58 million feet. These figures are summarized in the following table:

Forest Products Consumed

Class of Use	Volume Million Feet B. M.
Dwellings	122
Farm Improvements	85
Office and Factory Buildings	150
Mines	167
Railroads	100
Telephone, Telegraph and Power Lines	4
Irrigation	6
Fuel	100
Wood Using Industries	8
Miscellaneous	58
Total	800

By kinds of products the consumption is as follows:

Lumber from Montana mills	300,000 M
Lumber from Idaho mills	80,000 M
Lumber from Pacific Coast mills	213,000 M
Ties not included in lumber	20,000 M
Hardwood from the East	1,000 M
Posts	5,000 M
Poles, Piling, etc.	3,000 M
Free use and small sales to settlers	10,000 M
Stulls	33,000 M
Lagging and converter poles.....	2,000 M
Lath and shingles made in Montana	5,000 M
Shingles shipped in from the Pacific Coast	29,000 M
Fuelwood and miscellaneous products	100,000 M*
Total all forest products	801,000 M

*The consumption of fuelwood appeared high, but upon close analysis it was found that 100 million feet board measure was a very conservative figure. It is usually figured that one cord of wood is equivalent to 500 feet board measure. It was figured that 250,000 of the population of the state, largely the eastern part of the state, used 50 board feet of fuelwood per year or one-tenth cord per capita; 150,000 inhabitants in the cities and small towns in Western Montana used 300 board feet or six-tenths cord per capita and the remaining 100,000 inhabitants, largely ranchers in the western part of the state, used 500 board feet or one cord per capita. If this figure is in error, it is believed to be low.

According to the most reliable statistics for 1917, the population for Montana was approximately 500,000 people. This was checked by a curve plotted to show the increase over a long period and the maximum which could be determined from the curve was 500,000 inhabitants. Using this number as a basis to figure from, the consumption per capita for all forests products expressed in terms of feet board measure is 1,600 feet; excluding railroad ties, mine timber, and fuelwood and reducing it to lumber, lath, shingles, etc., the consumption was about 900 board feet per capita. This figure is an average for the state with is higher than for rural communities, where no large consumption for office and factory buildings, railroad, and other special projects brings up the average. For ordinary use such as dwelling, farm improvements, irrigation, etc., the per capita consumption would be between 400 and 600 feet b. m.

Cross Section of Lumber Consumption in Eastern Montana

In the spring of 1918 the Forest Service made two intensive studies of lumber consumption in Eastern Montana, which show some interesting figures. The figures collected cover the calendar year 1917. The Gallatin and Sun River Valleys were selected, the former, one of the oldest and best settled regions in the state, and the latter, still largely in the pioneer stage. The area selected in the Gallatin Valley contained a population of 14,000 people, with eight retail lumber yards and the Sun River, a population of 15,000 people, with twenty-one retail lumber yards. The following table shows the total and per capita consumption by classes of products (not including telephone or telegraph poles).

Consumption of Forest Products in M Feet B. M.

NAME OF AREA	Total							Total
	Lumber	R. R. Ties	Farm Timbers (Posts & Poles)	Fuelwood	Shingles	Lath	Mouldings, Sash Doors, Frames	
Sun River	7,177 65*	1,831 16.9*	671 6*	444 4*	633 5.5*	133 1.2*	162 1.4*	11,054 100*
Gallatin	4,722 37.5*	2,267 18.5*	478 4*	4,503 35.5*	342 2.5*	139 1*	115 1*	12,568 100*

*Per Cent.

Per Capita

Sun River	457	122	45	30	.....	84	.....	740
Gallatin	340	162	35	321	.....	42	.....	900

The following table shows the source of lumber only used in each Valley.

Gallatin Valley
Species of M Feet b. m.

SOURCE OF LUMBER	Native Species	Coast Douglas Fir	L.a. D. Fir	Y. Pine	W. Pine	Cedar	Total	Per Cent.
W. Coast .....	.....	865	.....	.....	.....	28	893	19
Idaho .....	.....	.....	1,257	295	175	29	1,756	37
W. Montana .....	.....	.....	354	160	143	.....	657	14
Local	1,416	.....	.....	.....	.....	.....	1,416	30
Total	1,416	865	1,611	455	318	57	4,722	100
Per Cents	30	18	34	10	7	1	100	.....

Sun River Valley

W. Coast .....	.....	1,750	.....	.....	.....	199	1,949	27.1
Idaho .....	.....	.....	10	.....	17	.....	27	.4
W. Montana .....	.....	.....	4,190	991	.....	.....	5,181	72.2
Local	20	.....	.....	.....	.....	.....	20	.3
Total	20	1,750	4,200	991	17	199	7,177	100
Per Cents .....	.3	24	59	14	.2	2.5	100	.....

The following shows the per cents of the grades of lumber used as graded at the retail yards:

Per Cent of Grades Used

NAME OF AREA	Selects Clears and Shop	No. 1 Common	No. 2 Common	No. 3 Common	No. 4 Common	Local Timber Mill Run	Total
Sun River	5	43	13	18	18	3	100
Gallatin	10	41	7	23	3	16	100

It will be noted that the per capita consumption of lumber only is 457 feet b. m. in the Sun River Valley and 340 feet b. m. in the Gallatin Valley. Considering the differences between the stages of development of the two localities, this difference is reasonable. Older well settled communities use less lumber per capita than those in earlier stages of development. The Sun River Valley is believed to be more representative of the greater part of Eastern Montana. Another difference which might be expected is the larger percentage of the select and clear grades of lumber (the most expensive) used in the Gallatin Valley. Older communities are able to afford more luxuries in general than people in the pioneer stage of development; the percentage of urban to rural population is also much greater in the Gallatin than in the Sun River Valley, which, as a rule, means better houses calling for a greater volume of the higher grades of lumber. Forty-five per cent of the lumber sold (including, in this case, lath, shingles, sash and doors) in the Gallatin Valley was for use in towns, and 55 per cent for the country trade. Corresponding figures for Sun River are 19 per cent, town trade, and 81 per cent, country trade. The fuelwood consumption in the two regions were approximately the same as to urban and rural, 10 per cent being for town use and 90 per cent for use on farms.

There is a very striking difference also in the quantity of wood fuel consumed in the two localities as well as in the total fuel (wood and coal) consumed. Converted to feet board measure, the Sun River uses 30 feet and the Gallatin 321 feet per capita. The coal consumption in Sun River amounts to 23,000 tons and in the Gallatin, 30,000 tons. Reducing this to feet b. m. (on the basis of $1\frac{2}{3}$ cords wood equals one ton of coal and 500 feet b. m. per cord of wood), the total consumption of fuel in terms of lumber is 1302 feet b. m. for the Sun River and 2100 feet b. m. for the Gallatin, per capita. Considering that the Gallatin Valley includes the comparatively large city of Bozeman, the Agricultural College, and several large flour mills, a brewery and other fuel-consuming industries, not represented in Sun River, the difference seems reasonable. The wood fuel consumption of Sun River is more representative of Eastern Montana conditions than is the Gallatin figures.

ECONOMIC IMPORTANCE OF THE LUMBER INDUSTRY

Investment in Business

The economic importance of any industry can best be determined from the investment represented in that industry, the labor it furnishes and the number of people that it supports directly or indirectly.

If the lumber industry in the state is analyzed on this basis, it would seem to be one of the most important industries in the state and in some respects it is by far the most important. Agriculture and mining are, of course, the most important industries, but these could not be economically and successfully operated unaided by the use of forest products. For that reason the forest resources, especially the timber, is without question first in importance if considered broadly.

All available data has been collected and an estimate of the investment in the lumber industry is given below. These figures are of necessity only estimates, but they are believed to be reasonably close to the actual facts.

As nearly as can be determined the investment is as follows:

Logging equipment	\$ 1,000,000
Logging railroads, steel etc	1,080,000
Manufacturing investment (Mills)	4,000,000
Planing mills, sheds, real estate, etc.	2,000,000
Investment in logs on hand	400,000
Lumber carried in stock	6,000,000
Other forest products	2,700,000
Retail yards, including lumber	8,723,000
Stumpage	17,260,000
Transportation; investment in equipment, transportation lines, etc.	34,819,200
Total investment rounded off to.....	\$78,000,000

As the total investment is much greater than the figures which have been formerly compiled, some of the items need explanation.

The investment in retail yards and transportation equipment have not been included in previous reports. Data from about 123 retail yards show that the average annual profit bearing investment ranges from \$11,000 to \$19,000 per yard. The average for the state was placed at \$18,000 per yard for the reason that no large yards were included in the 123 yards. There are 456 retail yards in the state and 143 other concerns which handle more or less lumber. The 143 yards referred to were estimated to have an average investment of \$5,000.

The investment in transportation facilities was much more difficult to determine. According to the statistical report of 1917, Board of Assessors, there are 5,804 miles of main railroad and 1,450 miles of spurs, side tracks, etc., in the state. This makes a total of 7,254 miles. The investment in this mileage, including everything except the passenger equipment is estimated to be \$40,000 per mile. On this basis the total investment is \$290,160,000. It is estimated that from 12 to 15 per cent of the total tonnage originating in the state is lumber and other forest products. Twelve per cent of the total investment was charged to the lumber industry in arriving at the total investment in that industry. This amounts to \$34,819,200.

It is believed that these figures are conservative. Statistics show, for the United States as a whole, that slightly more than ten per cent of the entire tonnage handled during 1914 was lumber and other forest products.

The statistics show, for the western district, that forest products comprise 16.68 per cent of the total tonnage while agricultural products account for 17.20 per cent of the total. The products from mines in the western district constitute 43.28 per cent of the total tonnage, while manufactured products comprise only 12.55 per cent.

It is, therefore, very evident that the lumber industry and other forest products furnish a large portion of the freight business and from that point of view they are among the most important industries.

Probably the total tonnage from any given industry is not the best index to the importance of that industry from a traffic point of view, because the rate per ton varies greatly for different commodities, and the haul also varies considerably. An analysis of the average haul, the revenue and average receipts per ton-mile is probably the best comparison. In the following table seven commodities are selected for this purpose. These figures are taken from the statistics of railways in the United States for 1914.

District	Commodity	Number of Tons	Number of Ton-Miles	Revenue	Av. Receipts Per Ton-Mile-Cents	Av. Length of Haul-Miles
Western.....	Grain	24,537,231	5,889,373,751	\$41,322,930	0.767	219.64
Western.....	Hay	3,445,889	523,156,568	6,043,796	1.155	151.82
Western.....	Livestock	8,315,039	1,749,226,521	24,558,161	1.404	210.37
Western.....	Dressed meats	978,009	336,201,540	3,584,746	1.066	343.76
Western.....	Anthracite coal	2,477,213	483,146,301	3,108,634	0.643	195.04
Western.....	Bituminous coal.....	44,276,336	6,050,456,162	37,612,063	0.622	136.65
Western.....	Lumber	40,832,434	7,905,602,432	56,954,077	0.720	193.61

The boundary of the western district is about as follows: Bounded on the northeast by the northwestern shore of Lake Michigan to Chicago, thence by line through Peoria to St. Louis, thence down the Mississippi River to its mouth. Alaska and the Island possessions are not included.

It was not possible to compile the classification of freight originating in Montana. The western district selected is believed to be fairly representative for this state, except that the tonnage from forest products would probably not be as great a percentage of the total for Montana as for the whole western district and for that reason it was estimated that 12 per cent would be a safe figure to use.

Number of People Employed in Lumber Industry

It is not possible to show the actual number of people employed in the various activities, but a knowledge of operating costs and the amount of forest products handled annually make it possible to closely approximate the number of people employed in the woods, mills and retail yards.

Every thousand feet of logs that is cut and transported to the mill under present conditions represents from 1.5 to 2.5 man-day's labor. It is believed that two man-days' labor per M feet b. m. is a fair estimate. Telephone, telegraph and power poles, piling, stulls, lagging, and converter poles represent considerably more labor for each thousand feet handled.

The labor for manufacturing lumber is not as much per M as for logging. The labor for manufacturing from pond to car varies from about 1.1 to 1.4 man-days per M feet of lumber. Some of the most efficient band mills may hold the labor down to one man-day per M, while some of the small mills would be as high as two man-days per M.

These figures are intended to include only the actual labor necessary to produce one M feet b. m. of logs or lumber. Depreciation, maintenance, taxes, insurance, general overhead, etc., are not considered in this part of the discussion.

The following table shows the estimated number of men employed in the production of forest products. It is believed that the employees in retail yards should be included because that is one of the important features in the lumber industry.

Men employed in woods.....	7,000
Men employed in mills	2,000
Men employed in retail yards.....	1,200
Miscellaneous	1,800
	<hr/>
Total	12,000

These figures are based upon an estimated average effective year of 200 days each for the logging and manufacturing. Because of the large overturn the actual number of men on the payrolls would greatly exceed these figures.

The number of men employed in the woods includes loggers, pole and stull makers and tie cutters. Miscellaneous includes cruisers, labor for fire protection, wood cutters, post makers, etc. It is believed that there are from 10,000 to 15,000 men employed in the various activities listed here.

Only a small percentage of the woods workers are married, but a large percentage of the mill employees and employees in retail yards have families. It is estimated that the lumber industry supports directly from 25,000 to 30,000 people. The number that is supported from other lines, such as building, secondary wood-using industries, etc., has not been included. According to the most reliable statistics there are at least 31 secondary wood-using industries in Montana. How many employes this represents is not known.

Labor Costs of Handling Forest Products

If the total business directly resulting from the forest products cut in Montana during 1916 could be completely analyzed, the importance of protecting and properly managing the forests so as to maintain a perpetual supply of timber would be evident without further discussion.

It costs in supplies, labor, transportation, etc., about \$8.00 per M to do the logging. It costs at least \$6.00 per M to manufacture, including all costs from the pond to f. o. b. cars. The costs for 1917 were, of course, considerably more. The average freight paid per M for each M feet b. m. shipped varies from about \$2.50 to \$6.50, with an average of probably \$5.00 per M for all forest products cut. Handling in retail yards is estimated at \$6.00 to \$8.00 per M for material actually handled and about \$4.00 per M prorated over all products handled.

The cost of putting the material in final place, such as laying ties, building bridges, trestles, houses, barns, granaries, etc., varies from about \$7.50 to \$15.00 per M. The cost of replacing ties under present labor conditions would be from 25c to 30c per tie, or from \$7.50 to \$9.00 per M. The cost of building barns, sheds, granaries, and similar structures would vary from \$6.00 to \$10.00 per M. Structural construction, bridges, trestles, etc., would range from about \$15.00 to \$25.00 per M. The cost of putting telephones, telegraph, power poles and piling in place would be much more per M feet b. m. than for the lumber.

The cost of dwellings varies greatly per M for different parts of construction. Setting up studding and framing walls of wooden dwellings would cost under present wages about \$18,000 to \$20.00 per M. Framing and setting floor joists 2x8 to 2x12 would cost \$16.00 to \$18.00 per M. Framing and setting heavy joists and girders 6x12 to 10x14 would cost \$14.00 to \$16.00 per M. The cost of laying 4-inch flooring would cost from \$35.00 to \$40.00 per M.

The average labor cost of construction or putting into final place is estimated to be \$20.00 per M. It is believed that this would be a fair and conservative weighted average per M feet b. m. for the labor of putting these forest products into final place after delivery of the finished product. The various figures making this total are estimates, but they are sufficiently correct to be used as an illustration.

The following tabulation shows the estimated average expenditure in labor, supplies, and transportation, for each thousand feet board measure of forest products that were cut in this state during 1916, from the stump to final place.

Item	Cost Per M
Logging	\$ 8.00
Manufacturing	6.00
Freight or wagon haul	5.00
Handling in retail yds., selling delivering, maintenance, depreciation, overhead, bad accts., etc., \$6.00 to \$8.00 per M, estimated average on total cut	4.00
Construction, buildings, etc.....	20.00
	<hr/>
Total Costs	\$43.00

These figures do not include the furniture and other wood-using industries which spend considerably more for each M feet handled. Cordwood converted to board measure represents only about \$10 per M feet in labor as compared to other products.

If the total cut of forest products (excluding cordwood) in Montana during 1916 is placed at a round figure of 495 million feet b. m. and the cost of handling from the stump to final place is rounded off to \$40.00 per M for supplies, freight, labor in logging, manufacturing, retail yards, constructing houses, bridges, and other structures and purposes, the industrial importance to the state directly and indirectly is \$19,800,000.00; and including cordwood at \$10.000 per M feet makes a total of \$20,800,000.00.

If the average wage scale for 1916 is placed at \$4.00 per day, the total number of effective days represented by the above sum is 5,200,000 days. This divided by 300 days, the result is 17,333 work years of \$1,200 per year, which is more than the average American family earned during 1916. In other words, the forest products cut in Montana during 1916 represents enough in labor, supplies, freight, etc., to support 17,333 average American families, or about 70,000 people, slightly more than 14 per cent of the entire population of Montana.

Some Interesting Comparisons

The best stands of mature timber for large areas will average about 20,000 feet b. m. log scale per acre. For a tract of 160 acres the total log scale on this basis would be 3,200,000 feet b. m. A large portion of the logs cut in this state are transported by rail for a distance of 10 to 100 miles.

Saw logs will average about 8,000 pounds or four tons per 1,000 feet b. m. On this basis 160 acres of the best stands of timber would yield 12,800 tons of freight in the form of sawlogs. The lumber overrun over log scale is not, on an average less than 20 per cent. The yield of lumber, then, from the same area would be 3,840,000 feet b. m. The total freight in lumber would be 9,600,000 pounds, or 4,800 tons, assuming that the shipping weight of Montana lumber and timbers will average 2,500 pounds.

The average yield of wheat for the state of Montana during 1916 was approximately 19 bushels per acre. Placing the weight of wheat at 60 pounds per bushel, the total amount of freight produced from 160 acres of wheat would be approximately 91 tons per year. On this basis, it would require about 140 years for 160 acres of wheat to yield the same number of tons of freight as 160 acres of the best stands of mature timber in the form of sawlogs, and approximately 53 years to produce the same amount of freight as 160 acres of timber would yield in lumber. Assuming 140 years as the average age at which Montana timber matures (and this is a conservative figure) 160 acres of timber lands will produce under forest management about 35 tons of freight in the form of lumber annually, which is about 38½ per cent as much as wheat land produces, based on the 1916 average. Considering the relative topography and productive capacity of the two classes of land, this is a very important economic consideration. Timberland, which we are considering, it must be remembered, will not grow wheat or any other profitable agricultural crop and is fit only for timber production.

Assuming that 8,000 feet b. m. log scale is a fair load of logs, the forest products cut in Montana during 1916 would require at least 52,000 cars to haul the logs in one load. This would make a train approximately 416 miles long, which would reach from Spokane to Helena with 39 miles to spare. The tonnage would be slightly more than the production of hay for the entire state during 1915.

If all the forest products cut in Montana in 1916 were converted into board feet, the lumber would be sufficient to make a sidewalk four feet wide and one inch thick 24,621 miles long, which would reach approximately around the world, or from New York to San Francisco 7.8 times. There

would be sufficient material to make a solid block of wood one mile square and 18.7 feet high.

Looking at it from another angle, the forest products cut in Montana during 1916 would make enough lumber to construct approximately 34,700 modern five-room cottages of average size which would be equivalent to about eight towns the size of Missoula.

If all the forest products cut in Montana during 1916 had been cut into cordwood it would be equivalent to all the spruce pulpwood cut in Maine, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, Oregon, and Pennsylvania during 1914.

The actual average labor cost of lumber delivered to the consumer at the retail yard, not including stumpage or the profit to which the manufacturer and the retailer are entitled, is about \$20.00 per M feet. Twenty-five per cent of this cost is freight, and **this timber is grown within the state!** It is easily apparent that the freight item alone will greatly increase the cost for lumber shipped longer distances. The consuming public is, therefore, interested in maintaining a continuous lumber business in the state for at least two very vital reasons: (1) because it means the cheapest lumber it will be possible to obtain; and (2) almost all of the land now naturally forested must either produce timber or become practically waste land, and this means higher taxes on productive land and fewer people to meet the burden.

The people of the state should wake up to the immense economic value of forests and the industry which they support and take action to insure the source of supply of the raw material and so regulate the cut that Montana will always have a thriving industry. The immediate need is a strong State Forestry organization which will keep the people and the state government informed concerning the need for action. That is the only instrument through which effective results can be obtained.

WHAT THE STATE SHOULD DO FOR THE FOREST INDUSTRY OF MONTANA

In the foregoing pages, an attempt has been made to present a picture of the present and future possibilities arising out of the possession of abundant forest wealth. The Creator gave to Montana three great natural resources with which to build an empire: rich agricultural lands, wonderful mineral resources, and abundant forest wealth. The development of the first two is dependent in large measure upon the third. A resource, the development of which support directly some 25,000 or 30,000 people and indirectly 70,000 people or 14 per cent of the present population, surely demands careful consideration upon the part of those responsible for the future welfare of the state.

When we consider that the future expansion in the lumber industry will mean the support of two or three times this number of people, that the lands which support timber must (except for a very small percentage) continue to grow timber or become non-productive waste land, that the future of the business is entirely within our hands—to develop and conserve and stabilize, or allow to expand and grow disproportionately as a mushroom, leaving nothing for future generations, we begin to realize that the preservation and right use of this resource is a matter of very great public concern.

It is not a question of a few needed laws only (although they would help) or of any overshadowing crisis which we are approaching. No man can tell now just what ought to be done to insure the state against the economic loss of so great an industry. This is a question of adapting a forest policy to the changing and growing needs of the people. This requires careful study and consideration of all factors in the case at various stages of development. What is needed is a strong Forestry Department of the State Government, which, through constant study of the problem, will be able to formulate a far-sighted forest policy and ask the support of the people and the legislature in carrying it out. Obviously, a very important part of the job is to inform the people and keep them informed of conditions and needs. Constant attention to the interests and welfare of the people of the state for all time is needed to bring about a wholesome and satisfactory condition of affairs. Any other policy will result in

wasting the heritage of forest wealth so generously provided and that in turn means a serious hindrance to the reaching of the fullest economic prosperity.

With the broad and far-reaching purposes of forestry in mind, I have attempted to indicate more specifically a few of the things the state should do in the immediate future.

(a) Commit itself, like the national government to a policy calling for the highest use of all lands.

(b) Classify the forest lands of the state and designate those of greatest value for permanent forest production regardless of ownership.

(c) Adopt measures which assist private, state, and federal owners to consolidate holdings so as to permit economical administration.

(d) Exercise some control of private lands with reference particularly to:

(1) methods of cutting so as to insure restocking of the land with trees;

(2) disposal of brush and debris left from logging to minimize the fire risk;

(3) distribution of cutting with reference to permanent industries;

(4) control of forest fires.

(e) Cooperate with the National Forest Service in regulating the cut to the limits of forest productivity. To do this will mean:

(1) some control over the number, location, and size of sawmills;

(2) collection of data on rate of growth of timber, distribution of age classes, etc.;

(3) silvicultural management of state forests;

(4) prevention of private owners from withholding ripe timber from the market when such policy interferes with development of local communities.

(f) Adopt measures for educating and making good citizens of woods workers. This means coordinating industries to make possible year-long employment and establishment of homes.

(g) Directly assist the lumber industry in:

- (1) gathering statistics of lumber manufacture, shipments, and consumption;
- (2) making a study of Montana markets and taking such action as may be possible to reduce the cost of lumber to consumer;
- (3) educating the people to use Montana forest products by giving euthentic information as to their uses and values compared to other woods;
- (4) making a study of wood substitutes and compiling data concerning relative values;
- (5) studying efficiency of methods of logging and milling in order to reduce costs;
- (6) creating an organization capable of impartially appraising stumpage values and scaling logs when in dispute.

RECOMMENDATIONS

1. An adequate Forest Fire Law defining a closed season from June 1st, to September 30th, inclusive, of each year, during which it would be unlawful for any person to set out, or cause to be set out, fires in any forest material without first procuring a permit therefor from certain designated officers: A copy of such proposed law, as well as the necessity thereof is fully set out in the article "PROTECTION OF PROPERTY AGAINST SLASH FIRES IN WESTERN MONTANA" embraced in this report.

2. Having had numerous applications for the purchase of Lodgepole Pine, this office has had to refuse the sale of same; under the present State Forestry Laws (Chapter 147—1909 and Chapter 119—1911) no timber can be sold that is less than 8 inches in diameter, 20 feet from the ground.

There is at least 75% of Lodgepole Pine that matures and decays before reaching the dimensions required by law, and is blown down, causing dangerous fire traps.

I respectfully recommend that the coming Legislature will amend the present laws so as to enable this office to dispose of this class of timber, thereby increasing the receipts of the office and will also avoid a dangerous fire menace, otherwise proving a total loss of thousand of dollars to the state.

3. A law authorizing the State Forester to sell without advertising live timber in quantities not to exceed five hundred dollars in value.

Having had applications from single individuals for immediate purchase of small amounts of Tie and Saw timber, a number of such sales have been lost to the state by having to comply with the present laws in regard to advertising same. From the date of application, advertising timber, and office work, from six to seven weeks elapse before the sale can be made, together with expense for each contract, averaging \$15.00.

I respectfully request that the State Laws be so amended, to allow the State Forester to sell up to \$500 worth of timber without advertising.

4. A law requiring any person, firm or corporation engaged in the cutting or removing of timber, logs, ties, poles, wood or other forest products, from lands within the State of Montana, whether public or private, to burn or otherwise dispose of the brush, slashings and all inflammable material incident to such cuttings, at such times and under such methods and restrictions as may be provided by law.

This law is urged for the following reasons: Practically all Forest Fires have their origin in dry, old and long neglected brush heaps and slashings, and until disposed of are a constant menace, furnishing fuel for fires once started, are very hard to control. I am convinced that a law enacted along these lines will reduce the fire hazard at least 40 per cent.

FORESTRY BUILDING

The importance of the lumber industry of Montana suggests the need of a Forestry Exhibit Building. Such a building should be located at the State Fair Grounds where forest and mill products can be assembled and displayed and publicity given showing the methods followed for the preservation of the great natural timber resources of our state as well as the necessity for making them permanent and increasing their value.

I feel this matter justifies the serious consideration of our Legislature. A suitable building could be erected for

\$15,000. The great interest manifested by citizens engaged in the lumber industry justifies this department in stating that \$5,000 of the amount could be raised by private subscription. I therefore suggest that the Legislature make an appropriation of \$10,000, contingent upon the securing of \$5,000 by private donation.

Such a building would make a handsome additional structure to the State Fair Ground where a permanent exhibit of Montana's lumber industry can be displayed.

AERO FOREST FIRE PATROL

It is estimated that Montana has a present stand of 58 billion feet, board measure, of mature merchantable timber and that the State of Montana owns 4% or about two and one-third billion feet.

The preservation of this great asset and industry devolves in a great measure upon the state, in cooperation with the Federal Forest Service and Protective Associations.

The greatest menace to our forests, at this time, is their destruction by fire. And in the development of a system of protection from this source, the method now in use is patrolmen, lookouts, and trail building with connecting telephone lines.

Agencies now engaged in forest fire protection in Montana annually employ 350 patrolmen and lookouts, for the summer period at an annual cost of about \$60,000. This is the present annual force for patrol work only, and is inadequate and should be greatly increased.

For fighting and suppressing forests fires during the year 1917, the total cost to all cooperating agencies in Montana, was the huge sum of \$480,000, with resulting damage of \$300,000.

The adoption of measures and means to quickly discover, locate and report fires in our forests is of the greatest importance; and in this connection I suggest the use of aeroplanes. From a limited investigation on the subject I feel justified in recommending the use of an Aeroplane Forest Patrol during the dry summer months, and that their use will prove practical, economical and the most adequate means for the prevention and suppression of forest fires.

Two men with an aeroplane, from an elevation of from two to three thousand feet could overlook a forest area forty miles in width and for an unlimited distance in traveling over the water-sheds of the state, thereby doing more effectively, patrol work than under the present system requires the employment of a great many men. As an estimate I would say one machine would equal the services of 60 men.

The war has caused great development in the navigation of the air, and demonstrated the practical commercial use of aeroplanes, as well as training great numbers of our boys in their use, which should make available both men and machines for such service and at a reasonable cost.

I respectfully submit this proposition for serious consideration by the State Board of Land Commissioners, with a view of authorizing this department to secure such equipment for the coming fire season.

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ECONOMIC USE OF THE FOREST OF MONTANA

By

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Assistant District Forester, U. S. Forest Service.

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