

THE

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LEWIS AND CLARKE FOREST RESERVE, MONTANA

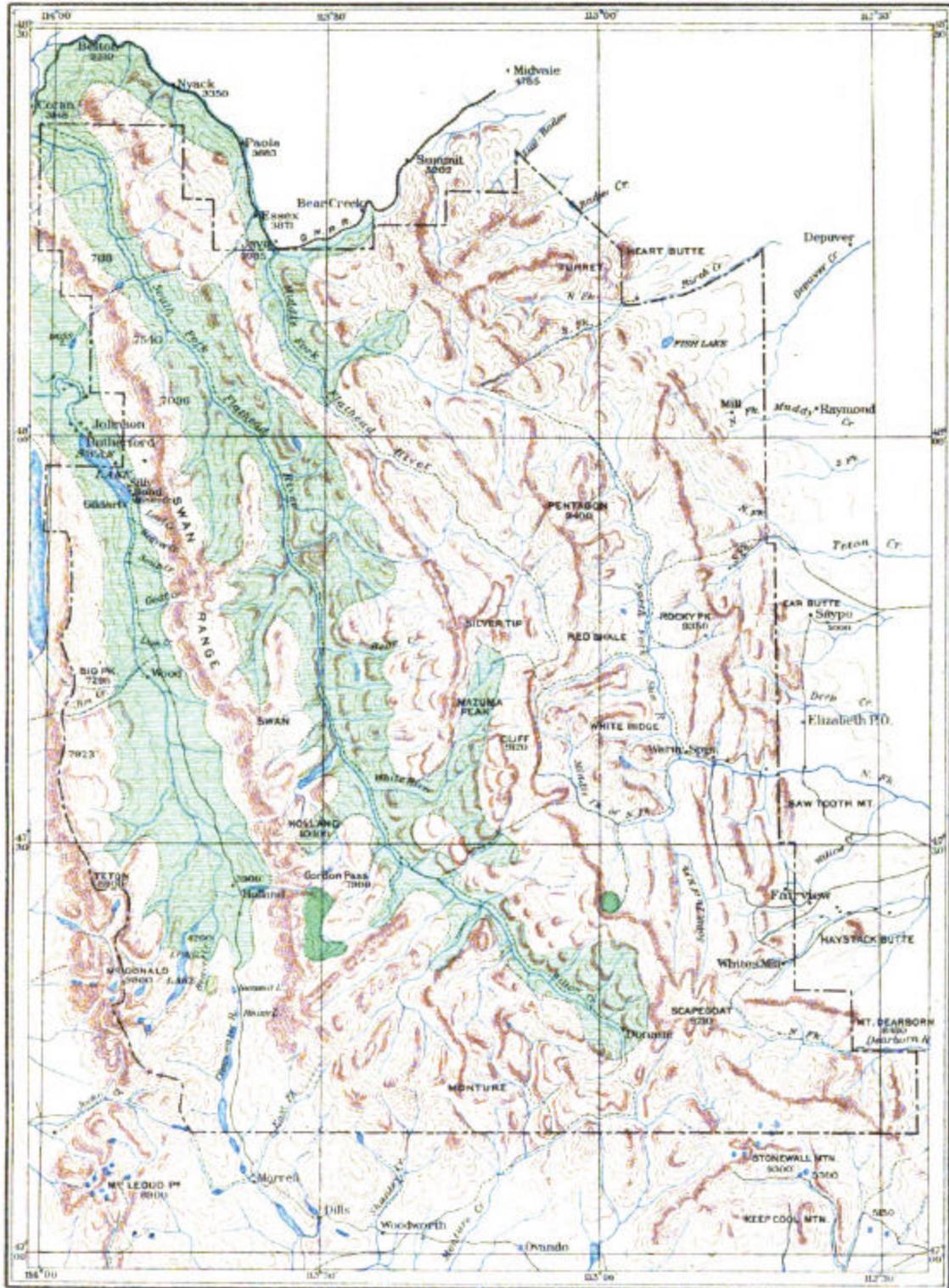
BY

H. B. AYRES

EXTRACT FROM THE TWENTY-FIRST ANNUAL REPORT OF THE SURVEY, 1899-1900
PART V, FOREST RESERVES—HENRY GANNETT, CHIEF OF
DIVISION OF GEOGRAPHY AND FORESTRY



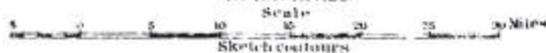
WASHINGTON
GOVERNMENT PRINTING OFFICE
1900



LEWIS AND CLARK FOREST RESERVE
MONTANA

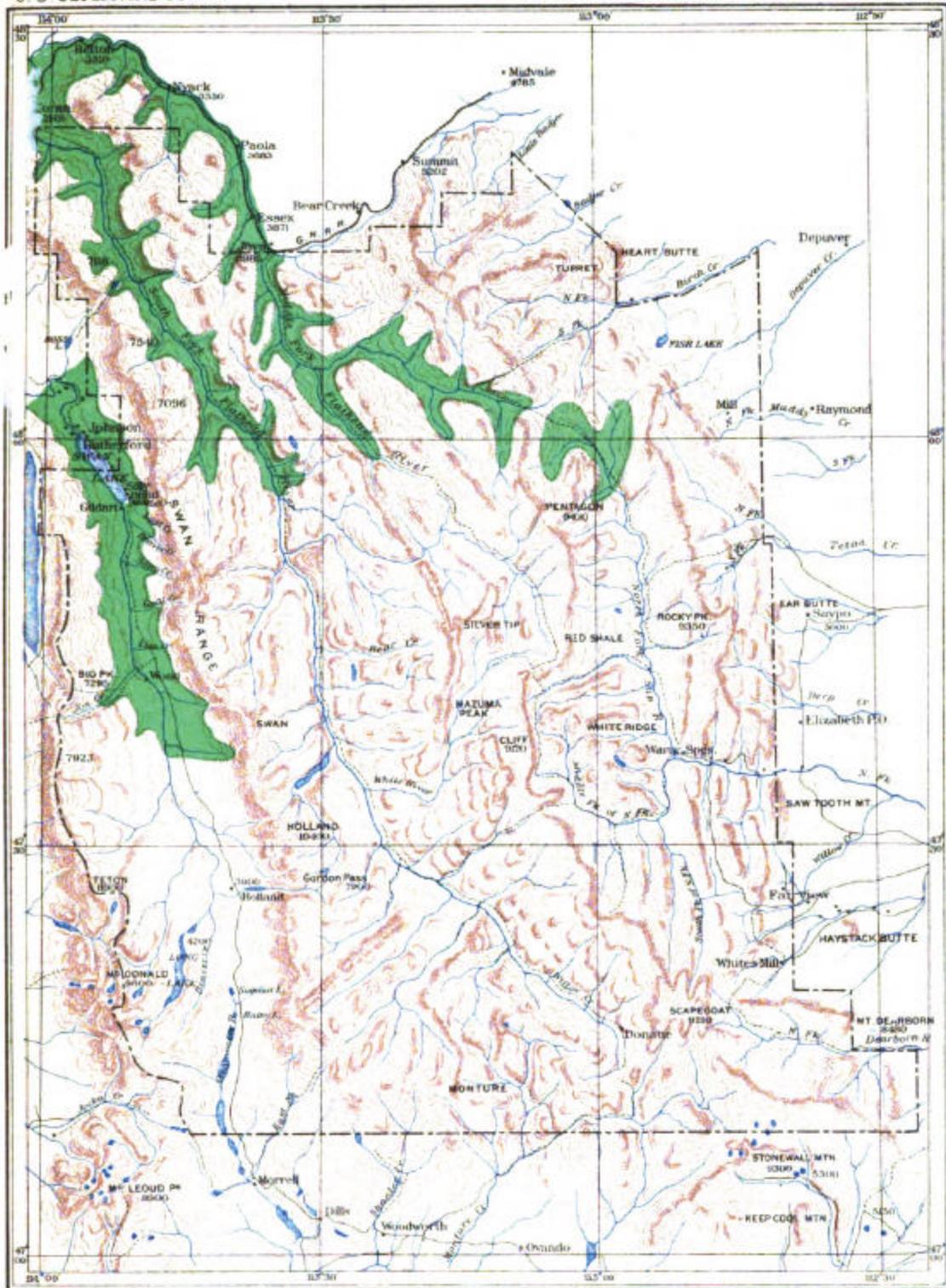
Showing distribution of Lyall larch, Western larch, and Patton hemlock
Prepared under the direction of Henry Gannett, Geographer in charge

BY H. D. AYRES



LEGEND

- | | | |
|---|--|---|
| LYALL LARCH
(<i>Larix lyallii</i>) | WESTERN LARCH
(<i>Larix occidentalis</i>) | PATTON HEMLOCK
(<i>Tsuga pattoniana</i>) |
|---|--|---|



**LEWIS AND CLARK FOREST RESERVE
MONTANA**

Showing distribution of cedar, hemlock, white pine and silver fir
Prepared under the direction of Henry Gannett, Geographer in charge

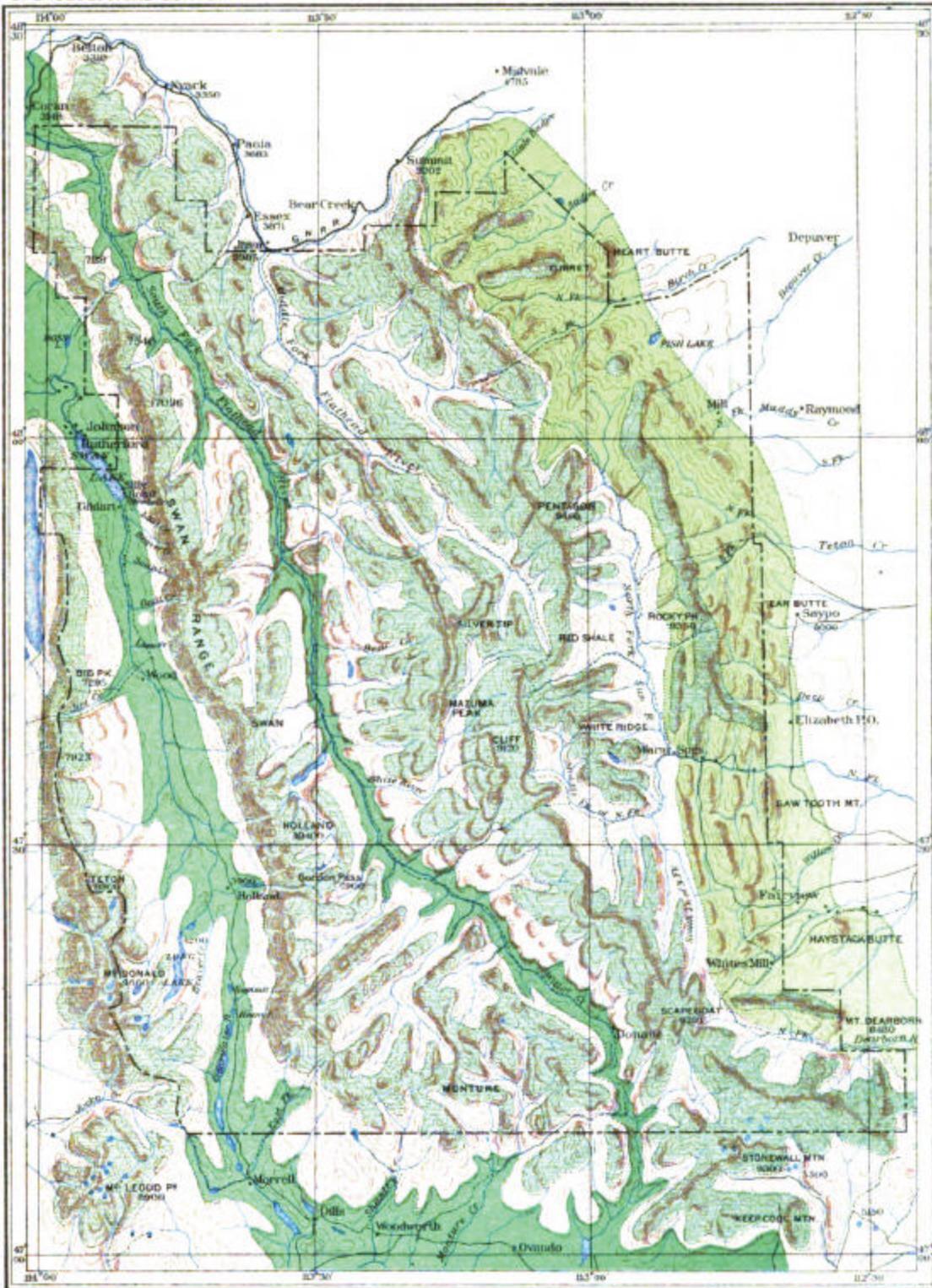
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Scale



Sketch contours

1899



LEWIS AND CLARK FOREST RESERVE
MONTANA

Showing distribution of yellow pine, white-bark pine, and limber pine
Prepared under the direction of Henry Gannett, Geographer in charge
BY H. F. AYRES

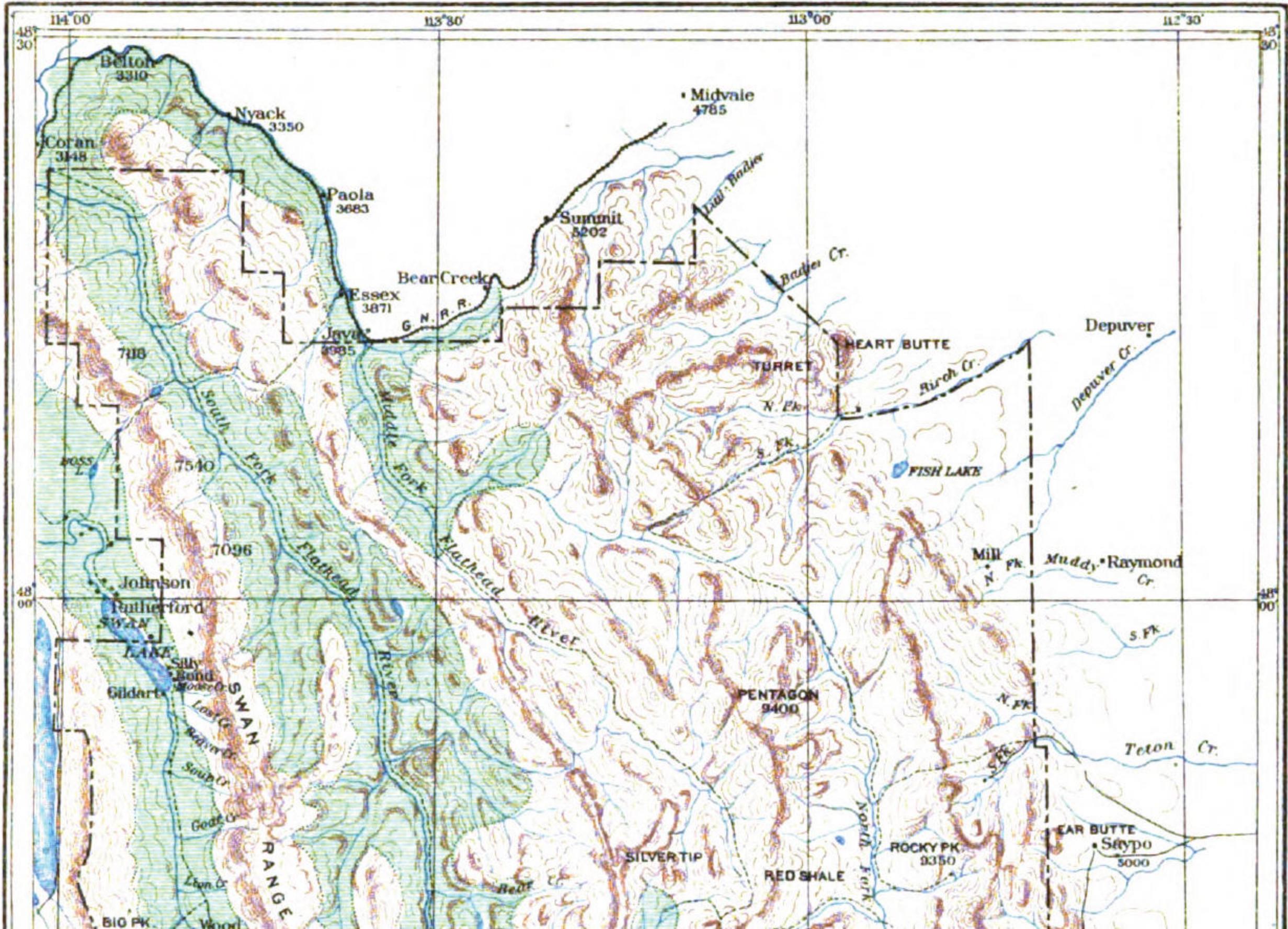
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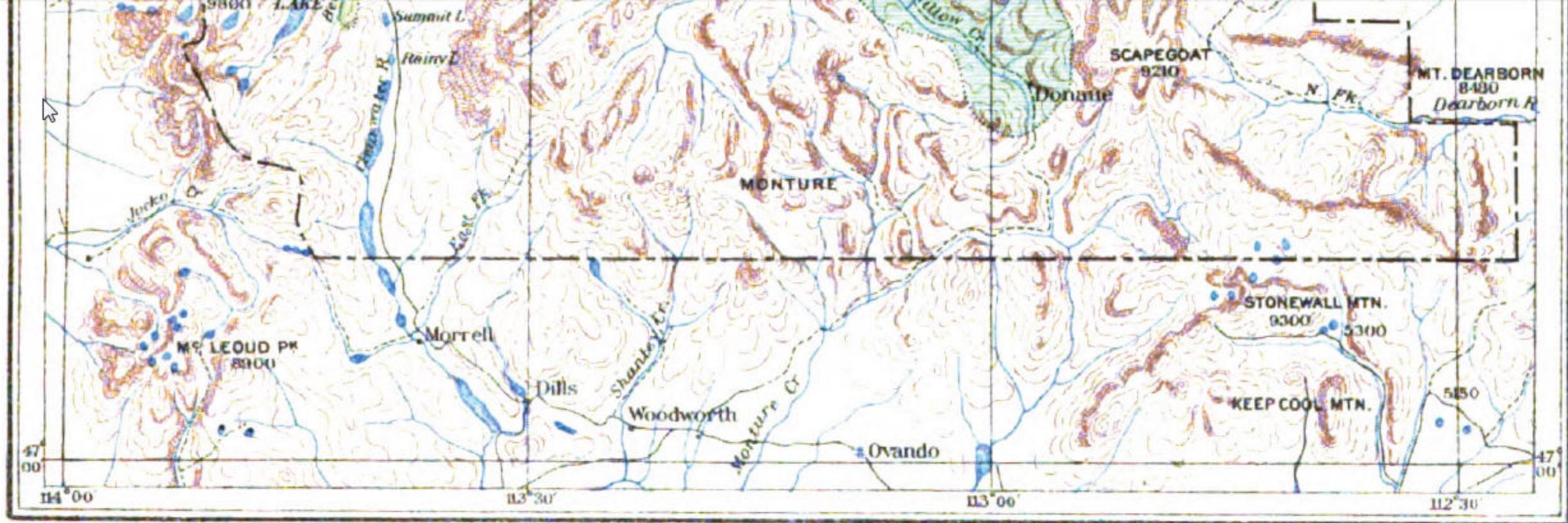
1899

LEGEND

- | | | |
|---|--|--|
| YELLOW PINE
(<i>Pinus ponderosa</i>) | WHITE-BARK PINE
(<i>Pinus albicaulis</i>) | LIMBER PINE
(<i>Pinus flexilis</i>) |
|---|--|--|





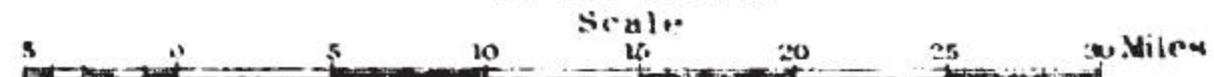


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LEWIS AND CLARK FOREST RESERVE MONTANA

Showing distribution of Lyall larch, Western larch, and Patton hemlock
Prepared under the direction of Henry Gannett, Geographer in charge

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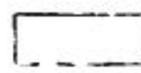


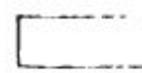
Sketch contours

1899

LEGEND

 LYALL LARCH
(*Larix lyallii*)

 WESTERN LARCH
(*Larix occidentalis*)

 PATTON HEMLOCK
(*Tsuga patoniana*)

the Swan-Clearwater Valley, more regular in outline and with broader bottom and lower altitude, having an area within the reserve of about 728 square miles. The valley of Swan River is continuous with that of the Clearwater, being separated only by a low morainic divide.

ROCK.

Limestone is of extensive occurrence, nearly all the summits, both of the peaks and ridges, being composed of it. Much of it is fossiliferous (Pls. IV, *B*, and V, *A*). Most of it is said to be of good quality for building stone.

Interbedded quartzites are occasionally seen, and green schistose rocks are found in the canyons. One especially good exposure of schist is in the lower canyon of the North Fork of Teton Creek.

Igneous rock, bearing traces of copper, occurs on Upper Smith Creek, southwest of Augusta, and extends southwestward. A dark igneous rock is also found extending northward from the warm springs on Sun River.

Black shale is abundant in the valley of the North Fork of Sun River. A bright-red arenaceous shale extends from near the warm springs southward to the headwaters of Ford Creek.

Cretaceous rocks form the eastern foothills. Tertiary coal-bearing rocks are found in the lower portion of the valley of the South Fork of the Flathead.

Few mining prospects are found within the reserve. Those seen were on Smith Creek and in the lower portion of the valley of the South Fork of Flathead River. Quartz is nowhere abundant.

Outside of the reserve, but not far from the boundary, copper claims are located on the North Fork of Blackfoot River, and on Smith Creek, below White's mill. Some other claims were staked during 1898 on Summit Creek, not far above Java.

Lignite coal is found on the South Fork of Flathead River, some 30 miles from its mouth.

East of the Continental Divide the strata dip southwestward, and west of the divide the general dip is northeastward.

SOIL.

In general the soil is shallow. The region has been glaciated in comparatively recent time and but a small amount of soil has accumulated. The rock of the region being principally limestone, one expects the soil derived from it to be productive where physical composition, moisture, and climate are favorable to plant growth. Travel through the region proved this to be true, for in all the well-moistened and sheltered localities having a fair depth of loam a luxuriant growth of vegetation was found. Thrifty vegetation is by no means a simple

The forested region not visited by recent fires has a very small amount of deadwood, usually very much less than is found on the burns, but here is much more of the fine litter, such as leaves, twigs, and moss.

Except for deadwood, the amount of litter is light east of the Continental Divide, and heavy in the unburned portion of the valley of the Middle Fork of Flathead River, where the old forest is being slowly replaced by new. It is moderately abundant in the valley of the South Fork of Flathead River, which is patched with burns. The lower half of the Swan River Valley is in about the same condition, but the upper half has been much burned and has a dense network of fallen trees over a large part of the surface.

AGRICULTURAL AND GRAZING LANDS.

Excepting that angle of the reserve reaching northeastward into the plains, with Birch Creek as its northern boundary, and having an area of about 90 square miles, there is no strictly agricultural land within the reserve. In each of the main valleys some vegetables and hay could be grown, but the product could not compete successfully with that produced under more favorable conditions.

While agricultural land is scarce, there are several favorable locations for small ranches (Pl. VI, *B*). These areas, excepting along the eastern foothills, are isolated and difficult of access and subject to deep snows in winter, which would make it necessary for the rancher to put up much hay. Natural hay is found in some quantity in willow bottoms, or sloughs, and some prairies would yield a good crop of hay under cultivation. On the North Fork of Sun River is a prairie having an area of about 10 square miles, on which there is but little natural hay, but the land could easily be irrigated, and timothy could be grown.

South of Sun River the valleys of Beaver Creek and of the South Fork of the North Fork of Sun River have considerable areas of grass land. All through the foothills bordering the plains and in the narrow valleys between the ridges south of Ear Butte are, perhaps, 100 square miles of land on which there is more or less grass, but it is rather difficult of access and undesirable for grazing on account of the deadwood killed by fires. This area, with the eastern foothills northward, has once been nearly all wooded, but frequent incursions of fire from the plains have reduced and even exterminated much of the forest, which has been succeeded by a mixture of grasses and weeds.

In the valley of the Middle Fork of the Flathead only one area of grass land was seen, and that was a willow bottom along a stream tributary to the Big, or East Fork. This area seemed to be about a mile long and a quarter to half a mile wide.

ESTIMATES.

Any attempt to estimate 4,800 square miles of very irregularly patched and broken forest in four months must have a somewhat unsatisfactory result. While the closest estimates are expected to come within 10 per cent of the actual amount, these can only be hoped to lie within 50 per cent, but they are all believed to be less than the actual amount.

These estimates are made on the basis of practice in the Lake States, viz, estimating as log timber every stick that will make a log 12 feet long, 6 inches in diameter at small end, and scaling two-thirds of a full scale.

In making the estimate it was of course necessary to pass many square miles by with only a cursory view from a mountain or hilltop. Small representative areas were examined in detail, and on these the general estimate was based. These estimates are as follows:

Estimate of timber in Lewis and Clarke Forest Reserve, Montana, by areas.

Locality.	Feet B. M.	Cords.
Eastern slope	63, 000, 000	1, 579, 000
Middle Fork of Flathead	154, 000, 000	1, 500, 000
South Fork of Flathead.....	442, 360, 000	5, 130, 000
Swan-Clearwater.....	1, 985, 000, 000	4, 660, 000
Total.....	2, 644, 360, 000	12, 869, 000

Estimate of timber in Lewis and Clarke Forest Reserve, Montana, by species.

	Feet.
Larch	1, 265, 444, 000
White pine	26, 547, 200
Yellow pine	235, 388, 800
Red fir	647, 690, 000
Spruce	350, 622, 000
Lodgepole pine	118, 668, 000

YOUNG GROWTH.

On the areas shown as recently burned the young growth is quite small and has been described under the head of reproduction. On the older burns it is common to find a dense stock of saplings; but these, as a rule, are principally lodgepole pine, especially on the slopes east of the Continental Divide. Engelmann spruce and red fir have made their appearance on some of these old burns, but rather subordinate to lodgepole pine. In rapidity of growth they are inferior, and in numbers they constitute but a small proportion of the new forest.

On the tracts that have been unburned for many years seedlings have sprung up as the old trees have died and fallen, so that these old forests are composed of trees of all ages, and in them the saplings too small for log timber constitute a very important factor to be considered in forest management. In many cases the mature trees may be cut out for lumber and the saplings left will be a sufficient stock, partly grown, for a new harvest of logs. By carefully marking the trees to be cut and by using care to preserve this young stock, the continuity of the forest may be unbroken by logging operations.

In this old forest the young growth is apt to have a large proportion of spruce and a small proportion of lodgepole pine, as the shade of the old trees is favorable to the starting of spruce, but unfavorable to the pine. Next in proportion to spruce, red fir is common, and in the more open places balsam follows next in order, while larch and lodgepole pine choose the spots that are most free from underbrush and grasses. Yellow pine seems to come in only on lands that have bare earth.

The areas having old mixed forests with a fair stock of young growth are very few on the eastern slope, except in some of the smaller valleys near the Continental Divide. Such areas occur on the headwaters of the Middle Fork and on the western tributaries of the North Fork of Sun River; also on the Middle Fork and on the lower half of the South Fork of Flathead River. The lower portion of the Swan River Valley, although considerably scarred by fires, has much of such forest still remaining, especially in the tributary gulches. The upper portions of these valleys have been overrun by moderate fires that have thinned the forest, and while most of the land is restocked, the seedlings are seldom over 10 feet high.

UNDERBRUSH.

The principal species of brush are alder, willow, dogwood, buckbrush, waxbush, yew, squawberry, service berry, brittlebrush, and juniper. Beside these shrubs, some of the trees often grow in such a manner as to practically form an underbrush in the forest, especially after a light fire that has not seriously thinned the forest, yet has permitted seedlings to start.

In general, the underbrush is not dense. With the exception of some of the damper ravines where yew abounds, the brush would offer no serious difficulty to taking horses anywhere, unless through the aspen thickets on the eastern slope (see Pl. XI, *B*).

Brush is most abundant, perhaps, in the valley of the Middle Fork and in the lower portion of the valley of the South Fork of Flathead River and in the lower portion of the Swan River Valley.

In the higher altitudes, especially where exposed, balsam and spruce, and east of the Continental Divide limber pine, are frequently matted

close to the ground, forming dense but small impenetrable thickets, although they are tree species.

Except where kept in subjection by light fires brush is usually abundant enough to be a serious hindrance to logging operations and to prevent the ready starting of seedlings.

CUTTING.

There are three small sawmills within the reserve, one on the South Fork of Depuyer Creek, another on the South Fork of Teton Creek, and a third on Smith Creek, southwest of Haystack Butte (Pl. XII, A). The logs for these mills are taken from the mountain sides or the basins above them.

For the mill first mentioned the logs are twitched down the mountain side to the stream, then floated with great difficulty about 2 miles through the canyon to the mill at its mouth. Some 300,000 feet B. M. have been cut in the valley of the South Fork of Depuyer Creek. This timber was spruce, red fir, and lodgepole pine.

The second mill is near the head of the South Fork of Teton Creek, about 6 miles from the plains. The logs are being taken from the mountain side near the mill and are almost entirely spruce and lodgepole pine. On the forks of Teton Creek are several old mill sites, and, roughly estimated, a million feet B. M. have been cut on the South Fork and 600,000 feet on the North Fork.

The mill on Smith Creek, but a short distance within the reserve line, is cutting logs from the high mountain side south of the headwaters of the stream. The logs are dragged with much difficulty and some danger about 2 miles down the steep slope. The timber used is lodgepole pine and spruce. There is little red fir in the basin. About a million feet B. M. of all kinds have been cut in this valley.

Besides the log timber cut east of the divide, some 300,000 railroad ties have been cut and floated down to the Helena branch of the Great Northern Railway. Some 200,000 of these were cut on the North Fork of Sun River and approximately 100,000 on Dearborn Creek.

All along the eastern front of the mountains the people from the treeless plains get fuel, house logs, and poles for fences and corrals. Almost every little valley that is wooded and that is reasonably accessible has a well-used wagon road leading into the timber. The people come and cut the timber as they need it, loading it immediately upon their wagons without leaving any amount cut and lying upon the ground, even over night. Ranchmen, as a rule, bring their own teams, but for village supplies there are half-breeds living among the foothills who make a business of taking out the wood and selling it. A colony of these woodcutters was found on the South Fork of Teton Creek (see Pl. XVIII, B), another on Smith Creek, and another on Dearborn, near the mouth of Falls Creek. Altogether about 62,000

cords of fuel, house logs, and fencing have been cut on the eastern slope of the mountains.

Along the Great Northern Railway there has been a great deal of cutting for bridge timber and ties, and besides some material has been taken for fuel, cribbing, tunnel timber, wagon bridges, and corduroys. The construction camps also have taken a large amount.

On account of lack of time no attempt has been made to estimate the amount of this material. It is said that all or nearly all the bridge and tie timber used in the construction of the railway through the mountains from Columbia Falls to Midvale was taken from the woods along the line.

Elsewhere on the reserve the only cutting has been for the cabins of prospectors, hunters, and trappers, and the few squatters in the Swan-Clearwater Valley, and for trails or camp use.

The logging operations of the Blackfoot Milling Company, on the Clearwater drainage, have worked up to but have not cut over the south line of the reserve. The logs are floated down Blackfoot River (see Pls. XIII, A, and XV, A).

FIRES.

Extent.—Only the areas recently burned, or those overrun by fire within the last forty years, have been shown on the map. The older ones have lost the characteristics and the features of burns that make them noticeable in the distant view necessary in mapping them. They have either become barrens or have been restocked with trees. A considerable but undeterminable portion of the mountain ridges shown on the map (Pl. III) as bare or destitute of forest has been made so by fires that have exterminated the stunted forests which were just able to exist under the severity of climate without the fire.

Many of the eastern foothills now grassed prove upon close examination to have been once wooded; for here and there upon them old charred roots and stumps are found. The fire lines on the map can be drawn only approximately, for the effects of fire often fade out with an imperceptible border.

Roughly estimated, the recently and severely burned areas within the reserve are as follows:

Areas recently burned in Lewis and Clarke Forest Reserve, Montana.

	Square miles.
East of the Continental Divide	600
Middle Fork of Flathead River.....	95
South Fork of Flathead River and the Blackfoot drainage.....	485
Swan-Clearwater Valley	240
Total	1,420

In addition there are, as shown on the map (Pl. III), outside the reserve the following burned areas:

Areas recently burned adjacent to Lewis and Clarke Forest Reserve, Montana.

	Square miles.
Along the Great Northern Railway.....	134
East of the reserve line.....	40
South of the reserve line.....	206
Total.....	380

This, added to the 1,400 square miles within the reserve, makes a total of 1,800 square miles of recently burned forest shown on the map.

Causes of fire.—While some of these fires have no doubt been caused by lightning, nearly all have been due to carelessness on the part of men. The causes of fire may be grouped into four classes: First, those originating directly or indirectly from the railroad; second, those running in from the prairie; third, those escaping from settlers on the borders of the forest; fourth, those caused by Indians, hunters, and prospectors.

The greater area, probably some 1,200 square miles, was burned during 1889. That year is said to have been exceptionally dry, and the smoke from the forest fires almost unendurable. At that time the Great Northern Railway was being built across the mountains, and the great number of men employed in its construction, and the many prospectors and claim hunters attracted by the opening of the country, made a combination of circumstances very favorable to the starting of fires.

About forty years ago, also, many fires occurred. Most of the burns of that time have been reburned since. Where not repeated, they have either been covered again by forest or they have become mountain barrens.

Intensity of fires.—On most of the burns mapped the fires have been severe enough to kill all, or nearly all, the trees and to consume the humus (see Pls. XIII, B, and XV, B). The borders of the burns are generally sharp and well marked. But many light fires have also occurred; these have crept over extensive areas, killing brush and the smaller and tenderer trees.

The fires have varied through all degrees of intensity. The severest have rushed through the tree tops consuming the needles and smaller twigs and igniting the humus lying upon the surface, which, even when burning slowly, has made fire enough to consume the smaller roots that were in the humus. The fires of 1889 were generally of this sort. Many other fires have occurred, doing much less damage to the forest. Creeping slowly along, they have killed much of the vegetation and even some large trees, but the lightest of them have merely thinned the forest, injuring many trees, but still leaving many seed trees and a favorable surface for seeds to start.

Damage by fires.—The damage done by fires might by some be estimated as nothing because the timber had no market value at the time, but by the community and the State it should be viewed as an injury to a great natural resource. While the timber trees, the saplings, and the seedlings killed had no immediate market value where they stood, they had a future value which has been destroyed. In addition, the fires have postponed the possibility of again having such a forest on much of this land within one hundred years, and on some of it a very much longer time, for the fires have consumed the product of centuries in humus, shade, shelter, and other necessities for the germination and growth of seedlings. These higher regions are now frequently found barren, or lightly covered with grass or mountain plants, with a few roots and stubs remaining as proof that a forest was once there.

Deadwood.—The amount of material standing dead is roughly estimated as follows:

Deadwood standing in Lewis and Clarke Forest Reserve, Montana.

	Cords.
Missouri River drainage	200,000
Middle Fork of Flathead River, within the reserve.....	100,000
Middle Fork of Flathead River, outside the reserve	150,000
South Fork of Flathead River	600,000
Swan-Clearwater Valley, within the reserve.....	128,000
Total	1,178,000

No effort was made to estimate the material that is down. It is not marketable and never can be until made accessible immediately after falling, as where logging and woodcutting are being carried on.

Reproduction.—The burned areas east of the Continental Divide and those of the valley of the Middle Fork of Flathead River are very scantily restocked, having little else than small lodgepole pine in strips and groups, usually near the unburned forest.

In the valley of Willow Creek (South Fork drainage) there is a dense stock of lodgepole pine coming up through the network of fallen trees.

The same condition prevails in the region about Spotted Bear, while on Hungry Horse the old burn has a very scant stock.

In the valley of Swan River the "Big burn," about 6 miles below Holland's ranch, has enough lodgepole pine to cover it in about twenty years.

The burn on Crow Creek Pass is principally occupied by brush, but has a sprinkling of spruce, lodgepole pine, and balsam.

The large burn on the mountain west of Swan Lake has a scanty stock of spruce, balsam, and lodgepole pine.

The upper portion of Swan River Valley has a dense stock of lodgepole pine and larch under the larger larch that has survived several incursions of moderate fires.

The burns on other mountain ridges, so far as stocked at all, have a mere sprinkling of nut pine, Engelmann spruce, and balsam.

The stock on lightly burned regions, as a rule, is not only mixed as to species, but also as to size. There are some areas on old burns which are occupied by lodgepole pine only, but these are the exception and are not large.

Liability to fire.—Until the appointment of forest rangers there had been no steps to prevent the starting or the spread of fires except the carefulness of those likely to cause them. During the season of 1899, however, no fires were found burning, though several had been extinguished by the forest rangers, who patrolled the trails and kept themselves posted as to the movements of persons within the reserve. Along the railroad the greatest danger of fires is from locomotive sparks, though they are liable also to be started by trackmen burning rubbish. East of the mountains the danger is from fires sweeping in over the prairie or from the lunch fires and smudges of the woodcutters who come from the plains. In all the mountain area the camp fires of prospectors, trappers, tourists, and sportsmen are a constant menace.

Effect of fire on composition of forest.—The severe fires below 6,000 feet have been followed by lodgepole pine where restocked at all (see Pl. XVI, A), but the moderate fires in the lower altitudes and all those in the higher altitudes have usually been followed by a mixed growth in which spruce predominates. Many of the severe old burns that have been restocked have first been covered with lodgepole pine, under which spruce, white pine, larch, balsam, and other shade-enduring trees have sometimes started. A very dense stand of the original stock, however, does not readily admit other species, and lodgepole pine in such cases is apt to remain until the trees begin to die of old age (see Pl. XVII, A).

Moderate fires may thin out the species most sensitive to fire and leave those protected by thick bark. A notable instance of this was found in the upper portion of the Swan River Valley, where a mixed stock of larch and lodgepole pine had been run through by light fires, which killed the thin-barked lodgepole pine, but left the thick-barked larch but slightly injured. On looking over this valley from the mountain side in October, when the leaves were colored, the upper half of the valley seemed almost entirely wooded with larch.

RATE OF GROWTH.

The rate of growth varies greatly not only according to soil and moisture, but also according to exposure and the influences of surrounding vegetation. The average increase on the stump in the lowland was found to be about an inch in ten years, accompanied by a proportionate growth in height.

Ascending the mountains, the rate diminishes until, near the line of perpetual snow, the annual rings are sometimes so thin as to be invisible to the naked eye. Height growth is especially slow in exposed situations, where even the hardiest species, as spruce and balsam, are compelled to lie matted on the ground without being able to form an upright trunk. The rate of accretion on the stump of open-grown trees in the lowland is sometimes one-fourth of an inch in one year, while densely crowded trees, especially those overtopped, may have only one-hundredth of an inch in one year.

The rate varies with the species also, larch being one of the most rapid-growing trees and lodgepole pine one of the slowest. The average rate seems less than in the forests of the Lake States. Here a crop of timber trees can hardly be expected in less than one hundred years, even on the most favorable portion of the lowlands.

ACCESSIBILITY.

Along the eastern slope of the mountains there are few streams that are practically drivable for log timber, possibly only Sun River and Dearborn Creek, but Birch and Badger creeks may prove drivable with some expense. The timber on most of the streams must be hauled out when cut. The question of transportation, however, will probably be how to reach the local market, as the treeless plains immediately east of the mountains could consume all the timber this slope would produce, with the exception of the Sun River Valley. This stream being easily drivable would afford fair transportation to the more distant or general market.

The valley of the Middle Fork of Flathead River has its only outlet by the way of Java, on the Great Northern Railway, and the river would afford the most feasible means of transportation, as it would be drivable at moderate expense. Should a permanent system of lumbering be established in this valley an electric railroad would perhaps be desirable to take supplies up the river, and possibly even to haul up empty cars on which logs could be taken down, perhaps in successful competition to river driving.

The valley of the South Fork of Flathead has also an outlet to the north, and the river may possibly be made drivable, although there is some doubt on this point, owing to the crookedness of several box canyons. It would be somewhat difficult to construct a railroad in this valley, because of many deep ravines cutting through the bench land.

The valley of the headwaters of the North Fork of Blackfoot River, continuous with this valley and separated from it by an almost imperceptible divide, has so little timber that the question of transportation need not be considered immediately. The valley of Willow Creek and the headwaters of the North Fork of the Blackfoot have a very smooth bottom and railroad grading would be very easy.

The tributary valleys of the South Fork of the Flathead are more

difficult of access, and it seems probable that chutes and flumes may be the best means of getting the material out to the main valley.

The Swan-Clearwater Valley, at least between Clearwater Lake and Goat Creek, can probably be worked best by a logging railroad, as the streams have many gravel bars and many places where logs would float out into the brush during high water. Logs put into Swan Lake could be easily driven to Flathead Lake, a favorable point for manufacturing.

The divide between the Swan and the Clearwater valleys is a low one, and offers no serious obstruction to a railroad if it should be found desirable to take logs over from Swan River to the Blackfoot.

Throughout the reserve are large areas on the mountain sides that can be logged only by means of chutes.

MARKETS.

At the small mills east of the mountains rough sawed lumber brings \$16 per thousand feet, and the deadwood is worth 25 cents a cord on the stump at Midvale, and would, doubtless, command that price all along the range southward. Log timber east of the range should be worth \$1 per thousand feet on the stump in the more accessible regions, but quite a large proportion of it, possibly 50 per cent, has no value because of difficulty of access.

West of the Continental Divide probably nothing within the reserve has a market value to-day, owing to the difficulty of transportation. Improvements to make the timber accessible would doubtless be profitable at once in the Swan River Valley, and capitalists able to make these improvements could probably afford to pay a moderate stumpage value on the standing timber.

Outside of the reserve, along the Great Northern Railway, the mountain slopes, though steep and rocky, are fairly accessible, and the material on them should have a slight stumpage value under a thorough system of cutting and marketing.

SUGGESTIONS FOR MANAGEMENT.

Considering the configuration of the land, the isolation of the valleys, the liability of fire, the difficulty of two or more operators working in the same valley, the benefit to the operator of having control of a definite area and also of the means of transportation leading to it, and the advantage of having one person responsible for fires or depredations in a single district, it seems advisable that the right to cut in each valley be leased entirely to one person, and that the lease be made for a long time. This person could then improve the stream, make flumes or roads, establish a permanent mill plant, and carry on his business in conformity with a system of forestry that should, of course, be decided upon before the lease is made. Under such a system of leases there would be an opportunity both for small and large operators.

there seems to be several species. The most abundant are about a foot long and weigh from one to two pounds. Salmon trout were seen on the South Fork of Flathead River, the largest being 36 inches long.

East of the mountains large game has been hunted until a track is seldom found.

In the center of the reserve, however, are elk, moose, goats, sheep, black- and white-tailed deer, and the several species and varieties of bear common in the Rocky Mountains. Blue grouse are abundant, especially eastward. The common ruffled grouse are rare eastward, but abundant in the Swan River Valley. The fool hen is common everywhere in medium altitudes.

SCENERY.

This region, though not as alpine as the Flathead Reserve, has many high mountains and rugged hills.

There are a few glaciers, a small one at the head of Gordon Creek,

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one near McDonald Peak, and the Stanton Glacier, west of Essex, one of the largest in the range.

The peaks about the Stanton Glacier, Scapegoat Mountain, Turret Mountain, Silvertip, and Pentagon on the main range, three or four points on the Kalispell Range, and McDonald Peak on the Mission Range, are 8,000 to 10,000 feet high and afford excellent views, while the valleys, though much marred by fires, contain many attractive places. The opening of the trails by the forest rangers is rapidly making the region accessible by saddle and pack horses.

EXPLANATION OF MAPS.

It should be said, in explanation of the maps, that sharp lines on the maps for distribution of species and the limits of burned areas do not represent the actual condition in the forest. A blending of

On the slopes a graduated difference is noticeable, according to the soil, moisture, and exposure. On the south side of Depuyer Creek where timber was being cut at an altitude of about 7,000 feet, Engelmann spruce, lodgepole pine, and Douglas spruce, on moist soil, average 150 to 500 feet per tree, but on the drier ground very few trees were large enough for log timber, and many of these were defective. In looking over the mountain side in this basin many small, brown areas of deadwood appeared in the green forest. These were first supposed to be the effect of fire, but examination proved them unburned, but on dry ground where no moist earth could be found near the surface.

Young growth.—Throughout the portion of this region facing the plains, an area of 600 square miles, tracts of young growth in good condition are rare. Where fires have run they have been so severe that over large areas no seed trees and no seeds have been left. In fact, on most of these burns the humus has been consumed. The few burns that have been restocked are about the basins at medium elevations where fires have been less severe, owing to greater moisture. Such restocking is best near the unburned tracts. In moving southward from the Great Northern Railway, a scant restocking was found on the Two Medicine drainage covering probably 4,000 acres south of the railway. South of that area the following small tracts of a few acres were seen: On Little Badger Creek (south of the stream), about 1,500 acres; about the head of Big Badger, some 5,000 acres; on the South Fork of Depuyer Creek, 500 acres; on Storehouse Creek, some 2,000 acres; on Beaver Creek, probably 3,200 acres; on Ford Creek, some 500 acres; on Elk Creek, 1,200 acres; on Dearborn Creek, 3,000 acres; on Falls Creek, 2,000 acres; a total, roughly approximated, of 37,000 acres.

Underbrush.—Underbrush is scant throughout this region. Only on the dampest ground is there enough to cause serious resistance to travel. The prevailing species on the northern slopes are brittlebrush and huckleberry, while along the streams are clumps and narrow strips of dogwood and willow. In the higher altitudes much of the brush consists of species that under favorable conditions form trees. Such are balsam, limber pine, and Engelmann spruce. In the higher ravines near the Continental Divide, especially under Engelmann spruce, brush is often found so thick as to be a serious hindrance to travel, but unless accompanied by fallen timber it does not form an impassable barrier.

Fires.—Outside of the reserve about 45 square miles along the Great Northern Railway and 95 square miles in the foothills bordering the plains have been very seriously burned.

Of the 1,600 square miles within the reserve nearly 600 have been seriously burned within the past 40 years. Besides this severely burned area there are many lightly burned areas that now have some

dead trees killed by fire, but are principally wooded. There are also many areas of old burns that have been restocked. The areas shown as burned have been severely burned. The fire of 1889, which seems to have run over most of this area, occurred during a very dry time, and most of the ground over which it ran has only dead trees and a very small amount of humus left. Within this area this fire covered about 530 square miles, most of which is now bristling with dead trees, except in places previously burned. On such places nearly all the material has been consumed. A previous fire covered an undetermined area, the signs of it being on much of the ground, obliterated by later fires. On some 50 square miles, principally along the Continental Divide, plain evidence of the fires of this period remain. The dead trees and stubs left by these fires are better preserved in the high altitudes than in the valleys, as, being more isolated, they have partially escaped the later fires, which, on the foothills bordering the plains, have obliterated nearly all traces of the forest they have destroyed. Only occasional stubs and roots remain in the grass or brush. The dates given on the maps are those of the later fires.

Reproduction.—The area restocked is about 6 per cent of the area burned over. Almost invariably the restocking has been with the same species that occupied the ground before. There is, however, a noticeable increase in the proportion of lodgepole pine, doubtless owing to the more abundant seeding of this species and the favorable condition for its growth after fires. Where spruce and balsam lands have been burned over the new stock is invariably sparse. That this is the usual habit of these species in restocking is inferred from the condition of all of the old forests composed of them. Such forests do not have trees of uniform age, but always have young trees coming in among the sparse old stock. Reasons for this condition are found both in the scant seeding of these species in the higher altitudes where they grow and in their preference for shade in which to germinate and grow while young. Old forests of lodgepole pine frequently have young spruce and balsam as an undergrowth. The extensive, almost continuous burns on the foothills once partially covered with limber pine (*Pinus flexilis*) have not been restocked and so far as covered with vegetation have only weeds and brush if recent, or bear grass and scant forage plants if old. The principal bushes are willow and aspen. Young trees of limber pine are found on the half barren knolls that reach out into the plains and on the recently and severely burned lands. The condition of the burned land is most desolate. Only about 6 per cent of it is restocked and the remainder bristling with deadwood, standing or fallen, sometimes has no plants growing upon it, especially if high in altitude or dry. Most of the area, during the years that have passed since the fires, has grown only a scanty stock of weeds, grasses, or brush. The best pasture grasses are seldom found on the burns. Pine

grass and "bear grass" (never eaten by stock) are more prevalent on such lands than the bunch grasses, but some grazing land is now found on the once wooded portions of the foothills. Although some ten years have passed since the principal fire, only about half the burned area is now covered with vegetation, and that is of very much less economic value than the original stock.

Effect of burns on water flow.—In the valleys or basins most thoroughly burned over the widening of the streams and the increased washing down of bowlders is quite noticeable. The valleys of Dearborn River, Ford Creek, and the forks of Teton Creek are much washed, the wide gravel and bowlder beds of the water courses being a prominent feature of the landscape (see Pl. XX, B).

Deadwood.—Wherever severe fires have recently run through the forests deadwood is standing. Even some of that killed by fire forty years ago remains standing, but only on the higher and drier portions where the climate is more favorable to the preservation of deadwood. Very little of such old material is suitable even for fuel and under the estimates only that killed within the past ten years which is standing and is suitable for fuel, fencing, or house logs is considered. None of the old deadwood is marketable as log timber. The estimate of the amount more recently killed is necessarily very rough and only approximate as follows:

Estimate of deadwood in valleys east of Continental Divide, Lewis and Clarke Forest Reserve, Montana.

	Cords.		Cords.
Two Medicine Creek.....	100,000	Other valleys, southward to	
Little Badger Creek.....	500	Beaver Creek	8,000
Badger Creek.....	500	Beaver Creek.....	5,000
Birch Creek.....	30,000	Ford Creek	2,000
North Fork of Depuyer Creek .	10,000	Smith Creek	1,000
Black Leaf Creek.....	5,000	Elk Creek	1,000
Other valleys, southward.....	10,000	Dearborn Creek	80,000
North Fork of Teton Creek....	10,000	Falls Creek	20,000
South Fork of Teton Creek....	12,000	Sun River.....	200,000
Other valleys, southward	6,000		
Deep Creek	3,000	Total	504,000

Some 20 per cent of this may have a stumpage value of about 25 cents a cord. The remainder is probably worthless, because of difficulty of access.

Cutting.—All that portion of this region fairly accessible from the plains has been invaded by ranchmen and by others cutting for village use. Wagon roads were found leading from the plains up almost every stream, and over these wood and poles, when needed, are hauled in small loads. Often the material can be taken out only with great difficulty. It is often cut high on the mountain slopes and slid down to the roads. In some places it is hauled a long distance from the stump to the wagon, where it is loaded, frequently 40 miles from where

it is to be used. Several small sawmills have been operated, and three were found running. On the South Fork of Depuyer Creek up to July 17 some 1,600 trees, scaling about 300,000 feet, had been cut in the basins and floated through the canyon to its mouth, where they were sawed and sold rough for \$16 per thousand. On the South Fork of Teton Creek is a mill about 6 miles from the plains (see Pls. XIX, B, and XXI, A). In this valley about 1,000,000 feet of lumber and 6,000 cords of wood and poles have been cut. On Smith Creek a mill has been operated some years, and from this valley about 1,000,000 feet of lumber have been taken, most of it lodgepole pine and spruce (see Pl. XII, A). It is not far from the unsurveyed reserve line, but there is little doubt it lies within the boundaries. On Dearborn Creek something over 100,000 ties were cut and floated to the Helena branch of the Great Northern Railway when that line was being built. In the valley of Falls Creek, a branch of the Dearborn, large quantities of poles and fuel have been cut. August 2 a party of half-breed Indians was found cutting 10 to 20 loads a day and hauling them to market on the plains.

Owing to the desultory manner of such cutting, accurate estimates of the amount cut are impossible without much time and labor.

Approximately the following amounts of both green and dry material have been cut within the reserve:

Estimates of cutting east of Continental Divide, Lewis and Clarke Forest Reserve, Montana.

Locality.	Cords.	M feet B. M.	Ties.
North of Badger Creek	2,000		
Badger Creek	2,000		
Birch Creek	2,000		
Birch to Teton Creek.....	5,000		
South Fork of Depuyer Creek.....		300	
North Fork of Teton Creek	6,000	1,000	
South Fork of Teton Creek	5,000	600	
Teton to Sun River.....	22,000		
North Fork Sun River.....	25,000		200,000
Sun River to Smith Creek	10,000		
Smith Creek		1,000	
Dearborn River			150,000
Falls Creek	3,000		
Total.....	82,000	2,900	350,000

Transportation.—The point on this land nearest the railroad is about 5 miles distant and the farthest is about 80. The streams, with the exception of Sun River, are of little value for transportation, as they

Wagner has 200 acres fenced in in pasture, and Hannon has about 30 horses on the North Fork of Sun River. On Ford Creek two ranches were found; one, recently established, has no land under cultivation; the other, on the main stream, has about 100 acres in grain and hay. At the head of Ford Creek about 500 cattle and as many sheep were found grazing July 27. This stock is owned by several different persons, the Fords, having ranches on the lower creek, being the principal owners. About the mouth of Falls Creek are several cabins occupied by half breeds who cut and saw wood from the reserve. About 5,000 sheep, said to be owned by J. C. Fay, of Hogan, Montana, were grazing in the valley of Falls Creek August 1.

Water power.—The numerous streams (averaging about 6 miles apart) furnish many water powers along the eastern border of the reserve. Sun River, the largest, was about 300 feet wide and 3 feet deep, with rapid current July 24. Dearborn River, next in size, was 100 feet wide, 2 feet deep, and moderately rapid. Ford, Deep, Depuyer, Birch, and Badger creeks in July were each 25 feet or more wide and 2 feet deep, with strong current.

Mining.—Some prospecting for gold and copper is being done on Smith Creek. Otherwise no mining operations were noticed. The principal rock is limestone.

VALLEY OF MIDDLE FORK OF FLATHEAD RIVER.

Topography.—This valley lies partly within and partly without the reserve. About 576 square miles, in a fairly compact body, are included within the boundaries. The portion of the valley outside the reserve is a strip, seldom more than 4 miles wide, along the Great Northern Railway. The portion within the reserve, while not reaching into the highest altitudes of the range, is still very rough and mountainous, excepting along the bottoms of the main valley and the two principal branches. With this exception there is very little level land. The principal areas are occupied by irregular mountain ridges and peaks, the highest of which hold snow in drifts throughout the year. The portion outside the reserve is simply a mountain side along Summit Creek and the Middle Fork of Flathead River below the mouth of Summit Creek.

Rock.—Limestone is the principal rock occupying the summits of all the higher ridges, but shales and schists are found in the banks of the river where it cuts across the range. Some beds of quartzite outcrop in the mountain sides, but these are much thinner than those in the mountains north of the railroad.

Soil.—As the soil is derived principally from limestone, it may be expected to be rich in plant food; and, in fact, wherever there is moist earth, unencumbered by snow, vegetation is luxuriant. A large part of the mountain summits is bare rock. Much of this area was once

wooded, but fires have so thoroughly consumed the mosses and humus covering the surface that trees could not grow there now.

Litter.—The amount of litter in this valley is greater than in any of the others. On the burned areas the trees killed by fire form a network over the ground, except where fires have been repeated and severe. On the unburned areas, covering nearly all of the two main forks of the valley, the old trees and others killed by overcrowding have fallen and such an amount of material has accumulated that it is difficult to take horses through the woods.

Humus.—Corresponding with litter, humus is very light or wanting on the burns and heavy where the forest is uninjured by the fire. Both the west branch and the east are covered by a dense growth of trees, and excepting a small area near the forks have escaped fire many years. This freedom from fire has permitted humus to accumulate to a depth of 2 or 3 inches over most of the valley. There are occasionally willow bottoms where black muck has a depth of a foot or more, but these have no large area.

Trees and timber.—Of this tract about 124 square miles are timbered. Besides this, 110 square miles are fairly covered with wood, about 180 are naturally bare, being on the high summits, and 162 square miles have been severely burned. Outside of the reserve some 35 square miles are scantily wooded with spruce and balsam, with some lodgepole pine, larch, and red fir on the lower slopes—perhaps 20 million feet B. M. of log timber and 200,000 cords of other material. The remaining 115 square miles are either burned or naturally barren. The species here do not differ from those in the South Fork Valley. Engelmann spruce is the principal timber tree. Larch, red fir, and lodgepole pine follow in importance. Balsam abounds on the higher mountain slopes, but is of little or no commercial importance. White pine may occur, but it was not noticed.

Estimates.—The amount of log timber in the portion of the valley within the reserve is roughly estimated at 154 million feet B. M. Besides this log timber, there are about 1,500,000 cords of material unfit for the saw. The log timber is about 30 per cent spruce, 25 per cent larch, 20 per cent lodgepole pine, 20 per cent red fir, and 5 per cent other species. As to size and quality, there is great variety. In the ravines are tall and straight spruce of rapid growth and usually sound, while on exposed ridges are dwarfed and knotty trees often defective.

Young growth.—Except on the burn on the main fork of the stream, there is no great amount of young growth. On the larger burns restocking has been scant and the trees are yet small. Among the older trees some young ones have started as the mature trees have fallen and made openings. These are of various sizes and are promising for timber. But there are not in all cases enough to form a new stock of desirable kinds if the old trees were cut. The abundance of brush is a serious hindrance to the starting of seedlings.

Underbrush.—Underbrush is more abundant than in any other portion of the reserve. The litter and brush make the trail through this valley almost impassable. Most of the hills east of the river, however, have been burned until they are almost free from brush. West of the river burns are older and brush has had time to reappear.

Fires.—About 95 square miles within the reserve and 60 outside of it have been severely burned within the past twelve years. The hills east of the river are almost barren as a result of fire. The origin of most of these fires seems to have been along the railway, and they probably started either during the grading operations, or from sparks, cinders, or camp fires along the line since. It is said that at the time of the grading of the road there were two dry seasons, and fires were burning everywhere through the mountains. These statements are confirmed by the conditions in which we now find the forest. The fires at this dry time were almost invariably severe, killing all the forest through which they ran. Very few trees, indeed, are left living; only a few clumps in damper places, often several miles apart. Owing to the severity of these burns, reproduction has been scant. Most of the new stock is lodgepole pine, and most of this is near the border of unburned forests. Probably not over 20 per cent of the burns are restocked with seedlings of any species. The view over the mountains south of Bear Creek reveals a very few small unburned tracts in the most sheltered places, but the surface is nearly all bare, with the exception of a few dead trees, either standing or fallen.

Deadwood.—Perhaps 100,000 cords of deadwood are standing within this portion of the reserve and 150,000 cords outside of the reserve line along the railroad.

Cutting.—Within the lines of the reserve there has been no cutting except for camps and trails, but on the adjoining strip a great deal was cut during the construction of the railway for ties, bridge timber, and fuel. No attempt was made to estimate the amount of this material, as there was not time.

Transportation.—The only outlet for this valley is down the stream. The stream is drivable at moderate expense, and at Java touches the Great Northern Railway. The material outside the reserve, in the narrow strip along the railway, is, compared with the rest of the region, very accessible, as it is only necessary to chute the timber down the mountain side to load it on the cars.

Demand.—Probably none of the material on this tract could be sold to-day at any price on the stump. East of this point, as at Midvale, and even near Summit, there is a growing demand for deadwood to be used on the plains eastward, but as this tract is on the western slope and below some of the heavier grades it could probably not compete at present with material from the eastern slope of the mountains, which now commands a price of only 25 cents a cord on the stump.

Agricultural land.—There is no prospect for agriculture in the valley except, perhaps, that on a few spots the vegetables or hay needed by lumbermen or miners working in the valley could be grown.

Water power.—Water power is abundant, the rapid fall of the stream furnishing many mill sites.

Occupancy.—There is no one living within the reserve, but along the railroad below are some three or four resident squatters. Essex is quite a little village, supported by railroad work, this place being used as a coaling station and for keeping engines used in helping up the mountain grade. At the other stations—Bear Creek, Java, Paola, and Nyack—are nothing but section houses.

Mining.—Along Summit Creek, not far above Java, are some mining prospects, staked during the season of 1898. Aside from these no claims were noticed in the reserve.

VALLEY OF SOUTH FORK OF FLATHEAD RIVER.

Topography.—The area of this tract is about 1,860 square miles. Excepting about 240 square miles draining into the Blackfoot, of which the surface is irregularly mountainous, with very narrow stream bottoms, this area comprises the whole drainage basin of the South Fork of the Flathead River. This basin is about 92 miles long and from 10 to 30 miles wide. It is bounded on the west by the high and sharp Kalispell Range, on the east by the Sheep Horn or Stanton Range, which southeastward joins the Continental Divide and with it forms an irregular boundary. This range has very rough topography on its western slope.

For some 40 miles above the mouth of the South Fork the valley is narrow and, excepting some recesses in the mountains eastward, fairly uniform, but above or southward the parallel ridges forming the foothills of the Continental Divide are sharply cut across by streams, and a very rugged topography is the result.

The west branch of the South Fork has a fan-shaped drainage, the western tributaries of which head in the mountains about Pend Oreille Pass and flow through sharp canyons until they reach the main stream.

Willow Creek, which joins the West Fork to form the South Fork of the Flathead, has a much broader valley bottom than the West Fork. Above the first canyon there is an area of gravelly land with a maximum width of about 3 miles. About 8 miles above the first canyon is a short canyon through a ridge which cuts the valley in two near its middle. Above this canyon is a willow bottom about 7 miles long and from half a mile to a mile wide. This glaciated U-shaped valley continues southward beyond the headwaters of Willow Creek to those of the North Fork of the Blackfoot. The divide between the two streams is so low that the headwaters of Willow Creek could easily be turned into those of the North Fork of the Blackfoot.

In quality there is a great variety, according to the situation where grown. In general, the timber has grown in dense forests and is fairly free from large knots.

The yellow pine, as usual, borders the prairies and other openings, and is limby above the first 25 or 30 feet from the ground. It is often fire scarred in the butt.

Red fir, while less defective here than on the eastern slope, is often found full of dry rot.

Lodgepole pine is usually sound and fairly clear, though small.

White pine is frequently defective; in fact, it is seldom sound. Much of it is dying, and in dying the sapwood turns blue. Besides this defect, it is common to find dry rot in the trunks, and the many defective logs greatly increase the cost of logging.

Some cedar 34 inches in diameter and 75 feet high was seen, but this size is exceptional. There are no large areas of this species. It is limited to ravines and other damp places.

Nut pine is greatly variable in quality, seldom being suitable for log timber, and where suitable it is so inaccessible as to be of no commercial value.

Young growth.—With few exceptions, there is a fair stock of young trees throughout the forest. The tracts not burned have young trees coming in where the old have fallen. Most of the burns in the low country are being fairly restocked, but the burns of 1889 were so severe that reproduction on them, as found on Hungry Horse, Upper Gordon Creek, and the eastern slope of the Kalispell Range, has been scant. Willow Creek, however, is fairly well stocked, but all the young growth there is small, usually from 2 to 10 feet high. But little of the unburned forest lacks sufficient young growth to constitute a new stock were the mature trees cut. On the burned land, however, the trees being small and usually all of one kind, the problem of thinning and securing a valuable stock would be a more difficult one, for the severe burns have little else than lodgepole pine.

Underbrush.—The species most abundant here are alder, maple, spiræa, dogwood, willow, brittlebrush, yew, juniper, redroot, and squawberry. These are often dense enough to form a serious obstruction to logging operations, especially on or near the bottom, where dogwood and yew are dense under the spruce. These species follow up the water courses into the gulches on the mountain sides, leaving ridges, especially the moraines, fairly free from brush. The northern mountain slopes, especially in high altitudes, have brittle brush and huckleberry in some abundance. The medium altitudes, both on the slopes and flats, especially if moist, have maple and yew often so dense as to be difficult to pass through; but the southern slopes and gravelly benches have some clumps of alder, service berry, squawberry, and redroot, but, as a rule, not enough brush to obstruct travel through them.

Deadwood.—The amount of deadwood standing is only about 600,000 cords, and this has no market value where it stands. Probably all will be fallen before it becomes accessible or marketable.

Cutting.—There has been no cutting on this tract, except for cabins and camp use, unless it be in the extreme northwest corner of the reserve, which could not be located exactly, as the boundary lines there have not been surveyed. Many ties were made in that vicinity and put into the track during the construction of the road.

Transportation.—The only way to get timber out of this region is northwestward, or down the stream. Were it not for several bad canyons, the river would be drivable for at least 80 miles above its mouth. It is possible these canyons can be improved so as to permit log driving, but the expense would be great. Elsewhere on the river driving would often be difficult because of the wide bed of the river and the frequent gravel bars. A railroad along the river could be built with easy grade, but the expense would be considerable, owing to frequent cut banks and ravines, and it is questionable whether the timber interests alone would warrant the construction of such a road.

Demand.—At present, excepting possibly in the extreme northwestern part of the reserve, timber has no market value where it stands. Prices at the nearest mill, Columbia Falls, are \$3 per M, and fuel, at present, hardly commands any stumpage.

Agricultural land.—While some vegetables and hay would doubtless grow in favorable spots throughout the valley, the liability of destructive frosts at any time during the season precludes the possibility of commercial agriculture. Perhaps 80 square miles are level enough to be arable, but much of this is gravelly and unsuitable for agriculture except for garden spots, to supply lumber or mining camps, in case of special need.

Irrigation.—Very little water, indeed, will ever be used for irrigation in this valley, but it is possible that it may be used in the Flathead Valley outside of the mountains, where agriculture, though carried on at present without irrigation, would be improved by it.

Occupancy.—There are about half a dozen cabins in the valley, but these are not occupied all the year. They belong to prospectors, who use them only while doing their assessment work.

Water power.—Water power is abundant along the main stream and three of the tributaries. Spotted Bear and two streams from the west are large enough to furnish power for sawmills. There are several very favorable sites for dams, and large amounts of water could be held above the canyons.

Mining.—No ore has been shipped from the valley, but several claims are held in the lower portion for coal, gold, silver, and copper.

usually limited to the mountain ranges. The hemlock, cedar, and white pine are found only in sheltered, damp places, as in the ravines or on the lower mountain sides, and the cottonwood is confined to the banks of streams; otherwise the species are fairly well mixed, with perhaps the exception of spruce, which seeks constant moisture and avoids dry subsoil (see Pls. XXVI, *B*, and XXVIII, *A*).

In size the trees in this valley are hardly as large as in some other localities. The yellow pine, for instance, on the flat between Holt and Columbia Falls, reaches a diameter of 6 feet, even 7 feet on the stump,

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and a height of 150 feet, while above Swan Lake the largest trees noticed were about 4 feet in diameter and 100 feet high. Lodgepole pine was rarely seen over 14 inches in diameter and 70 feet high, while spruce is seldom found over 30 inches in diameter and 90 feet high (see Pl. XXVIII, *B*). Although constituting the greater portion of the growth on the higher mountain sides, it has a size suitable for log timber only in gulches or on other damp, fertile land. The amount of log timber in the valley, roughly estimated to 8-inch top, is as follows:

Log timber in Swan-Clearwater Valley, Montana.

	M. feet B. M.
Larch	1, 050, 000
Yellow pine.....	100, 000
White pine	10, 000
Red fir	500, 000
Spruce.....	175, 000
Lodgepole pine.....	30, 000
Total	1, 865, 000

This estimate is regardless of accessibility, of present custom of cutting, and present demand. It is simply intended to express a safe estimate of the amount of log timber. For the whole amount of wood material in the valley there should be added that too small for log timber, which has been very roughly estimated in cords, as follows:

ing all dead material down the Swan River, at the mouth of which is an admirable location for a large and permanent mill plant.

Demand.—At present stumpage values in this tract, and even on more accessible land northward in the Flathead Valley, are nominal. Good timber there goes for 75 cents to \$1 per thousand feet on the stump. Within the reserve very little could be realized without extensive developments to make the timber more accessible.

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Agricultural land.—Commercially, agriculture within the valley will never be important. Vegetables, small fruits, and hay, perhaps some grain, would grow, but only in a small way, and stimulated by the difficulty of bringing such material from outside. There are some 200 square miles in the valley that are smooth enough to be arable.

Grazing.—There are about a dozen small prairie openings in the valley, probably 500 acres of upland and the same area of slough. Snow evidently falls deep and lies long, but hay is plenty, and a few cattle may be kept with some care.

Occupancy.—There is no stock now in the valley except at Holland's, where there are about 30 horses and a dozen cattle. On Clearwater Lake Mr. Seeley has been living some time, and has recently erected a substantial house. About the head of Swan Lake are 4 resident squatters and on Flathead Lake are 11. Scattered through the valley are 15 cabins, none of which were found occupied, though 2 of them were locked and evidently used at times.

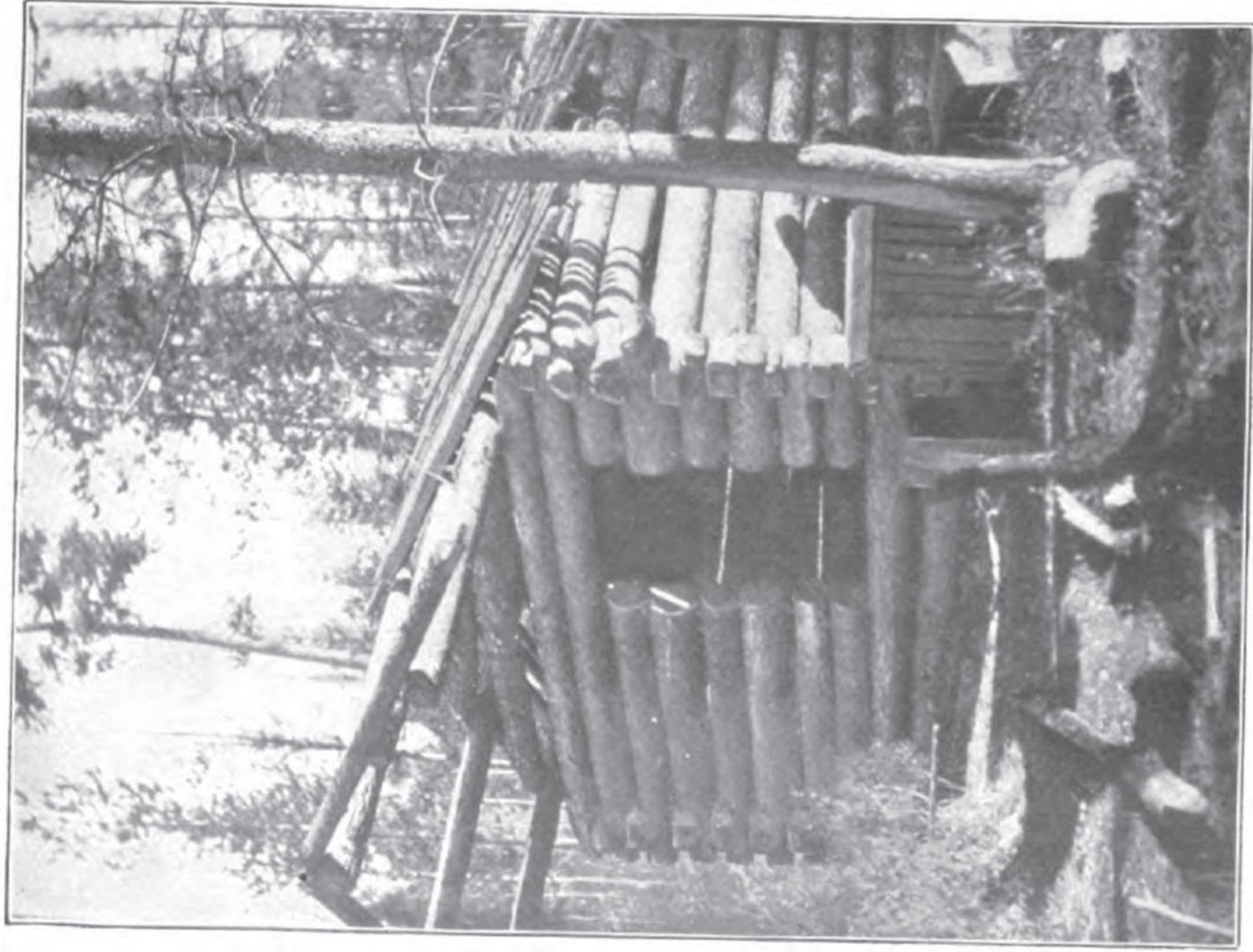
Water power.—Below Swan Lake are many fine water powers on the large and constant outlet of the lake. The smaller streams above the lake, excepting Holland Creek and the outlet of Long Lake, are of uncertain value, as they become quite low in autumn, although strong in spring. Holland Creek and the outlet of Long Lake having natural reservoirs, are much more steady and may be greatly improved for water power by building dams at the outlet of the lakes.

Mining.—There are no mining operations at present, and no pros-

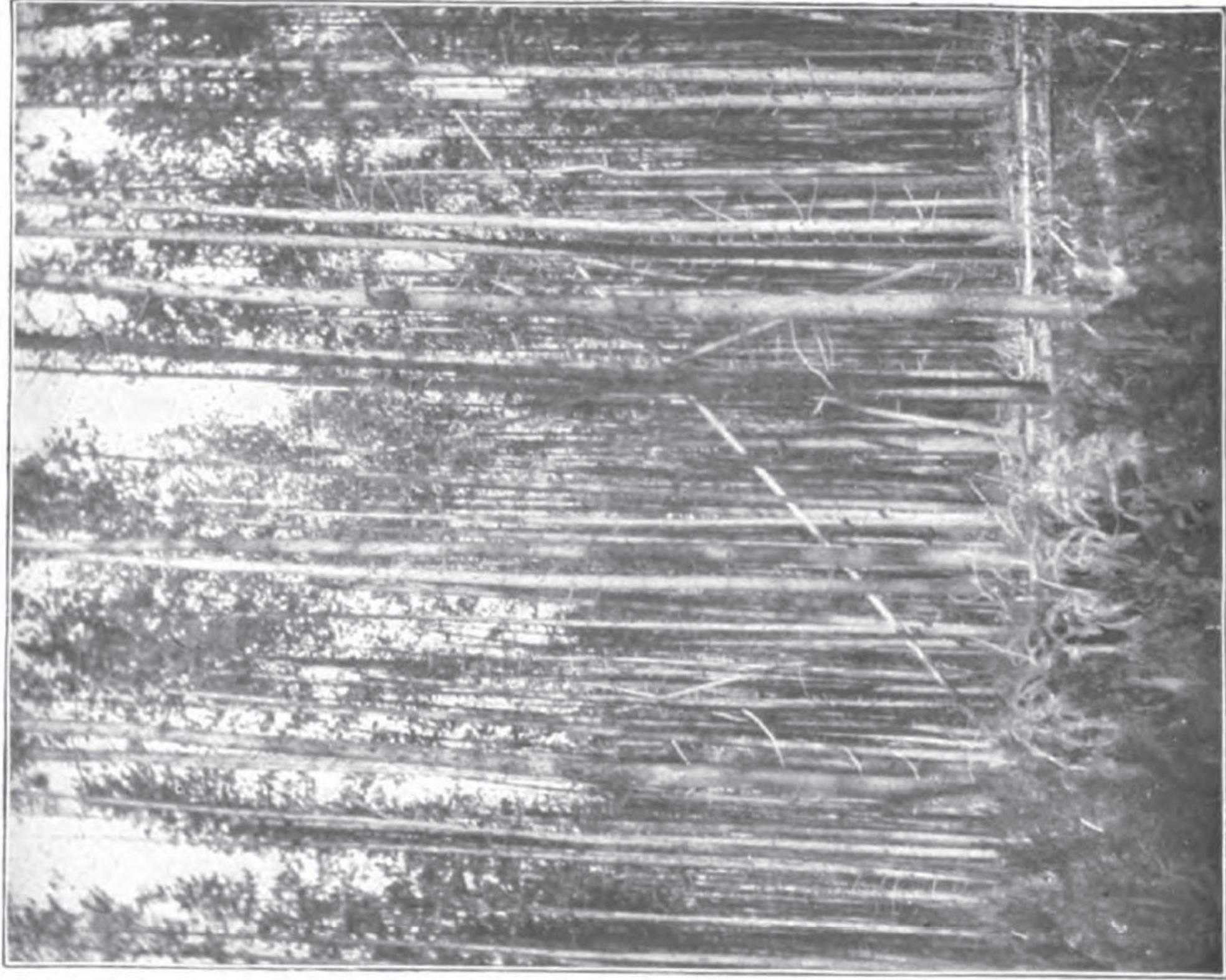


B. HEAD OF MIDDLE FORK OF FLATHEAD RIVER.

U. S. GEOLOGICAL SURVEY



A. HOMESTEAD CABIN.



B. LINE OF BURN OF 1889 IN LODGEPOLE PINE.



B. LARCH AND LODGEPOLE PINE ON BURN OF 1889.