

T H E S I S

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MANAGEMENT PLAN FOR THE POUDRE WORKING CIRCLE
ROOSEVELT NATIONAL FOREST

Submitted by
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I. Foundation

A. Purpose of Management Plan

The purpose of this management plan is to bring together all available data concerning the Poudre Working Circle in order to practice forest management; to determine the time, place, and amount of cutting which will best carry out the policies of the government in managing its forests, and ultimately place the area on a sustained yield basis.

B. Description of Working Circle

1. Location

The Poudre Working Circle is the largest in area and volume of timber of any within the Roosevelt National Forest. It is situated entirely within Larimer County, Colorado, and embraces all the Cache La Poudre River drainage area within the National Forest.

2. Boundaries

The Circle is bounded on the west by the divide, which separates the Cache La Poudre and the Laramie River drainage areas, and on the south by the divide between the Cache La Poudre and the Buckhorn River drainage areas. On the north and east, the circle extends to the boundaries of the Roosevelt National Forest.

3. Area

The area of the working circle is made up of 305,455 acres of timbered National Forest land; 76,620 acres of non-timbered National Forest land; 144,569 acres of private land; and 8,227 acres of state land. The total area amounts to 537,871 acres.

4. Land Status

The above figures show that about 28% of the circle is alienated land. These alienations consist of mining, homestead, and timber patents as well as state and railroad grant lands. They are interspersed with the National Government's holdings all through the lower portions of the circle. In addition, there are a few unperfected mining claims, and a small acreage of reservoirs and homestead filings.

Administration is difficult in the Ponderosa Pine forest type which covers most of the lower portion of the circle because of this large and widely distributed amount of land in private ownership. This area was not added to the National Forest until 1917 which accounts for the numerous alienations. As many consolidations as are possible are being made in order to remedy this situation, but because of the high grazing and recreational values, it is difficult to completely carry out this objective. A land exchange plan is also being carried out as rapidly

as opportunity permits.

5. Topography

The circle covers a very mountainous region broken up by numerous tributaries of the Cache La Poudre River. The main stream flows in an easterly direction and passes through steep walled canyons for most of the distance.

The topography south of the river is very rugged and has a spur of the Continental Divide known as the Mummy Range which divides it into two distinct units. The area north of the Poudre Canyon is drained by the North Fork of the Cache La Poudre River and its tributaries.

The elevations vary from 5,300 to 12,716 feet above sea level, the highest point being Commanche Peak. The average elevation is about 8,000 feet. The main road up the Poudre River reaches an elevation of 10,285 feet at Cameron Pass on the Medicine Bow Range.

6. Climate

The climate is typical of the eastern slope of the Continental Divide, with open winters below 8,000 feet elevation, and deep snows with long hard winters higher up in the mountains. The summers are usually dry and strong winds are common.

7. Soil

The soil, as a general rule, is thin, dry, and gravelly. It has a granitic origin and overlies much

solid granite. The area also contains a great deal of loose rock and rock outcrops of considerable size.

C. Economic Situation

1. Population

The Poudre Working Circle has no large centers of population within its boundaries. Places such as Livermore, Logcabin, Eggers, and Home, Colorado are merely post offices serving a small number of families. The greatest concentration of population is in the vicinity of Red Feather Lake, a recreational summer resort area in private ownership. During the summer approximately 3,000 people visit this locality.

The nearest town of any consequence is Fort Collins, a city of 17,000 people. Greeley, located thirty miles to the east, has a population of about 20,000. Another sizeable community is Loveland which numbers about 8,000 people and is located thirteen miles south of Fort Collins. This last community is in a position to be supplied by the Boulder-Estes Working Circle as well as the Poudre.

These three centers of population and their surrounding areas can absorb a major portion of any possible cuts of sawed products from the Working Circle.

2. Transportation

A very good highway follows the Cache La Poudre River from Fort Collins to Cameron Pass and then to Walden.

Another good road tops the Red Feather Lakes country via Livermore and Logcabin and continues westward to Deadman Park. The northern part of the circle is opened up by a road which goes from Livermore to the north and passes through Cherakee Park, and then continues westward along Sheep Creek to Eaton Reservoir.

To the south there is the Bennett Creek Road, which runs from the Cache La Poudre River to the Buckhorn Ranger Station. This road then continues to the east via Stove Prairie and goes down Rist Canyon to Bellvue and Fort Collins. Another road leaves the Cache La Poudre at Eggers and continues southward to Pingree Park.

Besides these arteries, there are numerous roads of fair to good condition which tap the greater portion of the circle. The Poudre Canyon road connects with the Fort Collins - Laramie highway about eight miles northwest of Fort Collins.

The Colorado and Southern Railroad has a track from Fort Collins to Engleside, approximately fourteen miles in length. This spur track is three miles distant from the southeast boundary of the Working Circle.

3. Local Industries

a. Wood Using

The following is a list of the wood using industries which are obtaining their material from the Poudre Working

circle.

1. Fred Bockman, 315 Parker St., Fort Collins, cuts about 1,000,000 board feet per year.
2. Don Bockman, 3 miles north on Loveland highway, cuts about 1,000,000 board feet per year.
3. Emery Jones, 204 West Lake St., Fort Collins, cuts about 500,000 board feet per year.
4. Carmel Warren, rear 126 W. Mountain Ave., Fort Collins, takes about 250,000 feet per year.
5. Jasper Davis, 701 Wood St., Fort Collins, takes about 200,000 feet per year.
6. Dickerson, Kitcherson, and Lackwood, Fort Collins, use only 100,000 feet per year.
7. Golden Ash Coal Co., Fort Collins, cuts 50,000 board feet per year of mine props.
8. Milligan Lumber Co., 701 Wood St., Fort Collins.
This company does no logging of its own. It is a planing mill only and buys select materials from Fred Bockman, Don Bockman and Jasper Davis. The Milligan Lumber Co., after air seasoning its stock, run it through the planing mill and sells it as C and D select. Fred and Don Bockman dispose of their common grades at their own retail lumber yards. Jasper Davis, who saws mostly railroad ties, has a contract with the Western wood Preserving Company of Denver.

The following is a list of wood using industries who obtain their material from the West Coast and Inland Empire.

1. King Coy Lumber Co. 324 Jefferson St., Fort Collins.
2. Carl Trostel Lumber Co., 351 Linden St., Fort Collins.
3. Gould Lumber and Investment Co., 243 No. College Avenue, Fort Collins, Colorado.
4. Mawson Lumber Co., 307 E. Mountain Avenue, Fort Collins.

These four companies have retail lumber yards.

b. Non-Wood Using Industries

The three communities mentioned are all surrounded by a considerable area of irrigated agricultural land. The water available for this purpose will be greatly increased with the completion of the Colorado Big Thompson Project. Water will be brought from Grand Lake through a tunnel underneath Rocky Mountain National Park to a reservoir near the village of Estes Park. From there it goes down the Big Thompson River, and part of it will be taken by a canal to Horsetooth Reservoir, which is six miles southwest of Fort Collins.

The Great Western Sugar Beet Company has a large factory in both Fort Collins and Loveland and will benefit considerably from the increased water for irrigation.

There is also much wheat grown in this area as well as other agricultural and some fruit crops. Many cattle ranches are scattered around in the foothills region and also out on the plain to the east.

The tourist trade is important to all this area as it is one of the major industries of the state of Colorado. Fort Collins and Loveland are both fairly close to Rocky Mountain National Park and benefit greatly by tourist trade.

Both Greeley and Fort Collins are the homesites for two of Colorado's state colleges. Colorado State College of Agriculture and Mechanic Arts is in Fort Collins and Colorado State Teachers College is in Greeley.

4. Labor Supply

The major source of labor is supplied by local hands and woods workers of little experience. Other laborers also without much experience in woods work are available from Fort Collins and vicinity, and are engaged in periodic work in the sugar factories and with the beet raising industry.

5. Private Lands

Approximately one-third of the total area is alienated. These private holdings are located largely in the Ponderosa Pine type. In the northeast portion, the Union Pacific Railroad was granted every odd section in about

four townships under the Railroad Grant Law. Homesteads have further reduced the government lands in this locality to less than 50% of the area. Throughout this entire Ponderosa Pine belt, the federal land is interspersed with private and state holdings.

In most of the Lodgepole Pine belt, 95% of the land is in government ownership, and the Forest Service has no trouble in controlling the time, place, and amount of cut.

Because of the complicated land ownership in the Ponderosa Pine area, small sales of government timber are the rule. In the Lodgepole Pine belt, larger and fewer sales can remove the mature and overmature timber without interference from or with private owners.

6. Markets

The local rancher, water development projects, and small settlements within the circle can absorb only a small fraction of the cut this circle will sustain. Fort Collins and vicinity along with Greeley have a population over 50,000 and a market which uses a large amount of forest products shipped in from the west coast. This market, together with a large region to the east, can easily absorb any possible cut from the circle. No market, however, will absorb local lower grade products as long as the better grade western material is available at favorable prices. Local operators have to grade, classify, and season their output to successfully dispose

of their products in these markets.

It would be very advantageous to the Forest Service if a steady market were developed, and lumber mills, both mills, shingle and box mills were established. There is plenty of material on hand to supply several large mills centrally located, but under present conditions the controlling factor is the high cost of transportation from woods to market. The future outlook is encouraging and a large development of the business in this circle is expected.

D. Forest Description

1. Types and Silvical Features

The three main types represented on this circle are Ponderosa Pine, Lodgepole Pine, and Engelman Spruce. Douglas Fir occur on small isolated areas or is intermingled with the main types. Aspen occurs in small patches widely distributed over the circle.

The National Forest land is classified by types as follows:

<u>Types</u>	<u>Acres</u>
<u>Nontimbered types</u>	
Grassland	63,000
Sagebrush	10,000
Barren	3,620

<u>Types</u>	<u>Acres</u>
<u>Timber Types</u>	
Ponderosa Pine	
Mature	68,120
Poles	15,500
Reproduction	20,000
Lodgepole Pine	
Mature	128,010
Poles	11,120
Reproduction	18,720
Engelman Spruce	
Mature	29,000
Reproduction	1,600
Aspen	<u>14,385</u>
Total	385,075 acres

The Ponderosa Pine type consists mostly of open stands of pine with a sprinkling of Douglas Fir in mixture on the better sites. In general, it may be classified as fairly thrifty, although there are a few very over mature stands. The sites occupied by most of this type are usually rocky or gravelly soils of poor quality and low productivity. The mature timber is short and limby, averaging no more than two 16-foot logs per tree. This species is naturally restocking most of the old burns and abandoned fields within its range. Mature stands are

open with numerous thrifty "blackjacks" well distributed throughout.

The Lodgepole Pine type generally comprises nearly pure stands of their species. On the ridges, Limber Pine occurs in mixture, while along the streams in the deep, moist soils Engelman Spruce and Alpine Fir are found. This type has a preponderance of mature timber some of which was culled over for railroad tie sized material 50 or 60 years ago.

The Engelman Spruce type, which is found at the higher elevations and along the stream banks, is generally composed of thrifty mature trees with Alpine Fir in mixture.

2. Protection

Very few serious fires have occurred within the circle since Forest Service protection was established even though the fire liability is high, especially in the Lodgepole Pine area. Through the cooperation of a well distributed population, coupled with a satisfactory fire plan and an adequate road and trail system, the actual fire loss has been slight. Extensive old burn throughout the region gives mute testimony as to what happened prior to the establishment of organized protection, but the possibility of such large fires in the future is considered remote.

The Ponderosa Pine timber has been attacked at various times in the past by the Black Hills Beetle (*Dendroctonus ponderosae*) which destroyed some of the overmature trees. In 1927, the attacks reached the epidemic stage and the overwinter loss was estimated to be 500 M. feet B.M. or more than the total year's cut on the circle. Active control measures are being taken against this insect and its activities are carefully watched. As regulated cutting places the overmature Ponderosa Pine stands in better silvicultural condition, danger from insect epidemics are reduced.

E. Tables

1. Volume

The volume figures are based on a minimum diameter of 10" d.b.h. and an 8" top utilization in the Ponderosa Pine and Engelman Spruce types. In the Lodgepole Pine type, the board foot estimate is based on the same d.b.h. but a 9" top utilization, while the mine prop material includes the top of the sawlog and railroad tie sized trees to 5" d.i.b., and the pole sized trees to a minimum of 6" d.b.h.

In the mature areas, the average stand per acre for each type is as follows: Ponderosa Pine 2 M feet B.M. for acre; Lodgepole Pine 5 M feet B.M. and 3000 linear feet of prop material; and the Engelman Spruce type contains an average of 9 M feet B.M. per acre.

2. Acreages and Volumes by Types

	Acreage	M feet B.M.	M Linear Feet
Ponderosa Pine Type			
Merchantable mature	52,000	112,856	
Inaccessible mature	16,120	20,000	
Pole stands	15,500	6,750	13,500
Reproduction	<u>20,000</u>		
Total	103,620	139,606	<u>13,500</u>
Lodgepole Pine Type			
Merchantable mature	104,010	357,287	280,500
Inaccessible mature	24,000	80,010	78,330
Pole stands	8,120	10,000	40,600
Reproduction	<u>16,720</u>		
Total	152,850	447,317	<u>399,430</u>
Engelman Spruce Type			
Merchantable mature	29,000	344,282	
Inaccessible mature	6,150	65,650	
Reproduction	<u>1,600</u>		
Total	36,750	409,932	

Total accessible merchantable stand

Saw and tie timber 814,425,000 feet B.M.

Prop material 412,930,000 linear feet in
tops of sawlogs and tie trees.

3. Composition and Volume of Types by Species

Mature Stands

a. <u>Ponderosa Pine Type</u>	<u>Percent of type</u>	<u>M Feet B.M.</u>
Ponderosa Pine	90	92,312
Douglas Fir	7	8,408
Lodgepole Pine	2	2,403
Limber Pine	<u>1</u>	<u>1,201</u>
Total	100	104,324
b. <u>Lodgepole Pine Type</u>		
Lodgepole Pine	81	319,754
Engelman Spruce	10	65,279
Alpine Fir	6	1,500
Douglas Fir	<u>3</u>	<u>19,583</u>
Total	100	406,116
c. <u>Engelman Spruce Type</u>		
Engelman Spruce	75	265,511
Alpine Fir	20	29,924
Lodgepole Pine	3	5,130
Douglas Fir	<u>2</u>	<u>3,420</u>
Total	100	303,985

4. Area and Volume of Private Land

Total area.....144,569 acres

Volumes of mature timber

Ponderosa Pine....41,591,000 feet B.M.

Douglas Fir.....8,809,000 feet B.M.

Lodgepole Pine...21,784,000 feet B.M.
 Engleman Spruce...2,723,000 feet B.M.
 Alpine Fir.....598,000 feet B.M.
 Minor Species.....476,000 feet B.M.

5. Area by Cover Types, National Forest, all Species, in Acres

Merchantable mature	117,721
Merchantable immature	45,251
Cut over	<u>12,010</u>
Subtotal	174,982
Inoperable	12,228
Young stands	103,860
Aspin	<u>14,385</u>
Total	305,455
Non-timbered	<u>76,620</u>
Grand Total	385,075

II. Management Plan

A. Management Policy

To produce the maximum volume of timber products under sustained annual yield, and the ultimate establishment of a productive forest on every acre of potential timber land by planting, fire protection, and regulation cutting.

To furnish steady employment for some of the resident population in woods work, and in the varied manufacture of forest products.

To consolidate the government lands through land exchange into logical and feasible logging units.

B. Objects of Management

1. Products

The Western Yellow Pine and Engelman Spruce types will be managed primarily for the maximum production of sawlog timber. Lodgepole Pine in this region is best suited for the manufacture of railroad ties, and that type will be managed for maximum production for this class of material. Utilization of tops and thinnings for mine props will be encouraged, although no stands will be managed primarily for the production of such products.

2. Markets

Efforts will be made to maintain a continuous yield

of forest products for the use of local people and industries, and to supply the general market with any surplus.

3. Watershed Protection

The primary need is to assure a supply of water to local ranchers for irrigation purposes, well distributed seasonally. The silvicultural system used will provide ample protection for this need.

4. Grazing

The use of grazing resources will be encouraged and protected insofar as this does not interfere with the proper timber production. Grazing use of potential timberlands will be restricted or prohibited where such use is detrimental to tree growth or restocking.

5. Recreational and Special Uses

Due consideration will be given important scenic and recreational resources as provided for under the Marking Policy Statement. The necessity, however, of providing sawmill sites, marking grounds, and roads into individual logging units will be kept in mind in allocating areas for recreational purposes. Care will be taken that essential outlets for timber are not blocked. These points will be explained fully to prospective summer home applicants on or adjacent to areas that will be logged. The same policy will govern all other forms of special use.

C. Silvercultural Policy

1. Objectives

All cutting will be directed towards placing the forest area in the best possible silvercultural condition through the removal of mature, overmature, diseased, insect infested trees, trees of inferior species, and through thinnings.

2. Insect Control

Special attention will be given to the removal of trees infested with *Dentroctonus ponderoseae* (Black Hills Beetle) or similar beetles regardless of age or class.

3. Christmas Tree Thinnings

In the narrow belts of pure Douglas Fir, which occur along the north slopes at the lower altitude, thinnings will be made to supply Christmas trees for the holiday demand. These stands are limited, since most of the bottom lands are privately owned, but wherever such stands exist on accessible government lands the policy will be to make them demonstration areas showing the value of thinnings.

4. Marking Rules

Marking will be done in each type according to the Marking Policy Statement in the appendix.

D. Regulation

1. Rotation and Cutting Cycle

A rotation of 160 years divided into four cutting cycles of 40 years each has been determined for all types within this circle. This rotation coincides closely with commercial maturity.

2. Allowable Cut

The annual allowable cut is 10,180 M feet B.M. of sawlog and railroad tie materials to be removed from approximately 5,628 acres.

No limitation is being placed on the volume of mine prop material to be cut annually, since the removal of such products is a matter of close utilization and desirable thinnings.

3. Selection of Cutting Areas

The following factors are to be considered in selecting areas for cutting.

- (a) The degree of maturity and decadence of the stand.
- (b) Volume of timber available.
- (c) Accessibility.
- (d) Location with respect to present operations.

The following units are in need of cutting and should be sold as rapidly as opportunity permits. Estimates and appraisals are being prepared for these areas:

Cameron Pass Compartment

Joe Wright Unit

Big South Unit

Home Compartment

Mummy Unit

Black Hollow Unit

Little South Compartment

Bennett Creek Unit

Crown Point Unit

Commanche Unit

Black Mountain Compartment

Panhandle Unit

Sheep Creek Unit

The above units are suitable for large operation with the exception of the Bennett Creek Unit in the Little South Compartment. Here a small operation is at present cutting approximately 200 M feet B. M. Irrigation projects and recreational developments in the Joe Wright and Panhandle Units require annually about 150 M feet B.M. Except for local needs, the small sale business will be directed to the scattered stands of mature timber in the Grey Rock and Lone Pine Compartments.

E. Timber Sale Policy

1. Established Industries

The yearly timber business at present amounts to about 2,900,000 feet B.M. of sawlogs, and an inconsequential amount of props, poles, and other minor products. The great disparity between this and the amount which can and should be cut, according to the allowable cut, indicates the need for aggressive action in expanding sales.

2. New Business

An increase in the business can be obtained only by a concentrated drive to develop markets and to interest new operators. Operators will be encouraged to install better equipment and manufacture higher quality and more uniform grades of products. If quantity and quality production is assured, local dealers can be expected to market an increased volume of home grown products.

The centrally located refinishing plant at Fort Collins, which works up the combined output of several small mills, is a partial solution to the present problem. This matter will have to be given considerable study and a prospectus prepared that will sell the idea to men who are in a position to develop such a proposition.

An unlimited potential market for fence posts exists to the east where a rich farming country uses many thousands of posts annually. A small plant treating Lodgepole and Ponderosa Pine posts from the pole stands, and tops of

sawlog and tie trees, is a very desirable development.

3. Size, Number and Distribution of Sales

The volume of timber sold will be subject to the limitations stated and sales will be located as much as possible within the areas listed as being most urgently in need of cutting.

Due to the manner in which government lands in the Ponderosa Pine type are broken up by private holdings, the concentration of the cuts into a few large sales is impractical. It will be the policy to divide the cut among a large number of small operators well distributed over this type. In the Lodgepole Pine type, the cut may be handled by larger sized operation.

4. Free Use, S-22 and Other Small Sales

The limited demands for free use can be satisfactorily supplied with dead timber.

Sales under Regulation S-22 will be confined to small isolated tracts of timber. It will not be necessary to set apart any special areas to take care of this business.

Sales of greenhouse logs and other special order material will be limited to trees which are stagnant or such that their removal is silverculturally desirable.

5. Logging Methods

Animal and tractor logging will be the general practice. Truck and tractors may be used for transportation.

Other forms of logging will be permitted only under written authorization of the District Forester.

6. Specific Requirements

Close utilization can be expected in the Western Yellow Pine and more accessible Lodgepole Pine areas. Utilization of mine prop material will be required in log and tie sales unless market conditions prohibit.

The details of timber sale administration are completely covered in the National Forest Manual and in the District II Forest Management Handbook. These instructions will govern the preparation of contracts and subsequent handling of the sales.

III. Appendix

A. Description of Circle by Compartments

The Poudre Working Circle embraces the entire watershed of the Cache La Poudre River and a small part of Sand Creek, which flows north into the Laramie River. For management purposes, this circle is divided into seven compartments, of which four have been subdivided. The others can be subdivided when necessary.

The circle contains the largest body of timber on the Roosevelt National Forest. Prior to 1890, the more accessible areas along the Cache La Poudre River were cut over for hewed railroad ties which were driven down the river to the railroad. Since that time, an automobile

highway has been constructed following the main stream to Cameron Pass. This road is very well constructed and passable five months of the year over the pass, and usually the entire year from Fort Collins to the Greeley-Poudre Irrigation Tunnel. In constructing the road, numerous solid rock bluffs were encountered and some large boulders were blown into the stream bed obstructing it as far as driving is concerned.

The northern half of the circle is a truck hauling proposition and will be developed slowly. The higher portions here have some very good mature stands of Lodgepole Pine that will make excellent railroad tie material. The lower or Ponderosa Pine type presents a small sale problem since 50% or more of the land is privately owned. Road construction is not difficult here, and with the numerous private and county roads now cutting up this region, the present mature timber can be easily reached. The long haul to market is the main objectionable feature under present conditions.

All but the Sand Creek Compartment may be logged toward Fort Collins. The timber on Sand Creek will go out by truck to Tie Siding, Wyoming on the Union Pacific Railroad.

The attached map shows the compartments, their boundaries, and a brief description of each follows:

1. Cameron Pass Compartment

This compartment includes the timber at the head of the Cache La Poudre River which can either be taken out to Fort Collins or to Laramie. It consists mostly of over-mature Lodgepole Pine and Engelman Spruce and has considerable subalpine type.

The timber in this compartment is relatively inaccessible as far as the markets to the east are concerned. However, it is now almost as accessible as the Twin Lake Unit or the Laramie River Working Circle. Very little, if any, uphill haul will place the product from this area on the Laramie River for driving to Laramie.

2. Home Compartment

This compartment embraces the timber which would come out to the main Poudre from the west slope of the Mummy Range and the north side of the river. Some of the finest uncut mature Lodgepole Pine timber on the Roosevelt National Forest is found in this compartment on the west slope of the Mummy Range. The Cameron Pass highway passes through this as well as the Cameron Pass Unit.

3. Little South Compartment

The entire drainage of the Little South Poudre River is embraced within this area. The Bennett Creek nine foot road, constructed by the Forest Service, connects the main body of the timber here with the highway along the main

Poudre. A large continuous stand of mature timber is found here on the west side of the road.

4. Grey Rock Compartment

This compartment comprises the eastern portion of the Mummy Range and consists almost entirely of Ponderosa Pine. Very little merchantable timber is found in this area. It is broken up by numerous alienation, approximately 50% being privately owned.

5. Lone Pine Compartment

This compartment embraces the Lone Pine Creek drainage and consists almost entirely of Ponderosa Pine except in the extreme western portion of the area. Lodgepole Pine is found on the east slopes of the North and South Bald Mountains.

Most of this compartment has been cut over thirty or more years ago, and the present stand is not in as urgent need of cutting as some of the other compartments of this circle.

6. Black Mountain Compartment

This compartment embraces the main North Fork of the Cache La Poudre River and its tributaries within the Forest boundaries. The timber here has been partly cut over in previous years, but there is considerable over-mature timber in the higher portion that should be cut as soon as possible.

7. Sand Creek Compartment

This compartment is a small logging unit topographically separated from the rest of the circle. Very little mature timber is in need of cutting on this area.

B. Area, Volumes and Type Composition

1. Area

Areas were obtained from the type map for the circle prepared from extensive information secured by the District Rangers. The status was taken from the status records. Division of the circle into types has been made on the basis of extensive timber surveys conducted by the Forest Service.

2. Volumes

The average volume per acre by types was determined from cruise data made on timber surveys. These volumes are as follows:

Engelman Spruce Type	9 M per acre
Lodgepole Pine Type	5 M per acre
Ponderosa Pine Type	2 M per acre.

3. Type Composition

The information available from the timber survey data indicate the following species in each type and the percentage of the type which they occupy.

Ponderosa Pine Type

Western Yellow Pine	90.0%
Douglas Fir	7.0%
Lodgepole Pine	2.0%
Limber Pine	1.0%

Lodgepole Pine Type

Lodgepole Pine	81.0%
Engelman Spruce	10.0%
Alpine Fir	6.0%
Douglas Fir	2.5%
Limber Pine	.5%

Engelman Spruce Type

Engelman Spruce	75.0%
Douglas Fir	2.0%
Alpine Fir	20.0%
Lodgepole Pine	3.0%

C. Silvercultural Condition
of Timber

The timber classed as mature is in need of improvement and release cuttings. A large proportion of the volume is found in mature, decadent, and overmature trees which should be cut as soon as possible, at least within the next forty year period. Portions of the stands classed as mature in the Lodgepole Pine type were cut over during the period 1880 to 1890, prior to the establishment of the National Forest. Hewed railroad ties

were produced, removing only trees 11" to 14" d.b.h. The old cut over areas require further cutting to place them in a desirable silvicultural condition. Some large over-mature trees left after the first cut and other trees which have since reached the 10" to 14" diameter class could now be removed.

The mature Ponderosa Pine type has a scattered stand of mature, overmature, and decadent timber which should be removed. In addition, the poles and reproduction are fairly well established in most of these mature stands.

As a rule, the pole stands are overcrowded and thinning would be desirable to improve the present growing condition even though the trees are vigorous and thrifty.

Reproduction stands are dense, even in the Ponderosa Pine type. Natural reproduction is no problem on this circle, and old burns and other openings are restocking satisfactorily. A number of abandoned plowed fields on some of the mountain ranches are slowly restocking to Ponderosa Pine timber.

D. Calculation of Rotation and Cutting Cycle

1. Rotation

A rotation of 160 years appears to be satisfactory as a basis for management. Under average conditions in the Lodgepole and Engelman Spruce types, trees varying from 13" to 16" in diameter will be produced during this period.

The rotation for these types is based largely on growth data collected on the Railroad Working Circle by Junior Forester Harmon. The timber on the Poudre is similar and not inferior to the timber on the Railroad Working Circle, which involves timber both on the Roosevelt and Medicine Bow National Forests. This rotation is also used on the Laramie River Working Circle, which joins the Poudre Working Circle on the west. In fact, the Lodgepole Pine timber on these two circles is one continuous stand being separated only for management plan purposes.

2. Cutting Cycle

On the Coconino National Forest and others, a 20 year cutting cycle with a light cut of about thirty-five percent of the merchantable volume, is being practiced. But this would not be feasible on the Poudre for the following reasons. The timber here is of a much poorer quality as the trees are smaller in size and tend to be more limby, the yields per acre are less, and the topography is very mountainous. These facts make it difficult for lumbermen to operate profitably and explains why the Poudre Working Circle is only disposing of about one-third of its sustained annual yield in spite of the present post-war boom in lumbering. If the cutting cycle were shortened and the allowable volume decreased, there would be even less demand for timber and this would not be to the best interest of the forest.

E. Calculation of Allowable Cuts

The estimated stand of merchantable mature timber of all species on the circle is 814,425 M board feet. The marking policy adopted for the various types will remove about 60 percent of the mature timber. On this basis, 488,655 M board feet will be cut in each forty year cycle. This indicates an annual cut of 12,216 M board feet per year.

By using Von Mantel's formula as a volume check, the following results are obtained. The total merchantable volume of 814,425 M board feet divided by one-half the rotation, or 80 years, indicates the annual cut should be 10,180 M board feet. Since Von Mantel's formula works well with a relatively long cutting cycle, this figure is chosen as the annual allowable cut.

The merchantable acreage divided by the cutting cycle of 40 years indicates the cut should cover 2,943 acres per year. Prorated over the main types, this would be 883 acres of the Ponderosa Pine type, 1,677 acres of the Lodgepole Pine type, and 382 acres of the Engelman Spruce type.

There is no point in setting any limitation on fence post or mine prop material, which is removed in thinning operations, as this is silverculturally desirable.

F. Marking Policy Statement

1. General Basis of Management

National Forest timber is a crop. The fundamental purpose of management is to harvest this crop at the point when it yields the largest or most profitable return.

Trees should be marked for cutting as nearly as possible at the time when the mean annual growth begins to fall off. When increment ceases to increase satisfactorily, the tree has reached commercial maturity and ordinarily should be harvested. "Maturity" throughout this statement is used with this meaning.

The point at which commercial maturity is reached varies with species, site, and market requirements. Some stands are commercially mature at railroad tie size, while others of the same species can be more profitably held for sawtimber production

2. Marking Practice

Marking in the Ponderosa Pine type will follow the selection system, will remove about sixty percent of the merchantable volume, and use Keene's classification system for Ponderosa Pine as a guide.

Clearcutting in strips and removing fifty percent of the merchantable volume is the system in use at the present in the Lodgepole Pine type. The plan is to come back in twenty years and remove the rest.

In the Engelman Spruce type, a group selection system is being used. Thirty or forty percent of the volume is being removed by heavy cutting in circles about 100 feet in diameter. These areas are spaced at least 100 feet apart. Another ten percent is being removed in between the groups by a light selection cut.

3. Diameter guides

Diameter guides are intended only to give forest officers, inexperienced in marking in a given type of timber, a general idea of the average sizes at which the different species reach commercial maturity. The guides are not intended as diameter limits to be applied mechanically.

4. Vary Marking

One of the chief faults in marking practice is failure to change the marking when the character of the stand changes. In passing from a thrifty mature stand to a pole or overmature stand, the marking must change abruptly. On ridges or other poor sites, trees naturally stop growing at small diameter than on good sites, and the marking must vary accordingly.

5. Forked and Leaning Trees

Trees will not be marked for cutting merely because of fork or slight lean. However, they should be marked even though immature, if they have a fork so located that

an appreciably greater quantity of the more valuable products will never be produced.

Unless a tree leans to the extent that it will possibly fall before a second cut, or lose in value through distortion, or rub against another tree it will not be marked only for the lean.

6. Basal Fire Scars

Basal fire scars are found on several species, being most important on Lodgepole and Ponderosa Pine. The damage done to individual trees depends upon the size and character of the scar. In a great many cases, particularly in Ponderosa Pine, the scars have become pitched over and consequently have little or no effect on the need for marking the tree.

Trees showing scars will be marked only when the scar is a serious defect that is retarding growth or threatening the life of the tree. However, basal fire scars should always be examined critically because they are very susceptible to rot, and if any rot is present the tree should be removed.

7. Cankers

Canker infections are important in Lodgepole Pine because they cause much breakage and allow fungous diseases to gain entrance into the tree. The pines with large infections should be removed, but those with small cankers

should be taken only when they can be removed as a thinning measure.

8. Mistletoe Infested Trees

Mistletoe attack a number of species but is of most frequent occurrence in this district on Lodgepole and Ponderosa Pine. Heavily infected trees are characterized by a general appearance of unthriftness; poor, thin crown; sickly, pale colored, and often short needles; distorted branches, frequently dead or dying; and the presence of witches' brooms.

As far as possible, all infected trees should be marked for cutting. Some stands are so heavily infected that it is impossible to get rid of all the mistletoe without practically clearcutting. In most Lodgepole stands, this treatment is proper. In Ponderosa Pine, this same treatment will be warranted in seriously infected stands, provided there is advance reproduction or sufficient seed trees remaining to restock the area. However, in the Ponderosa Pine type, care should be exercised not to carry this policy to the extreme of marking thrifty mature trees having minor infection which will have little or no effect on the growth of the tree or in the spread of the parasite.

9. Insect Infestation

Infestations of any consequence should be promptly reported with a view to undertaking special control

measure without delay in all cases where conditions warrant.

There is often the opportunity to reduce insect damage of a minor nature and eliminate the infestation before it becomes serious through intelligently directing the regular marking practice. Bark beetles cause the most serious damage and it is important that trees containing them be marked for cutting and utilized before the broods emerge.

10. Ponderosa Pine Type

Sawtimber will ordinarily be the major product secured in the management of this type. An inspection should be made in the occasional stands on steep slopes where sawtimber operations are not feasible or on other poor sites where the trees are relatively small and limby. These sites should be managed for railroad ties. Cutting should be light on these areas in order to protect the site and prevent Scrub Oak from taking over.

Where stands, as a whole, have not become seriously overmature, a second cut will be planned in about forty years. Thrifty, middleaged, and young trees will be left as a basis for this second cutting and for seed distribution. Trees in the "Black Jack" stage and thrifty intermediate trees will not be cut unless they contain defects sufficient to warrant their removal. Discretion must be exercised in marking immature trees on account of defects.

Those in openings or along the edge of openings should be left even though the defects they contain would warrant cutting if they were located in normally dense stands where a known improvement cutting would be desirable.

Trees with thin or flattened crowns are ordinarily growing slowly, and belong to the mature or decadent class. These should be cut unless they are needed for seeding purposes. Marking will usually move about sixty percent of the merchantable volume of the stand in trees 16" d.b.h. and over, though the percentage must be determined by the condition of the stand.

11. Seed Trees

In most stands ample immature trees will be left for seed without paying special attention to their selection. However, the sufficiency of trees reserved for seed distribution depends upon their spacing and seed production. Thrifty trees with deep, broad crowns in full light are ideal seed trees. At least two and preferably four to six well spaced trees should be left per acre. Trees with spiked tops or other defects will be left for seed only where absolutely necessary on account of the lack of sound trees. It is important that seed trees be left on areas supporting reproduction of a size not safe from fire.

A conservation policy will be followed in cutting isolated Ponderosa Pines or group of trees because of their

importance in restocking open or partially stocked areas. Only those trees will be cut which may be removed without reducing the possibilities of securing reproduction on such situations.

In some instances the stands along the upper slopes and crests of ridges are composed mainly of large, poorly formed trees, most of which should be cut from the standpoint of maturity. However, these trees, by reason of their commanding position, are valuable as seed trees and a sufficient number should be left in these situations to provide ample seed insurance.

12. Lodgepole Pine Type

Railroad ties, sawtimber, mine timbers, mine props, fence posts, and telephone poles are the products to be secured from this type. However, some stands show a very pronounced slowing down in growth at comparatively small sizes, reaching their point of commercial maturity at railroad tie size.

With the exception of some localities, railroad ties are the most important marketable product which can be secured from such stands, and they are obtained from the larger trees. In general; therefore, in thrifty as well as in older stands of sawlog or railroad tie size, trees are cut when they produce the maximum or nearly the maximum number of ties.

13. Limber Pine and Bristlecone Pine Type

These types occur in limited stands and generally on rocky slopes or ridges and sometimes mixed in with other types. They are useful for railroad ties and will be managed the same as Lodgepole Pine. When they occur in other types, they will be managed on the same basis as the species they are growing with.

14. Douglas Fir Type

Sawtimber and railroad ties are the major products to be secured from this type. By limiting cutting to trees which are commercially mature and to thinning, thrifty stands of well formed Douglas Fir, occurring on favorable sites, will be allowed to grow to sawtimber size. However, a great deal of Douglas Fir occurs in isolated patches or on steep or rocky slopes where sawtimber production will be impractical. Such stands will be cut on the basis of maximum production of railroad ties, even though this means cutting some trees before volume growth culminates.

Clear cutting is not justified on Douglas Fir stands and the selection system should be used.

15. Engelman Spruce Type

Sawlogs will be the most important product secured from this type and this should be constantly kept in mind. Trees that are mature should be marked as well as those that are diseased or seriously defective.

If trees much taller than the new canopy are left, they will offer little or no protection to the remaining stand and are the ones most likely to blow down. Accordingly, care should be taken not to leave tall trees, the crown of which will extend above the general crown level of the stand.

16. Blue Spruce Type

This type should be marked in the same manner as the stands with which it is found growing.

17. Aspen Type

Markets for Aspen are limited and this species generally contain a great deal of defects. Excelsior, fuelwood, and other minor products will be produced. Except when marking may be desirable because of some special local condition, such as along highways or on the vicinity of recreational areas, trees should be designated for cutting without marking.

18. Mixed Types

Mixed types will be marked in the manner prescribed for the major species involved. The same principle applies where small patches of a different species occur upon areas where railroad ties are being produced. This is illustrated by Engleman Spruce occurring in patches on slopes or along streams within a Lodgepole Pine stand that is adapted to the production of railroad ties.

19. Marking to Favor the More Desirable Species

Occasionally stands are found where the overstory of merchantable timber is of a different and less desirable species than the understory. An example is a stand of Blue Spruce with an understory of Douglas Fir, or a stand of decadent Lodgepole that is coming up to Engelman Spruce. In such cases, it is advisable to mark the overstory more heavily than would be the practice if this species were to remain the dominant one in the stand.

20. Inferior Species

White Fir and Alpine Fir are inferior species, the removal of which is desirable in all types. Except in extensive pure stands of these species, all trees of merchantable size will be cut, which means that utilization of all trees at least ten inches d.b.h. and larger will be required. The policy will be to withhold any areas from the market where the percentage of these species is so large that an operator cannot or will not utilize them. Until conditions become such that all inferior species, marked or outlined, can be utilized, applicants will be directed to areas where the percentage of such species is so low that they can be handled.

G. Thinning

Stands of immature timber which are too dense to permit proper development occur in all types. These may be pole stands covering considerable area or small patches occurring within area of older timber. In either case, it is good silviculture to thin these stands by removing sufficient trees to provide room for the remainder of the young stand to develop.

The extent to which thinning can be practiced depends to a large extent upon the class of product which the market can absorb. At the present, we are unable to conduct thinning operations in many stands of small sized timber where thinnings are silviculturally desirable.

The large area around Fort Collins and Greeley and out to the east which contains many ranches could absorb large amounts of fence post materials for replacement purposes. But most of the stockmen still want Juniper posts which have to be brought from as far south as Texas. They do not realize that local material which can be obtained very cheaply and easily treated with a chlorinated phenol will give longer service than untreated Juniper.

All thinnings operations must be handled with care. In general, thinnings will be made from below. The poorer, crowded, and suppressed trees will be taken out to make room for the better individuals. Where, through natural

survival of the fittest, a few trees in a group have attained dominance they should be saved and given more release to further speed up their growth.

In making thinnings in Lodgepole Pine stands, the general aim should be to obtain equal spacing of the trees that are left. This species does not usually express the characteristic of dominance and the dense stands often stagnate. But even here the thinning should not become one of mechanical spacing. An effort should be made to save those which appear to be healthier than their neighbors as well as those few which have been able to express dominance.

In fairly open stands, which will usually be Ponderosa Pine or Douglas Fir, thinnings will be largely confined to the removal of diseased or poorly formed trees.

H. Timber Cutting on Scenic Areas

Around the more important areas used, or likely to be used extensively for recreation, the policy will be to make an improvement cutting, removing dead, insect infested, and diseased trees, and only such other trees in need of removal as can be spared without marring the beauty of the setting.

Along highways the standard marking policy should not be revised if sufficient timber will remain to insure a forested appearance on the area. It is desirable for the public to see forestry in practice. However, in case the

character of the stand is such that under the regular marking policy only scattered trees will be left for any great distance along the road, trees of a character ordinarily marked for cutting will be reserved to the extent necessary to avoid leaving areas which have a denuded appearance.

On camp and summer home sites, shade is an important feature, and unless marking according to the standard practice will result in adequate shade on such areas, sufficient trees will be left for this purpose.

I. Administration

1. Marking Percentage in Contracts

Forest officers preparing timber sale contracts should not be influenced by the natural desire of operators to secure the great amount possible. The percentage stated in each contract should be based on conditions on the ground and application of the marking practice to the particular area.

2. Diseased Trees

Removal of diseased trees of all species are defined in timber sale contracts will be uniformly required as called for by the instructions in the Forest Management Handbook.

3. Sample Marking

Instructions relative to sample marking are those shown in the Forest Management Handbook.

4. Checking Marking

Regular inspection of the marking just in advance of the cutting presents an excellent opportunity to catch the trees that were overlooked in marking and every advantage should be taken of this.

Records of cut-over areas indicate that more attention should be given to the preservation of young trees in the residual stand. In the conversion of old forests where young trees are scarce, these are a very important asset, and administration which will prevent their needless destruction in felling and skidding operations will be required.

5. General

It is the duty of those in charge to see that the various Forest Service employees understand the principles and interpret and apply the instruction uniformly. One standard should hold for the entire forest. Men newly assigned to marking should not be allowed to mark independently until sufficient timber has been marked with them to insure their having a thorough knowledge of the marking work.

The above plans will govern all marking. Additions

or modifications will be approved by the Regional Forester before being made effective.

References

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2. CHAPMAN, H. H. 1931. Forest Management. J. B. Lyon Company, New York.
3. BROWN, N. C. 1949. Logging. John Wiley and Sons, Inc., New York.

