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Mike Duncan
July 1, 1995

95th comb 1892 (8/18/97)

August 3, 1992

Ray Mehaffey
Colorado State Forest Service
Foothills Campus
Ft. Collins, CO 80523

Dear Ray,

Following is a Work Plan for Section 36.

Legal: 11 North, Range 77 West, Section 36.
Common Name: La Garde Creek
Prescription: Regeneration Harvest
Practice Size: 224 acres
Species: Lodgepole pine
Products: Firewood, roundwood and sawlogs.
Volume: 600 cords dead, 2490 cords roundwood and 1500 mbf sawlogs.
Estimated Direct Cost: \$36000
Estimated Value: \$90000
Estimated Duration: 2 years
Other Benefits: Promote regeneration in dwarf misteltoe stands, Provide fuel breaks for wildfire mitigation. Promote forage production.

Why Practices is Recommended: Reduce misteltoe, promote regeneration to utilize site potential.

Sincerely,

William Gherardi
Forester, Woodland Management Consultants

FOREST MANAGEMENT PLAN

Section 36 T. 11 N. R. 77 W.

Prepared by: William Gherardi
Woodland Management Consultants

Date : August, 1992

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I. Objectives

- Regenerate burn area with lodgepole seedlings.
- Improve forest health by alleviating dwarf misteltoe.
- Convert decadent, overstocked lodgepole stands to utilize site productivity.

II. General Description

A. Location

Section 36 lies 4 miles west of the Laramie River Road. The only access is thru property owned by the UT Corporation. The existing 4 wheel drive road enters the section at the northeast corner and continues up a dry draw to the west property line.

La Garde Creek flows thru the SE $\frac{1}{4}$ of the section and Little Jenkins Creek dissects the northwest corner of the section.

This section is adjoined by US Forest Service lands on the west and south and private land on the north and east.

Gross area is 720 acres. Meadow comprises 170 acres, 92 acres are non-commercial forest land, 57 acres contain no live trees, thus 411 acres are commercial forest land.

B. Topography

The average elevation is 8500 feet with slopes lying in a northeast aspect, except for the southeast $\frac{1}{4}$ of the section which has a northwest aspect.

Slopes are generally less than 25% in the area north of La Garde Creek.

Streams crossing the section are La Garde, Little Jenkins and the southerly finger of Little Jenkins Creek.

Sagebrush meadows are scattered thru the southern half of the section. Refer to Exhibit A.

The climate here consists of moist, short growing seasons (May - September) with heavy snowfalls, average snow depth is 30 - 40 inches per year.

C. Economic Conditions

The primary source of income in the surrounding area is cattle ranching. All forest products markets exist along the Front Range which is 87 miles from the section.

Currently there is a market for all wood products, including small diameter roundwood as the USFS timber sale program has been pared down due to preservationist pressure. Existing mills are clamoring for all available timber not only to survive but to capitalize on the good lumber prices.

D. Management Units

Management units are based on timber type, size class and topographic features. Management units are commensurate with the stands shown on Exhibit A.

E. Current / Historical land use

Current land use is light seasonal grazing.

The lodgepole pine on this section is the result of fire 100+ years ago. Scattered remnant trees of Douglas-fir and Ponderosa pine with extensive fire scars attest to the fire history of this area.

A recent forest fire in 1989 consumed 57 acres of this section.

There are no unique ecological / biological features on this section.

F. Desired Forest Condition

To achieve the management objectives will require:

1. Harvest salvable timber from the burn area, followed by planting.
2. Harvest lodgepole stands in patches to mitigate dwarf mistletoe and encourage new seedlings to fully utilize site potential.

G. Impacts

Any harvesting activities will have minimal effect on neighbors. To wit, the surrounding US Forest Service lands are designated as roadless with no potential access. The surrounding private land is used for cattle grazing, by patch clearcutting a portion of this section will show increases in range carrying capacity.

III. Inventory

A. Vegetation

There is 170 acres of non-forest. The meadow areas are concentrated in the south half of the section. They are composed of sagebrush with a light stocking of native grasses. Slopes are greater than 30% with loose surface rock. Light commercial grazing in the summer is the primary use.

92 acres are designated non-commercial forest land. This area is made of aspen poletimber on the flats with Douglas-fir and Englemann spruce poletimber and sawtimber on the steeper ground. This area is located in the Southeast $\frac{1}{4}$ of the section, adjacent to La Garde Creek. Slopes are 30 - 50% with numerous boulders. No harvest activity have been scheduled due to the high road building costs and potential for erosion.

Commercial forest land is composed of four areas in three distinct stands, as shown on Exhibit A.

Stand A is composed of lodgepole sawtimber with scattered poletimber. Individual trees are 105 - 125 years of age with insignificant radial growth in the last 30 years. Site index is 65 on a 100 year basis. Misteltoe occurs in scattered groups thru both areas. This type occupies 110 acres with a 44 acre stand north of the existing road and 56 acres in the middle of the section. 60% of all trees have serotinous cones.

Stand B is the dominant forest type, i.e. lodgepole poletimber and saplings. This 301 acres is characterized by trees which are 100 years old, 3- 7 inches in diameter and 49 feet tall. Stocking levels are high (200 + ft. of basal area) with the number of stems ranging from 800 - 1400 per acre. Misteltoe is heavy throughout the stand. 50% of the trees have sertinous cones.

Stand C is a burn area of 57 acres. This area was burned 3 years ago from a wildfire started on US Forest Service land to the north. Lodgepole poletimber and sawtimber with an aspen poletimber stringer along the creek was killed. Natural regeneration has occured along the north edge of this stand for 2-3 tree heights from the seed wall. The bulk of the area contains grass cover. The grass is the result of the US Forest Service and Division of Wildlife aerial seeding effort following the fire.

Detailed Stand and Stock Tables are found in Exhibit B for the commercial forest.

B. Insects and Disease

The dominant disease problem is dwarf mistletoe. The heaviest infection is in Stand B with pockets all rating a 6 on the dwarf misteltoe rating system. No significant growth has occurred in the last 30 years and any regeneration is already infected with misteltoe.

Ips beetle occur as isolated individuals or groups of 3- 5 trees particulary along the north edge of the burn, in trees weakened by the fire.

C. Fire Hazard

The majority of the section is in a moderate fire risk, slopes are relatively gentle (25%), but high stocking levels provide an abundance of fuel for wildfire loss, as evidenced by the recent burn of Stand C.

Harvesting activities will break up the continuous forest cover and temporary roads will provide some potential fuel line breaks.

D. Soil Types

Exhibit C depicts the soil types of the section. The dominant soil type is Redfeather series which is sutied to the production of lodgepole pine in even aged stands. The hazard of erodin, equipment limitations and windthrow hazard are moderate.

E. Access Roads

Exhibit D shows the existing access road across UT Corporation property. A wheel drive is required for the portion of the road within Section 36.

A trail exists along the west line from the road to the top of the ridge north of La Garde Creek. Extensive blowdown is prevalent along this trail.

F. Water Features

Exhibit D also shows water features on this section. Little Jenkins Creek in the Northwest $\frac{1}{4}$ of the section is a perennial stream. La Garde Creek is also a perennial stream and flows thru the southeast $\frac{1}{4}$ of the section. The southerly branch of Little Jenkins Creek is also perennial since the forest fire.

There are no other developed springs or reservoirs on this section.

G. Cultural Features

Exhibit D also shows existing fences on this section. There are no buildings present on the section.

H. Noxious Weeds

There are known noxious weeds on this section.

I. Wildlife Species

Deer and elk occur on the section with browsing concentrated in Stand C. Light use occurs in the meadows and adjacent stand edges. Coyotes occur only as they pass thru the section on hunting forays. Pine squirrels are located throughout the section as scattered individuals.

Exhibit E details wildlife habitat potentials according to soil type.

J. Endangered Species

There are no known endangered plants or animals on this section.

K. Scenic Qualities

Since 70 % of the section is covered with overstocked Lodgepole pine there is little scenic diversity. The existing meadows provide some aesthetic diversity and will be maintained as such in all future harvesting activities.

L. Archeological Sites

There are no known archeological sites.

IV. Prescriptions by Management Unit

A. Recommendations

Stand A- north section. Patch cut poletimber where dwarf misteltoe occurs. Shelterwood harvest the sawtimber. This will maintain wind protection along the west boundary, stimulate regeneration and protect the Jenkins Creek watershed from potential erosion.

Stand A- south section. Patch ^{cut} sawtimber (8-10 acre patches) to promote regeneration and utilize site potential.

Stand B, patch cut poletimber (3-10 acres) to mitigate dwarf misteltoe and stimulate healthy regeneration. This stand is overstocked , with little radial growth in the last 30 years. Particular attention will be given to active beetle patches along the south end of Stand C.

Stand C. Harvest salvagable material for firewood and replant to lodgepole pine. Leave 4- 6 snags per acre for wildlife nesting sites.

B. Harvest Schedule

Stand	acres	Type of harvest	Volume	
			cords	mbf
A-north	10	patch cut	80	100
	34	shelterwood	60	170
A-south	30	patch cut	150	311
B	100	patch cut	2400	930
C	50	patch cut	600	--
Total		224	3090	1511

Future entries will be premised on stocking levels of patch cut areas. Normally 8-15 years is required to have clearcuts stocked with 6-8 foot trees.

C. Special Requirements

1. Any harvest activity is wholly dependent on access across UT property, there is no other cost effective access to this section. At the field trip with Bob Stovell, the manager for UT, the following concerns were discussed:

- a. Road improvements are needed on the existing road in Section 31 & 32, see Exhibit D. Improvements include; grade and ditch the first 1.6 miles from county road, construct bridge across La Garde Creek, add 1 new culvert and rebury existing culvert, realign and spot gravel .7 mile of road from La Garde Creek to northeast corner of section. Clearing west and north section lines so fences can be constructed for cattle grazing. Control of harvesting operation to prevent access and grazing conflicts. Road users fee for this private land access.

Mr. Stovell was amenable to timber harvesting as long as these concerns were addressed. All of the aforementioned items will be incorporated in the timber sale contract. Specific costs are listed in Section G.

2. To accomplish the actual harvesting will require;
 - a. New temporary road construction of 3.0 miles, with a minimum of 4 culverts.
 - b. Weather will play a key role in harvest activity, with the normal operating season being May 15- October 30. A minimum of 2 operating seasons will be needed for this sale.
 - c. Slash from the patch cuts will be machine piled and burned. This will ensure soil scarification, distribution of serotinous cones and potential loss from wildfire.
3. Stand C is also a special circumstance. This area was burned by a wildfire in 1989. Inadvertantly, as a post treatment to the fire, the US Forest

Service and Colorado Division of Wildlife aeriually seeded the burn with grass. Since no distinct property line exists the 57 acres in Section 36 were also seeded.

At the field trip with Steve Steiner, wildlife biologist for the Division of Wildlife, his primary concern was to leave a fringe of trees along the edge of the stand. This will make the elk feel "safe" as they browse the area. Since the area was seeded this will be prime elk habitat for 15-20 years.

Only merchantible material will be harvested, provided a firewood market is available. All roads will be of a temporary nature with controlled access on private land. This will allow little disturbance to big game use on the section.

Once harvest has occured, planting will be needed on 45 acres. Natural regeneration will occur along the south edge of Stand C for 2-5 tree heights from the seed wall, thus 12 acres will be naturally seeded.

Planting is justified by the high site index (65), gentle slopes and meeting stated objectives for this section. Costs are listed under Section G.

D. New Roads

Exhibit F shows the location of roads needed for harvest.

E. Standards

Folowing the prescribed treatments will address the concerns of UT Corporation, Division of Wildlife as well as improving the grazing capacity and timber stands on this section.

F. Implementation Priority

The harvesting operation will commence in the spring of 1993, with final work completed in the fall of 1995.

The planting will occur after Stand C is harvested , completion of all planting is dependent of funding and manpower availability.

G. Estimated Costs and Returns

All of the figures are based on best avialable information as of this date(8-1992).

<u>UT property</u>	<u>COSTS</u>
	\$
- grade and ditch 1.6 miles	1600
- install 2 culverts	500
- bridge on La Garde Creek	4100
- clear/spot gravel .7 mile	1500
sub-total	<u>7700</u>

<u>New road construction - 3.0 miles</u>	\$
-clear and grub 4 acres	4300
- excavation- 8 days with cat	3200
- install 4 culverts	1200
sub-total	9200
<u>Fence clearing- north & west lines</u>	
- clear 2.5 acres, pile slash	1200
<u>Road Use Fee</u>	
- 600 loads @ 10	6000
<u>Reforestation - 45 acres</u>	
- seedlings- 200/acre x 45 acres	9000
- contract labor (250 trees/day)	4500
sub-total	13500
<hr/>	
Grand Total - Costs	\$37600

Returns

- 600 cords dead @ \$ 1	600
- 2490 cords-green @ \$10	24900
- 1500 mbf sawlogs @ \$40	60000
<hr/>	
Grand Total- Returns	90900







V. Implementation Plan

Exhibit G details all accomplishments.

VI. Appendices

- Exhibit A - Forest Vegetation Map
- Exhibit B - Lodgepole Pine Stand and Stock Table
- Exhibit C - Soils Map and Description
- Exhibit D - Cultural Features Map
- Exhibit E - Wildlife Habitat Potentials
- Exhibit F - New Road Location Map
- Exhibit G - Accomplishment Record

TWP. 11.N.
R. 7.W.

-  = MEADOW
-  = BARN
-  = LABORATORY
-  = LARGE POLE BOX
-  = POLE TOWER
-  = Non-symmetrical

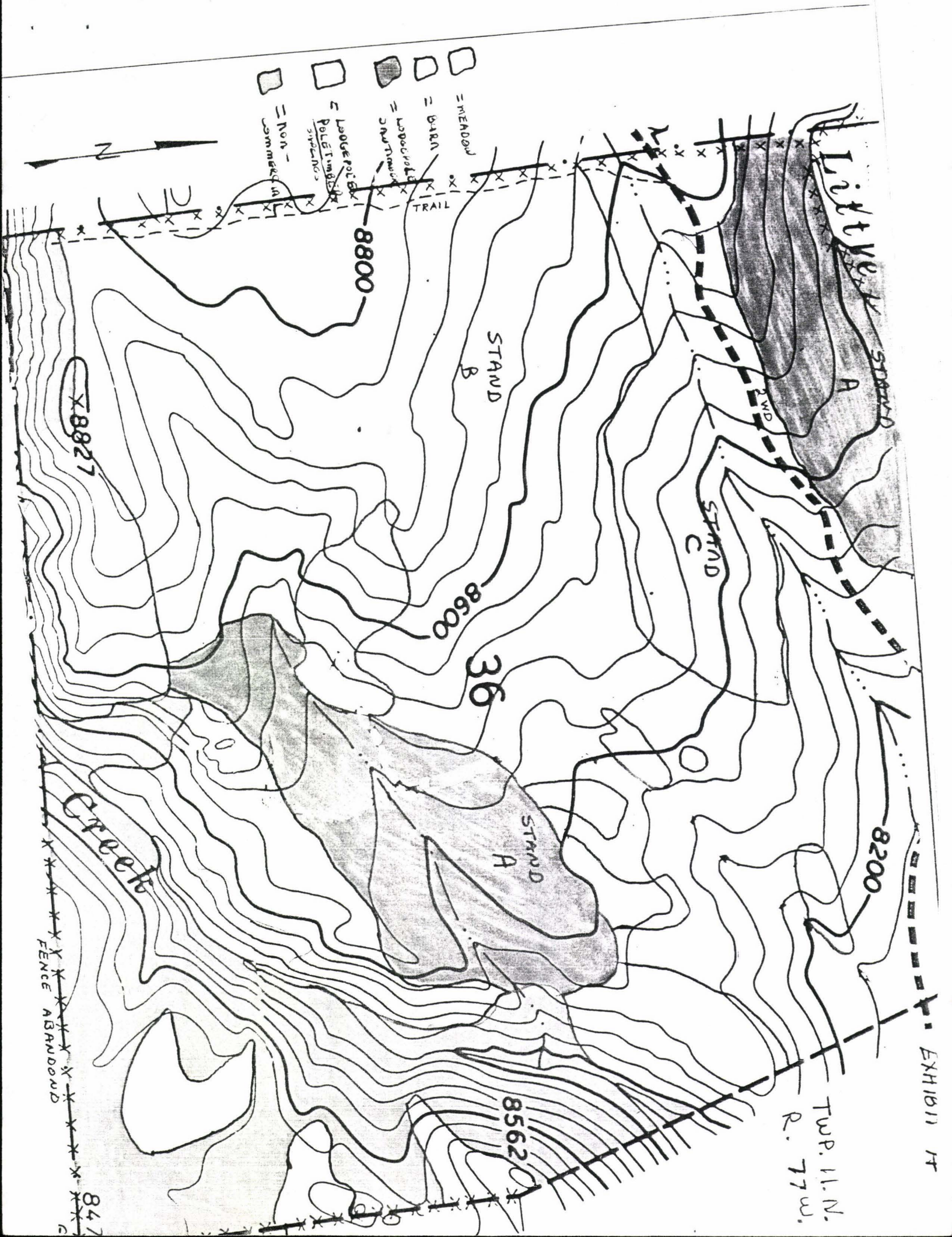


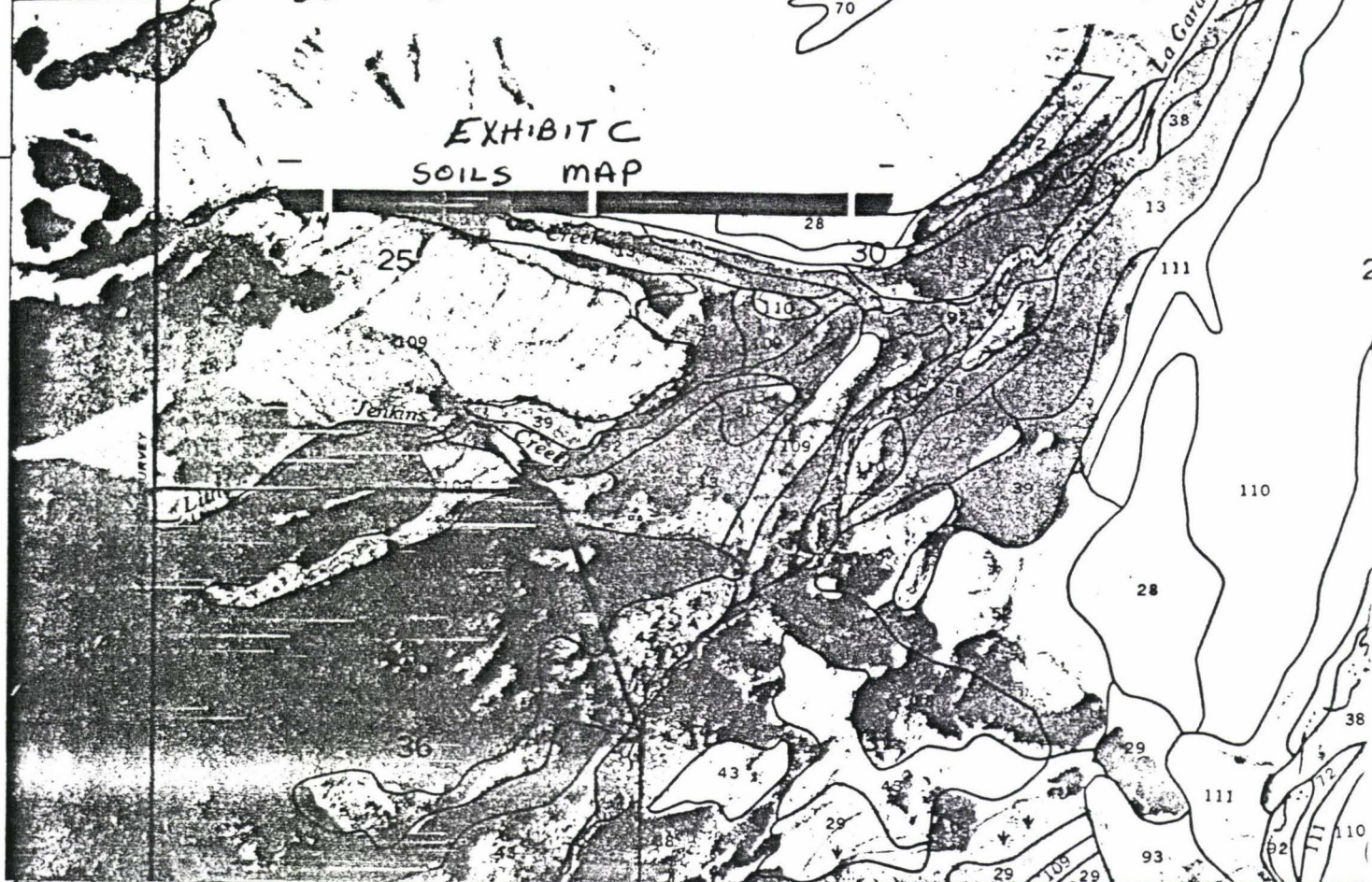
EXHIBIT B
 LODGEPOLE PINE STAND & STOCK TABLE

Parameter	Stand A	Stand B	Stand C
BAF	20	20	20
# plots	8	16	4
# acres	110	301	57
Average dbh	8.7	7.3	6.8
Average height	56	49	53
BA/acre	137	205	106
cubic feet/acre	670	2040	2044
board feet/acre	10700	9300	--
trees/acre	418	794	527
Average age	118	103	100
Site Index	65	50	60
Sample error	11%	15%	12%

EXHIBIT C SOILS MAP

70

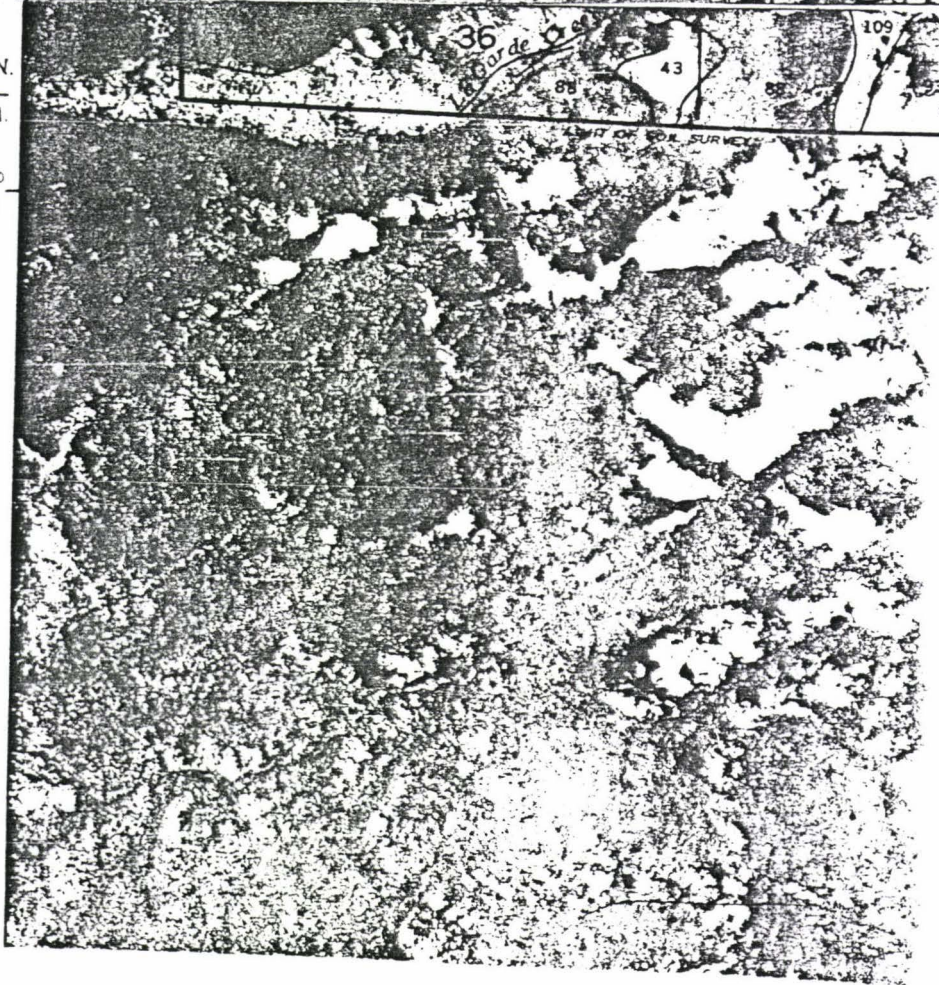
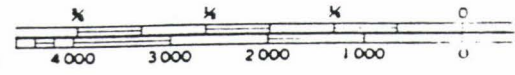
La Garra



40° 55' 30"

T. 11 N.
T. 10 N.

560 000
FEET



3/4) moist; massive; hard, very friable; violently effervescent; streaks and small specks of calcium carbonate; moderately alkaline.

Thickness of the mollic epipedon is 20 to 40 inches. The A horizon is loam, fine sandy loam, or sandy loam 5 to 12 inches thick. The B horizon is loam, light clay loam, or sandy clay loam. The A and B horizons range from neutral to mildly alkaline. They are leached of lime but are slightly effervescent in many places because of additions of lime by irrigation water. A sand and gravel substratum is below a depth of 40 inches in some places.

40—Garrett loam, 0 to 1 percent slopes. This level soil is on terraces and fans (fig. 6).

Included with this soil in mapping are a few small areas of soils that have gravel on the surface and a few areas of soils in which gravel is at a depth of 40 to 60 inches. Also included are small areas of Harlan, Otero, Connerton, and Barnum soils.

Runoff is slow. The hazard of erosion is slight, but some areas near stream channels have been cut in places. Lower areas near the channels are flooded at times in spring or early summer.

If irrigated, this soil is suited to corn, sugar beets, beans, barley, alfalfa, and wheat. It is also well suited to pasture. Under dryland management it is suited to wheat and barley and it is well suited to pasture and native grasses. Capability units IIw-1, irrigated, and IIIe-6, dryland; Overflow range site; windbreak suitability group 5.

41—Garrett loam, 1 to 3 percent slopes. This nearly level soil is on terraces and fans. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Harlan, Otero, Connerton, and Barnum soils. Also included are a few areas of soils in which gravel is on the surface and at a depth of 40 to 60 inches.

Runoff is medium, and the hazard of erosion is slight or moderate. Areas near the stream channel receive overflow at times and cutting occurs in places.

If irrigated, this soil is suited to corn, sugar beets, beans, barley, alfalfa, and wheat. Under dryland management it is suited to wheat and barley. It is also suited to pasture and native grasses (fig. 7). Capability units IIe-1, irrigated, and IIIe-6, dryland; Overflow range site; windbreak suitability group 1.

Gravel Pits

42—Gravel pits. This unit consists of areas where the soil and underlying gravel deposits have been removed. These areas have no value for farming and little value for grazing. Some areas are filled with water and provide habitat for fish and wildlife. Some areas are used for sanitary landfills. Also included are borrow pits and areas where material was removed in road construction, mainly along Interstate Highway 25. Capability unit VIIIs-1, dryland; not assigned to a range site or windbreak suitability group.

Haploborolls-Rock Outcrop Complex, Steep

43—Haploborolls-Rock outcrop complex, steep. This complex consists of steep and very steep, cool soils and



Figure 6.—Profile of Garrett loam, 0 to 1 percent slopes.

Rock outcrop on mountainsides and fans (fig. 8). The soils are extremely variable; about 50 to 70 percent of the unit, however, is stony and cobbly, dark colored soils that range from shallow to deep. These soils mainly have a surface layer and subsurface layer of sandy loam or loam that contain 10 to 25 percent cobbles and 20 to 35 percent stones. Stones that are on the surface are mainly boulders of granite, gneiss, and schist. About 30 to 50 percent of the mapped area is Rock outcrop. It is mainly on the steeper parts of the area, but it is scattered throughout.

Runoff is rapid, and the hazard of water erosion is severe.

These soils are used for a limited amount of grazing and are also used for wildlife habitat and watershed. Capability unit VIIe-1, dryland; Haploborolls in Stony Loam range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

Haplustolls, Hilly

44—Haplustolls, hilly. These strongly sloping to

site; not assigned to a windbreak suitability group.

86—Purner-Rock outcrop complex, 10 to 50 percent slopes. This complex consists of moderately steep or steep soils on uplands and ridges. It is about 55 percent Purner fine sandy loam and about 30 percent Rock outcrop. Purner fine sandy loam is smoother and less sloping, and Rock outcrop is steeper commonly on the western side of ridges.

Included with this soil in mapping is about 15 percent areas of Kirtley soils.

Runoff is rapid, and the hazard of erosion is severe.

This soil is suited to native grasses. Capability unit VIIe-1, dryland; Purner soil in Shallow Foothill range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

Ratake Series

The Ratake series consists of shallow, well drained or somewhat excessively drained soils that formed in material weathered from granite, schist, or phyllite. These soils are on upland ridges and mountainsides and are underlain by weathered phyllite, schist, or weathered granite at a depth of 10 to 20 inches. Elevation ranges from 6,800 to 8,500 feet. Slopes are 1 to 60 percent. The native vegetation is mainly blue grama, side-oats grama, slender wheatgrass, bluebunch wheatgrass, mountainmahogany, and sage. Mean annual precipitation ranges from 14 to 18 inches, mean annual air temperature ranges from 44° to 46° F, and the frost-free season ranges from 75 to 100 days.

In a representative profile the surface layer is reddish gray channery loam about 10 inches thick. The subsoil is reddish brown very channery loam about 5 inches thick. The underlying material is weathered phyllite or phyllite schist.

Permeability is moderate, and the available water capacity is low. Reaction is neutral.

These soils are mainly used for native grasses.

Representative profile of Ratake channery loam in an area of Ratake-Rock outcrop complex, 25 to 55 percent slopes, in native grass, about 2,350 feet east of the southwest corner of sec. 5, T. 8 N., R. 70 W.:

A1—0 to 10 inches; reddish gray (5YR 5/2) channery loam, dark reddish brown (5Y 3/2) moist; strong fine granular and crumb structure; soft, very friable; 20 percent soft phyllite channers; very high mica content; neutral; clear smooth boundary.

B2—10 to 15 inches; reddish brown (5YR 5/3) very channery loam, reddish brown (5YR 4/3) moist; moderate fine sub-angular blocky structure parting to strong fine granular; soft, very friable; 60 percent phyllite channers; very high mica content; neutral; diffuse boundary.

Cr—15 to 25 inches; weathered phyllite or phyllitic schist; coarse fragments are weathered and can be crushed in the hand with some difficulty but without significant contributions to the fine parts of the soil on first and second breakages;

The A horizon is loam or sandy loam 7 to 20 inches thick. The B2 horizon is absent in some profiles. Content of rock fragments, mainly phyllite, schist, or granite 1/4 inch to 2 inches in size, ranges from 35 to 80 percent.

87—Ratake-Rock outcrop complex, 25 to 55 percent slopes. This complex consists of steep or very steep soils on mountainsides and ridges. It is about 60 percent Ratake channery loam and about 30 percent Rock outcrop. Ratake channery loam is less steep, and Rock outcrop is throughout the complex but commonly is near ridgetops and is steeper.

Included with this soil in mapping is about 10 percent areas of Breece soils along drainageways.

Runoff is rapid, and the hazard of water erosion is severe.

This soil is suited to native grasses. Capability unit VIIe-1, dryland; Rocky Loam range site; not assigned to a windbreak suitability group.

Redfeather Series

The Redfeather series consists of shallow, well drained soils that formed in material weathered from granite. These soils are on ridges and mountainsides and are underlain by granite bedrock at a depth of 10 to 20 inches. Elevation ranges from 8,500 to 9,500 feet. Slopes are 5 to 50 percent. The native vegetation is mainly forest of lodgepole pine, spruce, and some aspen and a thin understory of grass. Mean annual precipitation ranges from 15 to 20 inches, mean annual air temperature ranges from 40° to 44° F, and the frost-free season ranges from 60 to 85 days.

In a representative profile a 2-inch-thick layer of organic material is on the surface. The surface layer is dark grayish brown and light brownish gray sandy loam about 8 inches thick. The subsoil is brown gravelly sandy loam about 4 inches thick and reddish brown gravelly sandy clay loam about 5 inches thick. Below this is hard granite bedrock.

Permeability is moderately rapid, and the available water capacity is low. Reaction is medium acid above a depth of about 1 inch, strongly acid to a depth of about 12 inches, and medium acid below a depth of 12 inches.

These soils are used mainly for forest and recreation.

Representative profile of Redfeather sandy loam, 5 to 50 percent slopes, in forest, approximately 1,300 feet south and 1,000 feet west of the northeast corner of sec. 21, T. 11 N., R. 74 W.:

O1—2 inches to 1 inch; undecomposed organic material, mainly needles, bark, and twigs and remains of understory plants.

O2—1 inch to 0; partly decomposed organic material like that in the O1 horizon.

A1—0 to 1 inch; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; noncalcareous; more than 10 percent gravel and stones; medium acid; clear smooth boundary.

A2—1 inch to 8 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish

- brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; about 15 percent gravel and stones; strongly acid; abrupt smooth boundary.
- A&B—8 to 12 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable; few patchy clay films on peds; about 30 percent gravel and stones; strongly acid; clear wavy boundary.
- B2t—12 to 17 inches; reddish brown (5YR 5/4) gravelly sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, firm; thin patchy clay films on peds; about 35 percent gravel and 10 percent cobbles; medium acid; gradual wavy boundary.
- R—17 to 24 inches; hard granite bedrock.

The A1 horizon is sandy loam or gravelly sandy loam 1 inch to 3 inches thick. The A2 horizon is sandy loam or gravelly sandy loam 5 to 10 inches thick. The B2t horizon is gravelly or very gravelly sandy clay loam. Content of rock fragments, mainly fine granitic gravel and cobbles, in the solum ranges from 35 to 80 percent. Reaction ranges from strongly acid to slightly acid.

88—Redfeather sandy loam, 5 to 50 percent slopes. This strongly sloping to steep soil is on mountainsides and ridges.

Included with this soil in mapping are some small areas of shallow soils that have a darker colored surface layer. Also included are a few small areas of Schofield and Naz soils and areas of Rock outcrop.

Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

This soil is suited to woodland and forestry purposes and to recreation. Some areas are used as sites for summer homes. Capability unit VIIs-1, dryland; woodland suitability group 6d2; not assigned to a range site or windbreak suitability group.

Renohill Series

The Renohill series consists of moderately deep, well drained soils that formed in material weathered from sandstone and shale. These soils are on uplands and are underlain by soft shale at a depth of 20 to 40 inches. Elevation ranges from 4,800 to 5,600 feet. Slopes are 0 to 15 percent. The native vegetation is mainly blue grama, buffalograss, western wheatgrass, and cactus. Mean annual precipitation ranges from 13 to 15 inches, mean annual air temperature ranges from 48° to 50° F, and the frost-free season ranges from 135 to 150 days.

In a representative profile the surface layer is pale brown clay loam about 3 inches thick. The subsoil is pale brown heavy clay loam about 4 inches thick and light yellowish brown clay about 12 inches thick. The underlying material is light yellowish brown clay loam about 10 inches thick. Below this is soft shale.

Permeability is slow, and the available water capacity is medium. Reaction is mildly alkaline above a

depth of 12 inches and moderately alkaline below that depth.

These soils are used mainly for irrigated and dry-farmed crops and for pasture and native grasses.

Representative profile of Renohill clay loam, 3 to 9 percent slopes, in grass, 200 feet north and 700 feet west of the southeast corner of sec. 12, T. 6 N., R. 69 W.:

- A1—0 to 3 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.
- B1—3 to 7 inches; pale brown (10YR 6/3) heavy clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; very hard, friable; mildly alkaline; clear smooth boundary.
- B2t—7 to 12 inches; light yellowish brown (2.5Y 6/3) clay, olive brown (2.5Y 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm; thin nearly continuous clay films on ped faces; mildly alkaline; clear smooth boundary.
- B3ca—12 to 19 inches; light yellowish brown (2.5Y 6/3) light clay, light olive brown (2.5Y 5/3) moist; weak medium angular and subangular blocky structure; extremely hard, very firm; thin patchy clay films on ped faces; calcareous; visible secondary calcium carbonate as soft spots; moderately alkaline; gradual smooth boundary.
- C1ca—19 to 29 inches; light yellowish brown (2.5Y 6/3) heavy clay loam, light olive brown (2.5Y 5/3) moist; weak medium subangular blocky structure; very hard, friable; calcareous; visible secondary calcium carbonate as soft spots; moderately alkaline; gradual smooth boundary.
- C2r—29 to 60 inches; calcareous clay shale.

The A horizon is clay loam or silty clay loam 6 to 11 inches thick in cultivated areas. A B1 horizon is present in some places. The B2t horizon is heavy clay loam, heavy silty clay loam, clay, or silty clay. The combined thickness of the A and B horizons ranges from 15 to 30 inches. Depth to calcareous material generally ranges from 6 to 20 inches, but some pedons are weakly calcareous throughout.

89—Renohill clay loam, 0 to 3 percent slopes. This nearly level soil is on uplands. This soil has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsoil is about 22 inches.

Included with this soil in mapping are a few small areas of soils that are more sloping and a few small areas of soils that have gravel on the surface. Also included are a few small areas of Ulm, Heldt, and Midway soils.

Runoff is medium, and the hazard of erosion is slight to moderate.

If irrigated, this soil is well suited to pasture and



Figure 11.—Area of Tassel sandy loam, 3 to 25 percent slopes, in foreground; Cache La Poudre river valley in background.

6/4) loam, light olive brown (2.5Y 5/4) moist; massive; hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C2r—37 to 60 inches; light gray (2.5Y 7/2) dry and moist interbedded shale and sandstone.

The A1 horizon is loam or light clay loam 4 to 11 inches thick. The C horizon is loam or light clay loam. Depth to calcareous material ranges from 0 to 6 inches. Reaction ranges from neutral to moderately alkaline. Content of rock fragments ranges from 0 to 15 percent throughout, but particularly in the surface layer.

107—Thedalund loam, 0 to 3 percent slopes. This nearly level soil is on uplands. This soil has a profile similar to the one described as representative of the series, but the surface layer is about 8 inches thick.

Included with this soil in mapping are some small areas of soils that are more sloping and a few small areas of Kim soils.

Runoff is slight, and the hazard of erosion is slight to moderate.

If irrigated, this soil is suited to barley, wheat, and corn and, to a lesser extent, alfalfa and sugar beets. Under dryland management it is suited to wheat and barley. It is also well suited to pasture and native

grasses. Capability units IIIe-3, irrigated, and IVe-3, dryland; Loamy Plains range site; windbreak suitability group 1.

108—Thedalund loam, 3 to 9 percent slopes. This gently sloping to moderately sloping soil is on uplands. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of soils that are more sloping or less sloping. Also included are a few small areas of soils that have a surface layer of clay loam and small areas of Kim, Cushman, and Midway soils.

Runoff is medium, and the hazard of erosion is moderate.

If irrigated, this soil is suited to barley, wheat, alfalfa, and pasture. Under dryland management it is suited to pasture or native grasses. Capability units IVe-1, irrigated, and VIe-1, dryland; Loamy Plains range site; windbreak suitability group 1.

Thiel Series

The Thiel series consists of deep, well drained soils that formed in alluvium or glacial outwash. These soils are on terraces and high benches and are underlain by sand and gravel at a depth of 20 to 40 inches. Elevation

ranges from 7,500 to 8,500 feet. Slopes are 5 to 25 percent. The native vegetation is mainly Idaho fescue, needleandthread, and sage. Mean annual precipitation ranges from 15 to 18 inches, mean annual air temperature ranges from 42° to 44° F, and the frost-free season ranges from 60 to 85 days.

In a representative profile the surface layer is brown gravelly sandy loam about 4 inches thick. The subsoil is brown very gravelly sandy loam about 8 inches thick and light yellowish brown very gravelly light sandy clay loam about 2 inches thick. The underlying material is very gravelly sandy loam about 16 inches thick over very pale brown extremely gravelly sand.

Permeability is moderately rapid above a depth of about 30 inches and very rapid below that depth. The available water capacity is low to medium. Reaction is neutral above a depth of 8 inches, slightly acid between depths of 8 and 12 inches, and moderately alkaline below a depth of 12 inches.

These soils are used mainly for native grasses.

Representative profile of Thiel gravelly sandy loam, 5 to 25 percent slopes, in native grass, about 2,350 feet east and 100 feet north of the southwest corner of sec. 4, T. 12 N., R. 77 W.:

A1—0 to 4 inches; brown (10YR 4/3) gravelly sandy loam, dark brown (10YR 3/3) moist; strong fine granular structure; soft, very friable; 40 percent fine and very fine angular granite gravel; neutral; clear smooth boundary.

B21t—4 to 8 inches; brown (7.5YR 5/3) very gravelly sandy loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure parting to strong medium granular; slightly hard, very friable; thin clay films on ped faces and on gravel fragments and as bridges between sand grains; 50 percent fine angular granite gravel; neutral; clear smooth boundary.

B22t—8 to 12 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure parting to strong medium granular; extremely hard, very friable; common thin clay films on ped faces and on gravel fragments and as bridges between sand grains; 50 percent fine granite gravel; slightly acid; clear wavy boundary.

B3ca—12 to 14 inches; light yellowish brown (10YR 6/4) very gravelly light sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; extremely hard, very friable; few clay films on gravel fragments; few clay bridges between sand grains; 50 percent fine granite gravel; moderate continuous accumulation of secondary calcium carbonate as soft concretions; calcareous; moderately alkaline; diffuse wavy boundary.

C1ca—14 to 30 inches; very pale brown (10YR 8/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; single

grained; extremely hard, very friable; 60 percent fine and very fine granite gravel; strong continuous horizon of secondary carbonate accumulation and carbonate in finely divided marl-like forms; calcareous; moderately alkaline; diffuse wavy boundary.

IIC2ca—30 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sand, brown (10YR 5/3) moist; single grained; very hard, loose; 70 percent fine angular granite gravel; moderate continuous horizon of secondary carbonate accumulation and calcium carbonate mostly in seams and streaks or as coatings on coarse fragments; content of carbonate decreases with depth; calcareous; moderately alkaline.

The A horizon is sandy loam to very gravelly sandy loam 3 to 8 inches thick. The combined thickness of the A and B horizons ranges from 8 to 15 inches. The B horizon is very gravelly sandy loam or very gravelly sandy clay loam. Depth to calcareous material ranges from 6 to 15 inches. Content of rock fragments, mainly fine granitic gravel, ranges from 35 to 80 percent.

109—Thiel gravelly sandy loam, 5 to 25 percent slopes. This strongly sloping or moderately steep soil is on high benches, terraces, and alluvial fans.

Included with this soil in mapping are small areas of soils that lack lime accumulations and a few small areas of soils that are underlain by sand and gravel at a shallow depth.

Runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

This soil is suited to pasture and native grasses. Capability unit VIe-7, dryland; Dry Mountain Loam range site; not assigned to a windbreak suitability group.

Tine Series

The Tine series consists of deep, well drained or somewhat excessively drained soils that formed in material weathered from alluvium or glacial outwash. These soils are on terraces and benches and are underlain by sand and gravel at a depth of 10 to 20 inches. Elevation ranges from 7,500 to 9,000 feet. Slopes are 0 to 40 percent. The native vegetation is mainly wheatgrass, junegrass, sedges, and sagebrush. Mean annual precipitation ranges from 13 to 17 inches, mean annual air temperature ranges from 42° to 44° F, and the frost-free season ranges from 60 to 85 days.

In a representative profile the surface layer is brown gravelly sandy loam about 15 inches thick. The underlying material is yellowish brown very gravelly loamy sand about 3 inches thick over sand, gravel, and cobbles.

Permeability is moderately rapid above a depth of about 15 inches and rapid below that depth. The available water capacity is low. Reaction is slightly acid.

These soils are used mainly for native grasses.

Representative profile of Tine gravelly sandy loam, 0 to 3 percent slopes, in native grass, about 2,000 feet south and 1,700 feet west of the northeast corner of sec. 35, T. 12 N., R. 77 W.:

grows, mainly in small groves or as scattered trees. One small isolated grove of pinyon, northwest of the city of Fort Collins, is unique in that it is the most northwestern location in the United States for this tree.

The woodland areas are about equally divided between private and government ownership. Most of the government-administered land is national forest, but some is State and county owned.

Much of this woodland was logged by early settlers. Little of the privately owned woodland is managed for timber production, although it is used for poles, fenceposts, and firewood. Almost all of the area is used for grazing, recreation, and wildlife habitat. In recent years much of the privately owned woodland has been used as sites for summer and year-round homes.

Woodland suitability groups

The soils in the mountainous part of Larimer County Area have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group is made up of soils that are suited to the same kinds of trees, that need about the same management, and that have the same potential production.

Each woodland group is identified by a three-part symbol, for example, 6o1. The potential productivity of the soils in the group is indicated by the first numeral in the symbol: 1 is very high; 2, high; 3, moderately high; 4, moderate; 5, moderately low; and 6, low. These ratings are based on field determination of average site index. Site index of a given soil is the height, in feet, that the taller trees of a given species reach in a natural, essentially unmanaged stand in a stated number of years.

The second part of the symbol is a small letter. In this survey, *x*, *d*, and *o* are used. The small letter indicates an important soil property that imposes a hazard or limitation in managing the soils for trees. The letter *x* indicates that the soil has major limitations because of rockiness or stoniness. The letter *d* indicates that the soil has a restricted rooting depth. The letter *o* shows that the soils have few limitations that restrict their use for trees.

The third part of the symbol, another numeral, differentiates groups that have the same first and second parts in their identifying symbols.

Soils that have not been placed in a woodland suitability group are not suited to or are not used for woodland. The woodland suitability group is shown at the end of the mapping unit description for applicable soils.

The woodland suitability groups in the survey area are briefly described in the following paragraphs.

Woodland suitability group 6o1.—The soils in this group are suited to the production of ponderosa pine. They are capable of producing about 2,020 cubic feet per acre, or 7,800 board feet, in a managed, even-aged stand of 100-year-old trees. There are no major limitations to the use of the soils for woodland.

Woodland suitability group 6x1.—The soils in this group are suited to the production of ponderosa pine. They are capable of producing about 1,610 cubic feet per acre, or 5,300 board feet, in a managed, even-aged

stand of 100-year-old trees. The hazard of erosion is high, and equipment limitations and seedling mortality are moderate.

Woodland suitability group 6x2.—The soils in this group are suited to the production of Engelmann spruce. They are capable of producing about 3,300 cubic feet per acre, or 9,000 board feet, in managed, even-aged stands of 90-year-old trees. Seedling mortality is severe, and the equipment limitations and windthrow hazard are moderate.

Woodland suitability group 6d1.—The soils in this group are suited to the production of ponderosa pine. They are capable of producing about 1,610 cubic feet per acre, or 5,300 board feet, in a managed, even-aged stand of 100-year-old trees. Seedling mortality is severe, and the hazard of erosion, equipment limitations, and windthrow hazard are moderate.

Woodland suitability group 6d2.—The soils in this group are suited to the production of lodgepole pine. They are capable of producing about 2,490 cubic feet per acre, or 4,900 board feet, in a managed, even-aged stand of 90-year-old trees. Seedling mortality is severe, and the hazard of erosion, equipment limitations, and windthrow hazard are moderate.

Windbreaks⁶

The native vegetation on the plains in Larimer County Area is grass. Early settlers planted trees for beautification and protection, mainly around farmsteads. Many of these trees still survive, although most of them, mainly cottonwood and willows, in the plains are along the streams and drainageways.

Windbreaks and tree plantings can be very beneficial to landowners. They help to reduce home heating costs by reducing winds. They help to protect livestock from winter storms and drifting snow. They provide habitat for wildlife and birds and enhance the beauty and value of homesteads.

If windbreaks are planted, care is needed establishing them. Evergreens are among the most desirable trees because they are long lived and resist damage by wind, snow, and disease. They provide protection from winds, which occur before deciduous trees leaf. Evergreens grow much more slowly than deciduous trees for the first few years and should, therefore, be planted in rows separate from the faster growing but short-lived broadleaf trees.

Climatic conditions limit the kinds of trees and shrubs that can be grown, and careful selection, therefore, is necessary. Cultivation reduces competition from weeds and grass and also the hazard of destructive fires.

Replacing trees lost in the first years to develop a continuous, uniform wind barrier. Pruning should be limited to the removal of dead branches.

Protection of newly planted trees from livestock and other animals is important. Rabbits, mice, deer, and antelope can damage trees. Repellants can be applied in fall to help protect the young trees. Providing supplemental water to newly planted trees is beneficial and increases survival. Adequate water should be sup-

⁶ SHERMAN J. FINCH, woodland conservationist, Soil Conservation Service, helped to prepare this section.

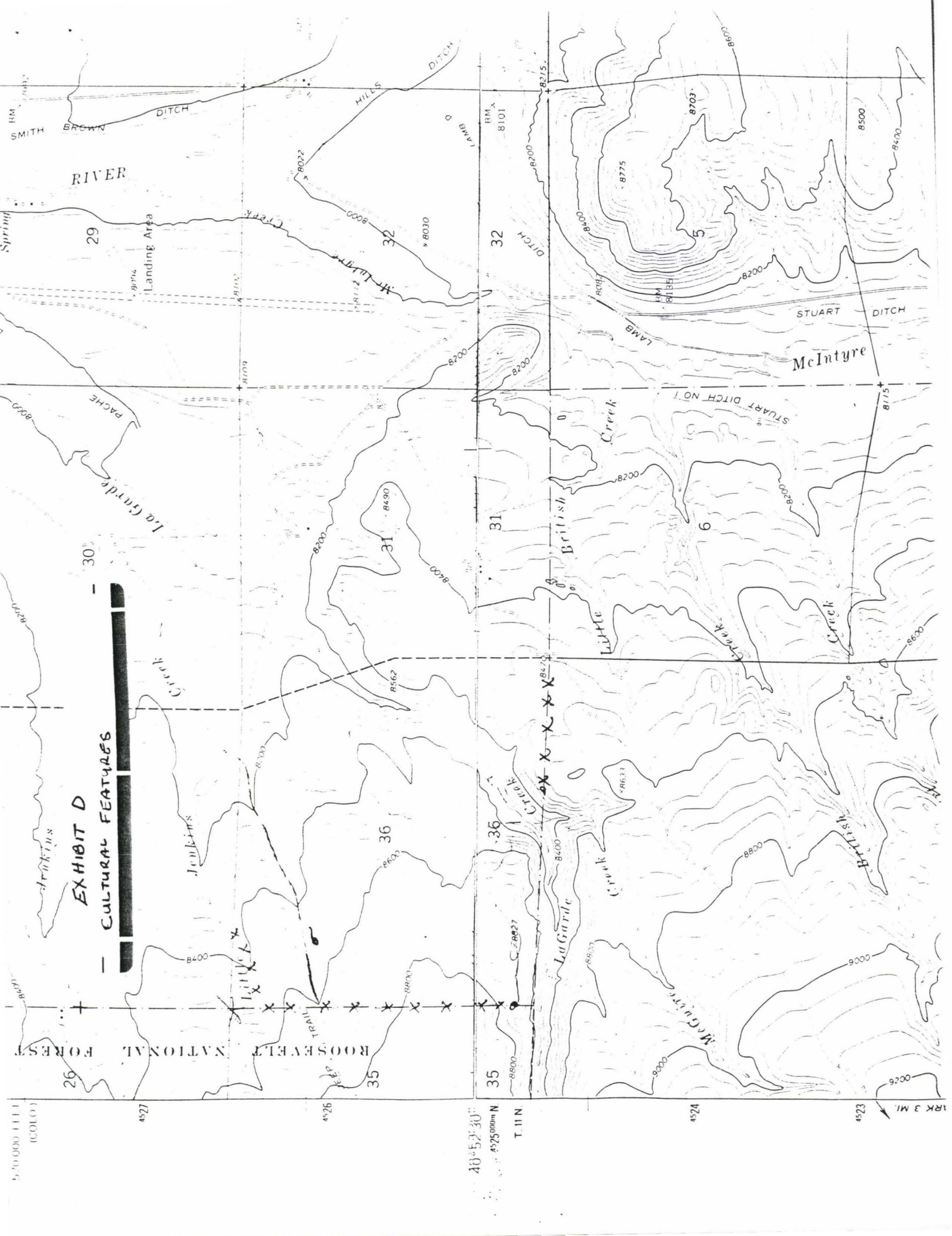


EXHIBIT E
 WILDLIFE HABITAT POTENTIALS

Soil Name & Symbol	GRAIN & SEED CROPS	GRASSES & LEGUMES	HERBACEOUS PLANTS	CONIFEROUS PLANTS	SHRUBS	WETLAND PLANTS	SHRUB WETLANDS	POTENTIAL OPEN-LAND	AS WILDLIFE WOODLAND	WETLAND HABITAT	SCORE
HMPDOROLLS - 43	VERY POOR	VERY POOR	VERY POOR	—	FAIR	VERY POOR	VERY POOR	VERY POOR	—	VERY POOR	POOR
REDFERTHOLD - 88	VERY POOR	VERY POOR	POOR	VERY POOR	POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	VERY POOR	—
THIEL - 109	POOR	FAIR	GOOD	—	GOOD	VERY POOR	VERY POOR	FAIR	—	VERY POOR	GOOD

phed during the first year to help the plants develop a good root system.

Assistance in planning windbreaks is available through the local office of the Soil Conservation Service or the Colorado State Forest Service.

Windbreak suitability groups

Soils in the eastern part of the survey area have been placed in five groups based on soil properties. The group in which each soil has been placed is shown at the end of the mapping unit description. The soils in each group are suited to similar species and have similar response to management. Table 3 lists the expected performance of a few of the species. The height, growth, and survival estimates are based on general observations and estimates. Group 4 is not rated in this table because it consists of soils on which establishment is marginal or not recommended. Group 5 is not rated in table 3, but the soils in this group have some native trees, mainly cottonwood and willows. The table also gives the expected height that trees and shrubs of each species reach at about 20 years of age and the survival rate of new trees that can reasonably be expected after 1 or 2 years, if replanting is required. The rating in the "Vigor" column refers to the density of foliage, freedom from disease or damage from insects, and the general appearance of the tree.

Soils on foothills and in the mountainous part of the Area have not been placed in windbreak groups, because windbreaks are seldom planted in these areas. Soils on the foothills that are similar to those on the plains can be expected to have growth rates equal to or better than those on plains because of somewhat better moisture relationships.

The windbreak suitability groups in the survey area are briefly described in the following paragraphs.

WINDBREAK SUITABILITY GROUP 1

This group consists of deep and moderately deep, well drained loams, silt loams, and clay loams. It occupies a large part of the plains part of the survey area.

WINDBREAK SUITABILITY GROUP 2

This group consists of deep and moderately deep, well drained sandy loams and fine sandy loams. This group is relatively small in extent and is mainly in the extreme eastern part of the survey area. Soil blowing is a hazard in some places. Leaving a strip of vegetation or stubble between rows of trees helps to overcome this hazard.

WINDBREAK SUITABILITY GROUP 3

This group consists of shallow soils and clayey soils that are well drained but that either have low available water capacity or lack good aeration for tree roots. Also included in this group are some complexes that include soils that are suitable for tree planting and soils that are not. Careful onsite investigation is necessary before planting on the soils of these complexes.

WINDBREAK SUITABILITY GROUP 4

This group consists of soils that are generally unsuitable or unfavorable for tree planting because of one or more limitations. These limitations are salinity,

ity.

WINDBREAK SUITABILITY GROUP 5

This group consists of deep and moderately deep, poorly drained soils on bottom lands, on low terraces, and in upland valleys. The water table is within the root zone of trees and shrubs. Salinity is slight to moderate. Many of the soils are subject to flooding. These factors limit the establishment of trees, and only water- and salt-tolerant trees and shrubs are suitable for planting. Cottonwood and willows generally grow on these soils, but these trees are seldom planted.

Wildlife⁷

Wildlife is a product of the soil on which it lives. From the soil must come the various components that make up areas where wildlife can find places to feed, breed, rear young, escape enemies, and otherwise survive. Basically, the soil must provide food, cover, and water; these make up wildlife habitat.

The quality and quantity of habitat available largely determine the kinds of wildlife that are present. Although the soils largely determine the availability and kinds of habitat, land use and management and availability of water also greatly influence wildlife populations in Larimer County Area.

Land use, to a large extent, determines the kinds of wildlife that are present and their populations.

The availability of water for irrigation has resulted in land use changes that greatly affected the kinds and numbers of wildlife. Irrigation has changed substantial areas from range, which has limited natural precipitation, to cropland. Wheat, barley, dry beans, corn, and hay are the main irrigated crops. The introduction of grain and, to a lesser extent, forage crops has allowed an excellent population of waterfowl and at least a fair population of pheasants to become established where previously only wildlife species native to range existed.

Soils directly influence the kinds and amounts of vegetation and the amount of water available, and in this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of the soil useful to crops, surface texture, available water capacity, wetness, surface stoniness or rockiness, hazard of flooding, slope, and permeability.

In table 4 the soils of this survey area are rated for producing seven elements of wildlife habitat and four groups or kinds of wildlife. The ratings indicate relative suitability for various elements. These ratings are good, fair, poor, and very poor.

A rating of *good* means that habitat is easily improved, maintained, or created. There are few or no soil limitations in habitat management, and satisfactory results can be expected.

A rating of *fair* means that habitat can be improved, maintained, or created on these soils, but that moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention is required to ensure satisfactory results.

⁷ By ELDIE W. MUSTARD, biologist, Soil Conservation Service.

TABLE 3.—Suitability of windbreak suitability

Soils	Ponderosa pine			Rocky Mountain juniper		
	Height at 20 years	Survival rate	Vigor	Height at 20 years	Survival rate	Vigor
	<i>Feet</i>	<i>Percent</i>		<i>Feet</i>	<i>Percent</i>	
Group 1	18-20	80	Good -----	8-12	80	Good -----
Group 2	20-22	90	Good -----	10-14	90	Good -----
Group 3	12-15	75	Fair -----	8-10	80	Good -----

A rating of *poor* means that habitat can be improved, maintained, or created on these soils, but the soil limitations are severe. Habitat management is difficult and expensive and requires intensive effort in places. Results are questionable.

A rating of *very poor* means that under the prevailing soil conditions it is impractical to attempt to improve, maintain, or create habitat. Unsatisfactory results are probable.

Each soil is rated according to its suitability for producing various kinds of plants and other elements that make up wildlife habitat. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development of wildlife habitat requires onsite inspection.

The elements of wildlife habitat for which the soils are rated in table 4 are briefly described in the following paragraphs.

Grain and seed crops are annual grain-producing plants, such as barley, wheat, corn, and dry beans.

Grasses and legumes are domestic grasses and legumes that are established by planting and provide food and cover for wildlife. Grasses include tall and intermediate wheatgrasses, meadow foxtail, Russian wildrye, reed canary-grass, and timothy. Legumes commonly used are alfalfa, sweetclover, red clover, and alsike clover.

Wild herbaceous plants are native or introduced perennial grasses and forbs that provide food and cover for upland wildlife. Examples are Indian ricegrass, western wheatgrass, alkali sacaton, blue grama, saltgrass, foxtail barley, alkali cordgrass, and switchgrass. Forbs include loco, fringed sage, hairy goldaster, sunflower, yucca, and pricklypear.

Coniferous plants are cone-bearing trees and shrubs that provide cover and frequently furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but can be planted and managed. Examples are pines, juniper, and ornamental trees and shrubs.

Shrubs produce buds, twigs, barks, or foliage that is used as food by wildlife, or they provide cover and shade for some wildlife species. These plants most com-

monly grow in their natural environment. Examples are four-wing saltbush, rabbitbrush, big sagebrush, mountainmahogany, bitterbrush, and serviceberry.

Wetland plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Examples are smartweed, tufted hairgrass, spikerush and other rushes, sedges, cattails, and northern reedgrass. Submerged and floating aquatics are not included in this category.

Shallow water areas are areas of surface water that have an average depth of less than 5 feet that are useful to wildlife. They are natural wet areas or those created by dams or levees or by water-control devices in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, wildlife ponds, and beaver ponds.

Table 4 also rates soils according to their suitability as habitat for the four kinds of wildlife in the survey area—open-land, woodland, wetland, and rangeland. These ratings are related to ratings made for the elements of habitat. For example, soils rated as *very poor* for shallow water developments are rated *very poor* for wetland wildlife.

Open-land wildlife consists of birds and mammals in areas of cropland, pasture, meadow, lawns and in areas overgrown with grasses, herbs, shrubs, and vines. Examples are robin, house finch, American kestrel, red-tailed hawk, pheasant, western meadowlark, mourning dove, killdeer, cottontail, jackrabbit, and red fox.

Woodland wildlife consists of birds and mammals in wooded areas containing either hardwood or coniferous trees and shrubs, or a mixture of both. Examples are blue grouse, Steller's jay, Clark's nutcracker, thrushes, vireos, woodpeckers, snowshoe hare, bobcat, mule deer, and black bear.

Wetland wildlife consists of birds and mammals in swampy, marshy, or open-water areas. Examples are ducks, geese, herons, shore birds, rails, red-winged blackbird, kingfishers, muskrat, mink, beaver, and raccoon.

Rangeland wildlife consists of birds and mammals in natural range. Examples are pronghorn antelope, coyote, jackrabbit, mountain plover, lark bunting, golden eagle, and western meadowlark.

EXHIBIT F
NEW ROAD LG

Little

8200

36

8600

8800

8562

X 8827

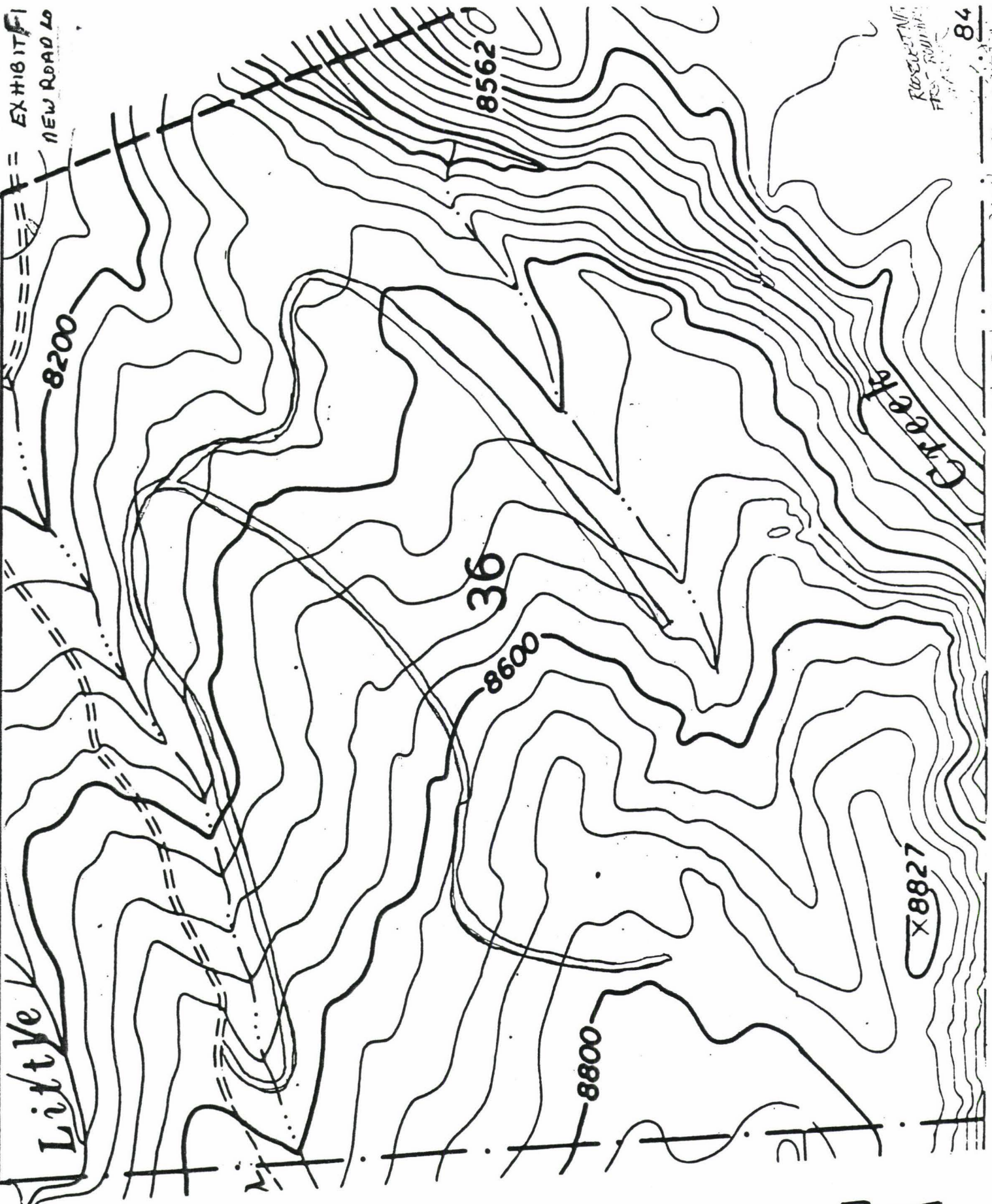
Creech

ROBERTS
FISH POND

84

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NEW ROAD LG



file 2310
FM PLANS/
STATE
LANDS

STATE LAND
FOREST MANAGEMENT PLAN

COMPILED BY
COLORADO STATE FOREST SERVICE
FOR
STATE BOARD OF LAND COMMISSIONERS

S36 T11N R77W
La Garde Creek

Prepared by:
Richard P. Jansky

STATE LANDS
FOREST MANAGEMENT PLAN
July 1979

S36 T11N R77W

- La Garde Creek -

Larimer County

General Description

This section is located four miles west of the Laramie River near the Four Corners area. The major access route is through the headquarters of the Rainbow River Ranch. Two-wheel-drive roads provide access to the north/central portions of the section, and a foot trail follows along the western boundary fence. See the cultural improvements map for the exact location of roads and fences. The section is bordered by national forest on the west and by private land on all other sides.

La Garde Creek crosses the SE $\frac{1}{4}$ and Jenkins Creek the NW corner. No man-made water developments are present. The average elevation is 8,600 feet with a northeastern aspect.

The current land use is limited to light seasonal grazing. Most of the lodgepole pine forests were partially cut over long ago by axe. Occasional groups of older ponderosa pine and Douglas-fir trees may be remnants of the original forest type here.

Vegetation

Forest Area

Nearly 480 acres of this section is forested. The majority of this area is well stocked lodgepole pine (334 A) with smaller areas of aspen (67 A), aspen/lodgepole mix (21 A), and Douglas-fir (62 A). The Douglas-fir type is limited primarily to steep, north facing slopes along La Garde Creek. The aspen occurs usually along drainage bottoms and stand perimeters.

Several stands have been delineated for inventory and discussion purposes. Stand A found in the extreme SE corner covers 18.5 acres. It is an aspen stand with occasional lodgepole pine, Douglas-fir, or ponderosa pine trees. The stand is noncommercial, averaging only three to five inches DBH and 20 feet tall. It is well stocked with considerable defect in the form of crook and sweep. No cruise was performed.

Stand B is a well stocked post and pole stand of lodgepole pine. The average DBH is 4.7" and the average height 36.8'. Volumes run in the neighborhood of 2,000 cubic feet per acre.

Stand C is a small stand of sawlog size lodgepole growing along Jenkins Creek. The site index is quite high (79) although the slopes approach 30% in some places. The average DBH is 7.4" even though some trees along the bottom exceed 20". The volume runs slightly under 5,000 cubic feet per acre or 20,000 board feet per acre.

Stand D covers nearly half of this section. It is primarily well stocked post and pole size lodgepole pine. Some aspen and small sawtimber size lodgepole may be found along drainages or mixing in with aspen along the eastern edge of the stand. The average volume is nearly 2,400 cubic feet per acre.

A more complete breakdown of stand statistics may be found in the timber resource section of this report. Dwarf mistletoe is the only significant disease and it only occurs in a few pockets. (See map section.)

Non-Forest Area

There is approximately 210 acres of non-forested land on this section.

Two feet tall sagebrush with a sparse understory of native grasses is the predominant vegetation here. Mountain Mahogany becomes the dominant brush type on a few of the steeper slopes in the southwest quarter. Grazing pressure appears to be light in the accessible areas and non-existent on the steeper and more isolated areas.

Management Recommendations

The RMYLD (RM-199) computer program was used to analyze various management options. The projected volumes shown below do not match the figures actually calculated for the stand due to variations in diameter limits and calculation procedures. However, the trends are useful management guidelines.

<u>Management Option</u>	<u>Stand B</u>	
	<u>Resulting Per Acre Volume</u>	
	<u>Yielding After 100 Years</u>	
	<u>Total Cu.</u>	<u>Sawtimber</u>
	<u>Ft. Vol.</u>	<u>Bd. Ft. Vol.</u>
Do nothing	3,580	0
Delay thinning for 30 years, then thin each 20 years thereafter	5,460	14,000
Thin now and each 20 years hereafter	6,370	17,500

This single storied stand is in a low wind fall risk situation (RM-136); therefore the third option should be applied in the following manner. Thin from below to a GSL of 120 now by removing 66% of the trees (50% of the volume). After 20 years, reenter the stand and again thin, but this time to a GSL of 90 by removing 55% of the remaining trees (70% of the volume). After an additional 20 years, the stand should be regenerated, by the three cut shelterwood system outlined by Alexander (RM-136). After this time, the stand should be managed by periodic thinnings to maintain the growing stock level at 90.

Stand C

This stand varies considerably from Stands B and D in that the site is much better, the trees larger and the slopes steeper. The wind-fall risk is moderate due to the northern aspect and steeper slopes. Considering the height of the trees (60'), the relative small area involved, and the high volume, this stand should be clearcut. Restocking will be accomplished through seed dispersal from surrounding stands and serotinous cones remaining on the logging slash (RM-121).

Stand D

<u>Management Option</u>	<u>Resulting Per Acre Volume Yield After 150 Years</u>	
	<u>Cu. Ft. Vol.</u>	<u>Bd. Ft. Vol.</u>
Do nothing	4,270	0
Delay thinning 40 years	7,510	23,000
Thin now	8,570	20,700

Various management options for this stand were also analyzed by computer with very similar results to Stand B. The wind fall risk factor is low so each cutting operation may be completed in one step. The first cut should reduce the basal area 50% by thinning from below and removing 64% of the trees. After 20 years, the stand should be thinned a second time; this time removing 30% of the existing basal area or 43% of the trees. After an additional 20 years, the stand should be regenerated through a three cut shelterwood system as discussed by Alexander (RM-136). Again as with Stand B, the regenerated stand should be maintained at a growing stock level of 90 through periodic thinnings.

Any areas infected with dwarf mistletoe should be handled according to Hawksworth's recommendations (PSW-31). That is: areas with a DMR of 3.0 or less may be thinned with emphasis on removal of the most severely infected trees. Any other infected areas of three to five acres should be clearcut.

INITIAL CUT VOLUME ESTIMATES

	<u>Cu. Ft.</u>	<u>#8 Ft. Pieces</u>	
Stand A	No Cutting		
Stand B	1,020	663	per acre
	33,660	21,800	stand total
Stand C	4,995	2,147	per acre
	54,945	23,613	stand total
Stand D	1,160	698	per acre
	<u>333,036</u>	<u>200,440</u>	stand total
	421,641	245,935	section total

THE TIMBER RESOURCE

S36 T11N R77W

	S T A N D			
	A	B	C	D
Species composition by % of BA	2% lodgepole 98% aspen	100% lodgepole	100% lodgepole	95% lodgepole 5% aspen
Acreage	19A	33A	11A	287A
Aspect	E	NE	N	NE
Average elevation	8,470'	8,480'	8,440'	8,500'
Average percent slope	5%	18%	30%	15-20%
Site Index	-	48	79	45
CCF (Lodgepole pine)	-	237	185	240
Average age of dominants	-	122	86	102
Number of rings/last inch	-	48	22	42
Percent growth	-	.86%	1.38%	1.32%

STAND INFORMATION

Stand B

BAF 20	8 sample plots	11% sampling error
Trees/acre *	1,377	
Average DBH	4.7"	
Average height	36.8'	
BA/acre	167	
Merchantable cu. ft./acre	2,040	
Board feet/acre	7,857	
Total merchantable cu. ft. volume	67,320	
Total board foot volume	259,281	

* Includes all trees from 2" DBH and 10' tall and larger.

Linear Feet Data:

Diameter inside bark at small end	Number of 8' Pieces Recovered †							
	3	4	5	6	7	8	9	10*
Height --								
30'	31	31	9	9				
40'	122	426	355	77	38	6		
50'	44	17	24	57	27	20	20	11
Totals:	197	474	388	145	65	26	20	11
Number of 8' pieces per acre	<u>1,326</u>							
Total number of 8' pieces	<u>43,758</u>							

† Includes all trees over 3" DBH and 30' tall.

	Stand C	
BAF 20	4 sample plots	28% sampling error
Trees/acre *	634	
Average DBH	7.4"	
Average height	58.9'	
BA/acre	190	
Merchantable Cu. Ft./ acre	4,995	
Board feet/acre	21,300	
Total merchantable cu. ft. volume	54,945	
Total board foot volume	234,300	

* Includes all trees larger than 2" DBH and 10' tall.

(Please see next page.)

Linear Feet Data:

Diameter inside bark at small end	Number of 8' Pieces Recovered ⁺									
	3	4	5	6	7	8	9	10	11	
Height --										
50	76	38	98	108	38					
60	83	133	311	277	90	185	72	19	12	
70	30	36	38	66	96	96	72	28	0	
80	7	12	7	19	19	19	19	31	12	
Totals:	196	219	454	470	243	300	163	78	24	
Number of 8' pieces per acre	<u>2,147</u>									
Total number of pieces	<u>23,617</u>									

+ Includes all trees over 3" DBH and 30' tall.

Stand D		
BAF 20	16 sample plots	12% sampling error
Trees/acre *	1,267 (lodgepole only)	
Average DBH	4.8	
Average height	41.5'	
BA/acre	174	
Merchantable Cu. Ft./ acre	2,392	
Board feet/acre	9,485	
Total merchantable cu. ft. volume	686,504	
Total board foot volume	2,722,195	

* Includes all trees larger than 2" DBH and 10' tall.

(Please see next page.)

Linear Feet Data:

Diameter inside bark at small end	Number of 8' Pieces Recovered [†]															
	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
- Height -																
30	23	34	11													
40	108	259	80	28	8	4	2	2								
50	153	163	196	114	29	17	7	3	0	1						
60	19	18	27	28	32	22	9	4	2	0	1	1	0	1		
70		5	4	5	7	6	10	5	3	2	2					
Totals:	303	479	318	175	76	49	28	14	5	3	3	1	0	1		

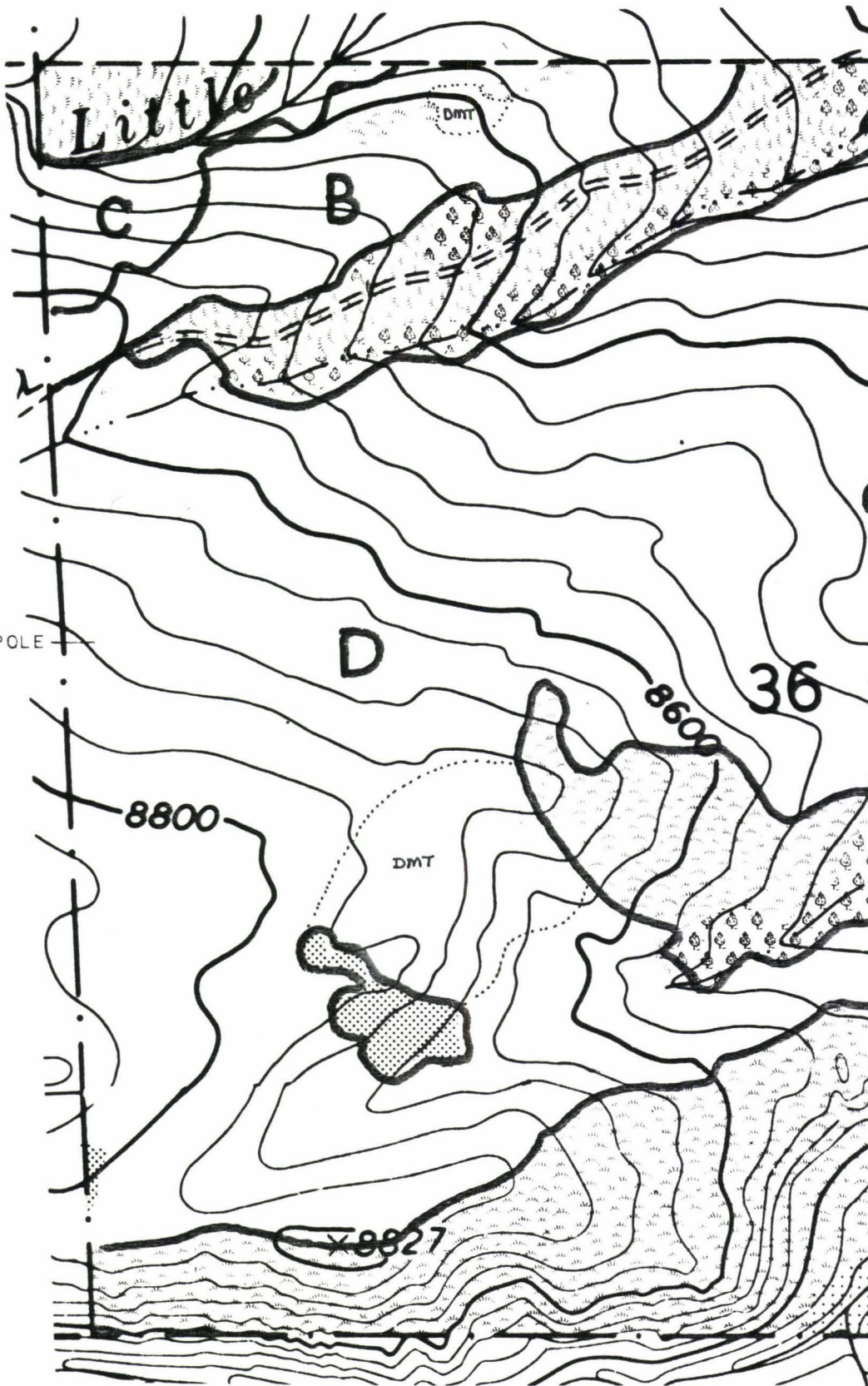
Number of 8' pieces per acre 1,455

Total number of 8' pieces 417,585

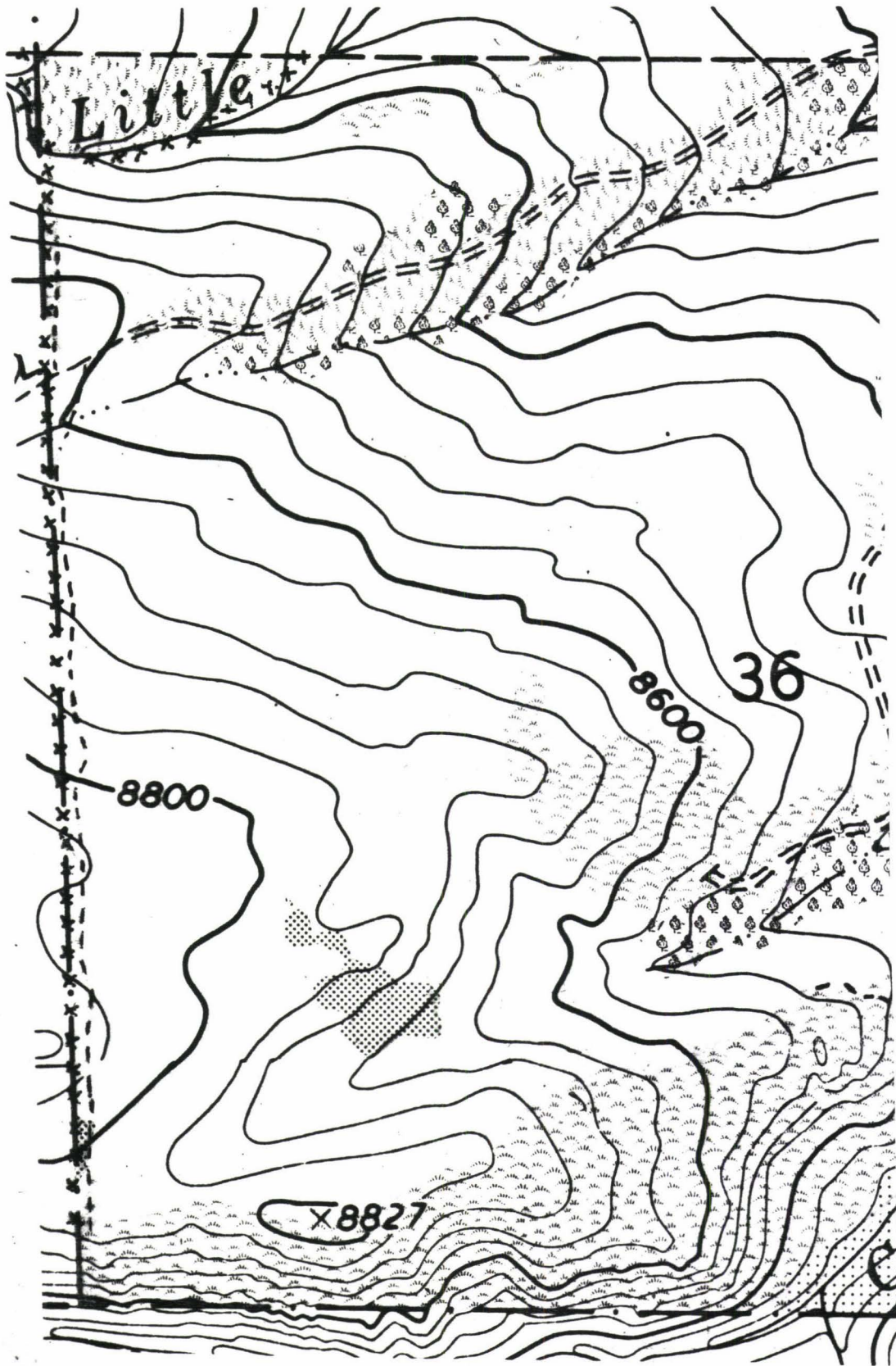
[†]Includes all trees over 3" DBH and 30' tall.

S36 T77N R11W LARIM

TIMBER TYPES & STAND BOUNDARIES



S36 T77N R11W LARIM



VOLUME SPECIFICATIONS

All volume figures were derived from the publications listed below.

PONDEROSA PINE

Board Foot Volumes

Publication - RM-2

Table - 5a

Specifications - Scribner rule

Top diameter variable

Stump height 1.0 foot

Total height in feet

Merchantable stem excluding stump and top

Minimum DBH - 12"

Cubic Foot Volumes

Publication - RM-2

Table - 2a

Specifications - Top diameter 4.0 inches inside bark

Stump height 1.0 foot

Total height in feet

Merchantable stem excluding stump and top

Minimum DBH - 5"

LOGEPOLE PINE

Board Foot Volumes

Publication - RM-157

Table - 1

Specifications - Scribner rule

Top diameter 6.0 inches inside bark

Stump height 0.7 foot

Total height in feet

Merchantable stem excluding stump and top

Minimum DBH - 6"

Cubic Foot Volumes

Publication - RM-157

Table - 3

Specifications - Top diameter 6.0 inches inside bark

Stump height 0.7 foot

Number of 16.5 foot logs

Merchantable stem excluding stump and top

DOUGLAS FIR

Board Foot Volumes

Publication - R-2 supplement No. 12

Specifications - Scribner rule

Top diameter 8" inside bark

Total height in feet

Minimum DBH - 10"

Cubic Foot Volumes

Origin - Equations from Intermountain Forest & Range Experiment

Station programmed by D. L. Brown

Specifications - Total height in feet

Merchantable stem excluding stump and top

Minimum DBH - 5"

LOGGEPOLE THINNING GUIDE BASED ON WINDFALL RISK AND BASAL AREA

	<u>High Windfall Risk Situations</u>	<u>Moderate Windfall Risk Situations</u>	<u>Low Windfall Risk Situations</u>
Basal Area of Existing Stand	<ol style="list-style-type: none"> 1. Ridge tops. 2. Moderate to steep middle south and west-facing slopes not protected to the windward and all upper south and west-facing slopes. 3. Saddles in ridge tops. 	<ol style="list-style-type: none"> 1. Valley bottoms parallel to the direction of prevailing winds. 2. All lower and gentle middle south and west-facing slopes not protected to the windward. 3. Moderate to steep middle and all upper north and east-facing slopes. 4. Moderate to steep middle south and west-facing slopes protected by considerably higher ground not far to windward. 	<ol style="list-style-type: none"> 1. Valley bottoms except where parallel to the prevailing winds, and all flat areas. 2. All lower and gentle middle north and east-facing slopes. 3. All lower and gentle middle south and west-facing slopes that are protected by considerably higher ground not far to windward.
Less Than 120	Two stages required. Cut 1: Cut 50% of total trees which need to be removed to achieve desired stocking level. Cut 2: Five years later. Cut to desired stocking, but no lower than 80 GSL.	Thin to desired level in one cut.	Thin to desired level in one cut.
More Than 120	Three stages required. Cut 1: Cut 30% of total trees which need to be removed to achieve desired stocking. Cut 2: Five years later. Cut 50% of the remaining trees which need to be cut to achieve desired stocking. Cut 3: 10 years after second cut. Thin to desired stocking, but not lower than 80 GSL.	Two steps required. Cut 1: Cut 50% of trees which need to be removed to achieve desired stocking level. Cut 2: Five years later, cut to desired stocking level.	Thin to 100 GSL in first cut. If lower stocking level is desired, wait five years and cut to desired level.

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Dept. of Agriculture Bulletin #234

Mason, D. T.
1915, Utilization and management of lodgepole pine in the Rocky Mountains.

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Alexander, R. R.
1975, Partial cutting practices in old-growth lodgepole pine.

PSW-31

Symposium on Dwarf Mistletoe Control through Forest Management

Hawksworth

1978, Intermediate cuttings in mistletoe-infested lodgepole pine and southwestern ponderosa pine stands.