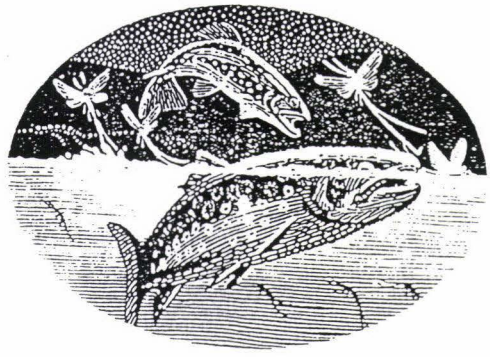
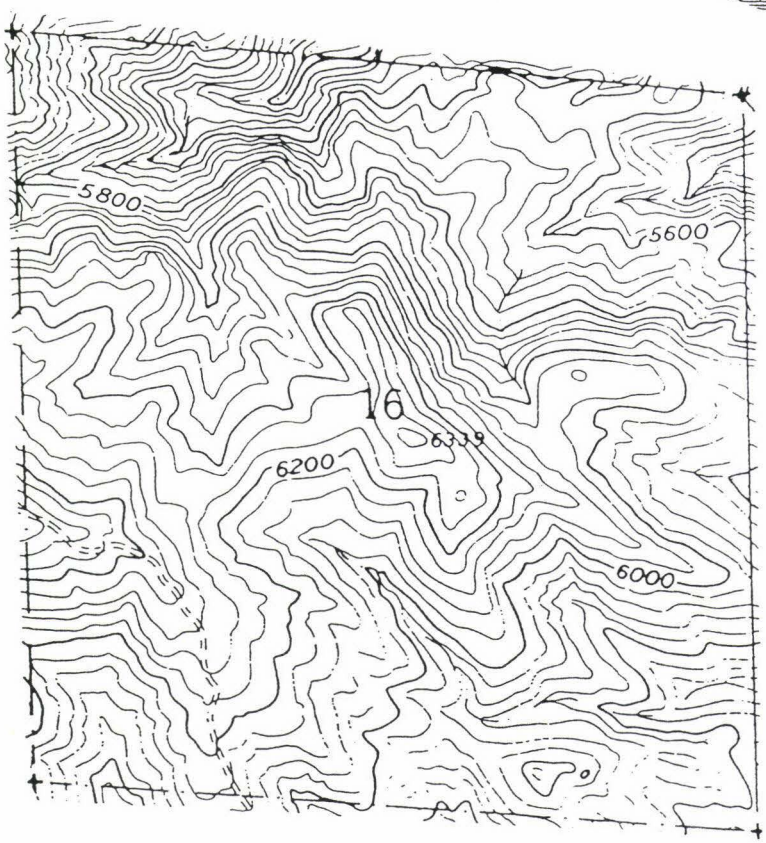
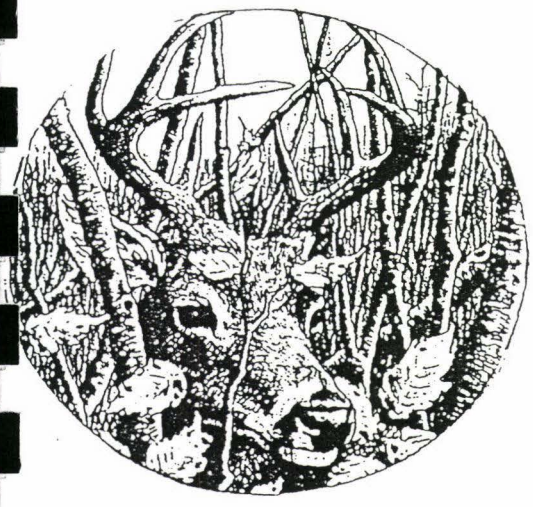
FOREST MANAGEMENT PLAN

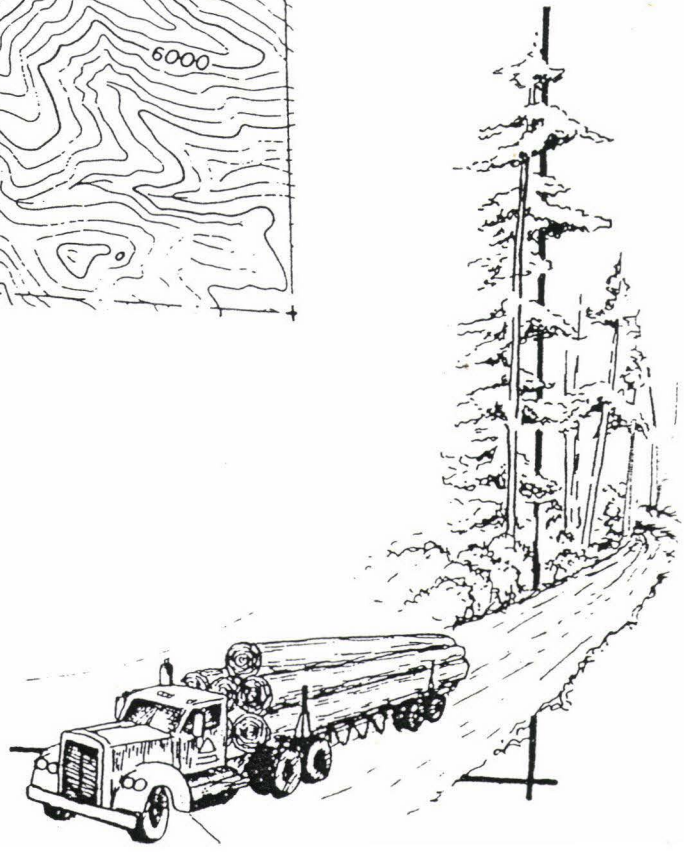
GRAVES SECTION

T.8N., R.70W. - SECTION 16









FOREST MANAGEMENT PLAN

GRAVES SECTION

T.8N., R.70W. - SECTION 16

Prepared by:
James Rassman

Colorado State Forest Service
Fort Collins District

March 14, 1991

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APPENDICES

STATEMENT OF PURPOSE

The driving purpose of this management plan is to generate revenue for the State Land Board, while insuring the long-term productivity and protection of the forest resources. This plan is sensitive, but not subservient to other resource considerations, such as grazing, wildlife, and aesthetics.

PROPERTY DESCRIPTION

Location and History

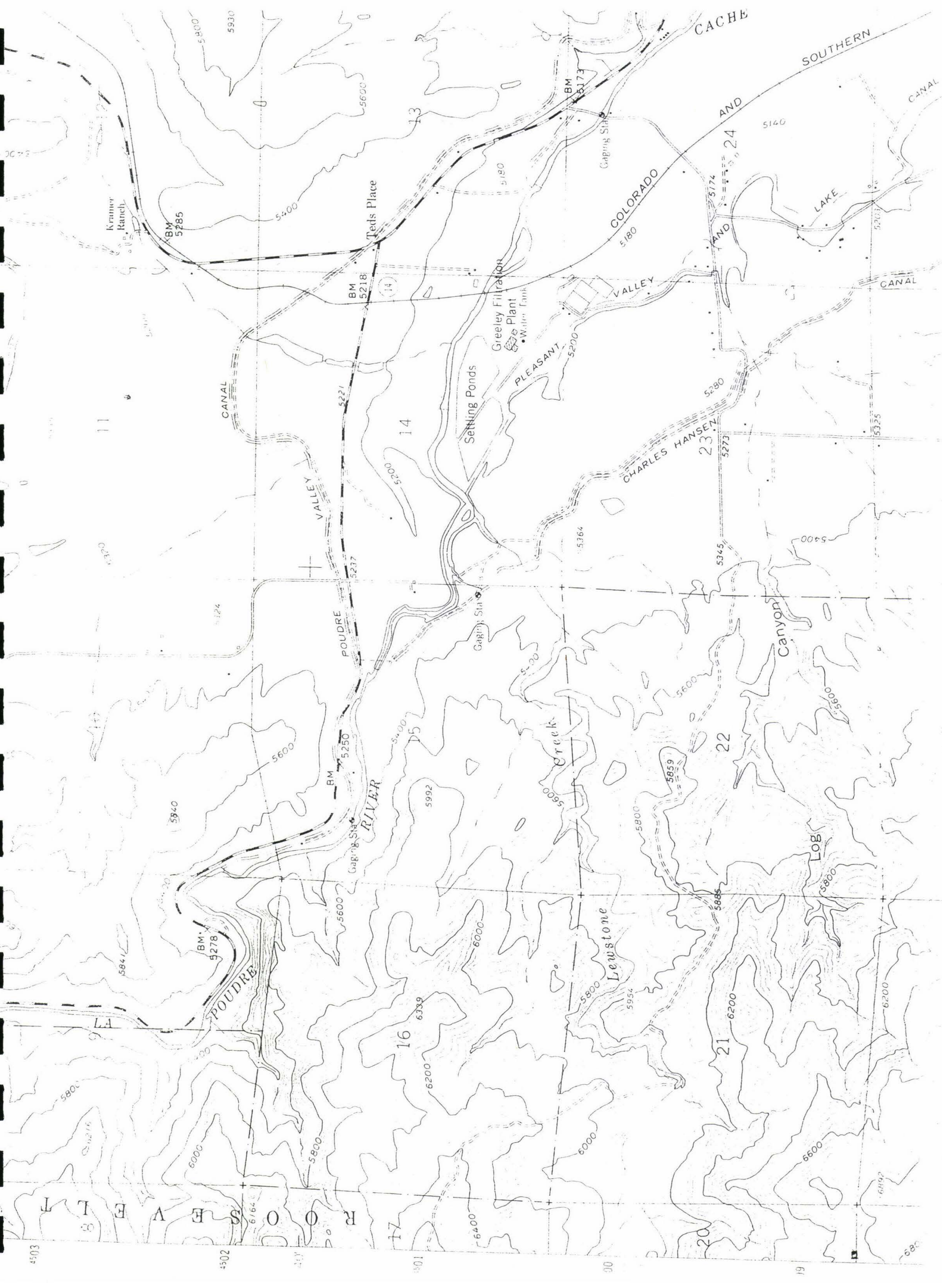
Section 16 (T.8N., R.70W.) is located approximately 7.4 miles northwest of the town of LaPorte (see maps on following pages for location and topography). The Colorado State Forest Service administers Section 16 for the State Land Board. The section is bordered on all sides by private land. The principle owner of these lands is Robert Graves. Mr. Graves is also secures the grazing rights on Section 16. The close association of this section with Mr. Graves often leads to the name Graves' Section, and this name will be used in this plan to avoid confusion.

The site has a history of logging and fire occurrences. Evidence of these activities and events can be seen in logging slab piles, high stumps and fire scars, as well as the structure of the forest itself.

This section came under state control, when lands were set aside for the state school system. Many of these sections have been consolidated or traded through the years. The remaining sections like the one being dealt with in this plan, should be wisely managed to meet the goals set by the State Land Board (SLB).

Topography

The elevation of Graves' Section ranges from 5310 feet along an intermittent stream that flows to the Cache La Poudre River up



CACHE
LA POUDRE
RIVER
COLORADO AND SOUTHERN
Kramer Ranch
BM 5285
Teds Place
BM 5218
BM 5173
Gaging Sta
Greeley Filtration Plant
Water Tank
Settling Ponds
PLEASANT VALLEY
CANAL
LAKE
CANAL
CHARLES HANSEN
POUDRE VALLEY
CANAL
BM 5250
BM 5278
Lewstone
Creek
Log
Canyon
ROOSEVELT
13
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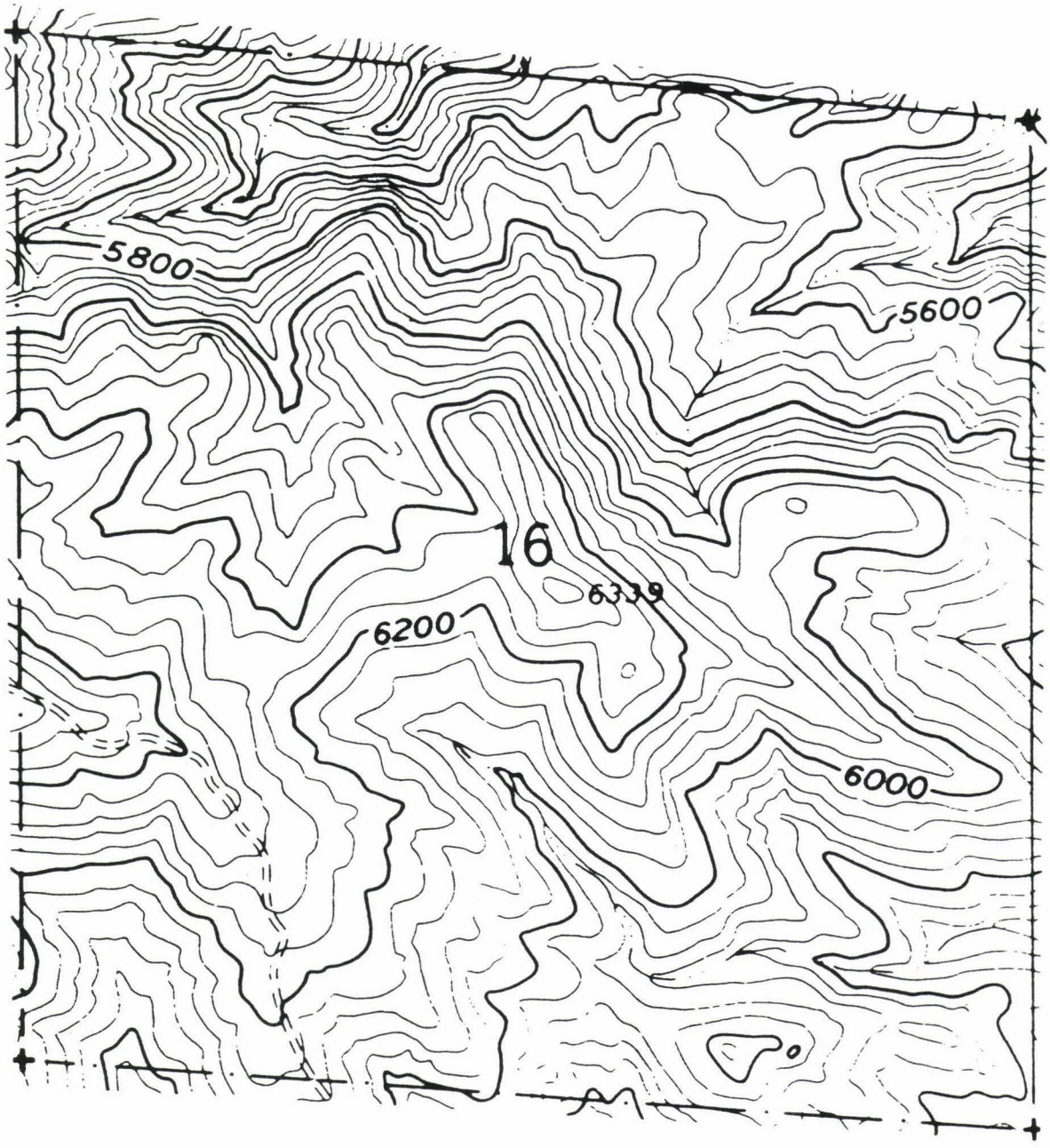
24

S16 T8N R70W



SCALE: 6" = 1 mile

to 6339 feet on a ridge that runs through the center of the section. Primary topographic features include this central ridge that runs east west through the section, ultimately sloping down to the Poudre river. This terrain is quite steep in the north half of the section and is drained by two intermittent streams that flow into the Poudre River. Several less dramatic ridges are found in the southern half as well as another intermittent stream that flows southeast and into Lewstone Creek.

Soils

There are five major soil types on the section. These soils correspond closely with the topography of the land, with the Wetmare-Boyle-Rock outcrop complex dominating the section. All soils found on the section are those associated with steep slopes and limited production. A soils map and description sheet can be found in Appendix 7.

Access

There is only one established access route into the Graves' section. This unimproved dirt road runs out of the south through Mr. Graves property, and can be difficult to travel on in the wetter months. The State has obtained a temporary agreement for access through Mr. Graves land. The relationship has been strained at several points in time, when gates were left open or not locked carefully. This can be avoided in the future with considerate responsible action by state personnel and permitees.

Access on foot is also available to those who wish to climb the steep slopes from the Poudre River up onto the property.

Wildlife

Although a formal inventory of the wildlife resource was not carried out on the section, informal observations were made. Mule deer sign was commonly seen, as well as the animals themselves on some of the cooler mornings. Several times wild turkeys were spotted running for cover into the ponderosa pine stands. Also noticed were squirrel, porcupine and other small rodent sign. Some of these wildlife comments will be found in the stand descriptions. At this time, no endangered species (plant or animal) are known to be in the section.

Fire

As in many areas of the Colorado Front Range, the fire danger on this section ranges from moderate to high. Many of the stands are older with poor vigor and heavy understory fuels. The sites also tend to be dry along steep ridges, which only increases the fire danger. It may be possible through wise timber management techniques to bring down the fire danger and revitalize many of these stands. Fire danger ratings can be found in Appendix 4.

Scenic and Cultural Resources

From the end of the road located on the central ridge, there

is a dramatic view of the Poudre drainage. This unique scenic resource is of value, and should not be impaired by poor land management practices.

As mentioned prior, the section has a history of grazing and wood production activities. The most common remnants of these activities are slab piles, and fence lines. Destruction of these cultural resources should be avoided, for the represent the settlement and history of the area.

No known archeological sites have been found on the property.

Insects and Diseases

The two most serious insect pests on the section are the mountain pine beetle (Dendroctonus ponderosae), and the Douglas-fir beetle (Dendroctonus pseudotsugae).

The mountain pine beetle, which attacks ponderosa pine and lodgepole pine, is the insect which killed thousands of ponderosa pine trees along the Front Range in the 1970's. At this time the pine beetle is at levels expected in normal forest conditions. Older weakened ponderosa pine are more susceptible to attack, although thick overstocked stands with diameter over seven inches are also capable of hosting the insect.

The Douglas-fir beetle, has become an increasingly important pest along the Front Range. As the result of widespread attacks of western spruce budworm, many of the Douglas-fir stands have become more susceptible to the beetle.

In both cases, control of infestations require identification of currently infested trees, evidenced in part by boring dust in bark crevices, pitch flows, and active beetles underneath the bark. Infested trees can be cut down and disposed of by burning as firewood, or removing all of the bark and spraying with the chemical lindane. Preventative spraying is generally not used in forest conditions, due to the cost of such an operation. Good forest management practices are our best hope in controlling these insects, as thinned stands of trees with vigorous growth are frequently able to withstand even heavy attacks.

Disease

The primary disease problem on the section is dwarf mistletoe (Arceuthobium vaginatum), which effects ponderosa pine. Dwarf mistletoe is a parasitic plant which obtains its nutrients for growth by growing under the bark of the host tree. The plant spreads by ejecting seeds that can travel up to 40 feet and land on the foliage of nearby pine. If the infection is successful, it will take six years for the parasite to complete its development and continue its spread. It takes a number of years for the tree to succumb to this disease , but it can further weaken a tree making it more susceptible to other insect and disease problems. Control in high value trees usually involves pruning out infested branches. In forest conditions large tracts of trees can be cut to halt the spread of the disease. Usually a

more acceptable practice is a thinning a stand to increase vigor. This increased vigor may allow the tree to hold up much longer under a dwarf mistletoe infection.

An additional disease of importance noted within the section is western gall rust (Peridermium larknessii). This rust occurs on ponderosa pine , creating swellings (galls) on the trunks of the infected tree. These galls may eventually girdle and kill the tree. Detailed descriptions of these insect and disease problems can be found in Appendix 2.

Timber

A detailed field inventory of the section was made during the month of October, 1988. This inventory was carried out on a stand basis. Forest stands are defined here as recognizable management units of similar tree species that are generally greater than five acres in size. The forest stands on the section are generally comprised of two overstory species, ponderosa pine (Pinus ponderosa), and Douglas-fir (Pseudotsuga menziesii). Ponderosa pine is the more common of the two species; it predominates on south and west slopes. Douglas-fir is often found on more moist north and east slopes in the section. Identification and life history of these species can be found in Appendix 1.

Within these forested stands, there are often openings occupied by mountain shrub or grass communities. Several areas of the section are quite steep and rock outcrops are common.

Noxious weed have not been identified on the section. Soils tend to be shallow, excessively drained, and rocky. This accounts for the low productivity seen in many of these stands.

On the following pages, there are detailed descriptions of these stands and their components followed by a stand map and a forest cover type map. The top line of each stand description contains the stand number, stand description code, and average trees per acre. Following that, are A) A Description of the stand stocking level, B) Forest products, C) Insect and disease problems(if any), D) Regeneration present (if any), and E) A miscellaneous section that may include, history, wildlife or access information. Finally, after each stand description, will be found a recommendation number. These recommendations will be described in detail later.

COLORADO STATE FOREST SERVICE
REMOTE SENSING UNIT

ECOSYSTEMS

AL - ALPINE
AQ - AQUATIC
AS - ASPEN
BG - BOG
BR - BOG-RIPARIAN
DF - DOUGLAS-FIR
GR - GREASWOOD
LB - LIMBER/BRISTLECONE
M - MEADOW
MC - MIXED CONIFER
MG - MOUNTAIN GRASSLAND
MS - MOUNTAIN SHRUB
N - NON-VEGETATED
O - DISTURBED
PJ - PINON/JUNIPER
PP - PONDEROSA PINE
R - RIPARIAN
SB - SAGEBRUSH
SF - SPRUCE/FIR

SIZE CLASSES
1 - UNDER 5'' DBH
2 - 5'' - 9'' DBH
3 - OVER 9'' DBH

CROWN DENSITY
A - 10 - 35%
B - 35 - 55%
C - 55 - 100%

STAND DESCRIPTIONS

Stand 1 PP2 TPA 303
A) Overstocked ponderosa pine (BA 148)
B) Poletimber to small saw timber
C) Some knee cankers
D) Very poor regeneration
E) Broken terrain, some mule deer sign.
Recommendation - 1,5,6 Unlikely

Stand 2 PP2 TPA 475
A) Overstocked ponderosa pine (BA 173)
B) Poletimber, some sawtimber in drainage
C) Some rust infection
D) Regeneration not present
E) Dry site with a history of fire. Some open clearings.
Recommendation - 1,5,6 Probable

Stand 3 DF2 TPA 648
A) Wellstocked to overstocked Douglas-fir, with ponderosa pine (BA 105)
B) Most of stand small diameter with some sawlog ponderosa by road.
C)
D) Some regeneration in Douglas-fir
E) High fuel build-up
Recommendation - 1,9 Probable

Stand 4 PP2 TPA 211
A) Well stocked ponderosa pine with Douglas fir (BA 93)
B) Some sawtimber ponderosa, smaller Douglas-fir
C) Mistletoe present
D) Fair regeneration
E) Fire history, broken terrain
Recommendation - 9 Probable

Stand 5 PP2 TPA 250
A) Understocked to well stocked ponderosa pine (BA 75)
B) poletimber to sawtimber
C) Little mistletoe
D) Poor ponderosa pine regeneration
E) Logging history
Recommendation - 5,6 Probable

Stand 6 PP2 TPA 250
A) Well stocked ponderosa pine (BA 85)
B) poletimber
C)
D) Fair regeneration
E) Two-storied stand possibly due to fire history
Recommendation - 1,9 Probable

Stand 7 PP3 TPA 192
A) Well stocked ponderosa pine (BA 94)
B) Sawtimber
C)
D) Poor regeneration
E) Some very large trees, but poor access. Stand tends to be patchy.
Recommendation - 1 Unlikely

Stand 8 PP2 TPA 401
A) Well stocked to overstocked ponderosa pine (BA 111)
B) Poletimber
C) Some cankers
D) Very poor regeneration
E) Road runs on ridge along stand. Good view of Fort Collins. Dry site.
Recommendation - 1,5,6 Probable

Stand 9 PP2 TPA 219
A) Well stocked ponderosa pine (BA 93)
B) Poletimber to saw timber
C) Gall rust present
D) Poor regeneration
E) Stand fills north side of draw. Some shrubs in rocky areas.
Recommendation - 1,5,6 Unlikely

Stand 10 PP2 TPA 202
A) Open to well stocked stand (BA 88)
B) Poletimber, some sawtimber
C) Some rust present
D) Very poor regeneration
E) Open and rocky in places. Mule deer sign in openings.
Recommendations - 5,6 Unlikely

Stand 11 PP2 TPA 375
A) Well stocked ponderosa pine with Douglas-fir (BA 86)
B) Poletimber
C)
D) Heavy Douglas-fir regeneration
E) Rocky and steep with Douglas-fir increasing lower in stand.
Recommendation - 8 Unlikely

Stand 12 PP3 TPA 124
A) Poorly stocked ponderosa with Douglas-fir (BA 64)
B) Sawtimber
C)
D) Good Douglas-fir regeneration
E) Dryer than stand 11. Some game trails.
Recommendation - 9 Unlikely

Stand 13 DF2 TPA 456
A) Well stocked Douglas fir (BA 96)
B) Poletimber
C)
D) Uneven regeneration
E) Steep, dry creek runs through stand
Recommendation - 1 Unlikely

Stand 14 PP3 TPA 117
A) Understocked ponderosa pine (BA 70)
B) Sawtimber
C) Mistletoe and rust
D) Some Douglas-fir regeneration
E) Some large trees. Stand fills north side of the draw. Very steep.
Recommendation - 5 Unlikely

Stand 15 PP3 TPA 95
A) Very poorly stocked ponderosa pine (BA 52)
B) Sawtimber
C) Some mistletoe
D) Very poor regeneration
E) Stand is patchy and open. Part of stand has been logged in past.
Recommendation - 5,6 Possible

Stand 16 DF2 TPA 391
A) Understocked Douglas-fir (BA 80)
B) Poletimber
C)
D) Poor regeneration
E) Stand dense in places. Past fire and logging evident.
Recommendation - 1,6 (Where dense) Possible

Stand 17 DF2 TPA 142
A) Understocked Douglas-fir (BA 56)
B) Poletimber, some sawtimber
C)
D) Good Douglas-fir regeneration
E) Steep rocky, moist in drainage. Broken terrain.
Recommendation - 9,6 Unlikely

Stand 18 DF2 TPA 519
A) Well to overstocked stand (BA 105)
B) Poletimber
C)
D) Poor Douglas-fir regeneration
E) Steep terrain. Dense in places.
Recommendation - 1,6 Unlikely

Stand 19 PP3 TPA 164
A) Poorly to well stocked ponderosa pine (BA 84)
B) Sawtimber
C) Mistletoe present
D) Poor regeneration
E) Dry site, two-storied stand. Steep except by road at bottom of stand. Mule deer sign.
Recommendation - 5,6 Probable

Stand 20 PP2 TPA 241
A) Well stocked to overstocked ponderosa pine (BA 100)
B) Poletimber and some sawtimber
C) Heavy mistletoe and rust
D) Very poor regeneration
E) Old road runs through stand, some scattered Douglas-fir
Recommendation - 1,5,6 Probable

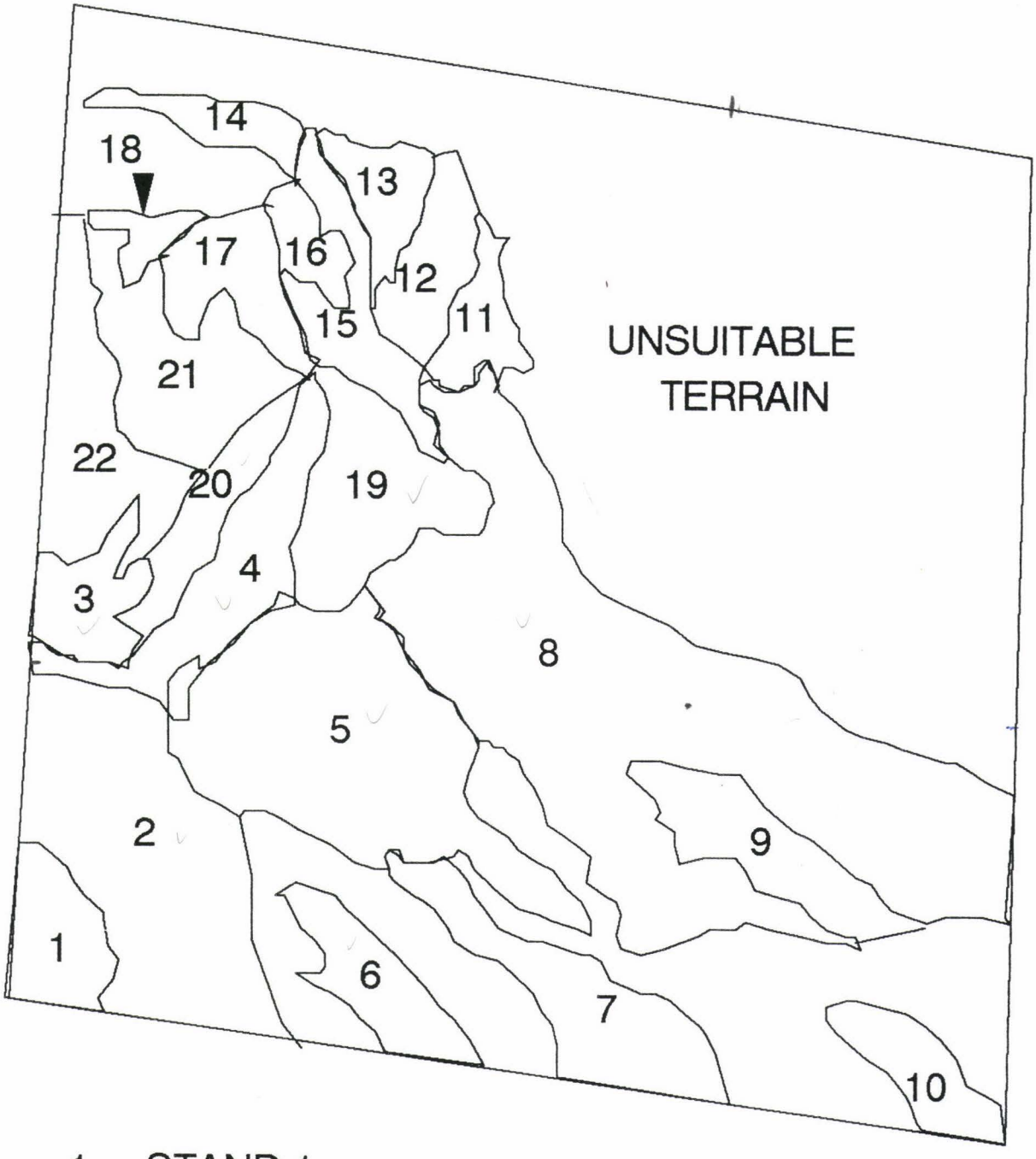
Stand 21 PP3 TPA 191
A) Well stocked ponderosa pine with Douglas fir understory (BA 105)
B) Sawtimber
C) Scattered mistletoe and rust
D) Fair Douglas-fir regeneration
E) Dry moderate slopes, moderate fuel loading.
Recommendation - 9,5 Unlikely

Stand 22 DF2 TPA 293
A) Well stocked Douglas-fir with small ponderosa component (BA 92)
B) Some sawtimber, mostly poletimber
C) Mistletoe heavy in ponderosa
D) Light Douglas-fir regeneration
E) Heavy fuels, old road bisects stand. Majority of stand is steep.
Recommendation - 1,5 Possible

Unsuitable Terrain
A) Mixture of shrub communities, grasses, and forest stands
B) Some timber, but unsuitable due to steep slopes, broken terrain, or poor access.
C) Scattered mistletoe and rusts in the forest stands
D) Regeneration varies, poor in shrubs and grasses
E) Mainly occupies steep slopes down to the Poudre River, receives heavy grazing pressure.
Recommendation - Better dispersal of grazing pressures, prescribed fire could be used to rejuvenate shrub and grass communities, access should remain limited to preserve wildlife habitat and escape cover.

NOTE: Printouts of cruise information can be found in Appendix 6.

T.8N., R.70W. - SECTION 16
STAND MAP



1 = STAND 1

SCALE
6 inches = 1 mile

N

T.8N., R.70W. - SECTION 16

COVER TYPE MAP

PONDEROSA PINE

PONDEROSA - DOUGLAS-FIR

DOUGLAS-FIR

UNSUITABLE/UNINVENTORIED

N

Product Market Description

There are many advantages to selling timber products from state lands. The obvious benefit is the revenue generated from these sales. With proper management, this revenue will provide a positive dollar return from the land. One of the only ways to effectively manage timber is through harvesting portions of it. If properly conducted, this management will ensure a perpetual supply of quality timber and revenue. Forest management strives to use tree resources at a rate constant with their renewal, and to harvest them in ways that ensure timely regeneration of future crops.

There is a wide variety of timber products available from the section. Fuelwood, posts & poles, sawlogs, houselogs, and christmas trees are the primary ones.

Fuelwood

The primary product available on section 16 is fuelwood. There are a great deal of local fuelwood contractors that either sell their own wood, or sell to firewood suppliers. The CSFS charges anywhere from $5 to $15 per cord, depending upon the logging requirements. Another option is to conduct a "public firewood sale" where the general public may cut their own wood, and haul it out themselves. The usual price range for this type of sale is between $5 and $50 per cord, depending upon the distance these people have to travel. Firewood sales are an

excellent way to clean up after a logging operation, and to generate revenue.

Posts and Poles

Two other major products available for sale off the property are posts and poles. This is due to the abundance of sapling and pole-sized ponderosa pine on the section. Along with fuelwood, posts and poles are obtained primarily from thinning. The tree size of this raw material limits its use to posts and poles only. The CSFS sells post and pole stumpage to contractors for anywhere from $5 to $15 per cord. Again, this fluctuates with logging requirements. Mills usually accept tree-length lodgepole and require 2-1/2" to 3" top diameters. Mills generally measure posts and poles timber by the linear foot, and this ranges from $.06 to $.15 per linear foot.

Sawtimber

The sawtimber on section 16 may be sold on the stump to various local logging contractors and haulers. The USFS is currently selling its stumpage for about $62 per thousand board feet (mbf). This is with average harvesting conditions, for the price fluctuates with factors such as hauling distance, skidding distance, temporary road construction, slash disposal, erosion control and other requirements for the logging contractor. Each sawmill has different merchantablilty standards, but most require tree-length logs, cut down to a 6" top diameter. Of course

defects in the logs (sweep, crook, rot, fire scars, excessive knots, etc.) will reduce their value when scaled at the mill. Sawmills will pay their logging contractors anywhere from $70 to $150/mbf.

Houselogs

Houselogs are a product that may be sold for a considerable profit. However, only the biggest and best are demanded. Mills generally require at least 30′ logs with 7" minimum top diameters. Live or sound, standing-dead Ponderosa pine or Douglas-fir may be used. A logger might pay anywhere from $10 to $20 per log, but must be insured a full truckload to make it worth his while. Mills pay anywhere from $.50 to $1.50 per linear foot.

Christmas trees and Transplants

The sale of Christmas trees and transplants is a good way to generate revenue if done correctly. Contractors may pay anywhere from $3 to $5 per Christmas Tree (usually lodgepole pine, Douglas-fir, subalpine fir, and Engelmann spruce). The USFS and the CSFS have very successful public Christmas tree sales where $6 to $8 per tree is charged, and the public cuts and hauls their own trees from the woods.

Company addresses and contacts may be found in Appendix 8.

RECOMMENDATIONS

After each stand description, there is a recommendation number. These numbers correspond to the forest management practices listed in this section. A more detailed description of these activities can be found in Appendix 3. Each recommendation number in the stand description section is accompanied by the word probable, possible, or unlikely. This represents the practicality of carrying out these activities in the particular stand. It is based on the present transportation network, the terrain and slope, and the economic costs and benefits of carrying out the activities. For example, a particular stand may need thinned from a forestry perspective, but if this stand is remote, and on extremely steep ground, the probability of this activity being carried out is low given the present economic considerations. Except in the most extreme situations (unsuitable terrain), a detailed recommendation is still given. This is based on the understanding that in the future many of these variables may change. For instance, roads may be extended, insects or diseases may become more active, or a change in market prices may make the activity feasible. Also, it should be noted that no action is in effect a management decision. This decision can be justified to preserve wildlife, scenic, or historical resources.

The task of wise management does not end with this management plan. If these recommendations are to be implemented

on the ground, professional personnel must use their discretion to come up with the activities plan. This would include burning plans, sale appraisal and administration as well as the on the ground management. This plan only lays the foundation of management, the actual work is still yet to come. Many of the final management decision will come 'on the feet and in the field', as it should be.

At the end of this section is found a review of stand recommendations and a section map, illustrating slope and access limitations.

(1)

Thin to Growing Stock Level (GSL) 80

Thinning the stand to a growing stock level of 80 means that the basal area (Appendix 4) is at 80.0 square feet per acre when the average stand diameter is 10.0 inches after thinning. Practically speaking, this yields an ideal spacing distance between the trees after thinning dependent on their average diameter. This enables the person thinning the stand to remove trees to optimize spacing at whatever size. By looking at the chart in Appendix 4 and determining what the average diameter of the stand is, an ideal distance between trees can be determined. For instance, an average diameter of 10.0 inches in a space between trees of 17.2 feet. During thinning, remove poorly shaped, damaged or diseased, and competing smaller trees. "Character trees", or trees with specific uses, such as wildlife snags, should be retained. Western gall rust infected trees should be discriminated against and removed during thinning as well (Appendix 3).

(2)

Thinning to Growing Stock Level (GSL) 100

This is similar to the previous thinning prescription, but to a slightly higher basal area. Distances between trees will be slightly less. Different sites may support, especially north facing slopes, and different species may require, Douglas-fir for example, a different spacing. Again, by looking at the chart in Appendix 4 and determining what the average diameter of the stand is, an ideal distance between trees can be determined. During thinning, remove poorly shaped, damaged or diseased, and competing smaller trees. "Character trees", or trees with specific uses, such as wildlife snags, should be retained. Western gall rust infected trees should be discriminated against and removed during thinning as well (Appendix 3).

(3)

Patch Cut to Sanitize Dwarf Mistletoe

Where patches of dwarf mistletoe occur, cut all infected trees within the infestation, to sanitize the stand (Appendix 3). These patch clearcuts should not exceed 5 acres in size for wildlife considerations. Patch cuts should be started on the outside of the infested areas, and proceed into the center of the infested areas. This prevents the further spread of this parasitic disease to uninfected trees outside the patch cut.

(4)

Thin to Growing Stock Level (GSL) 80 where necessary

In stands with considerable variability in the stocking level, some patches of higher density may need to be thinned, while other areas of the stand may not need to thinned. In fact, understocked areas within the stand adjacent to these higher density patches may need to be planted or regenerated. Thus, this recommendation indicates that thinning to GSL 80, as previously described, should be done when necessary.

(5)

Improvement Cut

The purpose of an improvement cut is to remove badly diseased, damaged, standing dead, and poorly shaped trees to reduce fire hazard, and improve the residual stand. Generally, these conditions will occur in stands that were heavily infested by mountain pine beetle or cutover during previous years. Frequently, the improvement cut may also serve as a salvage cut, and the stand may need to be replaced with seedlings or natural regeneration.

(6)

Replant or Reseed

This practice involves the establishment of new trees through planting of seedlings or natural regeneration. Generally, regeneration should be of the same trees present within the stand prior to management activities. However, in the case of patch cuts for dwarf mistletoe, or in stands where this disease is present and not under control, susceptible seedlings should not be established. In these cases, dwarf mistletoe-infested ponderosa pine can be underplanted with non-susceptible species like Douglas-fir or Rocky Mountain juniper prior to the complete removal and control of the infested trees. In other situations, natural regeneration from existing trees may be desired. In this case, suitable seedbeds must be present for seedling establishment (Appendix 2, 4).

(7)

Patch Cut

This is a variation of a clearcut regeneration system, where all the trees within an area are removed to establish a new, even-aged stand. In this case, the clearcuts should be designed as patches of not more than 10 acres (Appendix 4).

Shelterwood (8)

The shelterwood regeneration system utilizes the existing stand to provide a seed source for the new stand. As the stand matures, it is thinned to improve seedling establishment in the protection of the old stand. After the new regeneration is present, the older stand is removed (Appendix 4).

Group Selection (9)

The group selection system replaces the older stand by creating small openings within the existing stand, and using seeding in from adjacent trees to establish regeneration. This system differs from the patch clearcut system by having much smaller openings, which are partially shaded by the surrounding stand (Appendix 4).

Review of Stand Recommendations

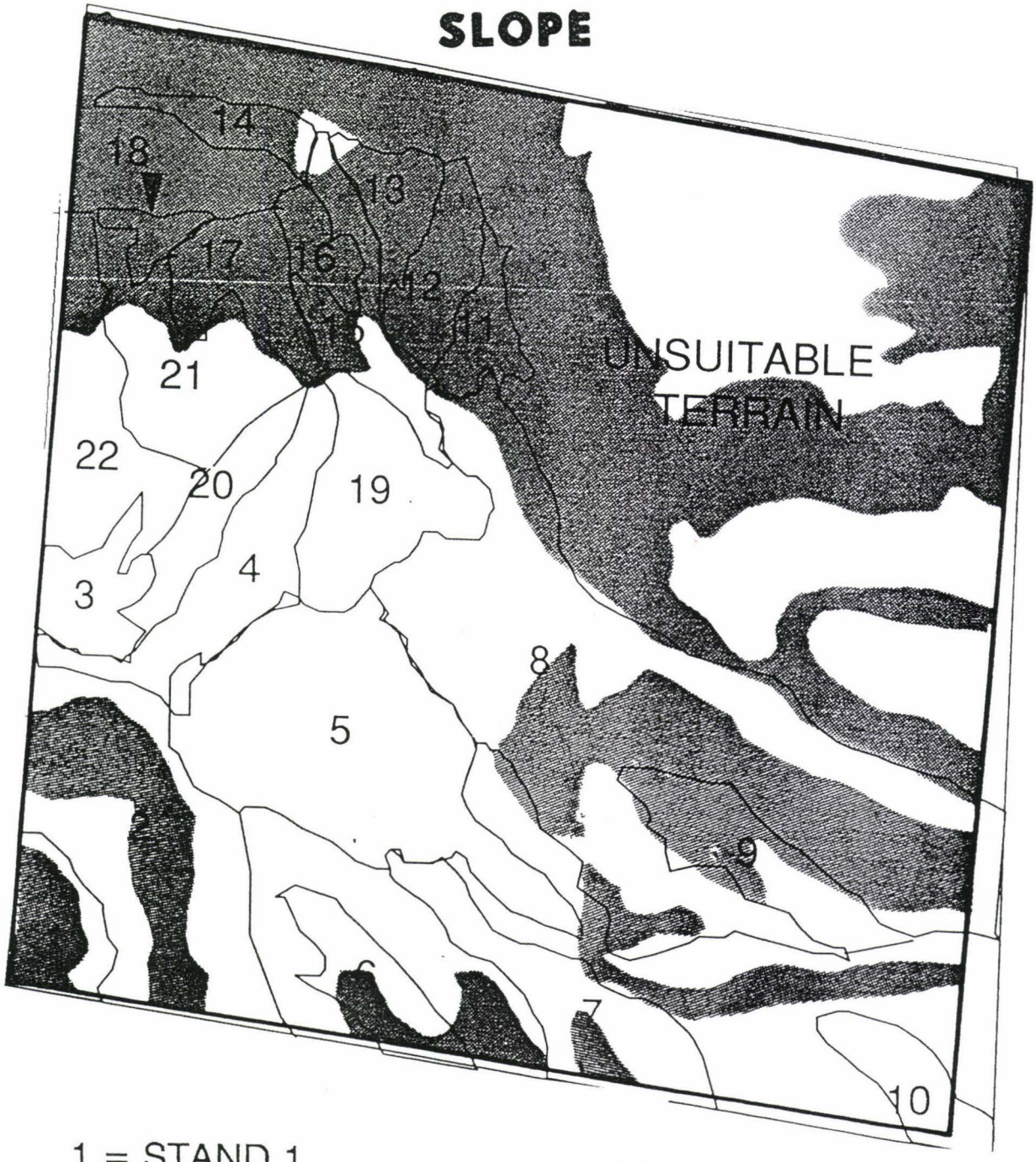
Stand 1 - 1,5,6 Unlikely
Stand 2 - 1,5,6 Probable
Stand 3 - 1,9 Probable
Stand 4 - 9 Probable
Stand 5 - 5,6 Probable
Stand 6 - 1,9 Probable
Stand 7 - 1 Unlikely
Stand 8 - 1,5,6 Probable
Stand 9 - 1,5,6 Unlikely
Stand 10 - 5,6 Unlikely
Stand 11 - 8 Unlikely
Stand 12 - 9 Unlikely
Stand 13 - 1 Unlikely
Stand 14 - 5 Unlikely
Stand 15 - 5,6 Possible
Stand 16 - 1,6 Possible
Stand 17 - 9,6 Unlikely
Stand 18 - 1,6 Unlikely
Stand 19 - 5,6 Probable
Stand 20 - 1,5,6 Probable
Stand 21 - 9,5 Unlikely
Stand 22 - 1,5 Possible

Unsuitable Terrain - Better dispersal of grazing pressures through salting and herding, Prescribed fire to rejuvenate shrub and grass communities. Limit access to preserve wildlife resources.

T.8N., R.70W. - SECTION 16

STAND MAP

SLOPE



1 = STAND 1

SCALE

6 inches = 1 mile

N

30% and over

APPENDIX 1

SPECIES DESCRIPTIONS

PONDEROSA PINE

(Pinus ponderosa)

Ponderosa pine is the most important pine in Western North America. It makes hard, strong, and fine-grained wood. High-grade ponderosa is used for doors, sashes, frames, and paneling; the low-grade wood for boxes, rafters, pallets, fencing, joists, and railroad ties. It also makes a handsome ornamental tree and hardy windbreak component. Ponderosa pine forests have also produced abundant forage and have long been grazed by domestic livestock. These forest areas produce much of the region's deer, elk, and other wildlife. Seventy species of birds were identified in the ponderosa ecosystem at Estes Park during the 1976 annual Audubon spring bird count. Recreational use has been expanding at a rapid rate.

Ponderosa pine in the Colorado Front Range occurs in the Montane Life Zone. This zone is the first timbered belt above the Plains on the east side of the Colorado Rockies. Ponderosa pine is a climax species within its normal altitudinal zone of 5,500 to 8,800 feet in Larimer County. Annual precipitation is very low for tree growth, averaging from 15 to 20 inches. Approximately two-thirds of the annual precipitation falls during spring and summer when it is most useful for regeneration and growth. Soils are largely granitic in origin.

The first harvest cutting in ponderosa pine forests occurred in the Front Range of Colorado about 1860. During the gold rush years, tens of thousands of acres were virtually clearcut for fuel, mine timbers, and lumber. The tree has been cultivated in the U.S. since 1827 for ornamental purposes.

Individual Tree Characteristics

Needles - Growing in 2's and 3's up to 7" long. They remain through 3 growing seasons.

Cones - Up to 4" long. Deciduous. Made up of scales with small prickles. Male and female flowers on same tree.

Seeds - ¼" long with 1" wing. Two on each scale. 12,000 seeds per pound.

Form - Symetrical single bole or trunk. Young trees conical while older trees are flat-topped.

Age - Reach maturity at 140-180 years.

Height - Tallest on record is 232 feet (California). Will reach 175 feet in best sites. Usually mature at less than 100 feet in Colorado.

Diameter - Up to 6 feet at 4½ feet above ground in western forests. May reach 4 feet in Colorado. Normally less than 30 inches.

Root system - Tap root

Bark - Dark brown to black in young trees (furrowed) yellow-brown to cinnamon-red in old growth (smooth and platey).

Stand Characteristics

Dry site species but gets best development on relatively moist, well-drained soils.

Light demanding species which does not reproduce naturally under low light intensity.

Root competition can not be tolerated.

Generally grows in pure stands. Douglas-firs occur as scattered trees in pine stands as well as in pure patches and stands on north-facing slopes and along streams.

Includes minor species of Douglas-fir, pinyon pine, juniper, and limber pine.

Windfall is not a serious problem.

Fire tolerance is low. Although old, mature, thick barked trees are highly resistant to light ground fires, old trees are killed or severely damaged by severe crown fires. Seedlings and small saplings are killed by light ground fires. Fire is not needed for seedbed preparation, but may be beneficial to reduce a heavy litter layer which would hamper seed germination.

Regeneration - Small quantities of seed are produced annually but large crops are released only at intervals of 3-5 years. Germination is as high as 50% in nature. Seedlings can exist under canopy of parent trees but grow quite slowly (only 3-4 feet during first 15-20 years). Reproduction is best in clearings made by fire or logging. There must be abundant seed supply and plenty of moisture for 2 or 3 years in a row to get reproduction. These conditions occur only once in every 20 years and then only in restricted localities.

Growth is slow but does respond well to thinning operations (release).

Destructive agents - Lightning, high winds, dwarf mistletoe, and mountain pine beetle have been the main causes of mortality. The oldest and least vigorous trees are the most susceptible. Other problem causing agents include ips beetles, pine needle miner, pine tip moth, pine budworm, western red rot, porcupines, deer, and small rodents. High rodent populations were found to be a major obstacle to establishment of natural regeneration.

Management - The principal forest values derived from the Montane Zone relate to beauty of the landscape and to various forms of outdoor recreation. Mountain communities located here rely on these values for existence. Tree management normally is not a tool to obtain maximum production of wood products. Instead, it is a means of

reducing the damage from mountain pine beetles, dwarf-mistletoe, and other agents that can lower the attractiveness and usefulness of the zone. It can be utilized to increase and perpetuate the values of landscape, wildlife, livestock forage production, recreation, and employment.

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DOUGLAS-FIR

(Pseudotsuga Menziesii)

Douglas-fir is the most important tree in the United States. It produces more lumber than any other species. The Rocky Mountain form is somewhat smaller than the Pacific Coast form, but can still be a very large tree. In Colorado, it may reach heights of 130 feet and diameters of three feet. It grows in pure and mixed stands and, in Colorado most frequently associates with ponderosa pine and lodgepole pine. Douglas-fir can grow in shaded conditions and so, in many stands, is replacing the pine overstory. It grows from about 6,000 to 10,000 feet in Colorado. Douglas-fir is a shallow-rooted species and so, subject to windthrow unless cuts are carefully planned.

Leaves - needles 3/4 to one inch long; yellow-green or blue-green, light-colored under sides.

Cones - 2½ to 3½ inches long, having a 3 tined bract (protrusion) coming out from under each scale.

Bark - smooth and white to gray on young trees, reddish brown to dark brown and heavily ridged on older trees.

APPENDIX 2

INSECTS AND DISEASES

Service-In-Action
Mountain Pine Beetle 5.528 (Revised)
By David A. Leatherman
Colorado State Forest Service
(491-6303)

QUICK FACTS

... Mountain pine beetle (MPB) is the most important insect pest of Colorado's pine forests, often killing large numbers of trees annually during outbreaks.
... MPB is the subject of Teletips #1705, a recorded phone message.
... Trees under stress from various causes such as old age, crowding, poor growing site, and mechanical damage are most likely to be attacked.
... Short-term controls include spraying, burning, and peeling, while long-term remedies include various forest management practices like thinning.
... Preventive sprays are available to protect green unattacked trees.

Mountain pine beetle, Dendroctonus ponderosae Hopkins, is native to western pine forests and is periodically epidemic in Colorado. Millions of trees have been killed during recent outbreaks. MPB infestations develop irrespective of property lines, being equally evident in wilderness areas, mountain subdivisions, and urban back yards. Even windbreak pines many miles from the mountains can succumb to beetles imported in materials like firewood.

Common Names

Mountain pine beetle, MPB, Black Hills beetle, Rocky Mountain pine beetle.

Colorado Host Trees

Commonly attacked and killed: ponderosa pine, lodgepole pine, Scots (Scotch) pine, and limber pine.

Occasionally attacked and killed: bristlecone pine and pinon pine.

Rarely attacked and killed: Austrian pine and other pines not mentioned above.

Life cycle: This bark beetle has a one-year life cycle in Colorado. In late summer adults leave the dead, brown-needled trees in which they developed and attack living, green trees. After tunneling just beneath the bark and mating, female beetles each lay about 75 eggs in vertical tunnels called egg galleries. Soon these eggs hatch into larvae which feed outward from the vertically-oriented egg gallery. Larvae overwinter in infested trees. Most larval feeding occurs in spring, with transformation (pupation stage) into the adult stage occurring in early summer. Emergence of new adults can begin in early July and may continue through September. However, the great majority of beetles exit trees during late July (lodgepole pine) and mid-August (ponderosa pine). All control efforts should, of course, be completed prior to beetle emergence. Upon emerging, beetles attack living trees, often in mass, and the cycle begins anew.

A key part of this cycle is the beetle's role in transmitting bluestain fungi. Spores of these fungi contaminate the bodies of all MPB (and many other bark beetle species) and are introduced into trees during attack. Beetle attacks are successful only when both larval and fungal development progress. Thus, the network of beetle

galleries plus growing bluestain act together to disrupt the tree's water transport system. Rapid tree death results.

Signs and symptoms of attack:

1. Popcorn-shaped masses of resin called pitch tubes on trunk (may be brown to white in color).
2. Boring dust in bark crevices and around tree's base.
3. Bluestained sapwood (check at more than one point around tree's circumference).
4. Characteristic MPB galleries beneath bark.
5. Evidence of woodpecker feeding on trunk (patches of bark removed, bark flakes laying on ground or snow below tree).
6. Fading or browning of entire tree crown (usually 8 - 10 months after successful MPB attack).
7. Live MPB eggs, larvae, pupae and/or adults in galleries under the bark.

Finding live stages of MPB actively feeding as in the last symptom (7), is by far the most certain indicator a tree is infested and needs attention. Thus, a hatchet for removing bark is needed to check trees correctly.

CONTROL

... Natural: Woodpeckers, certain insects and other natural agents, and extreme weather all exert at least partial control on MPB populations. However, if forest or tree conditions are favorable for beetle outbreaks these checks are not capable of keeping populations at low levels.

... Physical and mechanical: Burning (log decks or as firewood), peeling, some types of milling, exposing to solar radiation, and burying can all be effective treatments. Some of these obviously waste the wood resource.

... Chemical: Remember to READ AND FOLLOW ALL LABEL INSTRUCTIONS WHEN USING ANY PESTICIDE. The current status of chemicals for direct use in killing MPB within infested trees or logs is confusing. Formerly approved materials, like ethylene dibromide (EDB), cacodylic acid (Silvisar 510), and lindane are now completely banned, unavailable, or restricted to use by certain individuals in certain situations. Consult a local CSFS or Cooperative Extension Service office for current information on chemical control options.

PREVENTION

... Cultural: Forest management practices, such as thinning, which increase the vigor of potential host trees, are the best long-term approach to minimizing MPB losses. Consult a professional forester for assistance in deciding which prescription is best for your land.

... Chemical: Certain formulations of carbaryl are registered for early summer spraying of live, green pines to prevent MPB attack. These products go by several trade names. Read the label for application instructions. This

preventive is quite effective through one MPB flight period per application. In lodgepole pine areas, recent evidence indicates one spraying may provide satisfactory protection through two flights (two years).

MISCELLANEOUS INFORMATION

... Once MPB has successfully infested a tree, nothing practical can be done to save that particular tree.

... Under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill about two same size trees the following year.

... Ips and related beetles which emerge early in summer are often mistaken for MPB, leading to early reports of "MPB is flying." Be sure to properly identify the beetle you find before sounding the alarm.

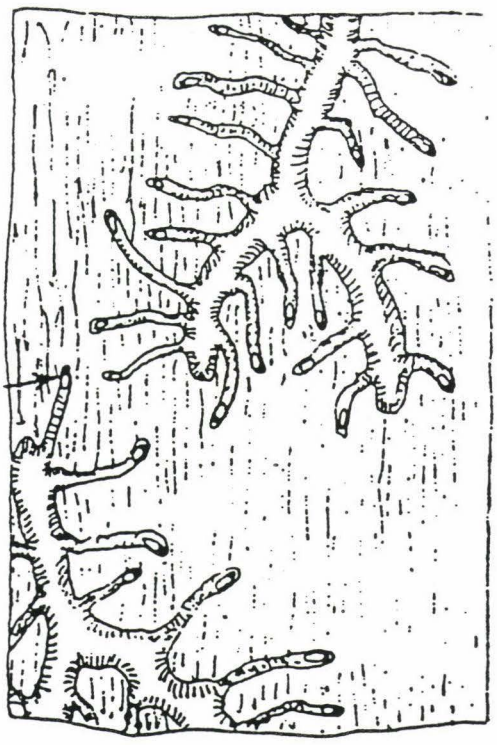
... Trees from which MPB have already emerged (look for numerous, round, pitch-free exit holes in bark) do not need to be treated.

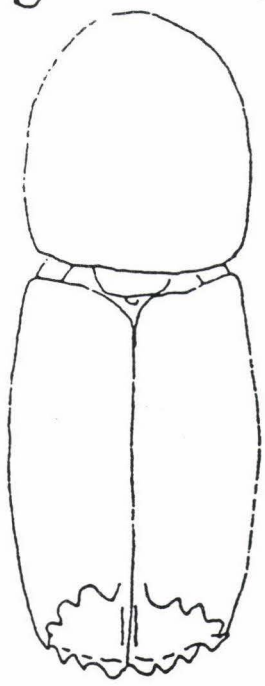
... The direction and spread rate of a beetle infestation is virtually impossible to predict. However, attacked trees/groups are usually adjacent or near previously killed trees/groups.

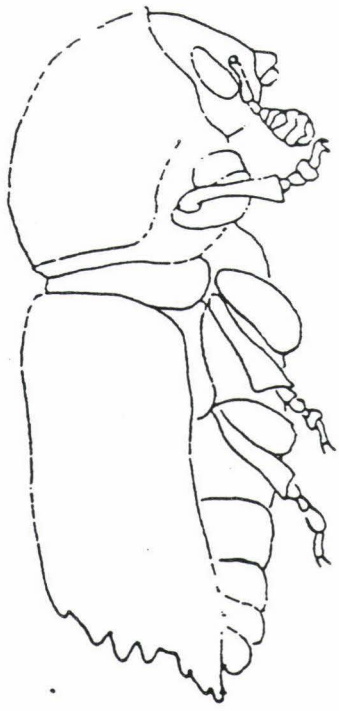
... Special lures, called pheromones, are now being used in some areas to attract and concentrate beetles into trees where some method of managing them is more feasible.

David A. Leatherman
Entomologist
Colorado State Forest Service

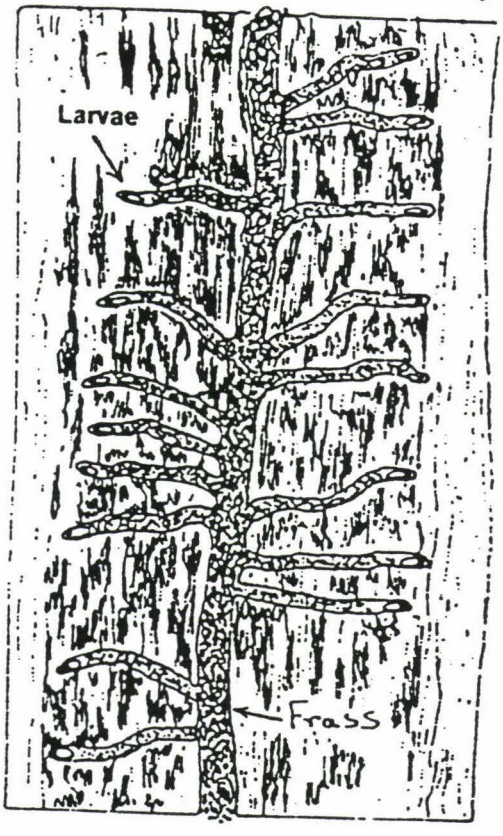
IPS

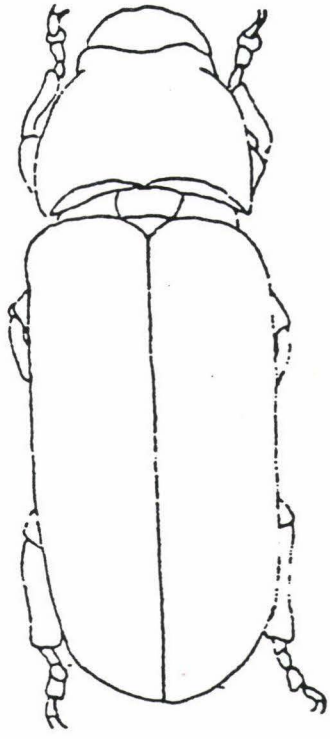


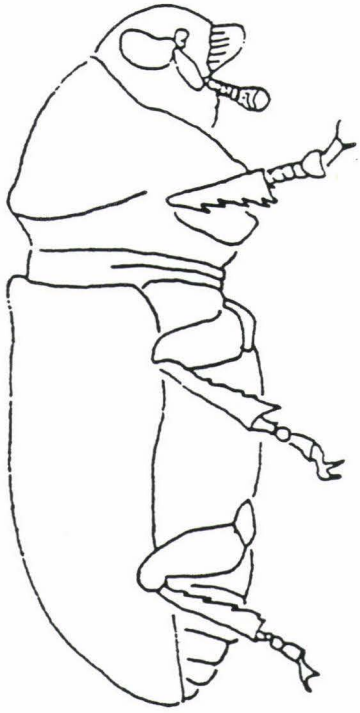




MPB







Drawings By Alan Babcock, CSFS

DOUGLAS-FIR BEETLE

The Douglas-fir beetle (Deudroctonus pseudotsugae) has developed since the late 1970's into a major pest of Douglas-fir throughout the Front Range of Colorado. This has happened as a result of the continued large-scale defoliation of Douglas-fir stands by Western spruce budworm. Continued defoliation has weakened the Douglas-fir, making them susceptible to attack.

The beetle is a small, shiny black insect about the size of a match head. It is similar in appearance to mountain pine beetle, and has a similar mode of attack.

Life Cycle

The Douglas-fir beetle has a one-year life cycle. In early June the adult beetles swarm and attack living trees. They bore into the trees, breed, and lay eggs just beneath the bark. The eggs soon hatch, and larvae tunnel under the bark as they feed on the cambium. Larvae pupate and become adults by the end of summer, although some larvae will wait until the next spring to complete the life cycle. When winter comes, the immature adults (and larvae) go into a cold-hardy condition of dormancy. In late spring the beetles break dormancy and resume feeding. The brownish adults darken as they mature, emerge from the bark in early June, and the cycle continues.

Hosts

Douglas-fir beetle attacks Douglas-fir only. Trees most susceptible to attack are over mature, crowded, damaged, or otherwise unhealthy. A healthy tree exudes enough resin, or sap, to "pitch out" the beetle as it tries to bore in, much the same way bleeding washes a wound clean. Trees are killed by a combination of two things; the girdling effect of the beetles' tunneling and the blue-stain fungus (Ceratocystis) carried by the beetle into the tree. This fungus blocks off the water conducting tissue to the crown and the beetle galleries block off the food carrying tissue to the roots. Thus, the tree dies due to lack of water and food.

Infestations usually occur in trees damaged by windfalls, fire-scorch, or defoliation. Where susceptible trees are abundant, the beetle population can build up rapidly and spread to adjacent green timber. Damage is greatest in dense stands of mature Douglas-fir. Tree susceptibility to attack is also linked to drought or root disease.

Symptoms of Successful Attack

1. Boring dust in bark crevices and around tree's base.
2. Blue-stained sapwood (check at several points around the trunk).
3. Characteristic Douglas-fir beetle galleries beneath the bark.

4. Evidence of woodpecker feeding, such as patches of outer bark removed.
5. Fading or turning red of the entire tree crown, which usually occur 8-10 months after infestation.
6. Live Douglas-fir beetle eggs, larvae, pupae, and/or adults in the galleries.

By far the best indications of successful attack are the presence of blue-stain fungus and beetle eggs, larvae, papal, or adults. To check for this, gently chop into the bark 8-10 inches above the entry hole, peel the bark back, and look for symptoms.

Control

Infested trees must be cut down and the larvae killed or they will infest more trees, at least two new trees for each infested tree. Logs can be burned, peeled (exposing the larvae to the sun), debarked and milled, or treated chemically. Care must be taken in each method to make sure that the larvae are actually killed. The two most common treatments are milling by an authorized mill and spraying with lindane (the only effective spray available to private landowners). Any treatment of currently infested trees must be done before the beginning of June, or it will be in vain.

By far the best method of beetle control involves prevention. Forest management for healthy Douglas-fir stands will minimize damage done by Douglas-fir beetle. Also, mixed stands of several species (such as Douglas-fir and ponderosa pine instead of pure Douglas-fir) are much more resistant to beetle attack. Thus, areas to be replanted should be replanted with several species. There is also a preventative spray (containing carbaryl) which can be used on high value trees, especially around homesites.

DISEASES

DWARF MISTLETOE

Dwarf Mistletoe is a parasitic plant that severely weakens and sometimes kills its host trees, ponderosa pine and lodgepole pine. Normally, different species of mistletoe affect ponderosa pine and lodgepole pine. The parasite (Arceuthobium americanum), usually infecting ponderosa pine but occasionally attacking lodgepole pine, greatly reduces the growth of an infested tree. It also limits cone production and thus, reproduction. Dwarf mistletoe infestation also increases susceptibility to other forest pests, especially the Mountain pine beetle.

Life Cycle

Dwarf mistletoe has a six-year life cycle. It flowers in the spring. Seeds mature in August and September, a year later. Upon maturing, the seeds are released explosively. Water pressure can expel them at velocities up to 50 feet per second and distances up to 66 feet. The average distance is closer to 20 feet. The seeds are covered with a sticky material and adhere to whatever they touch. If one lands on a pine needle. it will be washed to the base of the needles by rain, where it will sprout and send a shoot into a branch. Three to six years later, shoots appear on the branch of the tree. These shoots usually produce flowers two years after emergence.

Symptoms of Mistletoe Infection

The most conspicuous symptom of mistletoe infection is the presence of mistletoe shoots in the branches or trunk. Swellings on the branches can be caused by mistletoe shoots that are about to emerge. "Witches brooms", or bunches, contorted growths of branches are often caused by dwarf mistletoe.

Control

Severely infested trees should be cut down and disposed of. Such trees will probably die anyway, and are hazardous because of the possibility of dead branches or tops falling down. By leaving them standing, they will only continue to infest other trees. Patch cuts are recommended in an entire stand that is infested.

Trees not severely infested can be pruned, and will regain some of their health and continue to live. If the shoots occur mostly in the lower parts of the tree, the branches that are infested can be pruned off. All pruned branches should be cut off flush with the trunk. All live branches should be cut off up to and including the highest infected branch. If sufficient live branches remain (1/4 to 1/3 tree height), prune the tree to two feet above the highest infected

branches and brush off shoots arising from the trunk. If replanting is done, a mixed forest should be the goal. Where the pines are intermixed with Douglas-fir, for example, the rate of mistletoe spread will be greatly reduced.

FIGURE 2 Dwarf Mistletoe Rating (DMR) System

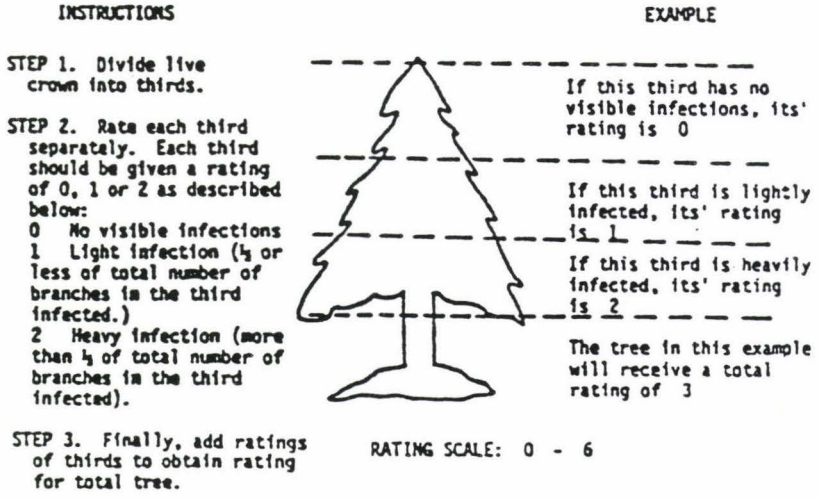


TABLE 3

SOME GENERAL CHARACTERISTICS OF THE MAJOR SPECIES OF DWARF MISTLETOE IN THE ROCKY MOUNTAIN REGION BY HOST TREE

HOST SPECIES (*Arceuthobium*)	CHARACTERISTICS OF DWARF MISTLETOE PLANT				
	SIZE AT MATURITY	COLOR	FLOWERING	SEED MATURITY AND DISPERSAL	GEOGRAPHIC DISTRIBUTION
Ponderosa pine *A. vaginatum* subsp. *cryptopodum*	Stout, normally 4 to 10 inches long; 1/10 to 2/10 inch in diameter	Predominately orange	May to June	Late July to August following year	Common throughout Colorado Front Range & SW Colorado. Not present in the Black Hills or Wyoming
Lodgepole pine *A. americanum*	Very slender and stringy. Mostly 2 to 3 inches long; 1/10 inch in diameter	Usually olive green	April and May	August and September. following year	Common throughout lodgepole pine stands in Region 2.
Douglas-fir *A. douglasii*	Mostly 3/4 to 1½ inches long; less than 1/10 inch in diameter	Usually olive green	Late April to early May	Late September to early October	Southern two-thirds of Colorado
Limber pine *A. cyanocarpum*	Stout normally 1 to 2 inches long; 1/10 inch in diameter	Yellow-green	Late August	Late August to early September	Occasional along Front Range in Colorado; throughout Wyoming
Pinyon *A. divaricatum*	3 to 5 inches long; 1/10 inch in diameter	Olive green to brown	Early August to September	Early September to early November	Western Colorado

RUSTS

Rusts are fungi that invade pines and cause gall and canker formation. Western gall rust (Peridermium larknesii) and commandra blister rust (Cronartium commandrae) are two common diseases of western pines. The gall rusts cause the tree cambium to divide rapidly, much like a cancer, and form galls. These galls kill the parts of the tree which bear them. Both types of rusts may eventually kill the host tree. Cankers on the main trunk of the tree mechanically weaken the tree at that point. Heavy winds will break off the tree at the canker.

Rusts have complex life histories, going through several stages of development. Commandra rust requires a second host, the commandra plant, to complete its life cycle. In both cases, microscopic spores produced by the different lifestages are spread by wind, rain, and animals to the susceptible tissues of the host pines and alternative host plants.

WESTERN GALL RUST:

Hosts: Ponderosa pine and lodgepole pine.

Symptoms: Galls (globose - shaped swellings) produced on branches and twigs cause death of individual branches. Galls on main stems enlarge causing "hip" cankers. Yellow-orange blisters develop on galls during the summer.

Importance: Trunk cankers affect the form, lumber content, and growth rate of their hosts and may kill individual trees, but is not known to wipe out entire stands. The rust infects pines of all ages.

Control Strategy: Removal of infected trees during thinning operations and during intermediate cuts is the only practical way to reduce damage.

COMMANDRA BLISTER RUST:

Hosts: Lodgepole pine and ponderosa pine (Commandra or bastard toadflax, Commandra umbellata are the alternative hosts).

Symptoms: Spindle-shaped cankers on branches and main stem; flagging (fading) of infected branches; top-kill and death of infected trees.

Importance: Commandra rust affects much of the lodgepole pine stands in the Rocky Mountain Region. It causes spiketops and whole-tree mortality, as well as reducing tree growth and lumber content.

Control Strategy: Control is generally aimed at reducing the disease incidence rather than preventing infections. Salvage harvests of heavily infected stands should be done while the trees are still usable. Trees with commandra rust and dwarf mistletoe should be removed first. Trees with multiple stem cankers, spike tops, and girdling stem cankers in the lower crown of the tree should be discriminated against during any timber stand improvement work.

APPENDIX 3

MANAGEMENT ALTERNATIVES

CLEARCUT

Clearcut: Removal of all trees within a stand, providing an open area for natural or artificial regeneration of stand.

A. Age of trees -- Even-aged.

B. Rotation -- Definite period, mature stand is cut at some given age.

C. Cutting --

1) Size of cutting depends on economics, species characteristics, site characteristics (slope, exposure, wind, etc.), and aesthetic and wildlife considerations. Cuts in size of 1-10 acres are generally called "patch" cuts. Larger sizes are possible, and are called clearcuts.

2) Select area of stand, or entire stand, to be cut. All trees, including non-commercial (unusable) trees, are cut. Commercial wood is removed, uncommercial wood is either removed or left on site. All trees are cut to eliminate competition to regeneration.

3) Tops, limbs, and unusable wood, also called "slash", are treated. Treatment can occur as lopping and scattering slash throughout the stand, or by piling and burning slash. Burning can be done in smaller piles scattered throughout the area, or in larger piles or windrows. Burning is generally done with snow cover present.

Lopping and scattering is done to increase decomposition rates, and to allow cones in the slash to distribute seed throughout the area for natural regeneration. Decomposing slash returns nutrients to the site very gradually, and helps protect the site. Piling and burning removes slash from the site immediately, but does not return as many nutrients to the site.

4) Natural or artificial regeneration are used to replace the harvested stand. Natural regeneration can occur from seed distributed by slash, of from adjacent stands. Artificial regeneration is accomplished by seeding or planting seedlings.

D. Results -- Creates openings in forest cover. Size and area of cutting is determined by management objectives. The stand will be even-aged.

Advantages

A. No competition from other trees to reproduction.

B. Operations easiest to design and administer.

C. No damage to residual stand or reproduction.

D. Cost of logging lowest of any method.

E. Profit is maximized with this system.

F. Some species will not regenerate without this type of system, such as aspen.

G. May produce large amounts of regeneration in some species, i.e., lodgepole pine.

H. Can be used to develop wildlife habitat, by increasing browse and forage material in cut areas.

Disadvantages

A. Large amount of slash disposal.

B. Aesthetically displeasing, i.e., "messy-looking."

C. Not suitable for shade tolerant species.

D. Regeneration may be limited by harsher site conditions, or by slash in cut area.

SHELTERWOOD

Shelterwood: The gradual removal of an entire stand in a series of partial cuttings which extends over a period of time.

A. Age of trees -- Even-aged, i.e., trees are nearly all the same age.

B. Rotation -- Definite period, mature timber is cut at some given age.

C. Cutting --

1) Cut about one-third of stand, preferably largest trees, to open up entire stand and admit more light, then wait for seed year.

2) After seeding, take out another one-third of stand to make room and light for seedlings; leave the last one-third of stand as an even shelter to protect seedlings against sun, wind, and frost and also to hinder rapid development of weeds and brush.

3) When reproduction is well established and no longer in need of shelter, but is in need of light, last one-third of the mature timber is removed.

In practice the method varies; it may use one or several seed years and may remove the stand in two cuts or in six cuts.

D. Results -- Cuttings usually resemble heavy thinnings. Natural reproduction starts under the protection of the older stand. Within the framework of the shelterwood method, it is possible to achieve wide variation. With long regeneration periods, individual trees of the new stand will have a wide range of age. The stand remains more nearly even-aged than otherwise and is managed as such.

Advantages

A. Reproduction is generally more certain and complete than with clear-cutting and seed-tree methods.

B. Best trees are retained until after regeneration is established.

C. Protects site and aesthetic conditions.

D. Produces better and more timber than selection cutting.

E. Length or rotation shortened; one crop is started before the preceeding one is harvested.

F. Growing space more fully utilized than other methods of regenerating even-aged stands.

G. Operations are more systematic and simpler to administer than those under the selection system.

H. Less slash disposal problems.

I. Shading stimulates decomposition and reduces danger of fire. Partial shading is advantageous in lodgepole stands to reduce danger of over-stocking.

Disadvantages

A. Larger number of residual trees and reproduction is apt to be damaged in logging; these also will impede harvesting operations.

B. Cost of logging is greater than seed-tree or clearcutting.

C. Intolerant species have greater reproduction loss because of increased shading.

D. Cutting poor trees first is financially unattractive.

GROUP SELECTION

Group selection: Removal of a group of mature trees with intent to obtain natural regeneration from seeds produced adjacent to the cut-over area.

A. Age of trees - uneven aged - containing a mixture of even-aged groups rather than a mixture of age classes by single trees.
B. Rotation - Determined by size, i.e., diameter limit.
C. Cutting - One-half to 1 acre in size; stand is cut every 10 years to a growing stock level of 80. Cut removes large "ripe" timber, including all defective, mountain pine beetle, mistletoe infested, or other diseased trees.
D. Reproduction - Clearly defined even-aged aggregations.
E. Results - A stand is created that is more readily adapted to a wider variety of conditions than any other because the ecological requirements of most species can be met within its framework. Stand of all-aged, even-aged groups. If total area occupied by different age, classes can be determined with a fair degree of accuracy, the cut under the group selection method can be regulated by the area as well as by volume.

Advantages.

A. Harvesting cheaper.
B. Less damage to reproduction and residual stand.
C. Reproduction develops in even-aged aggregations, thus reproduction has better form.
D. Less root competition - more reproduction.

E. Wildlife profits from combination of environmental conditions Existing along boundaries between young and older trees.

Disadvantages.

A. Root competition from older trees along perimeters.

B. Competition for soil moisture and nutrients.

Table 1: Growing stock levels for ponderosa pine. Average distance between residual trees in the stand in relation to average stand diameter after thinning to the growing stock levels.

DBH	GSL 40	GSL 60	GSL 80	GSL 100	GSL 120
	(Distance between trees, in feet)				
1.0	11.4	9.3	8.0	7.2	6.6
2.0	12.5	10.2	8.9	7.9	7.2
3.0	13.4	11.0	9.5	8.5	7.8
4.0	14.7	12.0	10.4	9.3	8.5
5.0	15.9	13.0	11.3	10.1	9.2
6.0	17.4	14.2	12.3	11.0	10.0
7.0	18.9	15.4	13.3	11.9	10.9
8.0	20.5	16.7	14.5	13.0	11.8
9.0	22.3	18.2	15.8	14.1	12.9
10.0	24.4	19.9	17.2	15.4	14.1
11.0	26.8	21.9	19.0	17.0	15.5
12.0	29.2	23.9	20.7	18.5	16.9
13.0	31.7	25.9	22.4	20.0	18.3
14.0	34.1	27.9	24.1	21.6	19.7
16.0	39.0	31.8	27.6	24.7	22.5
18.0	43.9	35.8	31.0	27.7	25.3
20.0	48.7	39.8	34.5	30.8	28.1

APPENDIX 4

SLASH DISPOSAL AND FIRE

SLASH DISPOSAL

Slash is a term used to describe the limbs, tops, and branches left from thinning and timber harvesting activities. Slash can add significant volumes of fuel to the forest. These materials can accumulate and can serve as ladder fuels, or can become hot spots, increasing the difficulty of suppressing wildfires. Slash decomposes very slowly in Colorado and proper disposal is essential.

Three treatment methods commonly used are: (1) lopping and scattering;(2) piling and burning; (3) chipping. Proper treatment reduces fire hazard, improves access for humans, wildlife, and livestock, encourages establishment of grasses and other vegetation (including seedling trees in some cases), and improves aesthetics. Size, amount, and location of slash dictates the method of disposal used.

Lopping and scattering is the easiest and cheapest method of disposal, but must be done properly to be effective. Large branches are cut into small sections and scattered over the area. All pieces are cut small enough so all slash is within 12 inches of the ground. (Contact with the ground increases decomposition rates). This method leaves a "messy" appearance to the site for several years, especially if slash is not cut into small enough pieces. Advantages to this method are greater nutrient recovery to the site as slash decomposes, reduced surface erosion, and improved seedling establishment by some species (especially lodgepole pine).

Piling and burning is a quick way to eliminate a large amount of slash at a moderate cost. Burning is done when sufficient snow cover exists to prevent fire spread. Piles are located far enough away from remaining trees to prevent scorching, and should be compact enough to burn easily. The county sheriff and local fire departments must be notified before any burning is done. In some counties, the Public Health Department requires a burning permit be completed before the burning season. A few scattered piles may be left for wildlife use without comprimising wildfire danger.

Pile dimensions will depend upon site specific conditions and manpower, but should be at least 6 feet across by 5 feet high in size (when compacted) to facilitate burning during winter conditions. Piles should be burned during the first winter following cutting for best results. This method requires reentry to the stand, frequently during inaccessable periods, to complete treatment. Cost is slightly higher than lopping and scattering. Adverse weather conditions may delay burning for several years, reducing the effectiveness of this treatment. Advantages to this method are a "clean" site after treatment, improved accessability within the area, and suitable seedbed for seedling establishment.

FOREST SLASH BURNING GUIDELINES FOR LARIMER COUNTY

This handout is designed to be used by forest landowners, land managers, and fire department personnel in Larimer County in planning and conducting safe and effective forest slash burning in woodland situations. It cannot guarantee safety from accidents, unforeseen circumstances, changing burning conditions, or negligent actions of the individual(s) burning slash. By following the intent of these guidelines and common sense, the landowner or forest manager can reduce forest slash accumulations, improve the appearance of their forestland, and reduce wildfire risk on their properties.

Definitions

Slash: The accumulation of limbs, tops, and miscellaneous residue left by forest management activities, such as thinning, pruning, and timber harvesting.

Piling and burning: The treatment of slash by piling the limbs and tops into managable piles. Piles are burned during safe burning conditions, generally during the winter following cutting.

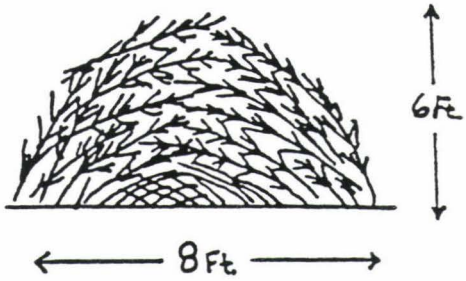
Broadcast burning: The treatment of slash by burning the limbs and tops as they lie on the ground after cutting. The slash must be distributed continuously throughout the burn area to be burned effectively. Burning is generally done during very wet periods or with light snow cover in late fall or early spring.

Mop-up: The final check of the burned slash to identify and extinguish still burning coals or materials. Extinguishment is usually accomplished by covering and mixing snow, water, or soil with the burning fuels.

CONSTRUCTION OF PILES

Pile slash immediately after cutting (while still green), and before winter snowfall. Remove all wood products such as firewood prior to piling. Pile branches and tops with the butt ends towards the outside of the pile, and overlapping so as to form a series of dense layers piled upon each other. Use a mixture of sizes and fuels throughout the pile. This prevents snow from filtering into the pile and extinguishing the fire while it is starting. Piles should be approximately 8 feet across in diameter and 6 feet in height, again to prevent drifting snow from entering the pile. Piles should be kept compact, with no long extensions, to reduce snow filtration and improve ignition. Do not place large stumps and sections of logs in the piles, as they will burn for extended periods and will frequently need to be mopped-up.

Do not include garbage or debris in the pile. Locate piles in meadows, rock outcrops, or openings in forest stands. Do not pile slash over stumps where possible, as these areas will also need to be mopped-up. Piles may be situated within forest stands, if they are at least 5 feet away from adjacent tree trunks and tree crowns do not hang over the piles.



PLANNING YOUR BURNING EFFORT

Landowners must complete the following steps before burning slash:

1. Obtain and have approved a burning permit from the Larimer County Health Department, 363 Jefferson St., Fort Collins, CO 80524, (303)-221-7460.

2. Signed authorization and approval from the legally constituted Fire Protection District for your area of Larimer County, or from the Larimer County Sheriff's Department, Emergency Services Section.

Burning permits consist of 3 parts, and require the completion of information about the proposed burning. Upon completion of the permit and approval of the Health Department, approval from the responsible fire authorities is required. Upon their approval, the white copy of the permit is retained by the landowner, the yellow copy is given to the responsible fire protection agency, and the pink copy is returned to the Health Department.

The landowner must notify the responsible fire protection agency the day burning is planned (see attached list). Notification of the Larimer County Sheriff's Department , at 221-7141 or 221-7142, is also mandatory and should include the dates, times, and an exact legal description of the burn location. Neighbors should be informed prior to burning as well.

Burning must be done during suitable weather conditions. Periods of snow or light rain, with light winds (for smoke dispersal) and sufficient snow cover (6-12 inches) are ideal. Do not burn during periods of high winds, low humidity or drying conditions, temperature inversions, and lack of snow cover or when these conditions are expected to develop after starting. Control of burning slash must be maintained at all times to reduce wildfire hazard and damage to residual trees. If snow cover becomes sparse during the burning period, additional water sources must be provided for wildfire control and mopping-up efforts. Persons conducting the burning should have at a minimum: leather gloves; shovels and mattocks; leather work boots; work clothing; masks or bandanas for covering the mouth and nose; and proper eye protection.

BURNING SLASH PILES

Piles may be ignited by several means. If the needles and fine fuels within the pile have dried out throughout the summer, then ignition can be easily started with a large ball of newspaper placed within the bottom of the pile. If fuels are still partially green, or the pile is wet from rain or melting snow, then a hotter and longer burning source may be necessary. Sawdust, saturated with diesel fuel and placed within the bottom of the pile, can be used. Flares used for highway emergencies can also be utilized to ignite the piles. Do not use gasoline for this purpose!

One pile should be burned first as a test pile to see how it burns and at what rate prior to igniting other piles. If suitable burning conditions exist, then additional piles may be started. Ignite only those piles that can be watched with the available manpower until the piles have burned down. Depending on weather conditions, pile size, and moisture content of the fuels, piles should burn down in 20 to 35 minute. As a general rule, 3 to 6 piles per person is a managable rate if piles are closely situated.

After the piles have burned down, repile any unburned slash and large wood chunks (called "chunking-in") into the beds of coals before starting any new groups of piles. Do not start any new piles after 2:00 pm. Piles started after this time may continue to burn into the evening and may not burn completely if temperatures drop and relative humidity rises. Additionally, burning piles may need to be mopped-up if weather conditions will not extinguish the piles or the fires pose a hazard. If high winds or warming (and drying) conditions are predicted, then burning piles must be mopped-up.

If landowners have questions about possible problems with burning slash, they should contact the Larimer County Sheriff's Department, Emergency Services Section at 221-7118, or the Colorado State Forest Service, Fort Collins District Office at 491-8660. Information about wildfire hazard reduction for forestland is available from the Fort Collins District, CSFS at 491-8660.

Prepared by the Larimer County Sheriff's Department, Emergency Services Section and the Colorado State Forest Service, Fort Collins District, 2/1/87

TABLE 1: Fire Behavior and Vegetation Characterizing Fire Hazard Classes

Timber Density	Hazard Class	Expected Fire Behavior	Vegetation (Fuel)
None	0	None	None (open water, bare rock, cultivated field, etc.)
< 35% Conifer Crown Coverage	A	Low Intensity - Short Duration Flames 5' high, higher flareups rare; duration of highest flames brief; fire spread slow to fast, 1-40 acres per hour; spotting generally rare, short range.	Grass, weeds, brush ≤ 2 feet high, deadwood in contact with ground; open conifer stand may be present; includes aspen, cottonwood, willow, grassland, brush other than oak, sage or ceanothus; becomes Class B if slash or ladder fuel is present. Consider slope.
35 - 55% Conifer Crown Coverage	B	Moderate Intensity - Longer Duration. Intermittent flareups occuring to many feet above tree tops; short and medium-range spotting common; behavior between flareups as in Class A.	Medium density conifer stands; surface fuel mainly herbage and litter; some patches of reproduction and deadwood; becomes Class C if slash or ladder fuel is present. Consider slope.
> 55% Conifer Crown Coverage	C	High Intensity - Long Duration Flareups higher than trees frequent to continuous; spread up to several hundred acres per hour; fire front impassable; spotting several hundred yards common, possible to a mile or more.	Dense conifer stands with any surface fuel; medium-density stands with Class X fuels or much deadwood from blowdown, bug-kill, or logging. Consider slope.
Gambel Oak, Sage Brush, etc. < 35% Conifer Crown Coverage	X	High Intensity - Medium Duration Flames 5-20' high, of brief duration; fire spread usually fast, at least 40 acres per hour; short range spotting common from blowing leaves.	Dense to moderatly dense flammable vegetation over 2 feet high, including Gambel oak (in fall), big sagebrush, conifer reproduction; abundant litter and/or herbaceous fuel; scattered conifer stand may be present.

APPENDIX 5

WILDLIFE

--SNAGS FOR WILDLIFE : MANAGEMENT GUIDELINES--

Numerous species of birds and mammals are dependant upon snags and den trees during part of their life cycle. In addition, snag and den trees are used by large numbers of insects, fungi, plants, and animals. These trees are important components of the ecosystem and must be accommodated in forest management. The increased demand for fuelwood and other wood products in recent times underscores the concern for maintaining these trees as part of the wildlife habitat. Land managers and owners should be aware of the importance of providing snag and den trees for wildlife.

Snags are standing dead or partially dead trees, at least 6 inches diameter at breast height (dbh) and 10 feet in height. Since large diameter snags meet the needs of many more wildlife species than smaller snags, value ratings of snags for wildlife are described below:

Rating	Diameter	Height
Excellent	20 inches plus	40-50 + feet
Good	15-19 inches	40-50 + feet
Fair	10-14 inches	15-40 feet
Poor	6 - 9 inches	10-20 feet

Den trees are trees possessing a cavity large enough to serve as a shelter for birds and mammals, or as a den site to give birth and raise young. Den trees generally must be 15 inches dbh or larger and have a cavity opening of 4 inches in diameter or more. Snag Replacements are trees, such as a cull tree (of no commercial value), which is selected to be retained on the site to produce a future snag tree.

Providing a continuing supply of good to excellent quality snag and den trees, distributed over time of management and over the whole area of management, should be a management goal on forestland. This distribution of snags and den trees is essential to maintain self-sustaining populations of all snag and cavity dependent wildlife species. In areas where good to excellent quality snag and den trees are lacking, poorer quality snags will have to be retained until larger diameter or taller trees develop.Some objectives for woodland managers and landowners to strive for in snag and den trees follow:

Den Trees

1. Managers should leave a minimum of one 15-inch or larger den tree per in all types of cuts.
2. Within 300 feet of bodies of water, at least two useful cavity trees per acre should be retained.
3. In addition, one tree per acre showing potential for development into a den tree should be retained.

Snag Trees

1. Retain a minimum of 4 excellent to good quality snags per acre. Den trees outlined above will serve as snag replacements.
2. Within 300 feet of openings and water, manage to provide 6 excellent to good quality snag trees per acre.

These recommendations are intended to help reach the goal of maintaining wildlife species dependant on snag and den trees. It may not be possible to have these den and snag trees evenly distributed over every acre. However, an even distribution over the entire management area is most desirable.

Adapted from: "Snags for Wildlife:Management Guidelines", by Doug Blodgett, in The American Tree Farmer Magazine, January-February 1986.

APPENDIX 6

CRUISE DATA

50TH ANNIVERSARY

PROGRAM RMCRUZ

STAND: GRAVES1

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	0	31	0	0	0	0	0	0	0	0	0 31
CUVOL	4	0	26	0	0	0	0	0	0	0	0	0 26
SCRIB	4	0	386	0	0	0	0	0	0	0	0	0 386
STEMS	6	0	37	0	0	0	0	0	0	0	0	0 37
CUVOL	6	0	86	0	0	0	0	0	0	0	0	0 86
SCRIB	6	0	312	0	0	0	0	0	0	0	0	0 312
STEMS	8	10	11	75	0	0	0	0	0	0	0	0 96
CUVOL	8	35	44	395	0	0	0	0	0	0	0	0 474
SCRIB	8	81	89	690	0	0	0	0	0	0	0	0 861
STEMS	10	0	0	72	6	0	0	0	0	0	0	0 78
CUVOL	10	0	0	552	70	0	0	0	0	0	0	0 622
SCRIB	10	0	0	1330	233	0	0	0	0	0	0	0 1564
STEMS	12	0	0	16	21	0	0	0	0	0	0	0 38
CUVOL	12	0	0	189	308	0	0	0	0	0	0	0 497
SCRIB	12	0	0	640	1161	0	0	0	0	0	0	0 1802
STEMS	14	0	0	3	0	4	3	0	0	0	0	0 11
CUVOL	14	0	0	68	0	90	109	0	0	0	0	0 267
SCRIB	14	0	0	287	0	386	503	0	0	0	0	0 1177
STEMS	16	0	0	0	2	0	5	0	0	0	0	0 8
CUVOL	16	0	0	0	76	0	222	0	0	0	0	0 298
SCRIB	16	0	0	0	341	0	1060	0	0	0	0	0 1401
STEMS	22	0	0	0	0	0	1	0	0	0	0	0 1
CUVOL	22	0	0	0	0	0	103	0	0	0	0	0 103
SCRIB	22	0	0	0	0	0	518	0	0	0	0	0 518
TOTAL												
STEMS		0	10	80	167	30	4	10	0	0	0	0 303
CUVOL		0	35	157	1205	455	90	435	0	0	0	0 2378
SCRIB		0	81	789	2949	1736	386	2081	0	0	0	0 8025

STAND: GRAVES1
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
303	148	9.5	42	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TRE ES/PT. = 7

OGRAM RMCRUZ

AND: GRAVES2

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	55	9	0	0	0	0	0	0	0	0	0 64
VOL	4	17	12	0	0	0	0	0	0	0	0	0 30
CRIB	4	290	55	0	0	0	0	0	0	0	0	0 346
TEMS	6	28	62	52	4	0	0	0	0	0	0	0 148
VOL	6	30	106	147	20	0	0	0	0	0	0	0 305
SCRIB	6	262	499	532	40	0	0	0	0	0	0	0 1335
TEMS	8	14	37	67	23	0	0	0	0	0	0	0 143
UVOL	8	36	145	339	153	0	0	0	0	0	0	0 674
SCRIB	8	116	301	585	306	0	0	0	0	0	0	0 1309
TEMS	10	2	16	26	28	0	0	0	0	0	0	0 73
CUVOL	10	8	107	228	274	0	0	0	0	0	0	0 619
CRIB	10	16	223	624	829	0	0	0	0	0	0	0 1694
STEMS	12	1	1	11	11	1	0	0	0	0	0	0 28
CUVOL	12	9	15	135	170	29	0	0	0	0	0	0 359
CRIB	12	13	40	461	648	124	0	0	0	0	0	0 1288
STEMS	14	0	0	1	6	1	0	0	0	0	0	0 8
UVOL	14	0	0	20	125	31	0	0	0	0	0	0 176
CRIB	14	0	0	82	531	141	0	0	0	0	0	0 755
STEMS	16	0	0	0	0	0	2	0	0	0	0	0 4
UVOL	16	9	0	20	0	0	101	0	0	0	0	0 131
SCRIB	16	31	0	90	0	0	476	0	0	0	0	0 598
TEMS	20	0	0	0	0	1	0	0	0	0	0	0 2
UVOL	20	0	0	0	0	85	35	0	0	0	0	0 121
SCRIB	20	0	0	0	0	417	176	0	0	0	0	0 594
TEMS	22	0	0	0	0	0	1	0	0	0	0	0 2
CUVOL	22	0	0	0	22	31	103	0	0	0	0	0 158
SCRIB	22	0	0	0	109	158	518	0	0	0	0	0 786
TEMS	24	0	0	0	0	0	0	0	0	0	0	0 0
CUVOL	24	0	0	0	0	32	0	0	0	0	0	0 32
SCRIB	24	0	0	0	0	161	0	0	0	0	0	0 161
TOTAL												
STEMS	0	102	127	160	75	5	4	0	0	0	0	0 475
CUVOL	0	112	386	891	767	210	240	0	0	0	0	0 2608
SCRIB	0	730	1121	2377	2465	1003	1172	0	0	0	0	0 8871

STAND: GRAVES2
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
475	173	8.2	41	64

OUTPUT SUMMARY

Pts sampled = 11

ES/PT = 8

OGRAM RMCRUZ

STAND: GRAVES3

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	0	254	133	0	0	0	0	0	0	0	0 387
VOL	4	0	107	186	0	0	0	0	0	0	0	0 293
RIB	4	0	0	636	0	0	0	0	0	0	0	0 636
STEMS	6	0	178	22	0	0	0	0	0	0	0	0 200
VOL	6	0	262	75	0	0	0	0	0	0	0	0 337
SCRIB	6	0	446	0	0	0	0	0	0	0	0	0 446
EMS	8	0	15	14	0	0	0	0	0	0	0	0 30
VOL	8	0	62	82	0	0	0	0	0	0	0	0 144
SCRIB	8	0	123	117	0	0	0	0	0	0	0	0 241
EMS	10	0	0	22	0	0	0	0	0	0	0	0 22
CUVOL	10	0	0	155	0	0	0	0	0	0	0	0 155.
SCRIB	10	0	0	406	0	0	0	0	0	0	0	0 406
EMS	12	0	0	7	0	0	0	0	0	0	0	0 7
CUVOL	12	0	0	81	0	0	0	0	0	0	0	0 81
RIB	12	0	0	279	0	0	0	0	0	0	0	0 279
TOTAL												
EMS	0	0	448	199	0	0	0	0	0	0	0	0 648
VOL	0	0	432	581	0	0	0	0	0	0	0	0 1014
SCRIB	0	0	570	1440	0	0	0	0	0	0	0	0 2010

TAND: GRAVES3
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
648	105	5.4	34	0

CRUISE SUMMARY
AF USED = 20 POINTS SAMPLED = 4 AVG. # TRE ES/PT. = 5

[redacted]OGRAM RMCRUZ

[redacted]TAND: GRAVES4

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH	20	30	40	50	60	70	80	90	100	110	120	TOTAL
STEMS 4	14	10	0	0	0	0	0	0	0	0	0	25
[redacted]VOL 4	4	10	0	0	0	0	0	0	0	0	0	14
[redacted]RIB 4	74	176	0	0	0	0	0	0	0	0	0	250
[redacted]TEMS 6	15	35	23	0	0	0	0	0	0	0	0	74
[redacted]VOL 6	14	66	68	0	0	0	0	0	0	0	0	149
[redacted]CRIB 6	73	352	134	0	0	0	0	0	0	0	0	559
[redacted]EMS 8	3	25	14	6	0	0	0	0	0	0	0	50
[redacted]VOL 8	11	91	74	47	0	0	0	0	0	0	0	225
SCRIB 8	29	202	147	130	0	0	0	0	0	0	0	509
[redacted]EMS 10	0	0	15	9	0	0	0	0	0	0	0	24
CUVOL 10	0	0	124	97	0	0	0	0	0	0	0	221
SCRIB 10	0	0	353	316	0	0	0	0	0	0	0	669
[redacted]TEMS 12	0	0	3	7	5	0	0	0	0	0	0	16
CUVOL 12	0	0	43	104	101	0	0	0	0	0	0	248
[redacted]RIB 12	0	0	161	399	417	0	0	0	0	0	0	978
STEMS 14	0	0	1	3	2	2	0	0	0	0	0	9
[redacted]VOL 14	0	0	21	78	66	74	0	0	0	0	0	240
[redacted]RIB 14	0	0	87	336	285	335	0	0	0	0	0	1044
STEMS 16	0	0	2	0	1	0	0	0	0	0	0	4
[redacted]VOL 16	0	0	43	27	33	0	0	0	0	0	0	105
[redacted]CRIB 16	0	0	187	125	156	0	0	0	0	0	0	469
[redacted]TEMS 18	0	0	0	0	3	0	0	0	0	0	0	4
[redacted]VOL 18	0	0	21	28	122	0	0	0	0	0	0	173
SCRIB 18	0	0	94	133	584	0	0	0	0	0	0	813
[redacted]TEMS 20	0	0	0	0	0	0	0	0	0	0	0	1
[redacted]UVOL 20	0	0	0	0	0	35	41	0	0	0	0	77
SCRIB 20	0	0	0	0	0	174	207	0	0	0	0	381
[redacted]TEMS 22	0	0	0	0	0	1	0	0	0	0	0	1
CUVOL 22	0	0	0	0	0	73	0	0	0	0	0	73
[redacted]CRIB 22	0	0	0	0	0	367	0	0	0	0	0	367
[redacted]TOTAL												
STEMS 0	34	71	61	28	12	4	0	0	0	0	0	211
[redacted]UVOL 0	29	168	398	383	324	183	41	0	0	0	0	1529
[redacted]CRIB 0	176	730	1166	1441	1444	877	207	0	0	0	0	6044

[redacted]TAND: GRAVES4
[redacted]ER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
211	93	9	43	86

CRUISE SUMMARY BAF = 20 Pts samples = 15 ES/Pt = 4

PROGRAM RMCRUZ

STAND: GRAVES5

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	65	0	0	0	0	0	0	0	0	0	0 65
VOL	4	31	0	0	0	0	0	0	0	0	0	0 31
SCRIB	4	289	0	0	0	0	0	0	0	0	0	0 289
EMS	6	9	52	11	0	0	0	0	0	0	0	0 73
VOL	6	12	101	19	0	0	0	0	0	0	0	0 133
SCRIB	6	37	225	83	0	0	0	0	0	0	0	0 346
EMS	8	0	26	18	0	0	0	0	0	0	0	0 44
CUVOL	8	0	92	95	0	0	0	0	0	0	0	0 187
SCRIB	8	0	211	151	0	0	0	0	0	0	0	0 362
TEMS	10	0	3	23	23	0	0	0	0	0	0	0 50
CUVOL	10	0	17	179	209	0	0	0	0	0	0	0 406
CRIB	10	0	28	436	597	0	0	0	0	0	0	0 1062
STEMS	12	0	0	11	2	0	0	0	0	0	0	0 13
CUVOL	12	0	0	131	30	0	0	0	0	0	0	0 161
CRIB	12	0	0	450	110	0	0	0	0	0	0	0 561
STEMS	16	0	0	1	1	0	0	0	0	0	0	0 2
UVOL	16	0	0	29	35	0	0	0	0	0	0	0 64
CRIB	16	0	0	127	159	0	0	0	0	0	0	0 287
TEMS	18	0	0	1	0	0	0	0	0	0	0	0 1
UVOL	18	0	0	28	0	0	0	0	0	0	0	0 28
SCRIB	18	0	0	128	0	0	0	0	0	0	0	0 128
OTAL												
TEMS	0	74	82	66	26	0	0	0	0	0	0	0 250
CUVOL	0	43	211	482	275	0	0	0	0	0	0	0 1012
CRIB	0	327	464	1377	867	0	0	0	0	0	0	0 3037

STAND: GRAVES5
ER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
250	75	7.4	37	0

RUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 12 AVG. # TRE ES/PT. = 3

GRAM RMCRUZ

STAND: GRAVES6

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	51	0	0	0	0	0	0	0	0	0	0 51
VOL	4	16	0	0	0	0	0	0	0	0	0	0 16
RIB	4	94	0	0	0	0	0	0	0	0	0	0 94
STEMS	6	29	55	0	0	0	0	0	0	0	0	0 84
VOL	6	26	80	0	0	0	0	0	0	0	0	0 106
RIB	6	141	770	0	0	0	0	0	0	0	0	0 912
EMS	8	29	12	17	0	0	0	0	0	0	0	0 59
VOL	8	66	53	71	0	0	0	0	0	0	0	0 191
SCRIB	8	236	101	141	0	0	0	0	0	0	0	0 479
EMS	10	0	0	36	8	0	0	0	0	0	0	0 44
CUVOL	10	0	0	304	95	0	0	0	0	0	0	0 399
SCRIB	10	0	0	821	310	0	0	0	0	0	0	0 1131
EMS	12	0	5	0	0	0	0	0	0	0	0	0 5
CUVOL	12	0	62	0	0	0	0	0	0	0	0	0 62
RIB	12	0	201	0	0	0	0	0	0	0	0	0 201
STEMS	20	0	2	0	0	0	0	0	0	0	0	0 2
CUVOL	20	0	62	0	0	0	0	0	0	0	0	0 62
RIB	20	0	285	0	0	0	0	0	0	0	0	0 285
STEMS	24	0	0	0	0	1	0	0	0	0	0	0 1
VOL	24	0	0	0	0	121	0	0	0	0	0	0 121
RIB	24	0	0	0	0	610	0	0	0	0	0	0 610
TOTAL												
EMS	0	110	75	53	8	1	0	0	0	0	0	0 250
CUVOL	0	108	259	375	95	121	0	0	0	0	0	0 961
SCRIB	0	472	1358	962	310	610	0	0	0	0	0	0 3714

STAND: GRAVES6
ER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
250	85	7.9	31	0

RUISE SUMMARY
AF USED = 20 POINTS SAMPLED = 4 AVG. # TRE ES/PT. = 4

PROGRAM RMCRUZ

STAND: GRAVES7

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	20	0	0	0	0	0	0	0	0	0	0 20
CUVOL	4	6	0	0	0	0	0	0	0	0	0	0 6
SCRIB	4	62	0	0	0	0	0	0	0	0	0	0 62
STEMS	6	13	39	0	0	0	0	0	0	0	0	0 52
CUVOL	6	10	72	0	0	0	0	0	0	0	0	0 83
SCRIB	6	99	384	0	0	0	0	0	0	0	0	0 483
STEMS	8	0	28	5	0	0	0	0	0	0	0	0 34
CUVOL	8	0	103	25	0	0	0	0	0	0	0	0 129
SCRIB	8	0	229	47	0	0	0	0	0	0	0	0 276
STEMS	10	4	19	22	0	0	0	0	0	0	0	0 46
CUVOL	10	17	109	167	0	0	0	0	0	0	0	0 293
SCRIB	10	34	200	391	0	0	0	0	0	0	0	0 627
STEMS	12	0	3	9	0	0	0	0	0	0	0	0 12
CUVOL	12	0	26	124	0	0	0	0	0	0	0	0 151
SCRIB	12	0	73	451	0	0	0	0	0	0	0	0 524
STEMS	14	1	3	3	0	0	0	0	0	0	0	0 9
CUVOL	14	18	50	63	0	0	0	0	0	0	0	0 131
SCRIB	14	55	180	254	0	0	0	0	0	0	0	0 490
STEMS	16	0	0	7	3	0	0	0	0	0	0	0 11
CUVOL	16	0	0	169	113	0	0	0	0	0	0	0 283
SCRIB	16	0	0	739	517	0	0	0	0	0	0	0 1257
STEMS	18	0	0	1	2	0	0	0	0	0	0	0 3
CUVOL	18	0	0	31	78	0	0	0	0	0	0	0 110
SCRIB	18	0	0	142	369	0	0	0	0	0	0	0 511
STEMS	20	0	0	0	0	0	0	0	0	0	0	0 0
CUVOL	20	0	0	0	40	0	0	0	0	0	0	0 40
SCRIB	20	0	0	0	194	0	0	0	0	0	0	0 194
STEMS	28	0	0	0	0	0	0	0	0	0	0	0 0
CUVOL	28	0	0	0	38	0	0	0	0	0	0	0 38
SCRIB	28	0	0	0	194	0	0	0	0	0	0	0 194
TOTAL												
STEMS	0	40	94	50	7	0	0	0	0	0	0	0 192
CUVOL	0	52	362	581	272	0	0	0	0	0	0	0 1269
SCRIB	0	252	1068	2026	1276	0	0	0	0	0	0	0 4624

STAND: GRAVES7
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
192	94	9.5	34	0

BAF = 20 PTS Sampled = 10 Each pt = 4

GRAM RMCRUZ

ND: GRAVES8

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH		20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	105	81	0	0	0	0	0	0	0	0	0 187
VOL	4	48	56	0	0	0	0	0	0	0	0	0 105
RIB	4	232	234	0	0	0	0	0	0	0	0	0 466
EMS	6	0	61	0	0	0	0	0	0	0	0	0 61
VOL	6	0	110	0	0	0	0	0	0	0	0	0 110
CRIB	6	0	652	0	0	0	0	0	0	0	0	0 652
EMS	8	10	49	29	0	0	0	0	0	0	0	0 88
VOL	8	23	196	162	0	0	0	0	0	0	0	0 382
SCRIB	8	80	394	273	0	0	0	0	0	0	0	0 748
EMS	10	0	4	37	0	0	0	0	0	0	0	0 42
CUVOL	10	0	37	302	0	0	0	0	0	0	0	0 339
SCRIB	10	0	96	770	0	0	0	0	0	0	0	0 866
TEMS	12	0	0	11	0	0	0	0	0	0	0	0 11
CUVOL	12	0	0	138	0	0	0	0	0	0	0	0 138
RIB	12	0	0	493	0	0	0	0	0	0	0	0 493
STEMS	14	0	0	2	2	0	0	0	0	0	0	0 5
VOL	14	0	0	46	50	0	0	0	0	0	0	0 97
RIB	14	0	0	180	211	0	0	0	0	0	0	0 391
STEMS	16	0	0	0	2	0	0	0	0	0	0	0 2
VOL	16	0	0	0	56	0	0	0	0	0	0	0 56
CRIB	16	0	0	0	252	0	0	0	0	0	0	0 252
EMS	18	0	0	1	0	1	0	0	0	0	0	0 3
UVOL	18	0	0	50	0	62	0	0	0	0	0	0 112
SCRIB	18	0	0	234	0	293	0	0	0	0	0	0 527
OTAL												
STEMS	0	115	196	82	4	1	0	0	0	0	0	0 401
CUVOL	0	72	401	699	107	62	0	0	0	0	0	0 1343
CRIB	0	312	1378	1951	464	293	0	0	0	0	0	0 4399

STAND: GRAVES8
ER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
401	111	7.1	34	0

RUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 7 AVG. # TRE ES/PT. = 5

PROGRAM RMCRUZ

STAND: GRAVES9

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH		20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	6	0	81	0	0	0	0	0	0	0	0	0 81
MVOL	6	0	116	0	0	0	0	0	0	0	0	0 116
SCRIB	6	0	548	0	0	0	0	0	0	0	0	0 548
STEMS	8	0	9	27	0	0	0	0	0	0	0	0 36
MVOL	8	0	39	141	0	0	0	0	0	0	0	0 180
SCRIB	8	0	74	243	0	0	0	0	0	0	0	0 318
STEMS	10	0	6	51	11	0	0	0	0	0	0	0 68
CUVOL	10	0	43	425	124	0	0	0	0	0	0	0 593
SCRIB	10	0	95	1123	414	0	0	0	0	0	0	0 1634
STEMS	12	0	0	4	20	0	0	0	0	0	0	0 25
CUVOL	12	0	0	46	316	0	0	0	0	0	0	0 363
SCRIB	12	0	0	155	1221	0	0	0	0	0	0	0 1377
STEMS	14	0	0	3	2	0	0	0	0	0	0	0 6
CUVOL	14	0	0	57	66	0	0	0	0	0	0	0 123
SCRIB	14	0	0	231	289	0	0	0	0	0	0	0 520
STEMS	20	0	0	0	1	0	0	0	0	0	0	0 1
MVOL	20	0	0	0	67	0	0	0	0	0	0	0 67
SCRIB	20	0	0	0	326	0	0	0	0	0	0	0 326
TOTAL												
STEMS	0	0	97	86	36	0	0	0	0	0	0	0 219
CUVOL	0	0	199	671	575	0	0	0	0	0	0	0 1446
SCRIB	0	0	718	1754	2253	0	0	0	0	0	0	0 4726

STAND: GRAVES9
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
219	93	8.8	41	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 6 AVG. # TREES/PT. = 4

PROGRAM RMCRUZ

STAND: GRAVES10

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	6	23	39	0	0	0	0	0	0	0	0	0 62
CUVOL	6	29	54	0	0	0	0	0	0	0	0	0 83
SCRIB	6	200	225	0	0	0	0	0	0	0	0	0 425
STEMS	8	7	45	0	0	0	0	0	0	0	0	0 53
CUVOL	8	15	167	0	0	0	0	0	0	0	0	0 183
SCRIB	8	62	364	0	0	0	0	0	0	0	0	0 427
STEMS	10	0	18	31	0	0	0	0	0	0	0	0 49
CUVOL	10	0	109	229	0	0	0	0	0	0	0	0 339
SCRIB	10	0	175	534	0	0	0	0	0	0	0	0 709
STEMS	12	0	3	9	11	0	0	0	0	0	0	0 23
CUVOL	12	0	28	107	160	0	0	0	0	0	0	0 296
SCRIB	12	0	79	367	599	0	0	0	0	0	0	0 1046
STEMS	14	0	0	2	7	0	0	0	0	0	0	0 10
CUVOL	14	0	0	38	165	0	0	0	0	0	0	0 203
SCRIB	14	0	0	153	704	0	0	0	0	0	0	0 857
STEMS	18	0	0	1	1	0	0	0	0	0	0	0 2
CUVOL	18	0	0	35	46	0	0	0	0	0	0	0 81
SCRIB	18	0	0	158	219	0	0	0	0	0	0	0 377
TOTAL												
STEMS	0	31	106	43	20	0	0	0	0	0	0	0 202
CUVOL	0	44	360	411	371	0	0	0	0	0	0	0 1189
SCRIB	0	262	844	1214	1522	0	0	0	0	0	0	0 3843

STAND: GRAVES10
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
202	88	9	36	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 9 AVG. # TRE ES/PT. = 4

ROGRAM RMCRUZ

STAND: GRAVES11

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	0	69	26	0	0	0	0	0	0	0	0 95
CUVOL	4	0	54	39	0	0	0	0	0	0	0	0 94
SCRIB	4	0	455	99	0	0	0	0	0	0	0	0 555
STEMS	6	24	45	77	0	13	0	0	0	0	0	0 160
CUVOL	6	13	55	191	0	67	0	0	0	0	0	0 328
SCRIB	6	343	461	540	0	287	0	0	0	0	0	0 1633
STEMS	8	0	0	9	44	32	0	0	0	0	0	0 86
CUVOL	8	0	0	51	250	213	0	0	0	0	0	0 515
SCRIB	8	0	0	76	577	428	0	0	0	0	0	0 1081
STEMS	10	0	0	7	7	6	0	0	0	0	0	0 20
CUVOL	10	0	0	53	62	75	0	0	0	0	0	0 191
SCRIB	10	0	0	124	173	287	0	0	0	0	0	0 586
STEMS	12	0	0	0	0	8	0	0	0	0	0	0 8
CUVOL	12	0	0	0	0	155	0	0	0	0	0	0 155
SCRIB	12	0	0	0	0	642	0	0	0	0	0	0 642
STEMS	14	0	0	0	3	0	0	0	0	0	0	0 3
CUVOL	14	0	0	0	69	0	0	0	0	0	0	0 69
SCRIB	14	0	0	0	291	0	0	0	0	0	0	0 291
TOTAL												
STEMS	0	24	114	120	55	60	0	0	0	0	0	0 375
CUVOL	0	13	110	335	382	513	0	0	0	0	0	0 1356
SCRIB	0	343	917	841	1043	1646	0	0	0	0	0	0 4792

STAND: GRAVES11
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
375	86	6.5	44	82

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 6 AVG. # TRE ES/PT. = 4

ROGRAM RMCRUZ

STAND: GRAVES12

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH		20	30	40	50	60	70	80	90	100	110	120 TOTAL
STEMS	6	20	0	17	0	0	0	0	0	0	0	0 37
CUVOL	6	28	0	57	0	0	0	0	0	0	0	0 86
SCRIB	6	314	0	87	0	0	0	0	0	0	0	0 401
STEMS	8	0	0	10	0	0	0	0	0	0	0	0 10
CUVOL	8	0	0	61	0	0	0	0	0	0	0	0 61
SCRIB	8	0	0	87	0	0	0	0	0	0	0	0 87
STEMS	10	0	7	16	20	6	0	0	0	0	0	0 51
CUVOL	10	0	47	132	236	85	0	0	0	0	0	0 502
SCRIB	10	0	86	439	819	302	0	0	0	0	0	0 1646
STEMS	12	0	0	5	10	0	0	0	0	0	0	0 16
CUVOL	12	0	0	60	162	0	0	0	0	0	0	0 222
SCRIB	12	0	0	198	637	0	0	0	0	0	0	0 835
STEMS	14	0	0	3	4	0	0	0	0	0	0	0 7
CUVOL	14	0	0	63	75	0	0	0	0	0	0	0 139
SCRIB	14	0	0	259	314	0	0	0	0	0	0	0 574
TOTAL												
STEMS	0	20	7	54	35	6	0	0	0	0	0	0 124
CUVOL	0	28	47	375	474	85	0	0	0	0	0	0 1011
SCRIB	0	314	86	1072	1770	302	0	0	0	0	0	0 3544

STAND: GRAVES12
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
124	64	9.7	41	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TRE ES/PT. = 3

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 10 AVG. # TRE ES/PT. = 4

OGRAM RMCRUZ

AND: GRAVES13

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	33	39	62	0	0	0	0	0	0	0	0 135
VOL	4	14	16	99	0	0	0	0	0	0	0	0 131
RIB	4	119	124	248	0	0	0	0	0	0	0	0 493
EMS	6	0	147	101	0	0	0	0	0	0	0	0 248
VOL	6	0	243	242	0	0	0	0	0	0	0	0 485
SCRIB	6	0	218	267	0	0	0	0	0	0	0	0 486
EMS	8	0	10	37	0	0	0	0	0	0	0	0 47
VOL	8	0	49	171	0	0	0	0	0	0	0	0 220
SCRIB	8	0	119	386	0	0	0	0	0	0	0	0 506
EMS	10	0	0	8	15	0	0	0	0	0	0	0 24
CUVOL	10	0	0	67	153	0	0	0	0	0	0	0 221
SCRIB	10	0	0	219	554	0	0	0	0	0	0	0 774
TOTAL												
STEMS	0	33	197	210	15	0	0	0	0	0	0	0 456
VOL	0	14	309	580	153	0	0	0	0	0	0	0 1058
RIB	0	119	462	1122	554	0	0	0	0	0	0	0 2259

AND: GRAVES13
ER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
456	96	6.2	35	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TRE ES/PT. = 4

PROGRAM RMCRUZ

STAND: GRAVES14

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	6	23	0	0	14	0	0	0	0	0	0	0 37
CUVOL	6	15	0	0	55	0	0	0	0	0	0	0 71
SCRIB	6	254	0	0	138	0	0	0	0	0	0	0 392
STEMS	8	0	0	12	12	0	0	0	0	0	0	0 24
CUVOL	8	0	0	47	57	0	0	0	0	0	0	0 105
SCRIB	8	0	0	99	138	0	0	0	0	0	0	0 237
STEMS	10	0	0	0	12	0	0	0	0	0	0	0 12
CUVOL	10	0	0	0	126	0	0	0	0	0	0	0 126
SCRIB	10	0	0	0	390	0	0	0	0	0	0	0 390
STEMS	12	0	0	4	4	4	0	0	0	0	0	0 13
CUVOL	12	0	0	47	68	78	0	0	0	0	0	0 195
SCRIB	12	0	0	147	277	325	0	0	0	0	0	0 750
STEMS	14	0	0	0	9	3	3	0	0	0	0	0 16
CUVOL	14	0	0	0	191	76	92	0	0	0	0	0 359
SCRIB	14	0	0	0	807	326	422	0	0	0	0	0 1556
STEMS	16	0	0	0	2	2	0	2	0	0	0	0 7
CUVOL	16	0	0	0	68	82	0	105	0	0	0	0 256
SCRIB	16	0	0	0	307	387	0	493	0	0	0	0 1187
STEMS	18	0	0	0	1	0	3	0	0	0	0	0 5
CUVOL	18	0	0	0	63	0	196	0	0	0	0	0 260
SCRIB	18	0	0	0	283	0	929	0	0	0	0	0 1213
TOTAL												
STEMS	0	23	0	17	57	9	6	2	0	0	0	0 117
CUVOL	0	15	0	95	632	237	289	105	0	0	0	0 1375
SCRIB	0	254	0	247	2342	1039	1351	493	0	0	0	0 5729

STAND: GRAVES14
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
117	70	10.5	50	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 6 AVG. # TREES/PT. = 3

PROGRAM RMCRUZ

STAND: GRAVES15

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH		20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	6	44	0	0	0	0	0	0	0	0	0	0 44
CUVOL	6	45	0	0	0	0	0	0	0	0	0	0 45
SCRIB	6	363	0	0	0	0	0	0	0	0	0	0 363
STEMS	8	0	0	10	0	0	0	0	0	0	0	0 10
CUVOL	8	0	0	54	0	0	0	0	0	0	0	0 54
SCRIB	8	0	0	81	0	0	0	0	0	0	0	0 81
STEMS	10	0	0	15	0	0	0	0	0	0	0	0 15
CUVOL	10	0	0	111	0	0	0	0	0	0	0	0 111
SCRIB	10	0	0	248	0	0	0	0	0	0	0	0 248
STEMS	12	0	11	5	0	0	0	0	0	0	0	0 17
CUVOL	12	0	93	57	0	0	0	0	0	0	0	0 150
SCRIB	12	0	238	181	0	0	0	0	0	0	0	0 419
STEMS	14	0	0	3	0	0	0	0	0	0	0	0 3
CUVOL	14	0	0	60	0	0	0	0	0	0	0	0 60
SCRIB	14	0	0	235	0	0	0	0	0	0	0	0 235
STEMS	20	0	0	2	0	0	0	0	0	0	0	0 2
CUVOL	20	0	0	64	0	0	0	0	0	0	0	0 64
SCRIB	20	0	0	295	0	0	0	0	0	0	0	0 295
STEMS	22	0	0	1	0	0	0	0	0	0	0	0 1
CUVOL	22	0	0	68	0	0	0	0	0	0	0	0 68
SCRIB	22	0	0	331	0	0	0	0	0	0	0	0 331
TOTAL												
STEMS	0	44	11	38	0	0	0	0	0	0	0	0 95
CUVOL	0	45	93	416	0	0	0	0	0	0	0	0 554
SCRIB	0	363	238	1374	0	0	0	0	0	0	0	0 1975

STAND: GRAVES15
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
95	52	10	29	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TREES/PT. = 2

PROGRAM RMCRUZ

STAND: GRAVES16

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	0	0	141	0	0	0	0	0	0	0	0 141
CUVOL	4	0	0	133	0	0	0	0	0	0	0	0 133
SCRIB	4	0	0	854	0	0	0	0	0	0	0	0 854
STEMS	6	0	0	144	45	0	0	0	0	0	0	0 190
CUVOL	6	0	0	316	164	0	0	0	0	0	0	0 480
SCRIB	6	0	0	1426	263	0	0	0	0	0	0	0 1689
STEMS	8	0	0	0	15	11	0	0	0	0	0	0 27
CUVOL	8	0	0	0	87	115	0	0	0	0	0	0 202
SCRIB	8	0	0	0	238	414	0	0	0	0	0	0 652
STEMS	10	0	0	0	18	0	0	0	0	0	0	0 18
CUVOL	10	0	0	0	207	0	0	0	0	0	0	0 207
SCRIB	10	0	0	0	772	0	0	0	0	0	0	0 772
STEMS	12	0	0	0	14	0	0	0	0	0	0	0 14
CUVOL	12	0	0	0	217	0	0	0	0	0	0	0 217
SCRIB	12	0	0	0	871	0	0	0	0	0	0	0 871
TOTAL												
STEMS		0	0	0	285	93	11	0	0	0	0	0 391
CUVOL		0	0	0	449	676	115	0	0	0	0	0 1242
SCRIB		0	0	0	2281	2146	414	0	0	0	0	0 4841

STAND: GRAVES16
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
391	80	6.1	46	92

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 4 AVG. # TREES/PT. = 4

PROGRAM RMCRUZ

STAND: GRAVES17

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
DBH		20	30	40	50	60	70	80	90	100	110	120	TOTAL
STEMS	4	0	25	0	0	0	0	0	0	0	0	0	25
CUVOL	4	0	28	0	0	0	0	0	0	0	0	0	28
SCRIB	4	0	320	0	0	0	0	0	0	0	0	0	320
STEMS	6	23	18	0	0	0	0	0	0	0	0	0	42
CUVOL	6	15	32	0	0	0	0	0	0	0	0	0	48
SCRIB	6	25	379	0	0	0	0	0	0	0	0	0	405
STEMS	8	0	11	0	0	0	0	0	0	0	0	0	11
CUVOL	8	0	31	0	0	0	0	0	0	0	0	0	31
SCRIB	8	0	25	0	0	0	0	0	0	0	0	0	25
STEMS	10	0	0	5	12	18	0	0	0	0	0	0	36
CUVOL	10	0	0	54	123	237	0	0	0	0	0	0	415
SCRIB	10	0	0	194	447	914	0	0	0	0	0	0	1556
STEMS	12	0	0	0	0	9	4	0	0	0	0	0	14
CUVOL	12	0	0	0	0	168	97	0	0	0	0	0	266
SCRIB	12	0	0	0	0	686	407	0	0	0	0	0	1094
STEMS	14	0	0	3	0	6	3	0	0	0	0	0	13
CUVOL	14	0	0	58	0	174	102	0	0	0	0	0	334
SCRIB	14	0	0	240	0	747	448	0	0	0	0	0	1436
TOTAL													
STEMS	0	23	55	8	12	34	8	0	0	0	0	0	142
CUVOL	0	15	92	112	123	579	200	0	0	0	0	0	1124
SCRIB	0	25	725	434	447	2348	856	0	0	0	0	0	4838

STAND: GRAVES17
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
142	56	8.5	51	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 6 AVG. # TRE ES/PT. = 2

PROGRAM RMCRUZ

STAND: GRAVES18

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	57	109	0	0	0	0	0	0	0	0	0 166
CUVOL	4	3	47	0	0	0	0	0	0	0	0	0 51
SCRIB	4	83	312	0	0	0	0	0	0	0	0	0 395
STEMS	6	0	32	177	21	0	0	0	0	0	0	0 231
CUVOL	6	0	40	426	81	0	0	0	0	0	0	0 549
SCRIB	6	0	22	422	144	0	0	0	0	0	0	0 589
STEMS	8	0	0	75	45	0	0	0	0	0	0	0 120
CUVOL	8	0	0	360	262	0	0	0	0	0	0	0 622
SCRIB	8	0	0	857	732	0	0	0	0	0	0	0 1590
TOTAL												
STEMS	0	57	141	253	66	0	0	0	0	0	0	0 519
CUVOL	0	3	88	787	344	0	0	0	0	0	0	0 1223
SCRIB	0	83	334	1280	876	0	0	0	0	0	0	0 2575

STAND: GRAVES18
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
519	105	6.1	37	74

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 4 AVG. # TREES/PT. = 5

PROGRAM RMCRUZ

STAND: GRAVES1

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	6	46	23	0	0	0	0	0	0	0	0	0 69
CUVOL	6	48	37	0	0	0	0	0	0	0	0	0 85
SCRIB	6	-3	75	0	0	0	0	0	0	0	0	0 73
STEMS	8	10	31	9	0	0	0	0	0	0	0	0 52
CUVOL	8	26	129	55	0	0	0	0	0	0	0	0 212
SCRIB	8	87	254	82	0	0	0	0	0	0	0	0 424
STEMS	10	0	0	6	0	0	0	0	0	0	0	0 6
CUVOL	10	0	0	57	0	0	0	0	0	0	0	0 57
SCRIB	10	0	0	153	0	0	0	0	0	0	0	0 153
STEMS	12	0	0	19	0	0	0	0	0	0	0	0 19
CUVOL	12	0	0	259	0	0	0	0	0	0	0	0 259
SCRIB	12	0	0	956	0	0	0	0	0	0	0	0 956
STEMS	14	0	0	8	3	0	0	0	0	0	0	0 11
CUVOL	14	0	0	134	82	0	0	0	0	0	0	0 216
SCRIB	14	0	0	545	358	0	0	0	0	0	0	0 904
STEMS	16	0	0	2	0	0	0	0	0	0	0	0 2
CUVOL	16	0	0	68	0	0	0	0	0	0	0	0 68
SCRIB	16	0	0	299	0	0	0	0	0	0	0	0 299
STEMS	18	0	0	0	2	0	0	0	0	0	0	0 2
CUVOL	18	0	0	0	73	0	0	0	0	0	0	0 73
SCRIB	18	0	0	0	344	0	0	0	0	0	0	0 344
TOTAL												
STEMS	0	57	55	46	5	0	0	0	0	0	0	0 164
CUVOL	0	75	166	575	155	0	0	0	0	0	0	0 973
SCRIB	0	85	330	2038	703	0	0	0	0	0	0	0 3157

STAND: GRAVES1
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
164	84	9.7	31	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TRE ES/PT. = 4

PROGRAM RMCRUZ

STAND: GRAVES20

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120 TOTAL
STEMS	6	18	51	0	0	0	0	0	0	0	0	0 69
CUVOL	6	29	110	0	0	0	0	0	0	0	0	0 139
SCRIB	6	113	887	0	0	0	0	0	0	0	0	0 1001
STEMS	8	0	106	9	0	0	0	0	0	0	0	0 115
CUVOL	8	0	329	55	0	0	0	0	0	0	0	0 385
SCRIB	8	0	848	79	0	0	0	0	0	0	0	0 927
STEMS	10	0	22	0	0	0	0	0	0	0	0	0 22
CUVOL	10	0	140	0	0	0	0	0	0	0	0	0 140
SCRIB	10	0	268	0	0	0	0	0	0	0	0	0 268
STEMS	12	0	15	4	5	0	0	0	0	0	0	0 26
CUVOL	12	0	141	69	71	0	0	0	0	0	0	0 283
SCRIB	12	0	404	264	259	0	0	0	0	0	0	0 928
STEMS	16	0	2	0	0	0	0	0	0	0	0	0 2
CUVOL	16	0	52	0	0	0	0	0	0	0	0	0 52
SCRIB	16	0	214	0	0	0	0	0	0	0	0	0 214
STEMS	18	0	0	0	0	2	0	0	0	0	0	0 2
CUVOL	18	0	0	0	0	93	0	0	0	0	0	0 93
SCRIB	18	0	0	0	0	443	0	0	0	0	0	0 443
STEMS	20	0	0	0	1	0	0	0	0	0	0	0 1
CUVOL	20	0	0	0	81	0	0	0	0	0	0	0 81
SCRIB	20	0	0	0	390	0	0	0	0	0	0	0 390
TOTAL												
STEMS	0	18	198	14	7	2	0	0	0	0	0	0 241
CUVOL	0	29	774	124	153	93	0	0	0	0	0	0 1176
SCRIB	0	113	2623	343	650	443	0	0	0	0	0	0 4173

STAND: GRAVES20
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
241	100	8.7	32	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 5 AVG. # TREES/PT. = 5

PROGRAM RMCRUZ

STAND: GRAVES21

PER ACRE STAND SUMMARY
ALL SPECIES

		HEIGHT CLASS										
	DBH	20	30	40	50	60	70	80	90	100	110	120TOTAL
STEMS	4	47	0	0	0	0	0	0	0	0	0	0 47
CUVOL	4	18	0	0	0	0	0	0	0	0	0	0 18
SCRIB	4	352	0	0	0	0	0	0	0	0	0	0 352
STEMS	6	25	0	0	0	0	0	0	0	0	0	0 25
CUVOL	6	32	0	0	0	0	0	0	0	0	0	0 32
SCRIB	6	-135	0	0	0	0	0	0	0	0	0	0 -135
STEMS	8	0	0	18	0	0	0	0	0	0	0	0 18
CUVOL	8	0	0	75	0	0	0	0	0	0	0	0 75
SCRIB	8	0	0	149	0	0	0	0	0	0	0	0 149
STEMS	10	0	0	0	38	0	0	0	0	0	0	0 38
CUVOL	10	0	0	0	385	0	0	0	0	0	0	0 385
SCRIB	10	0	0	0	1266	0	0	0	0	0	0	0 1266
STEMS	12	0	0	0	14	5	5	0	0	0	0	0 26
CUVOL	12	0	0	0	195	126	136	0	0	0	0	0 457
SCRIB	12	0	0	0	721	540	595	0	0	0	0	0 1858
STEMS	14	0	5	0	8	0	0	0	0	0	0	0 14
CUVOL	14	0	60	0	199	0	0	0	0	0	0	0 260
SCRIB	14	0	203	0	866	0	0	0	0	0	0	0 1070
STEMS	16	0	0	0	7	3	7	0	0	0	0	0 18
CUVOL	16	0	0	0	204	113	263	0	0	0	0	0 581
SCRIB	16	0	0	0	924	527	1235	0	0	0	0	0 2687
STEMS	18	0	0	0	0	2	0	0	0	0	0	0 2
CUVOL	18	0	0	0	0	119	0	0	0	0	0	0 119
SCRIB	18	0	0	0	0	570	0	0	0	0	0	0 570
TOTAL----------												
STEMS	0	72	5	18	69	12	13	0	0	0	0	0 191
CUVOL	0	50	60	75	985	358	399	0	0	0	0	0 1931
SCRIB	0	218	203	149	3779	1638	1830	0	0	0	0	0 7820

STAND: GRAVES21
PER ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
191	105	10	48	0

CRUISE SUMMARY
BAF USED = 20 POINTS SAMPLED = 4 AVG. # TRE ES/PT. = 5

PROGRAM RMCRUZ

PER ACRE STAND SUMMARY
ALL SPECIES

	DBH	HEIGHT CLASS 20	30	40	50	60	70	80	90	100	110	120	TOTAL
[redacted]S	4	39	0	0	0	0	0	0	0	0	0	0	39
[redacted]L	4	9	0	0	0	0	0	0	0	0	0	0	9
SCRIB	4	232	0	0	0	0	0	0	0	0	0	0	232
[redacted]S	6	16	61	48	17	0	0	0	0	0	0	0	143
CUVOL	6	32	108	102	65	0	0	0	0	0	0	0	307
[redacted]B	6	70	187	449	70	0	0	0	0	0	0	0	778
STEMS	8	0	34	13	0	0	0	0	0	0	0	0	47
CUVOL	8	0	135	50	0	0	0	0	0	0	0	0	185
[redacted]B	8	0	246	92	0	0	0	0	0	0	0	0	338
STEMS	10	0	0	16	22	0	0	0	0	0	0	0	38
[redacted]L	10	0	0	137	226	0	0	0	0	0	0	0	363
[redacted]B	10	0	0	431	709	0	0	0	0	0	0	0	1140
STEMS	12	0	0	0	16	0	0	0	0	0	0	0	16
[redacted]L	12	0	0	0	234	0	0	0	0	0	0	0	234
SCRIB	12	0	0	0	902	0	0	0	0	0	0	0	902
[redacted]S	14	0	0	0	3	0	0	0	0	0	0	0	3
[redacted]L	14	0	0	0	82	0	0	0	0	0	0	0	82
SCRIB	14	0	0	0	354	0	0	0	0	0	0	0	354
[redacted]S	16	0	0	3	0	0	0	0	0	0	0	0	3
CUVOL	16	0	0	72	0	0	0	0	0	0	0	0	72
SCRIB	16	0	0	304	0	0	0	0	0	0	0	0	304
TOTAL													
STEMS	0	56	95	80	60	0	0	0	0	0	0	0	293
[redacted]L	0	41	243	361	607	0	0	0	0	0	0	0	1254
[redacted]B	0	303	433	1277	2037	0	0	0	0	0	0	0	4052

[redacted]ND: GRAVES22
[redacted] ACRE SUMMARY

STEMS	BA	DBH	HT	AGE
[redacted]293	92	7.6	38	0

CRUISE SUMMARY
[redacted]AF USED = 20 POINTS SAMPLED = 5 AVG. # TREES/PT. = 4

APPENDIX 7

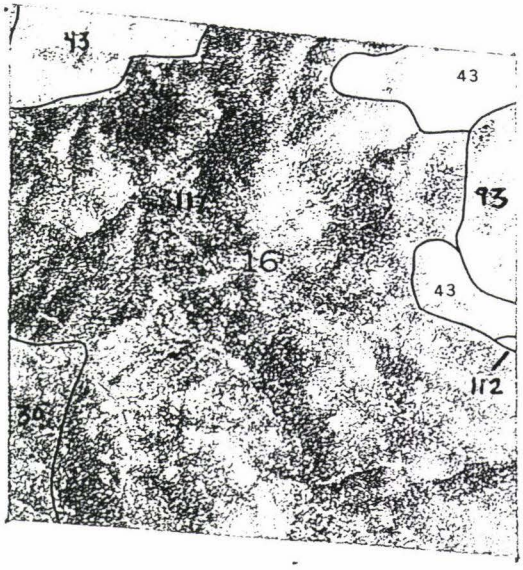
SOILS

SOILS MAP

FROM

US DEPARTMENT OF AGRICULTURE

(LAPORTE QUADRANGLE)



30 - Elbeth-Moen loams, 5 to 30 percent slopes
43 - Haploborolls-Rock Outcrop Complex, Steep
93 - Rock outcrop
112 - Trag-Moen complex, 5 to 30 percent slopes
117 - Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes

SOILS

30 - Elbeth-Moen loams, 5 to 30 percent slopes - Strongly sloping to steep soils on mountainsides and valleysides. Elbeth loams are covered with forest, and Moen loams are in open grassy areas. Runoff is medium to rapid, and hazard of erosion is moderate to severe. These soils are suited to woodland or native grasses, and wildlife habitat.

43 - Haploborolls-Rock Outcrop Complex, Steep - Steep to very steep cool soils and Rock outcrop on mountainsides and fans. Extremely variable, but usually stony and cobbly. Runoff is rapid, and hazard of erosion is severe.

93 - Rock outcrop - Bare or nearly bare rock. Runoff is rapid. The hazard of water erosion is severe on the included soils and in the adjacent areas that receive runoff. Used mainly for wildlife habitat and esthetic purposes.

112 - Trag-Moen complex, 5 to 30 percent slopes -Strongly sloping to steep soils on mountainsides and ridges. Moen loam is on ridges and higher side slopes. Runoff is medium to rapid, and soil erosion hazard is moderate to severe. Soils suited to pasture and native grasses.

117 - Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes - Strongly sloping to very steep soils on mountainsides and ridges. Runoff is rapid, and soil erosion hazard is severe. Soils support forests and native grasses. Rock outcrops are common.

APPENDIX 8

LOCAL MARKETS

LOCAL MARKETS

LOCAL MARKETS

COMPANY/INDIVIDUAL NAME	ADDRESS	PHONE	CONTACT
Louisiana Pacific Walden	PO Box 778 Walden, CO 80480	723-8231	Eric Sorenson
Louisiana Pacific Saratoga	PO Box 809 Saratoga, WY 82331	(307) 326-5241	Dave Slater
Big Horn Lumber Co.	1100 South Pine Laramie, WY 82070	(307) 742-3237	Dean Alexander
Forks Lumber Co.	1920 Westview Rd Fort Collins, CO 80524	493-0625	Dale Moon
Mountain View Lumber Company	3806 S. College Fort Collins, CO 80526	226-5424	Fred Bockman
United Wood Products	7860 Diagonal Hwy Longmont, CO 80501	652-2286	Raul Bustamonte
Colorado Wood Products	1313 W. CR 60E Fort Collins, CO 80524	484-3758	V.O. Augustine
Westridge Forest Products	2000 N. CR 23 Bellvue, CO 80512	482-3227	Ron Sondrup
Elkhorn Lumber Company	RR. # 1, CR 68C Livermore, CO 80536	881-2284	Russel Robinson
Needmore Forest Products	PO Box 326 LaPorte, CO 80535	484-3696	Mark Horvat
Majestic Log Homes	PO Box 772 Fort Collins, CO 80522	224-4857	Brad Burgat
Anson Perina	3900 Bingham Hill Fort Collins, CO 80535	493-5826 (home)	Anson Perina
George & Howard Hersh	237 N Overland Tr Fort Collins, CO 80521	482-8530 (home)	George Hersh

Unless otherwise noted, the area code is (303).

MARKET INFORMATION

COMPANY NAME: Louisiana Pacific, Walden
PRODUCT: Sawlogs
SPECIES USED: LP, ES
PRICE PAID*: $130-150/mbf
MERCHANTABILITY STANDARDS: Lengths:16'-6", 33'-0", 49'-6"
Minimum 6" top diameter

COMPANY NAME: Louisiana Pacific, Saratoga
PRODUCT: Sawlogs
SPECIES USED: LP, ES, SF, PP
PRICE PAID*: $110/mbf
MERCHANTABILITY STANDARDS: Tree length, minimum 5" top diameter

COMPANY NAME: Big Horn Lumber Company
PRODUCT: Sawlogs
SPECIES USED: LP, ES, SF, PP
PRICE PAID*: $76/mbf
MERCHANTABILITY STANDARDS: Tree length, minimum 6" top diameter

COMPANY NAME: Forks Lumber Company
PRODUCT: Sawlogs
SPECIES USED: LP, ES, DF, PP
PRICE PAID*: $140/mbf
MERCHANTABILITY STANDARDS: Tree length, 12"-15" butt diameter

COMPANY NAME: Mountain View Lumber Company
PRODUCT: Sawlogs, Posts & Poles
SPECIES USED: LP, ES, DF, PP
PRICE PAID*: $150/mbf
MERCHANTABILITY STANDARDS: Tree length

COMPANY NAME: United Wood Products
PRODUCT: Sawlogs, Posts & Poles
SPECIES USED: LP, ES, PP
PRICE PAID*: $750/load (80,000-85,000 lbs per load)
MERCHANTABILITY STANDARDS: Tree length, minimum 3" top diameter

COMPANY NAME: Colorado Wood Products
PRODUCT: Sawlogs, Posts & Poles
SPECIES USED: LP, ES
PRICE PAID*: varies
MERCHANTABILITY STANDARDS: Tree Length

* These prices are variable and subject to change.

MARKET INFORMATION, CON'T

COMPANY NAME: Westridge Forest Products
PRODUCT: Posts & Poles
SPECIES USED: LP
PRICE PAID*: $0.15/linear foot
MERCHANTABILITY STANDARDS: Tree length, minimum 3.5" top diameter

COMPANY NAME: Elkhorn Lumber Company
PRODUCT: Sawlogs, Houselogs
SPECIES USED: LP, ES, PP, DF, SF
PRICE PAID*: $120/mbf
MERCHANTABILITY STANDARDS: Lengths: 16'-6", 33'-0", 49'-6"
Minimum 6" top diameter

COMPANY NAME: Needmore Forest Products
PRODUCT: Shakes
SPECIES USED: LP
PRICE PAID*: $150/mbf
MERCHANTABILITY STANDARDS: Tree length, or 8' minimum length
Minimum 6" top diameter

COMPANY NAME: Anson Perina
PRODUCT: Posts & Poles
SPECIES USED: LP
PRICE PAID*: $0.75 each for 6'-6" log with 3.5"-4.5" top diameter
1.00 each for 8'-0" log with 3.5"-4.5" top diameter
1.10 each for 8'-0" log with 4.5"-7.5" top diameter
1.50 each for 10'-0" log with 4.5"-7.5" top dia.
MERCHANTABILITY STANDARDS: See above.

COMPANY NAME: George and Howard Hersh
PRODUCT: Christmas Trees, Transplants
SPECIES USED: LP, AS, ES
PRICE PAID*: $1.00 each for small aspen whips
3.00 each for large aspen transplants (6'+)
1.00 each for small lodgepole transplants
3.00 each for 4'-5' lodgepole transplants
3.00 to 5.00 each for Christmas Trees (LP, ES)
MERCHANTABILITY STANDARDS: See above.

* These prices are variable and subject to change.

SEE MAP 0561-150
SEE MAP 0561-190
SEE MAP 0561-300
SEE MAP 0561-290
SEE MAP 0561-280
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903
(902)
(019)
(018)
(003)
(002)
(004)
(020)
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(041)
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SMR
(038)
(039)
(040)
(045)
(042)
(024)
(020)
(027)
(028)
(026)
(021)
(025)
(004)
LEWSTONE CREEK
RIST CANYON ROAD
COUNTY RD
S 89 47'W 2603.2
N 89 47'E 2603.2
S 89 50'W 2626.1
S 89 31'W 2606.0
N 89 31'E 2606.0
N 86 9'W 2611.3
S 86 9'E 2611.3
N 89 29'E 2606.6
N 86 25'W 2614.5
S 86 25'E 2614.5
S 89 23'W 2608.4
N 86 18'W 2627.6
S 1 30'W 2662.2
N 1 30'E 2662.2
S 1 27'W 2649.9
N 1 27'E 2649.9
N 1 23'E 2637.6
N 3 40'W 2644.9
N 1 38'E 2646.7
S 1 4'E 2637.0
N 1 4'W 2637.0
S 0 42'W 2544.1
S 2 38'E 2594.6
S 0 16'E 2669.2
N 0 27'W 2556.1
N 86 47'E 2602.5
S 87 41'W 2602.3
N 87 41'E 2602.3
S 87 31'W 2549.4
S 87 31'W 2585.5
N 87 31'E 2585.5
S 87 21'W 2568.7
N 87 21'E 2568.7
S 87 55'W 2577.9
N 87 55'E 2577.9