Pinorealosa Ranch
Forest Resource Management Plan

Prepared by:
Forestry Services of Chama
Date: January 2012

FOREST STEWARDSHIP LANDOWNER PLAN APPROVAL SHEET

I have read the attached **Forest Resource Management Plan** and find that it will help me to accomplish the goals and objectives, which I have for my property. It is my intention to implement the plan recommendations to the best of my ability and as time and circumstances permit.

_____ _____

Land Owner Date
Ronnie Parker
President Pinorealosa Corp.

_____ _____

Planner Date
Gary Harris

Approved by:

_____ _____

District Forester Date

TABLE OF CONTENTS

FOREWORD

The Pinorealosa Ranch (PR) is owned by Pinorealosa Inc., a New Mexico Corporation with 24 current shareholders. The ranch is located about 15 miles southeast of Chama, New Mexico (see Map 1, Appendix 1). Much of the property boundary is not fenced, with exception of maintained fences along east boundary and a small section along the north boundary (Poso Valley). Some abandoned fence lines exist along some of the property boundary and within property interior. There are currently seven self-sustaining shareholder cabins on-site with exclusion zones of no allowed activity unless shareholder desires differently (see Map 2 Appendix 1). The main impact on the land prior to European settlement was the periodic burning by natural and Indian caused fires and other natural disturbance agents. European settlement resulted in the suppression of fires in conjunction with overgrazing by cattle and sheep associated with the agrarian lifestyles of this time period. The ranch currently allows 30-40 head of cattle to graze some meadow areas for a short duration periodically. Also high grade logging of Engelmann spruce with little post-harvesting stabilization activities was the usual area harvesting practice prior to New Mexico State Forestry implementing harvest regulations in1978. The last logging was done under these regulations from 1987 – 1992 by various contractors.

PR was originally part of T.A. Land Grant, (unsurveyed by USGS) which was subsequently subdivided into many land parcels. The PR is one such parcel, which current owners purchased in 1974. Center point of the property is located at approximately Lat. N 36º 50□ Long. W106º 27□ 30□ (NAD 1983, Zone 13). The ranch is primarily managed to maintain or enhance the natural qualities intrinsic to the area and as a recreational area for owners and guests. The ranch is also registered participant of American Tree Farm System.

PR is a 2,400 acre ranch in Rio Arriba County, New Mexico. Legal access to the property is by Buckman Road, which continues through the property to access other landowner properties. Besides some road maintenance conditions there are no restrictions on its use as a haul route for commercial purposes.

PR lies within the Chama River watershed. The Chama River is one of the larger order tributaries of the Rio Grande Basin and an important source of water for the largest population centers in New Mexico. Primary fluvial systems on the property include several small creeks with Little Poso Creek and Cañones Creek being most notable. Trout species inhabiting the creeks include rainbow trout, brook trout and cutthroat trout. The ranch provides a variety of summer habitat for migratory wildlife species and is a year-round home to a few hardy wildlife species.

Aesthetically, the ranch is located in an area with unsurpassed scenery and landscape diversity. Serene mountain areas abound, from the sheer rock walls of Cañones Box to windswept rocky ridges offering panoramic vistas, with lush forests and meadows dotted with elk grazing as part of the ranch's richness. Topography of the ranch ranges from 8,700 ft. elevation to 10,900 ft. It is just west of the 11,300 ft. Brazos Peak.

The ranch is located in a region conducive to the generation of summer and winter storms. Abundant rain during the growing season is the rule rather than the exception. Forage is luxuriant and conditions are ideal for the regeneration and growth of timber stands. The abundant moisture and soil types present on the ranch are a moderate concern in any ground impacting forest activity.

Climate data for the region shows average annual temperatures of 35°-37°F with a mean monthly high of 20°F in January to 64°F in July. Average annual frost-free period ranges from 60 - 90 days and average annual precipitation is 35 - 40 inches fairly evenly distributed between rain and snowfall.

Some 965 acres of the ranch are in forest stands available for management, i.e. operable by conventional logging equipment (<40% slope) and adequately accessed by main roads and numerous abandoned logging roads (see Map 3 Appendix 1). There are a few landowner imposed harvesting and road use restrictions. Primarily these are limiting activities during periods of heavy precipitation, high fire danger and use of certain roads. The harvest "window" for the area is normally June – October.

Timber stands are chiefly of aspen (*Populus tremuloides*) and Engelmann spruce (*Picea engelmannii*)/corkbark fir (*Abies lasiocarpa var. arizonica*) types, situated on moderate potential growth sites. Net growth over the entire area, of all species combined, averages about 200 board feet/acre/year. A. lasiocarpa/P. engelmannii/ Vaccinium scoparium (grouse whortleberry) is the primary forest habitat type. A variety of grass species occur in all vegetation types (e.g. muttongrass, sheep fescue, mountain brome etc.).The most common understory forb is grouse whortleberry with some kinnikinnick. The main shrubs are gooseberry, common juniper and snowberry. Alder and willow species are present in some riparian areas. Forest type and canopy closure impose limits on the forest understory vegetation quantity and composition.

Restrictions on harvesting in National Forests have created a fair market and economics for harvesting various forest products (e.g. conifer sawlogs and aspen) from private land. The primary limiting factors on utilizing some forest products is contractor desire or availability and distance to market areas, therefore adversely impacting the economics of utilizing some of these products. Large mill closures and current recession have also had detrimental effect on stumpage values, log size, quality requirements and quantities saleable. Conifer sawlog prices have decreased drastically in the last few years, but have bottomed out and are holding steady @ $50-100/MBF stumpage, depending on quality and species. There is a stable market for aspen with prices @ $4-$6/ton stumpage. The marketing potential of wood products will be improved if ability to utilize wood for heating, electricity and fuel promoted. The current energy crisis and the search for energy sources and independence will hopefully direct more interest into renewable wood as a viable alternative. Currently a feasibility study is being done on a wood biomass electric generation facility in Pagosa Springs, Colorado. A local landowner organization (Chama Peak Landowner Alliance contact David Harris) is researching possibilities for establishing a forest products business in the area with limited results to date. Also, forest carbon credits for carbon sequestration is another possible forest commodity that can provide landowner with income. This program is presently not available in New Mexico and Colorado, but may be in near future.

Any proposed timber harvest or forest protection work will have a beneficial impact on neighbors and surrounding communities by:

- Reducing wildfire severity potential.
- Protecting the watershed properties of the area.
- Supporting a variety of habitat types thereby wildlife populations.
- Supporting the local economies of some communities.

INTRODUCTION

A shareholders management committee meeting was held after completion of the initial forest resource survey and prior to the management plan development. At this meeting an evaluation of the current status of property forest resources, forest problems and forest management options were assessed. A management direction, landowner goal and forest management objectives were determined. The Pinorealosa Ranch Forest Resource Management Plan and its recommendations are developed around these decisions. Future shareholder decisions will determine if all or parts of the recommendations are implemented and at what intensity they are applied.

Landowner desired future conditions are to maintain the rugged beauty of the ranch while still developing and managing the natural resources. The landowners desire to maintain or improve the current character of the landscape while capturing some monetary value from land ownership and capital to invest into the land. They also want to allow the majority of the forested area to proceed along a “natural” successional route towards climax when appropriate. Balancing wildlife, water, aesthetics and recreational activities with management activities will be considerations in the decision process.

The recommended and landowner desired approach to land management is to pursue a proactive and multiple-use concept where resources are in balance and integrated to create a mosaic of landscape patterns that enhance biodiversity. This can lead to a beneficial resolution of a whole host of problems common to forest ecosystems and their dependent resources. The land resources, business enterprise and landowner will benefit greatly from this approach of managing for sustainable forest ecosystems. This can be accomplished by replacing some natural processes that are no longer acceptable or feasible with cultural equivalents, e.g. timber harvesting in lieu of fire.

Management units were delineated by dominant tree species, vegetation type or terrain into:

- Riparian – 150 acres a mix of meadows and forested perennial water areas
- Grassland – 360 acres of areas with <10% tree stocking and at least 120’ wide
- Aspen stands – 80 acres operable
- Spruce/fir stands – 885 acres operable
- Inoperable/inaccessible forested areas or extremely rocky areas – 925 acres

Landowner Goal and Forest Management Objectives for Pinorealosa Ranch

Landowner Goal:

The goal of Pinorealosa's Forest Resource Management Plan is to promote management practices that serve to dampen the vulnerability of the forest to pest invasions and wildfire while maintaining the biotic/ecologic integrity of the forest ecosystem. Biotic integrity is an organizing, self-correcting capability of the biota of an ecosystem that enables populations and communities to recover from disturbance and gain an end-state that is "normal and good." Related to this concept is the notion that actions that foster a diversity of future options rather than a single presumed optimum provides resilience in the face of an unknown but rapidly changing future. With this perspective, uncertainty and change become expected features of ecosystem stewardship rather than impediments to management actions.

Forest Management Objectives:

- Promote/maintain a healthy, diverse and resilient forest.
- Consider ways to reduce wildfire severity potentials and improve fire control activities.
- Protect the wildlife habitat value and enhance when feasible.
- Control erosion and maintain soil quality in areas disturbed by management activities.
- Protect water quality by limiting management activities around riparian zones.
- Monitor ranch for any developing problems and initiate corrective measures when feasible and economical.
- Maintain and protect the property's aesthetic values.

Landowner desired future condition and objectives achievement are dependent on the landowner's commitment to prescribed management actions over the expected period of plan implementation. Also important is the characteristics and potentials of land resources and a plan of operation. The core of the operation plan and its success depend on four items. They are:

- Action steps to attain planned goal.
- When should appropriate action be taken?
- Who will take appropriate action?
- How will it be done?

All management projects are further controlled by applicable county and state regulations and employing best management practices (see Appendix 3). In the plan, specific sections will discuss in more detail particular topics and terminology used in various areas of the plan, also refer to Glossary of Terms. Future discussions, site visits and filing of Harvest Permit applications will more clearly define implementation scheme for any proposed harvesting. A Timber Contract will be used to define special ranch requirements, logging contractor responsibilities and financial agreements.

FOREST RESOURCES

To realize the full potential of forest lands for profit and enjoyment, they must be proactively managed. A well stocked and managed forest provides many tangible and intangible benefits, while providing a stable forest environment. This type of forest can be expected to increase in value anywhere from 3% to l0% per year. The land's renewable natural resources are dynamic, interrelated, and dependent on each other and this balance is affected by man's activities (beneficially or adversely). Man's interference with natural processes and negative effects on environmental conditions along with misguided past harvesting and grazing practices have left us with altered and vulnerable forest ecosystems that may be outside the historical range of variation. Man's management tools and prescriptions should be adaptations of natural processes aimed at taming some of these processes making them work a little faster perhaps and toward some predetermined ends, while minimizing or mitigating any adverse impacts. The end result is a highly productive and healthy unit of land utilizing multiple-use concepts to attain a high rate of return from various resources, while in harmony with the environment. Top priority management areas are those that show the best economic returns for money and time invested and are at a high risk for unwanted conversion or catastrophic event. While some of the management practices cited in this plan have easily identified costs, there are also costs associated with not implementing these practices.

Current forest conditions are that most spruce/fir forest on Pinorealosa are suffering heavy corkbark fir mortality with some spots to sizable areas of spruce mortality. The corkbark fir/spruce mortality probably tied to drought and spruce budworm generated stress resulting in balsam bark beetle/spruce beetle infestation. Some mortality in corkbark fir results from natural succession towards climax stands of Englemann spruce. This process typically happens over a lengthy time span of 100 or more years. The problem with the current situation is that most corkbark fir is dying over an unusual short time span. These dead and dying trees with their susceptibility to rot are subject to substantial windthrow which will lead to jackstrawed tangles of down timber, accessibility issues, increased fuel loads/wildfire concerns and damage to residual trees. This problem in conjunction with on-going spruce beetle infestation creates a situation that is contrary to landowner desired future conditions. Also occurring on the ranch is the continuing spruce budworm infestation and an emerging problem with Western Tent Caterpillar infestation of aspen stands which has been observed over the past three years. Also noted during a timber survey, though not of imminent concern are some minor spruce broom rust infections and Cooley Spruce Gall Adelgid infestations. For more details see Insect/Disease section.

The following forest management recommendations are developed around primarily addressing the insect infestations and associated tree mortality problems mentioned above. Also included are prescriptions to prevent further damage to the forest resource base and prevent or reduce possible future insect epidemics and wildfire hazards.

Forest Management Recommendations:

- Use a combination of cutting methods to rectify some of the current situations.
- Skid majority of commercial and non-marketable cutting treatment slash and pile at landing areas for later burning/scarification/seeding.
- Accelerate site recovery on heavily cut-over areas by spot planting spruce seedlings at about 50 trees/acre (see Appendix 5).
- Conduct pre-commercial thinning in some areas in conjunction with other cutting treatments (see Appendix 4).
- Noxious weed monitoring and implementing control methods if necessary.
- Implement “Road Daylighting” prescription i.e. thinning trees along road edges.

These recommendations will positively impact the 60% of non-management forested area by decreasing spruce beetle presence and wildfire risks on the ranch. The remaining 40% of forested area, if recommendations implemented, will be subject to a variety of cutting intensities. This will create a wide variety of stages in spruce/fir successional cycle, thereby protecting and enhancing the land’s inherent resource sustainability and biodiversity.

Specific management recommendations and prescriptions to address the current situation are discussed under the various forest stand sections and in appendices. Different management tools are available to achieve land objectives, but the most cost efficient and effective is commercial harvesting. This management tool has been shown to be practical, economical, environmentally sound and somewhat mimics natural control processes. Commercial harvesting is regulated by silvicultural cutting method employed, New Mexico Best Management Practices and intention to generate a profit while protecting all associated land resource values. Any commercial harvesting above 25 acres requires a New Mexico State Forestry and Rio Arriba County Harvest Permits and compliance with applicable regulations. Information on these permits, regulations and Best Management Practices in Appendix 3.

Cost treatments, i.e. sanitation cutting, pre-commercial thinning and planting, even with cost share, should only be used on a limited scale unless beneficial intangible land and landowner values justify a different decision. From a strictly investment standpoint these types of expenditures because of slow growth rates, low stumpage values and lengthy time frame for return on investment in region do not recover cost in improved future wood product value.

Given landowner goal and objectives some use of these practices are justified on a limited basis. These management practices apply to those areas determined to be most appropriate, beneficial and economical:

- Sanitation cutting conducted in conjunction with other cutting treatments.
- Pre-commercial thinning, i.e. the removal of sapling and small poletimber trees because of poor form, damage or to reduce stand density. Also provides opportunity to remove corkbark fir thereby promoting spruce in the residual stand. This practice used only in primary sanitation cutting areas.
- Tree planting spruce seedlings is appropriate in heavily cut-over areas. In majority of cutting areas natural regeneration should be sufficient.

Silvicultural Cutting Methods:

A. Patch cutting – This even-aged system is the removal of all marketable trees in a small given area, typically 1 – 5 acres are treated. This is a primary regeneration method in aspen stands but it is also applicable to spruce/fir stands where a high concentration of tree mortality is being removed. Sometimes in this situation because of spruce/fir susceptibility to windthrow it becomes necessary to remove all trees in an area. The area size is determined by the distance to windthrow stable (wind firm) residual forest stands. Spruce and aspen reproduction is generally dependent on high levels of light to be successful. Spruce seedlings are usually better formed with enhanced growth in moderate to open sunlight conditions. Aspen seedlings sprout from root suckers and are stimulated by overstory removal. This provides for quick reforestation of the cut area. The patch cutting is done in irregular shaped patches so that cut areas blend with the natural variation of the land.

B. Individual and Group Tree Selection harvesting – This method is used in uneven-aged and multi-storied spruce-fir types where it simulates some past natural processes. This harvest system will maintain an uneven- aged forest with high forest canopy that is desirable to meet other management objectives or resource needs. Large mature trees are harvested along with diseased trees. Trees of poor form or otherwise undesirable are also removed as part of a stand improvement cut. This silvicultural cutting method used to moderately decrease stand density and maintain stand wind firmness by selectively removing less than one-third (<33%) of the trees.

Improved tree spacing is important for:

- Decreasing competition for water and nutrients among residual trees to lessen tree stress in adverse conditions and tree susceptibility to insect/disease attacks. Improved tree spacing improves the tree's ability to pitch-out beetles or recover from defoliating insect attacks.
- Allows for more sunlight into stand which may act as a deterrent to some bark beetle attacks because open stands are a less desirable or preferred stand conditions.
- Removes the most beetle susceptible trees from the stand, thereby reducing beetle breeding habitat.

These foregoing deterrents and stand protection measures may not have the intended effects of deterrence if insect populations to reach epidemic levels.

C. Salvage harvesting – This is done to harvest the dead and dying marketable trees from concentrated areas where tree mortality is high due to insect, disease, wind or wildfire. This cutting will help reduce future ground fuel loads while improving landscape aesthetics and promoting natural regeneration.

D. Sanitation cutting – A forest treatment that is an expense because it involves cutting and removing live and dead non-marketable trees for aesthetic purpose and to dampen the vulnerability of the forest to pest invasions and wildfire.

A forest management prescription is implemented on a site specific basis with consideration of:

- Action steps
- Cost-benefit analysis
- Possible impacts
- Mitigation measures if needed
- Protection of other resources
- Monitoring sites to evaluate prescription performance in achieving management goals and what future amendments may be necessary for better goal accomplishment.
- Market analysis for forest generated products.

Forestry Services of Chama has contact information for contractors that work in various aspects of forestry. Also New Mexico State Forestry is a source for contacts and sells tree seedlings. Forestry equipment and supplies can be found at Ben Meadows (1-800-241-6401) or Forestry Suppliers (1-800-647-5368), if considering any forestry related in-house projects, e.g. tree planting.

The cost share, “Forest Health Improvement Program” (FHIP) administered by New Mexico State Forestry, is available to help private landowners with the costs of natural/artificial regeneration, thinning and sanitation cutting projects. This additional source of money should be applied for as it would allow for more complete treatments to be completed on larger areas in a shorter time span therefore accelerating the protection and recovery factor on operable forest areas without large out-of-pocket costs.

Major forest types were stratified into stands on the basis of dominant overstory, condition class, commercial value and stand age. These stands were then delineated and mapped based on location, using roads, drainages etc. to define boundaries, see Timber Stand Table and Map 3. Timber inventory data are presented on pages 12--14 and in the Timber Inventory Tables Appendix1, which also discusses inventory methodology. Some forest resource information is contained in soil type descriptions for operable forest soils 206 and 211.

Inoperable forestland includes slopes >40%, rocky conditions or areas inaccessible because isolated by steep and/or rocky terrain. Riparian zones typically 100 ft on each side of a perennial water source or wetland. Both of these forest types are considered to be mostly non-management zones.

Timber Stand Table

Forest Stand Type	Stand Numbers	Acreage
Spruce/fir	1	200
Spruce/fir	2 & 5	345
Spruce/fir	3	220
Spruce/fir/aspen	4	200
Spruce/fir/aspen	Inoperable Forestland	925
Spruce/fir	Forest Riparian	120

ADDITIONAL SILVICULTURAL CONSIDERATIONS:

A key to good silviculture is the use of proper equipment and methods in harvesting the forest stands to prevent extensive damage to residual stands. The timber sale administrator or forester will have the responsibility of:

- Designating or marking trees to be removed and compliance with harvesting regulations.
- Approval of the type of logging equipment used in the harvest operation.
- Approving the location of landings and the layout of roads/skid trails, and holding the numbers of such sites to the necessary minimum.
- Suspending logging operations when it appears that unusual conditions in the forest will lead to substantial damage or fire risk.
- Methods of handling harvesting slash.

Slash treatment is an important consideration which must factor in landowner desires, aesthetic concerns and ecosystem health. Logging slash along with down woody material already present are important in managing acceptable fuel loadings, watershed impacts, erosion control functions and forest stand health.

Slash can be either beneficial or detrimental to the productive ability of the site.

The disadvantages of slash are:

- Potential forest fire fuel, especially when the needles and small twigs are still attached to the branches.
- Slash accumulations can be an impediment when constructing firebreaks.
- Heavy accumulations of slash can hinder the establishment and growth of seedlings and understory vegetation.
- Can cause serious build-ups in bark beetle populations that thrive in freshly cut slash and timber.
- Unsightly, especially along roadways.
- Can restrict area utilization by grazing livestock and wildlife.

The benefits of slash are:

- The shade provided by moderate amounts of slash can be helpful in protecting seedlings from intense sun, wind, and temperature extremes.
- Provide shade to aid in the establishment of shade-loving tree seedlings.
- Conserves soil moisture.
- Increases the organic material and nutrients in the soil when decomposed, although this is a very slow process in the Southwest.
- Enhances habitat requirements of some wildlife species, especially by leaving small wildlife piles.
- Provides an erosion control function, especially when placed on skid trails.

COURSE WOODY DEBRIS

The role of harvesting slash in forest ecosystems deserve further discussion and consideration in slash management decisions. A look at past and current research of timber utilization and slash management practices reveals that current utilization policies might be harmful to forest site productivity potentials, ecosystem health and tree regeneration. The role of wood residues, from harvesting activities, in long-term soil and forest productivity is critical for maintaining healthy functional ecosystems. This part of the ecosystem spectrum is where food chain and water/nutrient cycles start.

Some primary ecosystem organisms and functions that are affected by utilization standards that manage the amount of Coarse Woody Debris (CWD, woody material >3” diameter) in timber harvesting, are listed below:

- Mycorrizhal development- CWD favorable substrate for mycorrizhal which are very important in tree establishment, growth and water-nutrient uptake by trees. CWD from 4” to l6” in diameter especially important.
- CWD provide important sites for non-symbiotic nitrogen fixation, especially important on sites with little symbiotic nitrogen fixation.
- CWD is a major pathway for carbon or nutrient cycling and water storage.
- CWD a key habitat (especially large material) for many forms of microflora, macrofauna, and wildlife species. Also plays an important role in food chain of these same organisms.
- CWD is important in soil organic matter formation; doubling soil wood content may increase forest growth potential by 20%.

CWD and its management are important in other forest ecosystem functions (i.e. physical, chemical and biological) and will need consideration in the process. Recent research recommends a fresh input of CWD from harvesting that adequately provides enough organic matter for the development and function of the forest.

After landowner consideration of the above factors, it has been determined that harvesting slash will be treated by combination of methods which are:

- Lopping and scattering to 2 ft. height broken tops, push-overs, etc. in harvest area, part of contractor responsibility. Also create when appropriate occasional small wildlife piles of slash or distribute on skid trails.
- Piling and burning, majority of timber cut from all the cutting methods employed will be whole tree skidded to landings for processing and piling. The part of this process associated with market sawlogs will be the responsibility of contracted logger. The material generated from sanitation cutting will be a cost to landowner. Burning/scarification/seeding of piles a responsibility assumed by landowner @ a cost of $20 or so per average pile (~30 ft. x 30 ft.). Piles will be burned in the fall or winter a year after harvest and after first significant snow. This permits time for slash to dry which allows for easiest pile ignition and good consumption. Burning piles requires Rio Arriba County and New Mexico Air Quality Bureau burn permits and notification to New Mexico State Forestry. Information on burn permits in Appendix 3.

FOREST STANDS INFORMATION

SPRUCE/FIR STANDS 1, 2, 3 & 5

This forest type has 765 acres that are considered operable and accessible for management purposes. Much of the spruce/fir type is young uneven-aged and multi-storied stands. The silvicultural system best adapted for this type, is individual and/or group tree selection cutting methods. This method simulates the natural spruce/fir ecosystem dynamics and is most compatible with various associated resources. It provides a continuous high forest cover, controlled growth and development of trees through a range of size classes and naturally regenerates the stand. The type is in an unhealthy and high risk condition presently throughout the various stands. The management goal in this type is to initiate spruce beetle prevention and salvage work and sanitation cutting. Treatments likely to affect 30% of total land area or 40% or so of total forested area.

Englemann spruce is a long-lived tree at elevations generally above 9,000 ft. and usually occurs in mixed stands with aspen/corkbark fir. It is a highly valued sawlog species live or dead, with many commercial uses therefore usually good marketability. Corkbark fir a variety of subalpine fir is shade tolerant and accounts for majority of seedling/sapling counts in forest types. Its growth habitat and occurrence zone is similar to that of Engelmann spruce and it will be considered silviculturally with Engelmann spruce. This tree species is susceptible to many diseases/insects therefore relatively short-lived. Because of low commercial value therefore market demand it must be harvested in conjunction with substantial spruce harvest.

Given landowner goal and objectives it is recommended that most operable forest areas be treated over the next 5 years. Reasons for a five year time frame:

- Existence of a dependable supply of spruce/fir sawlogs to satisfy a market demand for 80-100 loads annually. The future for regional markets for spruce/fir sawlogs is unknown.
- Generate capital for reinvesting into cost share programs and/or out-of-pocket cost jobs.
- Timely implementation of forestland deterrent treatment for effective suppression of spruce beetle infestations.
- Shorten the disturbance time frame associated with harvest activities.

The treatment should be a combination of selection, salvage and sanitation cutting methods dependent on what is happening in a specific area. This strategy of combining cutting prescriptions would:

- Defray fixed and operating costs associated with individual operations and significantly reduce overall cost.
- Facilitate conducting some treatments in certain areas where independent operations would not be economical and/or feasible.
- Provide opportunity to complete treatments as one-time entry projects rather than more costly multiple entry projects. This approach also creates less site disturbance and allows site recovery to begin faster.

The selection and salvage harvesting component of recommended treatment would:

- Generate commercial sawlog loads of primarily live or dead spruce as most corkbark fir has or is quickly susceptible to rot when dead or dying, therefore is of little salvage value.
- Beneficially effect forest health, reduce wildfire risk, maintain wildlife species and promote aesthetic values.
- Hopefully suppress the current spruce beetle infestation taking place on property. Prevent epidemic population levels.

The sanitation cutting component of recommended treatment utilizing cost share program would:

- Cut and skid majority of non-marketable standing dead or down trees to landing piles.
- Provide opportunity to conduct some thinning of undesirable non-marketable trees.
- Beneficial impact on aesthetics, reduce future wildfire risk and improve accessibility for wildlife and firefighters.

Re-evaluate forest status after primary prescriptions completed. The following sections describe an individual Stands volume, composition, condition and recommendation.

Spruce/Fir Stand 1 – 200 acres of operable terrain. This stand is undergoing the most wide spread attack by spruce beetles and balsam bark beetles. Tree mortality and infestation are at a high level. Recommend that this stand be treated first utilizing a combination of three cutting methods.

This treatment is likely to generate 100 loads of primarily commercial spruce sawlogs or approximately 500,000 board feet (500MBF) from selection and salvage harvesting. The stand is mostly uneven-aged and multi-storied so there are areas that will require minimal cutting activities so post treatment forest cover should be substantial and fairly wind firm. The upper area of stand does have some windthrow risk that will require some cutting adjustments. Aspen is present in minimal amounts mostly along stand boundary edges. Logging activities in the area should stimulate some aspen sprouting. Due to the heavy mortality in some areas, patch cutting will be necessary and any reforestation efforts should take place in these sites.

Stand Data – Sawtimber volume averages 7 MBF (thousand board feet)/acre for a total volume of 1.4 MMBF (million board feet). Poletimber volume averages 172 cf. (cubic feet)/acre. Stand BA (basal area) is approximately 90 sq. ft./acre with seedlings/saplings at 520/acre. Dead spruce/fir density is about 50 trees/acre.

Spruce/Fir Stands 2 and 5 – 345 acres of operable terrain. These stands are uneven-aged and multi-storied with mostly corkbark fir mortality taking place. A minimal amount of aspen is present mainly along some boundary edges. Primarily these stands are recommended for cost sharing sanitation cuttings. A light selection harvest should be conducted in conjunction with sanitation cuts to help offset cost and to reduce stand factors that favor spruce beetle infestations. Selection harvest of these stands and portions of Stand 4 likely to generate 500 MBF of mainly spruce sawlogs.

Stand Data – Sawtimber volume average 6.4 MBF/acre for a total volume of 2.2 MMBF. Poletimber volume averages 550 cf/acre. Stand BA approximately 105 sq. ft./acre with seedlings/saplings at 1,400/acre. Dead spruce/fir density is about 15 trees/acre.

Spruce/Fir Stand 3 – 220 acres of operable terrain. This the best stand on the property with a high proportion of spruce. The stand is uneven-aged and multi-storied with mortality in corkbark fir and some spruce. Some aspen exist in this stand, primarily along western boundary. Also this western stand area has a higher risk for windthrow that will have to be accounted for in any cutting scheme.

This stand has minimal salvage value unless done in conjunction with commercial selection harvest and sanitation cut which is recommended course. Spruce beetle is present in the stand and a treatment should be implemented to protect this valuable stand from major infestation. A selection and minor salvage harvest should generate 500 MBF at a minimum of mainly spruce sawlogs.

Stand Data – Sawtimber volume average 8.6 MBF/acre for a total volume of 1.9 MMBF. Poletimber volume averages 470 cf/acre. Stand BA approximately 115 sq. ft/acre with seedlings/saplings at 475/acre. Tree mortality at about 10 trees/acre.

Spruce/Fir/Aspen Stand 4 – 200 acres of operable terrain. This stand a mix of intermingled mostly even-aged single-storied poletimber size aspen stands (~80 acres) and dense to open spruce/fir stands (~120 acres) with similar composition to stands 2 and 5. Upper portion of stand has the highest proportion of primarily corkbark fir mortality. Stand has the majority of operable management aspen but this type probably 50 years away from requiring decisions on management direction. There are a few mature aspen stands present ranch-wide and typically some mature aspen (i.e. parent trees) exist within the individual aspen clones.

Aspen is a fast-growing, comparatively short-lived pioneer species. Aspen regenerates rapidly, after disturbance forming single-storied even-aged stands. It prefers abundant light and grows best under those conditions. It is a clonal type species, i.e. common root system and genetics, that mainly regenerates by root suckering.

Aspen exhibits strong apical dominance at certain times of the year by producing auxin, a compound that suppresses suckering and is responsible for natural thinning of aspen stands. Aspen is second only to riparian zones in species diversity and wildlife importance. By regenerating aspen it's scenic and ecosystem value is maintained in the landscape matrix and it continues to provide excellent watershed protection.

Stand Data – (Spruce/fir Component) Sawtimber volume averages 6 MBF/acre for a total volume of 720 MBF. Poletimber volume averages 500 cf/acre. Stand BA approximately 100 sq. ft./acre with seedlings/saplings at 1,200 acre. Tree mortality at about 5 trees/acre.

Stand Data – (Aspen Component) Sawtimber volume is negligible. Poletimber volume averages 2,550 cf/acre for a total volume of 200 MCF. Stand BA approximately 150 sq. ft./acre with seedlings/saplings at over 2,000/acre. Tree mortality from mostly natural thinning is at about 30 trees/acre.

Windfall is a common cause of mortality in spruce and fir after harvesting operations, this usually attributed to a shallow root system. In any harvesting operation an effort should be made to select windfirm boundaries, be aware of stand topography and it's effect on windfall risk, and vary cutting methods and intensities to minimize windfall risk. Stand topography and slope aspects and how they relate to windfall risk are as listed below:

Low Risk Exposures
1) Valley bottoms and flat areas.
2) Lower and gentle middle north - and east - facing slopes.
3) Lower and gentle middle south - and west - facing slopes protected to the windward by higher ground.

Moderate Risk Exposures
1) Valley bottoms parallel to the direction of the prevailing winds.
2) Gentle middle south and west slopes not protected to winward.
3) Moderate to steep middle and all upper north - and east - facing slopes.
4) Moderate to steep middle south - and west - facing slopes protected to windward.

High Risk Exposures
1) Ridge tops.
2) Saddles in ridges.
3) Moderate to steep middle south - and west - facing slopes not protected to windward.
4) All upper south - and west - facing slopes.

There are other situations to be aware of that effect windfall risk, such as poor drainage, shallow soils, defective roots and boles, and overly dense stands. The multi-storied stand is probably the most windfirm type in spruce-fir, thus easier to manage for windfall.

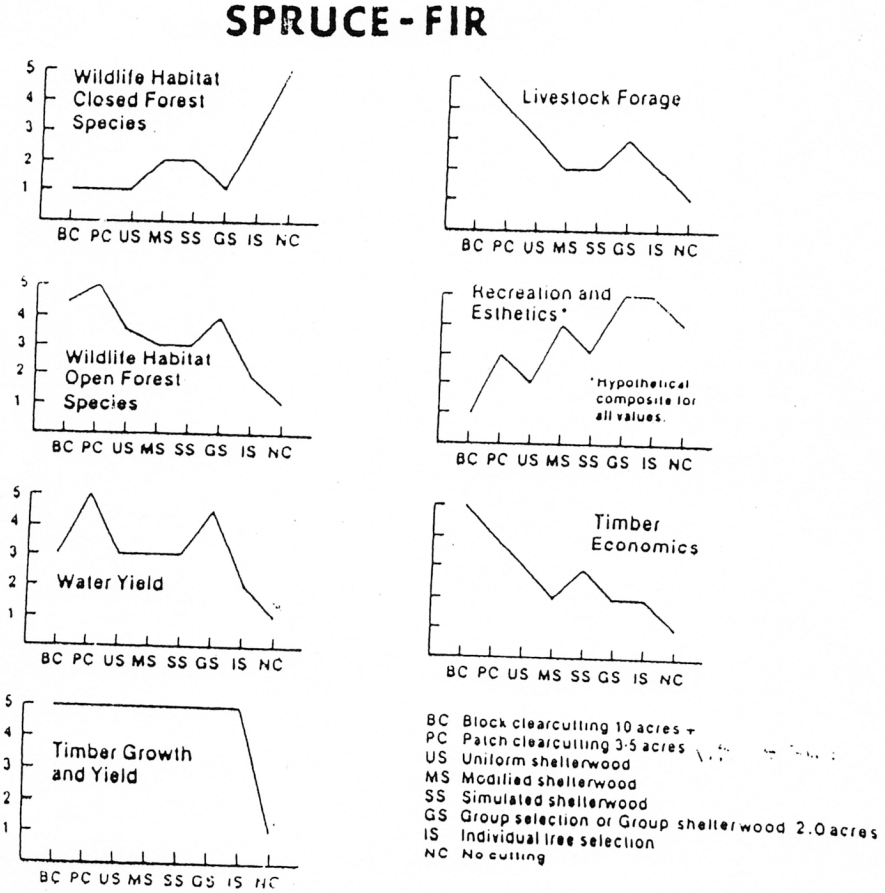


Figure 36.—Relative ranking of the effects of cutting methods on the resources of spruce-fir forests. Scale: 1 = least favorable, 5 = most favorable.

Figure 4. A bulldozed-fenced-slash-removed treatment, five growing seasons following regeneration.

Figure 5. A cut-unfenced-slash-removed treatment with no suckers, five growing seasons following regeneration.

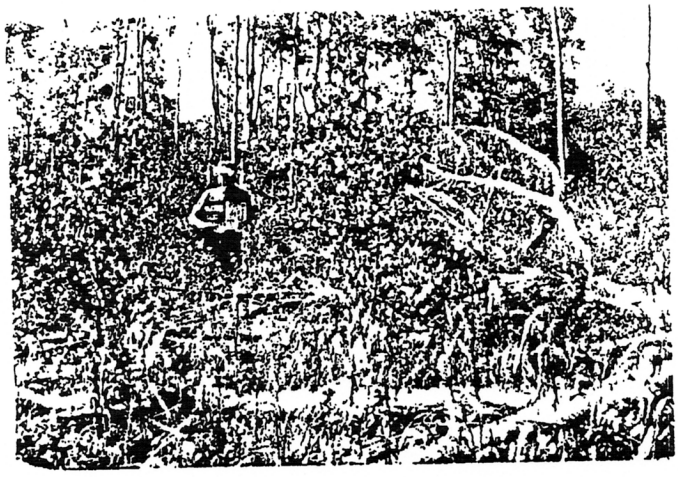


Figure 6. A bulldozed, unfenced, slash-left treatment with sparse stocking, five growing seasons following regeneration.

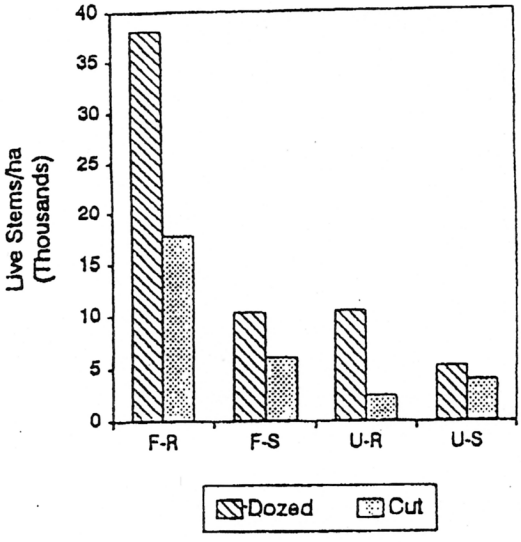


Figure 3. Histogram of average aspen sucker stocking after the completion of five growing seasons after treatment. F = fenced, U = unfenced, R = slash removed, and S = slash left.

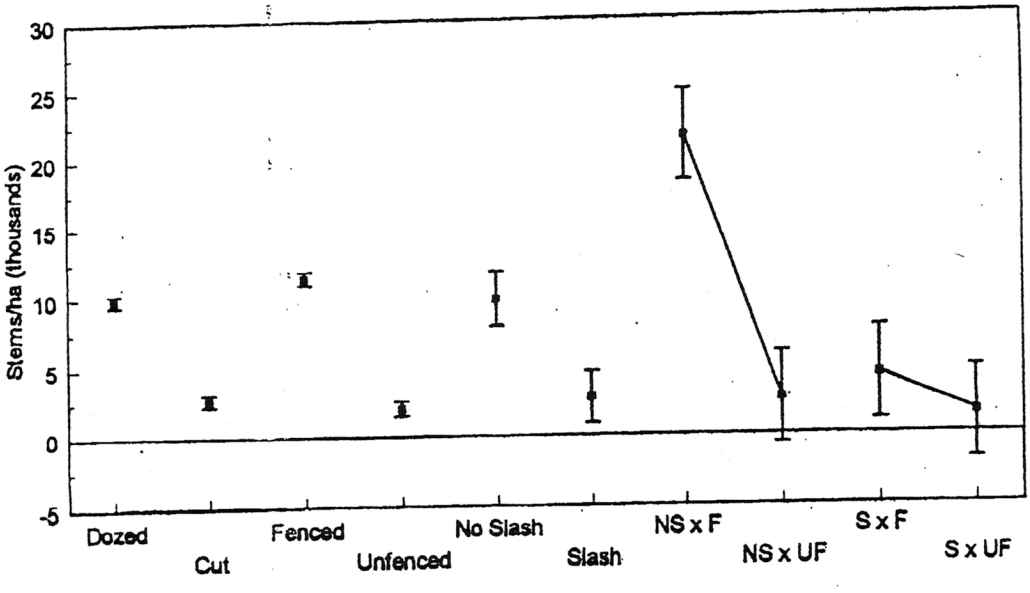


Figure 7. Comparison of average sucker stocking in dozed versus cut treatments, fenced versus unfenced treatments, and interaction of average sucker stocking by combinations of fencing and slash treatments, with standard error bars.

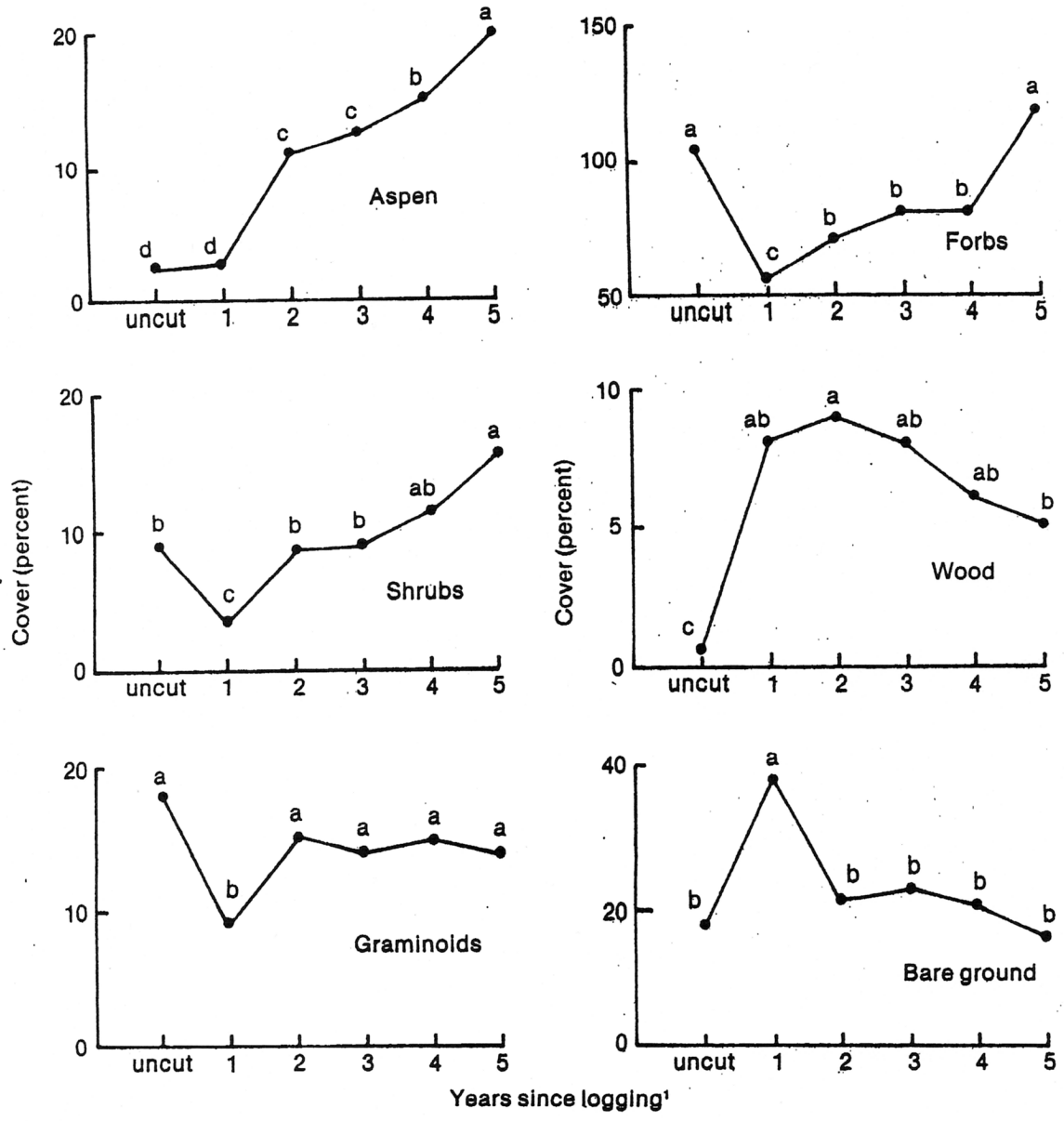


Figure 4.—Ground cover in clearcuts on Stoner Mesa study area. (Within categories, values among years followed by the same letter are not significantly different; P = 0.05.)

Table 1. Aspen sucker counts by treatment and block. Data is from 240 circular 4.047 m² plots (10 plots/treatment/block) sampled five growing seasons after treatment.

Treatment combination	Block 1	2	3	Total count	Avg/ hectare
Dozed, fenced, no slash	90	201	169	460	37,888
Dozed, fenced, slash	31	50	42	123	10,131
Dozed, unfenced, no slash	6	16	103	125	10,297
Dozed, unfenced, slash	18	25	19	62	5,108
Cut, fenced, no slash	20	70	123	213	17,544
Cut, fenced, slash	0	3	68	71	7,038
Cut, unfenced, no slash	1	3	23	27	2,224
ut, unfenced, slash	0	45	0	45	3,707
Total count	166	413	547	1,126	11,594

INOPERABLE OR INACCESSIBLE FORESTLAND

This land component consists of areas with slopes exceeding 40%, extremely rocky conditions or inaccessible because of physical or financial constraints @ 925 acres. This area is very important for its role in providing security/thermal cover for various types of wildlife and stabilizing the steep slopes. These timber stands are considered non-management zones because of their importance in fulfilling landscape, forest ecosystem and habitat diversity requirements. Therefore no recommended activity in these stands, it is good to have a percentage (~50%) of forest in this type for the reasons stated. Primary soil types 210 and 211.

This land type located throughout the ranch is a mix of vegetational habitats. Much of it is forested (~825 acres) with dense stands of mature spruce/fir, with substantial corkbark fir mortality, or dense immature poletimber size aspen stands. The remaining 100 acres consist of sparsely forested rocky areas that consist of:

- Glacial moraines
- Talus slopes at the toe of rock cliffs
- Rock outcrops
- Windswept rocky ridges with a dwarf forest of spruce/fir with some ponderosa pine, (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*) and limber pine (*Pinus flexilis*) present in areas.

FOREST PROTECTION

Preventative measures are necessary to protect the forestland against possible loss or damage from wildfires, insects/diseases and animal damage. Each of these poses a threat to the forest value ecologically, economically and aesthetically.

Wildland Fire

Wildfire prevention improved through harvest practices that factor fire into their application. Good harvest practices beneficial in breaking up quantity, continuity and spatial arrangement of ground fuels. Also thinning and harvesting activities reduce or remove interlocking tree crowns, this is also an important factor in insect/disease control.

The current mortality and breakage in corkbark fir in conjunction with the past mortality and downfall has or will result in some areas of high fuel loads. This condition along with extreme drought conditions may place this forested area at risk.

A primary PR management recommendation is that sanitation, salvage and selection cuts be conducted in most operable stands. The cutting/removal of trees with associated skid trails/landings are important in creating minor stand interior firebreaks. It is recommended that the majority of slash generated in any cutting activity be piled and burned to reduce fuel loads.

Another PR recommendation to facilitate wildfire prevention is the establishment of fire breaks (possibly in the form of emergency-use roads) used in conjunction with harvest program. Such breaks in the forest would be “daylighted” as part of harvest in an area. Employing this tactic increases the probability that a wildfire can be contained in a smaller area. It also improves access to ranch areas thereby increasing the ability of firefighters to reach a fire fast with the right equipment to quickly contain the fire. Fortunately, the wind, dry conditions, high temperatures and low humidity necessary for large fires are a very rare occurrence in PR forest types and elevation zones.

Currently, under average normal conditions, the PR forest has a low fire hazard rating, (U.S. Forest Service Fire Regime Condition Class Worksheet and Landfire data products). Spruce/fir and aspen forest types are not highly volatile or flammable fuel types and with ranch elevation areas are generally cool moist sites. Fuel loads and ladder fuels are generally low and understory vegetation is sparse. These factors create forest conditions that are not conducive to large ignitions or hot fast moving wildfires..

Insects and Diseases

Major long running insect problems are occurring throughout the west and it is unclear what the causative agent(s) may be. It is thought that extended extreme droughts, mankind induced changes to climate and/or environmental conditions may be contributing factors. Landowners should try to manage for the healthiest forest possible, improving the forest’s ability to withstand these conditions.

Currently on PR there is a major concern with insects and the tree mortality occurring. Typically there are few management options once an insect infestation or disease becomes prevalent. Salvage logging can be used in spruce/fir if the volume justifies it. The best method to prevent major losses is preventive management.

Maintenance of a healthy and vigorous forest through proper silvicultural methods is the best way to prevent insect and disease attacks. Most insects and diseases do not attack all age classes or all species at the same time, thus a more diverse forest is less likely to have a disastrous outbreak. All management prescriptions and silvicultural methods will incorporate prevention through diversity as a management goal.

The following insects and diseases are most damaging on PR also see Appendix 6.

A. Spruce budworm (*Archips fumiferana*) activity is present on PR. Spruce budworm is the most destructive defoliator in the West. Outbreaks may result in extensive dieback but trees commonly recover, though defoliated trees are weakened and more susceptible to other causes of mortality. Widespread outbreaks can cause reduced flower and cone production, top-killing, loss in tree growth and lost aesthetic values.

Young understory trees are especially vulnerable to budworm defoliation of new needle growth and can be severely damaged or deformed. In mature stands long-running outbreaks (3 to 5 years) cause about one tree in four to die. Spruce budworm damage to spruce and corkbark fir is substantial on PR currently.

B. Spruce beetle (*Dendroctonus rufipennis*) A major outbreak is presently taking place in Spruce/fir Stand 1 with lesser infestations in Stands 2 – 5.The spruce beetle is potentially the most dangerous insect on the ranch as they can kill most spruce over a large area. Spruce beetle prefer green downed material to standing trees, but if they attack standing trees, overmature large diameter spruce are first, if infestation becomes epidemic young trees are susceptible. Susceptibility of spruce stands, in relation to location, decreases in the following order:

- Trees in creek bottoms
- Healthier stands on benches and high ridges
- Poorer stands on benches and high ridges
- Mixed stands/multi-storied
- Immature stands

The following characteristics are associated with potential outbreak sites:

- Single or two-storied stands
- High proportions of spruce in the overstory
- Basal area of 150 sq.ft./acre or more in older and larger trees
- An average 10 year periodic diameter growth of .4 in. or less

The recommended harvesting will provide control of stand density, composition and vigor. The build-up of spruce beetle population in logging residue will be minimized by cutting to low stump heights, limbing cull logs and tops and removing all marketable material to a 8 in. top diameter (spruce beetle prefer 8 in. or larger down material). Selection cutting increases forest floor sunlight and removes the larger mature spruce thereby releasing younger healthier trees.

C. Western Balsam bark beetle (*Dryocoetes confusus)* is present on PR in stressed corkbark fir. Balsam bark beetles and other types of bark beetles depend mainly on quantity of overmature, damaged or stressed (weakened) trees to reach outbreak levels, at which time they may attack and kill healthier trees. Species of bark beetle are tree host specific and feed on the live cambium layer of standing and freshly cut or fallen trees. Silvicultural methods to prevent bark beetle outbreaks should create young healthy stands of mixed species. Corkbark fir mortality a somewhat natural occurrence and not necessarily bad as it provides more growing space to more desirable spruce, but stress from recent droughts and spruce budworm damage have accelerated the process.

D. Western Tent Caterpillar (*Malacosoma californicum*) is a defoliator of aspen and successive years of heavy defoliation can top-kill or kill the entire tree. The only silvicultural control is by maintaining stands in a healthy state, thus stands are better able to survive and recover from attack. Heavy infestations have occurred in the past and presently populations are on the increase but damage should be minimal on PR as most aspen stands are young and healthy.

E. Broom rust (*Chrysomyxa arctostaphyli*) appears on some Englemann spruce in the area. Broom rust causes bole deformations, loss of volume, spiketops, windbreaks and infection routes for decay fungi. The presence of broom rust is indicated by witches brooms, (i.e. masses of deformed branches). Removing any infected trees in harvest areas is the preferred control method.

F. Wood rots appear throughout the PR forested area. Stem, root and heart rots are common in corkbark fir and aspen. These species are very susceptible to rot producing fungi which can become rampant with advanced age, scarring or dead tops.

Rots are widespread in overmature trees and stands especially aspen where it is the main killing disease. Heart rot infects mortality corkbark fir rather quickly therefore the species has relatively little salvage value typically as is the case with most corkbark fir mortality on PR. Various rots on other species occur in negligible amounts and at this time are not serious enough to warrant specific mention. Wood-rotting fungi weaken affected trees, predispose them to windthrow or windbreak, and cause significant volume losses.

G. Sudden Aspen Decline (SAD) is a new concern in the region that seems to have been triggered by the last series of drought years (2002 – 2006). It is currently being researched for what might be the exact causative agent, but indications are that lower elevation, age and severe drought have been contributing factors. This problem has not occurred on PR currently, maybe because of the high elevation, and mesic conditions on level, and north-facing slopes, along with the overall eastern aspect of the property.

Animal Damage

There is a small amount of tree damage mainly caused by browsing of big game animals and by their action in antler polishing. Browsing impacts will increase with harvesting activity that stimulates aspen sprouting. Gophers will need monitoring in any reforestations sites.

RIPARIAN ZONE/WATER RESOURCES

Riparian Type – This land type of 150 acres occurs in a mix of grassland (~30acres) and forestland (~120 acres) vegetation types. The riparian zone of influence was considered to be about 100' on each side of a water source or wetland. Any management activities in proximity to this zone will be directed at protection of this extremely valuable land resource. Riparian ecosystems are the single most productive type of wildlife habitat, benefiting the greatest number of species. At present there are no areas of concern so no forest management activities are recommended for this land type beyond monitoring for any developing problems.

The riparian area of influence, though small in size, area of extreme importance to land value. Healthy riparian areas are a balance between watershed (i.e. areas upland from riparian zone) and riparian condition.

Riparian area damage usually includes reduction or elimination of vegetation, modified streambank and channel morphology, increased channel width and/or depth which can lower surrounding water tables and increase sediment transports which is not occurring on PR. Riparian areas ecologically important habitats that are sensitive to disturbance, but are resilient and recover with proper management.

The main trees on PR forested riparian areas are spruce/fir and aspen. Primary shrub species are willow (*Salix*) and alder (*Alnus*).

An important consideration in forest riparian zones is how to handle them in a harvesting scheme. The ranch will use New Mexico Best Management Practices regarding riparian zones, by establishing buffer strips.

The minimum standards for riparian buffer zones are as follows:

Slope of land above Watercourse	**Buffer strip width, each side of stream or other water source**
0%	50 feet
10%	70 feet
20%	90 feet
30%	110 feet
40%	130 feet

Water-soil health and stability are tightly interrelated. Adverse impacts on these vital resources can have a detrimental long-term effect on the total ecosystem. It is important to remember that water's erosive power and sediment carrying capacity are related to two key processes, volume and velocity, with erosion treatments developed around decreasing one and/or both factors to protect both soil and water resources.

In all harvesting operations a combination of water-barring, slash, ditching and grass seeding used to minimize impacts on PR water resources. Cañones Creek, Little Poso Creek and portions of Chavez Creek are the primary ranch water resources, fisheries and recreational area that are monitored and protected from ground disturbing activities. Also the many springs, seeps, small creeks and marshy areas will be protected.

Published research on watershed-harvesting interactions indicate that peak spring run-off may occur earlier, depending on cutting intensity, but that overall site water quantities are increased along with the duration which they run. This is a function of a larger snow-pack, fewer trees on site meaning less interception or evaporation-transpiration losses and some slash which acts as a protective mulch for water in the soil profile.

Table .—Important attributes of healthy and unhealthy riparian areas.

Healthy		Unhealthy	
A	Efficient channel shape with narrow channel that conveys all flows less than that of the mean annual flood (2.33-year recurrence interval) with minimal bank and channel erosion.	A′	Inefficient channel shape often braided or shallow and widely fluctuating. Most flows confined in channel. Severe bank and channel erosion and expanding width.
B	Stream power < critical power.	B′	Stream power > critical power.
C	Channels have low hydraulic energy gradient and high sinuosity.	C′	Channels have high hydraulic energy gradient and low sinuosity.
D	Flows above mean annual flood leading to low energy flow on the floodplain: dissipating energy, filtering sediment, and capturing sediment.	D′	Flows above mean annual flood lead to high velocity on the floodplain. Limited energy dissipation. Removal of sediment and nutrients from floodplain.
E	Log step and transverse gravel bar formation in confined channels. Infrequent occurrence of knickpoints. Well-developed meanders in nonconfined channel.	E′	Channel steps are lacking. Frequent occurrence of knickpoints.
F	Channel generally stable with aggrading floodplain.	F′	Channel degrading with mildly infrequent floodplain deposits. Floodplains undermined and eroded.
G	Water table near surface and increased water storage capacity.	G′	Deep water table and decreased water storage capacity.
H	Abundant vegetation with roots penetrating and stabilizing nearby streambanks.	H′	Little vegetation and roots to protect and stabilize streambanks.
I	Larger late summer streamflows.	I′	Low late summer streamflows.

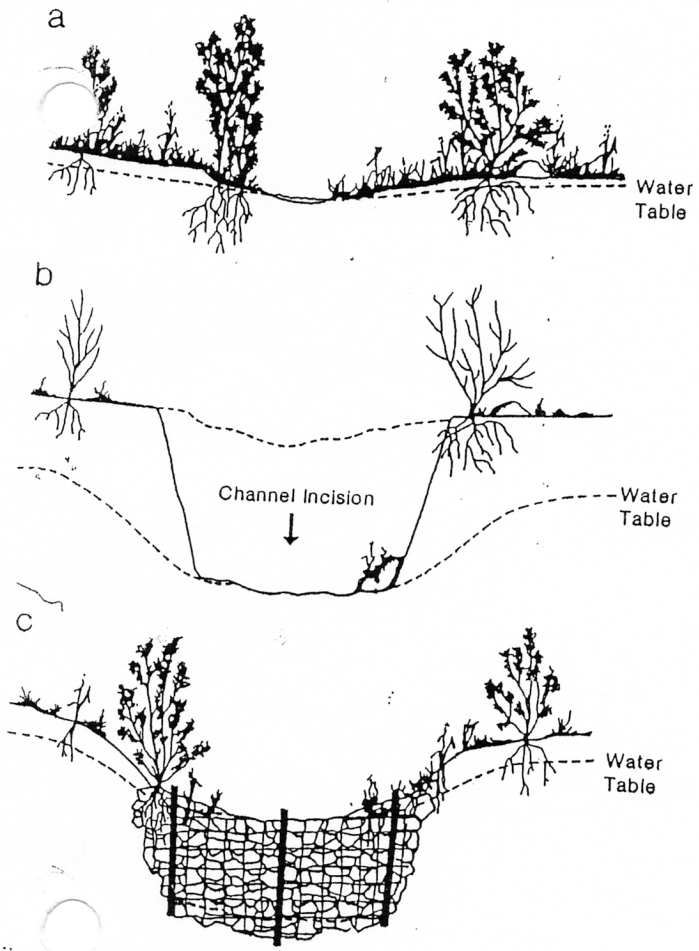


Figure .—Water table and riparian vegetation relationships: (a) before channel incision, (b) after channel incision, and (c) following rehabilitation with a channel structure.

Table .—Attributes of good and poor watershed condition.

Good level	
A	Vegetation and litter cover capable of absorbing precipitation energy, increasing infiltration, and extending release of flow to channels.
B	Minimal drainage density channel network is necessary for conveying runoff from watershed.
C	Large temporary storage of water in the watershed system.

Poor level	
A′	Storm energies detach soil, seal soil pores, increase erosion, thereby creating a flashy sediment-laden runoff, resulting in ephemeral flows.
B′	Expanding drainage density and channels to accommodate increased surface flow.
C′	Rapid conveyance of water from watershed with minimal retention of water for later release.

A well planned harvesting program allows opportunities and financial incentives to beneficially impact watershed values, water quantities and their duration while minimally impacting water quality or letting us improve it by increasing and rejuvenating understory vegetation, which has better soil holding root system than dense tree stands.

SOIL RESOURCES

Soil is the medium necessary for plant growth. Its health and stability are interrelated with plant growth it supports. Plant growth is dependent on, light, mechanical support, heat, oxygen, water and nutrients. Soil provides 5 out 6 of these factors, if out of balance impact plants establishment and growth. Lack of soil stability can have long reaching ramifications on an ecosystems health and productivity.

Some erosion is a natural occurrence, however it is increased by activities that upset the natural balance of ecosystems. Currently there are no major erosion source points on PR. All harvesting activities on PR shall use mitigating measures, i.e. grass seeding, slash and water bars, to minimize soil disturbance, control runoff and prevent degradation of water quality. The operable forest soil types are 206 and 211 and they require special attention when implementing some management activities because of slopes, severe erosion, slumping and rutting potentials, (See Appendix 2 Soil Types and Roads Information). Therefore harvesting/hauling operations will be restricted or suspended when conditions warrant it. Closely associated with soils are roads and their stability.

ROADS

Annual road inspections on PR are conducted to determine and fix any problems with main travel roads surfaces and drainage. Erosion and maintenance cost are minimized by proper roadway design and repairing problems and their causes before they become unmanageable. Most operable areas on the property are accessible by several miles of stable roads that present no problems in their being used. The major restriction, especially for hauling purposes, is that these roads are extremely slippery and rut prone when wet. During harvest operations, all road maintenance is the responsibility of the contracted logger. Opening and closing secondary roads will be the responsibility of the contracted logger. Road close-out procedures entail grading, water barring and grass seeding. A major road management option, that PR should implement is to “daylight the roads”, i.e. thin trees out along road edges approximately 50´ each side, used in conjunction with harvesting operations. This allows more sunlight and wind to dry out road surface, thereby reducing the incidence of potholes and rutting. Also, roads will provide better fuelbreaks and can be important wildlife forage areas.

WILDLIFE RESOURCES

This resource is important to the ranch and planned management strategies are designed to enhance the resource. Wildlife, especially grouse, turkey, deer and elk are benefited by many of these improvements. Elk and deer are important because of the visual quality they add to an area and recreational hunting opportunities and/or revenue returns to landowner. A diverse, healthy and stable land environment is conducive to attracting a wide range of wildlife and maintaining their continued presence. PR is well endowed with a good mix of meadows, aspen/conifer stands and plentiful water.

The recommended timber harvest will benefit wildlife by adding to diversity in the forest cover types, allow grass seeding of disturbed ground with high value forage mix and stimulating some aspen sprouting.

The presence of forest openings is fundamental to presence and number of wildlife species. A key element in level of habitat diversity is landscape patchiness. Also see Appendix 7 for additional wildlife information and regional species possible on property.

GRASSLAND RESOURCES

This habitat type, comprising a total of 360 acres, is an important component in the areal mix of habitat types, especially benefiting large and small grazers. Under conditions of moderate grazing intensity and semi-arid to more mesic conditions, grasslands serve to diminish the threat of soil erosion. Meadows are located throughout the property from small forest openings to large expanses in valley bottom or atop windswept rocky ridges. These meadows are in a healthy stable condition presently. Soil types associated with grassland are 207, 208, 209 & 216 and Appendix 2 provides most likely grass composition for each type.

RECREATION

The Pinorealosa Ranch is mainly a vacation and recreational area providing owners and guests a variety of land use opportunities. The recommended habitat modifications from timber harvesting are beneficial to many of these land uses:

- Fishing
- Hiking
- Camping
- Skiing
- Snowmobiling
- Photography/visual aesthetics
- Hunting
- Mountain Biking

Maintain and protect the appearance of streams and access roads is a prime landowner mandate in any proposed land management activity.

CULTURAL SITES, THREATENED AND ENDANGERED SPECIES AND NOXIOUS WEEDS

Cultural resources of significance are not known to exist on the property except for some old sawmill sites. If sites of significance are found in the future, protection measures will be instituted.

Threatened or endangered (T&E) animal, plant or fish species identified as possibly in the region are in Appendix 8. The ranch's habitat types are not unique from surrounding properties. A biological assessment of possible impacts and protection measures on T&E species regarding timber harvesting in various forest types is in Appendix 8. This section is a detailed list and discussion of possible T&E species that may be encountered in the various forest types present on the ranch and possible impacts of timber harvesting on their habitats, survivability and protection measures, to be followed in harvesting operations. This information is reviewed and incorporated into the marking prescription and actual harvest operations. Also recommended treatments will only affect approximately 30% of total land area or 40% of total forestland. Recommended management practices will add a few new habitat types therefore providing more diversity in the landscape. These practices should not be detrimental to possible T&E species on the property. Protection measures if necessary will be activated if any such species are identified. There are a few known Northern goshawk nests on the property that are protected from disturbance.

Noxious weeds are non-native plants that will compromise landscape integrity by outcompeting and displacing native vegetation. Once established on site, control costs can be significant, i.e. $100-$200/acre. On PR Thistle spp. are present in some disturbed roadside areas and are the only weed concerns. The herbicide Milestone is currently recommended for thistle control when used according to EPA approved label requirements. Also see Appendix 9 for State Noxious Weed List.

An integrated weed management program consisting of prevention and control is the best defense against noxious weeds. Prevention includes all measures employed to prevent weeds from becoming established on the property. Specifically, the following preventative measures are recommended:

A. Be on the lookout for noxious weeds and consider a feasible control method.
B. Use only certified weed free seed, hay, and straw.
C. Practice minimal disturbance of soil in road maintenance, ditch digging, or any type of dirt construction. Sow certified weed free grass seed on all disturbed areas to retard erosion and provide ground cover. A good ground cover of competitive grasses will help keep weeds out.

Control can be thought of as any method designed to contain, reduce, or eliminate noxious weeds. This means you identify and treat both the environmental conditions that led to the infestation and the infestation itself. Control typically involves the use of one or more of the following methods: cultural, mechanical, biological, and chemical.

If professional assistance is needed contact the Chama NRCS at (575) 756-2581 or Rio Arriba County Extension Office @ (505) 753-3405.

SUMMARY

A dynamic and progressive forest improvement program proposed on Pinorealosa provides monetary value but benefits go far beyond financial considerations and ultimately relate to the long-term ecological health of the resource. A management strategy can be defined as manipulating the course of events so that a desired outcome is reached. Only after cause/effect relationships are recognized and understood can effective management strategies be developed to treat problems and their "causes". All land areas evolved and developed their particular make-ups with some pattern of natural disturbance(s) as a primarily moving force. Many of these natural disturbances have been prevented or suppressed for more than a century in conjunction with past poor land use practices. Realization of ecosystem stabilization and improvement can be slow. It is important to remember that reestablishing all the conditions favorable to ecosystems and how they functioned in the past is beyond our capability. This being said, it usually best to start management on most logical course then modify as circumstances dictate. In forestry, any question can have many answers depending on a multitude of variables, therefore, "no simple answer", and tradeoffs are usually necessary.

The corner stone of the recommended timber harvesting plan is resource protection and improvement. All of which is designed to protect and wisely manage these renewable resources for the ranch today and for the future.

According to landowner's management goal and objectives and the forest resource and its current status, the following recommendations are applicable:

A. Apply a combination of selection, salvage and sanitation cutting methods in most operable forest stands, over the next 5 years to:

- Selection harvesting system initiated as hopefully preemptive deterrent to severe spruce beetle infestation by modifying some stand characteristics that favor spruce beetle attacks. Also as this is a commercial operation it will generate revenue that can be reinvested into land and cost treatments.

- Salvage harvesting used to remove marketable dead/dying trees while still saleable thereby generating revenue.

- Sanitation cutting used to cut and remove, at a cost, non-marketable dead/dying trees especially where concentrated corkbark fir mortality is occurring.

B. Pile and Burn majority of non-marketable harvesting and cutting material at cleared landing areas. After burning, scarify and grass seed sites.
C. Spot-plant spruce seedlings in heavily cut-over areas to accelerate site recovery and stabilization.
D. "Road Daylighting" on harvest roads.
E. Employ mitigation measures in all ground disturbing activities.

These treatments will beneficially effect:

- Forest health, growth and protection.
- Wildfire severity risk indices.
- Wildlife values.
- Aesthetic values.
- Protect water and soil resources.

Individual site evaluation and landowner desires will determine specific prescription implementations thereby generating a variety of treatments on about 800 acres (~40%) of forested area.

In conclusion implementing this proactive forest management plan and its recommendations will satisfy landowner goal, objectives and responsibilities as a steward of the land. The plan provides land resource protection, enhancements, resiliency, diversity and resistance today and into the future.

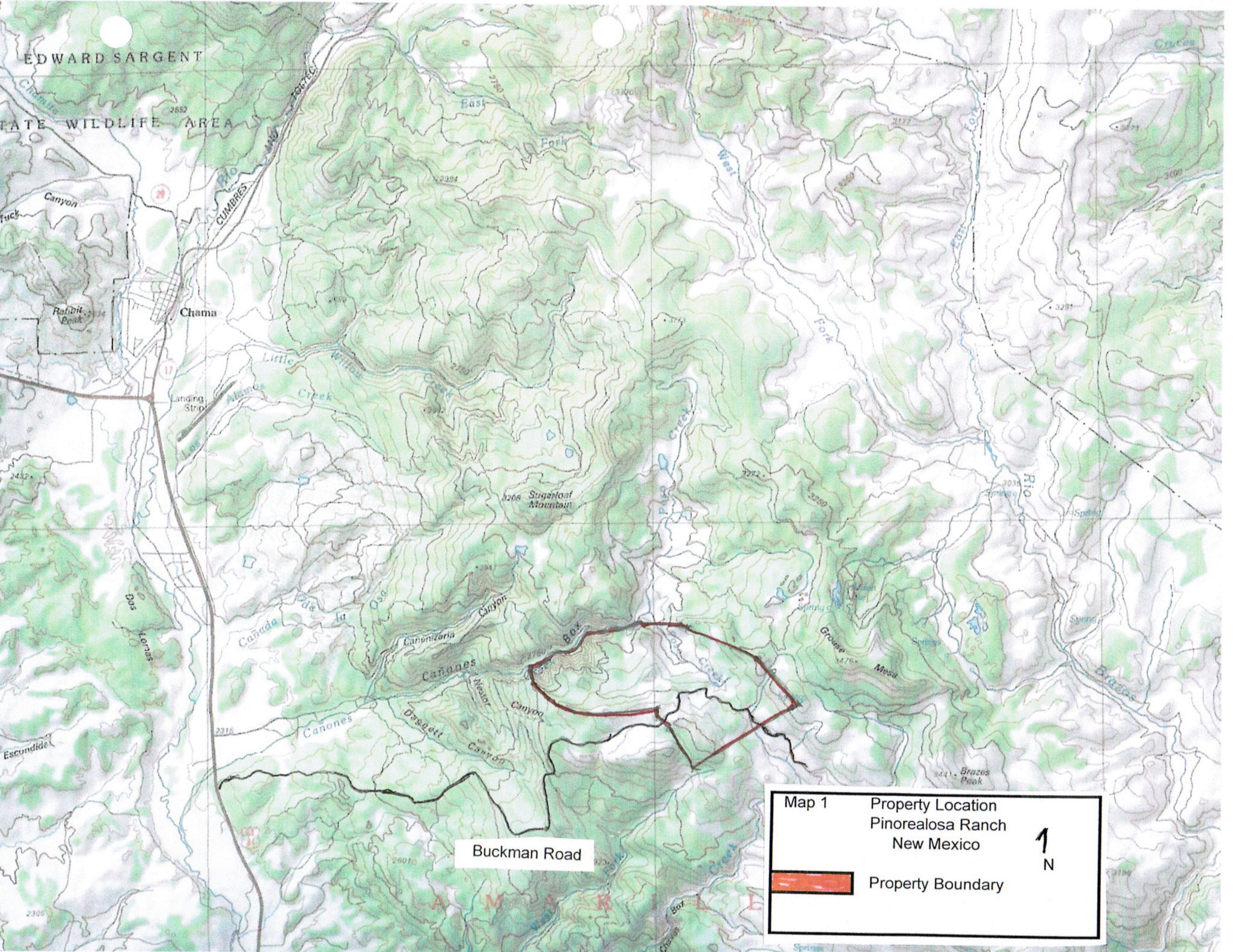
Appendices

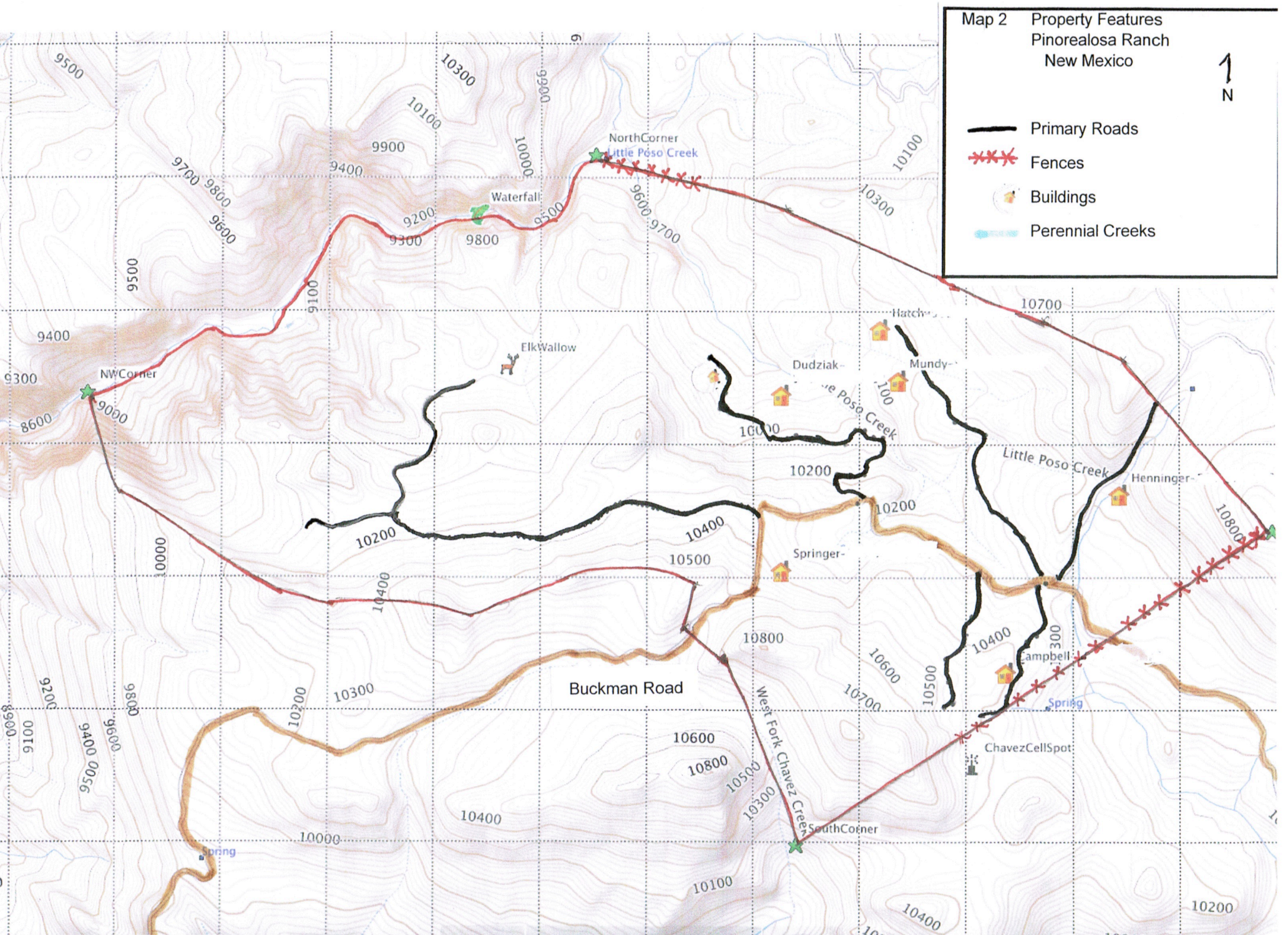
1. Maps and Timber Inventory Data
2. Soil Types and Roads Information (subsection R)
3. Timber Harvesting Information
   - New Mexico Harvesting Regulations and Best Management Practices
   - County Harvest Ordinances
   - Burn Permits
   - Sample Timber Sale Contract (subsection S)
4. Timber Stand Improvement by Thinning
5. Reforestation Guidelines
6. Forest Insect/Disease Information
7. Wildlife Considerations
8. Threatened and Endangered Species
9. Noxious Weed List
10. Glossary of Terms

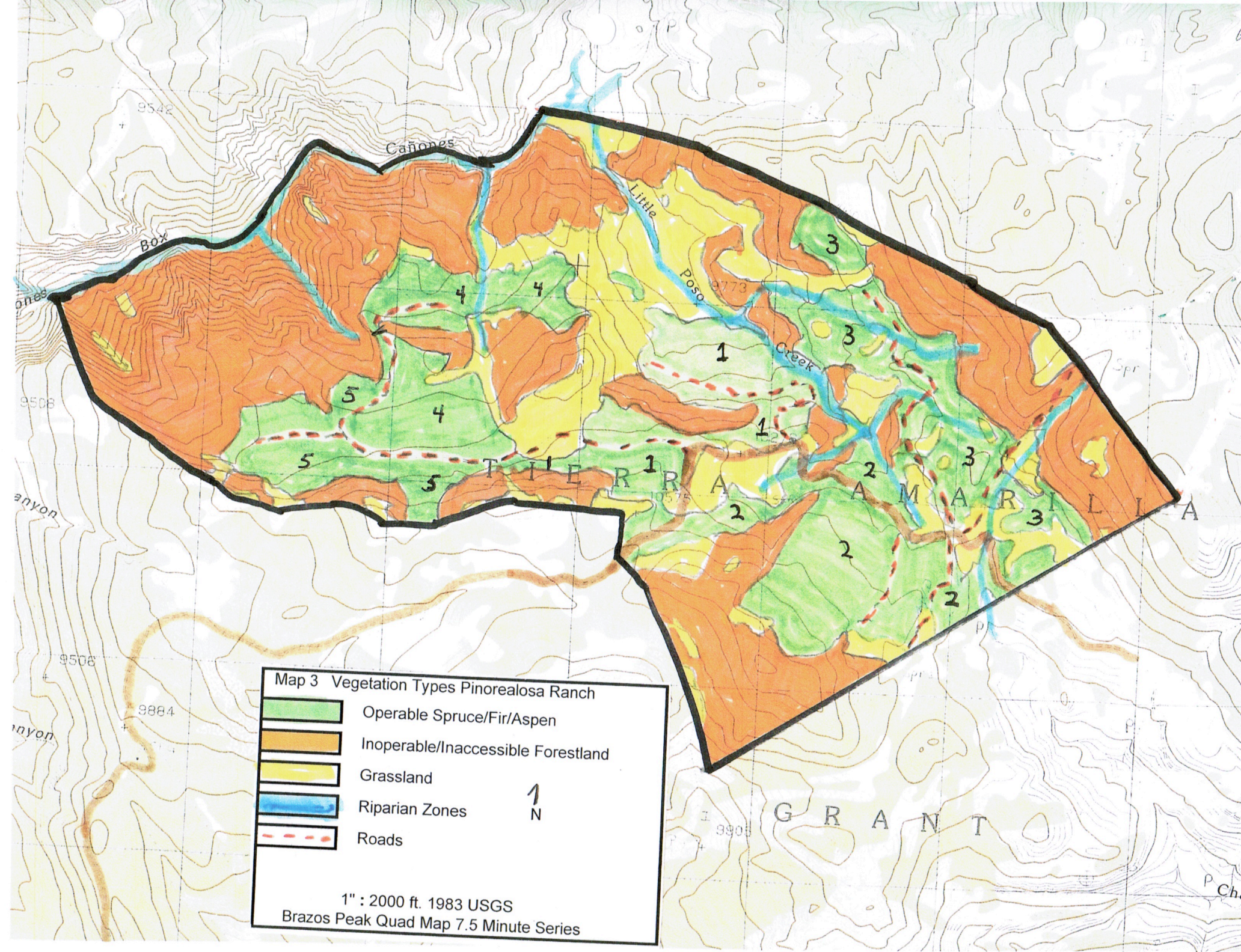
The following Appendix Sections contain information relevant to the property but also some general information that may or may not be applicable to property and/or the management objectives.

Appendix 1

Maps and Timber Inventory Data


EDWARD SARGENT
WILDLIFE AREA
Chama
Rio Cumbres
Canyon
Rabbit Peak
Landing Strip
Little Alamos Creek
Sugarloaf Mountain
Canada de la Osa
Canoncita Canyon
Cañones
Nestor Canyon
Daggett Canyon
Box Canyon
Grouse Mesa
Brazos Peak
Escondido
Buckman Road
Map 1
Property Location
Pinorealosa Ranch
New Mexico
Property Boundary
N


Map 2 Property Features
Pinorealosa Ranch
New Mexico
N
Primary Roads
Fences
Buildings
Perennial Creeks
NorthCorner
Little Poso Creek
Waterfall
NWCorner
ElkWallow
Dudziak
Mundy
Hatch
Little Poso Creek
Henninger
Springer
Campbell
Spring
ChavezCellSpot
SouthCorner
West Fork Chavez Creek
Buckman Road
Spring


Cañones
Box
Little
Poso
Creek
9542
9508
9884
9773
T I E R R A A M A R I L L A
G R A N T
Map 3 Vegetation Types Pinorealosa Ranch
Operable Spruce/Fir/Aspen
Inoperable/Inaccessible Forestland
Grassland
Riparian Zones
Roads
N
1" : 2000 ft. 1983 USGS
Brazos Peak Quad Map 7.5 Minute Series

Discussion Timber Inventory Data

Stands within Forest Type, though providing more tree stand specific information, are still highly variable due to many factors. Factors which effect a particular stands composition are elevation, aspect, soil type and topography. Majority of Riparian and Inoperable/Inaccessible forested area has stand characteristics and volumes similar to Stands 2 & 5 for spruce/fir type and aspen component Stand 4 for aspen type.

This general timber inventory was a variable plot cruise using a 30 BAF and 1/300th acre plot (6.8´ fixed plot radius) for seedling/sapling counts. Sample size determined by a desired cruise accuracy of ± 20% standard error at one standard deviation.

Site index data based on Ecology, Silviculture and Management of the Engelmann Spruce – Subalpine Fir Type in the Central and Southern Rocky Mountains (Alexander 1987). Site Index curves utilized are 100 year base with DBH age and indicate above-average growing site for both forest types. Site index specimen trees selected ranch-wide according to criteria of: Dominant ▪ Good health and form Good growing site conditions.

Sampling Error Calculation:

Inventory Standard Deviation (SD) ~5 MBF. Inventory coefficient of variation (CV) = 5MBF÷6-7MBF (average plot volumes) or 70% to 80% therefore Inventory standard error (SE) = 70-80%÷√36 or ±15% at one standard deviation.

Tables Key

Definitions of some terms in glossary

AS – Aspen
ES – Engelmann Spruce
CF – Corkbark Fir (subalpine fir)
S – Sawtimber Size Class
P – Poletimber Size Class
TPA – Trees Per Acre
S/S – Seedlings/Saplings
BAF—Basal Area Factor (Determines trees measured on a variable radius plot)

S – Volume – Board Feet
P – Volume – Cubic Feet
DBH – Diameter Breast Height
SI – Site Index
BA – Basal Area (sq. ft.)
MBF – Thousand Board Feet
MCF – Thousand Cubic Feet
MMBF – Million Board Feet
MMCF – Million Cubic Feet

PINOREALOSA RANCH TIMBER INVENTORY DATA
TABLE 1

Forest Stand	S-Vol/ac	P-Vol/ac	S-TPA	P-TPA	Avg S/S Per Acre	S Avg Age	S Avg DBH /Height
ES/CF							
Stand 1							
AS	100	18					
ES	6,740	154	60	10	520	90	16"/70'
CF	160						
ES/CF							
Stands 2 & 5							
ES	5,775	380					
CF	600	170	50	80	1,400	90	14"/60'
ES/CF							
Stand 3							
ES	7,650	425					
CF	950	45	70	70	475	100	16"/80'
ES/CF/AS							
Stand 4							
AS		2,550		270	2,400	50	8"/60'
ES	5,400	380	50	80	1,400	100	16"/70'
CF	600	170					

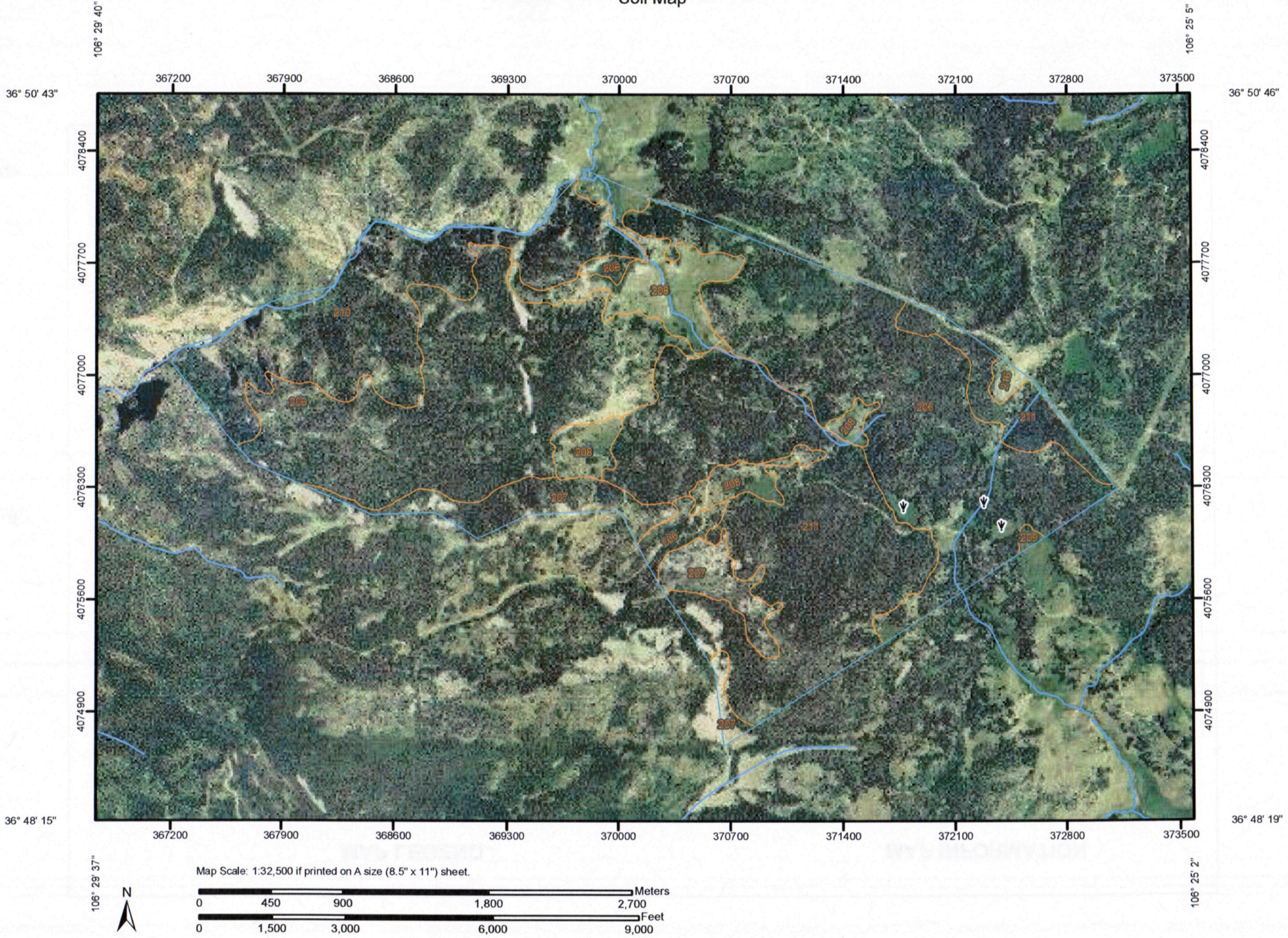
PINOREALOSA RANCH TIMBER INVENTORY DATA
TABLE 2

Forest Stand	Stand Number Within the Type	Acreage	Total Sawtimber Volume	Total Poletimber Volume	Site Index	BA/AC
ES/CF TYPE	1	200	1.4 MMBF	34 MCF	90	90
ES/CF TYPE	2 & 5	2=225 5=120	2.2 MMBF	190 MCF	90	105
ES/CF TYPE	3	220	1.9 MMBF	100 MCF	100	115
ES/CF/AS TYPE	4 ES/CF 4 AS	120 80	720 MBF	66 MCF 200 MCF	90 85	100 150

Appendix 2

Soil Types and Roads Information

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:32,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Rio Arriba Area, New Mexico, Parts of Rio Arriba and Sandoval Counties
Survey Area Data: Version 10, Dec 19, 2008

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Rio Arriba Area, New Mexico, Parts of Rio Arriba and Sandoval Counties (NM650)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
206	Angostura-Gromes complex, 15 to 35 percent slopes	1,155.8	45.5%
207	Gromes-Rock outcrop complex, 15 to 40 percent slopes	153.8	6.1%
208	Ess-Croftshaw complex, 3 to 20 percent slopes	195.0	7.7%
209	Crubas-Bywell-Croftshaw complex, 0 to 15 percent slopes	3.8	0.1%
210	Rock outcrop-Bracos complex, 40 to 80 percent slopes	372.6	14.7%
211	Angostura very cobbly loam, 15 to 40 percent slopes	649.9	25.6%
216	Angostura very cobbly sandy loam, 15 to 45 percent slopes	10.4	0.4%
Totals for Area of Interest		**2,541.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with

some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Appendix 10

Glossary of Terms

GLOSSARY

AFFORESTATION - The establishment of trees on a previously non-forested site.

AGE CLASS - One of the intervals of time into which the age range of tree crops or stands is divided for classification or use, and the trees whose age falls within such an interval.

ALLELOPATHY - Is the addition of toxic substances from one plant species that inhibits the establishment or growth of another plant species.

ANNUAL ALLOWABLE CUT - The acceptable amount of harvest for a given period of time (i.e. yearly) which provides for acceptable residual stocking levels that can produce harvests on a continual basis in perpetuity.

AUM (ANIMAL UNIT MONTH) - Amount of forage to sustain one animal unit for a month. One cow (1000 lbs.) and calf as animal unit.

BA (BASAL AREA) - A measure of a square feet of space occupied by the stem of a tree.

BARK BEETLE - A member of the family Scolytidae, whose adults and Larvae tunnel into the cambial region (either in the bark only or in the bark and sapwood) of living, dying and recently dead or felled frees and do immense damage to forests all over the world.

BF (BOARD FOOT) - The amount of timber equivalent to a piece of lumber 1 ft x 1 ft. x 1 inch thick.

BUFFER STRIP - A relatively undisturbed forest area adjacent to an area requiring special attention or protection such as stream, lake or road (a.k.a. Filter strip).

CLIMAX -
1. A community at a relatively stable condition which is able to reproduce itself indefinitely under existing conditions.
2. A stable community in which there will be no significant change in composition unless the surroundings change.

COMMERCIAL HARVEST - Type of harvest, from a stand of trees, producing merchantable material that has a value at least equal to the direct cost of the harvest.

CORD - Fuelwood measurement of 4 ft. x 4 ft. x 8 ft or 128 Cu. ft.

CROWN - (As it pertains to road design; Is the highest point of a cambered road in cross section.

CF (CUBIC FOOT) - unit of volume measure equivalent to a piece 1 ft. x 1 ft. x 1ft.

CULTIVARS - Superior seed varieties that show exceptional qualities overall in various categories (e.g. production, palatability, etc.)

CULVERT - A passage, usually a corrugated pipe, constructed beneath a road.

DBH (DIAMETER BREAST HEIGHT) - A point 4 1/2 feet above the ground on the uphill side of a tree, where, on a normally formed tree, the tree diameter is measured. Height of DBH may vary on abnormally formed trees.

DENSITY - Relative degree to which vegetation covers the ground surface usually expressed in numbers per unit area.

DIP - A shallow depression built diagonally across a light duty road or trail for the purpose of diverting surface water runoff therefrom.

DISCLIMAX - A climax resulting from disturbance by man or domestic animals (see subclimax).

DIVERSION - (Terrace or ditch) - A drainage depression or ditch built across the top of an erodible slope to divert surface water from that slope.

DRC (DIAMETER ROOT COLLAR) - Diameter at ground level above abnormalities.

ECOLOGY - 1. The science of interrelationships of organisms and their environment.
2. Study of the reciprocal relations between organisms and their environment.

EVOLUTION -The stepwise development of biological groups from prior groups as a result of the action of natural selection on hereditary variants existing in the populations. Such variants usually are initially ill-adapted and consequently rarely survive. When changes in their environment favor survival there is consequent increase in the frequency of their genes. The failure of certain groups to survive is also an aspect of evolution

ENVIRONMENT - The sum total of all the external conditions which act upon an organism or upon a community.

FORAGE - The edible vegetation for livestock and/or wildlife produced seasonally or annually on a given area.

FOREST - A combination of relationships in a community where trees dominate or will dominate the vegetation.

FOREST COVER - Ground covering of a forest; includes trees, shrubs, herbs, litter, duff and humus.

FOREST FLOOR - More or less decomposed vegetable matter above mineral soil.

FOREST TYPE - A forest stand essentially similar throughout as regards floristic composition, physiognomy and ecological structure maybe climax or seral.

FUEL LOADING - The oven dry weight of all existing fuels in a given area.

GRADE - (As pertains to road construction) - The rise or fall over a horizontal distance expressed as one unit vertical to so many units horizontal, i.e., 1/20 and also as percent, i.e. 5%, or as degrees of slope, i.e. 20 degrees.

HABITAT - The abode, natural or otherwise, of a plant or animal, considered particularly in relation to all the environmental influences affecting it.

HYDROLOGY - A science dealing with the distribution, circulation, and properties of water on the earth's surface, in the soil, and in the underlying rocks.

INTERMITTENT STEAM - A stream that flows only part of the year, when there is sufficient moisture, and is dry the remainder of the year.

INACCESSIBLE - (i.e. inoperable) Describes areas not available for timber cutting (using present equipment and technology) due to steepness, rocks, extremely unstable soils, etc.

INGROWTH - The net volume of trees that grew into growing stock or into sawtimber size during a specified year.

MANAGEABLE FORESTLAND - Areas of land that can be silviculturally treated and are not restricted by terrain features (i.e. > 50% slope) or economic value, aesthetic concerns and riparian zones

MISTLETOE - A flowering plant of the family Loranthaceae, parasitic on trees and other woody plants.

MORTALITY - The loss to a population from all lethal causes.

NICHE - The total role of an organism in its environment, such as what it is doing, its relation to food, enemies, etc.

PATCH CUTTING - A modification of the clear-cutting system whereby small areas are treated.

POLETIMBER - Trees at least 5.0 inches in DBH but smaller than 11.5 inches.

POOL: RIFFLE RATIO - The ratio of quiet-slow moving water to fast turbulent water.

REFORESTATION - Re-establishment of a tree/crop on forestland (a.k.a. Regeneration).

RESIDUAL - A general term for quantity remaining after some other quantity has been subtracted.

RIPARIAN - Streams, lakesides or any other area associated with surface water.

ROUND WOOD - Logs, bolts or other round sections cut from trees for industrial or consumer uses. (NOTE: Includes saw logs, veneer logs and bolts, cooperage logs and bolts, pulpwood, firelwood, piling, poles, ties, mine timbers and various other round, split or hewn products.)

SAPLING TREES - Trees O.1 inches to 4.9 inches in DBH.

SAWTIMBER - Trees which are 11.5 inches and larger at DBH.

SECONDARY SUCCESSION - Which is subsequent to the destruction of part or all of the original vegetation by man, fire, grazing, etc.

SEDIMENTATION - The process of depositing sediment (i.e. soil into waterways).

SEEDLING TREES - Seedling is a tree that is 6 inches in height, but less than 4.5 feet in. height.

SELECTION SYSTEM - An uneven-aged silvicultural system in which trees are removed individually or in small groups, here and there, from a given tract of forest over regular intervals of time.

SIDESLOPE - The incline of the road surface towards the side of the road in order for surface water to runoff into a proper ditch.

SILVICUILTURE - The theory and practice of controlling forest establishment, composition, growth, and harvesting.

SITE INDEX CLASS - A measure of site productivity based upon the height of trees at a given base age.

SLASH - The residue left on the ground after felling or thinning.

SPRUCE BUDWORM - A larva of the moth family Tortricidae, which feeds on, and in buds and young shoots, e.g. the Western Spruce Budworm, (Choristoneura occidentalis) and the black-headed budworm (Acleris variana) both serious forest defoliators in North America.

SUBCLIMAX (seral) - A stage below climax - the community simulating climax because its further development is inhibited by some disturbance factor such as fire.

SUCCESSION - The replacement of one community by another, developing toward a climax.

SUPPRESSION - The process whereby certain trees, shrubs, etc, in a community become weakened, essentially through the competition of neighbors.

SUSTAINED YIELD - The yield that a forest can produce continuously at a given intensity of management. Note: Sustained yield management therefore implies continuous production so planned as to achieve at the earliest practical time a balance between increment and cutting.

THINNING - A felling made in an immature crop or stand in order to accelerate diameter increment but also, by suitable selection, to improve the average form and spacing of the trees that remain

TIMBER STAND IMPROVEMENT - A loose term comprising all intermediate cuttings made to improve composition, condition and growth increment of a timber stand.

WATER BAR - A hump or small dike built across a light-duty road or skid trail for the purpose of diverting surface water runoff therefrom.

WATER QUALITY - A term used to describe the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

WATERSHED - A drainage area, separated from adjacent watersheds by a topographic divide, that collects and discharges precipitation into a given stream.

WATER TABLE - The upper limit of the portion of the ground saturated with water.

WETLAND - A general term for poorly-drained, uncultivated tract, whatever its vegetational cover and soil.

WILDLING - Wild trees with certain qualities that make them suitable for balled and burlapped transplants as nursery saleable ornamentals.

WINDTHROW - Tree or trees uprooted by wind (a.k.a. Windfall).