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Ecological Research at the Goosenest Adaptive Management Area in Northeastern California

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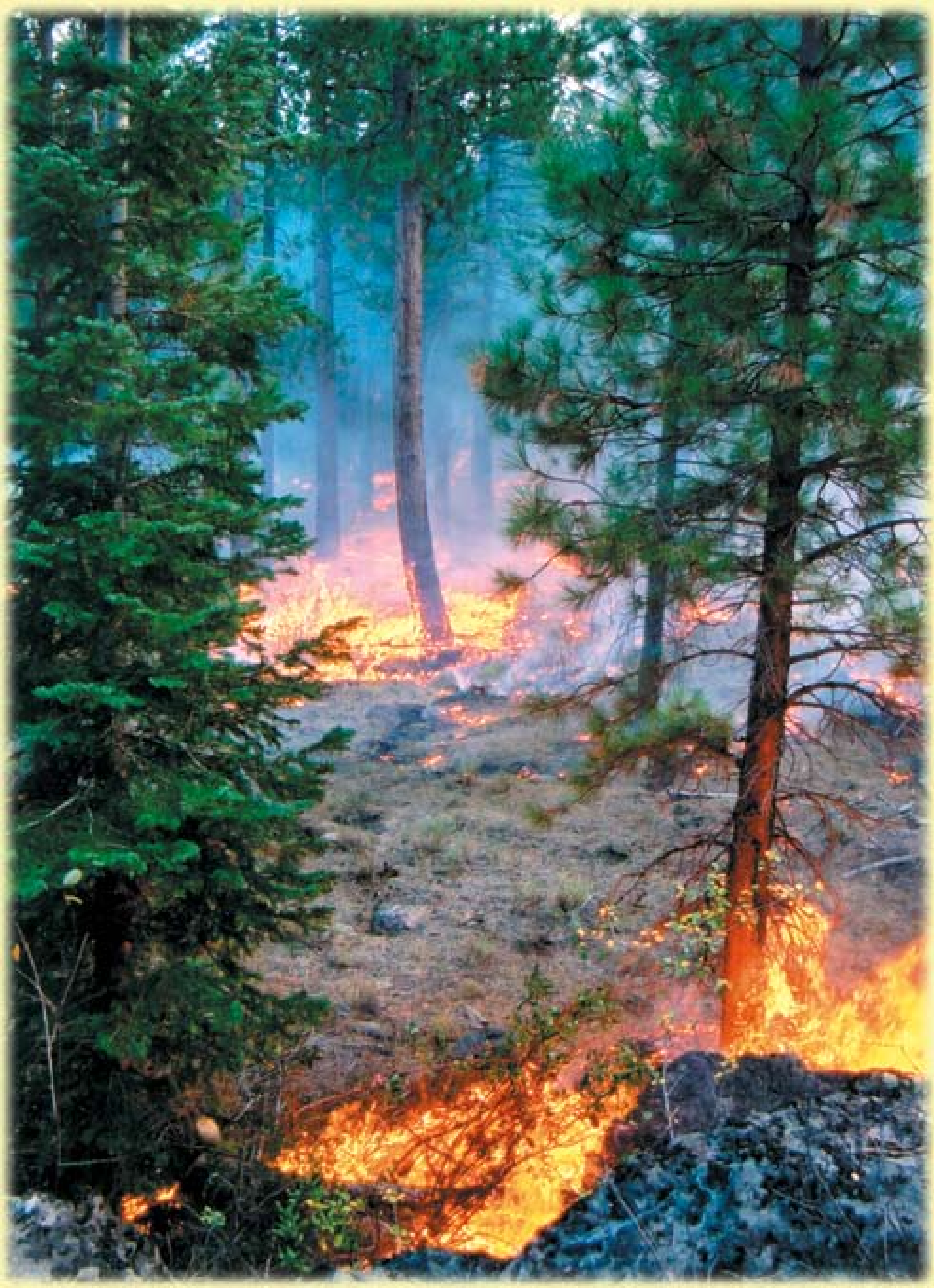

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Ritchie, Martin W. 2003. **Ecological research at the Goosenest Adaptive Management Area in northeastern California**. Gen. Tech. Rep. PSW-GTR-192. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 125 p.

Retrieval Terms: arthropods, bark beetles, forest health, forest management, forest restoration, passerine birds, ponderosa pine, prescribed fire, small mammals, stand development, stand structure, succession, thinning, white fir.

This paper describes the establishment of an interdisciplinary, large-scale ecological research project on the Goosenest Adaptive Management Area of the Klamath National Forest in northeastern California. This project is a companion to the Blacks Mountain Ecological Research Project described by Oliver (2000).

The genesis for this project was the Northwest Forest Plan (USDA and USDI 1994a). As a part of the Northwest Forest Plan, a network of Adaptive Management Areas was created in Oregon, Washington, and northern California. One of the primary goals of the Goosenest Adaptive Management Area was to investigate means of accelerating the development of late-successional forest properties.

Led by researchers from the Pacific Southwest Research Station in Redding, California, an interdisciplinary team of scientists designed an experiment to evaluate the use of mechanical treatments and prescribed fire to accelerate late-successional conditions in the Goosenest Adaptive Management Area. The experimental design features four treatments, each replicated five times. The treatment units are 100 acres (40.5 hectares), plus a buffer area of varying size, but generally close to 328 feet (100 meters) in width. The first of the four treatments features a thinning favoring the reestablishment of pine dominance in the forest (Pine-Emphasis Treatment). In this treatment the prescription favors the retention of dominant and codominant pine trees. The second treatment employs the same mechanical treatment as the Pine Emphasis, with the additional application of prescribed fire (Pine-Emphasis With Fire). A third treatment is a mechanical treatment intended to redistribute growth to the largest diameter trees without regard for species distribution (Large Tree Treatment). The fourth, and final, treatment is a control of no active management (Control Treatment), permitting the vegetation to continue along its current trajectory.

The last of the mechanical treatments were completed in 2000. The initial prescribed burn treatment was completed on the five Pine-Emphasis-with-Fire Treatments in fall 2001; these same five units will be reburned 5-10 years after the initial burn. The first post-treatment measurements of vegetation and wildlife were taken in summer 2002. Remeasurements are planned for a 5-year cycle for most forest attributes. Currently, however, birds and small mammals are observed yearly due to year-to-year variation in abundance common to these species.

Introduction

Existing forest structures and habitat are influenced by climate, topography, soil characteristics, and patterns of disturbance over time. These factors influence the productivity of the site as well as the species that may compete and thrive in any given area. Disturbance events will influence the species prevalence as well as the successional development of a forest.

A number of common disturbance events might be observed in forested areas of northern California. Fire has historically had a significant effect on stand development. Although intense stand-replacing fires are certainly a part of the fire history, these have tended to be relatively infrequent events. Preliminary work at Blacks Mountain Experimental Forest (BMEF) indicates that relatively frequent low-intensity fires have been prevalent in northeastern California (Carl Skinner, personal communication, May 2003). These fires appear to have produced a mosaic of structures in the landscape that featured many areas with open park-like conditions, with little understory. Frequent low-intensity fires tend to favor the development of the more fire-tolerant species, such as ponderosa pine, while reducing the abundance of less fire-tolerant species such as white fir (Agee 1994).

The Goosenest Ranger District of the Klamath National Forest is located in northeastern California near the Oregon border (*fig. 1*). The Goosenest Adaptive Management Area (AMA) was so designated by the Northwest Forest Plan (USDA and USDI 1994a). The AMA network was developed to provide managers with areas to test and evaluate effects of management activities, as they relate to forest plans and objectives. On the Goosenest AMA the effects of forest management (primarily logging and fire suppression) are evident. Much of the Adaptive Management Area was logged in the mid 1920s by the Long-Bell Lumber Company. Long-Bell operated a lumber mill in Weed, California, in the early 20th century and established a logging camp in Tennant in 1922 (Shoup 1981). The favored species for extraction at that time was ponderosa pine. This Adaptive Management Area was historically dominated by ponderosa pine with lesser amounts of white fir throughout the area. Occasionally sugar pine (*Pinus lambertiana Dougl*.) can be found in the AMA, but the distribution is not continuous. Red fir (*Abies magnifica A*. *Murr*.) is common in some of the higher elevation sites. In some of the lower elevations of the AMA, incense-cedar (*Libocedrus decurrens* Torr.), western juniper (*Juniperus occidentalis* Hook.), and (rarely) Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) may be found as well. Lodgepole pine (*Pinus contorta* Cougl. Ex. Loud.) is restricted to sites where cold air pools in the winter.

In the 20th century, fire suppression and logging have altered the historic pattern of stand development in many areas in northern California. Fire suppression,

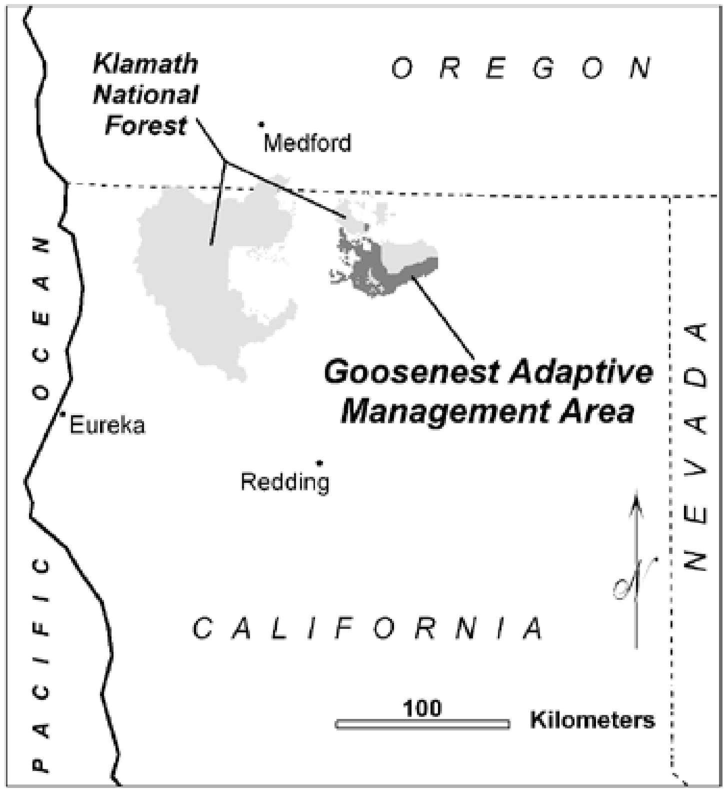

Figure 1 — Location of the Goosenest Adaptive Management Area.

while providing the benefits of a more stable supply of timber and improved air quality, also affects regeneration of trees and the species composition of understory vegetation.

A fire regime with relatively frequent low-intensity fires tends to favor the maintenance of those tree species with thick bark and to retard the development of a dense understory by consuming brush and small trees. Ponderosa pine may develop thick bark at a fairly early age, making it well adapted to areas with frequent low-intensity fires. White fir, the other species commonly found on the Goosenest AMA, has thinner bark, which makes it more susceptible to fire-induced mortality (particularly at a young age). These fire regimes produce conditions favorable to species with a very short cycle from establishment to the age of reproductive capacity. It takes years for common shrubs like manzanita (*Arctostaphylos* spp.) and ceanothus (*Ceanothus* spp.) to produce viable seed, and a species like white fir may take decades. Many grasses and forbs are able to reproduce relatively soon after becoming established and are thus more likely to thrive in areas where fires burn frequently.

The removal of the pine overstory, along with the advent of effective fire suppression in the area, resulted in a shift from stands that were usually dominated by pine to those which have a much heavier representation of white fir that is prevalent through much of the area to this day. The stands left after harvesting were composed of white fir and smaller, subcommercial ponderosa pine trees. The stands were not opened up enough to favor regeneration of an intolerant species like ponderosa pine, but tolerant white fir has regenerated well over the past 70 years. This was the first phase of species shift to white fir dominance.

The area around Tennant was transferred to the Klamath National Forest after Long-Bell abandoned operations there in1957. These lands are now a part of the Goosenest Ranger District. Throughout the latter half of the 20th century, the area was subjected to fire suppression and, in some areas, removal of dead and dying trees.

By the end of the 20th century, species composition of many stands in the area around Tennant had been modified. Stands in this area that formerly featured many large, old ponderosa pine trees (*fig. 2*), growing in open conditions with relatively few white fir had become dense second-growth stands with few large ponderosa pine trees (*fig. 3* a, b, c).

Figure 2—Before initial harvest of these areas (around 1920), many stands probably featured open, park-like conditions with large, well-spaced ponderosa pine trees and occasional firs.

Goosenest Adaptive Management Area

The Northwest Forest Plan was developed in response to concerns for the continued viability of the northern spotted owl (USDA and USDI 1994a). One component of this plan was the establishment of a network of 10 Adaptive Management Areas throughout the region. The purpose of the AMA network is to provide opportunities to explore different strategies for managing forests. The Adaptive Management Areas range from 92,000 acres (37,000 ha) on the Little River AMA in southern Oregon to 488,000 acres

(a)

(b)

(c)

Figure 3—Stand conditions immediately prior to treatment (1997) on three of the units to be treated: (a) Unit 6, grid point 97x29 (b) Unit 13, grid point 24x64 and (c) Unit 9, grid point 00x38.

(197,000 ha) on the Hayfork AMA in northern California. The Goosenest Adaptive Management Area is 172,000 acres (70,000 ha). The intended focus for the Goosenest AMA, as stated in the Northwest Forest Plan Record of Decision, is "*Development of ecosystem management approaches, including use of prescribed burning and other silvicultural techniques for management of pine forests, including objectives related to forest health, production and maintenance of late-successional forest and riparian habitat and commercial timber production*" (USDA and USDI 1994b, page D-14).

Most of the Goosenest AMA is characterized by gently sloping terrain and, within the boundaries of our study, no surface water. The absence of riparian areas makes the establishment of this study much more feasible than it would be if the team had to address limitations presented by steeply dissected terrain and water quality concerns. Soils consistently exhibit a pumice layer no more than several inches deep, over developed soil.

The designation of the Goosenest Adaptive Management Area in the Northwest Forest Plan created an opportunity for large-scale ecological research on the impact of forest management activities. The administrative designation of this land base for adaptive management activities created a place for researchers to operate. The Northwest Forest Plan has provided a stable source of research dollars for efforts within the geographic scope of the plan. Finally, the enthusiastic cooperation of the Klamath National Forest enabled a research team, led by individuals at the Pacific Southwest Research Station's Redding Silviculture Laboratory, to create a project to address the stated goals of the Record of Decision (Ritchie and Harcksen 1999). A proposal was submitted by the team requesting Northwest Forest Plan funding for the project in 1995. The proposal was funded that year and has been funded each year since.

Interdisciplinary Team

In 1991, a group of scientists came together to design a large-scale research project at Blacks Mountain Experimental Forest in northeastern California (Oliver 2000). The result was a 3000-acre (1200 ha) ecological research project designed to investigate the effects of stand structure, prescribed fire, and grazing on an array of forest components. The project was unusual in that the design was not guided by a single discipline, but rather by the work of an interdisciplinary team. The team included researchers from the Pacific Southwest (PSW) Research Stations in

Table 1—Current and past participants in the Goosenest AMA Ecological Research Project.

Participant	Role
Phil Aune	Program Manager (retired 2000) USDA Forest Service, Pacific Southwest Research Station, Redding
Walt Bavarskas	Forester (retired 1999) USDA Forest Service, Klamath N.F.
Bob Carlson	Sale Administrator USDA Forest Service, Pacific Southwest Research Station, Redding
Chris Fettig	Research Entomologist USDA Forest Service, Pacific Southwest Research Station, Davis
T. Luke George	Research Wildlife Ecologist Humboldt State University
Nancy Gillette	Research Entomologist USDA Forest Service, Pacific Southwest Research Station, Albany
Kathleen Harcksen	Project Coordinator (resigned 2000) USDA Forest Service, Pacific Southwest Research Station, Redding
William Laudenslayer	Research Wildlife Ecologist USDA Forest Service, Pacific Southwest Research Station, Fresno
Sylvia Mori	Statistician USDA Forest Service, Pacific Southwest Research Station, Albany
William Oliver	Research Silviculturist (retired 2003) USDA Forest Service, Pacific Southwest Research Station, Redding
John Perkins	Forester (retired 2001) USDA Forest Service, Klamath N.F.
William Reynolds	Forester USDA Forest Service, Klamath N.F.
Martin Ritchie	Biometrician USDA Forest Service, Pacific Southwest Research Station, Redding
Pat Shea	Research Entomologist (retired 2001) USDA Forest Service, Pacific Southwest Research Station, Davis
Carl Skinner	Research Geographer USDA Forest Service, Pacific Southwest Research Station, Redding
Nick Vaughn	Database Manager USDA Forest Service, Pacific Southwest Research Station, Redding
C. Phillip Weatherspoon	Research Silviculturist (retired 2003) USDA Forest Service, Pacific Southwest Research Station, Redding
Steve Zack	Research Wildlife Ecologist Wildlife Conservation Society

Redding, Fresno, Davis, and the headquarters office in Albany. The disciplines represented in this project included silviculture, entomology, wildlife biology, statistics, and range science.

A subset of this group forms an executive team that oversees the research operations at the Goosenest AMA. Currently, the executive team members are Bill Oliver, Carl Skinner, Steve Zack (Wildlife Conservation Society), and William

Reynolds (Klamath National Forest). A Memorandum of Understanding is in effect for the research project; it is updated every five years (*appendix J*).

When the Northwest Forest Plan was enacted in 1994, the Blacks Mountain research team was presented with another opportunity for establishing a cause-and-effect based research project on the Goosenest Adaptive Management Area. From 1995 to 1997, key members of the research team worked with staff of the Goosenest Ranger District (Klamath National Forest) to design and implement a project to determine the extent to which different combinations of silvicultural treatments (especially tree harvesting and prescribed fire) can accelerate the development of late-successional forest attributes in mixed stands of ponderosa pine and white fir in the Goosenest AMA. This project is consistent with the intent of the AMA as stated by the Record of Decision.

The interdisciplinary team was drawn from the participants in the Blacks Mountain Ecological Research Project (Oliver 2000; Oliver and Powers 1998). The initial effort was coordinated by Kathleen Harcksen, who served as the facilitator and liaison with the Klamath National Forest. *Table 1* lists the current (2003) and past participants in this research project. Bob Carlson and Kathleen Harcksen oversaw treatment implementation from 1997 through 2000.

The interdisciplinary team first attempted to address the question: what are the characteristics of late-successional forests in this system? The team selected three key components of late-successional forests in the interior-pine type to form the basis for the experiment. The first and most obvious feature is the presence of large trees. Ponderosa pine is a long-lived species which can be quite large. Trees with a diameter at breast height (DBH) in the 30- to 40- inch range were probably fairly common and can still be found in the area, although they are rare. At the time we began planning the experiment (1995), very few trees in excess of 24 inches DBH were found in the experimental area (*appendix C*).

The second key aspect of late-successional forests in this region is the dominance of ponderosa pine. Several factors indicate an abundance of ponderosa pine prior to the first harvests in the 1920's. First, Long-Bell Lumber Company chose to base operations here, which indicates a good supply of large-diameter pine. Second, the photographic record often shows open park-like stands with large ponderosa pine trees (*fig. 4*). However, these photo locations are not random in any sense and may represent more open conditions because these are more easily photographed, not because they represent typical conditions. Third, the continued presence of some large ponderosa pine stumps in this region indicates the presence of large pine trees.

The third component, or process, common to these forests during pre-settlement times is the frequent occurrence of fire. Preliminary evidence suggests that forests in the Goosenest AMA historically were subject to frequent fires. Agee (1994) reports fire return intervals on the order of 7 to 20 years on ponderosa pine sites at Pringle Butte in central Oregon, an area with similar species, soils and climate. We expect to find that fires in the Goosenest area were frequent during pre-settlement times. The presence (or absence) of these fires undoubtedly has a significant influence on many forest attributes, including the proportional representation of white fir, the amount and character of fuel (both coarse woody debris and the finer fuels), understory density and composition, and patterns of regeneration. These processes could all have served to indirectly affect wildlife species composition by influencing such factors as nest habitat and protective cover for prey.

The initial discussions of experimental design focused on mechanical treatments to restore pine dominance and restoring fire as an active component of these systems. The team recognized that thinning would also redistribute growth to fewer stems, thus accelerating growth on remaining trees.

Figure 4—Pre-harvest conditions of the area during Longbell operations.

Some of the design elements of the Goosenest study are the result of hours of debate between the scientists from a variety of disciplines. The team struggled with the experimental design for some time. In the initial plan there were only 2 active treatments and a control, each replicated 6 times for 18 total treatment units. The research team wanted to maximize replicates given the constraints presented by such large units. A third active treatment was added requiring a change in number of replications from six to five.

The team also chose to spatially reference all data collection in the experiment. For this purpose, and to remain consistent with the procedures at BMEF, a 100-meter grid of spatially referenced permanent points was established in each treatment unit. These points were located using the High Precision Geodetic Network (a survey-grade global positioning system) and have an error of less than 6 inches (15 centimeters) from the Universal Transverse Mercator (UTM) coordinates. Points are monumented by an 18-inch rebar with a brass

Figure 5—Grid point marker displaying the treatment unit number (4) and the UTM coordinates (25 24) in the Goosenest AMA.

cap stamped with the unit number and the last two digits of the UTM coordinate (*fig. 5*). All observations and other activities are referenced to this grid. Treatment units with grid point locations are shown in *appendix A*.

The data collected and referenced to these grid points are entered into a corporate database maintained at the Redding Silviculture Laboratory. A database manager receives field data annually and insures that there is adequate meta-data. A requirement of all individuals funded to conduct research at the Goosenest AMA is that they provide both the data and meta-data in a timely manner.

Methods

The research team attempted to maximize the power associated with any statistical tests in this experiment by limiting the number of treatments under consideration. The large size of the treatment units resulted in a rather limited amount of experimental material (area) to work with. Location of areas with sufficient uniformity, both within and between treatment units, was difficult and required a substantial reconnaissance effort by Walt Bavarskas and Kathleen Harcksen. Among the 20 units that were identified and chosen, several have undergone some harvesting (primarily removal of dead and dying trees) in addition to the first entry during the mid 1920s. Pre-treatment stand descriptions are provided in *appendix B*.

As with the project at Blacks Mountain Experimental Forest, the size of the treatment units was a key issue in this study. The team chose a large experimental unit of 100 acres (40.5 hectares) for each treatment unit. This was done because wildlife concerns were an important consideration in designing the study, and some passerine birds have large home-ranges. We wanted to make treatment-unit size sufficiently large to include the home-range of the species we expected to study. The 100-acre treatment unit size was a compromise. It was judged the minimum size to work with for some key species of interest; larger units presented problems with finding sufficient area with relatively similar conditions to complete the experiment. Each unit also has a buffer; the target width is 100 meters but varies depending on spatial constraints.

Two units originally selected and surveyed were later eliminated (these are now referred to as units 100 and 200 in the pre-treatment data). Species composition was very heavy to fir, and the stumps in this area provide evidence that these two areas historically had a higher proportion of fir than the selected sites. These two units also were more open as a result of previous management. Both units have a permanent grid established and are the same size as those chosen for the experiment, but currently there is no research activity in these two units.

Treatments 1 and 2 are both termed Pine-Emphasis Treatments. The primary feature of these treatments is the reestablishment of the dominance of ponderosa pine, defined as a stand with at least 80 percent basal area in ponderosa pine. Units selected for these two treatments were thinned from the lower diameter classes with a leave-tree constraint that dictated all dominant and codominant pine trees with DBH>12 inches must be left standing. In addition, approximately 15 percent of each treatment unit was regenerated in small group openings that ranged from 0.5 to 3 acres each. After harvest, the openings were ripped and then planted to a density of 350 trees per acre using ponderosa pine 2-0 planting stock (see *appendix H*). The subsoil treatment was conducted to incorporate the developed soil into the upper portion (pumice layer) of the soil profile. It is hoped that this will provide a more favorable environment for the establishment of ponderosa pine seedlings.

The only difference between the first two treatments is in the introduction of prescribed fire (Pine Emphasis with Fire) in five of the units. All burns are to take place in the fall of the year. The initial prescribed fires were conducted in all five units after completion of the first round of harvests, in October of 2001 (see *appendix G*).

The third treatment is simply a mechanical treatment (thinning from below) to accelerate growth on the largest trees in the stand; thus its name, the Large Tree Treatment. The justification for this treatment is that it provides a contrast with units where pine is not favored, to evaluate the impact of change in overstory species composition. Pine-Emphasis Without Fire and the Large Tree Treatments are likely to show only subtle differences early in the life of the experiment. Effects may become more evident through time as the impacts of the openings, clumpiness, and difference in tree species composition become more pronounced.

The fourth and final treatment in the suite is a control. In the Control Treatment, passive management is the aim. Fire suppression continues in these treatment units, but no prescribed burning or thinning is allowed. These four treatments are described in greater detail in *appendix D*.

Experimental Design

The four treatments are applied in a completely randomized design with five replications. Each treatment unit is 100 acres (40.5 hectares) plus a buffer strip. The buffer size varies somewhat but has a target width of 100 meters. Some of the treatment units were too close to allow for the full 100-meter buffer. Treatment unit boundaries were surveyed, and boundary trees were painted with a yellow blaze. The 20 treatment units were first identified, then treatments were assigned to those 20 units by random draw. *Appendix fig. A1* shows the arrangement of treatment units in the adaptive management area and their assigned treatments.

Treatment Implementation

The National Environmental Policy Act (NEPA) dictated a thorough analysis of the impacts of the project. Work on the NEPA process and a draft of the timber sale contract were conducted in 1995 and 1996. The sale was offered in 1998, and Columbia Forest Products was awarded the contract. The scale of this project presented some problems in implementation (Glaesman 2000); it was not possible to complete operations in one season. Timber harvesting started in Unit 14 on July 27, 1998, and was completed in Unit 8 on October 19, 2000 (*appendix E*). In each season of mechanical treatment, complete sets of replicates were finished. The felling of smaller trees (those with DBH<4 inches) took some additional time and was not completed until October 2001 (*appendix F*).

Whole trees were skidded to a landing, then trucked to one of two nearby staging areas (*fig. 6*). At the staging areas, trees were de-limbed, bucked, and products were sorted for shipment depending on species and size of the material (*fig. 7*). Clean material was chipped at the staging areas and shipped for pulp, and the remaining

Figure 6—Trees being loaded for transport to the staging area in the Goosenest Adaptive Manage-

Figure 7—Limbs were removed then, trees were sorted at one of two nearby staging areas.

biomass was shipped for electricity generation to Wheelabrator Co. in Anderson, California. Fir sawlogs were shipped to Columbia Forest Products in Klamath Falls, Oregon, and pine sawlogs were transported to Prineville, Oregon, for processing.

The original plan called for the burning to be completed over a period of three seasons with Unit 6 being burned first in 1999. However, 2 successive years without an adequate fall burning window resulted in the delay of burning until 2001 (*fig. 8*). In October 2001, all five of the Treatment 2 units were successfully burned (*appendix G*). All five of the units were bounded by roads or fire lines, and the Ranger District also installed some intermediate control lines through the units prior to the ignition.

Treated stands are now much more open (*fig. 9*), and this is quite noticeable when compared with control units. Quadratic mean diameter (QMD) is still low in comparison to expected QMD for stands that might be considered exhibiting “late-seral” characteristics. Treatments moved stands in the direction of late-seral conditions by increasing the average tree size, accelerating growth, and, in the case of Pine-Emphasis Treatments, modifying species composition. Four of the treatment units (6, 7, 9, and 20) stand out as having more large (DBH≥24 inches) trees per acre than the rest (*fig. 10*). Several units (3, 6, and 9) have achieved or are very near the target species proportion of at least 80 percent pine. *Figure 11* shows the species composition for each of the 20 units. Units lying on the reference line are a mix of ponderosa pine and either white fir or red fir. Units not lying on the diago-

Figure 8—Prescribed burning took place in October 2001.

Figure 9—(a) Unit 6, grid point 97x29, post-treatment photo taken 2002; (b) Unit 13, grid point 24x64, post-treatment photo taken 2002; (c) Unit 9, grid point 00x38, post-treatment photo taken 2002.

(a)

(b)

(c)

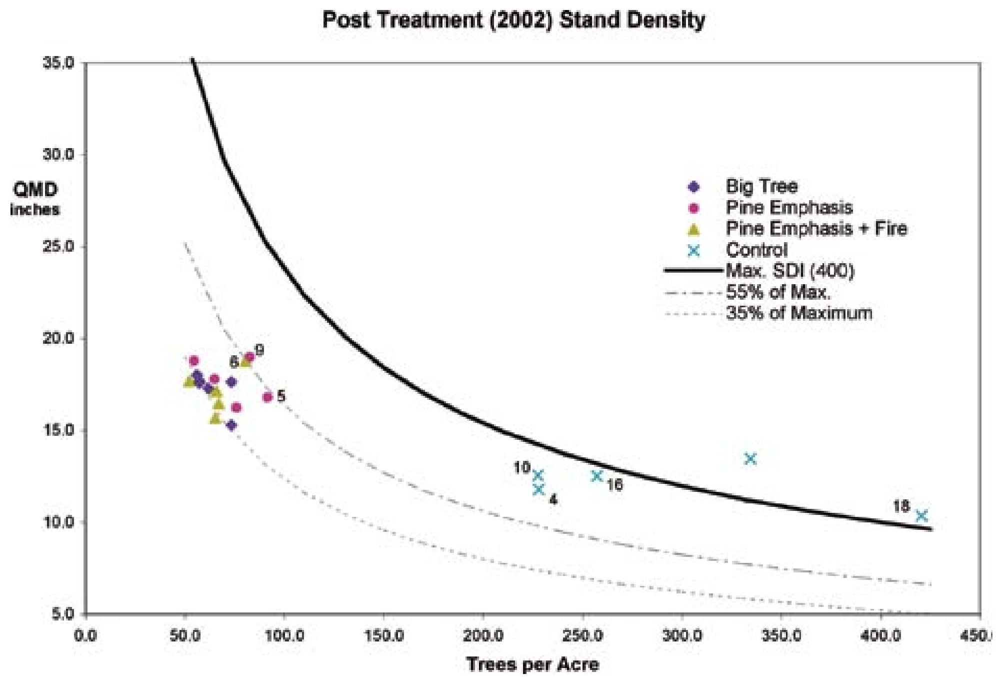

Figure 10—Post-Treatment percentage of fir basal area related to number of trees per acre >24 inches DBH, based on a sample not including planted openings.

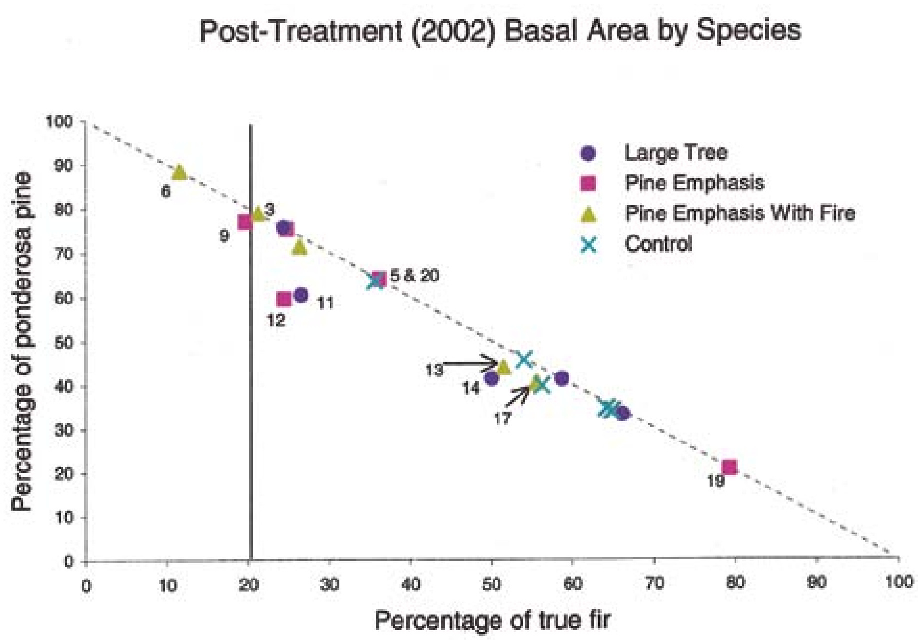

Figure 11—Percentage of ponderosa pine basal area related to percentage of true fir basal area, based on a sample excluding planted openings.

nal reference contain some other species; most notable is unit 12, with a significant component of pole-size sugar pine trees.

The impacts of treatments on stand density are an important consideration. Not surprisingly, thinned stands show a much reduced stand density when referenced to Stand Density Index (SDI; Reineke 1933), an index derived as a function of quadratic mean diameter and number of trees per unit area. The plot of number of trees per acre and quadratic mean diameter is shown in *fig. 12*.

Another way to consider the species distribution target in Pine-Emphasis treat-

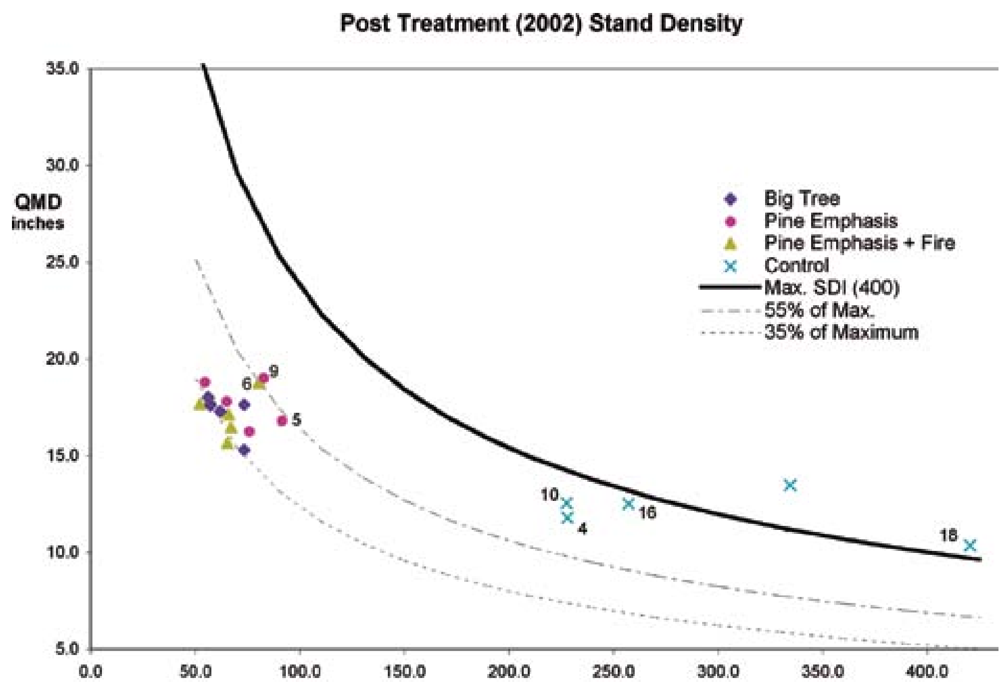

Figure 12—Size-density relationship of treatment units and maximum Stand Density Index (with 400 as a reference).

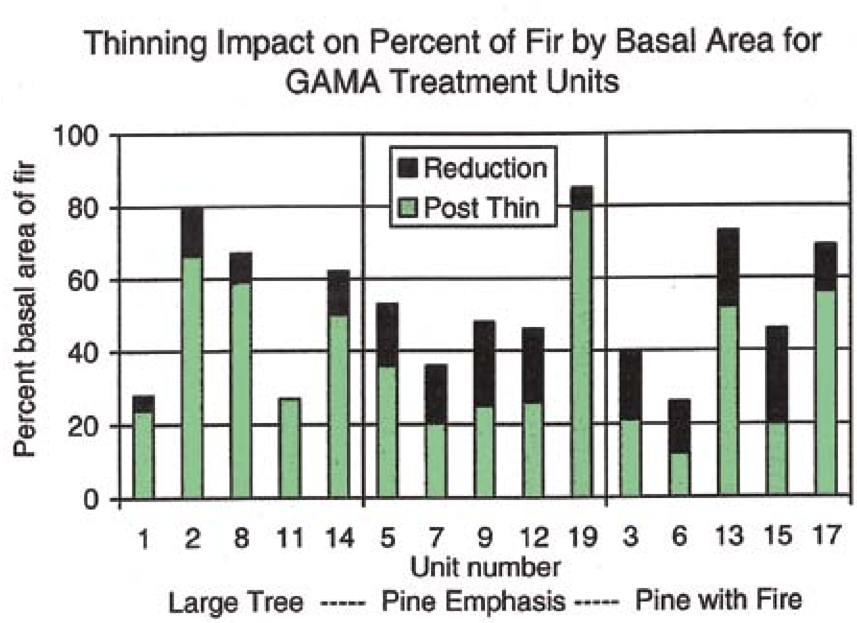

Figure 13—Thinning impact on percentage of fir by basal area for the Goosenest AMA treatment units.

ments is to consider the proportion of white fir. In most of the units, the percent of fir basal area was reduced as a result of treatments (*fig. 13*). This is true even for the Large Tree Treatment, primarily because this is a thinning from below and the understory is dominated by fir trees.

Fire and Fire Surrogates

The Fire and Fire Surrogates (FFS) study is a national network of sites designed to investigate the influence of fire and fire surrogates on forest structures, wildlife, and stand dynamics. The design of FFS study sites is a 2x2 factorial including burned/unburned and thinned/un-thinned treatments. Because the Goosenest project does not include a burn-only treatment, it is not consistent with the FFS study. However, after the Goosenest project was established, three FFS burn-only units were identified and established. The Fire and Fire Surrogates burn-only treatments were implemented the last week of October 2002. Three replicates from the Goosenest project are now included as an FFS installation. Nine of the 20 treatment units have been surveyed as part of the FFS study: Units 5, 9, and 12 (Pine Emphasis); Units 6, 13, and 15 (Pine Emphasis With Fire); and Units 4, 10, and 18 (Control). In selected areas of these units, FFS plots may be found on a 50-meter grid. These plots are monumented with brass capped rebar and an adjacent green and yellow stake, whereas the grid points for the Ecological Research Project have orange stakes and orange flagging.

Some of the FFS sampling methods are different from those used on the Goosenest project, requiring additional sampling using the FFS protocol. These FFS data are not a part of the corporate database. Carl Skinner is the coordinator for the FFS Goosenest site and is responsible for all data collected as a part of this separate research effort.

Activities

Wildlife Ecology

Collection of data on small mammals and birds was initiated in 1996. This work has continued annually with eight crew members. Four people conduct point counts of birds, and four others trap small mammals. Crews are in the area for approximately 12 weeks each field season.

Point count stations are set up throughout the study area for the estimation of density and diversity of breeding bird species (*fig. 14*). Species encountered through the 2002 field season are listed in *appendix I*. Nine point-count locations

Figure 14—Red-breasted Nuthatch (Sitta Canadensis)

have been established at grid points on each unit. Point count surveys are initiated within 15 minutes of sunrise and continue until all points in a unit are completed. The duration is 8 minutes per point. Each survey station is a minimum of 200 m from the next closest station and no less than 100 m from the edge of the treatment unit. The horizontal distance to each bird is classed as being within 50 m, or between 50 and 100 m, or greater than 100m from the point. Following the protocol in Martin and Guepel (1993), nests are monitored every 3-4 days until the nestlings fledge or the nest fails.

During the same period, small mammal populations are sampled using a grid of live traps (*fig. 15*). The traps are placed on an 8x8 sampling grid at 50 m spacing with two traps per station, one tomahawk and one Sherman trap. Captured chipmunks are marked with passive integrative transponder tags. Deer mice (*Peromyscus maniculatus*) are given temporary marks by clipping their fur. Sex, age, location, reproductive condition and weight are recorded for other species, but they are unmarked. Since 2001, surveys have been conducted for mammals in all 20 units each year.

To date, no studies of herpetofauna have been initiated at the Goosenest AMA. The reptiles and amphibians cited in *appendix I* are derived from anecdotal sightings made during other survey work in the area.

Graduate students have used the sites as well. Dusky flycatcher (*Empidonax oberholseri*) nest predation was described (Liebezeit 2001; Liebezeit and George 2002). Current study topics include seed caching of chipmunks, and the abundance and reproductive success of dark-eyed juncos (*Junco hyemalis*) in prescribed burn units.

Vegetation Sampling

This experiment is not intended to feature a comparison with pre-treatment conditions. Pre-treatment vegetation samples were conducted only to evaluate structural homogeneity among treatment units. We used a 20 Basal Area Factor (ft^2 per acre) variable-radius plot on a 50- by 100-meter grid to sample trees by 4-inch diameter classes (Ritchie 1997) for all trees >4 inches DBH (*Table 2*). This allowed for the comparison of species composition and stand density among units. We were primarily interested in quickly determining whether we had sufficient uniformity in conditions among the selected units to proceed with the experiment. As a result of this effort, two units were eliminated, and we subsequently found two units to replace them. We did not sample understory vegetation or any trees <4 inches DBH in the pre-treatment measurements. From these data, maps of high-density fir components in the Pine-Emphasis units provided locations for planted openings.

Post-treatment vegetation sampling began in the summer prior to the scheduled burning in the Pine-Emphasis-with-Fire units. In this initial pre-burn sample, we tagged all trees >3.5 inches DBH on selected plots, set the duff pins, and sampled

Figure 15—Shadow chipmunk (Tamius senex).

Table 2—Number of plots in pre- and post- treatment vegetation samples at the Goosenest AMA.

Treatment Unit	Treatment	Number of pre-treatment samples	Number of post-treatment samples
1	Large Tree	71	18
2	Large Tree	72	18
3	Pine + Fire	73	17
4	Control	72	18
5	Pine Emphasis	69	18
6	Pine + Fire	67	17
7	Pine Emphasis	72	18
8	Large Tree	72	18
9	Pine Emphasis	72	18
10	Control	72	18
11	Large Tree	72	17
12	Pine Emphasis	72	19
13	Pine + Fire	71	17
14	Large Tree	70	18
15	Pine + Fire	72	17
16	Control	73	18
17	Pine + Fire	67	17
18	Control	66	17
19	Pine Emphasis	70	17
20	Control	76	19

coarse woody debris on a 328-foot (100 m) transect. Trees were tagged in advance of burning to obtain information on fire-induced mortality. The first complete post-treatment vegetation measurements were taken in summer 2002 on all but the herbaceous vegetation. The collection of frequency data for herbaceous vegetation was postponed until 2003 to better reflect the response to harvesting and burning of these species.

The vegetation sampling methods include a number of different types of data and are similar to the methods used at Blacks Mountain (Oliver 2000). Trees are sampled on a fixed-area plot. The plot size for trees and snags >11.5 inches DBH is 0.2 acre (52.7-foot radius). Nested within this is a 0.05-acre plot (26.3-foot radius) for living and dead pole-size trees (3.6 inches to 11.5 inches DBH). Seedlings and saplings are sampled on a nested 0.01 acre plot (11.8-foot radius). The sampling intensity for this is every other grid point, or one plot for every 4.9 acres (2 hectares), approximately 20 plots per unit.

In addition, a 328-foot (100 m) transect centered on the grid point is established. This allows for the placement of duff pins (for measuring duff consumption in burned units), line-intercept sampling of woody vegetation (*fig. 16*), and line-in-

Figure 16—Field crews sampled coarse woody debris and shrubs with a 100-meter line-intercept sample

tercept sampling of coarse woody debris using methods described by Brown (1974).

Frequency of understory species was also observed on 0.5-m^2 circular plots placed at 6 locations along the 100-m transect. Cover of understory vegetation by species, or species groups, has also been estimated for this same small circular plot. The first post-treatment survey of frequency and cover was conducted in 2003. The species list is in *appendix I.*

Entomology

A census of bark-beetle-induced tree mortality was conducted within treatment units the year prior to mechanical treatments (*Table 3*). Parallel transects were run at 328-foot (100-m) intervals through the unit. Trees killed by bark beetles were initially located on the basis of needle discoloration. Trees showing evidence of beetle activity were identified by species and spatially referenced. In addition, the causal agent (*Dendroctonus, Ips*, or *Scolytus*) and year of death were recorded. In 2003, the initial post-treatment census was conducted. These data have been entered into the Goosenest database.

From 1997 through 1999 a study was conducted to investigate the diversity and community structure of macroarthropods found in the coarse woody debris at the Goosenest AMA (Koenigs and others 2002). The study contrasted insects captured by three different methods. The first component of the study was a sample of

Table 3—Dates of census for bark beetle-induced mortality conducted at the Goosenest AMA with dates of treatment completion.

Plot no.	Treatment	Pre-Treat. Census Date	Treatment Date	Burn Date	DatePost-Treat Census Date
1	Large Tree	5/18/1999	6/1999	--	7/02/2003
2	Large Tree	7/15/1999	11/2000	--	7/18/2003
3	Pine + Fire	5/1/2000	5/2000	10/12/2001	6/25/2003
4	Control	5/20/1999	--	--	7/22/2003
5	Pine Emphasis	7/1/1999	9/1999	--	7/17/2003
6	Pine + Fire	7/22/1998	12/1998	10/8/2001	7/17/2003
7	Pine Emphasis	5/23/2000	8/2000	--	7/03/2003
8	Large Tree	6/15/2000	10/2000	--	7/29/2003
9	Pine Emphasis	7/23/1998	11/1998	--	7/24/2003
10	Control	7/18/2000	--	--	7/15/2003
11	Large Tree	4/11/2000	5/2000	--	6/25/2003
12	Pine Emphasis	5/19/1999	7/1999	--	6/26/2003
13	Pine + Fire	7/14/1999	10/1999	10/11/2001	7/08/2003
14	Large Tree	7/21/1998	8/1998	--	6/27/2003
15	Pine + Fire	6/10/1999	8/1999	10/11/2001	7/01/2003
16	Control	8/26/2000	--	--	8/01/2003
17	Pine + Fire	6/5/2000	7/2000	10/12/2001	6/24/2003
18	Control	8/22/2000	--	--	7/232003
19	Pine Emphasis	6/20/2000	10/2000	--	7/02/2003
20	Control	7/21/1999	--	--	7/29/2003

insects emerging from down logs. These insects were sampled with 54 emergence traps on 18 logs (9 ponderosa pine and 9 white fir). In the subsequent years the sample was expanded to include 108 traps on 54 logs.

The second component was a sample of insects emerging from stumps. Traps were set up on 18 stumps in 1997, and this sample was expanded to 54 stumps in 1998.

The third component involved sampling insects from the surrounding environment with the use of pane traps. Acrylic panes (80 cm x 60 cm) were placed against down logs. Insects that fell into a tray at the base of the pane were sampled on 54 logs in 1997 and on 18 logs in 1998 and 1999. The time required to obtain these samples necessitated a reduction of sample size in the second and third years of the study.

Fire History

Large stumps may contain a long record of the fires that have burned in a particular area. Past fires will often leave a scar that is evident in the growth rings of each damaged tree. Sampling of stumps to obtain information from fire scars began in 1998 and continued to 2000 (data on file at the Redding Laboratory). The process involves removing a cross-section from the stump and returning it to the laboratory for dating of fire scars (*fig. 17*). Approximately 75 stumps were sampled from the units scheduled for prescribed fire; we wanted to obtain the fire record before burning consumed these stumps. Stumps in the unburned units have not been sampled.

Results

Although it is still very early in the study, it is clear that the treatments have significantly modified these stands. Mechanical treatments alone have moved the stands well along the trajectory toward some aspects of "late-successional" characteristics. Some of the units are now at or near 80 percent composition ponderosa pine, one of the key elements of the pine emphasis prescription. Obviously, obtaining tree sizes consistent with pre-settlement conditions will take some time; trees are relatively small at present, and these are not highly productive sites for tree growth. The prescribed burns generally appear more uniform than the burns conducted at Blacks Mountain Experimental Forest (Oliver 2000).

Based on conditions of post-treatment tree crowns (many trees show a fuller crown, carrying more foliage), we anticipate that the remaining ponderosa pine will show a positive growth response to harvest treatment. However, the fir response, if any, may be more muted.

Figure 17—Fire history records were obtained from fire scars in stumps prior to prescribed burning at the Goosenest Adaptive Management Area.

How to Get Involved

The team continues to seek involvement from other disciplines, and the research is currently supporting several graduate students. Those interested in participating should contact: Goosenest Interdisciplinary Team Coordinator, Silviculture Laboratory, Pacific Southwest Research Station, USDA Forest Service, 3644 Avtech Parkway, Redding, CA 96002. Written proposals are circulated among team members in advance of a presentation at the next team meeting.

The team meets twice yearly, once in the late fall to draft and agree to an initial budget and then again in early spring to finalize budgets. Meetings are held in Davis or Redding, California.

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Appendix A. Goosenest Adaptive Management Area Treatment Unit Locations and Treatment Unit Maps

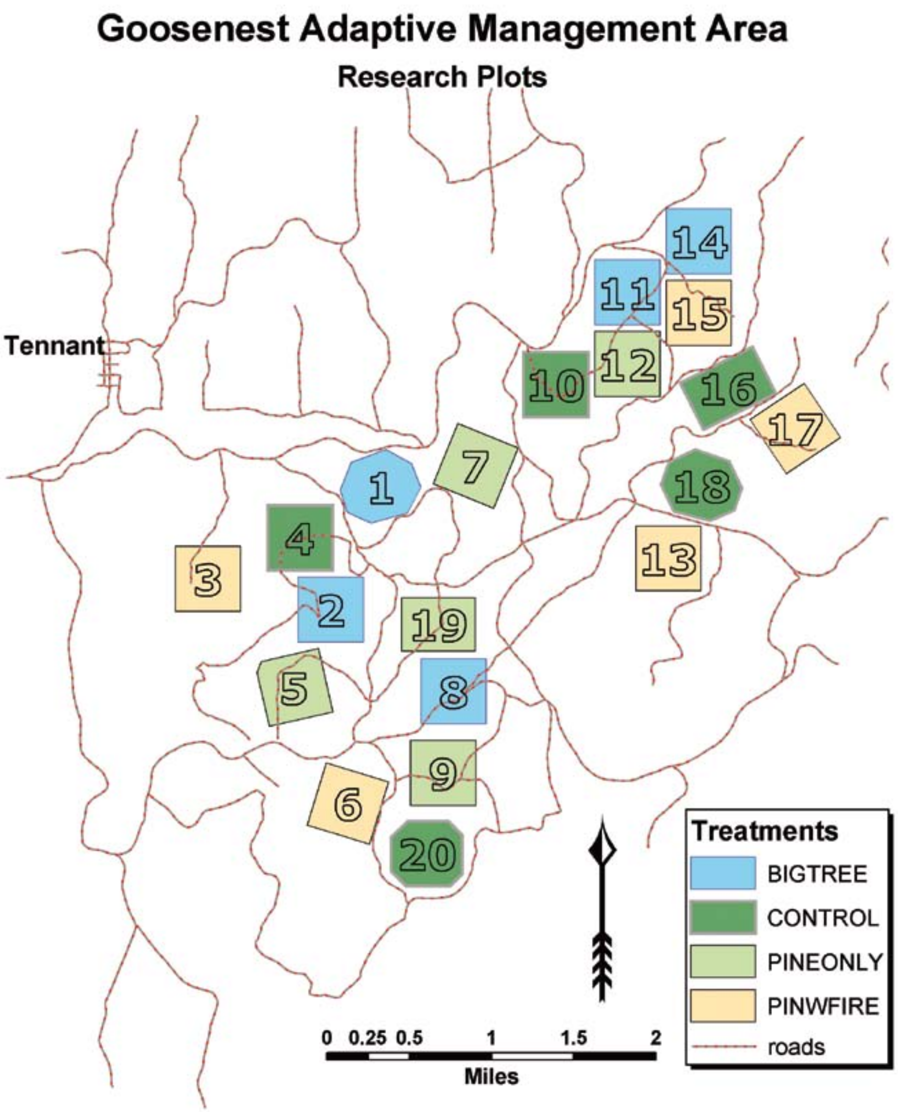


Figure A.1 -- Map showing the location of the 20 treatment units.

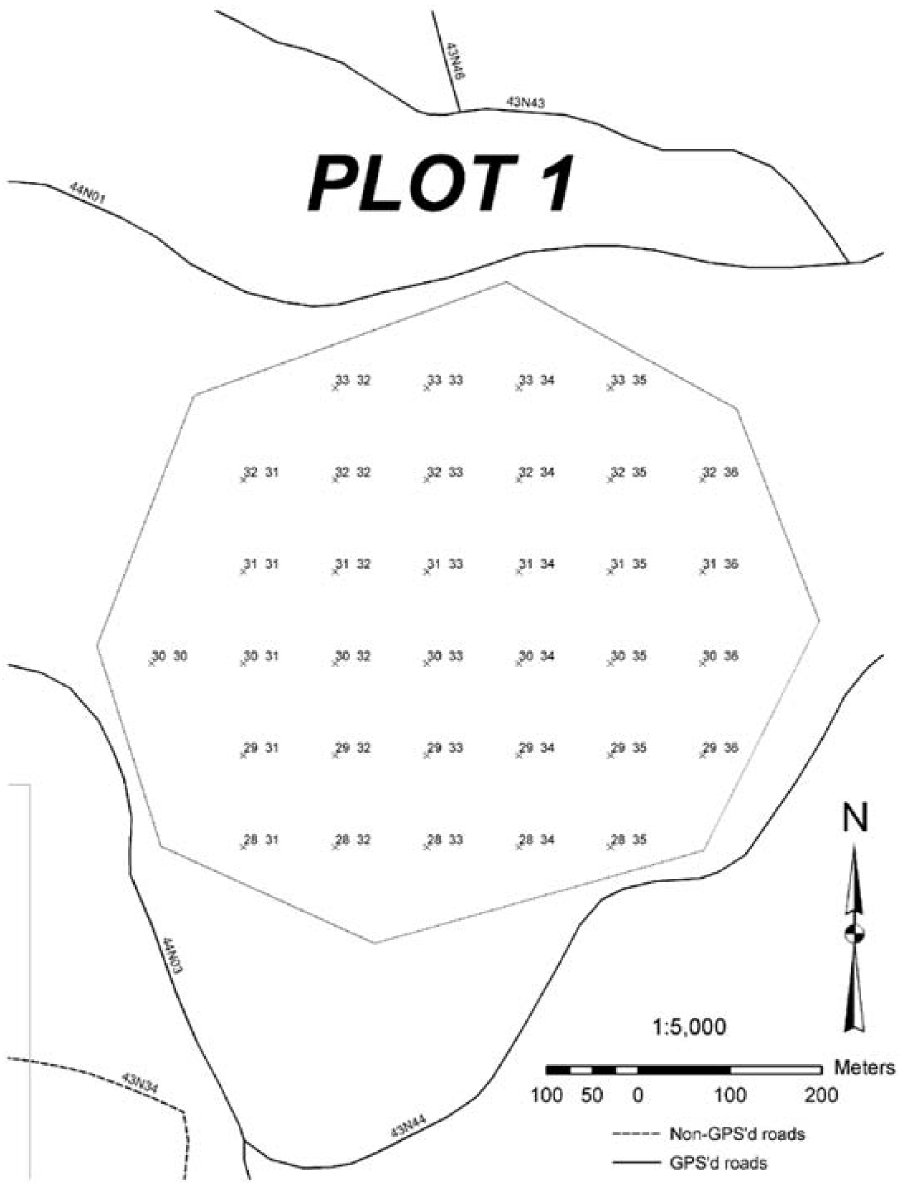


Figure A.2— Treatment Unit 1 with grid point locations.

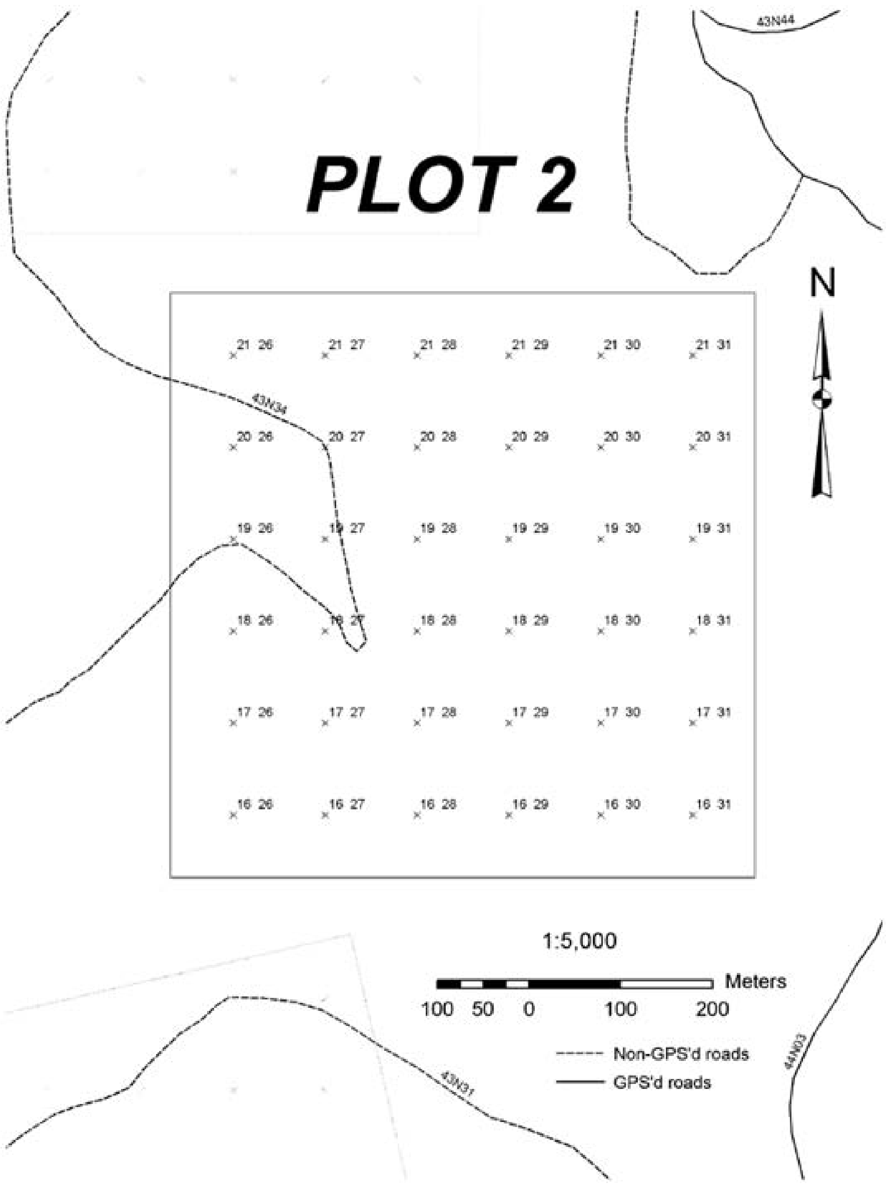


Figure A.3—Treatment Unit 2 with grid point locations.

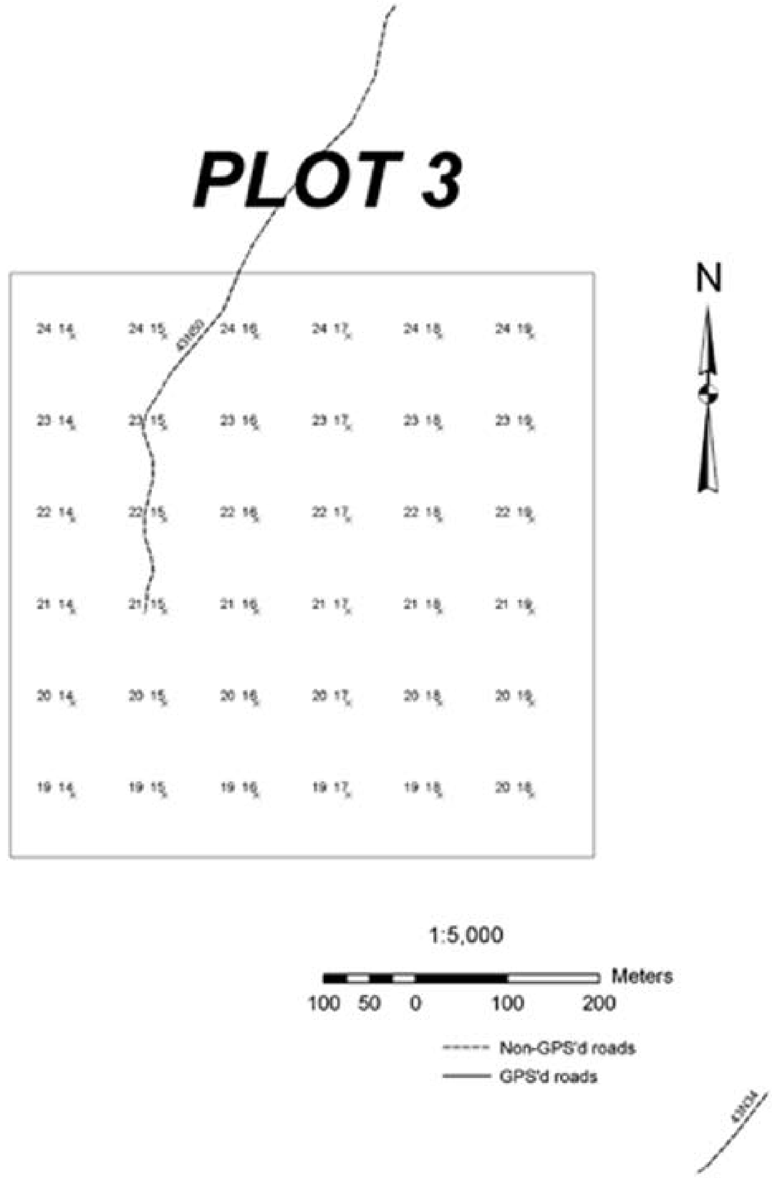


Figure A.4—Treatment Unit 3 with grid point locations.

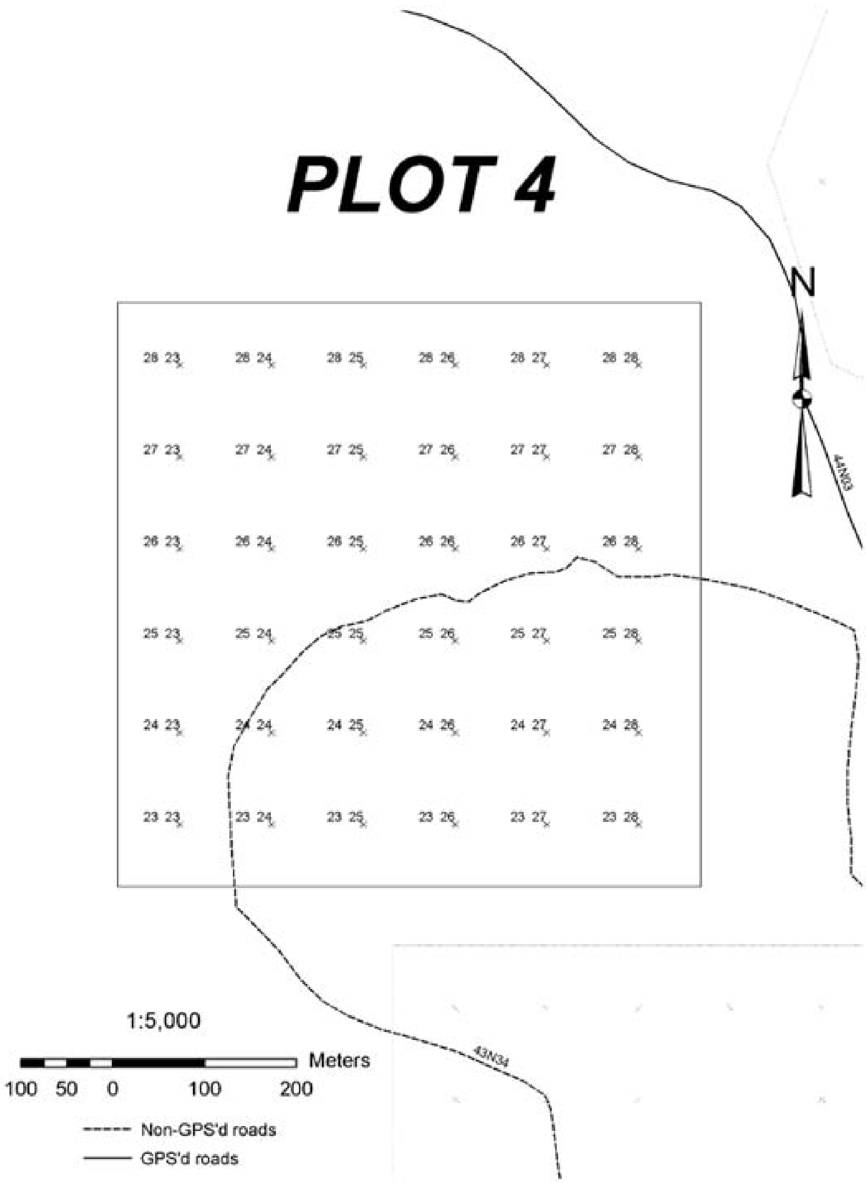


Figure A.5—Treatment Unit 4 with grid point locations.

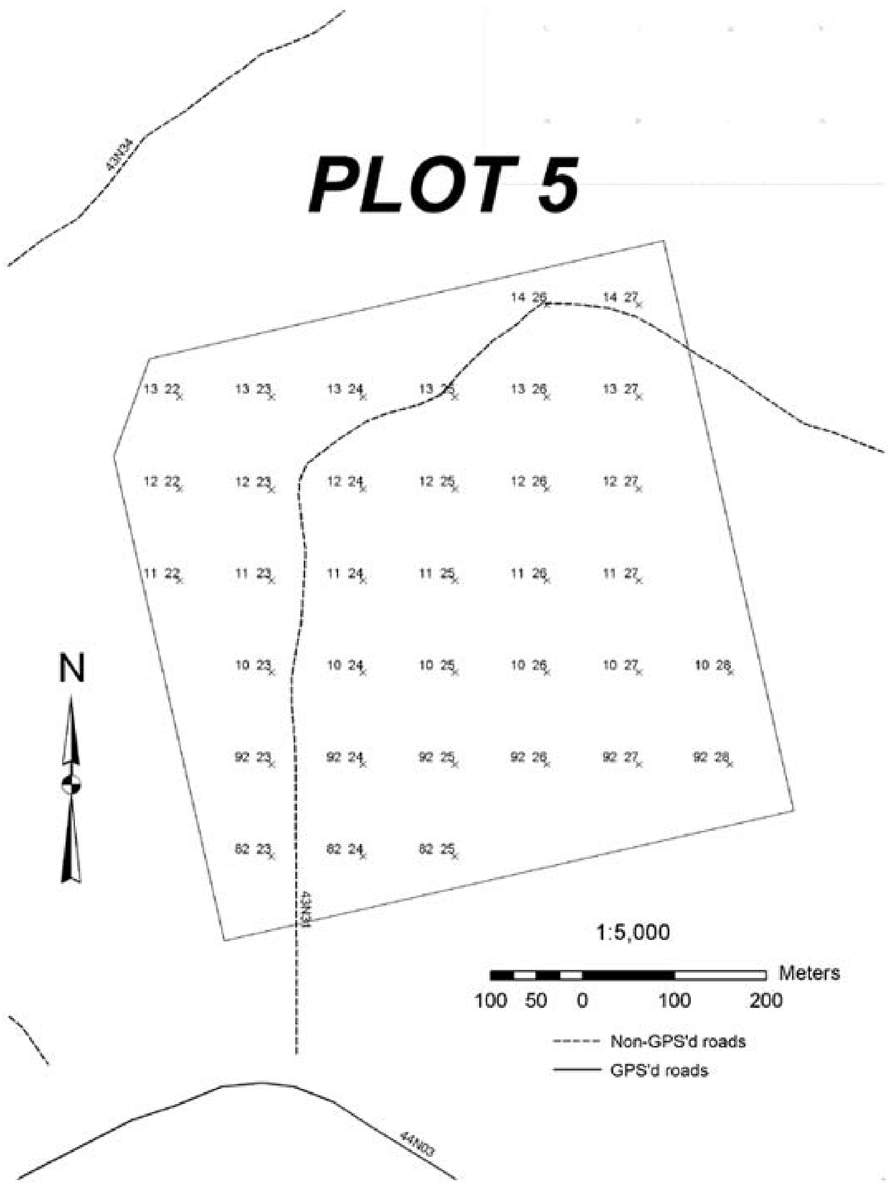


Figure A.6— Treatment Unit 5 with grid point locations.

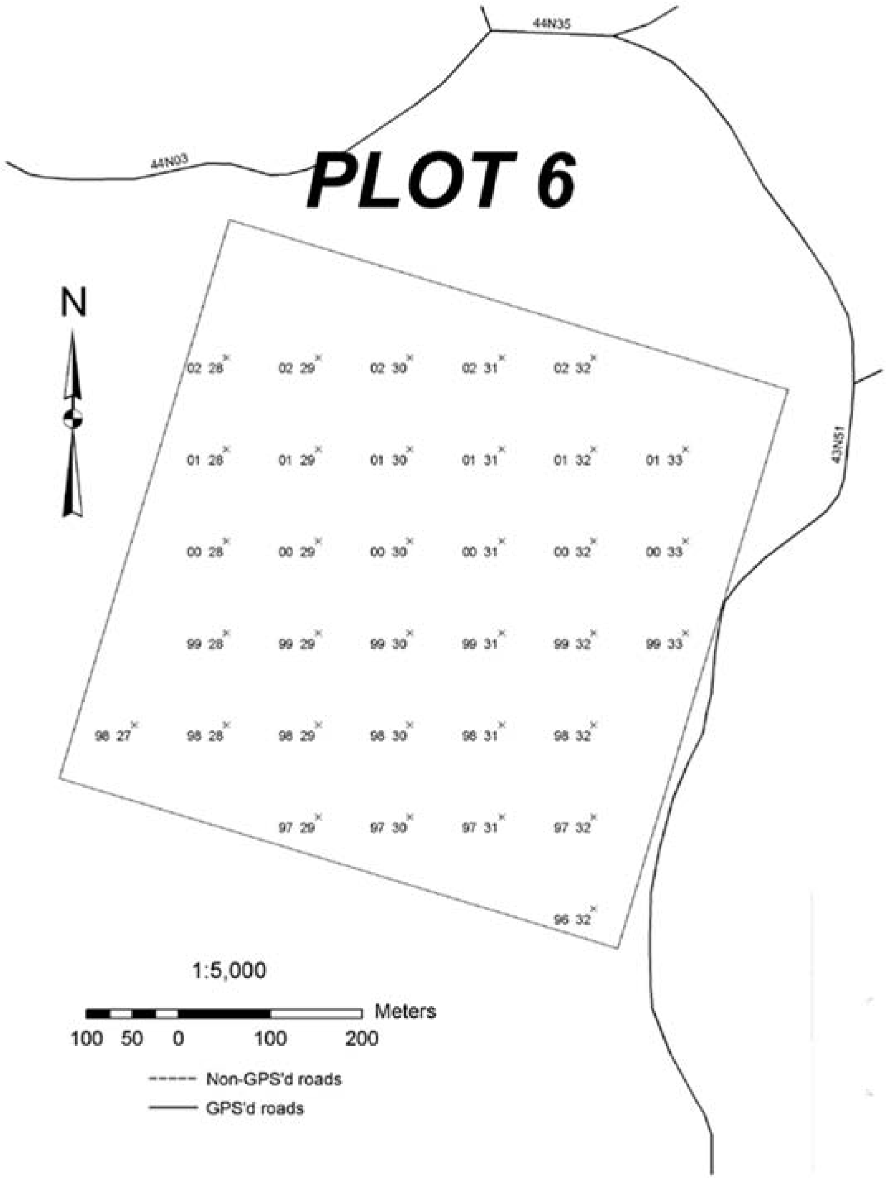


Figure A.7—Treatment Unit 6 with grid point locations.

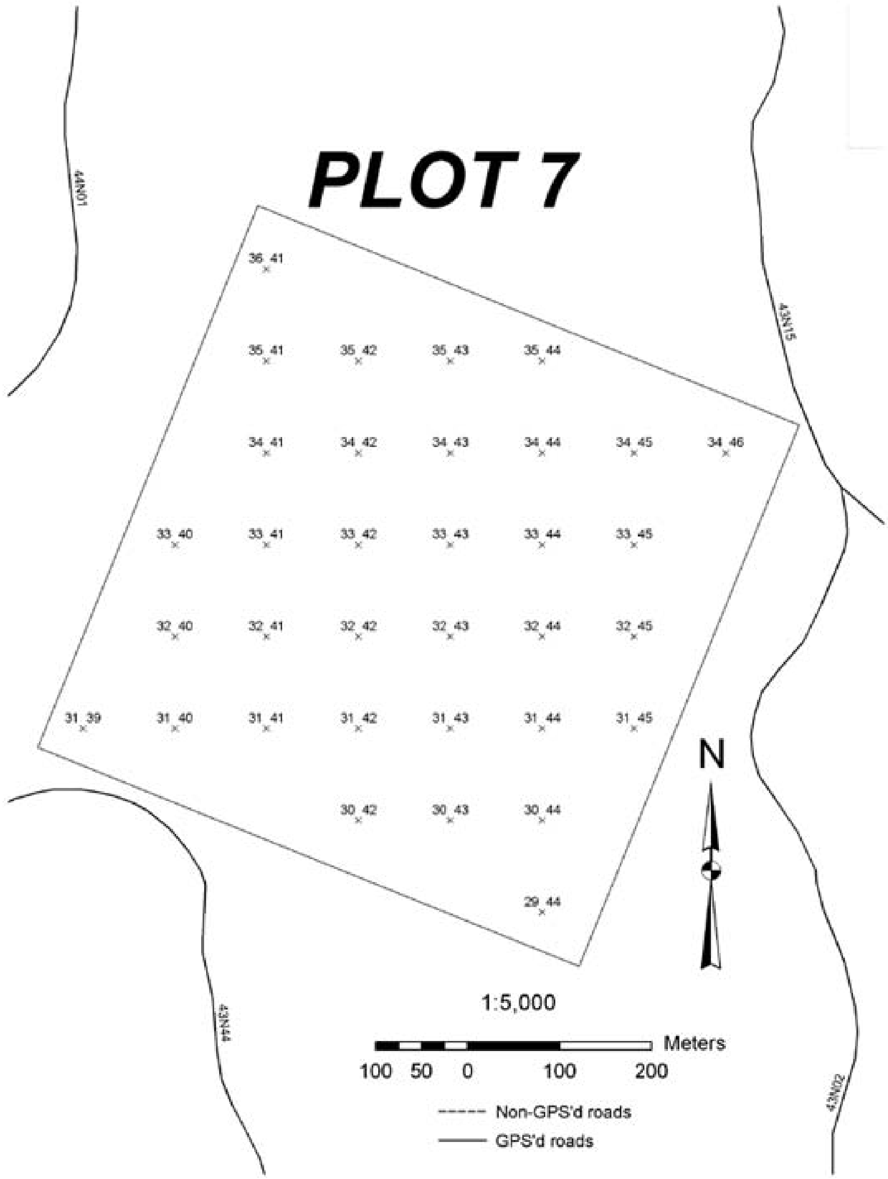


Figure A.8—Treatment Unit 7 with grid point locations.

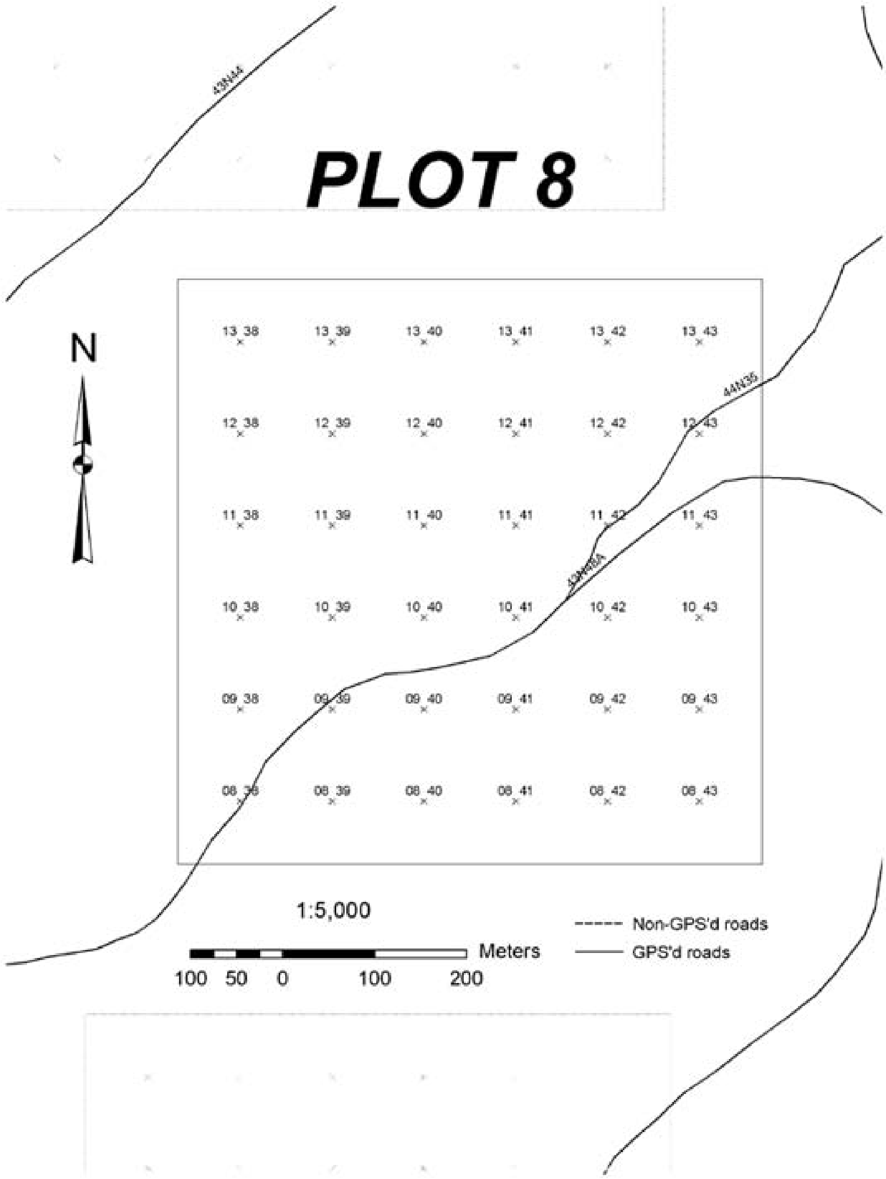


Figure A.9—Treatment Unit 8 with grid point locations.

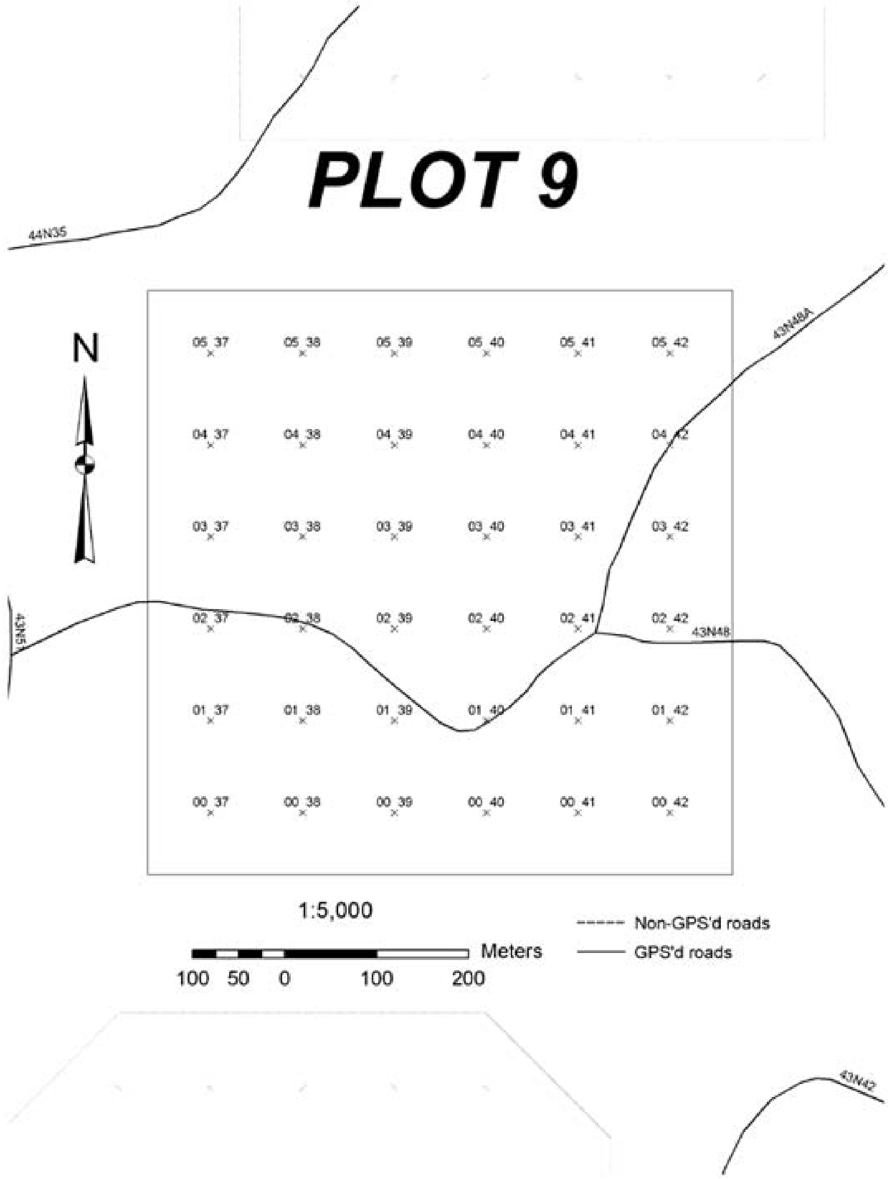


Figure A.10—Treatment Unit 9 with grid point locations.

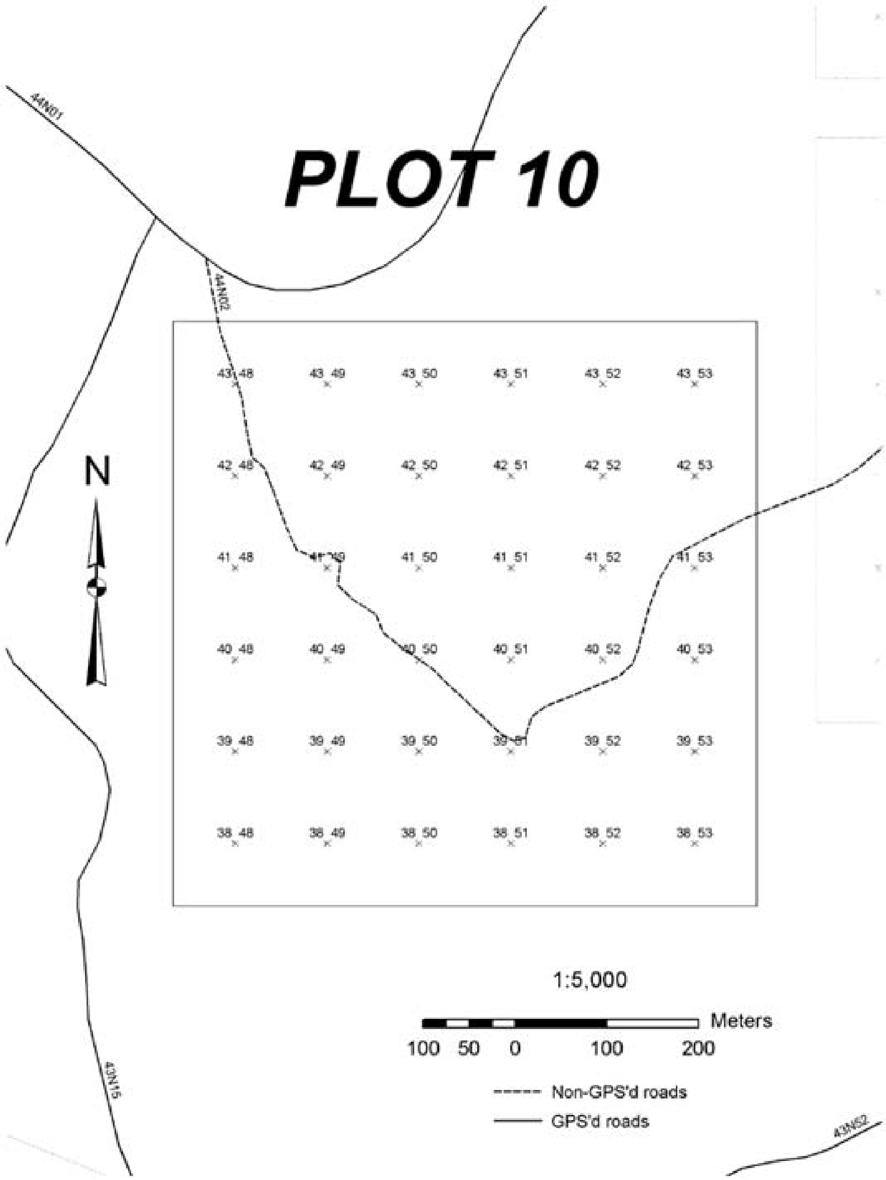


Figure A.11—Treatment Unit 10 with grid point locations.

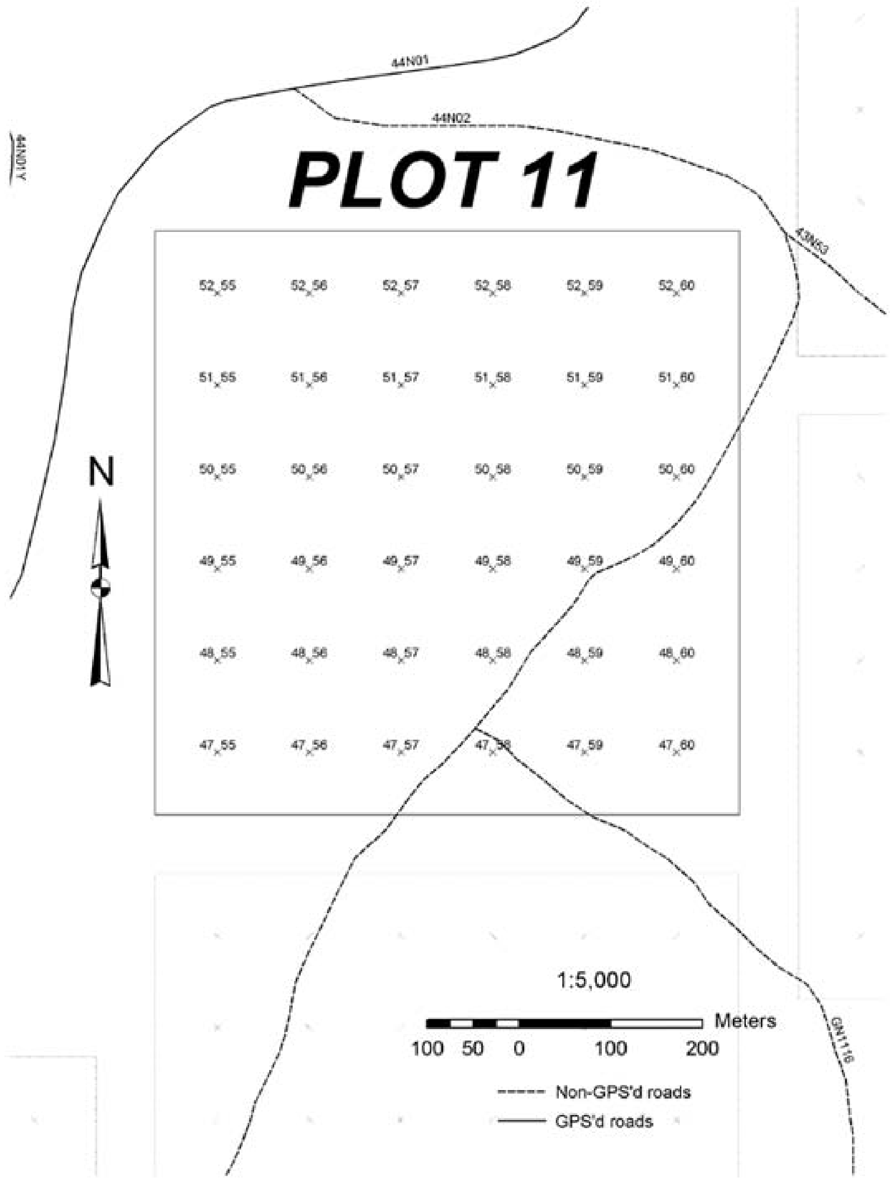


Figure A.12—Treatment Unit 11 with grid point locations.

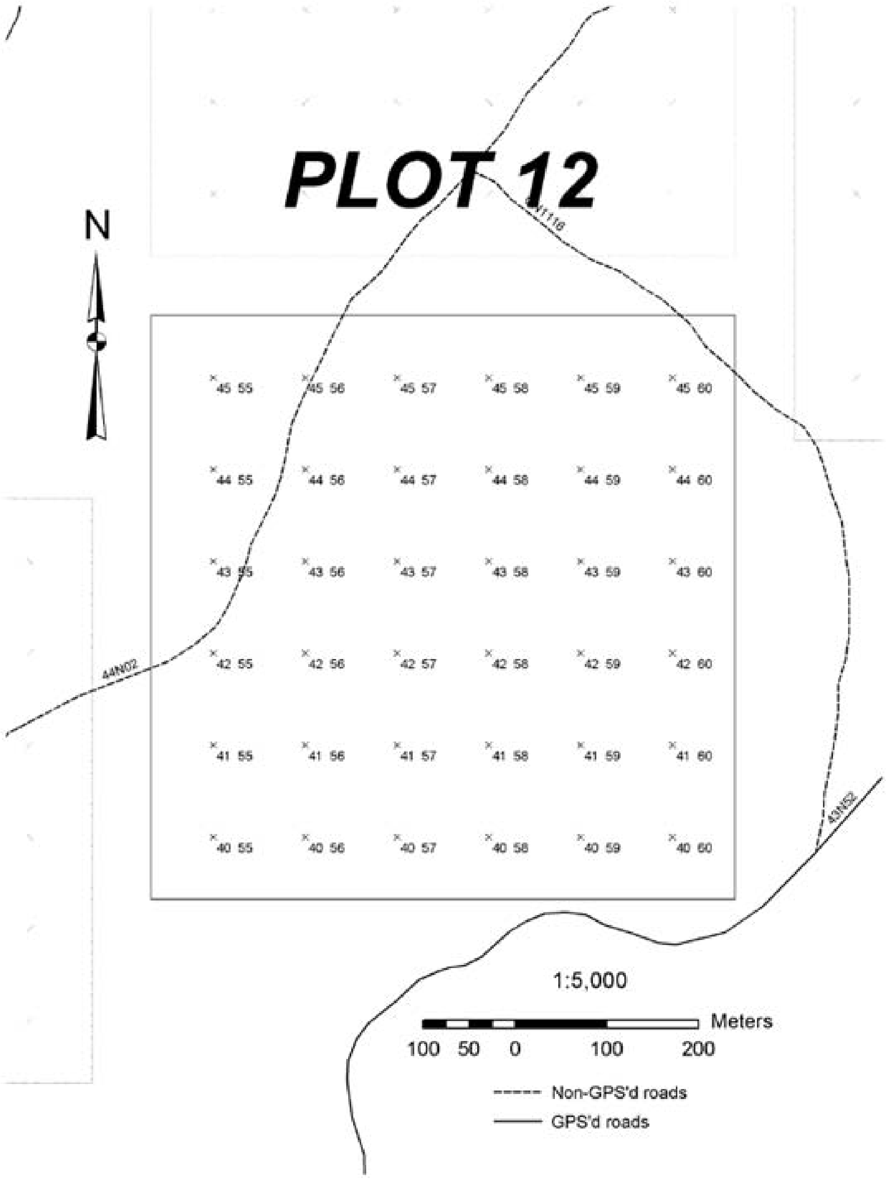


Figure A.13—Treatment Unit 12 with grid point locations.

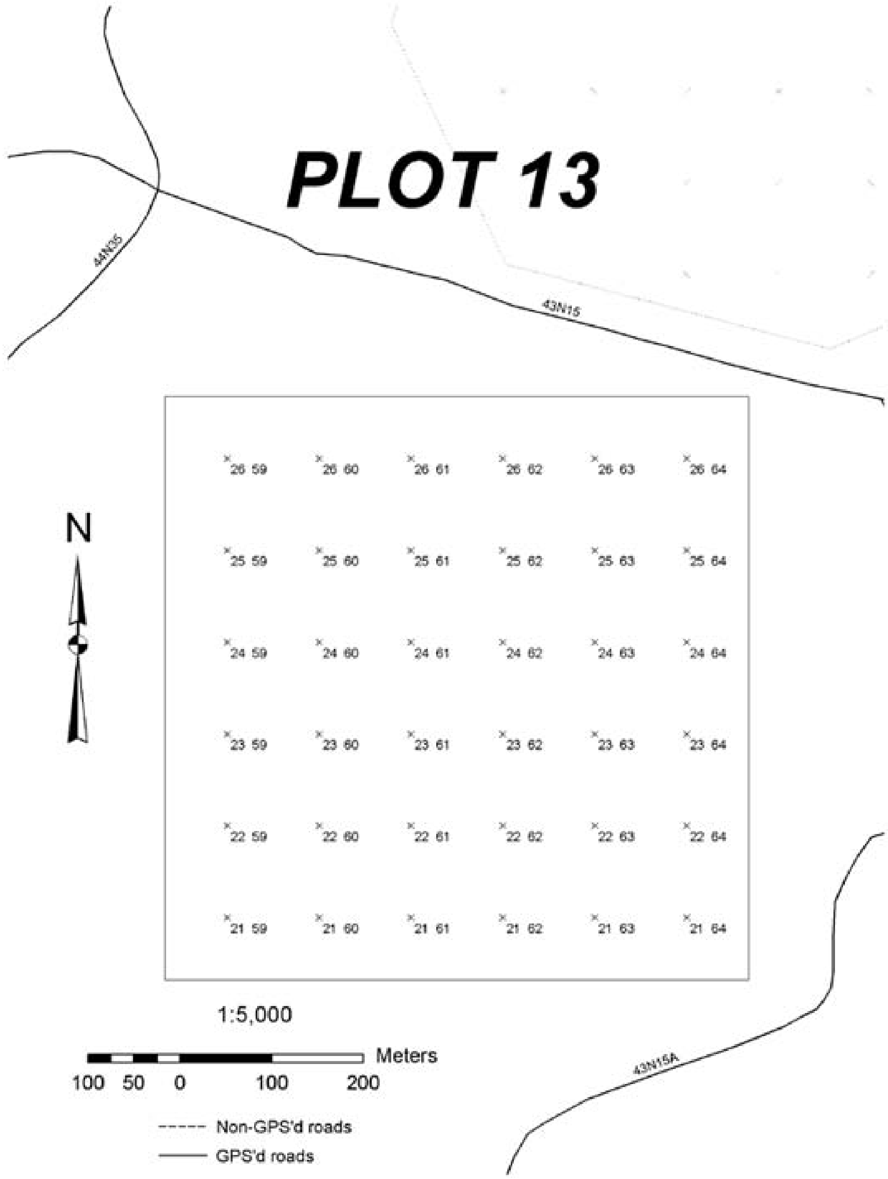


Figure A.14—Treatment Unit 13 with grid point locations.

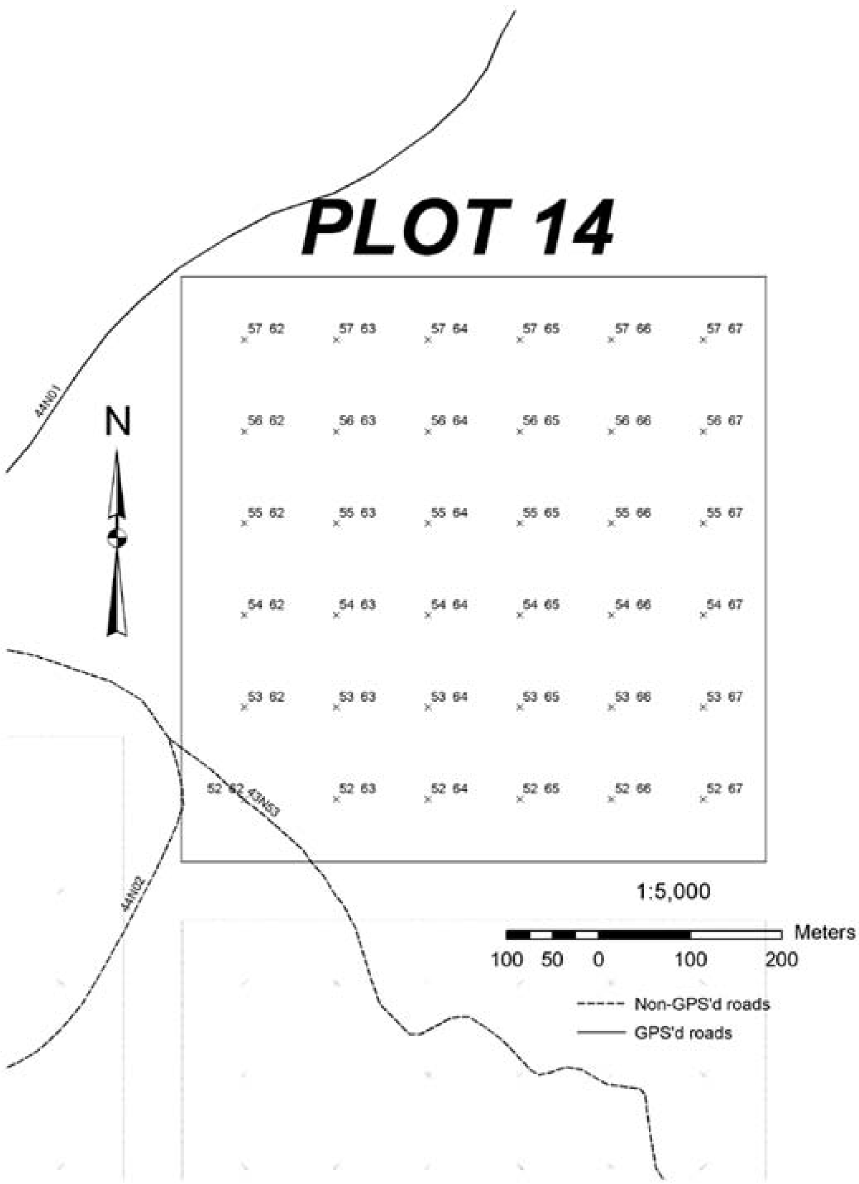


Figure A.15—Treatment Unit 14 with grid point locations.

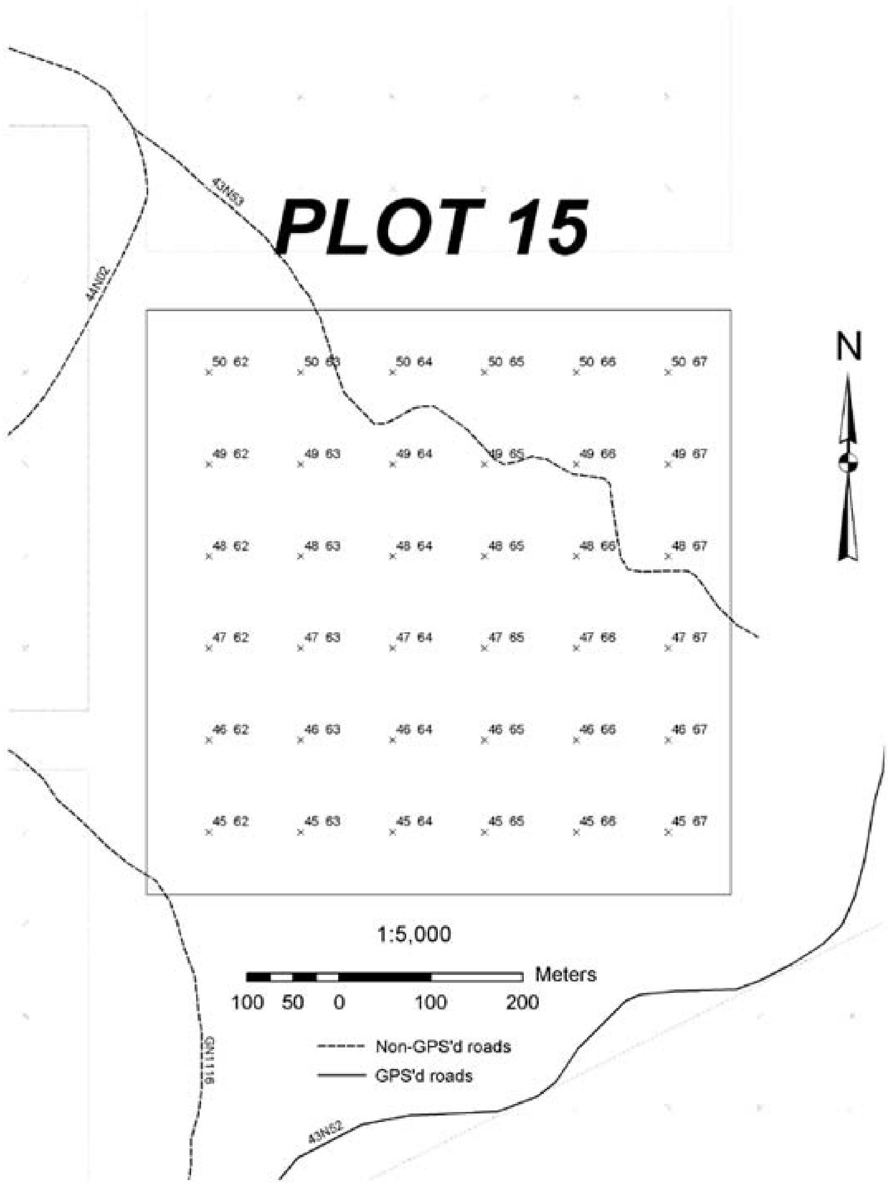


Figure A.16— Treatment Unit 15 with grid point locations.

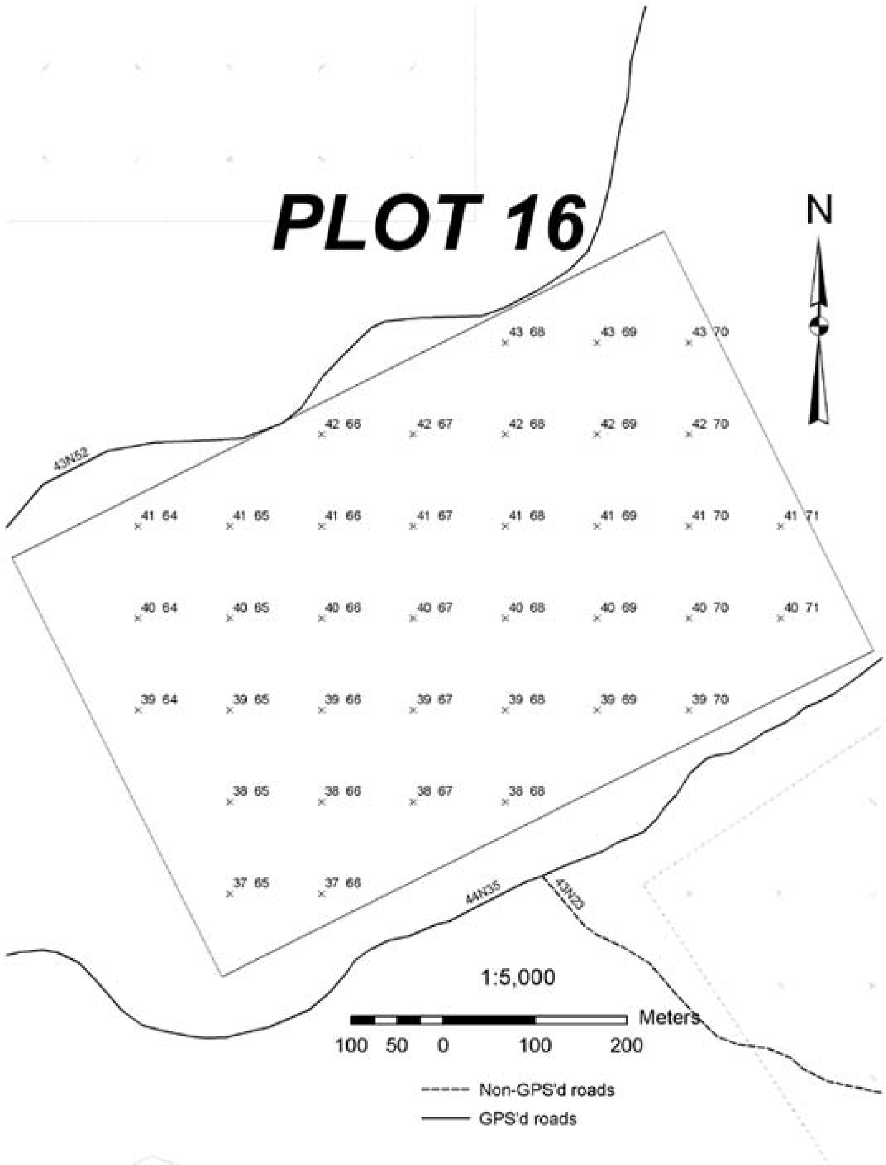


Figure A.17—Treatment Unit 16 with grid point locations.

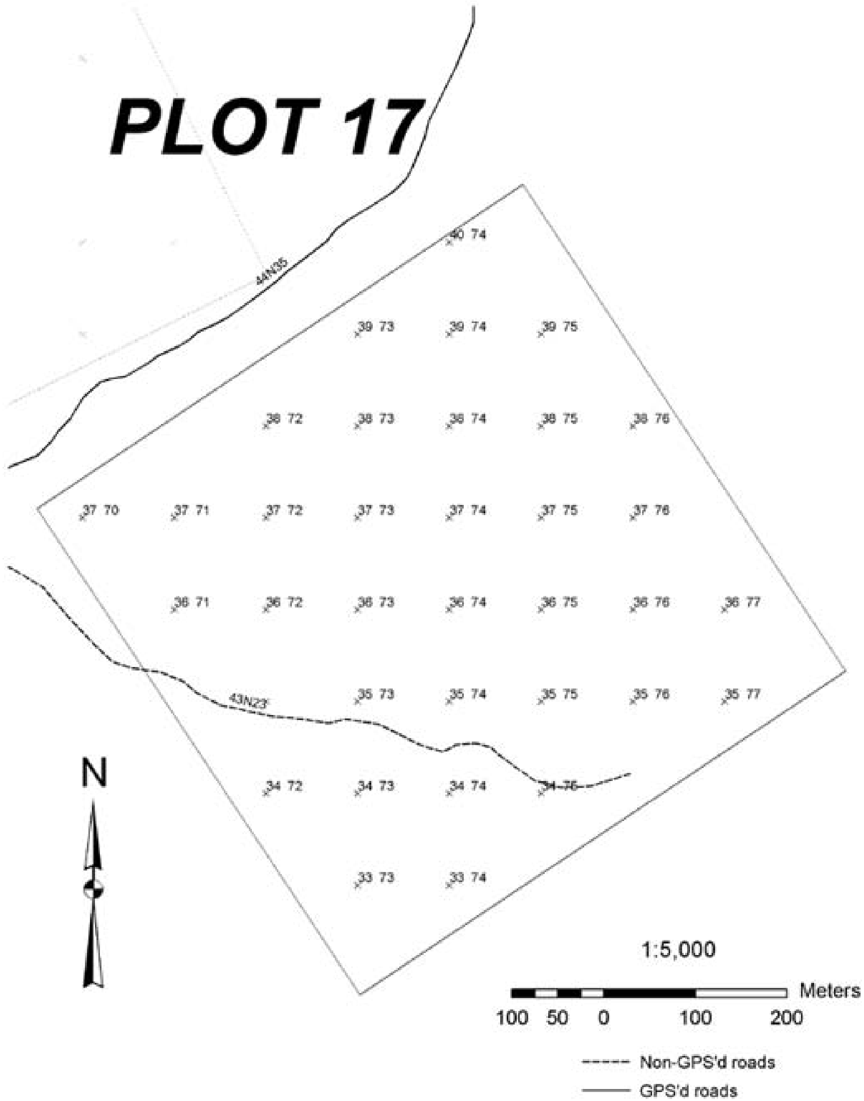


Figure A.18—Treatment Unit 17 with grid point locations.

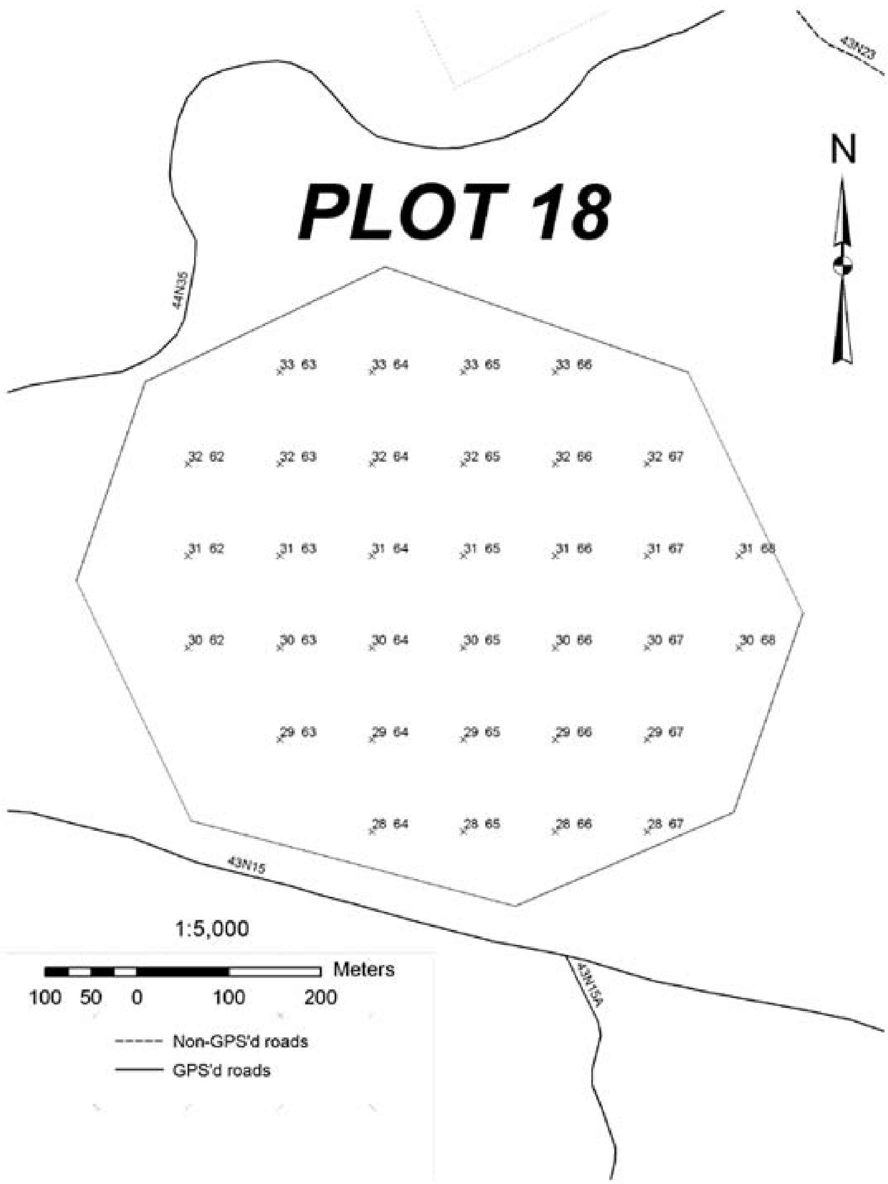


Figure A.19—Treatment Unit 18 with grid point locations.

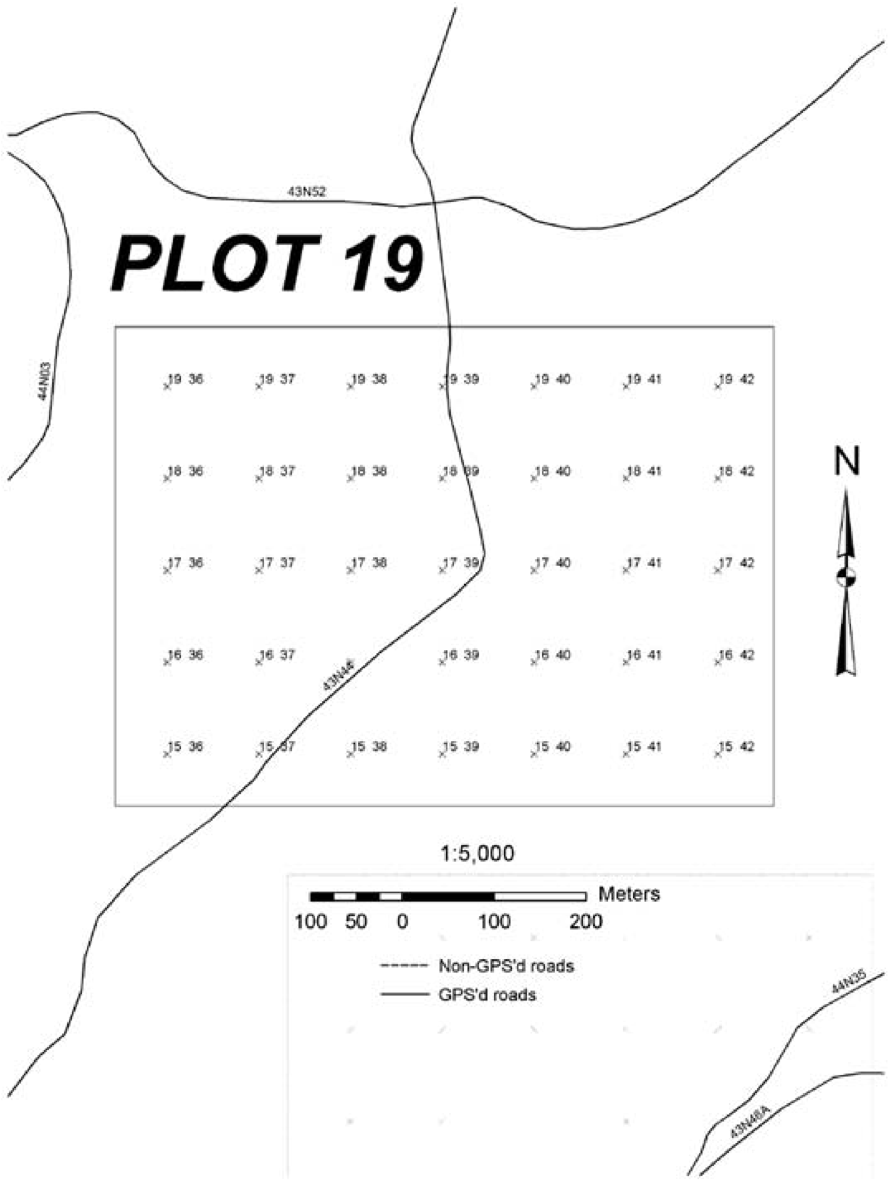


Figure A.20—Treatment Unit 19 with grid point locations.

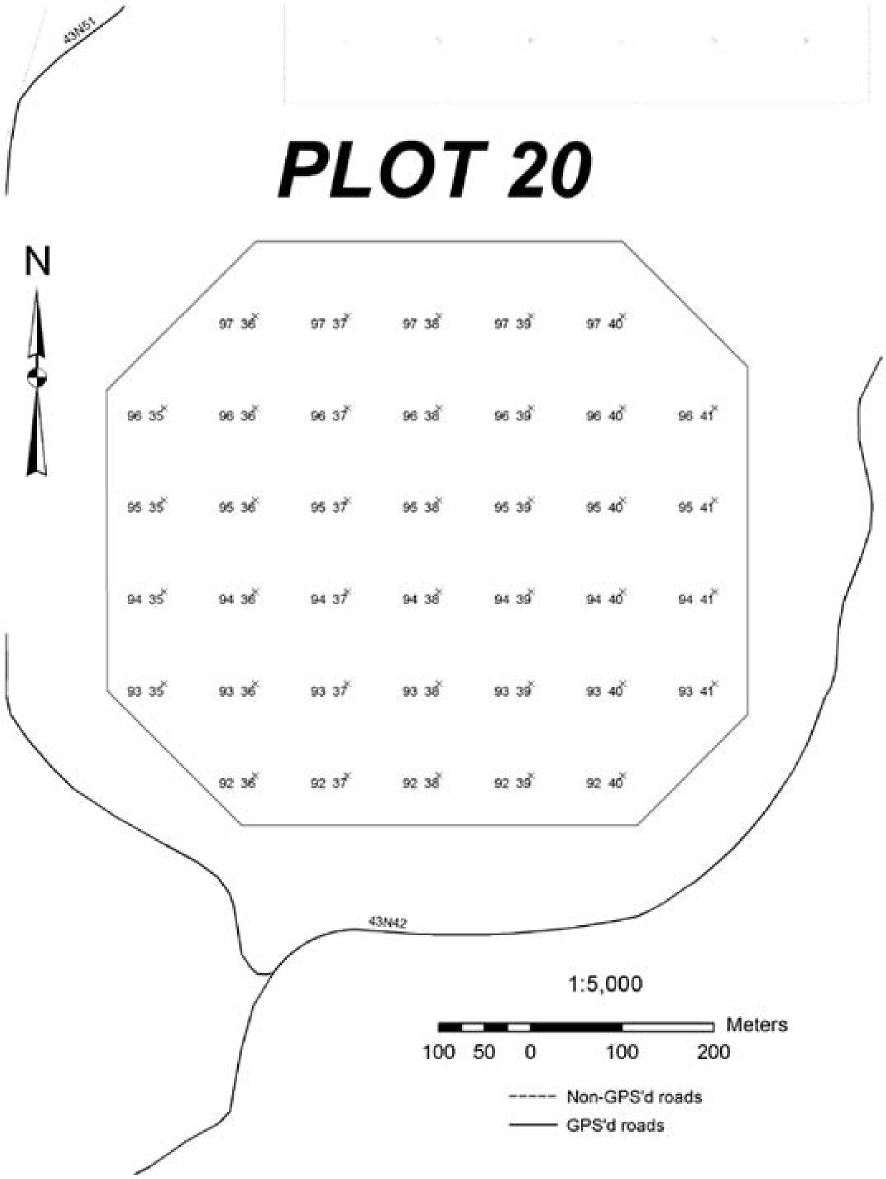


Figure A.21—Treatment Unit 20 with grid point locations

Appendix B. Treatment Unit Descriptions

Pre-treatment stand conditions were sampled in November 1995 using a rectangular, 164- by 328-foot, (50- by 100-m.) grid of 20 Basal Area Factor (ft2 per acre) variable radius plots for all trees greater than 4 inches DBH. Trees were tallied by 4-inch diameter classes for five species groups (ponderosa pine, true fir, sugar pine, incense-cedar and other conifers). This sample was obtained to assist in selecting treatment units that were as alike as possible in terms of species distribution and stand development. The plots were taken at the grid points and at 50-meter intervals in one direction to double the sampling intensity.

As a result of this effort, two units were removed from the experiment, the original units 1 and 2. Subsequently two additional treatment units were identified and then sampled in late 1996 using the same scheme.

There is some expected variation between the units in this study. Pre-treatment basal area varies from 116 to 254 ft2 per acre, with a median value of 161 ft2 per acre (*fig. B.1*). Several of the stands with lower values for trees per acre had been subject to sanitation/salvage harvesting within the previous 10 years.

White fir at the time of establishment of this experiment was a significant component in all the stands (*fig B.2*). Other conifers found infrequently were primarily sugar pine and incense-cedar, with an occasional lodgepole pine or Douglas-fir. There is some red fir on the higher elevation units, and these have been included in the figures for true fir. The only units with a significant component in incense-cedar are 11, 12, and 14 (all with between 10 and 20 ft2 of basal area). Units 3, 7, 10, and 15 had trace amounts of incense-cedar (<10 ft2 per acre); the remaining 13 units had none recorded in the sample. Ten units had some sugar pine (7, 8, and 10 through 17); however, none of these had more than 10 ft2 per acre. Minor species such as lodgepole pine or Douglas-fir occurred on all but 7 of the units (1, 2, 6, 11, 15, 17, and 19 all had zero recorded occurrences of these species).

Initially, all of the stands had more than 20 percent basal area in fir and all but six were above 40 percent basal area in fir (*fig. B.3*). This is a critical threshold because the goal for distribution of pine by basal area is 80 percent (therefore, no more than 20 percent in fir and other species).

The quadratic mean diameter ranged from 9.7 to 16.2 inches, with a median value of 11.4 inches. Confidence intervals with a half-width of 2 standard errors are shown in *fig. B.4*. Because trees <4 inches in diameter were not sampled, QMD values are biased on the high side somewhat.

Stand Density Index (SDI) (Reineke 1933) is a useful metric for mature even-aged stands (*fig. B.5*). The value is indexed to number of trees per acre at an index of 10 inches, quadratic mean diameter. Plot 1 for example has 144 trees per acre at a quadratic mean diameter of 12.6. With SDI, this density is equivalent to a stand with a diameter of 10 inches and 207 trees per acre. Although the application of SDI in mixed-species stands causes some problems, it can still be useful to observe the values obtained for the 20 units before treatments were applied. SDI values ranged from 192 to 439.

There were relatively few trees >24 inches DBH at the time of establishment (1995). Figure B.6 shows the scarcity of large trees. However, most of these units have at least 50 trees per acre in the small sawtimber size, indicating adequate material for recruitment into the larger size classes over time. Stand summaries for each of the 20 treatment units are shown in *table B.1.*

Table B.1—Pre-treatment density (stems/acre), quadratic mean diameter (QMD; inches) with estimated standard errors (SE), and stand density index (SDI; stems per acre) for 20 treatment units in the Goosenest Adaptive Management Area research project based on a variable-radius sample (20 basal area factor) of trees >4.0 inches breast-height diameter (data collected in 1995 and 1996).

Unit	N	Stems/Acre	SE	QMD (in.)	SE	SDI
1	71	144	22.8	12.6	0.47	208
2	72	346	33.2	9.7	0.30	329
3	73	234	28.9	11.2	0.35	280
4	72	168	15.1	11.3	0.32	204
5	70	317	27.9	10.4	0.30	339
6	69	186	23.9	12.6	0.42	271
7	67	136	14.0	12.5	0.40	195
8	72	366	23.4	11.2	0.25	439
9	72	355	26.7	11.4	0.25	439
10	72	216	23.1	12.3	0.39	301
11	72	105	7.8	15.6	0.39	214
12	72	160	17.4	12.4	0.38	226
13	71	290	29.4	10.9	0.35	331
14	70	109	8.0	14.4	0.39	195
15	72	88	6.2	16.2	0.47	192
16	73	231	22.4	11.2	0.31	277
17	67	260	28.1	10.4	0.32	276
18	66	314	28.8	9.9	0.30	309
19	70	277	23.7	11.4	0.34	342
20	76	318	25.0	12.1	0.25	432

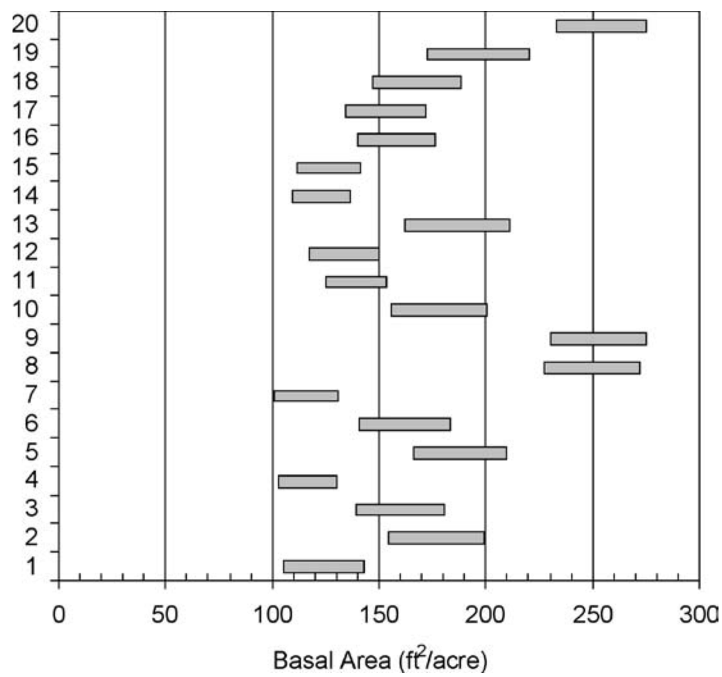


Figure B.1—The confidence interval (with a half-width of 2 standard errors) of the pre-treatment estimates of stand basal area per acre for each of the 20 treatment units on the Goosenest Adaptive Management Area research project.

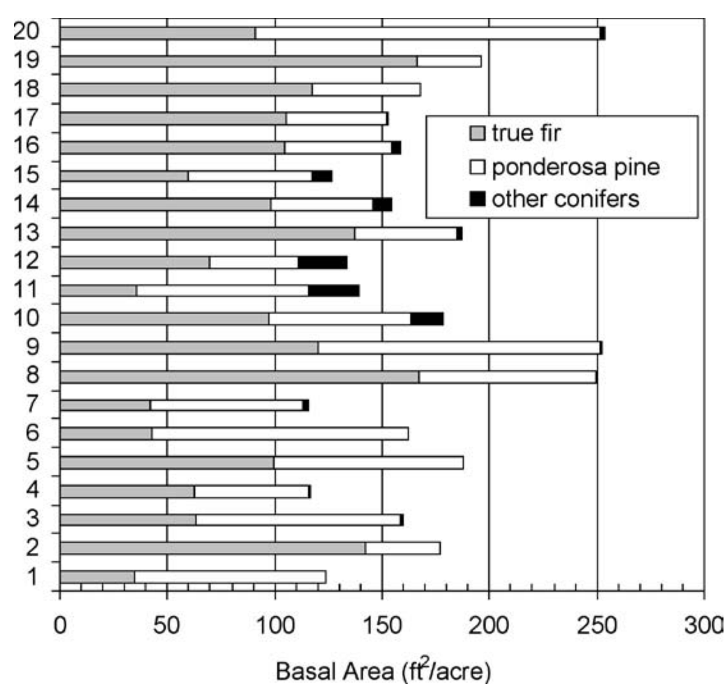


Figure B.2—Pre-treatment distribution of basal area by species groups for the 20 treatment units in the Goosenest Adaptive Management Area research project.

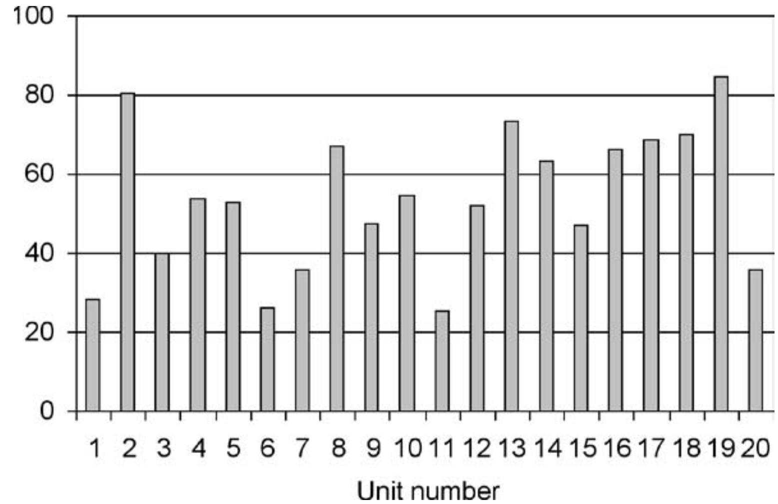


Figure B.3—Percent of pre-treatment basal area in red and white fir for each of the 20 treatment units before application of treatments in the Goosenest Adaptive Management Area.

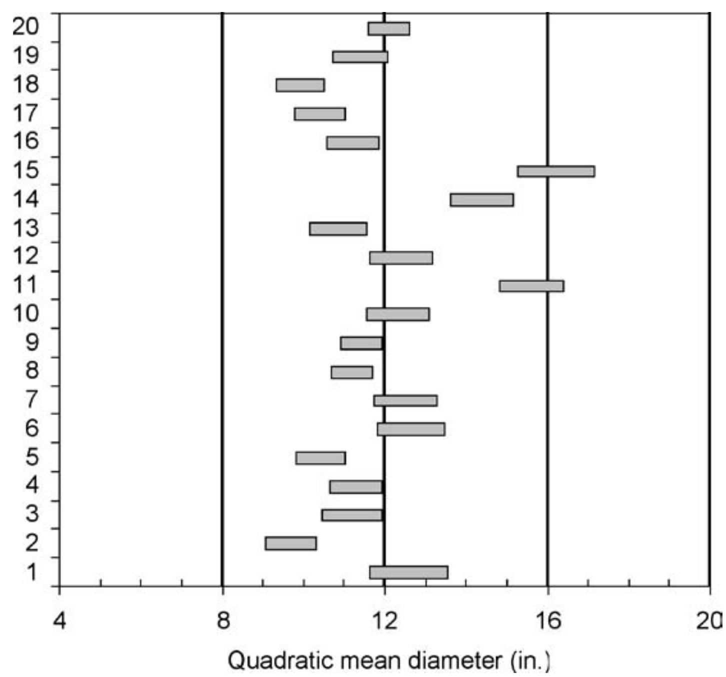


Figure B.4—Confidence interval with a half-width of 2 standard errors for the estimate of pre-treatment quadratic mean diameter by treatment unit in the Goosenest Adaptive Management Area (date for 1995 and 1996).

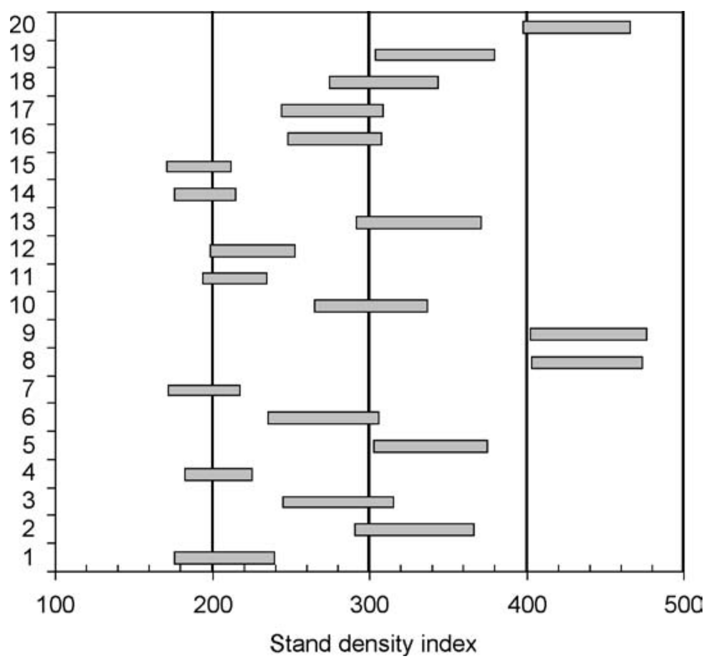


Figure B.5—Confidence interval with a half-width of 2 standard errors for the estimate of pre-treatment Stand Density Index (Reineke 1933) by treatment unit in the Goosenest AMA (data for 1995 and 1996).

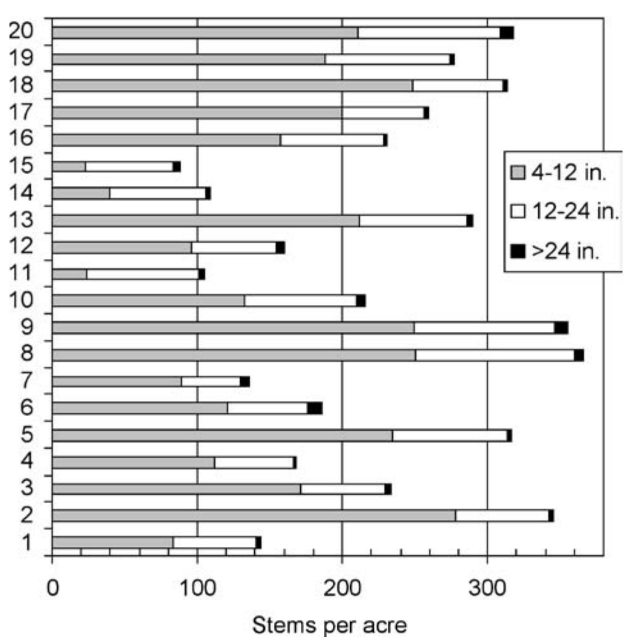
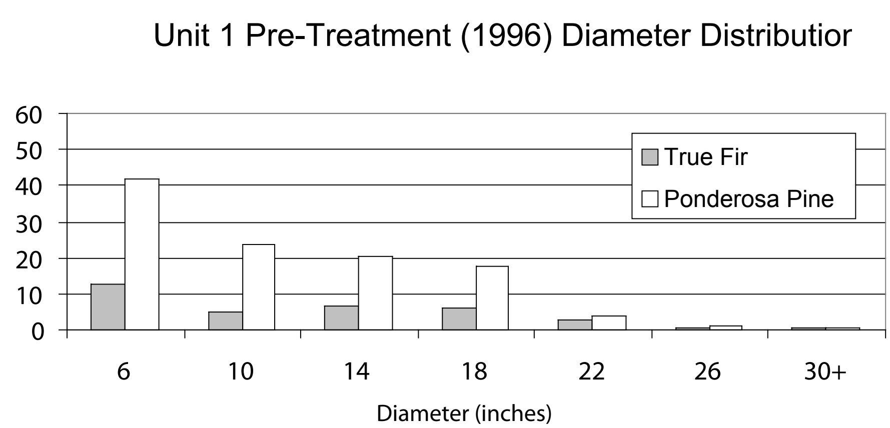


Figure B.6—Pre-treatment distribution of trees by size class (poles, small sawtimber and mature sawtimber) for each of the 20 treatment units in the Goosenest Adaptive Management Area in 1995/1996.

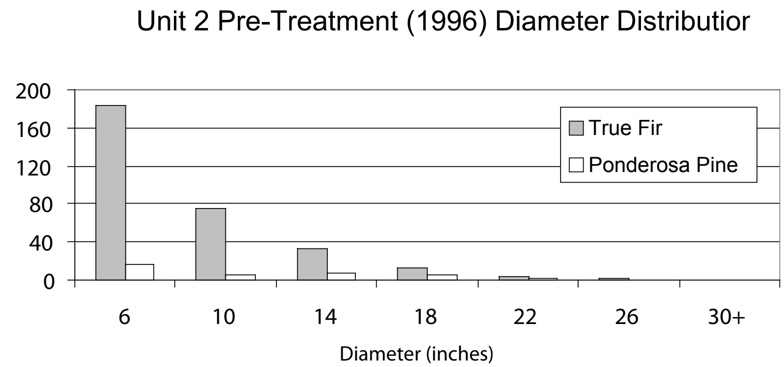
Appendix C. Treatment Unit Diameter Distributions at Establishment

Prior to assigning treatments, a sample to determine of tree density and species composition was conducted. Crews employed a systematic sample of each unit with a 20 Basal Area Factor variable-radius plot. Trees were tallied by species and by 4-inch- diameter classes starting with trees 4 inches DBH. The sampling intensity was about 70 plots per unit: a 50x100 meter grid. We used the established grid system and added one intermediate point between established grid points per line.

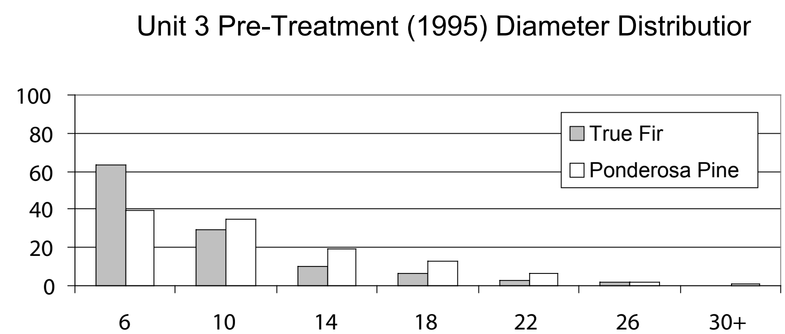
The primary goal of this sample was to obtain a pre-treatment characterization of stand structure and to locate dense pockets of fir for locating the 15 acres of planned openings. We were trying to target those areas with sparse distribution of pine trees. Since the target was 80 percent pine basal area, mechanical treatments of areas with little or no pine will do nothing to move stands toward this target. A pine-emphasis thin in pure fir stands will not be effective. The planted openings were intended to remedy this problem.



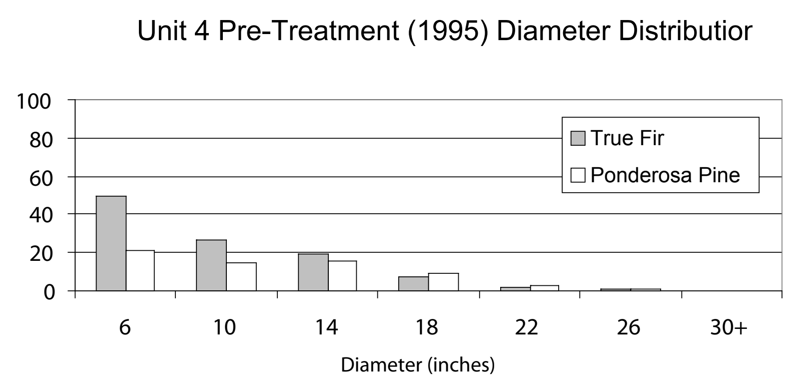
Unit 1 (Large-Tree Emphasis) basal area estimate was 124 ft^2 per acre with a quadratic mean diameter of 12.6 inches in October 1996. Unit 1 was subject to sanitation/salvage prior to treatment installation. Also, this unit is one of the lower elevation units and, because of this, has less fir than some of the other sites. Data are from a sample of 71 variable radius plots.



Unit 2 (Large-Tree Emphasis) pre-treatment basal area estimate was 177 ft^2 per acre with a quadratic mean diameter of 9.7 inches in October 1996. Data are from a sample of 72 variable radius plots.

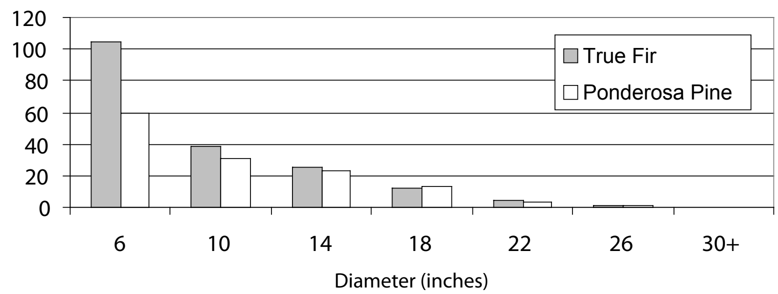


Unit 3 (Pine Emphasis With Fire) pre-treatment basal area estimate was 160 ft^2 per acre with a quadratic mean diameter of 11.2 inches in November 1995. Data are from a sample of 73 variable radius plots.



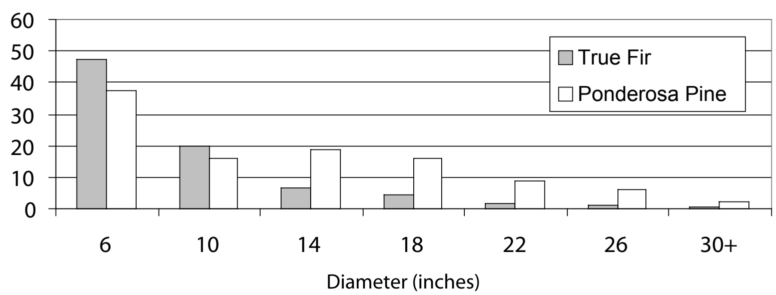
Unit 4 (Control) pre-treatment basal area estimate was 117 ft^2 per acre with a quadratic mean diameter of 11.31 inches in November 1995. Unit 4 was subject to some light sanitation/salvage work in the past. Data are from a sample of 72 variable radius plots.

Unit 5 Pre-Treatment (1995) Diameter Distributior



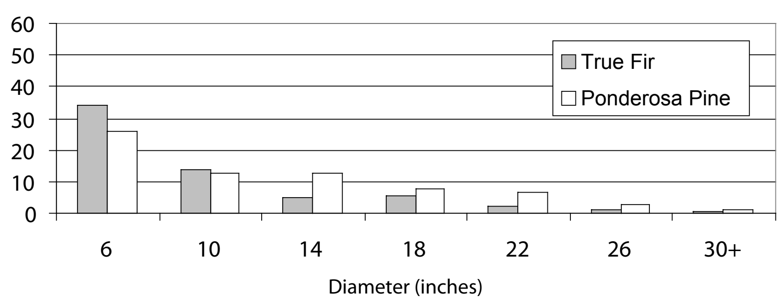
Unit 5 (Pine Emphasis) pre-treatment basal area estimate was 188 ft^2 per acre with a quadratic mean diameter of 10.4 inches in November 1995. Data are from a sample of 70 variable radius plots.

Unit 6 Pre-Treatment (1995) Diameter Distributior

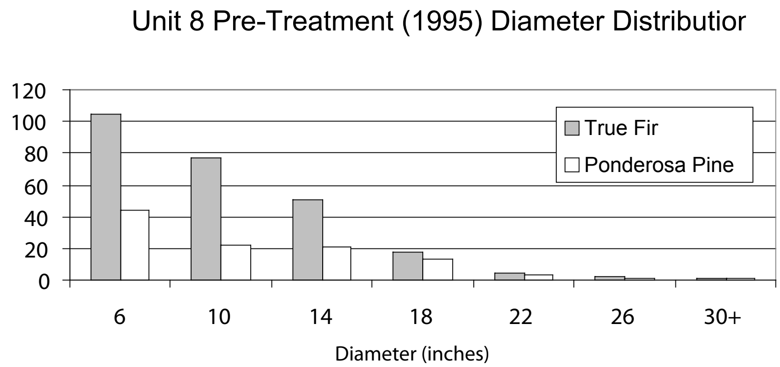


Unit 6 (Pine Emphasis With Fire) pre-treatment basal area estimate was 162 ft^2 per acre with a quadratic mean diameter of 12.6 inches in November 1995. Data are from a sample of 69 variable radius plots.

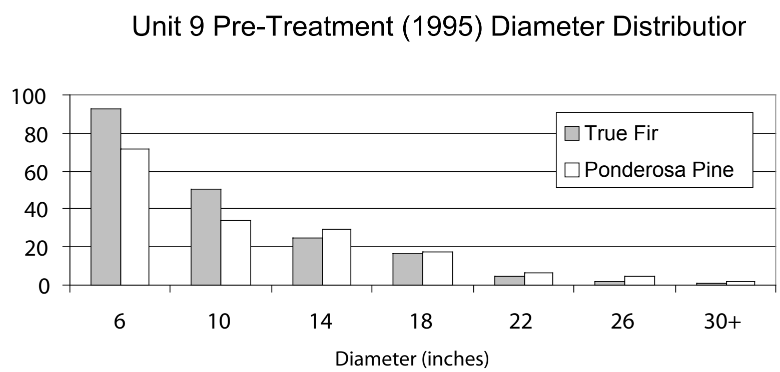
Unit 7 Pre-Treatment (1995) Diameter Distributior



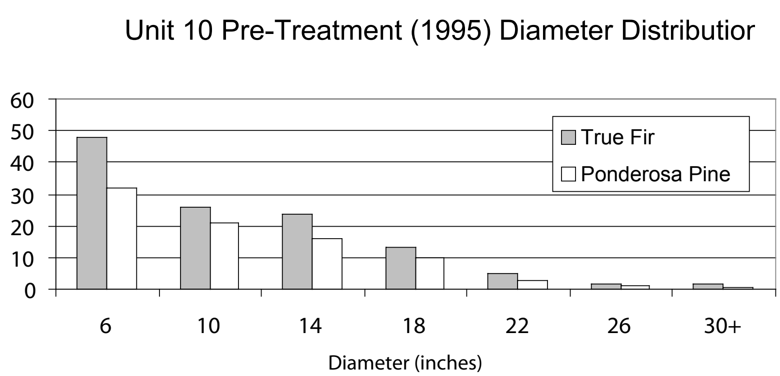
Unit 7 (Pine Emphasis) pre-treatment basal area estimate was 116 ft^2 per acre with a quadratic mean diameter of 12.5 inches in November 1995. Data are from a sample of 67 variable radius plots.



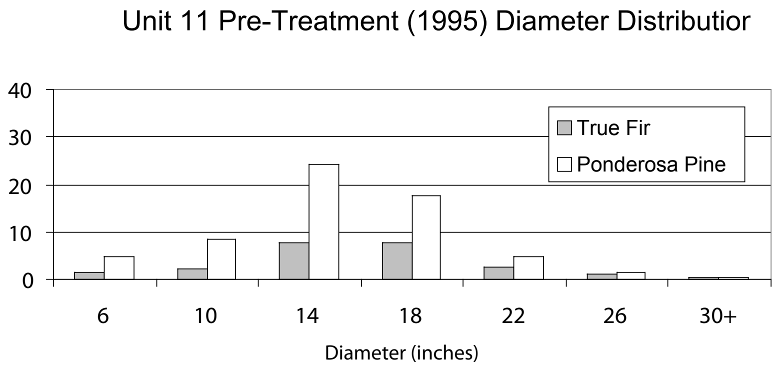
Unit 8 (Large-Tree Emphasis) pre-treatment basal area estimate was 250 ft^2 per acre with a quadratic mean diameter of 11.2 inches in November 1995. Data are from a sample of 72 variable radius plots.



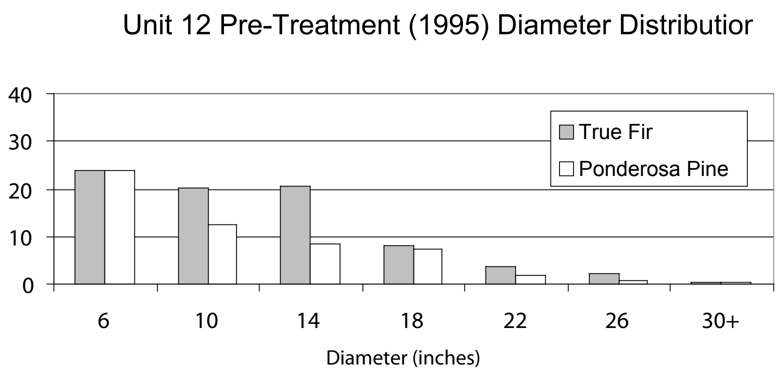
Unit 9 (Pine Emphasis) pre-treatment basal area estimate was 253 ft^2 per acre with a quadratic mean diameter of 11.4 inches in November 1995. Data are from a sample of 72 variable radius plots.



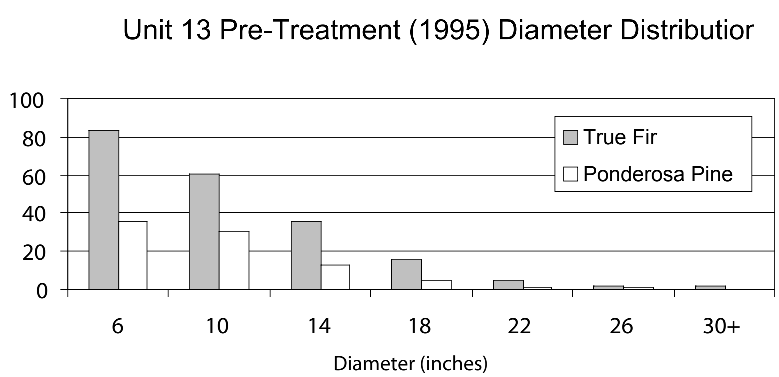
Unit 10 (Control) pre-treatment basal area estimate was 178 ft^2 per acre with a quadratic mean diameter of 12.3 inches in November 1995. Data are from a sample of 72 variable radius plots.



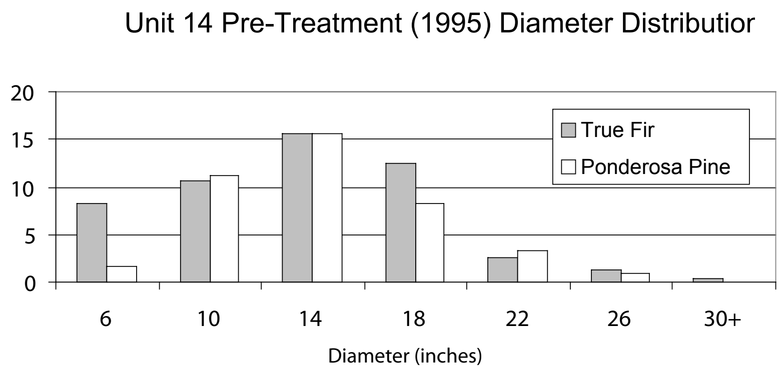
Unit 11 (Large-Tree Emphasis) pre-treatment basal area estimate was 139 ft^2 per acre with a quadratic mean diameter of 15.6 inches in November 1995. Data are from a sample of 72 variable radius plots.



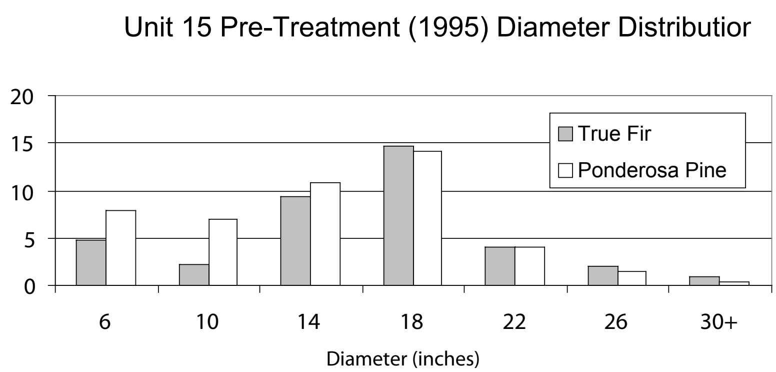
Unit 12 (Pine Emphasis) pre-treatment basal area estimate was 134 ft^2 per acre with a quadratic mean diameter of 12.4 inches in November 1995. Data are from a sample of 72 variable radius plots.



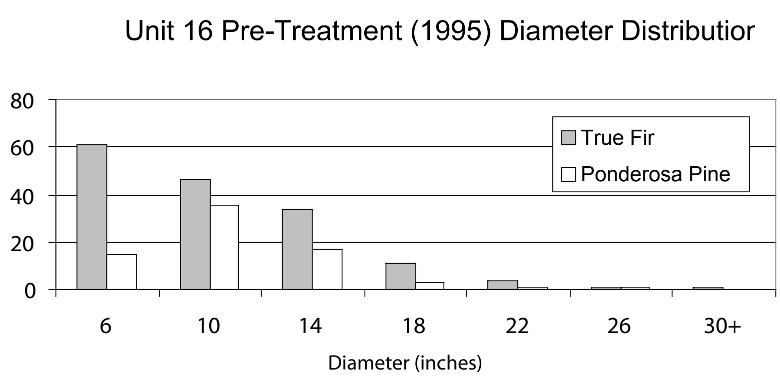
Unit 13 (Pine Emphasis With Fire) pre-treatment basal area estimate was 187 ft^2 per acre with a quadratic mean diameter of 10.9 inches in November 1995. Data are from a sample of 71 variable radius plots.



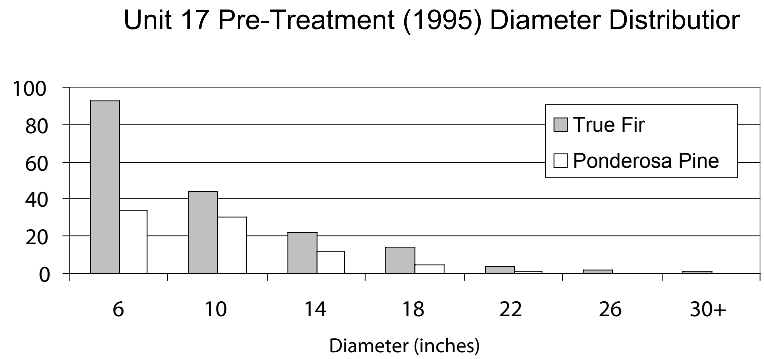
Unit 14 (Large-Tree Emphasis) pre-treatment basal area estimate was 123 ft^2 per acre with a quadratic mean diameter of 14.4 inches in November 1995. Data are from a sample of 70 variable radius plots.



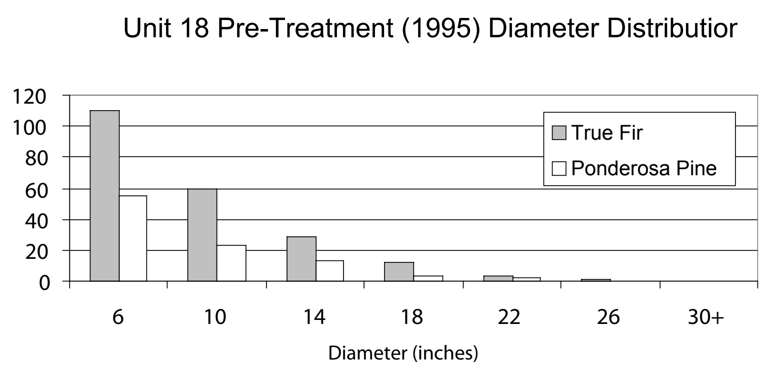
Unit 15 (Pine Emphasis With Fire) pre-treatment basal area estimate was 127 ft^2 per acre with a quadratic mean diameter of 16.2 inches in November 1995. Data are from a sample of 72 variable radius plots.



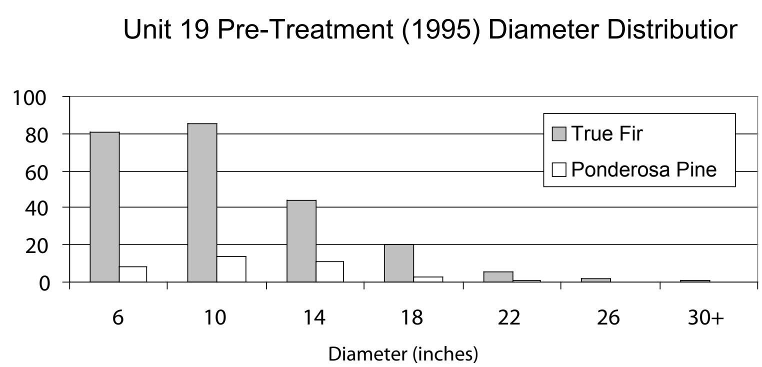
Unit 16 (Control) pre-treatment basal area estimate was 158 ft^2 per acre with a quadratic mean diameter of 11.2 inches in November 1995. Data are from a sample of 73 variable radius plots.



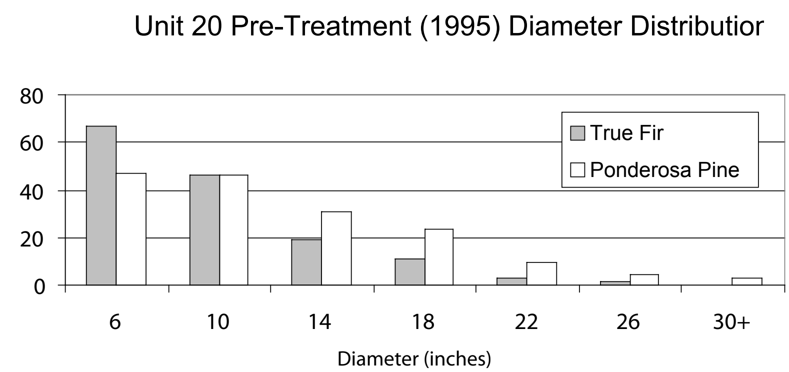
Unit 17 (Pine Emphasis With Fire) pre-treatment basal area estimate was 153 ft^2 per acre with a quadratic mean diameter of 10.4 inches in November 1995. Unit 17 was subject to sanitation/salvage prior to treatment installation. Data are from a sample of 67 variable radius plots.



Unit 18 (Control) pre-treatment basal area estimate was 168 ft^2 per acre with a quadratic mean diameter of 9.9 inches in November 1995. Unit 18 was subject to sanitation/salvage prior to treatment installation. Data are from a sample of 66 variable radius plots.



Unit 19 (Pine Emphasis) pre-treatment basal area estimate was 196 ft^2 per acre with a quadratic mean diameter of 11.4 inches in November 1995. Unit 19 was subject to sanitation/salvage prior to treatment installation. Data are from a sample of 70 variable radius plots.



Unit 20 (Control) pre-treatment basal area estimate was 254 ft^2 per acre with a quadratic mean diameter of 12.1 inches in November 1995. Unit 20 was subject to sanitation/salvage prior to treatment installation. Data are from a sample of 76 variable radius plots.

Appendix D. Implementing Treatments

D.1 Treatment Specifications

Overview

There are four treatments in the experiment. The primary feature of the thinning in Treatments 1 and 2 is the retention of dominant and codominant pine trees (where present). The intent of this thinning is to facilitate a species conversion. By favoring the retention of pine, it is anticipated that these stands will, over time, have 80 percent basal area in pine, or more precisely, less than or equal to 20 percent basal area in fir and other species. The first two treatments both feature identical mechanical treatments; the only difference between Treatment 1 and Treatment 2 is the application of prescribed fire.

One other element of Treatments 1 and 2 is the creation of small openings for regeneration of pine. With the high proportion of pine in these stands, it is not possible to achieve the goal of 80 percent basal area in pine by simply thinning out the fir. In many stands there is insufficient existing ponderosa and sugar pine to meet the objective.

The thinning treatments produced sawlogs and biomass. A total yield of 17.57 million board feet of timber was processed as a result of this treatment. In addition, 68,348 green tons of biomass were removed as well.

The primary feature of late-successional forests in this region is the presence of large trees. Accordingly, in Treatment 3, no consideration was given to species when thinning. The largest trees were selected for retention on a spacing guideline, producing a stand where growth is allocated among fewer large trees. These stands should then develop a large-tree component much more quickly than the control stands. These stands will continue to have a dominant component of white fir.

The control treatments (Treatment 4) will experience neither thinning nor prescribed fire. Sanitation and salvage also will be prohibited. The stands will continue to be subject to fire suppression: the Forest Service will continue to extinguish wildfires within the study area with no modification other than the expectation that firefighting efforts attempt to avoid destructive manipulations within the treatment units themselves (for example, no dozer lines). It is hoped that activities such as fire line construction would be directed, when possible, to areas beyond the boundaries of the treatments.

It was not possible to complete all thinning operations in a single season. The thinning work was divided up over a 3-year period, from 1998 to 2000. In 1998, one complete replication was thinned (Units 6, 9, and 14). In 1999, two complete replications were thinned (Units 1, 2, 5, 12, 13, and 15). In 2000, the final two replications were thinned (Units 8, 11, 7, 19, 3, and 17). Because of this timing, we originally intended to follow a similar schedule for burning: Unit 6 in 1999, Units 13 and 15 in 2000, and finally Units 3 and 17 in 2001. However, because of restrictions resulting from burn conditions, we did not complete any burning activities until 2001, when all five units were burned (*see appendix G*).

The treatments are described below in the marking guides. We had a 30-inch leave requirement. That is, any tree >30 inches DBH was left regardless of spacing. On the Large Tree Treatment, trees greater than 30 inches DBH were treated as invisible. This produced a more clumpy arrangement of trees in areas where the large trees were found.

Treatments 1 and 2: Pine Emphasis Mechanical Treatment

Objective

The objective is to accelerate development and enhance establishment of large pine trees by thinning and strive toward at least 80 percent composition of ponderosa pine by basal area (with minimal age class distribution differences between plots), while meeting mandatory tree retention criteria, spacing guidelines, desirable leave tree, regeneration, and slash criteria.

Evaluate for thinning every 10 years (2005, 2015, and so forth). Thin those plots that exceed Stand Density Index of 220 back to 205. Utilize the mandatory leave tree criteria, spacing guidelines and desirable leave tree criteria. (Note: To minimize within-treatment variability, some more open units will require little or no thinning in the first and/or second entries, while more dense units may require heavy removals in each entry.)

Increase the proportion of pine in this initial entry by regenerating approximately 15 percent of the area (15 acres), in each unit, with ponderosa pine (see *appendix H*).

Evaluate the need to increase the proportion of pine every 20 years (2025, 2045, and so forth). Conduct this evaluation immediately after “leave trees” have been selected and marked for commercial thinning so that the species composition remaining after thinning will be the source of information from which the decision to regenerate any entry will be made.

If the species composition is not approaching the desired goal of 80 percent in any one of the 10 units, artificially regenerate with pine no more than 15 percent of the total area in each of the 10 units (area to be regenerated must be the same in each of the 10 plots).

Mandatory Tree Retention Criteria

Retain all the following live trees:

- All white fir >30 inches DBH
- All dominant and codominant ponderosa pine >12 inches DBH
- All sugar pine
- All incense-cedar >10 inches DBH
- All Douglas-fir (note: only one Douglas-fir has been found in the study area).
- Trees similar in size to, and within 2 feet of, chosen leave trees (to minimize wind throw). Retain all snags (of any species) >15 inches DBH.

Spacing Guidelines

Space between all trees (regardless of species) should be derived from the diameter of the larger tree plus 5, plus or minus 10 percent. This value is then multiplied by 12 to obtain spacing in feet. The spacing (S, in feet) is a function of tree diameter (DBH, in inches):

$$S = 5 + DBH$$

For example, a 15-inch-DBH leave tree should have an approximate spacing of 20 feet to the next leave tree, if there are no mandatory leave trees within the 20-foot radius around the subject tree.

Note: Mandatory tree retention criteria have priority over spacing guidelines; therefore, a somewhat clumpy distribution of leave trees may result.

Desirable Leave Tree Criteria

- Largest dominants or codominants
- Species in order of preference: ponderosa pine, sugar pine, incense-cedar, Douglas-fir, true fir, lodgepole pine

Slash Criteria

- Remove all boles, limbs, and tops of trees >4 inches DBH and <18 inches DBH.
- Remove boles only of trees >18-inch DBH. Buck, lop, and scatter tops and limbs.
- Fall all damaged trees.
- Pre-commercial thin trees <4 inches DBH. Buck, lop, and scatter cut trees.
- Leave all cull (non-commercial) material in the woods.

Regeneration Criteria

Priorities for locating regeneration openings are as follows:

1. Dense clumps of white fir with <30 percent live crown ratio
2. Other dense clumps of white fir
3. Existing openings that will grow 20 cubic feet per acre per year.

Minimum opening size to be regenerated is 0.5 acres and the maximum is 3 acres, with a minimum dimension of 100 feet and a ratio of dimensions no more than 3:1 (openings are to be non-linear). The openings are to be evenly dispersed, if possible, and no closer than 200 feet to another opening.

The opening sizes are to be distributed approximately as follows:

- 5 percent of the area in openings 0.5 to 1.0 acre
- 5 percent of the area in openings 1.0 to 2.0 acres
- 5 percent of the area in openings 2.0 to 3.0 acres

Site Preparation and Planting

In Treatments 1 and 2, site preparation for planting will be accomplished by machine piling brush and harvest-created slash and burning the piles the summer following tree removal. That fall, the openings will be ripped to reduce competition from grass and expose developed soil beneath the pumice layer.

Plant 100 percent 2-0 bare root ponderosa pine at a density of 300 trees per acre, or 12-foot square spacing.

Post-Planting Treatments

Evaluate for need to reduce competing vegetation after the second growing season. If cover of grass is >10 or if cover of shrubs and grasses combined is >30 percent, remove this vegetation mechanically or by hand.

Evaluate for pre-commercial thinning at 10 and 20 years after planting.

- Thin if space between crowns is less than 5 feet.
- Create a minimum space of 5 feet and a maximum space of 10 feet between crowns.
- Lop and scatter tops and limbs to 12-inch depth. Buck boles to 6-foot lengths.

Evaluate the planted areas for commercial thinning at 20 years and at 10-year intervals thereafter. If stand density index exceeds 220, thin these small plantations to a stand density index of 205 utilizing the spacing guidelines, mandatory tree retention, and desirable leave tree criteria.

Treatment 2: Pine Emphasis with Prescribed Fire

Objective

Thinning objective is the same as objective for Treatment 1. Treatment 2 is identical to Treatment 1, except that prescribed fire is included in Treatment 2. The fire reintroduction objectives are to:

- Restore natural, physical, and biological processes by reestablishing a fire regime patterned after the natural fire regime, and
- Determine the effects of this disturbance regime on within-treatment variability.

In the fall (preferably) or spring, after tree removal and pre-commercial thinning activities, re-introduce fire to the entire unit, including the buffer area. Use prescribed fire throughout the next 50 years to mimic the natural fire regime, to the degree possible. Guidelines for prescribe fire are:

- Prescribed fire should result in no more than 10 percent mortality of the trees <8 inches DBH, and no more than 5 percent mortality of the trees greater than or equal to 8 inches DBH.
- Construct a line around each unit (including the buffer) prior to application of prescribed fire.
- Retain the large snags by constructing a handline around all standing snags >15 inches DBH.

Note: The Klamath National Forest, in preparation for the initial prescribed burns, established a network of handlines throughout the treatment units to aid in control of the fires. In some instances bulldozers were used for these lines as well. This disturbance, though undesirable for the experiment, was deemed necessary by forest managers and those responsible for controlling the burn because of the size of the units to be treated.

Treatment 3: Large-Tree-Emphasis Mechanical Treatment

Objective

Maximize individual tree growth and minimize the number and size of forest openings for a 50-year period, while meeting spacing guidelines, desirable leave tree, and slash criteria. Trees retained following treatment implementation, should be the largest, regardless of species.

- Evaluate for commercial thinning every 10 years thereafter.
- Thin those plots with SDI in excess of 260 back to SDI of 240, utilizing the spacing guidelines and slash criteria.

Spacing Guidelines – Apply only to trees <30 inches DBH

- Leave the largest dominant and codominant trees at 18- to 25-foot spacing, regardless of species.
- If trees are the same size (within 2 inches DBH), leave the tree with the great est live crown ratio.
- Leave all trees >30 inches DBH; there is no spacing requirement for trees >30 inches DBH. Determine the spacing between trees as if the trees >30 inches are not present.
- Leave trees similar in size to, and within 2 feet of, chosen leave-trees (to minimize wind-throw).

Slash Criteria

- Remove all boles, limbs, and tops of trees >4 inches DBH and <18 inches DBH.
- Sever the limbs from the boles of all trees >18 inches DBH, but do not remove these limbs from the woods.
- Leave all cull (non-merchantable) material in the woods.
- Remove all damaged trees.

Treatment 4: Control (Minimal Activity)

Objectives

Provide a comparison against which aggressive management activities can be evaluated.

- The only management activities to be utilized in this treatment are fire prevention and fire suppression.
- No salvage, sanitation, fuelwood cutting will be permitted.

D.2 Volume Removed

The timber sale contract with Columbia Plywood Corporation estimated 91,553 green tons of sawtimber (DBH >10 inches) and 21,875 green tons of smaller material to be produced in this sale, for a projected total of 113,428 green tons of product. Actual product removed was substantially higher than the contract estimate:

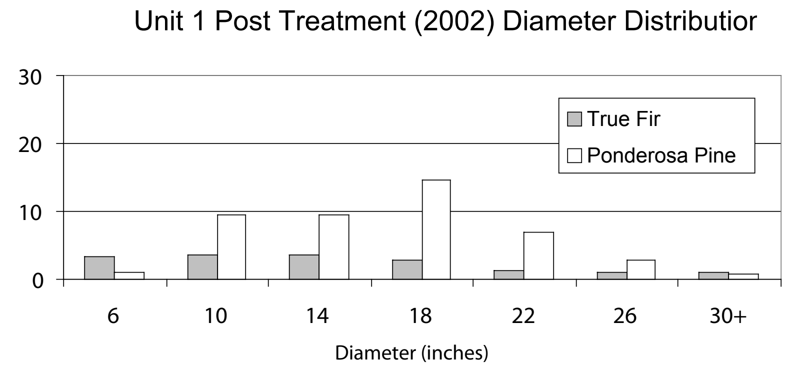
- 170,498 green tons recovered in biomass and sawlogs combined
- Estimated 102,150 green tons of sawlogs and 68,348 green tons of biomass
- 17.570 million board feet in sawlog volume
- 11.71 thousand board feet per acre (average) sawlog volume
- $5,474 million total revenue for sale

We have no product recovery data by species or size classes.

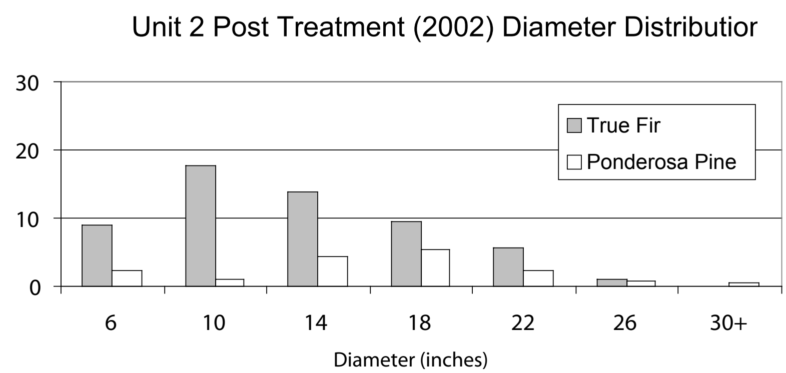
D.3 Treatment Unit Diameter Distributions after Establishment (2002)

All 20 units were sampled in 2002, as the first post-treatment vegetation survey. In the 2002 sample, permanent fixed-area plots were established on every other grid point in the treatment unit. Trees greater than 11.5 inches were sampled on a 0.20 acre plot. Trees between 3.6 and 11.5 were sampled on a 0.05 acre plot. Trees less than or equal to 3.5 inches were tallied, by 1-inch diameter classes, on a 0.01 acre plot. Only trees greater than 3.5 inches in diameter were tagged. Diameter at breast height was measured using a diameter tape. We did not establish plots in the planted openings at this time. These areas were essentially clearcut, and the only trees in the openings at this time are those planted after treatment.

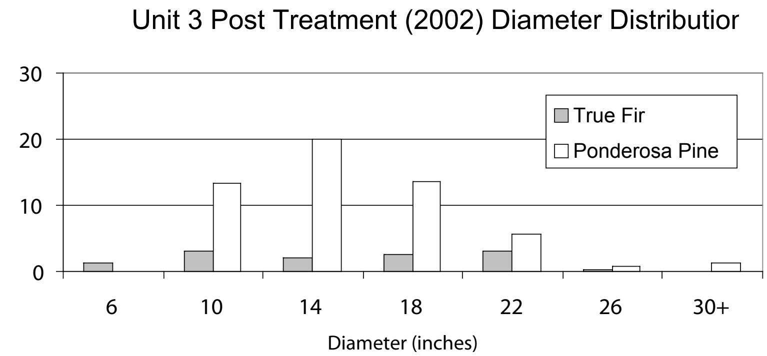
Per-acre estimates are calculated for the entire unit excluding the openings. For example, basal area is the estimate from summing basal area per acre; it reflects stand conditions of those areas not clearcut. Trees per acre is calculated in the same manner, meaning that the number of trees planted in openings is not reflected in this value. That is to say, trees per acre is an estimate of the density of trees not including planted trees; it assumes 0 trees per acre in the openings. Or it can be thought of as an estimate only for those areas in the unit not clearcut. This value can be adjusted for the entire treatment unit by taking the total acres planted multiplied by 350 trees per acre and divided by 100 acres. However, such a value is misleading because it is gives an impression of more trees distributed across the unit than is really the case. At this point we are attempting to stratify our units into planted areas and those not planted.



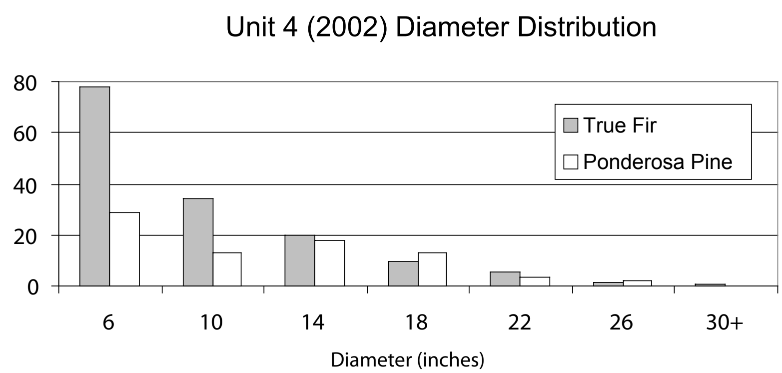
Unit 1 (Large-Tree Emphasis) post-treatment basal area estimate, derived from a sample of 18 grid points, was 98 ft^2 per acre (standard error = 6.0), and the quadratic mean diameter was 17.0 inches. Tree density was 62 trees per acre (standard error = 3.9). Ponderosa pine density was 45 trees per acre (standard error = 4.1). Density of trees >24 inches DBH was 5.8 per acre (standard error = 1.4). Much fir was removed from Unit 1 prior to establishment of the experiment; ponderosa pine still dominates in most diameter classes (total of 45 trees per acre in ponderosa pine). Hence, this stand actually resembles a Pine-Emphasis treatment in some respects. The total tally for trees <4 inches DBH was one per acre.



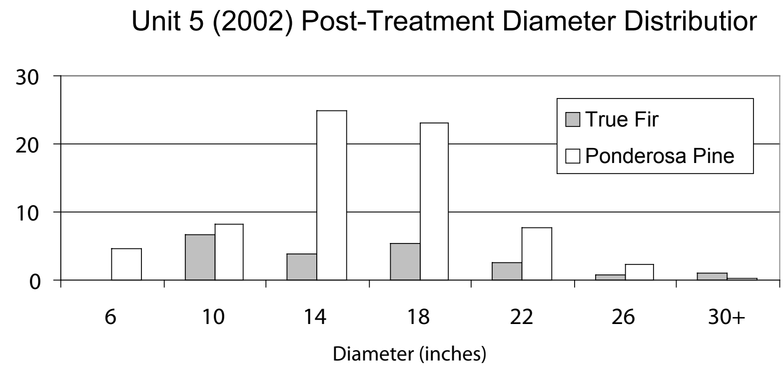
Unit 2 (Large-Tree Emphasis) post-treatment basal area estimate, derived from a sample of 18 grid points, was 87 ft^2 per acre (standard error = 4.6), and the quadratic mean diameter was 13.9 inches. Tree density was 82 trees per acre (standard error = 4.6). Ponderosa pine density was 17 trees per acre (standard error = 3.6). Density of trees >24 inches DBH was 2.7 per acre (standard error = 1.0). White fir still dominates all diameter classes in this stand. With so few trees per acre in pine it is likely to remain heavy to fir for quite some time. The total tally for trees <4 inches DBH was zero per acre.



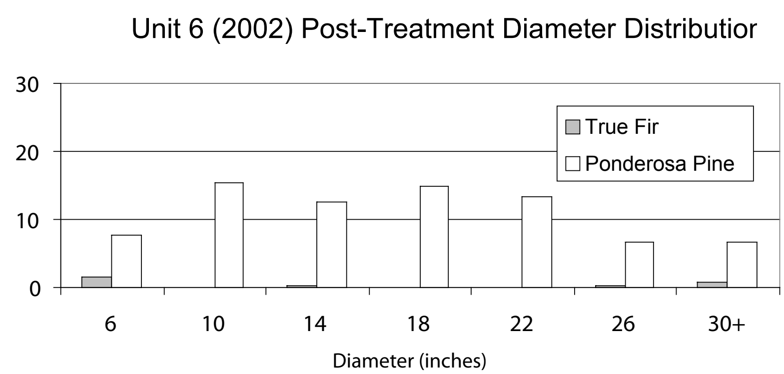
Unit 3 (Pine Emphasis With Fire) post-treatment basal area estimate, derived from a sample of 16 grid points not located in regeneration openings, was 97 ft^2 per acre (standard error = 6.8), and the quadratic mean diameter was 16.4 inches. Tree density was 66 trees per acre (standard error = 5.1). Ponderosa pine density was 54 trees per acre (standard error = 5.9). Density of trees >24 inches DBH was 2.5 per acre (standard error = 0.8). The total tally for trees <4 inches DBH was one per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.25 acres.



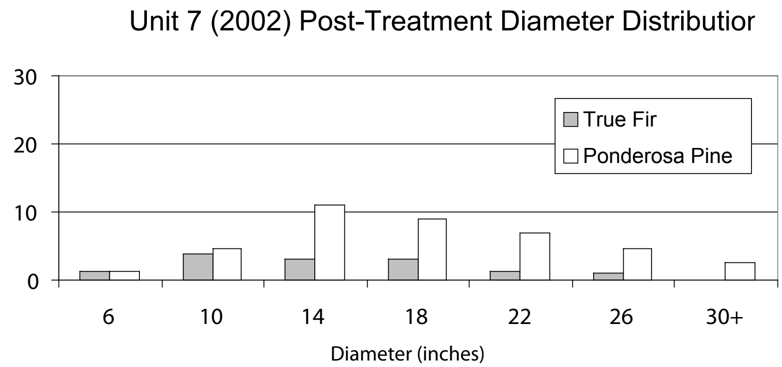
Unit 4 (Control) 2002 basal area estimate, derived from a sample of 18 grid points, was 155 ft^2 per acre (standard error = 15.9), and the quadratic mean diameter was 11.1 inches. Tree density was 230 trees per acre (standard error = 28.3). Ponderosa pine density was 79 trees per acre (standard error = 14.9). Density of trees >24 inches DBH was 3.8 per acre (standard error = 1.3). White fir still dominates the smaller diameter classes in this stand. The total tally for trees <4 inches DBH was 114 per acre.



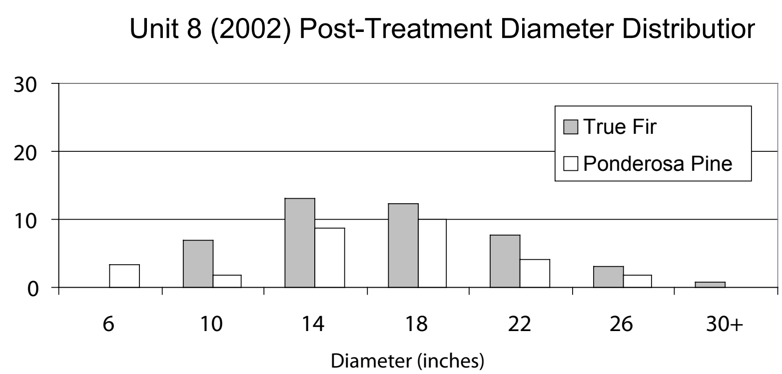
Unit 5 (Pine Emphasis) post-treatment basal area estimate, derived from a sample of 13 grid points not located in regeneration openings, was 136 ft^2 per acre (standard error = 13.1) and the quadratic mean diameter was 16.4 inches. Tree density was 92 trees per acre (standard error = 8.5). Ponderosa pine density was 74 trees per acre (standard error = 11.3). Density of trees >24 inches DBH was 4.6 per acre (standard error = 1.3). Ponderosa pine dominates all diameter classes in this stand. The total tally for trees <4 inches DBH was two per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.19 acres.



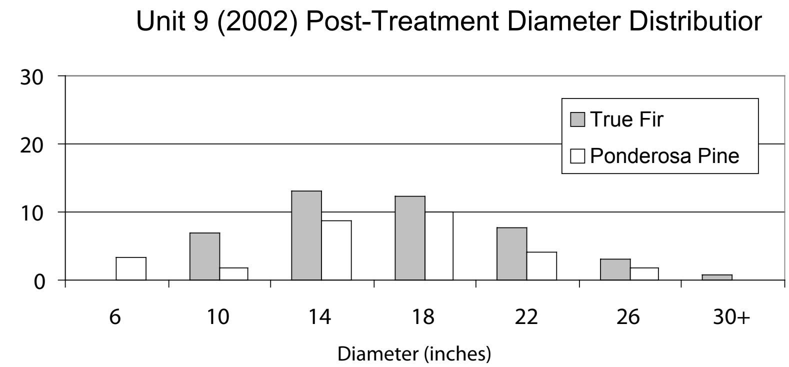
Unit 6 (Pine Emphasis With Fire) post-treatment basal area estimate, derived from a sample of 16 grid points not located in regeneration openings, was 150 ft^2 per acre (standard error = 15.8), and the quadratic mean diameter was 18.1 inches. Tree density was 83 trees per acre (standard error = 7.1). Ponderosa pine density was 72 trees per acre (standard error = 8.7). Density of trees >24 inches DBH was 11.8 per acre (standard error = 3.6). This is a nearly pure stand of ponderosa pine. The total tally for trees <4 inches DBH was nine per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 14.06 acres.



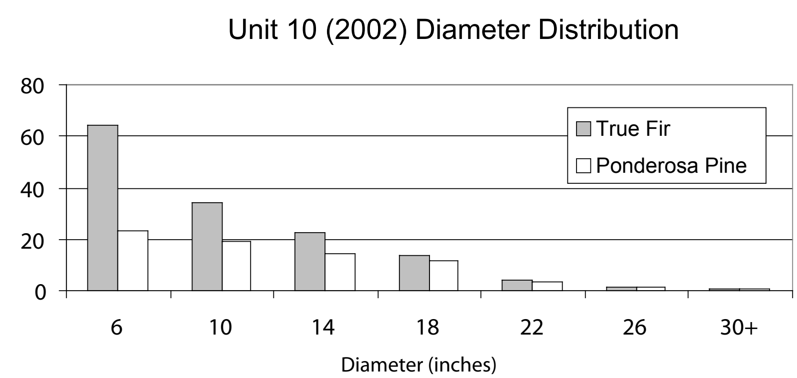
Unit 7 (Pine Emphasis) post-treatment basal area estimate, derived from a sample of 16 grid points not located in regeneration openings, was 105 ft^2 per acre (standard error = 11.0), and the quadratic mean diameter was 18.7 inches. Tree density was 55 trees per acre (standard error = 3.8). Ponderosa pine density was 41 trees per acre (standard error = 4.3). Density of trees >24 inches DBH was 9.0 per acre (standard error = 2.4). The total tally for trees <4 inches DBH was one tree per acre, not including those planted in openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.95 acres. Unit 7 also has trace amounts of sugar pine and incense-cedar amounting to about two per acre.



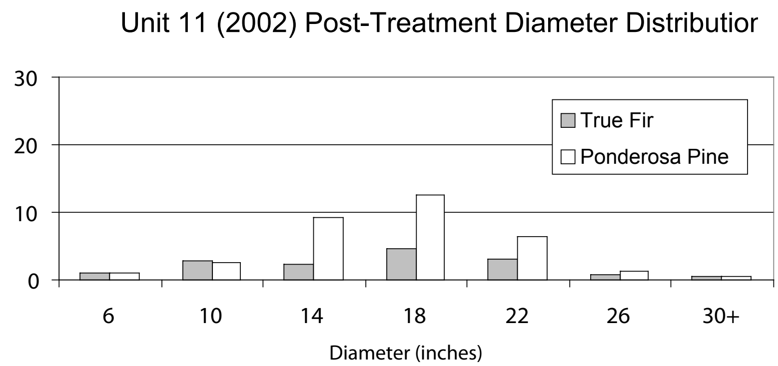
Unit 8 (Large-Tree Emphasis) post-treatment basal area estimate, derived from a sample of 18 grid points, was 121 ft^2 per acre (standard error = 9.1), and the quadratic mean diameter was 17.2 inches. Tree density was 75 trees per acre (standard error = 5.6). Ponderosa pine density was 30 trees per acre (standard error = 5.5). Density of trees >24 inches DBH was 6.1 per acre (standard error = 1.8). The total tally for trees <4 inches DBH was zero per acre.



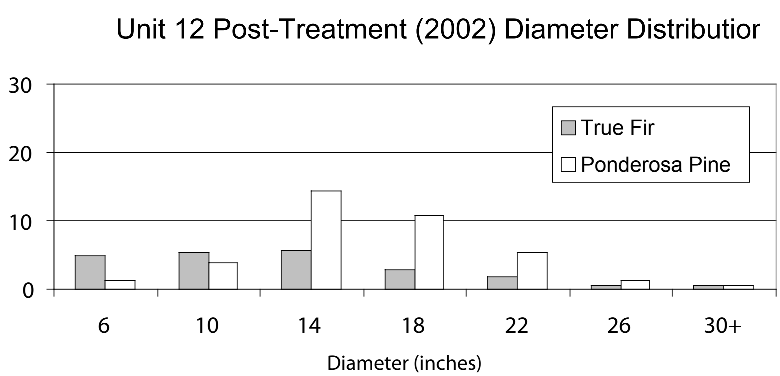
Unit 9 (Pine Emphasis) post-treatment basal area estimate, derived from a sample of 15 grid points not located in regeneration openings, was 156 ft^2 per acre (standard error = 10.5), and the quadratic mean diameter was 17.5 inches. Tree density was 93 trees per acre (standard error = 7.7). Ponderosa pine density was 76 trees per acre (standard error = 9.9). Density of trees >24 inches DBH was 11.7 per acre (standard error = 2.4). The total tally for trees <4 inches DBH was seven per acre, not including those planted in openings. Openings planted to ponderosa pine at 350 stems per acre totaled 14.31 acres.



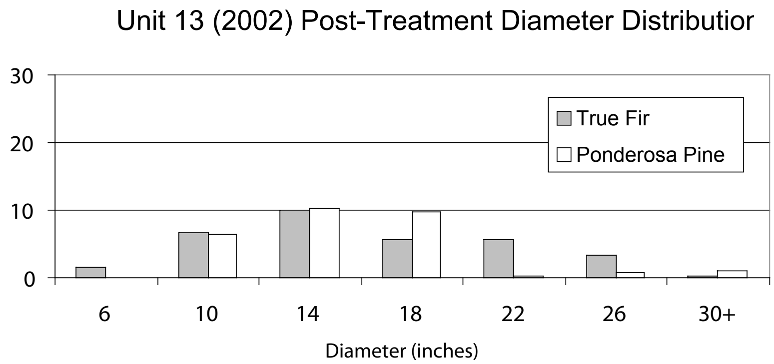
Unit 10 (Control) 2002 basal area estimate, derived from a sample of 18 grid points, was 177 ft^2 per acre (standard error = 16.7), and the quadratic mean diameter was 11.3 inches. Tree density was 253 trees per acre (standard error = 37.8). Ponderosa pine density was 90 trees per acre (standard error = 23.1). Density of trees >24 inches DBH was 5.3 per acre (standard error = 1.2). The total tally for trees <4 inches DBH was 71. It should be noted that Unit 10 also has significant amounts of sugar pine and incense-cedar (about 12 trees per acre, mostly sugar pine).



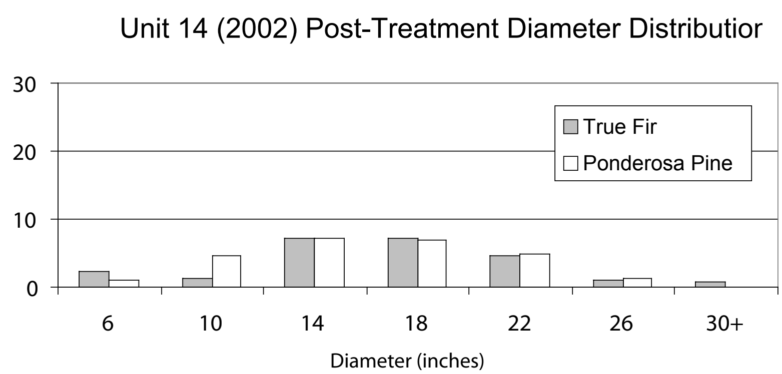
Unit 11 (Large-Tree Emphasis) post-treatment basal area estimate, derived from a sample of 19 grid points, was 98 ft^2 per acre (standard error = 7.1), and the quadratic mean diameter was 17.7 inches. Tree density was 57 trees per acre (standard error = 3.7). Ponderosa pine density was 34 trees per acre (standard error = 4.0). Density of trees >24 inches DBH was 4.7 per acre (standard error = 1.4). The total tally for trees <4 inches DBH was zero per acre.



Unit 12 (Pine Emphasis) post-treatment basal area estimate, derived from a sample of 30 grid points not located in regeneration openings, was 104 ft^2 per acre (standard error = 5.9), and the quadratic mean diameter was 15.7 inches. Tree density was 77 trees per acre (standard error = 5.8). Ponderosa pine density was 38 trees per acre (standard error = 3.0). Density of trees >24 inches DBH was 4.7 per acre (standard error = 0.8). The total tally for trees <4 inches DBH was five trees per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 14.44 acres. Unit 12 is the unit with the highest concentration of sugar pine and incense-cedar (about 15 trees per acre, mostly sugar pine).

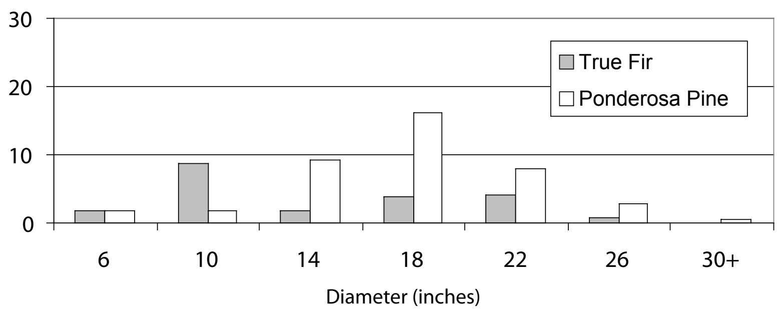


Unit 13 (Pine Emphasis With Fire) post-treatment basal area, derived from a sample of 13 grid points not located in regeneration openings, was 105 ft^2 per acre (standard error = 11.3), and the quadratic mean diameter was 16.2 inches. Tree density was 73 trees per acre (standard error = 7.9). Ponderosa pine density was 31 trees per acre (standard error = 8.9). Density of trees >24 inches DBH was 6.2 per acre (standard error = 1.7). The total tally for trees <4 inches DBH was four per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.25 acres.



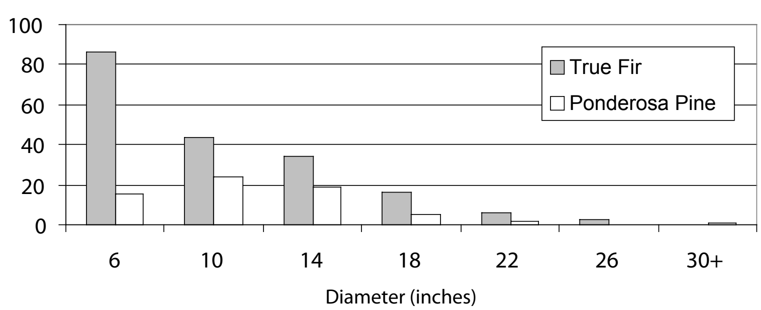
Unit 14 (Large-Tree Emphasis) post-treatment basal area, derived from a sample of 18 grid points , was 95 ft^2 per acre (standard error = 6.0), and the quadratic mean diameter was 17.2 inches. Tree density was 59 trees per acre (standard error = 3.9). Ponderosa pine density was 27 trees per acre (standard error = 3.6). Density of trees >24 inches DBH was 4.4 per acre (standard error = 1.4). The total tally for trees <4 inches DBH was 2 per acre. There is sparse coverage of incense-cedar and sugar pine in this unit (about 6 trees per acre, mostly incense-cedar).

Unit 15 (2002) Post-Treatment Diameter Distributior

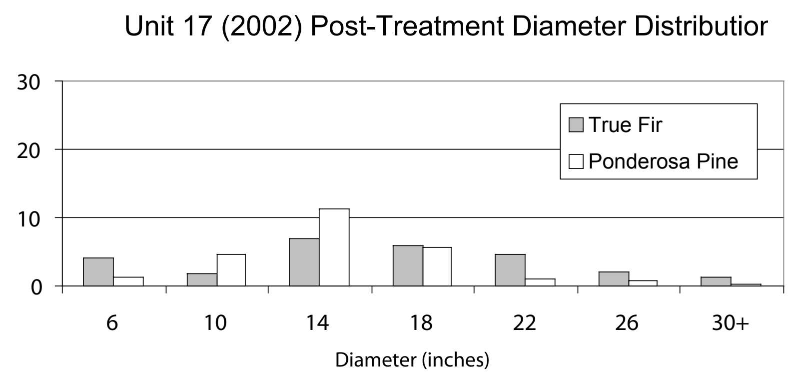


Unit 15 (Pine Emphasis With Fire) post-treatment basal area, derived from a sample of 12 grid points not located in regeneration openings, was 105 ft^2 per acre (standard error = 10.2), and the quadratic mean diameter was 17.1 inches. Tree density was 66 trees per acre (standard error = 5.3). Ponderosa pine density was 40 trees per acre (standard error = 6.8). Density of trees >24 inches DBH was 4.6 per acre (standard error = 1.3). The total tally for trees <4 inches DBH was six trees per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.84 acres. There are approximately four trees per acre of sugar pine in Unit 15.

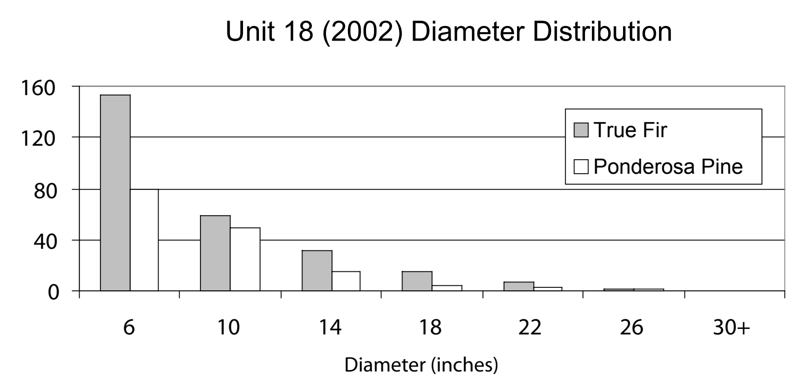
Unit 16 (2002) Diameter Distribution



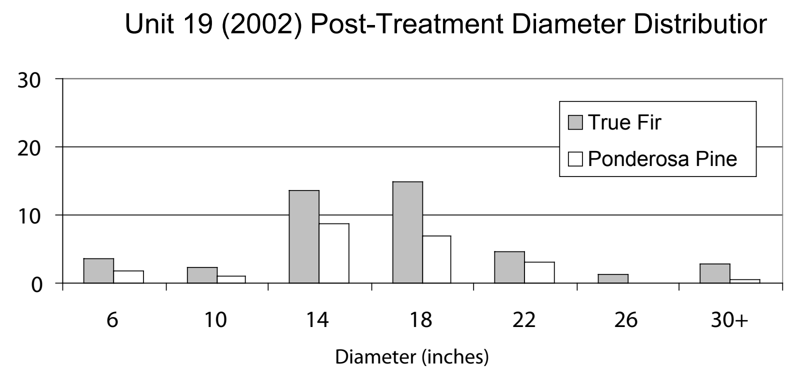
Unit 16 (Control) 2002 basal area, derived from a sample of 18 grid points, was 186 ft^2 per acre (standard error = 13.0), and the quadratic mean diameter was 10.9 inches. Tree density was 286 trees per acre (standard error = 47.2). Ponderosa pine density was 74 trees per acre (standard error = 13.6). Density of trees >24 inches DBH was 3.9 per acre (standard error = 0.8). The total tally for trees <4 inches DBH was 112 per acre. There are approximately two trees per acre of sugar pine in Unit 16.



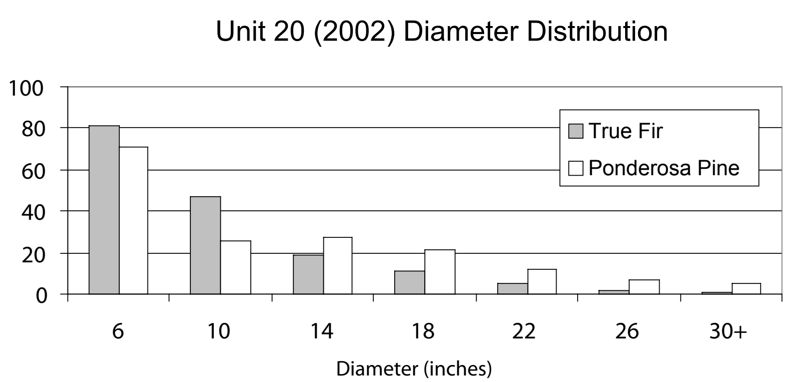
Unit 17 (Pine Emphasis With Fire) post-treatment basal area, derived from a sample of 14 grid points not located in regeneration openings, was 90 ft^2 per acre (standard error = 5.7), and the quadratic mean diameter was 16.4 inches. Tree density was 61 trees per acre (standard error = 2.9). Ponderosa pine density was 30 trees per acre (standard error = 4.5). Density of trees >24 inches DBH was 5.7 per acre (standard error = 1.2). The total tally for trees <4 inches DBH was six per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 17.07 acres.



Unit 18 (Control) 2002 basal area estimate, derived from a sample of 17 grid points, was 221 ft^2 per acre (standard error = 11.0), and the quadratic mean diameter was 9.3 inches. Tree density was 467 trees per acre (standard error = 54.4). Ponderosa pine density was 179 trees per acre (standard error = 55.9). Density of trees >24 inches DBH was 3.5 per acre (standard error = 0.8). The total tally for trees <4 inches DBH was 123 trees per acre.



Unit 19 (Pine Emphasis) post-treatment basal area, derived from a sample of 12 grid points not located in regeneration openings, was 111 ft^2 per acre (standard error = 11.7) and the quadratic mean diameter was 17.6 inches. Tree density was 66 trees per acre (standard error = 2.6). Total density of ponderosa pine was 22 trees per acre (standard error = 1.9). Density of trees >24 inches DBH was 5 per acre (standard error = 1.4). The tally for trees <4 inches DBH was six per acre, not including those in planted openings. Openings planted to ponderosa pine at 350 stems per acre totaled 13.84 acres.



Unit 20 (Control) 2002 basal area estimate, derived from a sample of 19 grid points, was 286 ft^2 per acre (standard error = 15.9) and the quadratic mean diameter was 11.3 inches. Tree density was 408 trees per acre (standard error = 45.7). Ponderosa pine density was 168 (standard error = 35.2). Density of trees >24 inches DBH was 15 per acre (standard error = 2.7). The total tally for trees<4 inches DBH was 93 per acre.

Appendix E. Tree Harvesting Operations; Dates of Thinning by Treatment Units

Plot	Treatment	Start Date	End Date
1	Large Tree	May 17, 1999	June 24, 1999
2	Large Tree	Sept. 7, 1999	November 9, 1999
3	Pine Emphasis with Fire	May 4, 2000	June 19, 2000
4	Control		
5	Pine Emphasis	June 24, 1999	September 15, 1999
6	Pine Emphasis with Fire	October 26, 1998	December 1, 1998
7	Pine Emphasis	July 25, 2000	August 29, 2000
8	Large Tree	August 23, 2000	October 24, 2000
9	Pine Emphasis	August 24, 1998	November 3, 1998
10	Control		
11	Large Tree	April 17, 2000	May 16, 2000
12	Pine Emphasis	June 17, 1999	July 26,1999
13	Pine Emphasis with Fire	August 3, 1999	October 4, 1999
14	Large Tree	July 27,1998	August 28,1998
15	Pine Emphasis with Fire	July 19, 1999	August 9, 1999
16	Control		
17	Pine Emphasis with Fire	June 8, 2000	July 20, 2000
18	Control		
19	Pine Emphasis	August 2, 2000	October 19, 2000
20	Control		

Appendix F. Understory Removal

Subsequent to mechanical treatment, each of the plots (excluding the control plots) was hand cleared of small-diameter understory trees (<4.0 inches DBH). These submerchantable trees were cut and left on the ground in all of the units, except in the control units where no trees were cut. For the burned units, this treatment took place before October 2001, the date of the first prescribed burn.

Unit	Date for thinning trees <4 inches DBH
1	June 2000
2	July 2000
3	October 2001
4	N/A (Control)
5	October 1999
6	August 1999
7	October 2001
8	October 2001
9	July 1999
10	N/A (Control)
11	October 2001
12	June 2000
13	August 2000
14	December 1998
15	July 2000
16	N/A (Control)
17	October 2001
18	N/A (Control)
19	October 2001
20	N/A (Control)

Appendix G: Burn Treatments for the Goosenest Adaptive Management Area

The burn treatments for all five burn units were completed in October 2001. This was not the original intent. Unit 6 was initially scheduled for burning in the fall of 1999, but an adequate burn window did not develop at that time. In the fall of 2000, when the next two units (13 and 15) were scheduled, we again did not have conditions that allowed the burning to be completed. A decision was made to complete all five units, if conditions allowed, in 2001. Burning conditions in the fall of 2001 were within the prescription, and the burning commenced on October 8, 2001. Average cost per acre ranged from $180 to $190.

Date	Unit	Acres	Cost
October 8	6	52	$9,360
October 9	6	56	$10,080
October 10	13, 15	150	$28,044
October 12	15, 17	55	$10,477
October 13	17	149	$28,384
October 15	3	65	$12,350
October 16	3	75	$13,500
October 17	3	35	$6,300

Observations during the burning were: time of day, flame length (inches), ambient or dry bulb temperature (Fahrenheit), relative humidity (percent), wind speed (miles per hour), and wind direction.

Unit 6—Day 1, October 8, 2001: This unit was originally scheduled to be burned in the fall of 1999. Harvesting in Unit 6 was completed in December of 1998.

Observation of day	Time Length inches	Flame Temperature °F	Ambient Humidity percent	Relative Speed miles/hour	Wind Direction	Wind
1	0830	—	39	57	1.4	N
2	0938	—	47	48	0	—
3	0940	16	—	—	—	—
4	1010	—	49	48	0.0	—
5	1015	30	—	—	—	—
6	1040	—	51	45	1.5	N
7	1045	24	—	—	—	—
8	1100	30	50.3	44	1.7	N
9	1115	25	—	—	—	—
10	1130	12	51.5	40	2.4	N
11	1145	24	—	—	—	—
2	1155	—	54.0	30	3.0	N
13	1200	10	—	—	—	—
14	1215	16	—	—	—	—
15	1225	—	57.0	24	0.0	—

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Observation of day	Time Length inches	Flame Temperature °F	Ambient Humidity percent	Relative Speed miles/hour	Wind Direction	Wind
16	1230	24	—	—	—	—
17	1245	14	—	—	—	—
18	1255	—	58.5	13	3.1	NW
19	1300	14	—	—	—	—
20	1315	10	—	—	—	—
21	1325	—	60.6	14	2.4	N
22	1330	14	—	—	—	—
23	1345	10	—	—	—	—
24	1355	—	57.6	16	3.2	NW
25	1400	12	—	—	—	—
26	1415	10	—	—	—	—
27	1425	—	57.9	18	0.8	NW
28	1430	14	—	—	—	—
29	1445	12	—	—	—	—
30	1455	—	58.9	21	2.5	NW
31	1500	—	—	—	—	—
32	1515	14	—	—	—	—
33	1525	—	59.6	18	1.6	NW
34	1530	14	—	—	—	—
35	1545	10	—	—	—	—
36	1555	—	59.1	15	1.5	NW
37	1600	16	—	—	—	—
38	1615	18	—	—	—	—
39	1625	—	59.0	19	2.7	W
40	1630	20	—	—	—	—
41	1645	18	—	—	—	—
42	1655	—	52.9	32	3.7	NW
43	1700	12	—	—	—	—
44	1707	8	52.9	32	2.1	NW

Unit 6—Day 2, October 9, 2001: The burning in Unit 6 was completed October 9, 2001.

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0755	—	28.1	71	1.1	N
2	0800	16	—	—	—	—
3	0815	24	—	—	—	—
4	0825	—	32.0	69	0.0	—
5	0830	8	—	—	—	—
6	0845	30	—	—	—	—
7	0855	—	33.9	75	0.0	—
8	0900	24	—	—	—	—
9	0915	20	—	—	—	—
10	0925	—	38.4	66	1.4	NW
11	0930	20	—	—	—	—
12	0945	24	—	—	—	—

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Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
13	0955	—	38.9	61	1.6	N
14	1000	10	—	—	—	—
15	1015	10	—	—	—	—
16	1025	—	38.4	55	2.7	NE
17	1030	12	—	—	—	—
18	1045	16	—	—	—	—
19	1055	—	45.2	50	0.0	—
20	1100	12	—	—	—	—
21	1115	10	—	—	—	—
22	1125	—	42.2	41	1.7	NW
23	1130	12	—	—	—	—
24	1145	12	—	—	—	—
25	1155	—	44.8	41	1.1	N
26	1200	10	—	—	—	—
27	1215	12	—	—	—	—
28	1225	—	47.7	35	0.5	N
29	1230	20	—	—	—	—
30	1245	30	—	—	—	—
31	1255	—	49.5	29	0.0	—
32	1300	20	—	—	—	—
33	1315	18	—	—	—	—
34	1325	—	47.5	32	1.7	NW
35	1330	10	—	—	—	—
36	1345	12	—	—	—	—
37	1355	—	50.5	25	1.0	NW
38	1400	12	—	—	—	—
39	1415	12	—	—	—	—
40	1425	—	53.9	21	1.0	N
41	1430	20	—	—	—	—
42	1445	20	—	—	—	—
43	1455	—	54.4	19	2.0	NW
44	1500	20	—	—	—	—
45	1515	16	—	—	—	—
46	1525	—	53.9	12	2.7	N
47	1530	20	—	—	—	—
48	1545	10	—	—	—	—
49	1555	—	55	10	2.3	N
50	1600	12	—	—	—	—
51	1615	16	—	—	—	—
52	1625	—	55.7	9	3.1	NW
53	1630	20	—	—	—	—
54	1645	20	—	—	—	—
55	1655	—	54.2	13	1.7	NW
56	1700	24	—	—	—	—
57	1715	20	—	—	—	—
58	1725	—	57.0	17	0.0	—

Unit 13—October 10, 2001: Unit 13 was burned in one day. There is a gap in the records for this day because Unit 15 was being burned simultaneously. Between 10:45 and 13:50 observations were made on Unit 15.

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0925	—	36.2	50	1.1	E
2	0930	8	—	—	—	—
3	0945	16	—	—	—	—
4	0955	—	50.3	35	2.0	S
5	1000	10	—	—	—	—
6	1015	20	—	—	—	—
7	1025	—	56.0	23	0.0	—
8	1030	18	—	—	—	—
9	1045	—	52.7	32	0.0	—
10	1350	—	64.7	27	3.0	SW
11	1400	18	—	—	—	—
12	1415	24	—	—	—	—
13	1420	—	60.0	25	2.0	W
14	1430	18	—	—	—	—
15	1445	12	—	—	—	—
16	1450	—	62.5	25	1.5	W
17	1500	20	—	—	—	—
18	1515	18	—	—	—	—
19	1520	—	60.9	24	1.3	W
20	1530	30	—	—	—	—
21	1545	12	—	—	—	—
22	1550	—	61.0	23	1.3	W

Unit 15—Day 1, October 10, 2001: Unit 15 could not be completed in the first day (75 acres were burned the first day). The southeast corner was completed October 12.

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	1140	—	52.2	19	1.1	SW
2	1150	20	—	—	—	—
3	1205	20	—	—	—	—
4	1210	—	63.0	15	3.0	W
5	1220	14	—	—	—	—
6	1235	12	—	—	—	—
7	1240	—	63.4	24	3.0	N
8	1250	10	—	—	—	—
9	1305	10	—	—	—	—
10	1310	—	63.7	24	1.1	N
11	1320	48	—	—	—	—
12	1335	36	—	—	—	—
13	1340	—	64.0	22	3.0	SW
14	1700	—	63.8	32	2.4	SW

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Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
15	1705	16	—	—	—	—
16	1720	12	—	—	—	—
17	1730	—	62.0	27	1.5	W
18	1735	12	—	—	—	—
19	1750	12	—	—	—	—
20	1800	—	60.7	28	2.5	N
21	1805	12	—	—	—	—

Unit 15—Day 2, October 12, 2001: All of Unit 15 was completed October 12, 2001

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0910	—	34.0	57	2.0	E
2	1050	—	50.4	30	0.0	--
3	1155	—	56.4	19	1.5	E
4	1240	—	63.1	28	0.0	--
5	1245	6	—	—	—	—
6	1300	5	—	—	—	—
7	1310	—	57.9	33	2.1	NE
8	1315	4	—	—	—	—
9	1330	6	—	—	—	—
10	1340	—	60.5	33	2.4	NE
11	1345	8	—	—	—	—
12	1400	10	—	—	—	—
13	1410	—	60.2	33	1.8	NE
14	1415	10	—	—	—	—
15	1430	10	—	—	—	—
16	1440	—	61.3	30	2.5	NE
17	1500	12	—	—	—	—
18	1510	—	63.0	36	0.8	NE
19	1515	8	—	—	—	—
20	1530	12	—	—	—	—
21	1540	—	64.0	31	2.9	N
22	1545	8	—	—	—	—

Unit 17—October 13, 2001: Unit 17 was the fourth unit burned. The entire burn (over 100 acres) was completed in one day, this was a more aggressive application of the burn treatment.

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0930	—	50.0	59	0	--
2	0950	—	48.0	58	1.5	NW
3	1000	16	—	—	—	—
4	1015	10	—	—	—	—
5	1020	—	48.1	57	2.1	NW
6	1030	10	—	—	—	—
7	1040	—	50.2	50	2.0	NW
9	1100	10	—	—	—	—
10	1110	—	50.5	47	3.0	N
11	1115	10	—	—	—	—
12	1130	8	—	—	—	—
13	1140	—	56.3	43	1.7	NW
14	1145	10	—	—	—	—
15	1200	14	—	—	—	—
16	1210	—	54.0	45	3.0	NW
17	1215	12	—	—	—	—
18	1230	10	—	—	—	—
19	1240	—	57.5	40	2.0	W
20	1245	8	—	—	—	—
21	1300	6	—	—	—	—
22	1310	—	60.0	40	3.6	NW
23	1315	12	—	—	—	—
24	1330	10	—	—	—	—
25	1340	—	63.2	21	2.6	NW
26	1345	10	—	—	—	—
27	1400	12	—	—	—	—
28	1410	—	63.3	18	3.0	NW
29	1415	12	—	—	—	—
30	1430	10	—	—	—	—
31	1440	—	64.0	18	1.5	NW
32	1445	12	—	—	—	—
33	1500	14	—	—	—	—
34	1510	—	65.7	22	0.7	NW
35	1515	16	—	—	—	—
36	1530	12	—	—	—	—
37	1540	—	64.4	23	2.0	NW
38	1545	14	—	—	—	—
39	1600	12	—	—	—	—
40	1610	—	63.7	26	1.0	NW

Unit 3—Day 1, October 15, 2001: Unit 3 was the last unit to be burned. This unit was burned very cautiously resulting in a three-day effort (October 15, 16 and 17) to complete the project.

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	1110	—	61.2	31	1.3	W
2	1115	12	—	—	—	—
3	1130	10	—	—	—	—
4	1140	—	69.5	17	1.5	SE
5	1210	—	74.1	15	0.0	—
6	1240	—	73.5	14	1.5	W
7	1310	—	72.0	14	0.0	—
8	1330	20	—	—	—	—
9	1340	—	74.0	12	1.0	SE
10	1345	14	—	—	—	—
11	1400	16	—	—	—	—
12	1410	—	72.0	14	1.0	SE
13	1415	16	—	—	—	—
14	1430	14	—	—	—	—
15	1440	—	72.0	12	2.0	SE
16	1445	18	—	—	—	—
17	1500	20	—	—	—	—
18	1510	—	72.0	14	0.0	—
19	1600	30	—	—	—	—
20	1620	—	71.2	16	2.1	SE
21	1630	24	—	—	—	—
22	1645	24	—	—	—	—
23	1650	—	68.6	18	1.3	SE
24	1700	20	—	—	—	—
25	1715	20	—	—	—	—
26	1720	—	67.2	20	2.8	SE
27	1730	24	—	—	—	—
28	1745	30	—	—	—	—
29	1750	—	65.0	20	2.9	SE

Unit 3—Day 2, October 16, 2001

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0830	10	—	—	—	—
2	0840	—	62.5	23	0	--
3	0845	10	—	—	—	—
4	0900	12	—	—	—	—
5	0910	—	63.5	23	1.9	SE
6	0915	12	—	—	—	—
7	0930	14	—	—	—	—
8	0940	—	66.0	23	1.7	SE
8	0945	36	—	—	—	—
9	1110	—	67.7	19	2.7	SE
10	1115	30	—	—	—	—
11	1130	12	—	—	—	—
12	1140	—	65.5	23	1.5	SE
13	1145	20	—	—	—	—
14	1200	24	—	—	—	—
15	1210	—	66.0	24	2.8	SE
16	1215	14	—	—	—	—
17	1240	—	69.0	21	2.9	S
18	1300	12	—	—	—	—
19	1310	—	66.6	25	3.3	S
20	1315	36	—	—	—	—
21	1340	—	67.0	23	1.3	S
22	1345	14	—	—	—	—
23	1400	16	—	—	—	—
24	1410	—	66.5	24	1.7	S
25	1430	20	—	—	—	—
26	1440	—	64.6	24	3.0	S
27	1500	14	—	—	—	—
28	1510	—	64.5	24	1.7	S
29	1515	20	—	—	—	—
30	1530	14	—	—	—	—

Unit 3—Day 3, October 17, 2001

Observation	Time of day	Flame Length inches	Ambient Temperature °F	Relative Humidity percent	Wind Speed miles/hour	Wind Direction
1	0825	—	44.0	63	0.7	N
2	0845	10	—	—	—	—
3	0855	—	44.0	56	2.2	N
4	0900	20	—	—	—	—
5	0915	12	—	—	—	—
6	0925	—	44.0	59	2.3	N
7	0930	14	—	—	—	—
8	0945	18	—	—	—	—
9	0955	—	45.2	54	1.0	N
10	1000	24	—	—	—	—
11	1015	12	—	—	—	—
12	1025	—	45.2	54	1.0	N

Appendix H. Planted Openings

Planting in Treatments 1 and 2 was scheduled for the second spring following the harvest. No planting is planned for Treatment 3 and planting is not allowed in the control units (Treatment 4). There were a total of 141.2 acres regenerated to pine in small openings; we targeted 150 acres, 15 acres in each of the 10 units receiving Treatments 1 and 2. Openings were ripped to a depth of up to 3 feet the first year after the units were harvested. The prescription called for planting the following spring using 2-0 bare-root stock at a density of 300 trees per acre. After planting, it was confirmed by the district that the actual planting density was 350 trees per acre. This is a difference in spacing of about 1 foot (300 trees per acre is a 12-foot spacing, and 350 trees per acre is about an 11-foot spacing).

The dates for planting the openings were:

Unit	Treatment	Planting Date
3	Pine Emphasis with fire	Spring 2002
5	Pine Emphasis	Spring 2001
6	Pine Emphasis with fire	Spring 2000
7	Pine Emphasis	Spring 2002
9	Pine Emphasis	Spring 2000
12	Pine Emphasis	Spring 2001
13	Pine Emphasis with fire	Spring 2001
15	Pine Emphasis with fire	Spring 2001
17	Pine Emphasis with fire	Spring 2002
19	Pine Emphasis	Spring 2002

Subsequent to planting, the regeneration was scheduled to be surveyed to determine success of plantings. This survey was scheduled for 1 year and 3 years after planting. As a result of these surveys, some units will be replanted in spring 2004.

In 1997 we developed iso-density maps of each of the 10 units to be regenerated. We used the pre-treatment sample to develop these for stems per unit area, basal area per unit area, and stand density index. These maps were used to locate areas of high concentrations of fir for conversion to pine. These areas were located on the ground, and then boundaries were established within each unit such that the areas summed as close as possible to 15 acres. The 15-acre target was only a goal and was not achieved exactly on any of the plots. Most were a little below the target acreage. Following is information on locations and sizes of regeneration openings. The openings were targeted to one of three different size classes: small (approximately 0.5-1.0 acres), medium (approximately 1.0-2.0 acres), large (approximately 2.0-3.0 acres). The prescription called for an approximately equal (5 acres) distribution of acres in each opening size.

Although we intended that all trees be removed from these openings, in some instances, individual trees were left standing. This was particularly true in those instances when healthy codominant sugar pine trees were found in the openings, the rationale being that sugar pine is relatively rare on the AMA, and we would like to make every reasonable effort to maintain a viable population.

Unit 3, Pine Emphasis with Fire (*fig. H.1*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 3 is 13.25 acres.

No.	Small	Medium	Large
1	0.51	—	—
2	0.55	—	—
3	—	1.26	—
4	—	1.32	—
5	—	1.20	—
6	—	1.22	—
7	0.68	—	—
8	1.10	—	—
9	—	—	1.94
10	—	—	2.93
11	0.54	—	—
Total	3.38	5.00	4.87

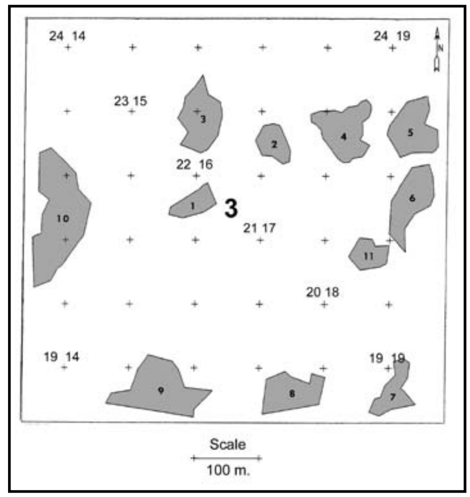

Figure H.1—Location of regeneration openings in unit 3, with grid point references.

Unit 5, Pine Emphasis (*fig. H.2*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 5 is 13.19 acres.

No.	Small	Medium	Large
1	—	1.63	—
2	—	—	2.54
3	—	—	1.92
4	—	1.20	—
5	0.49	—	—
6	0.96	—	—
7	0.76	—	—
8	—	1.58	—
9	0.45	—	—
12	—	1.15	—
13	0.51	—	—
Total	3.17	5.56	4.46

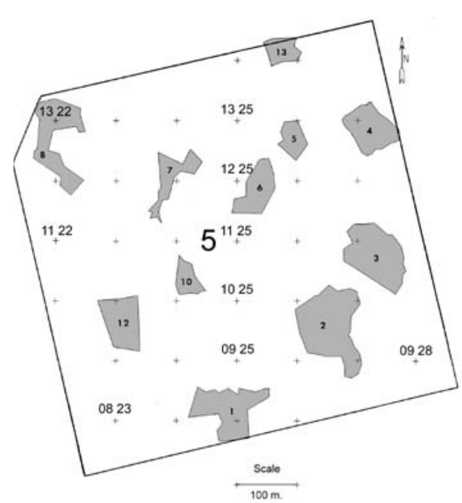

Figure H.2—Location of regeneration openings in unit 5, with grid point references.

Unit 6, Pine Emphasis with Fire (*fig. H.3*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 6 is 14.06 acres.

No.	Small	Medium	Large
1	—	—	2.34
2	—	1.87	—
4	—	—	2.09
6	0.81	—	—
7	—	1.58	—
8	—	1.59	—
9	0.52	—	—
10	0.72	—	—
11	0.67	—	—
12	0.60	—	—
13	—	1.27	—
Total	3.32	6.31	4.43

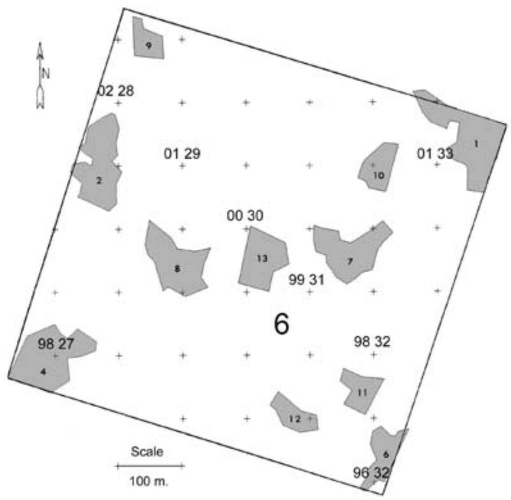

Figure H.3—Location of regeneration openings in unit 6, with grid point references.

Unit 7, Pine Emphasis (*fig. H.4*). Distribution of regeneration openings by size (acres). Total acreage in openings in unit 7 is 13.95 acres.

No.	Small	Medium	Large
1	—	1.67	—
2	—	—	2.97
3	0.55	—	—
4	—	—	1.94
5	0.99	—	—
6	0.74	—	—
7	0.96	—	—
8	—	1.67	—
9	0.79	—	—
10	—	1.67	—
Total	4.03	5.01	4.91

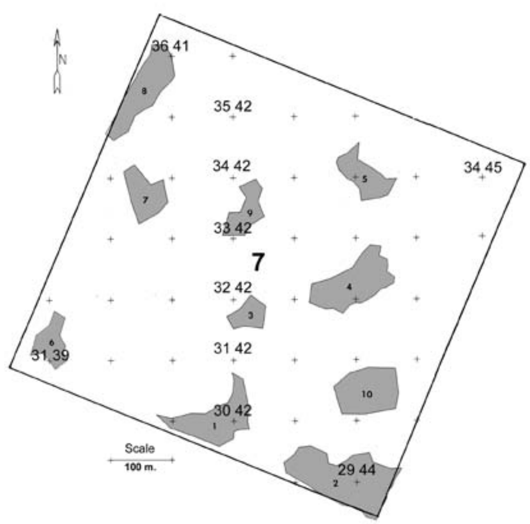

Figure H.4—Location of regeneration openings in unit 7, with grid point references.

Unit 9, Pine Emphasis (*fig. H.5*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 9 is 14.31 acres.

No.	Small	Medium	Large
1	—	—	2.25
2	—	—	3.22
3	—	1.58	—
5	—	1.36	—
6	0.40	—	—
7	0.62	—	—
8	—	0.90	—
9	0.55	—	—
10	—	1.98	—
11	0.72	—	—
12	0.73	—	—
Total	3.02	5.82	5.47

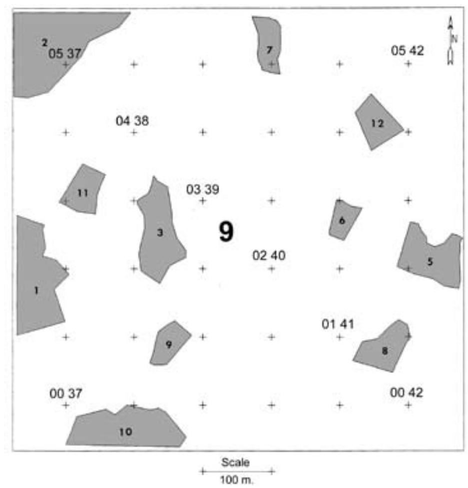

Figure H.5—Location of regeneration openings in unit 9, with grid point references.

Unit 12, Pine Emphasis (fig. H.6). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 12 is 14.44 acres.

No.	Small	Medium	Large
1	0.72	—	—
2	—	1.53	—
3	0.70	—	—
4	—	—	3.22
5	0.82	—	—
6	—	1.20	—
7	—	1.12	—
8	—	0.97	—
11	0.62	—	—
13	—	—	2.95
14	0.59	—	—
Total	3.45	4.82	6.17

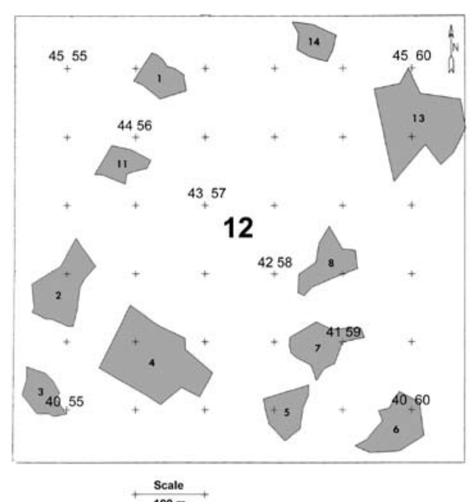

Figure H.6—Location of regeneration openings in unit 12, with grid point references.

Unit 13, Pine Emphasis with Fire (*fig. H.7*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 13 is 13.25 acres.

No.	Small	Medium	Large
1	0.60	—	—
2	—	0.99	—
4	—	—	2.18
6	0.85	—	—
7	—	1.06	—
8	0.73	—	—
9	0.45	—	—
10	—	—	2.64
12	—	1.13	—
14	0.63	—	—
15	—	1.99	—
Total	3.26	5.17	4.82

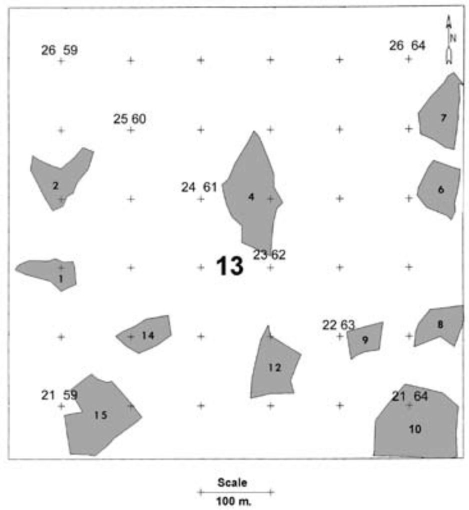

Figure H.7—Location of regeneration openings in unit 13, with grid point references.

Unit 15, Pine Emphasis with Fire (*fig. H.8*). Distribution of regeneration openings by size (acres). Total acreage in openings is 13.84 acres.

No.	Small	Medium	Large
1	—	1.38	—
2	0.65	—	—
3	0.68	—	—
4	—	—	3.03
5	—	0.99	—
8	—	1.70	—
9	—	—	1.80
10	—	1.40	—
12	0.62	—	—
13	0.90	—	—
14	0.69	—	—
Total	3.54	5.47	4.83

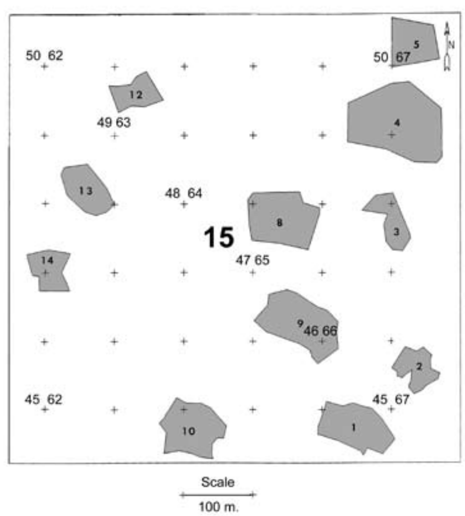

Figure H.8—Location of regeneration openings in unit 15, with grid point references.

Unit 17, Pine Emphasis with Fire (*fig. H.9*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 17 is 17.07 acres.

No.	Small	Medium	Large
1	0.87	—	—
2	0.70	—	—
3	—	1.13	—
4	0.76	—	—
5	0.61	—	—
6	0.65	—	—
7	0.45	—	—
8	—	1.00	—
9	—	1.03	—
10	—	—	2.23
11	—	—	2.87
12	—	1.43	—
13	—	—	3.34
Total	4.04	4.59	8.44

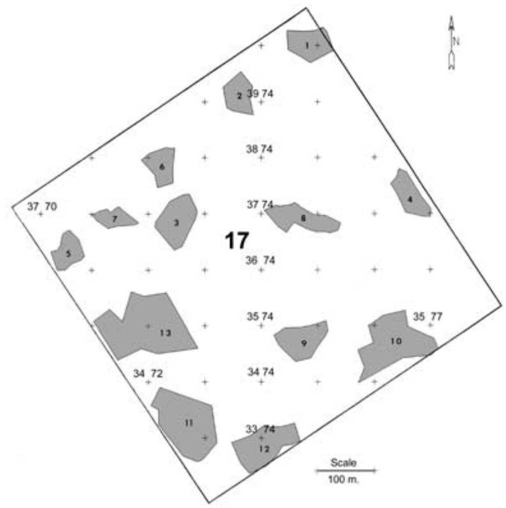

Figure H.9—Location of regeneration openings in unit 17, with grid point references.

Unit 19, Pine Emphasis (*fig. H.10*). Distribution of regeneration openings by size (acres). Total acreage in openings for unit 19 is 13.84 acres.

No.	Small	Medium	Large
1	—	—	2.54
2	—	1.53	—
3	—	—	2.71
4	—	1.01	—
5	0.89	—	—
6	0.85	—	—
7	—	1.01	—
8	0.93	—	—
9	0.39	—	—
10	—	1.98	—
Total	3.06	5.53	5.25

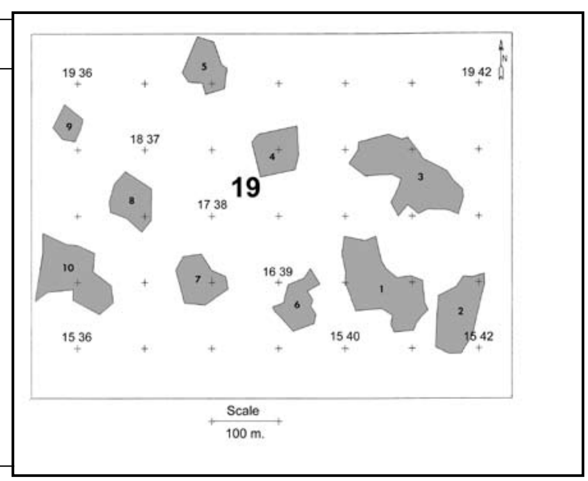

Figure H.10—Location of regeneration openings in unit 19, with grid point references.

Appendix I. Species Listings

These species were all observed during pre-treatment or (in the case of herbaceous vegetation) post-treatment surveys. Plants are listed alphabetically, by scientific name, within groups. A separate list of uncommon forbs is presented. These may have been misidentified, or more likely, they were found infrequently. Reptiles and amphibians recorded are those observed while conducting other surveys.

Plants

TREES

White fir	*Abies concolor*
Red fir	*Abies magifica*
Western juniper	*Juniperus occidentalis*
Incense-cedar	*Libocedrus decurrens*
Knobcone pine	*Pinus attenuata*
Ponderosa pine	*Pinus ponderosa*
Sugar pine	*Pinus lambertiana*
Lodgepole pine	*Pinus contorta*
Douglas-fir	*Pseudotsuga menziesii*

SHRUBS

Greenleaf manzanita	*Arctostaphylos patula*
Big sagebrush	*Artemisia tridentata*
Serviceberry	*Amalanchier alnifolia*
Mahalamat (squaw carpet)	*Ceanothus prostratus*
Snowbrush	*Ceanothus velutinus*
Mountain mahogany	*Cercocarpus ledifolius*
Princes's pine	*Chimaphila umbellata*
Bush chinquapin	*Chrysolepis sempervirens*
Rabbitbrush	*Chrysothamnus spp.*
Bloomers goldenbush	*Ericameria bloomeri*
Bitter cherry	*Prunus emarginata*
Chokecherry	*Prunus virginiana*
Bitterbrush	*Purshia tridentata*
Wax currant	*Ribes cereum*
Sierra gooseberry	*Ribes roezlii*

Sticky currant	*Ribes viscosissimum*
Wood rose	*Rosa gymnocarpa*
Interior rose	*Rosa woodsii*
Creeping snowberry	*Symphoricarpos mollis*
GRASSES	
California brome	*Bromus carinatus*
Cheat grass	*Bromus tectorum*
Needlegrass	*Achnatherum occidentalis*
Squirreltail	*Elymus elymoides*
Idaho fescue	*Festuca idahoensis*
Western fescue	*Festuca occidentalis*
Bluegrass	*Poa pratensis*
FORBS	
Pussy-toes	*Antennaria geyeri*
Pussy-toes	*Antennaria rosea*
Bitter dogbane	*Apocynum androsaemifolium*
Rock cress	*Arabis holboellii*
Sedge	*Carex inops*
	Carex rossii
	Carex whitneyi
Elk thistle	*Cirsium sacriosum*
Bull thistle	*Cirsium vulgare*
Clarkia	*Clarkia rhomboidea*
Miner's lettuce	*Claytonia perfoliata*
Claytonia	*Claytonia rubra*
Collinsia	*Collinsia grandiflora*
Blue-eyed Mary	*Collinsia parviflora*
Collomia	*Collomia grandiflora*
Cryptantha	*Cryptantha affins*
Cryptantha	*Cryptantha ambigua*
Fireweed	*Epilobium angustifolium*
	Epilobium minutum
Wild buckwheat	*Eriogonum nudum*
Woolly sunflower	*Eriophyllum lanatum*
Western wallflower	*Erysimum capitatum*
Mountain strawberry	*Fragaria virginiana*

Gayophytum	*Gayophytum diffusum*
Hawkweed	*Hieracium albiflorum*
	Hieracium bolanderi
Horkelia	*Horkelia fusca*
Kelloggia	*Kelloggia galioides*
Lettuce	*Lactuca serriola*
	Lactuca tieracium
Wild pea	*Lathyrus lanszwertii*
Washington lily	*Lilium washingtonianum*
Lupine	*Lupine argenteus*
Tarweed	*Madia minima*
Blazing star	*Mentzelia dispersa*
Monardella	*Monardella odoratissima*
Beardtongue	*Penstemon gracilentus*
	Penstemon humilis
	Penstemon roezlii
Phacelia	*Phacelia hastata*
	Phacelia heterophylla
Phlox	*Phlox diffusa*
	Phlox gracilis
Piperia	*Piperia unalascensis*
Pinedrops	*Pterospora andromedea*
White-veined wintergreen	*Pyrola picta*
Groundsel	*Senecio aronicoides*
	Senecio integerrimus
Catchfly	*Silene lemmonii*
Vetch	*Vicia Americana*
Violet	*Viola purpurea*

UNCOMMON FORBS

	Agoseris grandiflora
	Agoseris heterophylla
	Agoseris retrorsa
	Arnica discoidea
	Astragalus spp.
Indian paintbrush	*Castilleja applegatei*
Monkeyflower	*Mimulus jepsonii*
Cinquefoil	*Potentilla gracilis*

False Solomon's seal	*Smilacina stellata*
Chickweed	*Stellaria longipes*
Mullein	*Verbascum thapsus*

Birds

APODIFORMES (Swifts and hummingbirds)

APODIDAE (Swifts)	
Vaux's Swift	*Chaetura vauxi*
TROCHILIDAE (Hummingbirds)	
Black-chinned Hummingbird	*Archilochus alexandri*

CAPRIMULGIFORMES (Goatsuckers)

CAPRIMULGIDAE (Goatsuckers)	
Common Poorwill	*Phalaenoptilus nuttalii*

CICONIIFORMES (Herons, Storks, Ibises and relatives)

CATHARTIDAE (New World Vultures)	
Turkey Vulture	*Cathartes aura*

COLUMBIFORMES (Pigeons and Doves)

COLUMBIDAE (Pigeons and Doves)	
Mourning Dove	*Zenaida macroura*

FALCONIFORMES (Vultures, Hawks and Falcons)

ACCIPITRIDAE (Hawks, Old World Vultures and Harriers)	
Cooper's Hawk	*Accipiter cooperi*
Northern Goshawk	*Accipiter gentilis*
Sharp-shinned Hawk	*Accipiter striatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-shouldered Hawk	*Buteo lineatus*
Bald Eagle	*Haliaeetus leucocephalus*

GALLIFORMES (Pheasants and relatives)

PHASIANIDAE (Quails, Pheasants, and relatives)	
Blue Grouse	*Dendragapus obsurus*

ODONTOPHORIDAE (New World Quail)	
Mountain Quail	*Oreortyx pictus*
PASSERIFORMES (Perching Birds)	
TYRANNIDAE (Tyrant Flycatchers)	
Olive-sided Flycatcher	*Contopus borealis cooperi*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
VIREONIDAE (Vireos)	
Cassin's Vireo	*Vireo cassinii*
Warbling Vireo	*Vireo gilvus*
CORVIDAE (Jays Magpies and Crows)	
Common Raven	*Corvus corax*
Stellar's Jay	*Cyanocitta stelleri*
Gray Jay	*Perisoreus canadensis*
PARIDAE (Titmice)	
Mountain Chickadee	*Parus gambeli*
SITTIDAE (Nuthatches)	
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinesis*
Pygmy Nuthatch	*Sitta pygmaea*
CERTHIIDAE (Creepers)	
Brown Creeper	*Certhia americana*
REGULIDAE	
Golden-crowned Kinglet	*Regulus satrapa*
TURDIDAE	
Hermit Thrush	*Catharus guttatus*
Townsend's Solitaire	*Myadestes townsendi*
Mountain Bluebird	*Sialia currucoides*
American Robin	*Turdus migratorius*

STURNIDAE (Starlings)	
European Starling	*Sturnus vulgaris*
EMBERIZIDAE (Wood Warblers, Sparrows, Blackbirds, and relatives)	
Hermit Warbler	*Dendroica occidentalis*
Yellow-rumped Warbler	*Dendroica coronata*
Nashville Warbler	*Vermivora ruficapilla*
Orange-crowned Warbler	*Vermivora celata*
Wilson's Warbler	*Wilsonia pusilla*
THRAUPIDAE (Tanagers)	
Western Tanager	*Piranga ludoviciana*
EMBERIZADAE (Emberizines)	
Dark-eyed Junco	*Junco hyemalis*
Fox Sparrow	*Passerella iliaca*
Green-tailed Towhee	*Pipilo chlorurus*
Chipping Sparrow	*Spizella passerina*
CARDINALIDAE (Cardinals, Grosbeaks & Allies)	
Black-headed Grosbeak	*Pheucticus melanocephalus*
ICTERIDAE (Blackbirds, Orioles & Allies)	
Brewers Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Malothrus ater*
FRINGILLIDAE (Finches)	
Pine Siskin	*Carduelis pinus*
Lesser Goldfinch	*Carduelis psaltria*
Cassin's Finch	*Carpodacus cassinii*
Purple Finch	*Carpodacus purpureus*
Evening Grosbeak	*Coccothraustes vespertinus*
Red Crossbill	*Loxia curvirostra*
PICIFORMES (Woodpeckers and relatives)	
PICIDAE (Woodpeckers and Wrynecks)	
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*

Black-backed Woodpecker	*Picoides arcticus*
Hairy Woodpecker	*Picoides villosus*
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Williamson's Sapsucker	*Sphyrapicus thyroideus*

STRIGIFORMES (Owls)

STRIGIDAE (Typical Owls)

Northern Saw-whet Owl	*Aegolius acadicus*
Long-eared Owl	*Asio otus*
Spotted Owl	*Strix occidentalis caurina*

Infrequent sightings of migratory birds:

Ovenbird	*Seiurus aurocapillus*

Mammals

ARTIODACTYLA (Even-toed Ungulates)

CERVIDAE (Deer, Elk and relatives)

Mule deer	*Odocoileus hemionus*

CARNIVORA (Carnivores)

MEPHITIDAE (Skunks)

Spotted skunk	*Spilogale putori*

INSECTIVORA (Insectivores)

SORICIDAE (Shrews)

Shrew	*Sorex sp.*

LAGOMORPHA (Rabbits, Hares, and Pikas)

LEPORIDAE (Rabbits and Hares)

Snowshoe hare	*Lepus americanus*

RODENTIA (Squirrels, Rats, Mice, and relatives)

SCIURIDAE (Squirrels, Chipmunks, and Marmots)

Northern flying squirrel	*Glaucomys sabrinus*
Golden-mantled ground squirrel	*Spermopholus lateralis*
Douglas squirrel	*Tamiasciurus douglasi*
Yellow pine chipmunk	*Tamius ameonus*

Least chipmunk	*Tamius minimus*
Allen's or shadow chipmunk	*Tamius senex*
MURIDAE	
Vole	*Microtus sp.*
Mountain vole	*Microtus montanus*
Bushy-tailed woodrat	*Netoma cinerea*
Deer mouse	*Peromyscus maniculatus*
Pinon mouse	*Peromyscus trueii*
MUSTELIDAE (Weasels and relatives)	
Long-tailed weasel	*Mustela frenata*
PROCYONIDAE (Raccoons and relatives)	
Ringtail	*Bassariscus astutus*
URSIDAE (Bears)	
Black bear	*Ursus americanus*

Amphibians

ANURA SALIENTIA (Frogs and Toads)

BUFONIDAE (True Toads)	
Western toad	*Bufo boreas*
HYLIDAE (Treefrogs and relatives)	
Pacific treefrog	*Hyla regilla*

Reptiles

SQUAMATA (Lizards and Snakes)

ANGUIDAE (Alligator Lizards and relatives)	
Northern alligator lizard	*Gerrhonotus coeruleus shastensis*
BOIDAE (Boas)	
Rubber boa	*Charina bottae*
PHRYNOSOMATIDAE	
Short-horned horned lizard	*Phrynosoma douglassii*

Appendix J. Memorandum of Understanding

The memorandum of understanding (MOU) was signed by Barbara Holder, Forest Supervisor, Klamath National Forest, and Garland Mason acting for Hal Salwasser, Station Director, Pacific Southwest Research Station. The original MOU was effective from July 22, 1997 until July 22, 2003.

The dates in the timeline were approximates developed in advance of the work to be done. Some of those dates were not met. In particular, it was not practical to complete the harvesting in two summers. The commercial thinning operations took three seasons to complete and the complete suite of treatments was not actually completed (removal of sub-merchantable material, ripping and planting) until spring 2002 when the last of the regeneration units was planted.

Memorandum of understanding

between
PACIFIC SOUTHWEST RESEARCH STATION
FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE
and
KLAMATH NATIONAL FOREST
FOREST SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE
for

The design, development, and implementation of interdisciplinary research, to provide information on the effects of different management strategies to accelerate the development of late successional pine forests on biodiversity and sustainable productivity.

This MEMORANDUM, made and entered into the 22nd day of July, 1997, by and between the Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, hereinafter referred to as the STATION, and the Klamath National Forest, Pacific southwest Region, Forest Service, U.S. Department of Agriculture, hereinafter referred to as the FOREST,

WITNESSETH:

WHEREAS, the STATION is responsible for and conducts a program of research, and is active in the development and dissemination of scientific information and technology; and

WHEREAS, the FOREST is responsible for the management of National Forest Lands under its jurisdiction according to the policies and regulations of the Forest Service, as specified in Federal Law; and

WHEREAS, the STATION'S responsibilities for investigations of the impacts of both human-induced and natural disturbances on biodiversity and long-term productivity; and

WHEREAS, the FOREST Land and Resource Management Plan includes responsibilities for the "development of ecosystem management approaches . . . for management of pine forests, . . . including production and maintenance of late-successional forests"; and

WHEREAS, both parties have the common objective of promoting and facilitating implementation of ecosystem research and management; and

WHEREAS, it is to the distinct advantage of both parties to create and expand the cooperative partnership described in this Memorandum.

NOW, THEREFORE, in consideration of the above premises, the parties hereto agree as follows:

I. Purpose

The purpose of this memorandum is to establish the basis for a partnership of people and organizations with the common goal of performing forest ecosystem research on accelerating the development of young growth forests to rapidly achieve old growth structure and function characteristics. The primary objective of this partnership will be to develop and implement a large-scale, long-term interdisciplinary research project that meets the stated purpose. In order to achieve this goal, it will be necessary to focus interest, activities, and resources of both parties to develop treatments, locate and monument plots, install treatments, and collect and analyze response data.

II. Definition of the problem and Background

The Final supplemental Environmental Impact Statement (EIS) on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl states that "the primary objective of the 10 Adaptive Management Areas is the development and testing of new approaches for integration and achievement of ecological and economic health, and other social objectives" (page 2-12).

The Record of Decision for the above mentioned EIS documents the emphasis for the Goosenest Adaptive Management Area as the "development of ecosystem management approaches, including use of prescribed burning and other silvicultural techniques, for management of pine forest, including objectives related to forest health, production and maintenance of late-successional forest and riparian habitat, and commercial timber production" (page D-14).

The FOREST managers analyzed public comments and prioritized research projects to be implemented in the Adaptive Management Area. The need to "test treatments which can speed the development of stands to supply greater kinds and amounts of old-growth characteristics" was identified for the pine/fir transition zone in the AMA.

III. It Is Agreed by the Parties That:

1. Initial partners to this cooperation are the STATION and the FOREST. Additional partners will be sought as appropriate to further the combined objectives. Potential partners include, but are not limited to: universities with particular skills and interests in the subject area, additional National Forests, Federal Agencies, private industry, and State organizations.

2. A steering committee will be formed for the purpose of maintaining oversight and providing coordination of efforts. One or more representative(s) of each participating organization will serve on the steering committee. This committee will meet at least annually to evaluate progress of the work, resolve difficulties, identify new areas of cooperation and create a yearly work plan.

The committee will initially be composed of representatives of the Station Director and Forest Supervisor, the Goosenest Ranger District, and two members of the STATION science team. Additional members will be added, as deemed necessary by the committee.

Leadership of the committee will be on an annual basis as determined by the committee.

3. The FOREST agrees the STATION will have administrative responsibility of the research plots and the 100 meter area surrounding each of the research plots. This agreement shall be binding for a period of five years, at which time this agreement will be evaluated for extension.

4. The FOREST agrees to provide fire protection, law enforcement, road closures, and prohibit any activity detrimental to achieving the research objective in the research plots and adjacent areas for the duration of this Memorandum.

5. All parties to this Memorandum, including those who later join, agree to actively contribute to the development and promotion of the research. The interests, responsibilities, and contributions of each partner will be coordinated and guided by the steering committee; and on the ground coordination will be ensured through the submission of a Notice of Intent (See supplement D).

6. Nothing herein shall be considered as obligating the Forest Service to expend or as involving the united States in any contract or other obligation for the future payment of money in excess of appropriations authorized by law and administratively located for this work.

7. This instrument is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution of funds between the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures. such endeavors will be outlined in formal amendments to this Memorandum that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This instrument does not provide such authority. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition.

8. Modifications within the scope of this instrument shall be made by mutual consent of the parties, by the issuance of a written modification, signed and dated by both parties, prior to any changes being performed.

9. The principal contacts for this instrument are:

Pacific Southwest Research
Station, Forest Service, USDA
Kathleen Harcksen
2400 Washington Ave.
Redding, CA 96001
(916) 246-5455

Klamath National Forest
Forest Service, USDA
Thomas Farmer
37805 Highway 97
Macdoel, CA 96058
(916) 398-4391

10. This instrument is executed as of the date first shown above and expires no later than July 22, 2003, at which time it is subject to review, renewal, or expiration.

11. Attached to this Memorandum are Supplements for:
A. Responsibilities
B. Time Frames
C. Legal Descriptions, and
D. Notice of Intent

Additional Supplements will be attached, as needed.

IN WITNESS WHEREOF, the parties hereto have executed this Memorandum of understanding as of the date first written above.

PACIFIC SOUTHWEST	KLAMATH NATIONAL FOREST
RESEARCH STATION	PACIFIC SOUTHWEST REGION
FOREST SERVICE	FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE	U.S. DEPARTMENT OF AGRICULTURE
By	By
Name HAL SALWASSER	Name BARBARA HOLDER
Title Station Director	Title Forest Supervisor

MEMORANDUM OF UNDERSTANDING
Supplement A

RESPONSIBILITIES

The STATION shall:

a. Develop the Treatment Descriptions
b. Develop the Silvicultural Prescriptions
c. Develop the Marking Guidelines
d. Draft a Memorandum of Understanding, to include
  Time Frames (Supplement B)
  Protection Needs (Item 4 , Page 3)
  Land Allocation Commitment (Item 3, Page 3)
  Discussion regarding activities adjacent to Research Plots (Item 3, Page 3)
e. Submit a brief summary of the research project to the Regional Ecosystem office, if the project is determined to pose a significant risk to the Aquatic Conservation Strategy objectives or not comply with Standards and Guidelines.
f. Participate in Public Involvement Meetings
g. Cooperate in the Analysis of Public Comments
h. Review the NEPA Document
i. Develop the prescribed fire strategy
l. Provide input to the SAI Plan
m. Develop and Administer the Post Harvest Activities Contracts
n. Oversee Timber sale preparation
o. Participate in Development of Special "C" provisions
p. Assist in the administration of the Timber Sale Contract

The Goosenest Ranger District Shall:

a. Draft a Project Initiation Letter and News Release for Public Involvement.
b. Assess research activities to determine if they are consistent with the objectives of the appropriate Standards and Guidelines.
c. Implement the NEPA Process
  Conduct/Oversee Field Surveys for Environmental Reports
  Develop Environmental Resource Reports
  Conduct Public Involvement
  Analyze Public Comments
  Draft Environmental Document

d. Amend the FOREST LMP land allocation

e. Prepare the Timber Sales

Designate Timber

Prepare Maps

f . Develop the Appraisal and Contract

Prepare the Special "C" Provisions

Prepare the SAI Plan

g. Provide normal funding costs for timber sale contract administration

h. Provide FSR for the Timber Sale Contract

i. Cooperate during prescribed burn

j. Develop burn plans

k. Assist during implementation of treatments and SAI Plan

l. Develop and implement any necessary agreements with Allotment Permittee

m. Responsible for Fire Protection, Road Closures and Law Enforcement

n. Determine the Responsible official for NEPA purposes

MEMORANDUM OF UNDERSTANDING
Supplement B

TIME FRAMES (Critical Path)

Collect Baseline Data Wildlife, Vegetation	PSW	Summer ’95-‘97
Field Identify Plot Boundaries	PSW	Summer ’95-‘96
Locate/Monument Permanent Plot Centers	PSW	Summer ’95-‘96
Begin NEPA field work Archeological Survey Wildlife Owl survey Browse Species and Use Goshawk Survey	KNF	Summer ‘96
Begin Public Involvement	PSW&KNF	Summer ’96-‘97
Develop Silvicultural Prescriptions (Treatment Descriptions)	PSW	Winter ’96-‘97
Develop Marking Guidelines	PSW	Winter ’96-‘97
Develop cooperative grazing plan	KNF	Summer ‘97
Write NEPA Reports ARR BE CEA (owl, watershed) Fuels Plan Transportation Plan	KNF	Winter ’96-‘97
Prepare Environmental Analysis	KNF	Summer ‘97
Develop Sale Area Improvement Plan	PSW&KNF	Summer ‘97

Prepare Timber Sales	PSW&KNF	Summer ‘97
Develop and get Approval of Special “C” Provisions	PSW&KNF	Fall ‘97
Develop Appraisal and Contract	KNF	Winter ’97-‘98
Sell the Timber Sale	KNF	Spring ‘98
Harvest Treatments & Sale Administration	PSW&KNF	Summer ’98&’99
Conduct Prescribed Fire	PSW&KNF	Fall ‘99&’00
Prepare for Planting	KNF	Summer ‘00&’01
Plant Openings	KNF	Spring ‘01&’02
Begin Collecting Response Data	PSW	Summer ‘01

MEMORANDUM OF UNDERSTANDING
Supplement C

LEGAL DESCRIPTIONS

Legal Description and Maps of land parcels described in the Memorandum of understanding, Page 3, Section III, Item 3. (Attach maps)

All parcels are contained within the following Sections of T43N, R1E:

South 1/2 Sections 2, 3, & 18
North 1/2 Sections 14 & 19
Sections 10, 11, 15, 16, 17, 20, 21, 28, 29

MEMORANDUM OF UNDERSTANDING
Supplement D

NOTICE OF INTENT

As the Goosenest Adaptive Management Area (GAMA) is the site of a large-scale, interdisciplinary research project, many field activities are already underway. Activities underway or completed as of October, 1996 include:

Plot boundary location (flagging, blazing, painting)
Permanent plot location and monumenting (survey equipment, stakes, rebar)
Vegetation data collection (transect location, tree identification)
Herbarium development (plant collection)
Wildlife data collection (pitfall traps, transect location)

Activities planned for FY97 field season include:

Entomology sampling (net tents, pitfall traps, hanging funnel traps)
Surveys by District personnel: Wildlife, sensitive plants, archeology, engineering

With the tremendous number of people working at GAMA starting FY96, the fact that some sampling will be destructive, and the risk of loss due to walking, stumbling, and trampling - the need for coordination exists. Many of the activities have the potential to cause problems for others involved in this initial phase. Also, many of the activities could result in damage to data collection devices and locations belonging to others (destructive root sampling on a vegetation sampling transect or stumbling into a pitfall trap).

Therefore, to insure proper coordination and reduce potential damage to on-going or planned activities, a Notice of Intent shall be filed prior to conducting any activity.

The Notice of Intent is an internal Forest Service coordination document and includes all the cooperators working on the project.

The Notice of Intent will include:

A description of the proposed activities
A definition of the activities (installation, surveys, data collection, etc.)
The time frames encompassed by the activities
A description of the activity locations
A 1:24,000 map with activity locations depicted

*The Notice of Intent is required prior to each field season or prior to initiation of a new activity. The Notice of Intent must be approved by a two-thirds majority of the core Interdisciplinary Team before any activities can proceed in the Goosenest Project Area.

Please send your Notice of Intent for field activities at GAMA to:

Martin Ritchie, Redding Silviculture Lab
3644 Avtech Parkway
Redding, CA 96002

(530) 226-2551   FAX (530) 226-5091

USDA

United States
Department of
Agriculture

Forest Service

Pacific Northwest
Research Station

General Technical
Report
PSW-GTR-192
May 2005

Ecological Research at the Goosenest Adaptive Management Area in Northeastern California

Martin W. Ritchie