Sierra-Cascade Intensive Forest Management Research Cooperative

Series Report No. 2

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ANNUAL REPORT 2001

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INTRODUCTION ---

Gary Fiddler, Cooperative Manager

The Sierra Cascade Intensive Forest Management Research Cooperative has completed its second year as an organization. This past year was the first real productive one as the year 2000 was a formative year dealing with the many situations that confront a new organization. Cooperative procedures for handling new proposals were adopted, both Working Groups were up and running and held meetings, the co-op hosted its first subject-specific field trip, new members were added to our roles, and new proposals were received and considered by the membership.

This past year was one of accomplishment. Three of the studies the co-op funded in 2000 (Balderston Plantation/Powers, Site Preparation/Lanini, Fall Planting/Fiddler) and one study funded in 2001 (Wildlife Impacts/Fredrickson) present new results derived from our support. These results are found later on in this report. Three other funded studies (Fertilization-Stock Type/ Fredrickson, Exponential Fertilization/Timmer-Jopson, Competing Vegetation/Newton) are progressing on schedule and will have results to report this time next year. The results these studies are showing should be readily applicable to operations on co-op members' lands.

The co-op hosted its first field trip in June. It was well attended and based on comments from members was well received. The trip had a theme of "fall planting" and all stops on the field trip addressed this topic. Prior to the field trip, two "experts" on fall planting, Dave Henneman of the Bureau of Land management in Medford, Oregon and Tom Landis of the United States Forest Service in Central Point, Oregon presented a discussion on the nursery and operational aspects of fall planting. Tom and Dave participated in the field trip as well and served as a handy source of answers for members' questions. The idea of a subject-specific field trip was such as success with the membership, future trips will follow this format.

Our co-op was invited to a forum on cooperative research in the West sponsored by the Western Research Sub-committee of American Forest & Paper Association's Forest Science and Technology Committee in Wilsonville, Oregon, November 27-28. Two of our Directors made presentations about the Sierra Cascade Cooperative. Copies of our first annual report were made available to meeting attendees. It was encouraging to note that our cooperative, although new, was proceeding along similar lines to those older successful cooperatives at the meeting.

Despite consolidation of two companies who were members of our cooperative, our membership is actually increasing. Several potential new members have shown interest in joining the cooperative. Our cooperative membership of 22 is made up of a healthy mix of land owners, forestry-related industries, and federal agencies.

The year 2002 looks to be another active one for the cooperative. Our annual meeting is scheduled for January 21st in Redding. A panel with members from the University of Georgia, Sierra Pacific Industries, Simpson Timber Company, the Wildlife Conservation Society, and the United States Forest Service will discuss the implications/impacts on wildlife of intensive forest management. A couple more of the funded studies are scheduled for implementation during the year and some new proposals are due to be presented to the membership for funding. Our cooperative is off to a great start thanks to our membership and their willingness to share ideas and work.

Cooperative Directors:

Ed Fredrickson
Roseburg Resources
Weed, CA

Joe DiTomaso
University of California
Davis, CA

Robert F. Powers
PSW Research Station
U.S. Forest Service
Redding, CA

Cooperative Manager

Gary Fiddler
Silviculture Development
USDA Forest Service
Redding, CA

Land Manager Membership:

Boise Cascade
Collins Pine Company
Fruit Growers Supply Co.
Indian Hills Lumber
Roseburg Resources
Sierra Pacific Industries
Soper-Wheeler
W.M. Beaty & Associates

Associate Corporate Membership:

BASF
Cal Forest Nurseries
Dupont
IFA Nurseries
Monsanto Company
PRT
Wilbur-Ellis Company

Affiliate Membership:

Dow Agro Sciences
Pelton Reforestation
Silver Butte Timber Company
UAP Northwest

Supporting Members

PSW Research Station
University of California, Davis
USDA Forest Service

ORGANIZATION FUNDAMENTALS

The Sierra-Cascade Intensive Forest Management Research Cooperative was founded in February 1999. Its goal was to create a structure for ensuring and sustaining research in the areas of regeneration and early stand management. The SCIFMRC currently has 22 members.

The Cooperative is located at the Pacific Southwest Research Station in Redding, California. The membership is comprised of private, state and federal entities. The voting members pay yearly dues of $8,000 or $4,000, while non-voting affiliates pay $2,000. Research studies are approved by the full membership after review by the Board of Directors and the designated working groups. All members have full access to all the research results generated by the Cooperative.

MISSION STATEMENT

The SCIFMRC will conduct extensive research on conifer reforestation and young stand management in Northern California and Southwestern Oregon as a means of determining how trees react with their environment. The SCIFMRC will promote research on maximizing survival, growth and value while meeting other quality objectives of sound land stewardship.

OBJECTIVES

1. **Develop, implement and evaluate intensive management methods to increase conifer productivity while protecting and enhancing other forest values.**
2. **Integrate various aspects of intensive management into one inclusive cooperative, focusing on improving establishment, growth and yield of forest plantations.**
3. **Focus research on problems of young stand management on interior forests of the Cascades and Sierra Nevada.**
4. **Inform members of current young stand management research.**
5. **Produce results that foresters can integrate into the decision process.**

---MEETINGS OF 2001 ---

--General Business Meeting 1/15/01—

The first meeting in 2001 for the co-op was held on January 15th at Redding. This was a **general business meeting** and was open to potential members as well as co-op members. About 30 people attended.

The first item of business was an open discussion about how to share information among co-op members. It was decided that the web site served this purpose best, and members were encouraged to use the site and submit information for inclusion on the web site.

Bob Powers reported on the status of the Balderston proposal, Joe DiTomaso reported on the status of the Lanini proposal, and Gary Fiddler updated the progress on the fall planting proposal.

Working Group I chair Tom Jopson reported on progress of the two studies funded by the co-op that fell under that working group (stock type/fertilization – Fredrickson, and exponential fertilization – Timmer & Jopson).

Working Group II elected a chair – Brian Schlaefli of Boise Cascade – and scheduled a meeting for March 20th.

A short discussion of the status of the 2000 budget followed.

A motion was made and approved for the co-op to host a field trip during the early part of the summer. A theme of fall planting was chosen. The co-op manager was to solicit ideas from members as to places to go on the field trip.

The meeting ended with a request to the members to encourage new members to join our co-op.

--Working Group II Meeting 3/20/01–

The meeting was called to order by Brian Schlaefli, Working Group Chairman. In attendence: Tim Livingston, Bob Powers, Scott Johnson, John Fiske, Pat Minogue, Ed Fredrickson, Scott McDonald, Brad Dorken, Danielle Lindner, Brian Schlaefli, Gary Fiddler.

Bob Powers gave a short presentation on the forestry practices of Chile.

A discussion of the proposals submitted to the co-op for possible funding was the next item of business. Five proposals were discussed.

1. Re-evaluation of Shoestring, Applegate, Fir-Point, and Squaw competition threshold studies (growth/yield based on levels of competition) in south-western Oregon. Area of interest: development of growth and yield curves that reflect intensive forest management. Sponsor: Ed Fredrickson. Funds requested from co-op: $5000 - $6000 for remeasurement of studies and publication of results. Last measured in 1994; study designed by Mike Newton. Remeasurement would be in 2002. Study shows big differences in tree growth early on with herbaceous control. Co-op would have input as to measurements to be made and could use data for growth-simulator runs. Working Group conclusions: Ed will flesh out proposal for distribution to full membership at spring field trip/business meeting.

2. Development of growth curves for mixed species plantations and species not already being studied (Doug-fir, white fir, red fir) based on various levels of competition (included with this proposal would be the incorporation of zero nutrient deficiency and competition-free treatments). Area of interest: development of growth and yield curves that reflect intensive forest management. Sponsor: Ed Fredrickson. Funds requested: none at this point. This proposal was intended to determine what information is available at present, what information could be generated by re-measuring existing studies, and what researchers with

existing studies might be interested in getting involved in this effort. Working Group conclusions: form a committee to see what exists in the literature; possibly use a graduate student to compile data sets; possibly re-measure existing studies (Powers/Oliver, etc.); question Bob Heald at Blodgett, Ed Murphy at SPI, and Martin Ritchie at PSW as to what is going on in growth modeling; and check with researchers and determine if there is interest in getting involved.

3. Effects of intensive management on wildlife. Area of interest: impacts of intensive silviculture on non-commodity resources. Sponsor: Ed Fredrickson. Funds requested from co-op: none at this point (BASF has shown an interest in sponsoring this proposal). This proposal was intended to determine how to help answer the questions concerning impacts of cultural treatments on wildlife populations, i.e., what plant species are important to wildlife populations, what species of wildlife are utilizing treated areas, what plant species are coming in following cultural treatments and in what densities, etc. Working Group conclusions: present this proposal to full membership for discussion and decision on where to go from here; invite "expert" to talk to group as to what is possible in this area (S. Zack and R. Barrett recommended as contacts); include state regulators in discussion to keep co-op current as to what new regulations/policy changes might be coming in the future.

4. Evaluation of pre-harvest site preparation. Area of interest: efficacy of vegetation control. Sponsor: Ed Fredrickson. This purpose of this proposal was to quantify several site preparation methods compared to pre-harvest treatments as far as vegetative recovery, efficacy, and tolerance to conifers. Working Group conclusions: this proposal fits more in the area covered by Working Group I and should be submitted to that group.

5. Control of non-native and invasive species on forestry sites. Area of interest: noxious weed control. Sponsor: Pat Minogue. Funds requested from co-op: none; BASF currently funding this proposal. This proposal has an objective of identifying effective direct control measures and ecologically sensitive management systems for non-native and invasive weeds on forestry sites. No funding from the co-op would be required for this proposal, instead members of the co-op would provide study sites and serve in administrative roles. The study implementation and measurement phases would be accomplished through the use of a graduate student from Davis or some other western university. The data would be used as part of a thesis for an advanced degree in forestry, weed science, ecology, or environmental studies. Working Group conclusions: endorsed by the Working Group; recommended the proposal be presented to full membership for acceptance.

After discussion of the proposals, a short presentation about Latour State Demonstration Forest was made by Brad Dorken. Brad discussed the possibilities of research projects being located on the forest and stated that there were some dollars available to fund treatment installations.

The last item of business at the meeting was a short FYI from the group members.

Chairman Schlaefli called the meeting to a close.

--General Business Meeting 6/11/01—

The second general meeting of 2001 was held June 11th at Mt. Shasta. About 30 members and guests attended.

Working Group I chair, Tom Jopson, presented an update on the status of the Timmer/Jopson proposal. Due to some questions concerning this proposal, the Working Group scheduled a meeting for the 17th of July to discuss implementation of the proposal. Ed

Fredrickson then discussed progress on his stock type/fertilization proposal.

Working Group II chair, Brian Schlaefli, presented the proposals discussed at their March 20th meeting. Two of these proposals were recommended to the full membership for funding. Mike Newton's proposal for re-measurements of some of his older sites was approved by the co-op for 2002 funding of about $5000. The second proposal recommended by the Working Group was one that addressed the impacts of intensive forest management on wildlife populations. Ed Fredrickson was the sponser of this proposal. The full membership voted to approve the proposal and determined that the best approach to address this topic was through a presentation, by a panel of wildlife "experts", to the co-op membership at our general meeting in January 2002. The co-op manager was to follow up on this and organize the presentation.

Joe DiTomaso then presented an update on the co-op web site. Following this, Joe discussed the status of the 2000 and 2001 budget. With a surplus from the 2000 budget plus the 2001 working budget, the co-op has about $40,000 for funding proposals.

The next item on the agenda was a presentation by Dave Henneman of the Bureau of Land Management in Medford, OR and Tom Landis of the United States Forest Service in Central Point, Oregon on nursery and operational aspects of fall planting. Their presentations were a lead-in to the field trip scheduled for the 12th.

After the presentations by Dave and Tom, Jeff Anderson of Mycorrhizal Applications, Inc. in Grants Pass, OR gave an overview of mycorrhizal fungi and his company's experiences in outplanting survival and growth.

The meeting ended with a discussion concerning the field trip scheduled the next day.

The field trip sponsored by the co-op took place on Sierra Pacific Industries and Roseburg Resources lands near McCloud. Thirty-five members and guests attended. Mark Gray of SPI, Ed Fredrickson of Roseburg, and Pat Minogue of BASF conducted the discussions at the nine stops on the trip. The field trip was a subject-specific one with a theme of fall planting. All stops addressed an item of this theme. Subject matter of the stops included site preparation methods, mechanical and chemical; broadcast burning vs. no burning; VH Mulcher, spring and fall applications; stock type and planting timing trials; rehab logging; and pre-harvest site preparation. Dave Hennemen and Tom Landis contributed their experiences as they related to the operations viewed at each stop. The subject-specific field trip was well received by the co-op members and will be used for future field trips. The idea of an annual field trip was met with approval by the co-op.

--Working Group I Meeting 7/17/01 –

Working Group I met on July 17th in Mt. Shasta. Nine members were in attendance. As noted at our June 11th meeting, this meeting was designed to answer some of the questions arising from the Timmer/Jopson proposal.

Chair Tom Jopson opened the meeting with some comments on the incorporation of slow release fertilizer in the media of containerized conifer seedlings. Unusually high mortality in some seed lots during the spring 2001 planting season had prompted some concerns about this practice. Tom was to develop a list of questions about this subject and send the questions to the Working Group for comments.

Ed Fredrickson reported on a project that Simplot was promoting in which custom blends of fertilizer for California planting sites would be mixed by the company. Ed would get more specifics from Simplot at the Weed Tour. The co-op would require a scientific approach if we got involved – statistically sound design, etc.

The rest of the meeting was devoted to discussion of the Timmer/Jopson proposal. Slash treatments on the sites, ripping specifications, chemical site preparation mixes, and plot layout procedures were discussed. A lengthy discussion on the fertilization treatments that were to make up the treatments took up most of the time. Since there appeared to still be some unanswered questions about the proposal, it was decided to try to get Vic Timmer to come to California to provide some first-hand information on the proposal.

The meeting ended on this note.

AF&PA INDUSTRIAL RESEARCH FORUM
American Forestry and Paper Association
Western Research Subcommittee

The Sierra Cascade Intensive Forest Management Research Cooperative (SCIFMRC) participated in an Industrial Research Cooperative Forum held November 27-28 in Wilsonville, OR. Attending at the invitation of the sponsoring American Forestry and Paper Association (AF&PA) Western Research Subcommittee were officers Ed Fredrickson, Bob Powers, and Gary Fiddler. Organizers meant the forum to be a first step at addressing larger questions spanning traditional cooperative boundaries and at exploring avenues for integrating findings among cooperatives.

The forum opened with a review of industry's research needs for maximum fiber production and value in the west and the position of western forestry in the international market. Members perceptions on research needs were based on limited returns from membership questionnaires. Returns indicted that the highest priority research needs were in traditional fields of silviculture, such as growth and yield, soil nutrient management, and stand establishment. Other needs ranking high in priority were those affecting "license to operate," such as issues of riparian zones, chemicals, and biodiversity. The opening address concluded that productivity issues are tightly linked to environmental issues, that there was a need to understand underlying processes, that multidisciplinary research is required for many current issues, and that many important questions require long-term studies with stable funding.

Most of the forum was spent reviewing the structure, direction, progress, and constraints to progress of each of the 16 cooperatives represented. Cooperatives covered all of the Pacific Coast states, Idaho, and Montana. They centered on such themes as Genetics and Tree Improvement (6), Vegetation Management/Growth and Yield (4), Nursery Technology (1), Disease (1), Tree Nutrition (1), Hardwood Silviculture (1), Riparian Research (1), and Remote Sensing/Inventory (1). Speakers were allotted 35 minutes to tackle the structure and direction of their cooperatives. SCIFMRC is the newest research cooperative, and its scope seems broader than any of the others. Its purpose and organizational structure were described by Ed Fredrickson, and findings from its first sponsored project, the remeasurement of Balderston plantation, were presented by Bob Powers. They concluded by outlining several research opportunities fitting within the aims of SCIFMRC, but which also carry broader value to society (such as the role of managed forests in carbon sequestration). Most presentations, including ours, were followed by discussion among speakers and participants.

The afternoon of the second day was devoted to group breakout sessions meant to identify gaps between industry needs and cooperative capabilities, and to set priorities to address gaps.

Unfortunately, a major winter storm was projected for midday, along with the prospect of a closed I-5. Discretion being the better part of valor, SCIFMRC officers headed south left early. The outcome of the breakout sessions is not known at the time of this writing, but the conclusions will be published when they are available.

RESEARCH STUDIES

FURTHER ANALYSES FROM BALDERSTON PLANTATION

Robert F. Powers, Pacific Southwest Research Station, Redding, CA

The first project funded by SCIFMRC was to remeasure plots at Balderston Plantation on the Eldorado National Forest. One unusual trait of the Balderston site at 3,200 ft. near Georgetown is the occurrence of two distinctly different soils. The poorer of the two is the Mariposa soil series developed from 200 million year old marine sediments. The more productive is the Cohasset soil series developed on a volcanic mudflow occurring during the Pleistocene some 50,000 years ago.

Balderston was planted with ponderosa pine in 1967 following brushfield clearing by tractor. The experiment I began in 1976 was the first in California to test interactions between brush competition and soil fertility. Treatments were applied before the pines began their 10th growing season. They consisted of retaining or manually removing woody shrubs (manzanita) crossed with three levels of nitrogen fertilization (0, 200, or 400 lbs N per acre). Growth and nutrient changes were measured over 5 years (through plantation age 14) and findings were published. The site lay fallow until winter 1986, when treatments showing superior growth were retreated (further brush removal, fertilization, or thinning as needed). In 2000 we obtained SCIFMRC funding to remeasure the plots. That winter we reestablished plot boundaries and remeasured all trees. Twenty five-year effects of treatment and retreatment on mean stand diameters, heights, and volumes at plantation age 33 were reported in SCIFMRC Progress Report 2000.

Volume Differences. Remeasurements reported in last year's Progress Report showed that stand volumes on the Mariposa soil were 9 times greater where brush had been removed at age 9 than where it had not, and volumes were up to 14 times greater where brush control and fertilization were applied twice. Results from the Cohasset soil were proportionally more modest, although absolute growth was far greater. Standing volumes doubled over 25 years from varying combinations of fertilization, weeding, and thinning on Cohasset. But standing volumes after 25 years give us no clue as to the trend *during* the 25-year period. For insight, I analyzed height growth increment.

Defining the Trend. During remeasurements in winter 2000 we measured every 3rd to 5th tree for past heights at 5-year intervals between 1980 and 2000. From this we could estimate height growth patterns for a variety of height classes in each treatment plot. Averaging the heights of sample trees per plot gave us estimates of plot (stand) averages. We also measured heights for 1987 and 1988 (the 1st and 2nd years following retreatment). From this, heights could be reconstructed for the period covering the life of the experiment, including the period immediately after retreatment.

Procedures. We examined height growth trends for individual trees, plot means, and stand averages by treatment. Stand averages produced trends that fell into five groups of interest (Fig. 1). On the Mariposa soil, plots fertilized once in spring 1976 with 200 or 400 lbs N per acre showed slightly greater height growth than unfertilized, unweeded controls, but the difference of 2 to 3 feet seen by age 5 changed little thereafter. In contrast, plots with early brush control showed consistently greater rates of height growth, with differences widening with time. Weeded plots that were retreated with brush control and fertilization in 1986 (red and orange curves, Fig. 1) showed higher growth rates between 1987 and 2000 than those weeded and fertilized only once (blue curve, Fig. 1). However, all treatments with initial brush control responded similarly regardless of single or multiple fertilization. Mean stand heights for those treatments were twice those of controls.

Trends on Cohasset were similar to those on Mariposa. Fertilization at 200 to 400 lbs N per acre increased mean stand height by an average of 2 to 3 feet where brush was untreated (yellow and white curves). Although differences were not significant statistically, they seem to be widening. Brush control (the red curve) produced stands that averaged 10 feet (60%) taller than controls after 10 years, and this absolute difference has carried to the present.

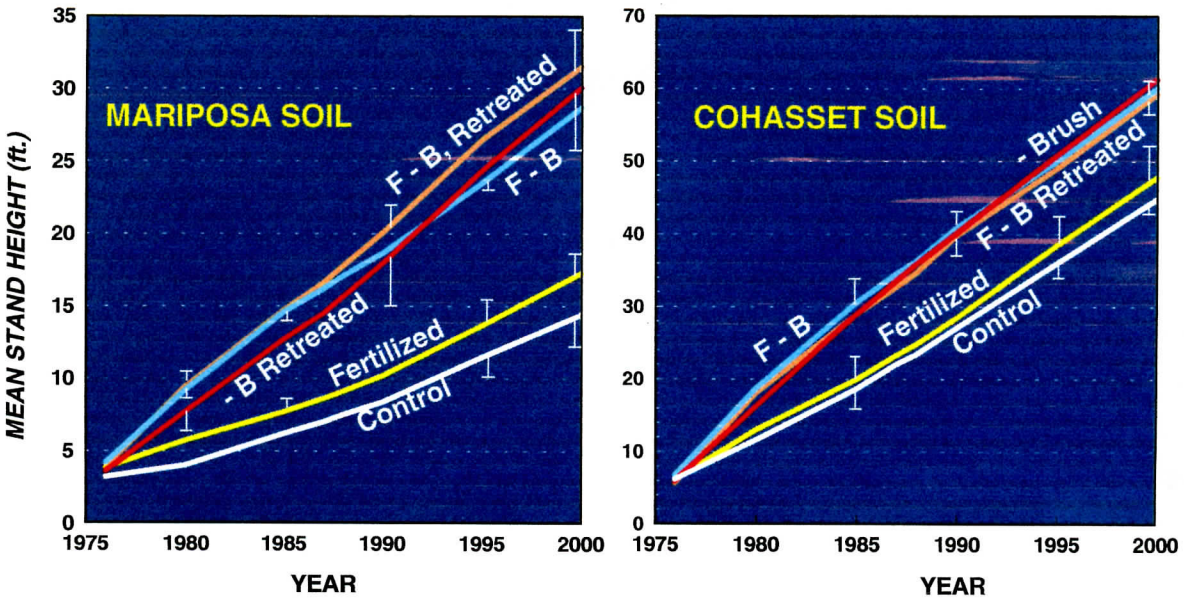


Figure 1. *Trends in mean stand height with time on the Mariposa and Cohasset soil series (F = fertilization, -B = manual removal of brush). Treatments with nearly identical trends were combined, and no distinction was seen between initial fertilization rates of 200 and 400 lbs. N per acre. Error bars indicate one standard deviation of the mean stand heights among treatments. Note that height trends on the Mariposa and Cohasset soil series are not to the same scale.*

On Cohasset, fertilization combined with brush control improved mean stand heights over brush control alone by year 5, but no differences were evident by year 15 (1990).

Conclusions. Height growth was increased by both brush control and fertilization on both soil types, but the greatest effect by far was from brush control. On the poorest site (Mariposa), retreating plots in the second decade after the initial treatments sustained relatively high rates of height growth beyond the normal point of decline. Twenty-five years after the initial treatments, stands with initial brush removal and subsequent retreatment averaged twice the height of control stands, and differences were widening. By 2000, mean differences between controls and the best treatments amounted to about 16 feet on both soils. Tree heights in control stands on Mariposa averaged only 14 feet tall after 33 years. Although trees were twice as tall as the 7-foot mean canopy height of living manzanita, brush appeared vigorous and there was no indication that it would be suppressed soon. On the better Cohasset soil, trees in control stands averaged 45 feet tall and largely had shaded out the 9-foot-tall manzanita understory. However, a dense fuel load of dead brush remained, establishing a fuel ladder between the ground and live crowns of overstory pine (see Fig. 2c in Progress Report 2000).

Survival and Growth of Three Conifer Species Following Three Types of Site Preparation and Three Levels of Subsequent Shrub Control 21 Years After Planting

W. Thomas Lanini and Steve R. Radosevich
University of California, Davis and Oregon State University

Disturbance, such as fire or logging, often lead to a forest site being occupied by commercially undesirable vegetation. On the west side of the Sierra Nevada mountains, weedy trees such as black oak (*Quercus kelloggii*), and shrubs, such as manzanita's (*Arctostaphylos sp.*) and *Ceanothus sp.*, are common invaders after disturbance, particularly on harsh (hot, dry) sites. Efforts to re-establish conifers on harsh sites have often led to failure. In order to determine the best type of site preparation for conifer planting on harsh sites, an experiment was established in the fall of 1978. The objectives of the experiment were to compare the survival and growth of transplanted white fir, sugar pine, and ponderosa pine following site preparation by the use of fire, a rotary masticator (Hydroax), and a brush rake. We also examined three levels of subsequent weed control, a single herbicide treatment at one year after planting, two yearly herbicide treatments at one and two years after planting, and no subsequent treatment after planting.

A seven-acre area on Humbug ridge road in Tahoe National Forest (Foresthill Ranger District) was used for the study. The area chosen for the study had been occupied by shrubs and weedy trees for at least 18 years since the Volcano fire, and possibly much longer. A split plot design was used with three replications. Main plots were site preparation method (150 ft. X 200 ft.), and sub-plots were number of herbicide release treatments (150 ft. X 66 ft.). Site preparation was done in September, 1978. A Hydroax cut shrubs off close to ground level, with no disturbance to the soil. A brush rake pushed all the shrubs and trees into a pile in the center of each plot, also removing large roots in the process and causing disturbance in the top 12- to 18- inches of soil. Brush piles were later burned, but no effort was made to redistribute the ashes prior to planting. The brush rake also drove over the fire plots (no blade) to crush the shrubs to aid in shrub drying and allow a hotter fire. Several weeks later, the fire plots were burned, with only a few random, charred branches still standing after the burn. Soil disturbance on the fire plot was limited to heating of the top layer and the addition of ash to the surface.

In early May 1979, 1-0 ponderosa pine, sugar pine, and white fir seedlings were transplanted into every plot. A forest service crew used a power auger to prepare each planting hole. Trees were planted in a 6 ft. X 6 ft. grid, with 11 trees per row and 24 rows in each subplot. Each 11-tree row consisted of a single species, with 8 rows of each species being randomly arranged in each sub-plot. The untreated subplot did not receive any further management.

The single release plots received a directed herbicide treatment in the spring of 1980, and the two-release plot received a directed herbicide treatment in the spring of 1980 and 1981. In September 2000, 21 years after conifer planting, conifer survival, diameter at breast height, and height were measured on each surviving tree.

Ponderosa pine survival was affected by an interaction of site preparation and the level of subsequent weed control (Figure 1). Each release treatment increased ponderosa pine survival approximately 10%. However, each site preparation method differed. Following brush raking, a single release treatment resulted in less survival than the untreated, but two-release treatments improved ponderosa pine survival about 10 % over the untreated. Ponderosa pine survival on the fire plots benefited greatly (over 25%) by a single release treatment, but no further gain occurred with two treatments. On Hydroax plots, survival increased by 15% following a single release, and by 22% when two release treatments were made. In general, the greater the level of soil disturbance, the better the ponderosa pine survival, but also the lower the response to subsequent weed controls.

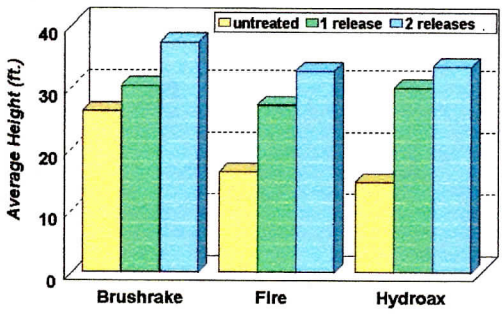


Figure 1. Ponderosa pine survival percentage relative to site preparation and the number of subsequent herbicide applications.

Ponderosa pine height was least when no weed control was used after planting (Figure 2). A large growth increase (over 10 ft. in ht.) in ponderosa pine was observed when a single herbicide treatment was used. Ponderosa pine ht was greatest when two yearly weed control treatments were used, but the increase over a single treatment was only about 5.4 ft. in height. There was no interaction between site preparation method and subsequent weed control on the height of ponderosa pine.

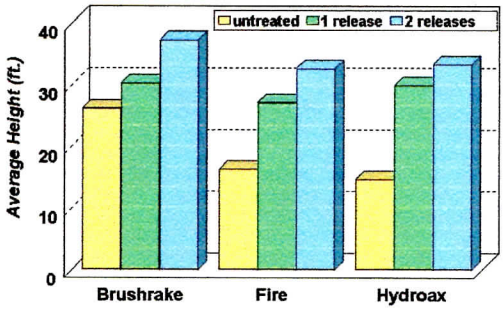


Figure 2. Average height of ponderosa pine relative to site preparation and the number of subsequent herbicide applications.

White fir survival was affected by the level of subsequent weed control following site preparation, but not by the interaction of site preparation and the level of subsequent weed control (Figure 3). The first release treatment appeared to have decreased white fir survival by over 50%, down to only 15%. Two release treatments improved white fir survival about 10% over the single release treatment, but still 9% less survived than the average survival on the untreated plots. At the 10% confidence interval, the white fir survival on the brush rake plots receiving two herbicide

treatments or untreated, was greater than survival on other plots.

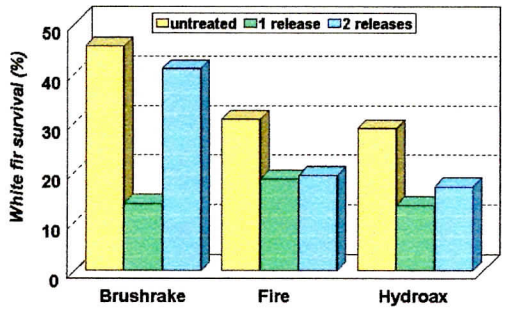


Figure 3. White fir survival percentage relative to site preparation and the number of subsequent herbicide applications.

White fir height was least when no weed control was used after planting (Figure 4). A large growth increase (almost 2 ft in ht) in white fir was observed when a single herbicide treatment was used. White fir heights were greatest when two yearly weed control treatments were used, with an increase of 4.5 ft. in height over the single treatment. There was no interaction between site preparation method and subsequent weed control on white fir.

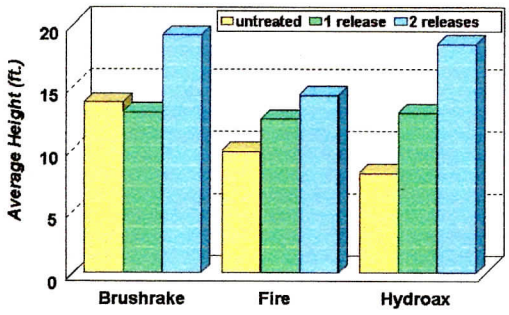


Figure 4. Average height of white fir relative to site preparation and the number of subsequent herbicide applications.

Sugar pine survival was extremely poor in all plots (Figure 5). Disease has killed most of the sugar pine found in these plots. There was better survival with two herbicide release treatments compared to the other treatments. The reduction in weeds on these plots may have reduced alternative host plants for the disease, which killed the sugar pine. There was less survival on the Hydroax plots than on the other two site prep methods. Sugar pine survival on the fire plots with two release treatments and the brush rake plots with one or two release treatments was greater than survival on other plots. Again, these plots had less competing weeds, which could have reduced the alternative host plants for the disease which killed the sugar pine.

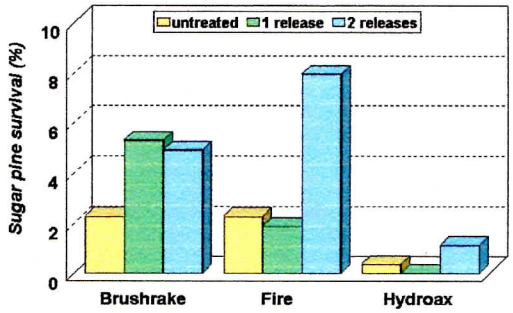


Figure 5. Sugar pine survival percentage relative to site preparation and the number of subsequent herbicide applications.

Sugar pine height data (Figure 6) should be regarded as less reliable than the other two species, due to the small number of surviving trees. Sugar pine height was greatest when two herbicide release treatments were used and also better on brush rake plots. As the trends in the sugar pine data parallel the other two conifer species, it seems that these are an accurate representation of tree growth response.

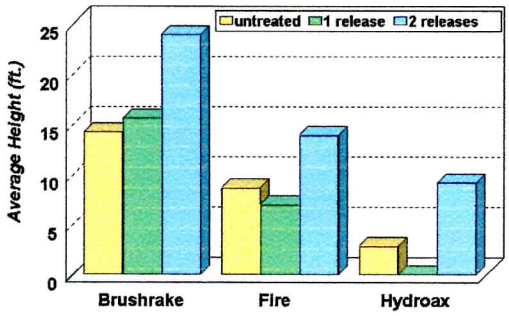


Figure 6. Average height of sugar pine relative to site preparation and the number of subsequent herbicide applications.

At 21 years after transplanting, ponderosa pine survival was about 60%, white fir about 25%, and sugar pine less than 5%, of the original number of planted trees. On many of the plots which received two herbicide treatments, conifers had achieved canopy closure and shrub growth was minimal. However, if tree survival was poor, the shrubs continued to significantly compete with the remaining conifers. It appears that the brush rake treatments reduced shrub re-growth better than fire and Hydroax treatments, which has improved survival and growth. Although there were consistent conifer growth benefits associated with herbicide treatments, there also appeared to be some conifer injury, based on the reduction in white fir survival. Where survival is high, trees are competing more with each other than other vegetation, as they are planted on a 6 ft X 6 ft grid.

These and other details of our 21-year findings can be viewed at http://wric.ucdavis.edu/sierracascade/ under the members only section. Future plans include assessing GPS coordinates, which will allow others to view this research site and know where they are located. Once those data are obtained, they will be forwarded on as an attachment to this report.

Fall Planting Literature Search and Review

Gary Fiddler, USDA Forest Service, Redding, CA

At the January 15, 2001 meeting the co-op membership decided to form a committee to proceed to the next level with the fall planting proposal. The initial efforts had concentrated on a literature search for publications relevant to the subject matter. Hundreds of publications had surfaced as a result of these searches. The next step was to go through these publications and sort out those that had application to the geographical area of interest to the co-op, southern Oregon and northern California. This has been done and references sited in these publications are being gathered and summarized. The library at the University of California at Berkeley has been the source of these latter publications. Thirty-seven publications have been summarized so far from this last search. Plans are to develop two documents on fall planting based on information from the literature searches. One will concern nursery practices, the second will cover the operational aspects of outplanting. The goal is to have these documents finished in 2002.

A secondary phase of research into the fall planting question was initiated while the literature searches were proceeding. Three subject-matter experts were contacted by John Fiske and Gary Fiddler and asked if they would be willing to contribute to our efforts in this proposal. Jim Jenkinson (retired) of the United States Forest Service Pacific Southwest Research Station in Berkeley, CA, Dave Hennemen of the Bureau of Land Management in Medford, OR, and Tom Landis of the United States Forest Service in Central Point, OR agreed to help us.

Jim was interviewed by John and Gary on February 27th, 2001. The report on the interview can be found at the end of this discussion. Following Jim's advice, Dave and Tom were contacted and reviewed Jim's comments from the interview and contributed their own observations on fall planting. These comments are a part of the report mentioned earlier. In addition, Tom and Dave agreed to be a part of our June 11th & 12th meeting in Mt. Shasta. Their participation in the formal meeting and the field trip is documented in the previous pages dealing with co-op meetings held in 2001.

The following summarizes the results of a 2/27 meeting in the Forest Service Regional Office that Gary Fiddler and John Fiske had with Jim Jenkinson, retired PSW Researcher, and subsequent comments about fall planting by Tom Landis, Forest Service State and Private Forestry National Nursery Specialist and Dave Henneman, Bureau of Land Management, Oregon, reforestation specialist.

Background.

Members of the Sierra Cascade Intensive Forest Management Research cooperative (SCIFMRC) are very interested in the fall-planting option for container stock regeneration on industry lands in Northern California and

Southwestern Oregon. Successful fall planting significantly increases management options. However, fall-planting of container or bare-root stock has failed more often than not. Reasons for failure or success have rarely been documented. At SCIFM request, Gary had done a thorough literature review, but the sparse results were insufficient for SCIFM member use. At the last SCIFM coordination meeting I agreed to set up a meeting with Jim Jenkinson to get his experiences, knowledge, and recommendations to better assess what the forestry community knows about fall planting in the geographic area of interest to SCIFM members.

Jim Jenkinson's Experience.

Jim cautioned that almost all of his fall-planting experience is with bare-root conifer stock in maritime environments, planting 2-0 Douglas-fir from Humboldt Nursery in the Coast Ranges in northern California and southwestern Oregon. Jim's results are available in a General Technical Report: Jenkinson, James L., James A. Nelson, and May E. Huddleston. 1993. *Improving Planting Stock Quality – The Humboldt Experience.* PSW-GTR-13, pp. 170-173. Jim also is generally familiar with fall planting trials of true fir (2-0 Shasta red fir) conducted by Will Ellington, Lava Nursery, Parkdale, Oregon, in the 1980's on true fir sites in the California Cascades. Consequently, Jim has some firm ideas, based on conifer seedling physiology, about the requirements for successful fall planting on both inland and maritime sites in geographic areas of interest to SCIFM members. The following section **Six Principles** summarizes those ideas.

Jim recommended that since his experience was mostly with bare-root, SCIFM should work with Dick Tinus, USFS, Southern Research Station, and Tom Landis, Forest Service State and Private Forestry Nursery Specialist, to get their container expertise.

Tom Landis' comments are included below, followed by those of Dave Henneman.

Six Principles.

Fall planting of conifer stock, whether bare-root or container, succeeds on prepared sites in northern California or southwestern Oregon sites **only if**:

1. The **nursery stock used is capable of growing roots when planted in an environment that can support root growth.** Nursery cultural practices are developed to produce planting stock with this capability.

2. After outplanting, **sufficient root growth must occur to ensure over-winter survival**, so the fall planting environment must be able to support root growth **for a minimum of approximately 2-3 weeks**. This guide reflects Will Ellington's observed minimum fall root-growth period for planted 2-0 red fir seedlings. **The minimum root-growth period may be less for container stock, since this stock can be delivered with intact root tips**, which have the capacity to elongate without delay, a critical advantage where the fall planting window is very narrow.

3. **Soil moisture required for root growth - moisture at near-field-capacity levels to planting depth, 10 to 12 inches.** A general rule of thumb is 2" of rain prior to fall plant. Adequate soil

moisture is essential for both proper planting and sufficient root growth.

4. **Soil temperatures required for sufficient root growth - soil temperature thresholds are: at least 50 degrees F for ponderosa and Jeffrey pines, 47-48 degrees F for Douglas-fir, and 43-45 degrees F for red or white fir**. All soil temperature guidelines are at **3-4" depth, measured at 8 am** … the coldest part of the 24-hour day.

5. **Following fall root-growth, snow covers the seedlings until spring, or**

6. **Where seedlings will *not be covered by snow,* soils are consistently warm enough to permit water uptake during winter. Soil temperatures that limit water uptake are about 32 degrees F (true fir) and about 35 degrees F (ponderosa and Jeffrey pines)**. In colder soils, root cell membranes become impermeable to water. Where root temperatures often drop to freezing and lower temperatures, uncovered seedlings rapidly desiccate and die.

Important things we don't know?

1. How does the minimum root-growth period needed for overwinter survival vary with species and seed source?

2. Are the fall planting windows (as specified by the above six principles) valid for other conifer species, such as sugar pine, giant sequoia, or incense-cedar?

Summary of March 5, 2001Comments
Tom Landis

1. He agrees with Jim Jenkinson's comments.

2. Low vs. high-elevation planting windows. The fall-planting window is more often limited by soil moisture at low-elevation sites, but more often by cold soil temperatures at high-elevation sites.

3. Crop scheduling. Because of the unreliability of the fall-planting window opening, nurseries and customers should agree on a schedule with an "escape clause". The seedlings should be ready for fall planting if the window opens, but seedlings can be held over and outplanted the following spring if the window does not open.

4. Stock conditioning. Shoots of seedlings grown for fall outplanting are moderately hardened, but not fully dormant or cold hardy when shipped. However, roots are still active.

5. Reliability of early stock trial results. Early results, suggesting that container stock could be outplanted almost year-round, should be lightly regarded for two reasons. First, most of the stock used in those trials were not properly conditioned (shoots not hardened). Second, most comparisons were invalid because stock of different sizes were used.

6. Strongly recommends doing some operational trials using "target seedling" guidelines.

Summary of March 5, 2001 Comments
Dave Henneman

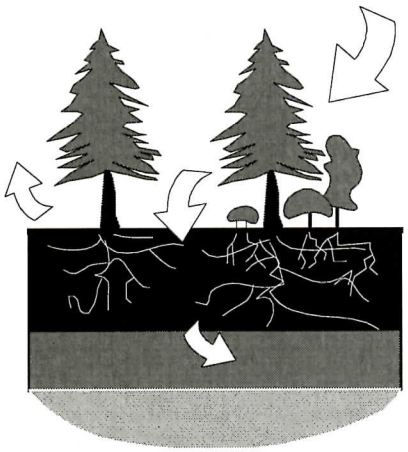
1. Extensive BLM Oregon fall planting experience indicates wider fall-planting windows for container (vs. bare-root) stock. Greater soil/root contact in container stock means better capabilities to withstand handling stresses and over-winter drought conditions.

2. Following fall planting, want 3-4 weeks when soil temperatures are at least 45 degrees F.

3. Fall vs. spring plantings. Fall plantings (container or bare-root stock) of pine and hardwoods have better average survival and growth rates, compared to spring plantings. However, experience with Douglas-fir and true fir is more variable.

4. Suggest "hot plant" strategy for fall planting. Typically 10 days maximum between nursery "lift" and planting of container stock – but maximum of only 4 days for bare-root stock. Don't cold-store lifted stock (e.g., at 34 degrees F) prior to outplant.

5. Do a realistic assessment of the risks of spring vs. fall planting. (BLM rarely considers fall-planting on most "run-of-the-mill" reforestation units.) Spring planting factors include probabilities of hot or dry conditions the following spring, access to sites, and adequacy of site prep. Other spring planting factors include histories of spring planting results on like sites, likely growth rates of probable competing plants, and the extra seedling caliper and roots if left in the nursery over-winter. Need strong reasons against spring planting to justify taking on the many significant risks of fall planting.



Effects of Intensive Forest Management on Wildlife

Ed Fredrickson, Co-op Sponsor

At the 3-20-01 meeting of Working Group II, Ed Fredrickson brought a proposal before the group for consideration as a recommendation to the full co-op. The title of the proposal was Effects of Intensive Management on Wildlife.

Quoting the proposal "we have very little information to provide the regulators and other critical parties as to what effects we are having on wildlife from intensive management activities, especially vegetation management practices. Focusing on vegetation management in plantations, the questions I would have are what are the successional trends following site prep and release operations? What species (vegetation) are coming back and at what densities? Which species are important to wildlife? What species of animals, birds, etc. are utilizing our intensively managed plantations? These are difficult questions and ones foresters hate to deal with. But the truth of the matter is, we are forced to justify our actions these days in the field and it is getting more difficult without good information."

The Working Group recommended the proposal to the full co-op membership at our June 11, 2001 meeting. After discussion among the members as how to best approach this topic, the membership agreed to take on the proposal.

The membership decided that the best approach to this subject matter was to have a panel of subject-matter experts make a presentation to the co-op membership at our January, 2002 general meeting. The theme of the presentation would be "Intensive Management Effects on Wildlife". Co-op members would be canvassed as to potential speakers for the panel. A budget of up to $1000 would be provided by the co-op for speakers' expenses.

A mailing went out July 25th to co-op members requesting candidates for the wildlife panel. After responses were received from the membership, the Directors decided on a tentative list of speakers. On October 1st, Bill Laudenslayer, Research Wildlife Ecologist of the Pacific Southwest Research Station in Fresno, agreed to serve as chair for the panel.

With Bill's input the following panel was chosen:

Steve Zack, Wildlife Conservation Society, birds.
Cajun James, Sierra Pacific Industries, tree growth and wildlife needs.
Lowell Diller, Simpson Timber, amphibians and small mammals.
Karl Miller, University of Georgia, southern examples of wildlife and intensive forestry.

The presentation by the panel will be the featured item at our January 21st meeting. Co-op member BASF, through Pat Minogue, has agreed to cover the expenses of panel member Karl Miller.

RESEARCH STUDIES

IMPLEMENTATION UPDATE

Improving Seedling Nutrition in the Nursery to Increase Seedling Performance in the Field

Victor R. Timmer and Thomas Jopson, Principal Investigators.

Objectives: Determine optimal nutrition for planting stock of Douglas-fir, white fir, and ponderosa pine to ensure high field survival and rapid early growth. Secondly, identify nursery nutritional practices to accomplish the first objective.

Seedlings grown with constant and sufficient internal nutrient concentrations achieved through exponential fertilization are free of nutrient stress. Seedlings can be produced with balanced, high reserves of nutrients superior to those possible through late-season heavy fertilization. Presumably, balanced, surplus reserves of nutrients at planting affords growth that is rapid enough to offset weed competition and soil drought. Questions to be answered are: (1) what techniques are best for western species? (2) how does nutrition favoring rapid growth affect seedling resistance /susceptibility to drought, pests, and temperature extremes?

At one or more forest nurseries, seedlings will be raised according to various nutrient regimes including conventional fertilization and exponential fertilization. Growth and nutrient status of the seedlings will be assessed at 2-week intervals during the culture period to chart the progress and adjust nutrient supply schedules. At lifting, seedlings will have nutrient contents that vary incrementally from conventional to very high values, and should identify a treatment optimal for outplanting success. Survival and growth of these seedlings will be followed for at least 5 years, at which time a firm decision can be reached on the best treatment(s) to apply to operational planting.

Status: A trial run using the fertilization rates specified in the proposal was made during 2001 at Cal Forest Nursery in Etna, CA. Three co-op members supplied seedlings for the test, Boise Cascade, Fruit Growers Supply Co., and Soper-Wheeler. Three species were grown, Douglas-fir, pondersoa pine, and white fir. Vic Timmer is scheduled to visit Cal Forest and other nurseries in January 2002 to help determine the best way to proceed.

Improving the Establishment and Growth of Douglas-fir and White Fir On Dry Sites Through Fertilization and Stock Type

Ed Fredrickson, Principal Investigator.

Objectives: (1) To determine the partial contributions of stock size and fertilization to Douglas-fir and white fir survival, growth and total above ground biomass on dry sites in the interior Sierra Cascade region of northern California and southwest Oregon under vegetation-free conditions. (2) To determine the partial contributions of stock size and fertilization on initial root growth and total root volume (dry weights) after the first growing season in the field. (3) To determine differences attributable to site based on low and high precipitation zones.

Douglas-fir and white fir seedlings in four stock sizes will be subjected to two fertilization regimes and out-planted on three sites. Treatments will be replicated four times per site. Twenty-five trees will be planted per replication. Assume 3 years complete vegetation control for all treatments. Root volume measure-ments will be made at time of lifting and at the end of the first growing season in the field. Trees will be measured (ground-line diameter, height, survival) when planted and at years 1, 2, 3, 4, and 5. Foliar nutrient samples and dry weights per 100 needles will be collected and analyzed at years 1, 3, and 5.

Status: Seedlings (Douglas-fir, ponder-osa pine, and white fir) are being grown at the following nurseries: Pelton Reforestation, Cal Forest Nurseries, PRT Group, Fowler Nursery, and IFA Nurseries, for out-planting in spring, 2003 on co-op members' land (Roseburg Forest Products, Sierra Pacific Industries, and Boise Cascade.) Plot layout is tentatively scheduled for fall, 2002.

Long-Term Competition Threshold Studies in Southwestern Oregon

Mike Newton, Principal Investigator; Ed Fredrickson, Co-op Sponsor

Objective: Determine the long-term (20 year) effects of various levels of shrub and herbaceous competition on planted ponderosa pine and Douglas-fir on four contrasting study sites.

In the early 1980s, Mike Newton established a series of studies in southwestern Oregon designed to look at how the growth of planted conifers was affected when the conifers were grown with various levels of competition. Four separate studies are still intact and have been measured regularly, but they have not been evaluated since 1994. The Applegate Study consists of ponderosa pine and Douglas-fir growing in various levels of manzanita competition. The study looks at no competition, 25%, 50%, 75%, and full competition from the manzanita. The Shoestring Study looks at Douglas-fir growth at four levels of competition from pacific madrone (none, low, medium, and high). The Fir Point and Squaw Studies are similar in design but focus on Douglas-fir growth with varying densities of tanoak cover. Three of the studies also look at the interactions with herbaceous cover (with and without).

These studies present an excellent opportunity to obtain growth and yield information based on various levels of competition which could be used to either validate, or make projections using the growth simulators SYSTUM-1 or its later variant, CONIFERS. These data would allow us both to improve these young stand simulators and to make projections as to what these treatments might produce farther down the line.

Proposal: Re-measure all trees in those study sites which have not been compromised by subsequent management activities. Collect the type of measurements needed in order to make long-term projections using SYSTEM-1 or CONIFER. Martin Ritchie of the Pacific Southwest Research Station at Redding will work with Mike as to what measurements need to be made.

Provided that sufficient data were collected to either validate, or make projections using the growth simulators, the co-op agreed to funding at a level of about $5000 for 2002. Some of the study sites may have been compromised. In one case, some of the numbered trees and tanoak have been cut by the landowner. In another, some of the plots have been brushed recently. Thus, some of the original group of study sites may have been lost. Mike will determine which of the study sites remain viable and report to the co-op.

ANNUAL MEETING 2002

Most of you will attend the Forest Vegetation Management Conference January 22-24, 2002 at the Holiday Inn in Redding. To take advantage of this conference, **the SCIFMR Co-op has scheduled a meeting for Monday, January 21st.** This will be a business meeting plus a panel of experts discussing the impacts of intensive forest management on wildlife.

The panel discussion on wildlife is a response to one of the proposals that was presented at our June 11, 2001 meeting in Mt. Shasta. The original proposal was first presented to Working Group II in March, 2001 and was intended to determine how to help answer the questions concerning impacts of cultural treatments on wildlife populations. The panel will consist of five speakers from private industry, the federal government, University of Georgia, and the Wildlife Conservation Society. Bill Laudenslayer, Research Wildlife Ecologist of the Pacific Southwest Research Station will chair the panel. Panel members are expecting a lively exchange with Co-op members.

Prior to the panel discussion, we will hold a business meeting to cover the following:

Budget update
Update on funded research proposals
Presentation of new proposals
Updates from the working groups
Summary of AF & PA Industrial Research Cooperative Forum meeting
New business

Our co-op has been in operation for almost two years now. This meeting would be a good opportunity to discuss ideas on how to improve our organization. So do some thinking on this and bring your ideas to the January meeting.

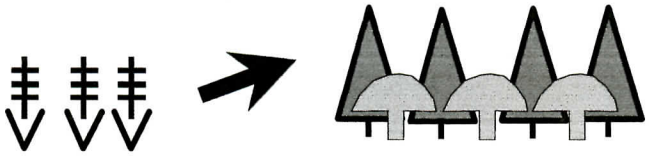
In order to allow plenty of time for the panel discussion, **the business meeting will start at 10:00 and run through the lunch hour if needed.** The panel will start at 1:00, so it might be wise to bring a "brown bag" lunch to the business meeting as there might not be time to get something to eat before the panel discussion starts. Coffee will be provided.

A conference room has been reserved at the Shasta Trinity National Forest office in Redding. The address is 2400 Washington Avenue. Our meeting will be held on the first floor in the south building. Ample parking is adjacent to the building. Entrance to the conference room is through the door located in the breeze-way between the north and south buildings. Again, the business meeting starts at 10:00 followed by the wildlife discussion at 1:00.

If you have any items to add to the agenda, let me know and they will be included.

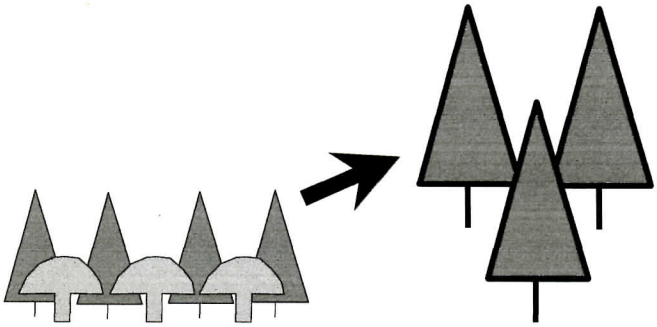
Gary Fiddler, Manager
SCIFMR Cooperative
(530-242-2450)

WORKING GROUP MEMBERSHIP



'Seed to Establishment'

Working Group I
Tom Jopson, Chair
John Fiske
Jerry Gallagher
Stuart Gray
Ron Hague
Tom Harvie
Glenn Novak
George Severson
Tom Young



'Out-planting Through Precommercial Thinning'

Working Group II
Brian Schlaefli, Chair
John Fiske
Ed Fredrickson
Stuart Gray
Scott Johnson
Danielle Lindler
Tim Livingston
Pat Minogue
Bob Powers