Sierra-Cascade Intensive Forest Management Research Cooperative

Series Report No. 3

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ANNUAL REPORT 2002

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The Sierra Cascade Intensive Forest Management Research Cooperative has completed its third year as an organization. The year 2002 was another productive one for the Co-op. Both Working Groups held meetings, the Co-op hosted its second subject-specific field trip, new proposals were presented to the membership, three funded proposals were installed, and new members were added to our roles.

Much was accomplished during 2002. Two of the studies the Co-op funded in 2000 (Site Preparation/Lanini and Exponential Fertilization/Timmer-Jopson) present new results in this issue. One of the studies funded in 2001 (Intensive Forestry and Wildlife Effects/Fredrickson) reports on its implementation and results, and a new study funded in 2002 (Eucosma Pheromone/Rappaport-Webster) reports first year results. Three other funded proposals (Competing Vegetation/Newton, Fertilization and Stock Type/Fredrickson, and Slow Release Fertilization/Fredrickson) are progressing on schedule and will have results to report at this time next year. All of these studies have been designed to answer questions about subjects that influence Co-op members' forestry operations.

The Co-op hosted its second annual field trip in September. It was well attended and those present benefited from a well-organized trip. This trip had a theme of "plantation fertilization and release" and the stops on the field trip addressed these topics. The trip featured stops on Boise Cascade and Indian Hill, LLC holdings near Medford, Oregon. Co-op members Brian Schlaefli and Bruno Meyer were industry contacts. A more detailed report on the field trip can be found later on in this report.

Membership in our cooperative increased during 2002. The current membership of 23 consists of a mix of land-owners, forestry-related industries, and federal/state agencies. Several more potential new members have shown interest in joining the Co-op.

Like the current year, 2003 looks to be another active one for our Co-op. Our annual meeting is scheduled for January 13, 2003 in Redding. At least one new proposal (Competitive and Ecological Effects of Understory Vegetation/Powers) will be presented at this meeting to the membership for approval and acceptance by the Co-op. Accomplishments of on-going studies will be reported. The two Working Groups will report on their 2002 meetings. The location and theme for our third annual field trip will be another subject on the agenda. Two previously-funded proposals are scheduled for implementation during 2003, and two others will receive second-year remeasurements. A new budget/accounting agreement will be initiated with the California Forestry Association. This arrangement should simplify our bookkeeping system.

All things considered, the Sierra Cascade Intensive Forest Management Research Cooperative is off to a good start. The members' willingness to share ideas is making this possible. Hopefully it is functioning as the membership envisioned it would at its inception.

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

Associate Corporate Membership:

BASF
Cal Forest Nurseries
Dupont
IFA Nurseries
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 23 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 2002

General Business Meeting 1/15/02

The first Co-op meeting in 2002 was held in Redding on January 15th. This was our annual business meeting and was open to members and potential members. Thirty-seven people attended.

The first item of business was an update on the status of the 2001 Co-op budget by Joe DiTomaso. The budget showed a surplus of $43,000 going into the new year after all obligations were met. Joe then encouraged the membership to make use of the web site for sharing information with Co-op members. Ed Fredrickson asked for a show of hands from those who had used the web site. Very few hands were raised. The point was made that there needs to be more use of the site.

Working Group I Chair Tom Jopson scheduled a meeting for his group for February 19th in Mt. Shasta. Tom then reported on the progress of the Timmer/Jopson proposal (Exponential Fertilization). In January Vic Timmer had visited the nursery where the seedlings were being raised. The exponentially applied fertilization treatments for this study failed in the nursery and will not be outplanted as part of the study. Only the conventionally applied treatments (50, 100, 200, and 300ppm) will be lifted and outplanted in the spring of 2002 (this decision was altered later – see meeting notes for February 19th meeting). The membership decided to send foliar samples from the conventionally fertilized seedlings to a private lab for analysis to determine if there were real differences between the different rates. The Co-op members providing sites for this study are Boise Cascade, Fruit Growers Supply, and Soper-Wheeler. Tom expressed concern that we shouldn't be researching nursery practices, but should set seedling nutrient requirements and let nurseries determine how to meet these needs.

Ed Fredrickson then reported on the status of the Stock Type/ Fertilization proposal. The Co-op members providing sites for this study are Boise Cascade, Sierra Pacific Industries, and Roseburg Resources. Seedlings for this study are being raised by Co-op members Cal Forest Nurseries, IFA Nurseries, Pelton Reforestation, and PRT. Additional seedlings are being raised at Fowler Nursery. The work on this study is right on schedule and outplanting is scheduled for next spring.

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Working Group II Chair Brian Schlaefli scheduled a meeting for his group for February 20th in Mt. Shasta. Brian updated three of the funded proposals that are under his group. The three were: Balderston/Powers, Wildlife-Intensive Forest Management/Fredrickson, and Competing Vegetation/Newton. Tom Lanini made a presentation on results of his proposal (Site Preparation) that received Co-op funding. After Tom's presentation, the membership voted to provide another $5,000 to Tom in order that he could get his data analyzed to the extent that it could be submitted to a refereed journal.

The next item of business was the presentation of new proposals to the Co-op members for possible funding. Jeff Webster of Roseburg Resources presented a proposal entitled "Evaluation of New Formulation for Mating Disruption of the Western Pine Shoot Borer" (see detailed version of this proposal later on in this report). Since this proposal would be implemented in spring 2002 if funding was available, the membership voted to do a quick turn around review. An email survey would then be conducted to determine if the voting membership was in favor of funding the proposal.

Ed Fredrickson then presented a new proposal for consideration of funding. This new proposal was titled "Evaluating the Effect of Slow Release Fertilizers Incorporated into Containerized Seedlings in Mediterranean Climates" (see detailed version of this proposal later on in this report). The members decided that Ed should present his proposal to Working Group I at their meeting in February. This group would decide on whether to recommend the proposal for funding by the full membership.

David Jackson of Simplot presented a proposal on seedling fertilization trials in southern Oregon and northern California. The membership decided that Ed Fredrickson would get a write-up on this study summarizing it for the Co-op. The main need from the Co-op was funding for the data analysis. The request for this funding was then to be sent out to the voting members as a proposal.

The morning session of the general meeting was closed with a short discussion on possible sites and themes for the 2002 field trip.

The afternoon session consisted of presentations on the subject of wildlife and intensive forest management by a panel of speakers from private industry, the University of Georgia, the Wildlife Conservation Society, and the U.S. Forest Service. This panel/presentations were arranged to help answer the questions raised in Ed Fredrickson's proposal "Effects of Intensive Forest Management on Wildlife".

The panel consisted of Moderator Bill Laudenslayer, U.S. Forest Service; Steve Zack, Wildlife Conservation Society; Lowell Diller, Simpson Timber Co.; Cajun James, Sierra Pacific Industries; and Karl Miller, University of Georgia. Each panel member made a short presentation and then the panel took questions from the Co-op members. After this question-answer period, Karl Miller reported results of some of his studies documented in the publication "Wildlife in Managed Forests: The Evolution of Research in the South".

The meeting ended after this presentation.

Working Group I Meeting 2/19/02

In attendance:
Tom Jopson, Chair, Cal Forest Nurseries
Mark Gray, Sierra Pacific Industries
Ron Hague, Soper-Wheeler
Tom Young, Fruit Growers Supply
John Fiske, US Forest Service
Jerry Gallagher, Wilbur-Ellis Company
Ed Fredrickson, Roseburg Resources
Don Pierce, W. M. Beaty & Associates
Bob Powers, US Forest Service, PSW
Brad Dorken, CDF

David Lloyd, Pelton Reforestation Ltd.
Danielle Linder, UAP
Lewis Howe, Silver Butte Timber Co.
Tom Harvie, PRT
Gary Fiddler, US Forest Service, PSW

Stock Type/Fertilization Proposal
The meeting opened with a discussion led by Ed Fredrickson on the status of the stock type/fertilization proposal. The landowners involved in this proposal are Boise Cascade, Roseburg, and Sierra Pacific Industries.

Double ripping has already been done on the Boise and Roseburg sites; SPI may have to find another site, which will need to be double ripped.

All the transplants sent to the Fowler Nursery look good. Ed indicated there is a normal loss of about 20% of the Douglas-fir sent to Fowler. Planting is scheduled for spring 2003.

The discussion then moved to how much fertilizer to apply and how best to apply it to the bare root treatments. The fertilizer of choice is Simplot's 16-5-11. The proposal calls for rates of ½ gram for the styro-8s and 1 gram for the styro-20s. The fertilizer for the bare root treatments will be a one-time event done at time of planting (see discussion of this topic at Working Group II meeting). Bob Powers will suggest how much to apply.

A question was brought before the group about the spacing of the planted seedlings. The original proposal called for 5' x 5' spacing. The group noted that 10' x 10' is operational and this wider spacing would allow for the effects of the treatments to be followed for a longer time. Bob Powers favored the original spacing and suggested that if the Co-op wants to follow the treatments for a longer time frame than the original study was designed to cover, it should design a long-term study to follow the treatment effects for a longer time and not complicate this study by piggybacking on it. The group did not make a final decision on this subject (see discussion of this topic at Working Group II meeting).

Timmer /Jopson Proposal
Tom Jopson updated the group on the status of this proposal. Companies involved in this study are Fruit Growers, Boise Cascade, and Soper-Wheeler. Problems with pH complicated the study. The constant-rate fertilized seedlings outgrew the exponentially fertilized ones. Mortality was excessive with the latter application technique.

Ed discussed the January visit of Vic Timmer. He visited Cal Forest Nursery and a new IFA nursery being constructed at Klamath Falls, OR.

The foliar analysis done at Davis showed a range of nitrogen levels in the seedlings, but only in the constant-feed application, not in the exponentially fertilized application. Timmer believed that nutrient concentrations were too low in the early stages for the exponential treatments and that seedlings were stunted and not able to catch up to those in the constant-feed. Later, foliar samples (whole top) were sent to Scotts for analysis. Results from this test showed minor, but consistent differences in nitrogen levels among the various treatments. Bob discussed these results from the Scotts' lab. As expected, whole seedling nitrogen concentrations generally increased in proportion to N

concentrations in the constant-feed solution. Somewhat surprisingly, phosphorus also increased for one species (Douglas-fir).

The group decided to out-plant only the two extreme treatments: the 50 ppm and 300 ppm rates. A foliar sample of needles only will be made at time of lifting and sent to Scotts, along with some test samples, for analysis. This will serve as baseline data. All three species will be out-planted if sufficient numbers of seedlings are available. Plot layout will begin as soon as the sites are open; planting will be done in a timely fashion. Plot size will be 70' x 70' and will include one row of buffer trees on all sides. Each plot will contain 25 measure trees. The sites on Fruit Growers and Boise Cascade have been ripped; the site on Soper-Wheeler has not. To overcome this difference, the seedlings for the Soper-Wheeler site will be auger planted. Vegetation control will be applied chemically to all plots. There will be five replications where seedling numbers allow (this was changed to six replications during Working Group II meeting). Spacing will be 10' x 10'. Foliar analysis will be done at the end of the first growing season. Measurements will be for height and caliper.

Tom Jopson led a discussion on the feasibility of a study like this. He sees a nursery having a problem in trying to repeat a study that was developed at another nursery. He feels that results will be hard to duplicate because of operational differences in the two nurseries. A study on a nursery-by-nursery basis is needed. The Co-op shouldn't fund the development of nursery processes, but should decide the results wanted (seedling nutrient specifications) and let the nursery develop methods to supply seedlings that will meet these specifications. Tom gave his ideas on what is the appropriate level of various nutrients in seedlings ready for out-planting. He said on an operational basis, the landowners should set this nutrient level for seedlings and then the nurseries will try to meet these specifications.

David Lloyd discussed nutrient loading practices in Canada and a history of this process. He agreed that land managers should set nutrient levels they want in their seedlings, but he says there are still lots of questions concerning what these levels are and how to produce seedlings with the correct levels of nutrients.

Tom Harvie stated that in Canada, nutrient-loading was used only in Ontario. He is concerned with land managers setting nutrient levels for their seedlings. Tom says nutrient-loading is a tricky procedure and there are still a lot of concerns. Cold storage could increase some of these concerns.

Tom Jopson also expressed concerns about cold storage regimes as did other members of the Working Group. They decided to have a literature search made for information on this topic. Some points to research included cold storage, freezing/thawing procedures, storage temperature, etc. Members of the Co-op who manage nurseries were asked to share their storage regimes with the membership.

This discussion ended on the note that it was unknown by members present whether Timmer's results had ever been duplicated. The general opinion

expressed by group members was to recommend that the Co-op back off on exponential fertilization trials, at least for the time being.

Evaluating the Effect of Slow Release Fertilizers Incorporated into Containerized Seedlings in Mediterranean Climates

This was a new proposal presented to the Working Group by partial contributions of fertilizer type and rate to seedling survival and growth for Douglas-fir and ponderosa pine. A second objective was to determine the influence of site quality and precipitation on seedling response to incorporated slow release fertilization.

Ed discussed the history of slow release fertilizers on the west coast and some of the early results. Early results from studies in Oregon were encouraging and showed strong potential for volume increases at the early stages of seedling growth. Timber companies began to experiment with this process in northern California and southwestern Oregon. Initial results were promising, but as the procedures were tried operationally, significant problems with survival and growth were encountered with the fertilizer type and rates used from the Oregon data. These results led to this proposal for addressing the Co-op members' area of concern.

The study's experimental design, treatments, and measurements to be taken were then presented to the group. The group then commented on the new proposal.

Tom Jopson said that slow release fertilizer comes in types that either are particularly sensitive to temperature, moisture, or both. Thus, depending on type and site climatic conditions, a considerable amount of the fertilizer could still be in the soil after a year. He stated that there are still a lot of questions about slow release fertilizers including differences in the amounts of fertilizer that actually get into the fertilizer pellets.

Tom Young stated that there is a real need to monitor the atmosphere and soil conditions. A discussion on what measurements need to be taken on all Co-op projects followed. Bob Powers will get a list of monitoring equipment the Co-op should get and present this to the membership.

Tom Jopson suggested one stock size and commented that he felt the proposed rates were too low. He felt that a lot of seedling mortality from slow release fertilizer that shows up after outplanting was caused in the nursery. Nursery issues need to be ironed out prior to trying outplanting studies.

Comments from the group:
Lodgepole pine doesn't seem to respond to slow release fertilizer.
Fall planting seems to utilize slow release fertilizer better than spring planting.
Longest running slow release study is about 4 years.
After initial increase from slow release fertilizer, Doug-fir growth continues to increase over nonfertilized seedlings; after initial increase, ponderosa pine growth parallels unfertilized growth. Therefore with Doug-fir, bigger stock at time of planting = keeps getting bigger compared to unfertilized stock; with white fir and ponderosa pine, bigger stock at time of planting does not mean

bigger stock than unfertilized stock later on.

The discussion ended on this proposal with Ed going to rewrite it, incorporating the group's suggestions, and present it to the full membership for consideration of funding.

Simplot Study
The last item brought before Working Group I was the status of the Simplot proposal. Ed gave an update on this study. Seems that specifications of how the study is to be implemented and who is to do the work change daily. The latest proposal from Simplot has co-op members doing most or all the field work and PSW doing all the statistical analysis. The custom-blended site-specific fertilizers for each site promised by the company have turned into the same blend for all sites. Ed has lost interest in a large-scale formal test. He sent Simplot a letter suggesting a small-scale pilot program and if this shows real results, Simplot could bring a new proposal to the Co-op.

Working Group II Meeting 2/20/02

In attendance:
Brian Schlaefli, Chair, Boise Cascade
Bill Libby, UC Berkeley
Tom Young, Fruit Growers Supply
Bob Powers, US Forest Service, PSW
Ed Fredrickson, Roseburg Resources
Bruno Meyer, Indian Hill, LLC.
Lewis Howe, Silver Butte Timber Co.
David Lloyd, Pelton Reforestation Ltd.
Jerry Gallagher, Wilbur-Ellis Co.
Don Pierce, W. M. Beaty & Associates
Bob Rynearson, W. M. Beaty & Associates
Scott Johnson, Wilbur-Ellis Co.
John Fiske, US Forest Service
Mark Gray, Sierra Pacific Industries
Tim Livingston, Sierra Pacific Industries
Glenn Lunak, Sierra Pacific Industries
Pat Minogue, BASF
Gary Fiddler, US Forest Service, PSW

Chair Schlaefli opened the meeting with an introduction of those present. An agenda was distributed and the schedule for the day discussed. The group voted to retain Brian as the chair for another "term".

The members who had attended the Working Group I meeting the previous day updated this group on what had been discussed (a more detailed discussion of these topics can be found in the meeting notes for Working Group I):

Timmer/Jopson Proposal
Brian and Ed led a discussion on how this proposal could dovetail into Working Group II work, ie. a new proposal that Ed was going to bring before the group later in the day. This new proposal concerned the development of growth and yield curves that reflect intensive forest management (see discussion later on in minutes). A big need for growth models is data on how trees grow from year 1 through the first 20 years.

Lewis Howe suggested the working group come up with what kind of plot design would best meet their needs and Working Group I could help meet this need when the treatments from the Timmer/Jopson study (50 ppm and 300 ppm) are out-planted. In other words, it would be more efficient if seedlings planted for Working Group I studies could dovetail with studies planned by Working Group II.

The group then discussed what plot design might best serve the needs of both working groups. Six replications of each treatment will be out-planted if there are sufficient seedlings available (the seedlings had not yet been lifted). Spacing will be 10' x 10' with each plot having 25 measure trees surrounded by a row of buffer trees. This gives us enough replication to detect meaningful differences between two nutrient levels in Group I seedlings (possibly a short-lived effect), and also provide larger blocks of seedlings for future Group II projects. Based on current information, Fruit Growers and Soper-Wheeler would plant 3 species and Boise Cascade two (lifting of the seedlings later in the week reduced the number for Boise to one species). Seedling protection will be netting applied at time of planting. Mark Gray stressed that the netting must be maintained in order to be effective.

Stock Type/Fertilization Proposal
The group had a discussion, similar to the one that Working Group I had the day before, concerning the "dangers" of fertilizing bare root seedlings with controlled release fertilizer. The low amounts being applied in this study seemed to lessen the danger.

Brian suggested putting in preliminary, small-plot studies this planting season trying different fertilizer products and application rates. This would help us to see what kind of problems might develop before we decide on the final rates for this proposal. The only "measurement" on these case studies would be seedling mortality. The group felt this was a good idea and a message will be sent to the co-op membership requesting participation in the case studies. Only one fertilizer formulation will be used (16-5-11) and this will be applied to bare root seedlings. The group agreed on three rates: 1 gram, 2 grams, and 4 grams.

The group recommended that the spacing on this proposal also be increased to 10' x 10'. Planting is planned for spring 2003.

Ed stated that the total costs for fertilizing at time of planting is about $25/acre.

Evaluating the Effect of Slow Release Fertilizers Incorporated into Containerized Seedlings in Mediterranean Climates
As decided at the meeting the previous day, Ed explained that he was going to incorporate the comments from Working Group I into the proposal and submit the revised one to the full membership for approval. At this time Working Group II had some suggestions for the proposal.

Bob Powers discussed how best to take the measurements needed for the study. Precipitation can be collected with funnels, soil temperatures with Hobos. There is a need for measures of water availability. He said this is hard to measure and that he would look into instruments to do this.

Soil pits are needed on the various sites involved in the proposal. Costs to install these pits will be worked up utilizing figures from an existing Forest Service contract and presented to the membership.

The topic of storage methods and freezing/thawing regimes was discussed by the group. They were informed that a literature search on the subject had been

proposed by Working Group I and would be started as soon as possible.

Simplot Proposal
Ed informed the group that David Jackson from Simplot would probably be submitting a new proposal to Working Group I. Hopefully this new proposal would consider the concerns raised by that group.

As with Working Group I, this group seemed to lack interest in this proposal as it stands. A possibility might be to put before the full membership the idea of the Co-op funding the analysis of the data, but not get involved in study installation, data collection, etc. One member questioned as to whether the Co-op should sponsor a commercial product development study.

Brian suggested that Working Group II recommend dropping this proposal.

Giant Sequoia Proposal
Bill Libby, representing U. C. Forest Products Lab, presented a proposal on young-growth giant sequoia to the group. The original funds for the work included in this proposal were to be generated from logging receipts collected at Jackson State Forest. Due to appeals on logging at the state forest, these funds are no longer available. Bill expanded on the handout for the benefit of the working group. Bill is requesting about $20,000 from the Co-op. The proposal was then opened for discussion.

The first item of discussion concerned the marketing of giant sequoia. It has been marketed with white fir or incense cedar or as a stand-alone product. Bill indicated success of the marketing effort depends on the inventiveness of the person trying to sell the product. Some trials have had complete success with others having no success at all.

Giant sequoias like the same environments as sugar pine. Sequoia will not tolerate a lot of the herbicides. There seems to be little generic differences in growth characteristics between trees growing on the best sites and those growing on poorer sites. It is a noninvasive species. A comment was made about the benefit of mixed plantings as far as growth, and giant sequoia could be a part of these mixed conifer plantations. Bob Powers brought up the possibility of planting sequoia with other conifers and then harvesting the sequoias at an early age for Christmas trees. This harvest would function as a precommercial thinning at the same time.

A question was raised as to this proposal being within the scope of the Co-op. Comments were as follows:
Scott Johnson mentioned that the normal growing area for sequoia was found on only two of the Co-op members' lands – Sierra Pacific Industries and Soper-Wheeler.
Glenn Lunak stated that SPI is doing some work with sequoia. They are planting it in place of sugar pine where blister rust is a problem.
Lewis Howe commented that the Co-op's scope included research work that lasted until trees reached about 20 years of age. He expressed a concern about limited funds at the Co-op's disposal and how these funds are being spent. We need to know how this proposal would rank with other Co-op projects.
Mark Gray stated that the proposal would help determine if sequoia was worth milling.

Tim Livingston said the proposal needs more discussion and also raised a concern about how much the Co-op could fund.
Bob Rynearson suggested scoping the full membership's interest in the proposal.
Tom Young said Fruit Growers is undecided about backing the proposal.
John Fiske said the Co-op could take on the proposal as a special case but might have to expand the charter to do so.
Ed Fredrickson stated that the Co-op's objectives must be maintained and this proposal was probably outside our objectives.

Tim Livingston made a motion that was seconded that all Co-op members go back to their organization or company and see if there is support for reviewing this as a proposal for the Co-op to even consider funding. A mailing to this effect is to be sent out to all members with a quick response time requirement. (This was done 2/26/02 with a response due in two weeks).

PSW Budget 2003
At Brian's request, Bob Powers presented the President's Forest Service budget for fiscal year 2003 and the actions proposed by PSW to adhere to this budget. The proposed budget would result is some drastic cuts in PSW staffing and operations. Two Labs, Fresno and Redding, would be closed and other programs would take hits in funding and personnel. Science Team One from the Redding Lab would be moved to Davis. Impacts on the Co-op would result from Powers and Fiddler no longer being close to work sites in northern California and southern Oregon. Clerical support provided by the Redding Lab would no longer be available.

Brian and Ed then led a discussion on what action the Co-op could take if this situation becomes reality. Concern was voiced on the loss of long-term studies and statistical services that the Redding Lab now provides.

Co-op members can respond as individual citizens, professional foresters, and employees of forestry-related companies. Brian and Ed will summarize what Co-op members can do to respond to this budget situation. A motion was made and seconded for the Co-op to draft a resolution supporting the Redding Lab remaining in place. Ed will handle the writing of this resolution.

Eucosma Proposal
Mark Gray and Bob Rynearson updated the status of this proposal as far as sites selected and plan of operation. Spraying will be done before the central measurement plots are laid out. Sites have been selected and GPS'd on SPI and W. M. Beaty lands so far. There was discussion from the group about including study sites in the Fountain Fire (Roseburg lands) as the pest has been detected there.

The group then discussed the measurements that should be taken for this study. There will be about 1000 trees to measure in the study as a whole. Trees are about 12 feet tall in the plantations. Height and DBH measurements plus pest conditions will need to be recorded for each tree prior to treatment and then yearly after that for the life of the study. Original thoughts were for the landowners to take the preliminary measurements and the

investigators would do the follow-up measurements.

The discussion then moved to the amount of funds that the Co-op had allocated to this proposal. The original proposal had requested $5000 from the Co-op with the assumption that the participating Co-op members would do the measurements. A follow-up proposal had an option in which the investigators were responsible for the measurements. This option would require $7500 from the Co-op. The vote that was approved by the Co-op membership was for $5000. After discussion by the working group on the cost of measurements, a motion was made to resubmit the proposal for the $7500 amount. The motion was seconded and passed. As there were enough voting members present at the working group meeting to represent the needed majority to pass a motion, a vote was taken. This vote passed and the amount of $7500 was approved for this proposal. Those members who had voted on the original proposal and were not at the working group meeting were notified of the new vote and asked to approve this new vote (this was done and PRT, Cal Forest, and Soper-Wheeler agreed with the new vote).

Very few members responded to the original request for approval of this proposal. The working group discussed the situation of votes not being cast – were these votes "no" votes? The decision was that from now on, an un-submitted vote is a "no" vote.

Bob Powers asked the three landowners involved to consider overlaying a pruning study on these plots. He has money from a grant to cover this extra work. Treatments would be: do nothing; prune; and prune with fertilization. The group decided to include this suggestion in the proposal.

Newton Proposal
Ed reviewed the status of this proposal. Mike is remeasuring the plots this month (February). One of the areas has had so much additional work done in it by the landowner that the integrity of the study has been compromised. This site, Squaw, will have to be thrown out; the other three sites (Applegate, Fir Point, and Shoestring) are still valid study sites. The Co-op approved $5000 for the remeasurement of these sites.

Silvicultural Challenges in 2002
Brian then asked the working group members to list their biggest silvicultural challenge for this year. The following concerns were voiced:

The need for regeneration tables for the best intensive silviculture – Brian.

Cost effective weed control, especially for tan oak – Bruno.

Economic justification for weed control – Pat.

Cumulative watershed effects – Scott.

Clean vs. dirty site preparation – Tom.

Models for growth and costs to justify silvicultural practices – Bob Rynearson.

Reduced capacity for supplying improved seed – Glenn.

The need to incorporate improved seed and disease-resistant seed into Co-op work – Ed.

Vegetation control in mixed species plantations – Tim.

Growth of mixed species stands/plantations – Lewis.

How late is too late to interplant? Is it species dependent? – John.

Soil fertility, especially micronutrients – Bruno.

Quantify edge effect/shade on plantations – Tom.

Intensive forestry effects on wildlife; riparian management/width; recruitment of LWM – Bob Powers.

Effects of no shade, dead shade, and live shade on tree performance – Lewis, Tim.

Clone bank management and protection – Glenn.

Seedling storage including freezer storage, cold storage, and thawing regimes – Bob Rynearson.

Planted forest values including productivity/acre and carbon storage (below ground C sinks) – Bob Powers.

Biological limit of productivity, especially with Doug-fir -Bob Powers.

Brian suggested using this list to generate new proposals. There is a need to make sure all Co-op proposals can be bridged from Working Group I proposals to Working Group II objectives.

Pat felt a working plan should be submitted with each new proposal in order for Co-op members to better understand the proposal. The working group decided that proposals submitted to this group would include a study plan, a time-table, and budget information.

Ed asked what should be done with this list as a working group? He suggested that a smaller committee be formed to prioritize these ideas and develop them into proposals, especially the ideas concerning regeneration tables for the best intensive silvicultural practices, and developing models for growth and costs to justify silvicultural practices. He then called for volunteers for this committee. Those expressing an interest included: Pat Minogue, Tim Livingston, John Fiske, Lewis Howe, Brian Schlaefli, Ed Fredrickson, Tom Young, Bob Rynearson, and David Lloyd.

A meeting for this committee was scheduled for May 14, 2002 in Mt. Shasta, starting at 8:30. The meeting will be held at the Tree House Motor Inn.

The group decided to do a literature search for existing growth and yield publications. It was suggested that Martin Ritchie of the PSW Lab at Redding could be invited to talk to the group on Conifers – his next generation growth model for conifers and competing vegetation.

The meeting was concluded at this time

Field Trip September 19, 2002

The 2002 field trip sponsored by the Co-op was held on Boise Cascade and Indian Hill, LLC lands near Medford, Oregon on September 19, 2002.

Eighteen members attended. Brian Schlaefli of Boise Cascade conducted the tour and provided the handouts and refreshments.

The tour was originally planned with 7 stops, but due to the interest/questions from the group at each stop, some of the stops had to be deleted. Brian did a masterful job of arranging each stop and the handouts could not have been better. Topics covered included: seedling response to soil-active herbicides; Simplot Soil Builders fertilizer trial; Timmer/Jopson fertilization installation; cell size trials; species x stock type x fertilizer trials; and PP/DF vegetation free plantation.

During the break for lunch, Bob Powers discussed an opportunity for the Co-op to become involved in a study that would come with government funding. The funds had to be applied to research that related to intensive silviculture in young plantations, centered on increasing productivity, involved Douglas-fir, and advanced science as well as management. The proposal was well received by those in attendance and they decided to make a formal presentation of the idea at a Working Group II meeting to be held later in the year.

Based on the interest and enthusiasm of those that were on the field trip, it was a great success. Brian is to be commended for his efforts. Extra copies of the handouts that were prepared for the trip are available for those who were unable to attend.

Working Group II Meeting December 3, 2002

This meeting was scheduled as a follow-up to our field trip to address the proposal presented during that trip by Bob Powers. A sub-group of Working Group II met to develop this idea into a proposal to put before the full Co-op membership.

Bob Powers successfully competed for grant money from Agenda 2020 funds and offered the Co-op the opportunity to design a study that would be funded by this grant. Funding will amount to about $55,000/year for the next three years (see following pages for the proposal developed by the group that will be presented to the membership on 1/13/03).

AN EXPERIMENT TO EVALUATE THE COMPETITIVE AND ECOLOGICAL EFFECTS OF UNDERSTORY VEGETATION ON THE PRODUCTIVE POTENTIAL OF YOUNG DOUGLAS-FIR PLANTATIONS

Robert F. Powers
Senior Scientist, PSW Research Station

Background

In 1994 the American Forestry and Paper Association (AF&PA) formed a partnership with the U.S. Department of Energy (DOE) to begin a competitive grants program called "Agenda 2020." The purpose was to focus research on industrial priorities for increasing productivity and energy efficiency. One of the priorities was "Sustainable Forestry." This Agenda 2020 priority centers on four research pathways: Biotechnology and Tree Improvement, Basic Physiology of Forest Productivity, Sustainable Forest Productivity, and Remote Sensing to Improve Forest Inventory and Stand Management. The goal is to substantially improve the productivity of our forests which provide the raw material for the industry. Forest Service Research joined the partnership in support of Sustainable Forestry in 1998. The Forest Service and DOE provide funds and technical support. AF&PA provides oversight and establishes priorities through various working groups. The National Council of the Paper Industry for Air and Stream Improvement (NCASI) provides technical expertise.

A national call for Forest Service Research proposals went out in 2002. Proposals were reviewed and ranked by AF&PA foresters for geographic regions of the U.S. R.F. Powers submitted a proposal titled "Treatments to Enhance Forest Productivity." The proposal was based on priorities raised at the February 2002 session of the Sierra-Cascade Intensive Forest Research Cooperative (SCIFMRC) in Mt. Shasta. A top priority was to determine the limits of plantation productivity for Douglas-fir and other species under various silvicultural alternatives. Powers' proposal received high marks by AF&PA, and in July 2002 he was awarded a 3-year grant of $56 thousand per year. He notified the SCIFMRC Executive Team that he'd like to use the funds to enhance the Co-op's efforts. He then asked Brian Schlaefli, Chair of Working Group 2, to convene a meeting of SCIFMRC individuals to hone this research proposal. The original proposal was a modified "Garden of Eden" study expanded to Douglas-fir and other geographic regions. With this as a talking point, a half-day discussion was held December 3 in Mt. Shasta. A consensus was reached to initiate the study described below.

The Study

Problem statement. Early productivity of pine plantations declines as understory competition increases. Growth drops as ground cover of woody shrubs approaches 20 to 30%, with the effect persisting well after trees have overtopped the brush. Consequently, managers have tried to keep understory cover well-below the 20 to 30% threshold. However, the role of N-fixing shrubs is controversial. Some ecologists argue that the long-term value of N-fixing species exceeds their early competitive effect. Arguments

such as these largely are speculative, because critical experiments have not been designed to test the concept. Further, with the exception of work by Newton and colleagues in Oregon, few findings have surfaced on the competitive effect of woody and herbaceous species on the development of Douglas-fir plantations in drier climates characterizing the interior sites managed by SCIFMRC members.

Critical questions. Our group defined a series of major questions for research:

- How are interior Douglas-fir plantations affected by understory species?
- Are there understory density thresholds?
- Is there a competitive difference between herbaceous plants and woody shrubs?
- Is there a difference between N-fixing and non N-fixing shrubs?
- Do effects vary by site?
- Does fertilization make a difference?
- How do treatments affect the time to reach a target tree size?

Approach. The experiment will center on freshly prepared sites within the natural range of Douglas-fir in southern Oregon and Northern California. The treated area will encompass 15 acres, bordered by a cleared buffer with a minimum width of 100 feet. Sites will be wing-subsoiled in two directions before planting to minimize any legacy of skid trails or landings. Sites will be planted at a 12-ft spacing with superior quality Douglas-fir and a second species, such as ponderosa pine. Tree spacing and size of treatment plots (1/4 acre) are appropriate to maintain stand-like conditions until trees reach a DBH of 8 inches. Six main effect treatments applied randomly to each of four replicate plots are:

- No vegetation control (4 plots)
- Complete vegetation control using appropriate herbicides (4 plots)
- Herbaceous competition, only (no herb control vs 1st-year only = 8 plots)
- Woody shrubs, only (non N-fixing = 16 plots)
- Woody N-fixing shrubs, only (16 plots)
- Fertilization with a nutrient complete mix at lower levels of competition (12 plots)

Herbaceous competition will be at two levels: no initial treatment of herbs, and 1st-year only. For the woody shrub treatments, manzanita and ceanothus seedlings appropriate for the site will be produced in a nursery and planted with tree seedlings to achieve, by 5 years, ground covers of 5, 15, 30, and 50 percent. Planting densities will be based on assumed rates of mortality and estimated diameters of shrub crowns at 5 years. Each ground cover density will be maintained by spot treating individual plants when a ground coverage treatment has increased to one-third of the target level of the next highest cover treatment

Treatments with a target ground cover of 15% will be fertilized with mixtures of macro and micro nutrients at two intervals: (1) at 3 to 5 years when trees are well established; (2) when tree crowns have reached about two-thirds ground cover (the rapid stage of crown building).

Measurements. Soil profiles will be characterized according to the national standards of the Natural Resource Conservation Service. Meteorological data (plus soil moisture and temperature) will be recorded continuously using data loggers. Tree survival, height, crown length and width, and ground cover will be measured at growth years 1, 3, 5, 7, and 10. Foliar samples will be taken from current and 1-year foliage for nutrient analysis at each measurement interval. Samples also will be analyzed for cumulative water stress as indexed by ^{13}C and ^{12}C isotopic ratios. Soil samples will be analyzed for microbial abundance and diversity (functional and numerical).

Costs per installation through the 3-year life of the grant

Activity	**Year 1**	**Year 2**	**Year 3**
Site identification and preparation (20 acres)	5,000		
Slash abatement	1,300		
Tree seedlings	4,000		
Brush seedlings	12,000		
Plot layout	1,700		
Meteorological station		6,000	
Plant trees		2,500	
Plant brush		4,500	
Herbicide treatment		3,000	
Tree and brush measurements		5,000	
Brush density adjustments			2,500
Chemical analyses			12,500
Soil sampling			5,000
Microbial analysis			8,000
Data analysis			6,500
Total by year	**24,000**	**21,000**	**34,500**

Approximately $168 thousand are available over three years for this study. The estimated total of $79,500 per site covers 47 percent of PSW's available funds. This means that we can fund two installations and must decide on where they will be.

Demands on SCIFMRC

Powers takes overall funding and research responsibility. SCIFMRC will propose candidate sites. While 15 acres are needed for the 60 treatment plots, total cleared area probably will approach 30 acres. The first site is projected for Boise land in southern Oregon in the western Cascades. A second site should be established the following year in the eastside Cascades (on the most productive land), or in the northwestern Sierras or Cascades on very productive ground. Which was to go is the prerogative of the Co-op. Harvesting/clearing the site is the responsibility of the SCIFMRC partner, as is protection from other uses. If approved as a SCIFMRC project, Gary Fiddler will oversee the first three years of work to establish the experiment and SCIFMRC will assist by underwriting

his time through membership dues. We will seek new grants to fund further work and to encourage piggybacking of other studies, such as forage production and wildlife use.

This proposal was sent out to co-op members on December 18, 2002. It will be discussed at the business meeting scheduled for January 13, 2003. If this discussion doesn't raise any critical questions concerning the proposal, a vote for acceptance of this proposal as a Co-op study will be taken at the meeting. If it is accepted by the Co-op, implementation will begin in the spring of 2003 with site selection being the first order of business.

RESEARCH RESULTS

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, Joe DiTomaso, 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 (*Arctostaphylos sp.*) and Ceanothus *spp.*, 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 herbicide treatments at one and two years after planting, and no subsequent treatment after planting.

Methods: 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 rotary masticator 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.

In the summer of 2002, trails were cut between individual main plots in order to allow access to the plots. Additionally, GPS coordinates were taken at the corners of the main plots to help guide visitors or future researchers to the site and individual plots.

Results: Ponderosa pine survival was affected by the site preparation method and the level of subsequent weed control following site preparation (Table 1). Survival was best where shrubs were brush raked and least on the Hydroax plots. This was similar to what was observed in 1982, however, the difference among treatments was much greater in 2000. Ponderosa pine survival declined about 17% on the brush rake plots between the 1982 and the 2000 evaluations, while survival declined by 25% on the fire and Hydroax plots. Survival of ponderosa pine was also greater with herbicide release treatments, compared to not treating (Table 1). This is the reverse of what was observed in 1982, where survival was poorest on plots that had two release treatments. The herbicide release treatments injured and killed some trees, however, surviving trees were able to grow quickly due to increases in resources and quickly dominated the site. Where shrubs were not controlled, ponderosa pine growth was slower and eventually some of the trees died. This is especially true on the fire and Hydroax plots where survival declined by over 40% when no herbicides were applied. In general, the greater the level of soil disturbance and subsequent shrub control, the better the ponderosa pine survival.

Sugar pine survival was extremely poor in all plots (Table 1). 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, and also the brush rake plots compared to the Hydroax treatment. The reduction in weeds on these plots may have reduced alternative host plants for the disease, which killed the sugar pine. 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.

White fir survival was affected by the level of subsequent weed control following site preparation, but not by the site preparation method (Table 1). The first release treatment appeared to have decreased white fir survival to only 15 %. Two release treatments improved white fir survival about 10 % over the single release treatment, but still less survived than the average survival on the untreated plots. Similar to what was observed with ponderosa pine, white fir survival in 1982 declined between 1982 and 2000, by over 15% on plots that received 0 or 1 release treatment, but only 5% where two release treatments were applied.

Ponderosa pine diameter at breast height (dbh) was not affected by site preparation method but increased substantially with a single release treatment (Table 2). Two release

treatments increased dbh growth only slightly compared to a single treatment. As with survival, dbh growth was best where shrubs were suppressed more effectively or for a longer period of time.

Sugar pine dbh was also not affected by site preparation method but increased substantially with a single release treatment and even more with two release treatments (Table 2). Maximum dbh was observed on the brush rake and Hydroax plots that received two release treatments, but the single release treatment was best on the fire plots. The very low number of surviving trees makes data interpretation difficult with sugar pine.

White fir dbh was also increased substantially with a single release treatment and even more with two release treatments (Table 2). Unlike the other two conifers, white fir dbh was also affected by site preparation method, with trees on the fire plots having the smallest dbh and brush rake having the largest dbh.

Ponderosa pine height (ht) was least when no weed control was used after planting (Table 3). A growth increase (approx. 6 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, with the increase over a single treatment of over 9 ft. Although site preparation method did not significantly affect ponderosa pine ht, there was a 10 ft. difference between the brush rake and Hydroax plot, with trees on brush rake plots being much larger, particularly where no or only one release treatment was used.

Sugar pine ht data should be regarded as less reliable than the other two species, due to the small number of surviving trees (Tables 1 and 3). Sugar pine ht was greatest when one or two herbicide release treatments were used. Height was also greater on brush rake plots compared to Hydroax plots. Since the trends in the sugar data parallel the other two conifer species, with the exception of the fire plots that received one or two release treatments, it seems that these are an accurate representation of tree height growth response to the treatments.

White fir ht was the shortest when no weed control or a single release treatment was used after planting (Table 3). A small height increase (1 ft) in white fir was observed when a single herbicide treatment was used. White fir ht was greatest when two yearly weed control treatments were used, with an increase over the single treatment of 4.6 ft. in height. Site preparation method did not statistically affect ht of white fir, but like the other conifer species, was best on the brush rake plots.

GPS coordinates are shown on the plot map (Figure 1).

Conclusions: At 21 years after transplanting, ponderosa pine survival was about 55%, white fir about 24%, 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 hydro ax 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.

Pathways cut in 2002 should allow easier access, although some maintenance will likely be required in the future. A firebreak was supposed to be cut around the entire research site by a contractor for the Foresthill Ranger District; however, the contractor was not able to do this. It is hoped that this could be done in the near future. Additionally, if future funding is available, pathways between subplots will be cut, and the current pathways will be maintained.

Table 1. Survival (%) of conifer species (Sept. 2000), in relation to site preparation method and number of herbicide applications made after planting. Survival in 1982 is indicated in parenthesis following the 2000 value.

Treatment	# Herb. Treat.	Ponderosa	Sugar Pine	White Fir
		----------(%)----------		
Brush rake	0	66 (85)	3 (50)	40 (52)
	1	65 (84)	4 (48)	13 (36)
	2	71 (83)	4 (47)	35 (45)
Fire	0	34 (80)	2 (34)	26 (45)
	1	57 (84)	2 (45)	19 (39)
	2	69 (72)	7 (46)	27 (36)
Hydroax	0	26 (74)	0 (27)	24 (41)
	1	43 (75)	0 (23)	12 (33)
	2	62 (59)	1 (11)	15 (11)
Brush rake		67 (84)	4 (48)	29 (44)
Fire		53 (79)	3 (42)	24 (40)
Hydroax		44 (69)	0.3 (20)	17 (28)
		*	**	NS
O releases		42 (80)	2 (37)	30 (46)
1 release		55 (81)	2 (39)	15 (33)
2 releases		67 (71)	4 (35)	26 (31)
		**	**	*

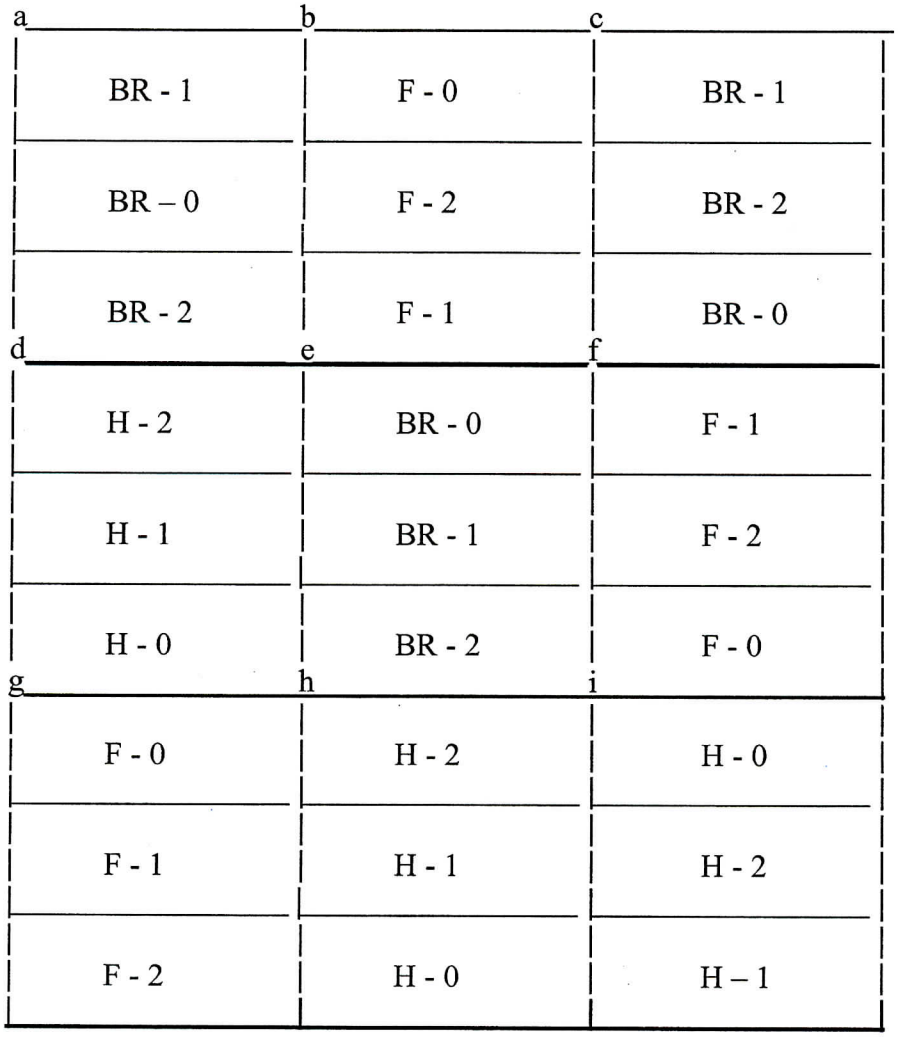
Table 2. Diameter at breast height (cm) in September 2000, of conifer species in relation to site preparation method and number of yearly herbicide applications made after planting. Diameter at breast height (cm) in 1982 is indicated in parenthesis following the 2000 value.

Treatment	# Herb. Treat.	Ponderosa	Sugar Pine	White Fir
		----------(cm)----------		
Brush rake	0	15.4	9.6	6.7
	1	18.6	8.5	7.1
	2	22.5	12.7	9.2
Fire	0	9.0	3.0	3.5
	1	18.9	9.9	4.9
	2	20.9	7.2	5.8
Hydroax	0	10.6	3.4	3.9
	1	20.6	7.0	5.8
	2	20.6	10.6	8.8
Brush rake		18.8	10.3	7.7
Fire		16.3	6.7	4.7
Hydroax		17.3	7.0	6.2
		NS	NS	*
O releases		11.7 (0.9)	5.3 (0.5)	4.7 (0.9)
1 release		19.4 (1.7)	8.5 (0.8)	6.0 (1.0)
2 releases		21.4 (2.6)	10.2 (1.2)	7.9 (1.4)
		***	**	**

Table 3. Height (ft.) in September 2000, of conifer species in relation to site preparation method and number of yearly herbicide applications made after planting. Height (ft.) in 1982 is indicated in parenthesis following the 2000 value.

Treatment	# Herb. Treat.	Ponderosa	Sugar Pine	White Fir
		----------(feet)----------		
Brush rake	0	24.2	17.2	13.6
	1	30.8	15.6	14.3
	2	37.2	23.9	19.2
Fire	0	17.7	8.6	9.5
	1	27.2	26.5	11.7
	2	32.8	14.5	13.0
Hydroax	0	14.6	8.5	8.6
	1	15.9	13.4	8.7
	2	31.2	18.4	16.5
Brush rake		30.7	18.9	15.7
Fire		25.9	16.5	11.4
Hydroax		20.6	13.4	11.3
		NS	NS	NS
O releases		18.8 (1.1)	11.4 (0.7)	10.6 (1.0)
1 release		24.6 (1.6)	18.5 (0.9)	11.6 (1.0)
2 releases		33.7 (2.0)	18.9 (1.1)	16.2 (1.2)
		***	**	**

Figure 1. Plot map for research site, including GPS coordinates.
Symbols - BR = Brush rake, F = Fire, H = Hydroax, 0 = no release treatments, 1 = one release treatment, and 2 = two release treatments. Subplots are 66 ft. X 150 ft. and main plots are 200 ft X 150 ft.



GPS coordinates:

	Latitude – West	Longitude - North
a	120.675978885	39.172046853
b	120.675658299	39.171730032
c	120.675300897	39.171444757
d	120.676494300	39.171690629
e	120.676161000	39.171400957
f	120.675820929	39.171083741
g	120.677029946	39.171354277
h	120.676705674	39.171038209
i	120.676367388	39.170732524

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 out-planting 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

Problems with pH complicated the study while the seedlings were in the nursery. Over all, the constant rate fertilized seedlings outgrew the exponentially fertilized ones. Mortality was excessive with the latter application technique.

Vic Timmer visited Cal Forest Nursery in January of 2002.

The foliar analysis done at Davis showed a range of nitrogen levels in the seedlings, but only in the constant feed application. Timmer believed that nutrient concentrations were too low in the early stages for the exponential treatments, and that seedlings were stunted and not able to catch up to those in the constant feed treatment. A later foliar sample from Scott's Lab showed minor but consistent differences in nitrogen levels among the constant feed treatments. Whole seedling nitrogen concentrations generally increased in proportion to nitrogen concentrations in the constant feed solution.

It was decided to out-plant only the two extreme treatments in the constant feed technique: 50 ppm and 300 ppm.

The seedlings were lifted in February. Seedling height and caliper were recorded for each treatment and needles were collected and sent to Scott's Laboratory for analysis. This data will serve as baseline data.

In order to make this and other studies under Working Group I more compatible with the needs from Working Group II, the original design for this study was changed (see meeting notes for February 19 –20). Six replications of each treatment were to be out-planted if there were sufficient seedlings available. Spacing was to be increased to 10' X 10'. Plot size was to be 70' X 70' with 25 measure trees surrounded by a row of buffer trees in each plot. Seedling protection was to be applied at time of planting. The sites on Boise Cascade and Fruit Growers had been ripped; the site on Soper-Wheeler had not. To overcome this difference, the seedlings for the Soper-Wheeler site were to be auger planted. Vegetation control would be applied chemically to all plots and the plots will be kept weed-free during the life of the study.

All plots were established by the last week in March, 2002. Plot corners were marked by metal conduit and planting spots were designated with wire stake flags. All three sites had been planted as of the first week in April. Only ponderosa pine had sufficient numbers of seedlings to be out-planted on the Boise Cascade site. Six replications of the 50 ppm and 300 ppm treatments were out-planted there. Fruit Growers had enough seedlings for 5 replications of each treatment for ponderosa pine and white fir; four replications of Douglas-fir were out-planted. Six replications of each treatment for ponderosa pine and white fir and five replications of Douglas-fir were out-planted on the Soper-Wheeler site.

Measurements for seedling height and caliper were taken at all three sites in October, 2002. Needle samples were taken at this time for foliar analysis. This foliar analysis is currently being done. Survival was noted at the time the measurements were being taken.

First year data were analyzed in December, 2002. The experimental design was completely randomized with one-way treatment structure. Two treatments were each replicated 4 to 6 times. To test for treatment effects and significant differences among treatments, one-way analysis of variance of treatment means and Tukey tests were applied. Statistical significance in all tests was at the 0.05 level.

Results: Survival at the end of the first growing season was uniformly high for both treatments with all species on the three sites. Survival was always higher for the 50 ppm treatment when compared to the 300 ppm treatment but not statistically higher. For the study as a whole (all three sites), ponderosa pine survival ranged from 97-100 percent; white fir from 91-100 percent; and Douglas-fir from 94-100 percent.

Caliper, height, and volume values for the seedlings are presented in Table 1 and Table 2. The first table shows values at the time of lifting at Cal Forest Nursery in February of

2002. The second table shows the values at the end of the first growing season after out-planting. These measurements were taken in October, 2002. Volume is derived by multiplying squared caliper by the height.

For ponderosa pine, the only significant differences at time of lifting were for caliper of the Boise Cascade seedlings, where the 50 ppm treatment seedlings were larger than those in the 300 ppm treatment (a 19% increase), and height of the Fruit Growers seedlings, where the 300 ppm treatment seedlings were taller than those in the 50 ppm treatment (17% taller)

White fir seedlings showed no significant differences in caliper at time of lifting. Seedling height and volume for the 300 ppm treatment were always significantly larger than their counterparts in the 50 ppm treatment, however. The height of the seedlings receiving the 300 ppm treatment was about 45% greater than the height of those that received the 50 ppm treatment. The volume of the 300 ppm seedlings was about 50% more than volume of the 50 ppm seedlings.

For Douglas-fir, there were significant differences in height and volume at time of lifting for both Fruit Growers and Soper-Wheeler seedlings. The seedlings from the Fruit Grower's 300 ppm treatment also had significantly larger caliper than those seedlings in the 50 ppm treatment. Seedlings that were fertilized at the 300 ppm rate showed about a 30% increase in height over those fertilized at the 50 ppm rate. Volume was about 60% larger for the 300 ppm seedlings when compared to the 50 ppm seedlings.

It is obvious from the data presented in Table 1 that the seedlings are responding early on to the different levels of fertilization. For the most part, the seedlings that received the largest fertilizer rate (300 ppm) were bigger than those seedlings that received the smaller rate (50 ppm). At the time of their lifting in the nursery, white fir and Douglas-fir showed significant differences in height and volume for all seed lots. Those seedlings receiving the 300 ppm treatment were always larger than those receiving 50 ppm. Generally speaking, ponderosa pine seedlings did not show these differences.

The values shown in Table 2 represent the seedlings at the end of their first growing season after out-planting.

Even after one growing season in a plantation, ponderosa pine caliper does not differ significantly between the two fertilizer treatments. This is true for all three sites. The caliper for those seedlings receiving the 300 ppm treatment is always larger than that for the seedlings receiving 50 ppm, but not significantly so. Height and volume are a different story. Unlike at the time of lifting, these two values show significant differences between the two treatments after one growing season in a plantation. The values for the 300 ppm treatment are always significantly larger than those for the 50 ppm treatment. Height for the 300 ppm treatment shows about a 20% increase (average for the three sites) over the 50 ppm treatment. Volume shows about a 30% increase.

White fir seedlings showed significant differences in caliper, height, and volume between the treatments at the end of the first growing season on both sites. The 300 ppm treatment always had significantly larger seedlings than did the 50 ppm treatment. Caliper was about 17% larger, height about 43% larger, and volume about 97% larger for the seedling in the 300 ppm treatment when compared to those in the 50 ppm treatment.

Douglas-fir followed the pattern shown by white fir. In all instances except for the caliper of the Fruit Grower's seedlings, the values for the seedlings receiving the 300 ppm treatment were significantly larger than the values of those seedlings receiving the 50 ppm treatment. Height for the 300 ppm treatment was about 30% taller (two site average) than that of the 50 ppm treatment. Volume was about 65% more in the 300 ppm treatment than in the 50 ppm treatment.

In summary, after their first growing season, seedlings that were fertilized at the 300 ppm rate are always significantly taller and have significantly more volume than do their counterpart that received the 50 ppm rate. With the exception of ponderosa pine, this is also true for caliper. The percentage differences in height and volume that showed up at time of lifting are continuing to show after one year. The difference in volume is actually increasing. Survival is high regardless of treatment.

The seedlings will be measured at the end of their second growing season (fall 2003) to determine if these differences will continue to show. The higher level of fertilization does produce a larger seedling at least through the first growing season.

Table 1-- Values for caliper, height, and volume for seedlings for the Timmer/Jopson Proposal at time of lifting, February, 2002.

	Caliper (cm)	Height (cm)	Volume (cm^3)
Ponderosa Pine			
Boise Cascade			
50 ppm	0.487a	15.000a	3.602a
300 ppm	0.409b	17.000a	2.928a
Fruit Growers Supply			
50 ppm	0.495a	16.200b	4.040a
300 ppm	0.457a	19.000a	3.909a
Soper-Wheeler			
50 ppm	0.476a	14.450a	3.295a
300 ppm	0.436a	16.850a	3.267a
White Fir			
Fruit Growers Supply			
50 ppm	0.347a	15.056b	1.842b
300 ppm	0.347a	23.889a	2.915a
Soper-Wheeler			
50 ppm	0.371a	16.600b	2.298b
300 ppm	0.384a	22.300a	3.313a
Douglas-fir			
Fruit Growers Supply			
50 ppm	0.383b	21.553b	3.229b
300 ppm	0.429a	30.580a	5.727a
Soper-Wheeler			
50 ppm	0.406a	26.000b	4.404b
300 ppm	0.440a	32.100a	6.252a

For land-owner and species, treatment means in each column followed by the same letter do not differ significantly at the 0.05 level.

Table 2-- Values for caliper, height, and volume for seedlings for the Timmer/Jopson Proposal at end of first growing season, October, 2002.

	Caliper (cm)	Height (cm)	Volume (cm^3)
Ponderosa Pine			
Boise Cascade			
50 ppm	0.756a	26.818b	16.948a
300 ppm	0.803a	29.170a	20.435a
Fruit Growers Supply			
50 ppm	0.896a	24.360b	21.178b
300 ppm	0.940a	29.976a	28.244a
Soper-Wheeler			
50 ppm	0.879a	19.977b	16.582b
300 ppm	0.921a	26.186a	24.009a
White Fir			
Fruit Growers Supply			
50 ppm	0.416b	20.628b	3.791b
300 ppm	0.484a	29.217a	7.282a
Soper-Wheeler			
50 ppm	0.490b	19.653b	5.045b
300 ppm	0.579a	28.399a	10.259a
Douglas-fir			
Fruit Growers Supply			
50 ppm	0.584a	28.475b	10.757b
300 ppm	0.659a	36.941a	17.544a
Soper-Wheeler			
50 ppm	0.592b	25.319b	9.663b
300 ppm	0.669a	33.945a	16.136a

For land-owner and species, treatment means in each column followed by the same letter do not differ significantly at the 0.05 level.

Western Pine Shoot Borer Mating Disruption
Nancy Rappaport and Jeff Webster, Principal Investigators

A new study was initiated this year in northern California to test mating disruption of the western pine shoot borer (*Eucosma sonomana*). This moth is a serious pest, known to reduce height growth of pines up to 20% per year in western North America. A synthetic pheromone registered for the eastern pine shoot borer (*E. gloriola*) is also effective against the western pine shoot borer. This year, FHTET sponsored a new microencapsulated formulation of the pheromone for aerial application, and tested it for an area-wide effect on five 50-acre plots.

Preliminary results indicate that 12g/acre, applied aerially as a microencapsulated formulation of the active pheromone ingredient, significantly reduced early season trap catch (we report only results for the first month post-treatment, since moth flight was nearly over by that point).

Table 1. Numbers of moths responding to pheromone-baited traps, by week

	2 Weeks	2 Weeks	4 Weeks	4 Weeks
Location	**Treatment**	**Control**	**Treatment**	**Control**
Pondosa 1	0	15	2	127
Pondosa 2	0	82	0	41
Scarface 1	0	182	1	141
Scarface 2	0	24	19	168
Crank	0	96	7	44

The effect on infestation level was variable, with the best results seen in the two Pondosa plots and the worst results seen in the two Scarface plots (Table 2):

Table 2. Percent infestation of leaders by WPSB, treatment vs. control plots

Location	Treatment	Control	% Reduction
Pondosa 1	14	62	77.4
Pondosa 2	6	48	75.0
Scarface 1	32	70	54.3
Scarface 2	30	38	21.1
Crank	20	56	64.3

The reduction on infestation level varied between 21.1% and 77.4%, with the best results seen in the two Pondosa plots and the worst results at Scarface 2.

We have not yet determined the reason for the differences in efficacy at the different plots, but there are several possible explanations. First, differences in temperature and humidity may have caused the active ingredient to release at a more rapid rate on the Scarface and Crank plots than at Pondosa. Second, differences in weather may have caused differential degradation of the active ingredient (this possibility is not likely considering the nature of the pheromone). Third, there were different WPSB population pressures at the different sites (Scarface 2, in particular, started out with a very low pre-

treatment infestation rate (2%), but infested leaders at the control site increased astronomically (to 38%), between 2001 and 2002) (Table 3).

Fourth, and probably most likely, differences in temperature and/or snow cover may have resulted in later emergence at some sites, thus missing the window of pheromone elution from the microcapsules. Results from the monitoring traps (Table 1), support this conclusion. For example, if the higher levels of infestation in treated plots resulted simply from increased population pressure, then we would expect Pondosa 1 to have had a high infestation level, because by one month following treatment the Pondosa 1 control plot had one of the highest trap catches. But in fact, Pondosa 1 had the second-lowest level of infestation in the treated plot. We conclude, therefore, that the greater levels of control seen at the Pondosa plots resulted from better synchrony of local phenology with spray timing. This conclusion suggests a need for a longer-releasing microcapsule, perhaps on the order of just 7-14 days longer.

Table 3: Percent infestation of leaders by WPSB, 2001 vs. 2002 (control plots only):

Location	2001	2002
Pondosa 1	54	62
Pondosa 2	48	48
Scarface 1	64	70
Scarface 2	2	38
Crank	50	56

The striking increase in background populations at Scarface 2 suggests that those plots constituted a stronger challenge to the treatments than did the Pondosa plots, where background populations were either flat or only increased moderately. A second year of testing and statistical analyses is necessary to determine stand growth benefits. We will clearly need to assess treatment effects using the annual increase in infestation as a covariate, since it appears that rapid increases in background populations can affect efficacy.

These results, while somewhat disappointing, compare favorable in terms of efficacy with results from the luretape technology. We feel that the technology still has promise for use in western plantations, because it remains the only formulation that can be aerially applied using conventional spray equipment. We are currently trying to recruit funding for a second application, which we hope would further suppress moth populations.

Principal investigators and cooperators on this project include: **Gary Daterman**, Pacific Northwest Research Station, **Nancy Rappaport** and **Gary Fiddler**, Pacific Southwest Research Station, **Jeff Webster**, Roseburg Resources, **Mark Gray**, Sierra Pacific, **Don Owens**, California Department of Forestry and Fire Protection, **Bob Rynearson** and **Don Pearce**, Beaty Inc, **Ed Frederickson**, Sierra-Cascade Forest Intensive Management Research Corporation, **Gary Grant**, Canadian Forest Service, **John Stein**, Forest Health Technology Enterprise Team, and **Grant Oliver**, 3M Canada.

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. If the working group was in favor of the proposal, it would recommend the proposal to the Co-op membership. 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. Co-op member BASF, through Pat Minogue, agreed to cover the expenses of potential panel member Karl Miller if he was chosen to serve on the panel.

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.

The following panel was chosen to make the presentation to the Co-op membership at the January 21, 2002 general meeting:

Bill Laudenslayer, U. S. Forest Service
Steve Zack, Wildlife Conservation Society
Cajun James, Sierra Pacific Industries
Lowell Diller, Simpson Timber Company
Karl Miller, University of Georgia

Prior to the January meeting, Bill shared with his panel members some thoughts that would help direct their individual presentations toward answering the questions raised by the Co-op proposal. Bill suggested that the panel look at tradeoffs in attaining various objectives when managing plantations (of any age) especially on industrial forest land. Some of the expected tradeoffs might be trading off canopy closure for faster tree growth. Or one might want to trade off tree growth to foster higher mortality rates and /or maintain a greater canopy closure. Another approach Bill suggested was that the panel members consider a suite of critical species to manage and then discuss the tradeoffs of managing for those species to other wildlife species as well as to the forest and economics of the land owners. Bill's charge to his panel was for them to address the question: what are the impacts of intensive forest management, especially in a plantation context, on wildlife populations?

During the January meeting, the panel made individual presentations and then answered questions from the Co-op membership. Following this question/answer session, Karl Miller concluded the panel discussion by reporting on results from some of his studies documented in the publication "Wildlife in Managed Forests: The Evolution of Research in the South".

RESEARCH RESULTS – IMPLEMENTATION STATUS

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.

Status: The principal investigator received permission from the Co-op to measure these plots in the winter of 2003 (instead of 2002 as originally planned). Results will be reported in 2003.

Evaluating the Effect of Slow Release Fertilizers Incorporated into Containerized Seedlings in Mediterranean Climates

Ed Fredrickson
Roseburg Forest Products Co.

Objectives:

1. To evaluate the partial contributions of fertilizer type and rate to seedling survival and growth in the field for Douglas fir and ponderosa pine.

2. To determine the influence of site quality and precipitation on seedling response to incorporated slow release fertilization.

Introduction:

Over the last several years, the use of slow release fertilizers incorporated into container seedling media has become increasingly popular. Early results from studies done by the Nursery Technology Cooperative (Oregon State University) and others on Douglas fir response to slow release fertilizers were encouraging and showed strong potential for volume increases at the early stages of seedling growth.

These early results prompted timber companies to experiment with this process in other regions, specifically northern California and southwestern Oregon. The majority of the work done extrapolated the fertilizer data from Oregon to a more Mediterranean climate. Initial results were promising, however, as time went on significant problems with survival and growth were encountered with the fertilizer type and rates used from the Oregon data.

The purpose of this study is to determine appropriate fertilizer ratios and rates for typical conifer species grown in a Mediterranean climates and to evaluate survival and growth responses over a range of site qualities and moisture regimes.

Methods:

The experimental design within sites will be a completely randomized 2x2x4 factorial treatment structure split across sites. The treatments will be as follows:

3 sites (20-30" ann. Precip., 30-50" ann. Precip., >50" ann. Precip.)
2 species (Douglas-fir & ponderosa pine, sugar pine on Soper Wheeler Site)
1 stock size per species (ST-8, pine & ST-10, doug-fir)
1 fertilizer blend (Nutra-cote), ratio to be determined
4 rates per species (ST-8 pine = 0, 0.8, 1.6 & 3.2 grams per cell),
(ST-10 doug-fir = 0, 1, 2 & 4 grams per cell)
2 plant timings (fall and spring)

16 total treatments per site x 5 replications = 80 plots per site.

Plots will contain 25 trees per plot spaced 5' x 5'. This will require 2000 total trees per site (1000 p. pine & 1000 d. fir)

Total land area needed will be approximately three acres. Buffer rows

of trees should not be necessary since the experiment will be of short duration.

The low precipitation site will be on land managed by W.M. Beaty & Associates, the moderate precipitation site will be on land managed by C & D Lumber Co. and the high precipitation site will be on land managed by Soper-Wheeler Company.

Site Prep: All sites will be doubled ripped and site prepped with 4 lbs a.i./ac of atrazine. Follow up foliar treatments as necessary.

Soil Temperature: Since the release rate of the fertilizer is temperature dependent, soil temperatures will be monitored at two points on each site at a depth of six inches using Hobo data recorders over the entire first growing season. The Co-op will also look into installing a local weather station as an alternative option.

Status: The seed for this study has been sent to PRT this fall for sowing. Site selection/preparation will be done in 2003.

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 measurements 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 are being grown at Pelton Reforestation, Cal Forest Nurseries, PRT, IFA Nurseries, and Fowler Nursery for outplanting in the spring of 2003. Co-op members in this study include Roseburg Resources, Sierra Pacific Industries, and Boise Cascade. Plot establishment and lay-out was completed on the first two sites in the fall of 2002. Plot work will be done on the Boise Cascade site just prior to planting in 2003.

Sierra Cascade Intensive Forest Management Research Cooperative
Income/Expense Statement
Calendar Year Report for the Period Jan. 1 to Dec. 31, 2002

Beginning Balance on January 1, 2002		**$61,798.69**
Total Income (Membership Dues)		**$84,000.00**
Expenses:		
Meeting Rooms	310.00	
Plot Lay-Out Supplies	1,411.03	
Plot Measurement/Lay-Out Contracts	7,951.77	
Plot Measurement/Lay-Out PSW Per Diem	779.06	
Ripping, FGS Timmer Study	3,200.00	
Vic Timmer January '02 Trip	500.00	
Foliar Analysis	2,052.00	
Helicopter Use, Eucosma Study	1,850.00	
WeedRic, Website	10,000.00	
New Proposals, Funding	12,814.00	
Co-op Manager Expenses	50,000.00	
Total Expenses		**$90,867.86**
Year End Balance as of December 31, 2002		**$54,930.83**

Co-op Manager's Time Breakdown

Annual Report	8%
Annual Business Meeting	2%
Working Group Meetings	5%
Proposal Work	58%
Field Trip	8%
Weed Tour	2%
Literature Searches	2%
Billings, Invoices, etc.	15%

Total time: 127.5 days

WORKING GROUP MEMBERSHIP

Working Group I
Seed to Establishment

Tom Jopson, Chair
Jerry Gallagher
Mark Gray
Stuart Gray
Ron Hague
Tom Harvie
Lewis Howe
Duane Nelson
Glenn Novak
George Severson
Tom Young

Working Group II
Out-planting Through Precommercial Thinning

Brian Schlaefli, Chair
Ed Fredrickson
Mark Gray
Stuart Gray
Scott Johnson
Danielle Lindler
Pat Minogue
Duane Nelson
Bob Powers
Tom Young