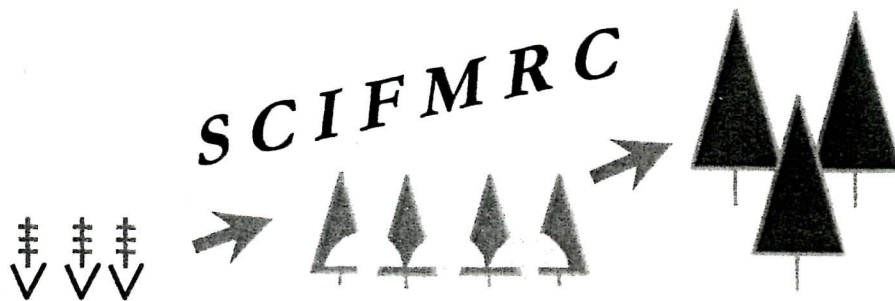


Sierra-Cascade Intensive Forest Management Research Cooperative

Series Report No. 10



<http://wric.ucdavis.edu.sierracascade/>

ANNUAL REPORT

2009

The year 2009 marked the tenth year as an organization for the Sierra Cascade Intensive Forest Management Research Cooperative.

Membership dropped as three members withdrew. All of these withdrawals were directly related to the continuing downturn in the timber/lumber industry. The current membership consists of a mixture of landowners, forestry-related industries, State of California and federal agencies. There are currently thirteen member organizations in the Co-op.

The Steering Committee met on January 22, 2009 to review critical factors affecting activities and the budget for the year. Having received comments from several members of the Co-op concerning the economic situation in the timber industry, the Steering Committee considered the status of our studies, our financial situation and various options. Recognizing the financial challenges facing the membership in 2009, several recommendations were made for approval by the full membership. These recommendations included lowering the 2009 dues to 50 percent of normal annual dues; reducing the manager's time spent on Co-op work from the normal 800 hours per year to approximately 500 hours; funding no new studies in 2009; and funding will continue for planned 2009 activities on approved on-going studies. The full membership approved all the recommendations and the changes were put into effect for the 2009 year. A discussion will be held in the fall of 2009 to determine if this one year dues reduction will be needed for 2010.

The annual business meeting was held April 1st in Redding (a summary of the meeting can be found in this Annual Report).

Thirteen members and guests attended. The first item of business was a review of the Annual Report. Membership status was discussed. As of the date of the meeting, two members had dropped out of the Co-op (an additional member withdrew later on). No new members have joined.

The four executive summaries in the 2008 Annual Report were reviewed. Two of these studies are on-going: Proposal 03-01 Agenda 2020 and Proposal 07-01 Glyphosate/Evergreen Brush. Since there were significant differences due to treatment in both the studies (Proposal 00-04 Stock Type/Fertilization; Proposal 02-02 Slow Release Fertilization) that received their final measurements in fall of 2008, the membership decided to have the Principal Investigator (Ed Fredrickson) contacted to see if he would write up these two studies. At a minimum, a summary document was requested. (Ed was contacted on April 6th and replied that he would be receptive to writing up the results if he were paid for his efforts - no decision has been made on this as of yet).

The next item of business was a discussion on the budget. The Co-op ended 2008 with a surplus of \$11,541.62. After funding on-going studies and following the recommendations adopted by the membership in January, there should be a surplus of approximately \$12,800 at the end of 2009 (actual surplus as of December 31, 2009 was \$6,920 – see comment in

following discussion on funding new proposals).

A discussion on the desirability of a field trip for 2009 followed the budget discussion. The membership decided to have a field trip on June 10th with the main focus of the trip being the Elliot Ranch plantation near Auburn, CA (the Elliot Ranch stop was augmented with a stop at Tom Lanini's study on Humbug Ridge).

Following the discussion on the field trip, updates on three recently funded Co-op studies were presented. Mark Gray reported on Proposal 07-01 Glyphosate/Evergreen Brush; Jason Warshawer on Proposal 08-02 Cedar Trials; and Alice Ratcliff on Proposal 03-01 Agenda 2020. These updates can be found in the write-up of the annual business meeting found in this Annual Report. Executives Summaries of these studies can be found in this Annual Report.

Following the updates on funded proposals, new proposals were presented to the membership. The first proposal "Competition and Productivity in Mixed vs. Single-Species Plantations" was presented by Rob York, Manager of Blodgett State Forest. The second new proposal "Reevaluating Maximum Stand Density of Ponderosa Pine Stands in the Southern Cascades and Northern Sierra Nevada" was presented by Jianwei Zhang of the Pacific Southwest Research Station in Redding. The complete proposals are available at the Co-op's Redding office. After discussion by the membership, a decision was made and agreed to by Rob that he would develop a more specific plan for establishing study sites on Co-op members' lands and would

submit this revised proposal to the membership for possible future funding. Members present at the meeting recommended that Jianwei's proposal be sent to the voting membership for funding approval. If the membership approved the proposal for funding, it would be funded in 2009 if sufficient funds are available to cover it. Otherwise this proposal will be funded in 2010 (the membership approved this proposal and sufficient funds were available in 2009 to fund it).

The annual meeting ended with a discussion on members' expectations concerning the Co-op. A common response from several members was to the effect that the Co-op should concentrate on more applied, practical studies rather than scientific studies. As to the question whether the Co-op should continue to exist, the membership was unanimously in favor of continuing the Co-op.

The new proposal funded in 2009 by the Co-op, 09-01 Stand Density Index (SDI), reports results in this issue of the Annual Report. Another funded proposal, 05-01 Carbon Allocation, finished collecting field data/samples in 2009. These samples are being processed and the data resulting are being analyzed. Results will be published as soon as possible. Several publications have already resulted from this study.

The year 2010 should be an interesting one for the Co-op. Work will be required on the Agenda 2020 proposal to determine its future. The glyphosate study will be measured at the end of the growing season. More sites could be added to this study. The cedar trials study should have the first out-

planting this spring. Other sites could be added to this study as well. The SDI study will see more sites being measured.

Hopefully new proposals will be presented to the membership during the year.

2009 MEMBERSHIP

Land Manager Membership

California Department of Forestry
Fruit Growers Supply Co.
Roseburg Resources Co.
Sierra Pacific Industries, Inc.
Soper-Wheeler Co.
Timber Products Co.
W.M. Beaty & Associates, Inc.

Associate Corporate Membership

Cal Forest Nurseries & Mountain Gate Gardens

Affiliate Membership

Silver Butte Timber Co.

Supporting Members

California Forestry Association
PSW Research Station
University of California, Davis
USDA Forest Service

Sierra Cascade Intensive Forest Management Research Cooperative
Annual Meeting April 1, 2009

The 2009 annual meeting was held at the Forest Service office in Redding, CA on April 1, 2009. Thirteen Co-op members and guests attended.

The 2008 Annual Report was the first item of business. Membership status was discussed. Two members have dropped out of the Co-op so far in 2009. Two more members have not paid their 2009 dues as of this time. No new members have joined.

The four executive summaries in the 2008 Annual Report were reviewed. These were Proposal 00-04 Stock Type Fertilization, 03-01 Agenda 2020, 02-02 Slow Release Fertilization, and 07-01 Glyphosate/Evergreen Brush. The Agenda 2020 and the Glyphosate studies are on-going. The Stock Type Fertilization study had sixth year and the Slow Release Fertilization study had fifth year remeasurements completed in fall of 2008. As originally planned, these remeasurements were to be the final ones for these two studies. Statistical analysis showed significant differences due to treatment in both studies. The membership decided to have the Principle Investigator (Ed Fredrickson) contacted to see if he would write up these two studies. At a minimum, a summary document was requested.

A general discussion followed concerning how best to get power point presentations published in order to get the information out to the public. Tom Young explained the process the Forest

Vegetation Management Conference was going to try for the 2010 conference.

The next item of business was a discussion on the budget. The Co-op ended 2008 with a surplus of \$11,541.62. Dues for 2009 have been reduced by 50% due to the current economic conditions. Tentatively this reduction is only for 2009. This matter will be revisited in the fall of 2009. Dues for 2009 received at the time of this meeting totaled \$21,000 with \$4,000 more promised. Bob Rynearson volunteered to contact the two members who have not paid their 2009 dues as of yet. To supplement the summary of the 2008 budget found in the Annual Report, spread sheets of the proposed budget/workload for 2009-2013 and the co-op manager's time/contract costs through the same period were presented to the membership. Three options were included: 1. dues reduced by 50% in 2009 and then returned to normal for 2010; 2. dues reduced by 50% for 2009 and 2010 and then back to normal; and 3. budget status if the write-up for the Stock Type Fertilization or Slow Release Fertilization studies (only one of the two) were done by the manager. A general discussion concerning budget matters followed.

A discussion on the desirability of a field trip for 2009 followed the budget discussion. The membership decided to have a field trip on June 10th with the main focus of the trip being the Elliot Ranch Plantation near Auburn, CA. Other stops will be added to round out

the day. One possibility would be Tom Lanini's study on competition/conifer survival which the Co-op help fund. Gary Nakamura volunteered to contact Tom to see if he could make a presentation to the membership. If anyone who took pictures on our 2008 field trip would forward them to Bob Powers, he will consolidate them and send them out to all paid members of the Co-op.

Following the discussion on the field trip, updates on three recently funded Co-op studies were presented. Mark Gray reported on Proposal 07-01 Glyphosate/Evergreen Brush; Jason Warshawer on Proposal 08-02 Cedar Trials; and Alice Ratcliff on Proposal 03-01 Agenda 2020.

Weather conditions prevented installation of the May, June, and July treatments on the glyphosate study. These treatments will be applied in 2009. The August and September treatments were applied as scheduled. All base line data were collected in September. A complete summary of the study progress to date is included in the 2008 Annual Report. Plans are to install another replication of the study on a second site on Sierra Pacific Industries lands in 2009.

The cedar stock trials will probably not be outplanted until the spring of 2011 due to sowing schedules at nurseries. So far there is just one site for the study – Ponderosa on Roseburg Resources lands northeast of Burney, CA. A discussion followed concerning how to hold ground, free of competing species, until 2011 if that ground has already been harvested. Jason is looking for other sites in order to replicate the study.

The final update was for Agenda 2020. A complete summary of the progress on this study is included in the 2008 Annual Report. Plans were to measure shrub cover and N fixation rates on both the Dana and the Big Bend sites in 2008. The shrub cover was measured as scheduled. Because of the scarcity of ceanothus and manzanita at Dana and manazinita at Big Bend, the decision was made not to measure N fixation rates. A discussion followed as to where to go from here with this study. Plans are for Bob Powers and Jason Warshawer to visit the Big Bend site as soon as possible. Following this site visit, a decision will be made as to how to proceed with the study. In the mean time, Roseburg and Sierra Pacific will treat the "complete vegetation control" plots on their respective sites this spring in order to keep that treatment viable.

Following the updates on funded proposals, new proposals were presented to the membership. The first proposal, with a title of "Competition and Productivity in Mixed vs. Single-Species Plantations", was presented by Rob York, Manager of Blodgett State Forest. The complete proposal is available at the Co-op's Redding office. Clarification on the proposed budget request for \$31,518 indicated that this sum would fund the remeasuring of the plots on Blodgett. Rob would like to replicate the study at other sites. Two clearcuts of between 15-20 acres each would be needed at each new site. Any site established on Co-op members' lands would require additional funding. A discussion about other possible sources of funding followed Rob's presentation. The decision was made by the membership and agreed to by Rob that he would develop a more specific plan

for establishing study sites on Co-op members' lands and would submit this revised proposal to the membership for possible funding. Some specific items that need to be addressed include species mix, number of species, and costs.

The next new proposal, titled "Reevaluating Maximum Stand Density of Ponderosa Pine Stands in the Southern Cascades and Northern Sierra Nevada", was presented by Jianwei Zhang of the Pacific Southwest Research Station in Redding. The complete proposal is available at the Co-op's Redding office. Members present at the April 1st meeting recommended this proposal be sent to the voting membership for funding approval. If the membership approves the proposal for funding, it will be funded in 2009 if 2009 dues are sufficient to cover it. Otherwise this proposal will be funded in 2010.

The final item on the agenda was an open discussion on the members' expectations concerning the Co-op. Was the Co-op meeting these expectations? If not, what improvements could be made? A common response from

several members was to the effect that the Co-op should concentrate on more applied, practical studies rather than so many scientific studies. These latter studies seem to tie up large amounts of funds over several years and don't leave any funds for the simpler, short-term studies. More trials like the glyphosate study and the cedar stock trials are needed. Another member commented that the Co-op needs to be more selective on peer-reviewed studies – everything doesn't need a paper published in a journal. Less formal studies should require just a simple write-up or summary paper.

As to the question whether the Co-op should continue to exist, the membership was unanimously in favor of continuing the Co-op. One member commented that the Co-op was the only way to get this type of research work done on members' holdings. Another member stated that more work of the type done by the Co-op was needed as long as there was a good balance between practical vs. scientific studies.

The meeting adjourned following this discussion.

**Sierra Cascade Intensive Forest Management Research Cooperative Proposal 03-01
Agenda 2020**

Principal Investigator: Bob Powers

**Title: An Experiment to Evaluate the Competitive and Ecological Effects of Understory
Vegetation on the Productive Potential of Young Douglas-fir Plantations**

Executive Summary:

As a follow-up to the January 13, 2003 Co-op meeting at which the Agenda 2002 proposal was accepted as a Co-op project, the membership was contacted in order to get suggestions on possible sites for the study (originally the first site was going to be located on Boise Cascade lands but the site nominated was not selected). In response to this request, two companies, Roseburg Resources (Ed Fredrickson) and Sierra Pacific Industries (Mark Gray) offered possible sites.

The Roseburg site consisted of two clearcut blocks located east of Redding near Big Bend. The stands had been harvested in the summer of 2003 and the additional site preparation required for implementation could be done in the fall. The stands harvested were high-site mixed conifer and the topography was almost flat. There were no restrictions on either of the blocks that would hinder the installation of the study. After two confirmation visits the Roseburg blocks were selected as the first Agenda 2020 site.

The SPI site was located northeast of Burney near the intersection of Highway 89 and the Dana Cutoff road. This site consisted of a single block that was scheduled for harvest in the fall of 2003. The stand was mixed conifer growing on a good site. Topography was flat. As

with the Roseburg site, there were no restrictions on this stand that would hinder installation of the Agenda 2020 study. This block was chosen as the second site for the study

As of December, the Roseburg site has been harvested and site preparation has been completed. The SPI site has been harvested with site preparation to follow in 2004. The goal is to install the Agenda 2020 study on both sites during the same time period. Plot layout is scheduled for summer of 2004 with planting to be done in the spring of 2005.

Tom Jopson (Cal Forest Nurseries) has started the collection of manzanita cuttings in order to raise the seedlings (root cuttings) of this species that will be needed for the study. The ceanothus seedlings will be raised from seed that Tom has ordered from the Lawyer Nursery. Both shrubs will be raised by Cal Forest at their Etna, CA. location.

2004: Site preparation was completed on the Sierra Pacific Industries site during the summer of 2004. Plot layout on both sites was completed by September. Some changes were made to the original proposal prior to plot installation. Conifer spacing was changed from 12x12 to 8x8 feet resulting in 168 trees per plot. Of these

168 trees, 80 are measure trees. There will be a total of 8736 seedlings (4368 pine and 4368 Doug-fir) planted per site. There are thirteen treatments replicated four times per site. This makes a total of 52 plots per site. Contracts for marking the planting spots at both sites were let during November. The conifer seedlings for this study are being raised at Cal Forest Nursery. Ceanothus seedlings are growing at Cal Forest Nursery, also. Nursery crews collected plant material in November from the sites in order to start raising the manzanita plants required by the study. The treatments will be installed in the spring of 2005 as originally planned.

2005: The Dana site was planted on March 31. Weather was clear with a slight breeze. Planting started at 6:30 and was completed by 10:00. All planting was done using hoedads. Fourteen planters and one foreman along with two Sierra Pacific Industries inspectors accomplished the planting. The Douglas-fir were Styro 8 stock from Cal Forest Nurseries, 4500 foot elevation, seed zone 521. The ponderosa pine were Styro 6 stock from K & C Silviculture, Oliver, BC.

The two Roseburg sites were planted on the morning of April 1st. It was partially cloudy with no wind. All planting was done with hoedads. Thirteen planters and one foreman along with two Roseburg Resources inspectors accomplished the planting. The Douglas-fir seedlings were Styro 8 stock from Cal Forest Nurseries, 3000 foot elevation, seed zone 521. The ponderosa pine were also Styro 8 stock from Cal Forest Nurseries, 3200 foot elevation, seed zone 521.

In July, the plots receiving complete vegetation control were treated with a directed spray application using Roundup. Both the SPI and Roseburg sites received this treatment. The ceanothus species being raised at Cal Forest Nurseries for outplanting at the two sites are doing fine.

All attempts to raise manzanita have failed. Another attempt will be made in the spring at the height of the flowering season.

2006: Because of poor survival on the Dana Site, the half of the plot originally planted with Douglas-fir was replanted in the spring of 2006. At this time each planting spot was double planted with a white fir. This replanting was applied to all plots on the site.

In April, the plots receiving complete vegetation control, the fertilization treatment and those plots having some level of either manzanita or ceanothus stocking were treated with 4#/a atrazine applied with a pressurized broom. Both sites were treated at this time. In June these same plots received a directed spray application of 5% Buccaneer mixed with 5% Hasten.

On the Dana site, stocking of manzanita is still a problem. As we are still having no success raising this species, attempts will be made in the spring of 2007 to transplant wild seedlings, taken from the buffer around the plots, into the plots requiring manzanita. Other sources may have to be used to supplement the supply of seedlings if there are not enough seedlings in the buffer.

During 2006, two tours were conducted at the Dana site. A stop on the Weed

Tour of the California Pest Council took place in July; and a tour for faculty from Oregon State University was conducted in the fall.

2007: All release treatments were applied on schedule during the spring on both sites. This consisted of manual release on the Dana site and herbicide release on the Big Bend site. Survival of the fir component is still unsatisfactory despite two replants on the Dana site. The pine component is acceptable. The fir component on the Big Bend site suffered major mortality during 2006 and fir stocking is now marginal. As with the Dana site, the pine component at Big Bend is acceptable.

Another attempt was made in the spring to increase the population of manzanita in the plots at the Dana site. This attempt involved transplanting of freshly lifted wild seedlings harvested within a couple of miles of the study site. Planting weather was ideal with rain occurring before and after the planting. Despite careful lifting, storage, and planting, only about 10% of the seedlings survived the summer. Previous attempts have involved trying to raise seedlings at Cal Forest Nursery from seed purchased from dealers and from cuttings (harvested in the spring and in the fall from areas adjacent to the study site). To date, there has been little success with the attempts to raise manzanita seedlings.

In November a crew from PSW inventoried the amounts of brush on the plots at the Dana site. The Big Bend site will be inventoried in 2008. Plans for 2008 include measuring the amounts of nitrogen being taken up by the two species – manzanita and ceanothus – to

determine any differences in nitrogen fixation between the two species.

2008: Funding support was given to Matt Busse (PSW Redding) to measure shrub cover and N fixation rates on all plots on both the Dana and the Big Bend sites. The shrub covering was measured on both sites in summer 2008, the third growing season after tree planting.

Shrub cover measurements from Dana (Figure 1) confirm the poor performance of shrubs across all treatments. Because of the scarcity of ceanothus at Dana, the decision was made not to measure N fixation rates.

Ceanothus cover at the Big Bend site (primarily whitethorn) ranged from 30 to 50 % on plots designed to retain N-fixing shrubs (Figure 2). However, manzanita cover was conspicuously low, which precludes the ability at present to assess the competitive difference between scrub species.

2009: At the Annual Meeting held April 1, 2009 an update on the status of the Agenda 2020 study was presented to the Co-op membership. A discussion followed as to where to go from here with this study. It was decided that Bob Powers and Jason Warshawer would visit the Big Bend site as soon as possible. Based on the results of this visit, recommendations would be made to the membership as to how to proceed with the study. This site visit was made on April 22nd. Following this visit the decision was made by the Executive Committee to continue with the study with hopes that the manazinta at both sites and the ceanothus at the Dana site would eventually reach the cover percentages needed to meet study

objectives. The “complete vegetation control” plots on both sites were treated in 2009 in order to keep that treatment viable. No other plots were treated at Dana. The manzanita plots were not treated at Big Bend, but the ceanothus plots had sufficient cover to meet the study objectives. Several of these plots had more ceanothus cover than was called for in the study. The decision was made to bring the ceanothus plots to the cover percentages outlined in the study plan. This was done by matching existing plots with desired treatments. After this was done, the remaining plots required removing some of the ceanothus in order to match these plots with desired treatments. The ceanothus to be removed in these latter plots was designated with marking paint by Co-op members in October and November. A

contract was let with Forest Protection from White City, Oregon to remove the surplus ceanothus. The work was done on December 2nd and 3rd. Surplus brush was severed at ground line with chainsaws and Garlon 3A or Garlon 4 was applied to the cut surfaces immediately after cutting. This contract was financed from the \$3400 originally set aside to do the N fixation rates.

The plan is to re-assess the cover of ceanothus in the treated plots next spring to determine how close these plots are to meeting study targets. Hopefully the original study plans can continue on the Big Bend ceanothus plots at the same time giving the plots at Dana and the manzanita plots at Big Bend time to develop the shrub stocking needed for the study.

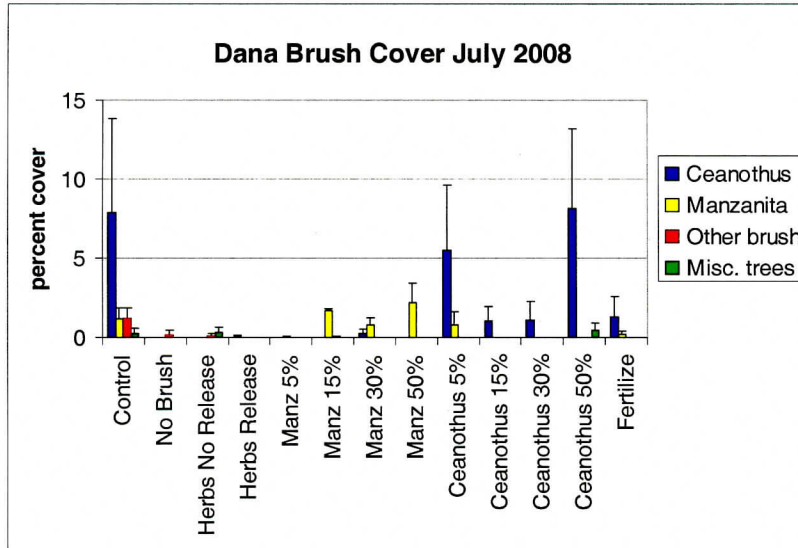


Figure 1.

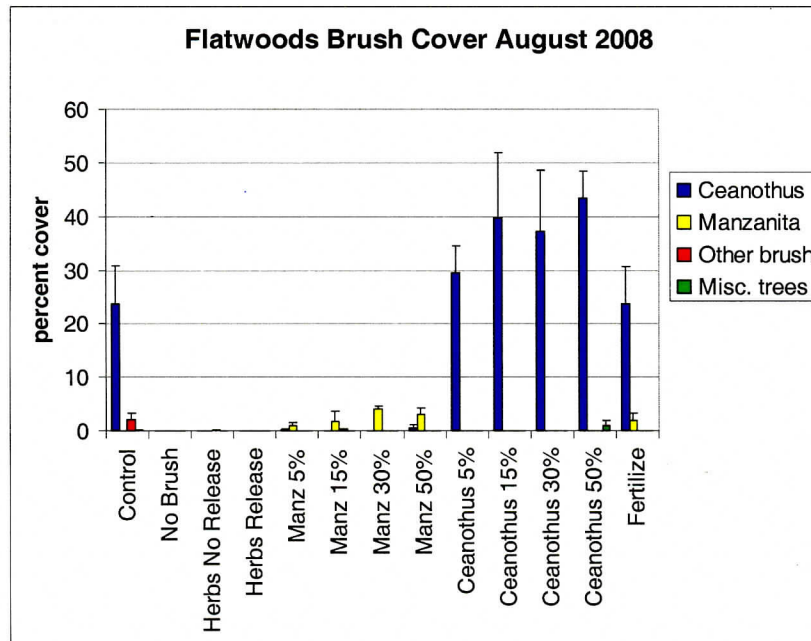


Figure 2.

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 07-01, Glyphosate Control of Evergreen Brush

Principal Investigator: Mark Gray

Title: Investigating the Efficacy of Glyphosate for Control of Evergreen Brush Species

Year Funded: 2007

Executive Summary:

Glyphosate has been used effectively for control of many common weed species that infest conifer plantations.

Treatments of evergreen species have historically had mixed results. Recent price reductions, due to the Roundup patent expiration, have renewed interest in developing effective treatment regimes for these harder to control species. Operational experimentation indicates control of manzanita, snowbrush, chinquapin, and tanoak is possible with various glyphosate/surfactant combinations and, conversely some attempts result in poor control. Is the variability in control a function of timing, material applied or a combination of factors? A more controlled investigation of the treatment parameters would provide better guidelines for this promising application.

The stated purpose of this study is to determine the optimal rate of application of various glyphosate formulations for control of manzanita, chinquapin, snowbrush and brush-form tanoak. Additional purposes include determining surfactant superiority and the best application timing for each target pest.

Several sites on industrial timberlands that contain adequate populations of the target species will be selected.

Treatments to be studied will include: 5% glyphosate, 5% oil; 10% glyphosate, 5% oil; 5% glyphosate, 5% sylvac; 10% glyphosate, 5% sylvac; and an untreated

control. All vegetation will be treated with a directed foliar spray.

Operational-size test plots will be 1 acre in size. Each study site will require 21 one acre plots. Treatment timing will be once a month starting in May and concluding in September (5 treatment dates). Base line data will be taken in the control plots prior to applying the other treatments. Crown reduction of the target species will be determined at the end of the second growing season after treating.

2008: The first site chosen for the study was located on Sierra Pacific Industries land near McCloud, California. The site was a conifer plantation about ten years old that contained a good compliment of the target brush species. The planted conifers were taller than the adjacent brush. Brush species present included manzanita, rabbit brush, snowbrush, current, bitter cherry, and chinquapin. Plots were laid out in August and base line data from the control plot was collected in September. Shrub data was collected using the line intercept method. The control is very representative of the plantation as far as amount of competing shrubs. This plot had shrub foliar cover of 53%. The August set of treatments were applied August 15th; the September set on September 25th. Weather conditions prevented installation of the May, June, and July treatment sets. These treatments will be applied in 2009.

2009: Final plot layout (Figure 3) and the May, June, and July treatment applications were completed by July, 2009. The primary study objective is to evaluate the effectiveness of the treatments, through the quantification of crown reduction of the target species, two growing seasons after treatment. Therefore all treatments will be evaluated at the end of the 2010 growing season and compared to the control plot.

The study site was one of the featured stops on the 2009 Weed Tour.

In addition to the Ski Park site, plans are to install another replication of the study on Sierra Pacific Industries lands. An area near Indian Springs is a possible location. Additional replications could be installed on lands of other Co-op members if desired.

Ski Park Hwy

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	18	17	20	19	21
10%Gly,5%Oil June 09	5%Gly,5%Syl May 09	10%Gly,5%Syl May 09	5%Gly,5%Oil June 09	10%Gly,5%Oil Aug 08	5%Gly,5%Oil Sept 08	5%Gly,5%Syl Sept 08	10%Gly,5%Oil Sept 08	10%Gly,5%Syl Sept 08	5%Gly,5%Oil May 09	5%Gly,5%Syl June 09	Control	10%Gly,5%Oil May 09	10%Gly,5%Syl Aug 08	5%Gly,5%Syl Aug 08	5%Gly,5%Oil Aug 08	10%Gly,5%Syl June 09	10%Gly,5%Syl July 09	5%Gly,5%Oil July 09	10%Gly,5%Oil July 09	5%Gly,5%Syl July 09

SCIFMRC
Glyphosate Study

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 09-01 Stand Density Index Study

Principal Investigator: Jianwei Zhang

Title: Reevaluating Maximum Stand Density of Ponderosa Pine Stands in the Southern Cascades and Northern Sierra Nevada

Year Funded: 2009

Executive Summary:

Starting in 1944 and continuing through 1991, permanent plots in ponderosa pine and Jeffrey pine stands were established by U.S. Forest Service research scientists from the Pacific Southwest Research Station, personnel from the Pacific Southwest Region (R5), and researchers from the former Weyerhaeuser Company across northeast California. The common purpose of the original plot establishment was to determine the growth and yield of even-aged ponderosa pine or Jeffrey pine plantations in the region, although the specific objectives might vary for each installation. Therefore, these plots test various management treatments (Table 1). Some were studied for optimal stand density for conifer growth. Some were studied for the effect of understory vegetation control, with no, partial, and/or complete control of competing vegetation. Others plots, which were usually not replicated, were established for the purpose of constructing a yield table. Most studies were established in plantations ranging in age from 0 to 77 years at the time of plot establishment. Eleven plots were in natural stands ranging from 42 to 87 years old.

In 1995, Bill Oliver, a former Principal Silviculturist at the Pacific Southwest Research Station examined a self-

thinning rule in even-aged ponderosa pine stands using these growth and yield plots. The self-thinning rule describes a relationship between size and density of organisms including even-aged plant populations. Because the slope of relationship was found to be $-3/2$ by Yoda et al. (1963), it is also called the $-3/2$ power rule or "Yoda's law." While ecologists were celebrating this discovery, people found that a forester had introduced the rule for forest stands 30 years earlier (Reineke 1933). He called it Stand Density Index, which is calculated:

$$SDI = TPA * (D/10)^{1.605}$$

Where: TPA = number of trees per acre, D = average stand diameter at breast height (quadratic mean diameter) in inches. Note that Reineke used a slope for the maximum stand density line of 1.605. A slope of 1.77, however, has been found to be a better fit for ponderosa pine data in this region (Oliver and Powers 1978, DeMars and Barrett 1987).

Applying the principle of "Reineke's stand density index (1933)", Oliver found that self-thinning started when stand density index reached 230, "as the beginning of a zone of imminent bark beetle mortality" and significant mortality occurred when SDI reached 365. This value was well below the

maximum SDI of 500 used in Region 5 or 429 used in Region 6 for the Forest Vegetation Simulators. However, Oliver (1995) argued that a SDI of 365 was the result of increased bark beetle activity during contemporary drought. Conventional self-thinning rules only included inter-tree competition as a cause.

Recent reviews of maximum stand density index for ponderosa pine in northern California based on the latest measurements on plots from 2004 to 2007 indicated that maximum SDI could have been higher than 365 as Oliver (1995) proposed. The proposal was to remeasure all the plots used in Oliver's paper (1995), add some plantation data available from California, and incorporate this new data into an analysis. An objective of this 2009 study is to determine whether Oliver's limiting SDI of 365 is still valid after 20 years of stand development.

2009 Measurements: Starting in 2000 and continuing through 2009, tree diameter and mortality on 121 of the plots listed in Table 1 were remeasured and quantified. The bulk of these plots were measured in 2009. Since the majority of these plots were established around 1970, these remeasurements represent 40 years of growth data. DBH was re-measured and mortality and overall condition noted for the trees in 40 plots located at 12 sites in 2009, 20 plots in the Initial Spacing Study at Challenge Experimental Forest in 2007, 60 plots at 3 sites in 2005, and one plot at Dockwell in 2000 (Table 1). Previous measurements usually included dbh and tree condition for all trees in the plot and total height and height of live crown for 25-100% of the sampled trees in the plot.

Inventories were usually conducted at five year intervals following plot establishment. The plots at Adin Pass, Antelope Mountain, Dockwell, Edson Creek, Hog Lake, Jelly Camp, Joseph Creek, Show Plantation, Sugar Hill, and Washington Mountain were established by Region 5 personnel and later transferred to PSW. Plots at KC Reservoir, Prattville, and Spaulding Butte were established by Weyerhaeuser researchers and transferred to PSW after the company terminated the project in 1987. With the exception of the Blacks Mountain Experimental Forest plot which was established by other PSW scientists, the rest of the plots were established by William Oliver. The plots have been appropriately maintained and each tree is numbered with a metal tree tag.

Preliminary results (a paper reporting these results can be found at the PSW office in Redding) indicated that stands at all sites, if not in all plots, experienced mortality (Table 1, Figure 1). The SDI reached over 200, close to the SDI value of 230 defined as the threshold for a zone of imminent bark beetle mortality, in at least one plot at each site suggesting that all plots should be included in the analysis.

After adding the 2000-2009 data, it was found that many plots exceeded the limiting SDI of 365 established by Oliver in 1995 (Figure 1). The SDI in some plots reached as high as 579 and yet massive mortality has not occurred in these plots. Size-density trajectories seem to have topped off when the stand SDI reached 500 in many plots.

Since Oliver felt the SDI value of 365 was a result of increased bark beetle

activity during contemporary drought, the size-density trajectories were re-analyzed after eliminating the plots in which at least 25% of the trees were Jeffrey pine. This species is not as sensitive to bark beetles as ponderosa pine (Figure 2). It was found that only a few plots passed over the SDI value of 365 at Antelope Mountain, Challenge, KC Reservoir, and Prattville. Only one plot at Challenge showed mortality after exceeding the 365 value. Preliminary results indicated that all plots that exceeded a SDI value of 365 are plantations. The natural stands did not reach this line because of slow growth (Adin Pass) or heavy mortality (Edson Creek).

Values higher than 365, without heavy mortality, can be explained by bark beetle absence in the plots at Prattville and Challenge. The heavy mortality occurred due to normal competition in the high density plots when the SDI reached 500 at both sites. More interesting, it was observed that trees were killed by bark beetles in natural stands at Challenge but this type of mortality was not observed at the Prattville site.

There is no complete explanation for the heavy mortality on one of the plots at Antelope Mountain. This mortality was caused by both competition and bark beetles. Despite this heavy mortality, the SDI is still 572. The SDI for this plot was 584 in 1991 (plot establishment) and 637 in 2002. This is a very small plot (0.19 acre) and is surrounded by a treated stand and a road. These trees might not be influenced by the high SDI, as would have been expected, due to edge effect of the surrounding stands.

Plans are to measure additional intensively managed plots and natural stands. With additional funding or through in kind contributions, the Garden of Eden sites at Chester, Pondsosa, and Jaws will be remeasured in 2010 and the resulting data, along with data from Levels of Growing Stock plots at Blue Mountain and Lookout Mountain which were remeasured in 2009, will be included with our data analysis. A hypothesis that plantation trees with early intensive management will grow at higher SDIs without mortality could be tested on plantations established on forest industry lands.

Table 1. Geographic information, site index, stand history, and plot characteristics of ponderosa and Jeffrey pine established in the past across northeast California.

Location	No. plots	Site index	PIPO/ others	Lat. (N)	Long. (W)	Elev. (ft)	Stand History	Establishment year			Latest measurements			Max. SDI at site	
								Year	TPA	QMD	Age	Year	TPA		QMD
Adin Pass	1	70	100:0	41.21	120.56	5200	N	1957	122	6	61	2009	109	14.4	207
Antelope MT	4	90-105	mixed	40.34	120.56	6000	P	1991	156-518	10.7-15.9	64	2009	62-396	12.3-21.3	572
BMEF	1	72	0:100	40.44	121.08	6000	N	1957	700	2.2	55	2009	600	8.2	425
Challenge	20	120	100:0	39.28	121.13	2650	P	1968	122-1212	0	3	2007	101-1010	6.0-16.1	501
Dockwell	1	85	100:0	41.39	121.42	5200	N	1968	160	9	42	2000	150	15.4	321
Edson Creek	3	130	100:0	41.2	121.56	3900	N	1972	41-66	18.1-19.3	87	2005	39-49	26.7-28.6	314
Elliot Ranch	15	120	100:0	39.04	120.45	3880	P	1969	68-548	7.0-10.0	20	2009	18-108	17.5-33.9	428
Hog Lake	1	65	99:1	41.35	121.03	4900	N	1944	256	6.5	61	2009	194	13.8	345
Jelly Camp	1	60	26:74	40.48	121.16	5400	N	1962	203	7.5	77	2009	192	12.4	281
Joseph Creek	3	55-75	100:0	41.37	120.2	5600	N	1974	184-283	7.5-9.5	62	2009	72-111	13.9-16.8	328
KC Reservoir	1	105	98:2	41.18	122.17	4000	P	1972	242	9.8	35	2009	163	18.1	465
Prattville	3	90-110	100:0	40.12	121.11	4700	P	1971	100-433	4.2-6.2	15	2009	100-342	13.1-16.9	579
Show Plantation	3	130	100:0	41.19	121.59	3900	P	1972	60-156	13.4-17.8	53	2005	51-90	20.4-25.8	332
Spaulding Butte	3	70-80	mixed	41.32	121.09	4650	P	1972	268-525	4.2-5.6	52	2009	92-256	11.7-14.0	337
Sugar Hill	6	75-85	mixed	41.5	121.18	5400	P	1958	43-300	5.5-7.8	27	2009	43-300	12.7-23.0	489
Trough Spring	54	80	100:0	39.17	122.4	4200	P	1970	193-1193	0.9-1.9	11	2005	193-1120	3.4-10.1	339
Washington MT	1	65	100:0	41.28	120.58	5200	N	1963	120	7.5	42	2009	109	14.6	213

Stand history: N = natural stand; P = plantation.

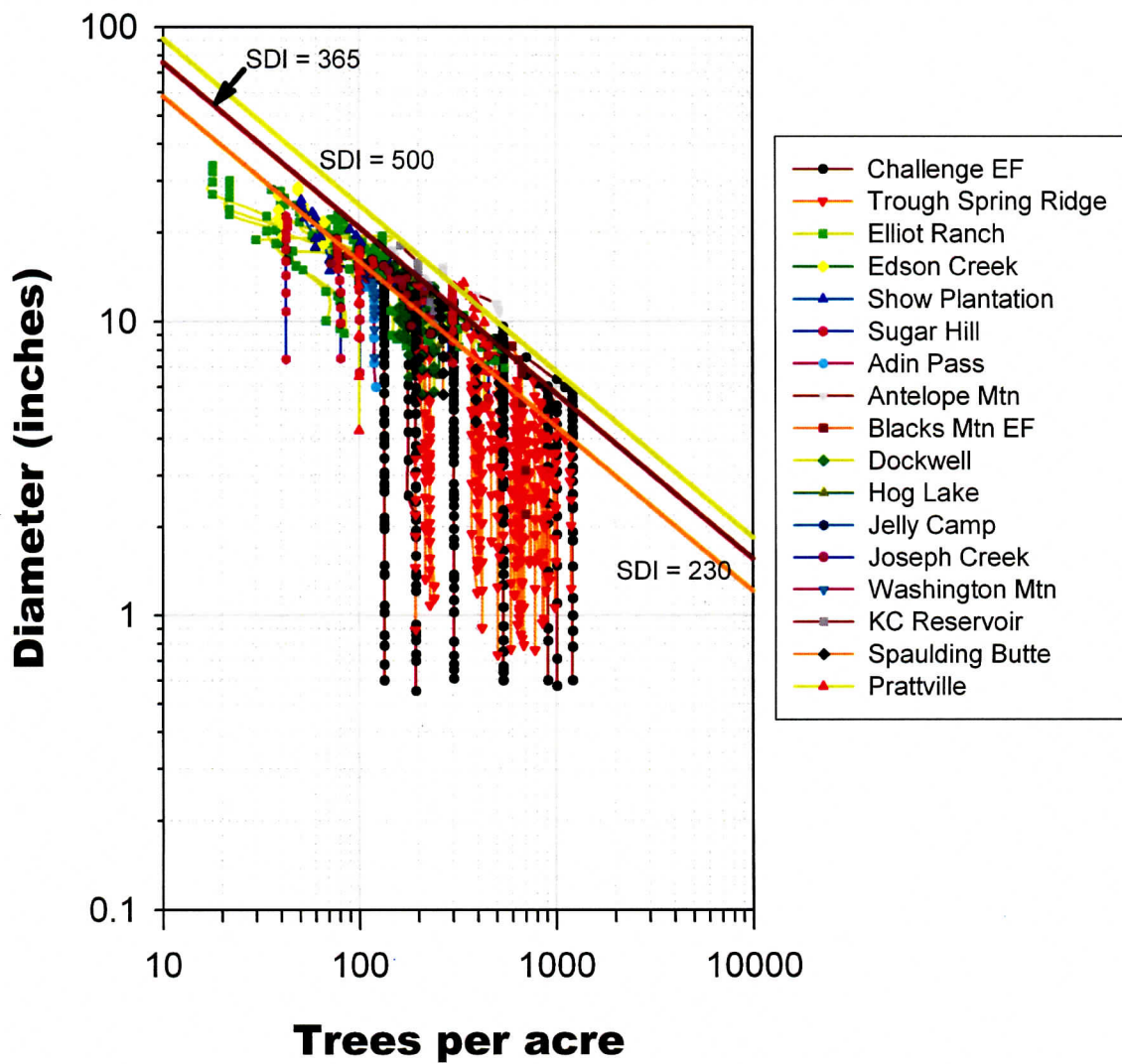


Figure 1 – Size-density trajectory based on 121 ponderosa pine and Jeffrey pine plots across northeast California. The three lines are when SDI= 230, defined as a threshold of the zone of imminent bark beetle mortality, SDI=365, a limiting SDI and SDI=500, a line which characterizes the current data in the figure.

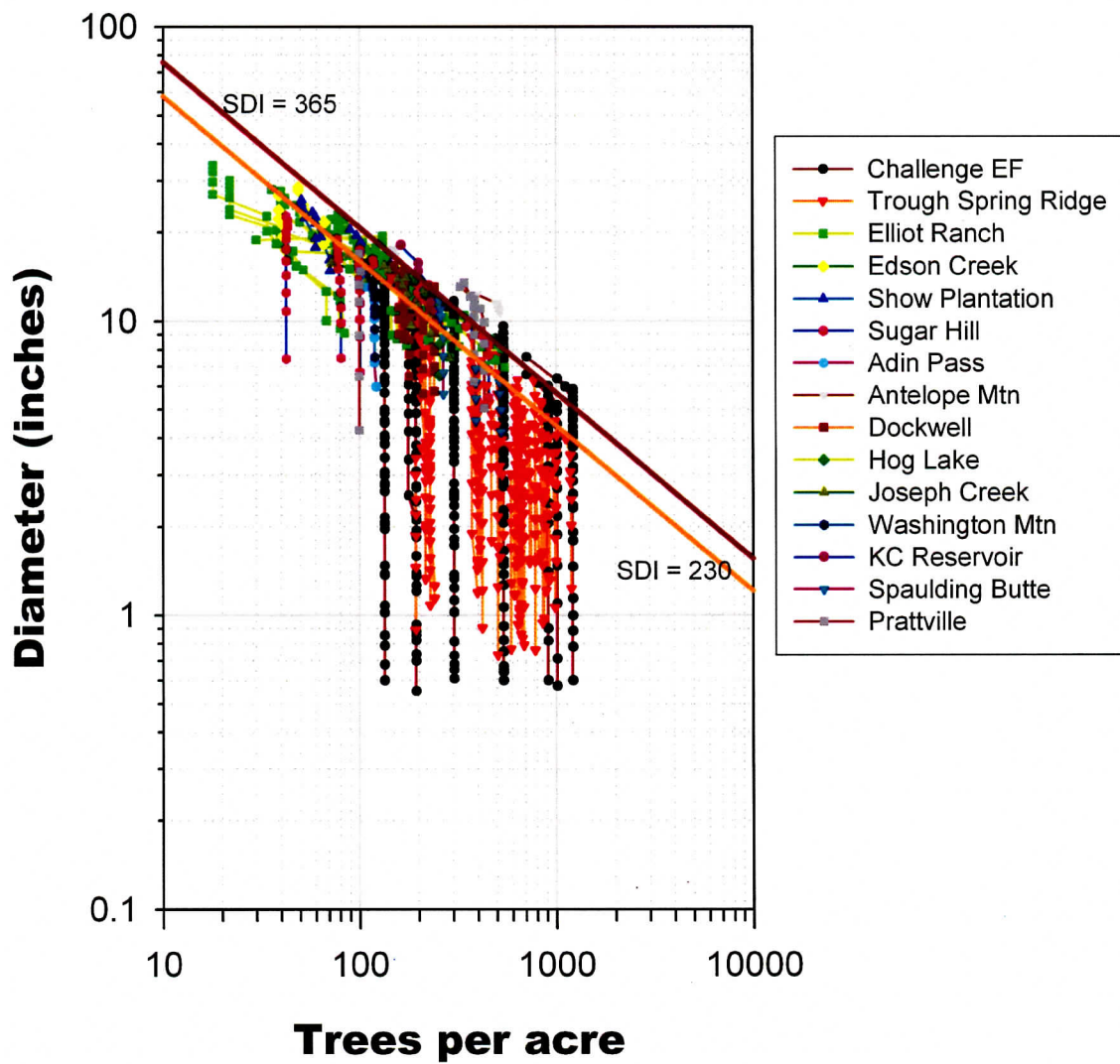


Figure 2 – Size-density trajectory based on only ponderosa pine plots across northeast California. The three lines are when SDI= 230, defined as a threshold of the zone of imminent bark beetle mortality, SDI=365, a limiting SDI.

**Sierra Cascade Intensive Forest Management Research Cooperative Proposal 08-02,
Incense Cedar Stock Type Trials**

Principal Investigator: Jason Warshawer

Title: Improving the Establishment and Growth of Incense Cedar on Dry Sites Through Stock
Type Trials

Year Approved: 2008

Executive Summary:

To help address a lack of knowledge concerning growing cedar - in nurseries as well as after out-planting - as a component species in conifer plantations, a study was proposed in 2008 to determine the principal contributions of stock type to incense cedar (*Libocedrus decurrens*) and sugar pine (*Pinus lambertiana*) survival, early growth, and total above-ground biomass on dry sites in the interior Sierra Cascade region of northern California and southern Oregon under vegetation free conditions. The study will also provide information on effects of time of sowing on seedling performance. Sugar pine was dropped from the trials for the time being at the annual meeting of the Co-op in March, 2008.

Planting sites on lands managed by Co-op members Sierra Pacific Industries, Roseburg Resources and possibly Silver Butte Timber Co. were proposed for the initial installations of the study.

The study will include stock types Styro 5, 8, 10D, and 15; bare root 1-0 and 1-1; and plug-1. The styro stock types will have three periods of sowing: April, May, and June. This results in 15 treatments which

will have 4 replications at each site. Plot size is 72'x72' per replication with 60 plots per site. Planting spacing will be 8'x8' resulting in 81 seedlings per plot. The center 25 seedlings will be measure trees with in-plot buffering of two rows of seedlings receiving the same treatment. Each site will require 7 – 8 acres for installation.

Caliper and height will be taken pre-planting and at the end of the fifth growing season. Survival will be monitored annually at the end of each growing season.

2009: The initial installation of the study will be on Roseburg Resources land. One thousand Stubby 4's were grown at Cal-Forest Nursery in Etna, California for the plug-1 stock type and will be transplanted in the spring of 2010 at IFA's nursery in Elkton, Oregon. Two thousand bare root seedlings were grown at the IFA nursery in Canby, Oregon for the 1-1 stock type and will be transplanted in the spring of 2010 at the IFA nursery in Elkton. The seedlings for the 1-0 stock type will be grown in Canby. Seed for the Styro 5, 8, 10D, and 15 stock types will be sown in April, May, and June

of 2010 at Cal-Forest Nursery for the 2011
spring plant.

Hopefully more installations of this study
will be initiated, as was originally planned,
in 2010.

Sierra Cascade Intensive Forest Management Research Cooperative
Income/Expense Statement
Calendar Year Report for the Period Jan. 1 to Dec. 31, 2009

Beginning Balance on January 1, 2009		\$11,541.62
Total Income (Membership Dues)		\$27,000.00
Expenses:		
SDI Proposal	\$5,000.00	
Agenda 2020	\$301.41	
Co-op Manager Expenses	\$26,320.00	
Total Expenses		\$31,621.41
Year End Balance as of December 31, 2009		\$6,920.21

WORKING GROUP MEMBERSHIP

Working Group I

Seed to Establishment

Tom Jopson, Chair
Bob Amesbury
Mark Gray
Lewis Howe
Bill Morrison
Bob Rynearson
Tom Young

Working Group II

Out-planting through Precommercial Thinning

Jason Warshawer, Chair
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