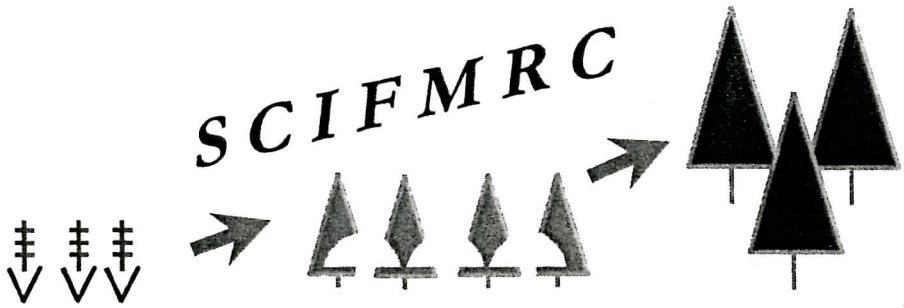
Sierra-Cascade Intensive Forest Management Research Cooperative

Series Report No. 12



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ANNUAL REPORT 2011

TABLE OF CONTENTS

The year 2011 marked the twelfth year as an organization for the Sierra Cascade Intensive Forest Management Research Cooperative.

Membership increased with the addition of one new member. Dow AgroSciences joined the Co-op in the spring at the Affiliate Membership level. The current membership consists of a mixture of landowners, forestry-related industries, State of California and federal agencies. There are currently fifteen member organizations in the Co-op.

Changes in member representatives and the steering committee occurred in 2011. Bob Rynearson will no longer be on the steering committee. Mark Gray will be the sole industry representative on that committee. Scott Carnegie will replace Bob as the W.M. Beaty membership representative. Jianwei Zhang will replace Bob Powers as the PSW membership representative; Bob will remain on the steering committee. The retirement of Gary Nakamura opened up the university position on the steering committee. A replacement has not been selected.

Mark Gray presented results from the Glyphosate/Evergreen Brush Study (Proposal 07-01) at the Forest Vegetation Management Conference in January. His presentation was titled: "Investigating the Efficacy of Glyphosate for Control of Evergreen Brush Species". The presentation was well received by the audience and Mark included a "plug" for the Cooperative in his talk.

Working Group II met at the Roseburg Resources' office in Weed in March (a summary of this meeting can be found in this Annual Report). Seven new proposals were presented to the group by the authors. Following discussions on these proposals, five were selected to be presented to the general membership at the 2011 business meeting scheduled for April. These included three herbicide-related proposals, a proposal to investigate how freezing and sun scald effect mortality in young conifer plantations, and a proposal to remeasure the Co-op's Stock Type/Fertilization study (Proposal 00-04).

The annual business meeting was held at the Forest Service office April 13, 2011 in Redding (a summary of the meeting can be found in this Annual Report). Fourteen Co-op members and guests attended. The first item of business was a review of membership status and the budget. The Co-op ended 2010 with a surplus of $3,086. As previously decided, dues for 2011 were reduced by 25 percent; the manager's funding was reduced by 50 percent. Dues/funding will return to normal rates in 2012.

Following the discussion on the budget, updates on four recently funded Co-op studies were presented. Executive Summaries of three of these (Cedar Trials, Proposal 08-02; Milestone, Proposal 10-01; and Vista, Proposal 10-02) can be found in this Annual Report. The fourth one, Proposal 07-01 Glyphosate/Evergreen Brush was completed in 2010.

The final item of business at the annual meeting was the presentation of five new proposals for possible Co-op funding. The Co-op was able to finance four of these

proposals (Proposal 11-01, Sunscald; Proposal 11-02, GF9999; Proposal 11-03, Mat 28; and Proposal 11-04 Stock Type/Fertilization Remeasurement).

Spring treatments for the two herbicide studies approved in 2010 (Proposal 10-01, Milestone; Proposal 10-02, Vista) were applied in March and April respectively.

Seedlings for the cedar stock trial study (Proposal 08-02) were measured and then outplanted in May. The treatments for the sunscald study (Proposal 11-01) were also installed in May.

The Co-op hosted a field trip in June. Fifteen Co-op members, industry representatives, and guests attended. The field trip included stops at six Co-op study sites.

Instruments for collecting soil/weather information were installed on the sunscald study in July.

As decided by the membership at the annual meeting, the stock type/multiple species study that Roseburg Resources installed in 2007 in the Sacramento River canyon was measured for fifth year growth in September. Survival was recorded at this time. This study featured superior planting stock vs. nursery-run stock for Douglas-fir and ponderosa pine. Results will be presented to the membership at the 2012 annual meeting.

Also in September, two of the sites scheduled for remeasurement in the stock type/fertilization study were evaluated and remonumented. The results of this evaluation will be discussed at the 2012 annual meeting and a decision on how to proceed with this study made at that time.

Treatments for the two herbicide studies approved in 2011 (Proposal 11-02, GF9999; Proposal 11-03, Mat 28) were applied in mid-October. The sites will be planted in the spring of 2012. Survival counts were done on the sunscald and cedar trial studies in October/November.

The year 2012 should be another busy one for the Co-op. As of January 10, 2012, four new proposals have been submitted to the Co-op for funding consideration. Several funded studies will have final measurements made and other studies will have second year treatments applied. Based on the success of the 2011 field trip, another field trip featuring Co-op study sites should be planned for 2012.

20011 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
- Dow AgroSciences
- Silver Butte Timber Co.
- Thunder Road Resources

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 13, 2011

The 2011 annual meeting was held at the Forest Service office in Redding, CA on April 13, 2011. Fourteen Co-op members and guests attended.

The 2010 Annual Report was the first item of business. Membership status was discussed. All members from 2010 have either paid 2011 dues or indicated that dues payments are on the way. A new member, Dow AgroScience, has joined the Co-op in 2011. There are currently fourteen member organizations in the Co-op.

The next item of business was a discussion on the budget. The Co-op ended 2010 with a surplus of $3,086. As previously decided, dues were reduced by 25 percent for 2011. The expenses for the Manager were reduced by 50 percent as in 2010. Dues received for 2011 at the time of the annual meeting totaled $40,500. Another $4,500 has been promised. To supplement the summary of the 2010 budget found in the Annual Report, spread sheets of the proposed budget/workload for 2011-2015 and the Co-op manager's time/contract costs through the same period were presented to the membership. A discussion followed concerning dues for the near future. As in our discussions at the 2010 annual meeting, the membership was unanimous in the opinion that dues should return to normal levels (full dues) as soon as possible. The membership decided that full dues will be collected for 2012. The manager's funding will be increased to normal levels at this time.

A discussion of the desirability of a Co-op field trip for 2011 followed the budget discussion. The membership voted to have a field trip. Possible locations were brought up. Since the field trip for 2010 was not conducted, the locations planned for that trip could form the basis for the 2011 trip. These stops included four completed Co-op studies in Oregon near Prospect/Butte Falls – three on former Boise Cascade holdings and one on Silver Butte lands. Five year data are available for each of these studies. Another idea for the field trip was to base it around some of Ed Fredrickson's herbicide trials. Ed has at least eleven of these trials with 3+ years data. Another suggestion was a field trip centered around the True Fir Co-op plantations that are 25 years old. They were last measured in 1996. It was the consensus of the membership that a trip based on stops in the Pondosa area could feature some of Ed's plots, one of the True Fir Co-op study sites, A Garden of Eden site, and a PSW sub-soiling study site. A mid-June date was decided on by the members.

Following the discussion on the field trip, updates on four 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 Ed Fredrickson on

Proposal 10-01 Milestone and Proposal 10-02 Vista. An executive summary for each of these studies can be found in the 2010 Annual Report.

Following the updates on funded proposals, the meeting was opened up for general discussions of various items from the membership. Bob Rynearson will no longer be on the steering committee. Mark Gray will be the industry representative on the committee. Gary Nakamura is also leaving the committee. He will check with Rick Standiford and Rob York to see if one of them would like to be the university representative on the committee.

Scott Carnegie will be the new representative for W.M. Beaty replacing Bob Rynearson. Jianwei Zhang will replace Bob Powers as the representative for PSW. Bob will remain on the steering committee.

Tom Young wanted to know if the Co-op had any problem with precommercially thinning the Timmer/Jopson study site on Fruitgrowers' land. He is going to treat adjacent stands and would like to include the study site as all the area was planted at the same time. After discussion by the membership, the decision was made not to thin the study site but instead ask for proposals as to how the site could be used in other studies.

Jason Warshawer described one of his stock type/multiple species studies in the Sacramento River canyon that will have been planted for five growing seasons by the fall of 2011. He wondered if the Co-op would be interested in doing the fifth year measurements. The membership decided to do this and a budget will be worked up and presented to the membership for approval.

Ed Fredrickson asked the membership if it would be all right to combine the Co-op funded Aminocyclopyrochlor (Mat 28) study with similar studies he has installed for FSC. This would double the data base for this product. The membership could not make a decision on the issue at this time (an email was sent out on April 14th asking for a decision).

The next item discussed was led by Bob Powers and concerned a modification of the Co-op website. Bob demonstrated an example of how the website might function. The membership was in favor of making the changes necessary for this modification. Representatives from Sierra Pacific Industries and W.M. Beaty will determine if their systems can handle this much data and report back to the membership. A discussion was held at this time concerning the status of the progress reports/publications resulting from Co-op funded studies. To date fortyeight reports/publications have been generated by the Co-op. A list of these articles was distributed to the membership at the meeting. All of these articles will need to be included on the website when it is modified.

The next item of business was a discussion on the future of the Garden of Eden study. Bob Powers made a powerpoint presentation of the history of the sites that make up the GOE study and reported on some of the results this study has generated. Three options were presented for the study: discontinue; continue to measure; or harvest the existing sites, reforest, and test for carry-

over effects in the second rotation. The membership decided to entertain a new proposal at the 2012 annual meeting as to the future of the study.

After the general discussion was concluded, five new proposals were presented for possible Co-op funding. Zhang presented a proposal for remeasuring the Stock Type/Fertilization Study (Proposal 00-04). This would be nine growing seasons for this study. Warshawer presented a proposal for a study looking at sunscald and frost damage on Douglas-fir seedlings. Fredrickson presented three proposals for herbicide trials (Pindar, Mat 28, and GF 9999). After clarification questioning from the membership, it was decided that the new proposals would be emailed to the voting members for their decision as to which proposals should be funded. A quick turn around will be required in order to facilitate installation of some of the new proposals if they are selected for funding (an email to this effect was sent out on April 14th).

The meeting adjourned at this time.

Working Group II Meeting March 10, 2011

Working Group II met at the Roseburg Resources office in Weed on March 10, 2011. In attendance were Tom Young, Mark Gray, Ed Fredrickson, Bob Amesbury, Scott Worden, Darin McMichael, Ben Folgate, and Jason Warshawer (Chair).

If all current Co-op members renew their membership, the budget should have a surplus of about $25,000 to be applied to new research proposals in 2011.

Jason asked each attendee to list what issues they would like to see addressed with the available funds. Mark: herbicide trials, new chemistry, slash effects on long term results of plantations; Tom: good seedlings, site prep, chemicals, Doug-fir establishment, cooler/freezer storage; Bob: Doug-fir frost issues, ripping, slash lopping/gill poking, site prep residuals; Scott: herbicides, sugar pine in chemical trials; Darin: cedar issues, frozen stock studies (plugs); Jason: multiple-seedling stock trial in the canyon (fifth growing season in 2011) – should the Co-op remeasure the study this fall?

Jason's study on slash treatments might help answer Mark's question on slash effects on plantations. If the Co-op could get Tom Landis to make a presentation on recent developments in seedling handling and planting and frost issues, the issues of cooler or freezer storage of seedlings could be addressed as well as the implications of frost damage to seedlings. An approach to address Bob's concerns about ripping could be through a canvassing of Co-op members addressing who rips, success stories, etc. The Co-op could sponsor a field trip showing reforested sites with different approaches to residual management. This should lead to discussions about how residuals effect seedling growth.

Ed Fredrickson presented the new proposals he is submitting to the Co-op for possible funding. These include an "X" compound from DowAgro Science, Gallery/Pindar, and Mat 28 Site Prep. The Working Group members discussed these three new proposals and offered suggestions to Ed about possible changes in order to make them more useful to the membership. Ed agreed to make these changes and will submit the three proposals to the full Co-op membership at the April 13th meeting. Ed originally planned to submit two additional proposals to the Co-op (Mat 28 Release and Mat 28 Pre-harvest Site Prep) but after discussions at this meeting, decided to hold off on them for the time being.

Jianwei Zhang's proposal to remeasure the Stock Type/Fertilization Study was presented to the group. He will present his proposal to the full membership on April 13th.

Darin discussed the pilot study that was done in 2010 regarding thawing/time studies of Doug-fir. Originally it was planned to submit a proposal to the Co-op for funding of a replicated study to investigate this subject. Due to several problems on the pilot study (late planting season, browse damage, etc.) this study was put on hold for the time being. It will be revisited at a later time.

Jason then presented a proposal for a new study dealing with the causes of mortality in young plantations. How can the effects of freezing and sun scald be minimized? He proposes using several approaches to achieve this – shade cloth, tubes, powder such as that applied to walnut trees, bud caps, and netting. A discussion followed about the specifics of the study. Jason will present the revised proposal to the full membership on April 13th.

Jason closed the meeting after the discussion of the new proposals to be presented in April.

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 11-01
Sunscald and Frost Effects

Principal Investigator: Jason Warshawer

Title: Sunscald and Frost Effects on Douglas-fir Survival

Year Funded: 2011

Executive Summary:

In recent years, Douglas-fir has been increasing as a percentage of planted species in many of our plantations. Douglas-fir is one of the more difficult conifer species to get established. Minimizing the number of seedlings lost to mortality and the subsequent replanting costs represent the greatest opportunity for cost savings in establishing our plantations. The purpose of this study is to quantify the amount of mortality to planted Douglas-fir seedlings resulting from sunscald and/or frost. Imbedded in the study will be an investigation of the most cost effective ways to protect Douglas-fir seedlings from sunscald.

Planting sites on lands managed by Co-op member Roseburg Resources were proposed for the initial installations of the study.

Planting stock type will be Styro-8's. Planting spacing will be 8 feet by 12 feet. A replication will consist of 20 seedlings. Each treatment will be replicated four times for a total of 320 trees per study site. The four treatments include: sun protection with mesh screen/wire bracket, frost protection with plastic tubing, sun protection with calcium carbonate, and control.

Data collection will consist of survival exams conducted annually at the end of the growing season. These exams will be conducted for three consecutive years following initial planting.

A pre-harvest spray of 2% Chopper plus oil was applied in September of 2008. The study site was harvested in 2010. The site was single ripped in July and Velpar was applied in November of 2010.

2011: The study site was planted in May by Co-op members from Roseburg Resources and Thunder Road Resources. The treatments were applied immediately following planting by the same Co-op members.

This site was one of those visited during the Co-op field trip in June.

Instruments for collecting soil/weather data were installed in July. Sensors for collecting soil temperature were buried to a depth of 10 centimeters at five randomly located spots in the study site. Sensors to record air temperature were installed 12 inches above ground immediately adjacent to seedlings receiving the four treatments. There were nine of these sensors installed. The sensors located in the plastic tubing treatment were placed within the tube. Finally, two temperature-collecting stations equipped with radiation shields for the sensors were located at either side of the study site. The sensors at these stations were five feet above the

ground. All sensors have 2-hour recording intervals.

The calcium carbonate treatment had to be reapplied three times during the year due to rain washing the material off of the treated seedlings. Employees from Roseburg Resources did all of the reapplication work. Minor maintenance was required on the screen/wire bracket and plastic tubing treatments during the year.

Survival counts were done in late October/early November. First year survival ranged from 94 to 96 percent with no significant differences between treatments. There were numerous brown tips on seedlings in the plastic tubing treatment. Also, some terminal buds were clipped by wildlife in this treatment.

Second-year survival will be taken at the end of the growing season in 2012.

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 feet x 8 feet 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.

2010: Because of the wet spring, some changes were made in the nurseries that were to receive seedlings for transplanting. Instead of going from Cal-Forest (Etna, CA) to IFA at Elkton, Oregon as originally planned, the Stubby 4's were sent to the IFA nursery at Canby, Oregon for transplanting. Planting date was 4/26/10. The 1-1 stock type transplants from Canby were planted in Elkton on 6/16/10. The 1-0 stock type were grown at Canby and all Styro stock types were grown at Cal-Forest as originally planned.

Plot layout was completed in November. The study site is located near Pondosa on Roseburg Resources land in a new clearcut. The clearcut has been doubled ripped. Planting spots will be marked in early 2011 with planting to follow. Representative measurements for caliper and height for each stock type will be taken prior to out-planting.

Due to the wet spring, late planting dates, and less than ideal nursery practices, the 1-1's are poor representatives of this stock type. The 1-0's are small, averaging about 2 inches in height. Plug-1's look good. All stock will be frozen for the trial.

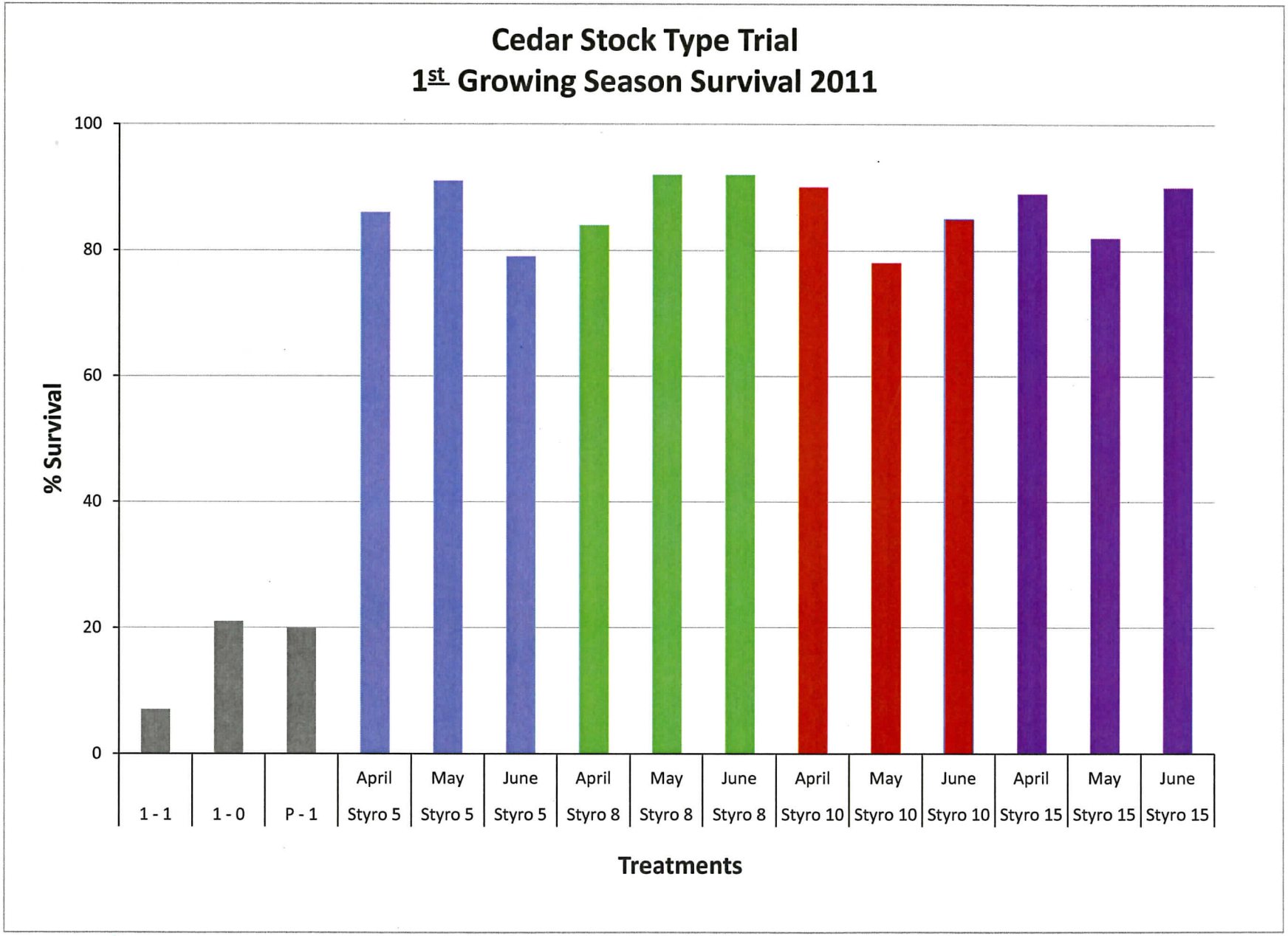
2011: Representative samples of all stock types were measured for seedling height and caliper in mid-May (Figure 1). These data are available at the Co-op manager's office in Redding. Out-planting was accomplished using contract crews during the week of May 23rd. The weather was ideal for planting with rain and snow showers occurring on all planting days. Planting spots were selected by Roseburg and Forest Service inspectors.

This study site was one of the stops on the Co-op field trip in June. At this time it was noted that all three bare-root stock types were having survival issues. The container stock types looked good regardless of time of sowing.

First year survival exams were done in late October/early November (Figure 2). Two of the bare-root stock types, 1-0 and plug-1, had survival rates of about 20 percent; the 1-1 seedlings had a survival rate of 7 percent. First year survival for the container stock ranged from 78 to 92 percent with no sowing date consistently producing bigger seedlings than the other dates.

Survival counts will be taken at the end of each growing season through 2014. Growth measurements will be taken/analyzed at the end of the fifth growing season (2015).

Cedar Stock Type Trial
Stock Types At Time Of Planting May 2011


Cedar Stock Type Trial
1st Growing Season Survival 2011
% Survival
100
80
60
40
20
0
1 - 1
1 - 0
P - 1
April Styro 5
May Styro 5
June Styro 5
April Styro 8
May Styro 8
June Styro 8
April Styro 10
May Styro 10
June Styro 10
April Styro 15
May Styro 15
June Styro 15
Treatments

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 10-01
Milestone VM

Principal Investigator: Ed Fredrickson

Title: Aminopyralid Site Preparation and Conifer Tolerance

Year Approved: 2010

Executive Summary:

Milestone VM (aminopyralid) is a relatively new product in California. It was registered for use in 2008 for non-crop sites. Currently Dow AgroScience is compiling data in the hope of obtaining a forestry label. Milestone VM is a pre and post emergent herbicide that controls a wide variety of broadleaf weeds (including legumes) and brush. It is an auxin and has both foliar and soil activity. The residual control is proving to be quite good and the product is an excellent inhibitor of seed germination. It is also showing some unique properties for brush control when tank mixed with other products. It has very low use rates, with maximum label rates at seven ounces per acre (0.1 lb ae/ac).

Previous testing has indicated no conifer tolerance for "over the top" applications, but directed applications around trees appears to be feasible. There is also a strong potential to broaden the spectrum of control when tank mixed with Velpar DF. The major questions surrounding Milestone VM and forestry at this point are regarding conifer tolerance as a site preparation spray and the duration of control by season. Milestone VM might have a fit as a site preparation treatment for some of the chemically intolerant conifers such as sugar pine, cedar, and redwood, although testing has yet to be done.

The stated objective of this study is to evaluate the effect of aminopyralid rate and timing on vegetation control and conifer tolerance of ponderosa pine and Douglas-fir when applied as a pre-plant site preparation treatment with Milestone VM alone and in combination with Velpar DF compared to Velpar DF as the operational standard.

The study will have two sites, one east side Cascade site and a low elevation west side Cascade site. Each site should be a fresh clear-cut or wildfire that has not had any chemical treatment prior to the trials. The plan will be to spray the east side site in the fall of 2010 and the low elevation site in the spring of 2011. Both sites will be planted in the spring of 2011. The study design will be a completely randomized block design with four replications. Stock type and seed lot will be the same for all trees of each species in the study. The stock type will be similar to what is operationally planted on the site.

Treatments to be studied include: Milestone VM alone at 0.0625, 0.11, and 0.22 lbs. a.i./acre; Milestone VM at 0.11 lbs. a.i./acre plus Velpar DF at 1.0 a.i./acre, and Velpar

DF alone at 2.5 lbs. a.i./acre. All applications will be applied at 10 gallons per acre at 30 psi. Base line data for conifer height and caliper will be taken at time of planting. End of season evaluations will take place at the end of the first and second growing seasons after treatment and will consist of ocular estimates of vegetation percent cover by species for the weeds and brush, ocular rating of conifer damage, and measurement of conifer seedling height and caliper.

2010: The fall site is located on property owned and managed by Sierra Pacific Industries approximately 10 miles west of Dana, California. Elevation is approximately 4000 feet. Slope is between 0 and 10 percent. The site is a sub-soiled clear-cut that was planted three years ago and has never received any herbicide treatment. As a result, the site is dominated by herbaceous vegetation with relatively poor stocking. Study plots were established in areas with no conifer stocking. Plot size is 12 feet by 36.3 feet (0.01 acre).

The study site was installed and sprayed on October 6, 2010. All treatments were applied with a 12 foot backpack boom sprayer and all plots were sprayed with one timed pass. Sprayer was calibrated prior to application.

2011: The spring site is also located on property owned and managed by Sierra Pacific Industries approximately ten miles south of Dunsmuir, California in the Sacramento Canyon. Elevation of the site is approximately 3000 feet on a west aspect. The site was pre-harvest sprayed with Chopper prior to logging. After logging, no further chemical or mechanical treatments were conducted.

The spring trial was installed and sprayed on March 11th, 2011. Treatments and application procedures were similar to those used on the fall site.

Plots were planted on both sites in the spring of 2011. Ten ponderosa pine and ten Douglas-fir were planted in each of two rows in every plot. All ponderosa pine were styro 6's and Douglas-fir were styro 8's. The spring site was planted on March 17, 2011 and the fall site was planted on May 6, 2011. All seedlings were initially measured for caliper and height at planting.

The spring and fall sites were evaluated on August 31, 2011. Percent cover for competing vegetation was visually estimated by species as was percent bare ground. Caliper and height were measured for all surviving trees and percent survival was calculated along with stem volume. Terminal bud damage and needle damage were assessed on a scale from 0 to 10 with 0=No Damage and 10=Most Severe.

Data were analyzed using SAS statistical software and analysis of variance with Tukeys HSD procedure for multiple comparisons. Data were analyzed as a completely randomized block design with four replications.

First year results indicated that Milestone VM by itself has extremely good tolerance

on both Douglas-fir and ponderosa pine at all rates tested in these trials at either timing. Vegetation control with Milestone VM by itself was poor. Control improved dramatically with the addition of Velpar DF at 1.33 lbs product per acre. See Tables 1 and 2 for efficacy data.

Percent bare ground was significantly greater for both the Velpar DF treatment at 3.33 lbs product per acre and the 1.33 lbs Velpar DF plus 7 oz of Milestone VM treatment compared to all other treatments and the control in the fall trial. The spring site had very little vegetation occupy the site in the first season after planting. At the end of the first season, percent bare ground in the controls averaged 87.5 percent. As a result, no significant differences were found between treatments regarding percent bare ground.

Annual grasses were controlled very well with the operational standard of 3.33 lbs Velpar DF in the fall having a percent cover of 1.5 percent compared to 52.5 percent in the controls. The result was significantly different from the controls and the lowest rate of Milestone VM by itself ($p<0.05$). The tank mix of Velpar DF at 1.33 lbs plus Milestone VM at 7 oz did very well having an annual grass percent cover of 16.25 percent, however the result was not significantly different from the control. No significant differences were found on the spring site for annual grass control, but this was due to virtually no annual grass occupying the site.

The main effect of treatment was also significant for prickly lettuce control in the fall, however multiple comparisons between treatments failed to yield any treatments significantly different from each other. The Velpar treatment at 3.33 lbs, Velpar at 1.33 lbs plus 7 oz of Milestone VM and the 14 oz Milestone VM treatment gave good to excellent control (0%, 3.25% & 5.75% cover respectively) compared to 18.75% cover in the controls.

While treatment was determined to be significant regarding snowberry and deerbrush control in the spring, the results appear to be an artifact due to the overall lack of cover for either species. Therefore, the results are not deemed to be real. Similar results were found for yellow nutsedge in the fall trial but also are most likely the result of high variability between replications. No other individual species were significantly affected by treatment.

The ponderosa pine seedlings planted in the spring trial, appeared to suffer from some type of nursery issue, as seedlings suffered an abnormal amount of mortality even in the control plots.

Douglas-fir and ponderosa pine survival, height or stem volume was not significantly affected by treatment in either the spring or the fall trial ($p<0.05$). Douglas-fir caliper was significantly larger in the treatment with Velpar DF at 3.33 lbs compared to the control trees in the fall. Caliper was not significantly different for Douglas-fir seedlings among any of the chemical treatments. Calipers were significantly

larger for ponderosa pine seedlings treated in the fall with either the Velpar DF alone at 3.33 lbs or 1.33 lbs Velpar DF plus 7 oz of Milestone VM compared to all other treatments with the exception of the 14 oz Milestone VM treatment. Caliper was not significantly affected by treatment in the spring trial. See Tables 3 through 6 for conifer tolerance data.

Stem volume in the fall timing for both Douglas-fir and ponderosa pine was largest with either the 7 oz Milestone VM plus 1.33 lb Velpar DF combination or the Velpar DF by itself at 3.33 lbs. The results were not statistically significant at the $p<0.05$ level, but the values were very close and the trend is probably real.

Overall, Milestone VM appears to provide insufficient vegetation control by itself. However, in combination with low rates of Velpar DF, control is increased significantly. Ponderosa pine and Douglas-fir both appear to be very tolerant to Milestone VM in either the spring or fall, even up to twice the maximum label rate. No terminal bud or needle damage was noted in either species. The fact that no significant differences existed for seedling caliper, height, stem volume or survival for either Douglas-fir or ponderosa pine between the operational standard of Velpar DF alone at 3.33 lbs compared to the tank mix of 7 oz Milestone VM plus 1.33 lbs Velpar DF suggest that this may be a suitable alternative to straight Velpar, especially when intolerant conifers are involved. The tank mix also provided similar vegetation control. These data compare well with the analogous trials conducted in the FSC Research Group. Final data will be collected in the fall of 2012 for both timings.

TREATMENT	%Bare Ground	% Cov Annual Grass	% Cov Prickly Lettuce	% Cov Deer Brush	% Cov Willow Herb	% Cov Yellow Nutsedge
4 oz/ac MVM	16.25	60.0	12.0	4.25	2.25	3.25
7 oz/ac MVM	26.25	42.5	15.0	1.25	0.75	4.5
14 oz/ac MVM	40.0	33.75	5.75	1.25	0.5	3.75
7 oz MVM + 1.33 lbs Velp DF/ac	73.75	16.25	3.25	1.0	0.25	1.25
3.33 lbs/ac Velp DF	93.75	1.5	0.0	0.0	0.5	0.0
Control	18.75	52.5	18.75	2.25	1.0	2.5

Table 1. Percent bareground and percent cover by species ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

TREATMENT	%Bare Ground	% Cov Ann. Grass	% Cov Prickly Lettuce	% Cov Deer Brush	% Cov Bull Thistle	% Cov Snow Berry	% Cov Brack. Fern	% Cov Yellow Nutsedge
4 oz/ac MVM	92.75	2.5	0.0	0.25	0.0	0.5	2.25	0.75
7 oz/ac MVM	95.75	0.0	0.0	0.0	0.0	1.0	5.0	1.0
14 oz/ac MVM	95.0	0.0	0.0	0.25	0.0	0.0	4.25	1.0
7 oz MVM + 1.33 lbs Velp DF/ac	95.5	0.0	0.25	0.0	0.25	0.0	3.75	0.5
3.33 lbs/ac Velp DF	97.75	0.0	0.0	0.0	0.0	0.25	0.5	0.0
Control	87.5	0.0	0.5	1.5	0.0	0.25	7.5	1.25

Table 2. Percent bareground and percent cover by species five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

TREATMENT	Cal mm	Ht cm	Stem Vol cm^3	Percent Survival	Terminal Bud Rating	Needle Rating
4 oz/ac MVM	3.64	25.04	3.74	92.5	0.0	0.0
7 oz/ac MVM	4.01	27.51	4.69	75.0	0.0	0.0
14 oz/ac MVM	4.06	25.45	4.69	95.0	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	4.44	26.12	5.59	87.5	0.0	0.0
3.33 lbs/ac Velp DF	4.58	25.14	5.69	92.5	0.0	0.0
Control	3.41	22.82	2.88	90.0	0.0	0.0

Table 3. Douglas-fir measurements ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

TREATMENT	Cal mm	Ht cm	Stem Vol cm^3	Percent Survival	Terminal Bud Rating	Needle Rating
4 oz/ac MVM	5.55	33.23	11.49	97.5	0.0	0.0
7 oz/ac MVM	5.61	34.38	12.16	100.0	0.0	0.0
14 oz/ac MVM	5.85	34.22	12.41	92.5	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	5.36	31.7	9.65	100.0	0.0	0.0
3.33 lbs/ac Velp DF	5.48	32.58	11.31	100.0	0.0	0.0
Control	5.37	32.18	10.36	95.0	0.0	0.0

Table 4. Douglas-fir measurements five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

TREATMENT	Cal mm	Ht cm	Stem Vol cm^3	Percent Survival	Terminal Bud Rating	Needle Rating
4 oz/ac MVM	4.69	16.92	4.03	97.5	0.0	0.0
7 oz/ac MVM	4.68	18.44	4.21	92.5	0.0	0.0
14 oz/ac MVM	5.10	16.41	4.62	95.0	0.0	0.3
7 oz MVM + 1.33 lbs Velp DF/ac	5.57	20.43	6.65	95.0	0.0	0.0
3.33 lbs/ac Velp DF	5.61	17.53	5.77	97.5	0.0	0.0
Control	4.59	20.45	4.65	92.5	0.0	0.0

Table 5. Ponderosa pine measurements ten months after treatment for the Fall Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

TREATMENT	Cal mm	Ht cm	Stem Vol cm^3	Percent Survival	Terminal Bud Rating	Needle Rating
4 oz/ac MVM	5.79	20.29	7.04	72.50	0.0	0.0
7 oz/ac MVM	6.29	24.01	9.99	52.50	0.0	0.0
14 oz/ac MVM	5.83	18.7	6.79	72.5	0.0	0.0
7 oz MVM + 1.33 lbs Velp DF/ac	5.7	19.92	6.83	70.0	0.0	0.0
3.33 lbs/ac Velp DF	6.07	21.38	8.33	70.0	0.0	0.0
Control	5.68	21.38	7.59	62.5	0.0	0.0

Table 6. Ponderosa pine measurements five months after treatment for the Spring Milestone VM site preparation trial . MVM=Milestone VM, Velp DF=Velpar DF. All rates amount product per acre.

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 10-02
Fluroxypyr (Vista XRM)

Principal Investigator: Ed Fredrickson

Title: Vista XRT Conifer Tolerance and Manzanita Control

Year Approved: 2010

Executive Summary:

Vista XRT (fluroxypyr) is a newly registered chemical to California and forestry. The active ingredient fluroxypyr has been around since the late 1908's. It is a growth regulator herbicide similar in action to triclopyr with several unique characteristics. The main one being fluroxypyr having a greater conifer tolerance compared to triclopyr. The second is that fluroxypyr is very effective in controlling manzanita.

A limited amount of development work was done in the late 1980's and early 1990's with fluroxypyr in forestry. The results showed a potential for conifer release "over the top" applications. Conifer tolerance was good overall, but varied with geographic location. All of the early conifer tolerance and efficacy work on manzanita was with application in either April or June, timings not typical for usual conifer release. Further tests need to be done in a more typical timing for aerial release applications, such as late August or early September. The other concern is that since its conception, the formulation of fluroxypyr has changed significantly. This change in formulation may increase conifer tolerance but could decrease efficacy on a waxy-leaf species such as manzanita.

The significance of a herbicide that could be applied over the top of conifers to release seedlings from evergreen brush cannot be overstated. The potential cost savings of being able to release plantations with aerial applications rather than ground directed treatments is dramatic. Fluroxypyr is currently labeled for aerial release in pine plantations. Applications at a more typical time for release should provide an even greater degree of tolerance than previous studies have shown. Based on previous data, there may be the potential for an early season release window.

The stated objective of this study is to evaluate the effect of Vista XRT rate and timing on manzanita control and tolerance of ponderosa pine and Douglas-Fir with "over the top" broadcast applications. The study is a trial that will look at several application rates and timing of application to define the conifer tolerance of Vista XRT.

The study site should be a two or three year old conifer plantation with a manzanita brush component. Plans are to look at ponderosa pine and Douglas-fir tolerance to the herbicide treatments; however, plot size is limited and it may be hard to find a plantation with enough of each species for a

good sample size. The study site should be chosen and laid out by August 2010. The study design will be a completely randomized block design with four replications. At least four seedlings of each species must be present in each plot to provide a valid sample size if both ponderosa pine and Douglas-fir are included. For a pine only trial, 8 seedlings per plot would be a minimum.

Two spray timings will be utilized in this study (late August 2010 and April 2011 – or as soon as the site opens in the spring prior to bud-break). Treatments will include: Vista XRT alone at 0.25, 0.5, and 1.0 lbs. a.i./acre; Vista XRT at 0.25 and 0.5 lbs. a.i./acre plus Garlon 3A at 0.5 lbs. a.i./acre; and a control. No surfactants will be added to the treatments. All applications will be applied at 10 gallons per acre. At treatment, conifer caliper and height will be measured on all conifers as well as initial manzanita percent cover. Post-treatment evaluations will take place at the end of the season in 2011 and 2012. Percent crown and stem reduction will be evaluated for manzanita; conifer evaluations will consist of caliper and height measurements and an ocular rating of damage.

2010: The fall study site is located on property owned and managed by Sierra Pacific Industries approximately 5 miles southwest of Burney, California. Elevation is approximately 4500 feet. Slope is between 0 and 10 percent. The site was clearcut and planted to a mix of ponderosa pine, Douglas-fir, and white fir. The site was initially treated with Velpar DF as a site preparation treatment. Seedlings were two years old at the time of treatment. Study plot size is 12 feet by 72.6 feet (0.02 acre). A minimum of three ponderosa pine and Douglas-fir were in each plot.

The plots were sprayed on September 3, 2010. All treatments were applied with a 12 foot backpack boom sprayer and all plots were sprayed with one timed pass. The sprayer was calibrated prior to application. Initial measurements of caliper and height for all conifers within the plots were recorded at the time of treatment.

The trial was evaluated on October 21, 2010. No conifer growth had occurred since treatment, therefore only ocular evaluations were conducted. Percent foliar brownout was evaluated for greenleaf manzanita, gooseberry, ponderosa pine, Douglas-fir, and white fir where it was present. White fir was not a part of the study but it did occur in the majority of the plots. Tolerance was evaluated for white fir, but the results are anecdotal and any statistical analysis would be invalid. Terminal and lateral bud damage was assessed for all conifers on a scale of 0 to 10 with 0 being no damage and 10 being dead. Results were taken only seven weeks after treatment and are preliminary. Full treatment effects will not develop until the end of the 2011 growing season. See 2010 Annual Report pages 18-22 for these results.

2011: The spring study site is on property owned and managed by Roseburg Resources Company approximately ten miles west of Burney. Elevation is approximately 2500 feet. Slope is between 0 and 10 percent.

The site was clearcut and planted to a mix of ponderosa pine, Douglas-fir and white fir. The site was initially pre-harvest sprayed with Chopper and larger hardwoods were injected with Arsenal prior to logging. The site was ripped following logging. No other site preparation treatments occurred.

The plots were sprayed on April 22, 2011. Treatments and application procedures were similar to those used on the fall site.

Both sites were evaluated on August 29, 2011. Percent foliar brownout was evaluated for greenleaf manzanita, pondersa pine, Douglas-fir and white fir where it was present on the fall treatment site and for greenleaf manzanita, whitethorn, ponderosa pine and Douglas-fir on the spring treatment site. White fir was not part of the study but it did occur in the majority of the plots on the fall site. Tolerance was evaluated for white fir, but the results are anecdotal in nature only and any statistical analysis would be invalid. Terminal and lateral bud damage was assessed for all conifers on a scale from 0 to 10 with 0 being no damage and 10 dead. Caliper, height, survival and stem volume were also measured at both sites. A visual assessment of percent control for brush species was made on each site. See Tables 1- 6 for treatment means.

Statistical analysis was done using SAS software. Data were analyzed as a randomized complete block design. Analysis of variance was used to determine significance of the main effect of treatment. Tukeys HSD test was used for multiple comparisons of treatments.

Greenleaf Manzanita control was poor overall for either timing. Acceptable control was achieved in the fall with the highest rate of Vista XRT (1 lb a.i./ac), however this rate is twice the labeled rate. For the spring trial, only the 1 lb a.i./ac rate of Vista XRT was significantly different from the control ($p<.05$). In the fall trial, the lowest rate of Vista XRT (0.25 lb a.i./ac) alone or in combination with 0.5 lb a.i./ac Garlon 3A were not significantly different from the control. No significant differences existed between any of the Vista XRT treatments at 0.25 or 0.5 lbs a.i./ac alone or in combination with 0.5 lbs a.i./ac Garlon 3A. The highest rate of Vista XRT (1 lb a.i./ac) was significantly different from all treatments with the exception of the 0.5 lb Vista XRT with 0.5 lb Garlon 3A combination. Overall, greenleaf manzanita control was unacceptable at currently labeled rates for either Vista XRT by itself or in combination with Garlon 3A. It should be noted however, that these applications contained no adjuvants of any type. Control could have been improved with the addition of a surfactant but conifer damage would most likely have been dramatically increased.

Whitethorn was only present in the spring trial. Control of whitethorn was poor with all treatments and only the tank mix of Vista XRT and Garlon 3A at 0.5 lb a.i./ac each was significantly different from the control ($p<.05$). The significance is irrelevant due to the poor control of this treatment. Neither, Vista XRT by itself or Vista XRT with Garlon 3A provides acceptable control of whitethorn. Gooseberry was evaluated in the fall timing but was not in every plot and

therefore all information is anecdotal. Gooseberry that was initially controlled very well at the time of the 2010 evaluation with Vista XRT alone had re-sprouted significantly by the 2011 evaluation. Control was unacceptable at this evaluation. Adding Garlon 3A improved control but still probably not up to acceptable standards.

No treatments were significantly different from the controls regarding foliar brownout of ponderosa pine or Douglas-fir in the spring, and Douglas-fir showed no differences between any treatments in the fall compared to the controls. Fall treatments showed significantly higher damage of ponderosa pine at 1 lb a.i./ac of Vista XRT by itself compared to all other treatments including the controls ($p<.05$). This brownout data is somewhat deceiving in that terminal bud damage was severe for both ponderosa pine and Douglas-fir when Garlon 3A was added to Vista XRT at either the 0.25 or 0.5 lb a.i./ac rates. Survival was excellent for all treatments with the spring or fall timing. No significant differences in survival existed for ponderosa pine or Douglas-fir between treatments, including the controls.

Caliper, height or stem volume were not significantly affected by any treatment in the spring trial for either ponderosa pine or Douglas-fir. Caliper and stem volume were not significantly affected by any treatment in the fall trial for ponderosa pine or Douglas-fir. Douglas-fir height was significantly influenced by treatment in the fall. Douglas-fir treated with Vista XRT at the 1 lb a.i./ac rate were significantly shorter than all other treatments. No differences existed between any of the other treatments. Ponderosa pine trees were shortest with both treatments containing Garlon 3A, however, the results were not significantly different from any of the other treatments.

The most obvious data that showed the damage associated with the addition of Garlon 3A was the terminal and lateral bud rating scale. Due to the low numbers associated with the scale, statistical analysis was not practical, however the effects are obvious. The spring and fall treatments produced very little if any terminal or lateral bud damage to either ponderosa pine or Douglas-fir with Vista XRT alone. Significant increases were noted when Garlon 3A was added to either rate of Vista XRT, especially with the 0.5 lb a.i./acre rate of Vista XRT. Ponderosa pine was affected more than Douglas-fir. Virtually total terminal bud kill was seen in pine with the higher rate of Vista XRT in combination with Garlon 3A in the fall. Damage was somewhat less pronounced in spring treatments.

In summary, greenleaf manzanita and whitethorn were not adequately controlled with any treatment tested in either the spring or fall timing at labeled use rates. Both ponderosa pine and Douglas-fir show remarkable tolerance to Vista XRT by itself up to the maximum label rate of 0.5 lb a.i./ac with no surfactant. The addition of Garlon 3A at 0.5 lb a.i./ac did not improve control of manzanita or whitethorn and severely increased terminal bud damage to both ponderosa pine and Douglas-fir. The lack of brush control is most likely due to a lack of adjuvant in the spray treatments coupled

with less coverage provided by broadcast treatments. Other data have unequivocally shown excellent control of manzanita species with directed hand spray treatments with an oil based or non-ionic surfactant added. Dow AgroSciences is currently testing several adjuvants to be used over conifers on manzanita with Vista XRT and Rodeo.

All evaluations are complete at this point for the fall timing of the Vista XRT trial. The final evaluation for the spring timing will be in the fall of 2012.

Treatment	Manzanita	Gooseberry	Pine	Doug F	W. Fir
Lbs a.i./acre	% Brownout	% Brownout	% Brownout	% Brownout	% Brownout
Vista 0.25	28.8	10.0	0.0	2.5	0.0
Vista 0.5	46.3	17.5	2.5	1.3	0.0
Vista 0.25 + 0.5 Gar 3A	13.8	80.0	8.8	3.8	1.3
Vista 0.5 + 0.5 Gar 3A	51.3	63.3	26.3	17.5	0.0
Vista 1.0	87.5	10.0	2.5	16.3	5.0
Control	0.0	1.3	0.0	0.0	0.0

Table 1. Fall percent brownout data one year after treatment.

Treatment	PP Term	PP Lateral	DF Term	DF Lateral	WF Term	WF Lateral
Lbs a.i./acre	Bud Dam.	Bud Dam.	Bud Dam.	Bud Dam.	Bud Dam.	Bud Dam.
Vista 0.25	0.0	0.0	0.3	0.0	0.0	0.0
Vista 0.5	0.5	0.5	0.0	0.0	0.0	0.0
Vista 0.25 + 0.5 Gar 3A	2.3	1.8	0.0	0.0	0.0	0.0
Vista 0.5 + 0.5 Gar 3A	7.8	6.8	2.3	1.5	0.0	0.0
Vista 1.0	0.8	0.0	2.5	2.3	0.7	0.7
Control	0.0	0.0	0.0	0.0	0.0	0.0

Table 2. Fall terminal and lateral bud damage by species. 0 = no damage 10 = dead bud.

Treatment			PP Stem			DF Stem
Lbs a.i./acre	PP Cal. mm	PP HT cm	Vol cm^3	DF Cal. mm	DF HT cm	Vol cm^3
Vista 0.25	41.3	113.9	2306.1	22.4	95.4	664.0
Vista 0.5	36.2	99.3	1548.5	21.4	81.0	418.3
Vista 0.25 + 0.5 Gar 3A	35.1	86.1	1183.4	19.8	80.9	564.7
Vista 0.5 + 0.5 Gar 3A	43.4	75.1	1850.3	22.7	76.0	494.6
Vista 1.0	37.0	100.0	1680.8	17.0	49.1	180.8
Control	31.6	88.1	1095.4	21.0	87.7	527.8

Table 3. Fall caliper, height & stem volume one year after treatement.

Treatment	Manzanita	Whitethorn	Pine	Doug F	
Lbs a.i./acre	% Brownout	% Brownout	% Brownout	% Brownout	
Vista 0.25	1.3	0.0	1.3	2.5	
Vista 0.5	32.5	7.5	2.5	7.5	
Vista 0.25 + 0.5 Gar 3A	7.5	1.3	0.0	1.3	
Vista 0.5 + 0.5 Gar 3A	30	17.5	7.5	5.0	
Vista 1.0	67.5	12.5	6.3	7.5	
Control	2.5	0.0	0.0	0.0	

Table 4. Spring percent brownout data four months after treatment.

Treatment	PP Term	PP Lateral	DF Term	DF Lateral		
Lbs a.i./acre	Bud Dam.	Bud Dam.	Bud Dam.	Bud Dam.		
Vista 0.25	0.0	0.0	2.5	0.0		
Vista 0.5	0.5	0.0	1.8	0.0		
Vista 0.25 + 0.5 Gar 3A	1.0	0.5	0.0	0.0		
Vista 0.5 + 0.5 Gar 3A	2.5	2.3	0.5	0.0		
Vista 1.0	1.0	0.8	0.8	0.3		
Control	0.0	0.0	0.0	0.0		

Table 5. Spring terminal and lateral bud damage by species. 0=no damage 10=dead bud.

Treatment			PP Stem			DF Stem
Lbs a.i./acre	PP Cal. mm	PP HT cm	Vol cm^3	DF Cal. mm	DF HT cm	Vol cm^3
Vista 0.25	19.5	60.0	271.0	9.8	40.9	43.1
Vista 0.5	24.2	75.7	515.4	9.8	49.1	56.0
Vista 0.25 + 0.5 Gar 3A	22.2	65.1	400.7	8.5	37.4	28.6
Vista 0.5 + 0.5 Gar 3A	24.8	71.7	503.1	10.6	47.7	61.67
Vista 1.0	24.7	71.6	478.4	12.6	48.8	80.7
Control	21.9	69.0	399.2	12.1	49.7	88.4

Table 6. Spring caliper, height & stem volume four months after treatement.

Sierra Cascade Intensive Forest Management Research Cooperative
Income/Expense Statement
Calendar Year Report for the Period Jan. 1 to Dec. 31, 2011

Beginning Balance on January 1, 2011		$3,086.21
Total Income (Membership Dues)		$45,000.00
Expenses:		
Sunscald Proposal	$5,920.00	
Mat 28 Proposal	$4,800.00	
GF 9999 Proposal	$5,400.00	
Co-op Manager Expenses	$25,000.00	
Total Expenses		$41,120.00
Year End Balance as of December 31, 2011		$6,966.21

WORKING GROUP MEMBERSHIP

Working Group I
Seed to Establishment

Tom Jopson, Chair
Bob Amesbury
Scott Carnegie
Mark Gray
Lewis Howe
Scott Worden
Tom Young

Working Group II
Out-planting through Precommercial Thinning

Jason Warshawer, Chair
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