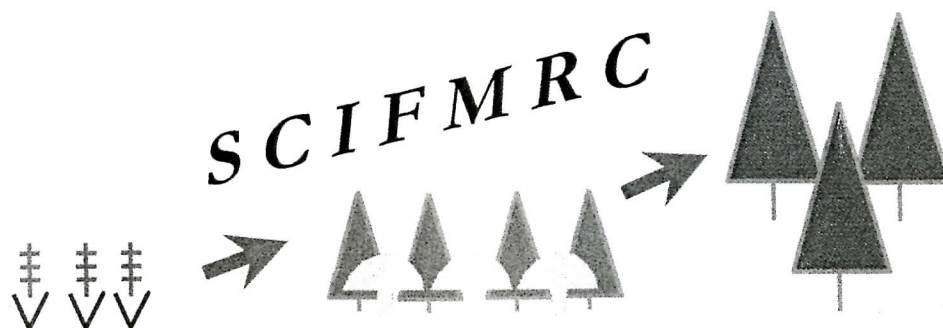


# Sierra-Cascade Intensive Forest Management Research Cooperative

Series Report No. 8



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

**ANNUAL REPORT**

**2007**

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The year 2007 marked the eighth year as an organization for the Sierra Cascade Intensive Forest Management Research Cooperative.

Membership in the Co-op remained stable with one new member joining (IFA Nurseries, Inc.) and one member withdrawing. The current membership consists of a mixture of landowners, forestry-related industries, State of California and federal agencies.

Working Group II held a meeting in February. Chair Jason Warshawer asked each attendee to list what aspect of regeneration they would like to see funded with available funds from the Co-op in 2007. This survey resulted in the development of two new proposals that were presented to the Co-op membership at the annual business meeting. These two proposals involved slash loading and its effects on conifer seedling survival and efficacy of glyphosate on evergreen shrubs. Stu Farber of Timber Products Co. presented an idea for another proposal concerning intensive forest management effects on plant species and structure in northern California and southern Oregon. The Group decided to expand on this idea and present it at the business meeting to see if the full membership would like to see the idea developed into a proposal.

The annual business meeting was held March 27th at Redding. Twenty Co-op members and guests attended. One of the first items of business was a discussion of the annual field trip. A trip was planned for late May or early June to avoid conflicts with the Weed Tour. The theme chosen was precommercial thinning with stops at Blodgett State Forest, Elliott Ranch, the Co-op's

Timmer/Jopson site on Soper-Wheeler, and thinning sites on Challenge Experimental Forest.

Updates for three recently funded Co-op studies were presented at the annual meeting. Jeff Webster reported on Proposal 02-01, the Eucosma study; Bob Powers on Proposal 05-01, 3-PG; and Don Owens on Proposal 04-02, Verbenone. An executive summary of the 3-PG study can be found in this 2007 Annual Report. Fifth year data from the Timmer/Jopson study, Proposal 00-05, was also presented to the membership. This study was planned originally to run for five years. The membership decided to do some additional work on the study – soil type determination and foliar analysis – and then decide where to publish the results of the study. The study would be terminated after this final work. The sites will be maintained and could be used for other purposes later on.

Three new proposals were presented at the annual meeting. Jason Warshawer presented one on slash loading/conifer survival; Mark Gray one on glyphosate control of evergreen shrubs; and Jeff Webster one on verbenone installations at McCloud and Big Valley. Full proposals were mailed to the membership in April for consideration of funding. The glyphosate proposal was selected for funding by the Co-op in 2007.

Stu Farber of Timber Products Co. made a presentation on the possible proposal on intensive forest management effects on plant species and structure that was initiated at Working Group II's meeting. A subgroup was formed to develop this idea into a proposal and this subgroup

met in April to accomplish this task. A presentation of the full proposal will be made at the annual meeting in 2008. Later in 2007, Stu managed to secure some start-up funds for the study so hopefully work can start in 2008 if the Co-op accepts the proposal.

One previously funded proposal – Stock Type/Fertilization, Proposal 00-04 – was due to be measured in 2007. This was the fifth year of the study. In order to free the Co-op manager to work on other proposals, the membership decided to postpone these measurements until later. For this same reason, it was decided not to hold the 2007 field trip.

Two of the proposals funded by the Co-op report updated results/progress in this issue of the annual report. These are 3-PG (05-01: Powers and Zhang) and Agenda 2020 (03-01: Powers). Results are presented in the form of an executive summary. Full data sets and the analysis are available from the Co-op office in Redding.

The year 2008 should be an active one for the Co-op. The Agenda 2020 (03-01) sites will require treatment maintenance. The problem with establishing manzanita at the Dana site still needs to be solved. Matte Busse will continue the work he started last year, inventorying the shrub component, with work at the Big Bend site. He plans to begin foliar analysis for nitrogen-fixation by the various shrub species at the two sites.

Root harvesting operations similar to those conducted at the Whitmore Garden of Eden site in 2007 for the 3-PG study

(05-01) will be done at two more Garden of Eden sites – Feather Falls (SPI lands) and Elkhorn (Crane Mills lands) this spring. The trees and shrub component were remeasured in the fall of 2007. These harvested stumps will be brought to the Forest Service lab at Redding for analysis.

The Slow Release Fertilizer Proposal (02-02) will complete its fifth growing season this fall. Original plans were to carry this study for five years and then reevaluate plans for it. Measurements are scheduled for August/September. Following the procedure developed at our business meeting in April 2006, the Co-op Manager with in-kind help from the host landowners will do these remeasurements. There are three landowners involved: W.M. Beaty, Soper-Wheeler, and C & D Lumber.

The Stock Type/Fertilization Proposal (00-04) fifth year remeasurements were due at the end of the growing season in 2007. This work was postponed due to workloads. Tentative plans are to remeasure these sites at the end of the growing season this year. The three landowners involved with this study are: Boise Cascade, Roseburg, and SPI. Unless otherwise directed by the Co-op membership, the remeasurements will be done with in-kind help from the landowners.

Tentative budget projections seem to indicate a surplus that can be applied to new research proposals during 2008. Based on expected dues, this surplus should be in the \$15,000 to \$20,000 range.

## 2007 MEMBERSHIP

### Land Manager Membership

California Department of Forestry  
Collins Pine Co.  
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

BASF Corporation  
Cal Forest Nurseries & Mountain Gate Gardens

### Affiliate Membership

IFA Nurseries, Inc.  
Silver Butte Timber Co.  
Total Forestry, Inc.

### Supporting Members

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

Sierra Cascade Intensive Forest Management Research Cooperative  
Annual Meeting March 27, 2007

The 2007 annual business meeting was held at the Forest Service office in Redding, CA on March 27, 2007. Twenty Co-op members and guests attended.

Following introductions, some general items of business were discussed. Bob Powers conducted a short discussion on the possible formation of a new co-op based in Oregon. He had attended the formative meeting of this new group and presented organizational fundamentals, objectives, etc. of our Co-op to the group. The objectives for this new co-op appear similar to ours. Bob will monitor this new group and provide the latest information to our membership.

Two new members joined the Co-op in 2006 – Total Forestry and California Department of Forestry and Fire Control.

Next followed a discussion concerning the annual Co-op field trip. The membership decided to have one in late May or early June in order to avoid conflicts with the Weed Tour. The theme chosen was precommercial thinning. Field trip stops would include Blodgett State Forest, the Elliott Ranch study of Bill Oliver (a Levels of Growing Stock Study), the Co-op's Timmer/Jopson study on Soper-Wheeler lands, and thinning studies on the Challenge Experimental Forest. Electronic copies of publications which have resulted from these studies would be sent to the membership prior to the field trip.

A review of the 2006 Annual Report was then presented. Executive summaries

were presented for four studies funded by the Co-op. These included Proposal 02-01 Eucosma Study; Proposal 03-01 Agenda 2020; Proposal 05-01 3-PG Study; and Proposal 00-05 Timmer/Jopson Study. Agenda 2020 and the 3-PG study are on-going studies. The measurements taken at the end of the 2006 growing season on the Timmer/Jopson study represent five-year data. As originally proposed, this latter study was to run for five years and then be evaluated as to future uses. A data sheet summarizing these fifth year results was presented to the membership. There was only one treatment showing any significant difference from the other treatments at this time – one species on one of the three study sites. This fifth year data had been shared with Vic Timmer in October of 2006. After reviewing the data, Vic felt it would be difficult to publish the results in a journal based on growth alone – it would require hard and tight supporting data like soil and plant analysis - and recommended publication as an extension note. The question as how to best utilize this data was presented to the Co-op membership. One suggestion was to present the findings at the Forest Vegetation Management Conference. Another suggestion was for Tom Jopson to write up the nursery part of the study, combine that with a write-up of the field results (hopefully Vic could help on this) and then determine if this combined effort might be publishable. As a minimum, the membership decided soil type information should be collected for the study sites and foliar analysis should be run one more time. Gary Nakamura volunteered to get prices for running the

foliar samples. After this work was done, Bob Powers said he would look at the data and recommend what to do next. After this last bit of field work (foliar samples/soil type determination) was completed, the Co-op would close this study. The plots could be maintained and used for other purposes as needed.

The next item of business was the status of the budget. The Co-op ended 2006 with a surplus of \$5365 after all pending expenses were covered. Dues for 2007 received at the time of the business meeting totaled \$64,000 with \$4,000 more promised. Spreadsheets showing the current status of all funded studies and yearly plans for these studies through 2011 were handed out to the attendees. Summary sheets of the Co-op Manager's time spent on various proposals/projects in 2006 and an estimate of his time to be spent in 2007 were presented along with the spreadsheets. In order to free the manager to work on other proposals, the membership decided to postpone the fifth-year remeasurements scheduled in fall 2007 for the stock type/fertilization study and also not to sponsor a field trip during 2007 (the precommercial thinning field trip).

It was brought to the membership's attention that the Co-op had a thirty-minute slot on the 2008 Forest Vegetation Management Conference scheduled for January. Bob Rynearson will make the presentation. Ideas about what to present were discussed by the membership. A list of publications funded by the Co-op was passed out.

A discussion on the status of the Co-op web site was next on the agenda. A show of hands revealed little use of the

web site and the question was raised as to the desirability of continuing with it. It was decided that the executive committee would investigate the feasibility of continuing/maintaining the web site. Gary Nakamura will check with Joe DiTomaso about what he recommends we do about the site.

Following the discussion on the web site, updates on three recently funded Co-op studies were presented. Jeff Webster reported on Proposal 02-01 Eucosma study, Bob Powers on Proposal 05-01 3-PG, and Don Owens on Proposal 04-02 Verbenone.

Jason Warshawer, Chair of Working Group II, summarized the meeting held by that group on February 7, 2007. One of the results of this meeting was the development of two new proposals to be presented to the full membership at the annual business meeting in March. An idea for another new proposal titled "Effects of intensive forest management on plant species and structure in northern California and southern Oregon" was discussed by the Working Group members. This idea will be expanded and presented at the March meeting to see if the full membership would like to see it developed into a proposal.

The last item of business was the presentation of new proposals. Three requests for funding were presented to the membership:

1. Slash loading/conifer survival and growth
2. Glyphosate control of evergreen brush
3. Verbenone installations at McCloud and Big Valley Mountain

The sponsors of these proposals are to summarize their proposals (including cost estimates) and get these summaries to the Co-op Manager who in turn will send them out to the voting members to rank for funding.

The meeting ended with a presentation by Stu Farber of Timber Products Co. expanding on the idea initiated at the Working Group II meeting in February. This was the idea about intensive forest management effects on plant species and structure. The membership decided to

form a sub-group to further develop a study proposal that would be presented to the full membership at a later date, probably the next business meeting. In order to accomplish this, the sub-group would need to: (1) describe all the existing studies conducted within our general environment (2) develop a formal study design (3) create a study timeline, and (4) create a study budget. Members of the sub-group included Jason Warshawer, Jeff Webster, Bob Powers, Bob Rynearson, and Stu Farber.

**Sierra Cascade Intensive Forest Management Research Cooperative  
Proposal 05-01 3-PG Study**

**Principal Investigators: Robert Powers and Jianewi Zhang**

**Title: Modeling Carbon Sequestration in Managed Forests  
Findings from Whitmore Garden of Eden**

**Executive Summary:**

We analyzed above- and belowground biomass in a 21-year-old research plantation typical of many sites in northern California. The Whitmore Garden of Eden installation is the oldest among the most intensively studied pine plantations in the West. Treatments included a control (C = planting and no further treatment), fertilization without vegetation control (F), vegetation control without fertilization (H), and both vegetation control and fertilization combined (HF). Total perennial biomass of planted trees spanned more than a 3-fold difference at 21 years, ranging from 54 Mg/ha (C) to 180 Mg/ha (HF), equivalent to about 27 and 90 Mg carbon/ha. However, perennial biomass differences between extreme treatments disappeared when living understory vegetation on control plots was included (C = 172 Mg/ha, HF = 181 Mg/ha). Of this, between 25% (HF) and 32% (C) occurred belowground, indicating that treatments improving top growth also allocated proportionally less carbon to perennial roots. Untreated plots (C) at 21 years had one-fifth greater total biomass than plots receiving vegetation control (H). However, understory shrubs accounted for two-thirds of the biomass on C plots, and one-quarter of the biomass on F plots because fertilization hastened tree canopy closure and the gradual decline of the understory. Fertilization treatments increased the carbon mass of the forest floor (13.3 and 12.2 Mg/ha for F and HF treatments, respectively; 8.7 and 9.2

Mg/ha for C and H treatments, respectively). Thus, the forest floor is a substantive carbon sink, holding between 9 and 14% of total ecosystem carbon exclusive of soil, and 12% to 19% of all aboveground carbon.

Fire behavior simulations calibrated for typical August conditions were applied to each of the treatments from the 10th to the 21st year of plantation development. Throughout this period, simulated flame lengths on C plots exceeded tree heights, leading to complete tree mortality. Fertilization (F) increased the growth of understory shrubs through the first 15 years so that simulated flame lengths exceeded tree heights, producing passive crown fires and 100% plantation mortality. By 21 years, planted pine canopies had closed on F plots and live understory shrubs had declined. Simulated flame lengths were less than tree heights, but heat convection still triggered nearly complete mortality. Fire effects in the H and HF treatments were simulated by surface litter models because these treatments lacked a shrub layer. Simulated flame lengths were always less than 1 m in H and HF treatments and less than average tree heights. However, crown scorch would be sufficient to kill about two-thirds of the trees at age 10. With time, trees grew larger and became more resistant to fire. By 21 years, mortality was projected to be 48% in H treatments, and only 42% in HF.

Additionally, three plots in the H treatment and three in the HF treatment had been thinned at age 10, removing the smallest 50% of the planted trees. Because thinning increased growth rates of the remaining trees, mortality projections from simulated wildfire were less than in the unthinned plots receiving H or HF treatments. Models predicted only surface fires with mortality ranging from a high of 56% to 61% (H and HF) at plantation age 10 years to between 32% and 39% (H and HF) at age 21. Although thinning slash was removed in this study, precommercial materials in operational thinnings sometimes are left on site. If retained, thinning slash creates ground fuels with persistent tinder-dry foliage. Simulated fire occurring two years after thinning and slash retention would produce flame lengths of 2.3 m, creating passive crown fires and nearly complete tree mortality. However, fuel loadings lessen with time. Simulated mortality from later fires fell to 45% by 15 years and to 30% by 21 years. Impacts of wildfire on carbon loss depend on the fraction volatilized during combustion and the fate of dead or dying residual material. Carbon dioxide will be released from residual slash through slow decomposition, but some will remain as inert charcoal. Estimating carbon quantities released as CO<sub>2</sub> or retained as charcoal is beyond the scope of this study.

Assuming fire-free conditions and a future climate similar to that of the present, we projected plantation development for C, F, H, and HF treatments to 50 years using the stand-level process model 3-PG. This model estimates carbon assimilation and allocation based upon leaf area, relative humidity, soil water availability and soil fertility, and accounts for self-thinning.

Understory shrubs dominated total productivity on untreated C plots through the first 21 years of plantation development, but shrubs declined to possible extinction after three decades. By 50 years, total ecosystem forest biomass on untreated plots was projected at 243 Mg/ha. Stands receiving only fertilization (F) showed an initial biomass peak of 201 Mg/ha at 18 years, followed by a decline lasting about a decade. This peak was dominated by understory shrubs that declined rapidly as tree canopies closed. Biomass accumulation began to accelerate by year 22, and total biomass by 50 years was projected to be 376 Mg/ha, mostly in tree stems. Tree stems dominated the biomass throughout the life of the stand where vegetation had been controlled (H), culminating in a total ecosystem biomass of 407 Mg/ha by age 50. Combining vegetation control with fertilization (HF) projected to the greatest gains of all: 487 Mg/ha at 50 years. Thus, 3-PG simulations project carbon accumulations of between 122 and 244 Mg/ha, exclusive of gains to the soil and assuming no incidence of wildfire.

Free of fire, these projections translate conservatively to mean annual carbon sequestration rates of from 2.4 to 4.9 Mg/ha exclusive of soil, offering a broad range of carbon management options. In reality, wildfire is likely. Fuels accumulating from understory shrubs in C and F treatments create a risk of very high mortality from passive crown fires, but H and HF treatments would likely survive. Implications for carbon sequestration are profound. Modeling forest carbon fluxes with a hypothetical fire return interval of 20 years suggests a potential loss of about 50 to 100 Mg carbon/ha over a 50-year span. Lacking understory management, sites with conditions similar to those at Whitmore would probably become fire-susceptible brushfields. Should one or more commercial thinnings occur

(unlikely in the C treatment, but a viable option in the H, F, and especially HF treatments), a sizable proportion of carbon would be transferred to long-lived forest products, with only a minor decline in carbon in the residual plantation.

**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 1<sup>st</sup>. 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.

In July, all plots on both sites were monumented and color-coded as to treatment.

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.

Sierra Cascade Intensive Forest Management Research Cooperative  
Income/Expense Statement  
Calendar Year Report for the Period Jan. 1 to Dec. 31, 2007

Beginning Balance on January 1, 2007		\$5,365.46
Total Income (Membership Dues)		\$66,000.00
Expenses:		
New Proposal Funding (3-PG 3rd Installment)	\$15,402.00	
Annual Report	\$255.00	
Manzanita planting Contract	\$12,256.00	
Co-op Manager Expenses	\$37,744.00	
Total Expenses		\$65,657.00
Year End Balance as of December 31, 2007		\$5,708.46

## WORKING GROUP MEMBERSHIP

### **Working Group I** Seed to Establishment

Tom Jopson, Chair  
Steve Akehurst  
Bob Amesbury  
Ed Fredrickson  
Jerry Gallagher  
Mark Gray  
Lewis Howe  
Bill Morrison  
Duane Nelson  
Bob Rynearson  
Tom Young

### **Working Group II** Out-planting through Precommercial Thinning

Jason Warshawer, Chair  
Steve Akehurst  
Bob Amesbury  
Ed Fredrickson  
Mark Gray  
Lewis Howe  
Bill Morrison  
Duane Nelson  
Bob Powers  
Bob Rynearson  
Tom Young