Compartment 380 Post-Burn

Blodgett Forest Research Station

RESEARCH WORKSHOP 2003

The CENTER FOR FORESTRY provides leadership in the development of basic scientific understanding of ecosystem process, human interactions and value systems, and management and silvicultural practices that ensure the sustainability of forest land.

The CENTER coordinates interdisciplinary teams of campus faculty and students, Cooperative Extension specialists and advisors, and staff from various agencies and organizations to develop research projects, outreach and public education activities, and provide policy analysis on issues affecting California's forest lands.

Current research at Center sites aim to provide basic and applied science to improve management of young growth mixed conifer / oak forests and restore old forest ecosystems. Center properties are managed in a manner that conserves basic air, water, soil and biological resources. Management practices are designed to maintain and improve wood production, beneficial uses of water, wildlife habitat, visual quality, forage for livestock and recreation potential. Land units are managed at a scale and in a diversity of styles useful for small private landowners, industrial, state and federal forests.

Center resources are available for educational workshops, conferences, and tours in addition to research.

University of California, Berkeley
College of Natural Resources
CENTER FOR FORESTRY

The CENTER FOR FORESTRY manages five research forest properties:

- UC Forestry Camp/Baker Forest (Plumas County)
- Blodgett Forest Research Station (El Dorado County)
- Howard Forest (Mendocino County)
- Russell Research Station (Contra Costa County)
- Whitaker Forest Research Station(Tulare County)

All properties offer field research locations and most have facilities (lodging, meeting rooms) for workshops or conferences on natural resource issues. For information on use of Center properties, contact:

Blodgett Forest Research Station
4501 Blodgett Forest Road
Georgetown, CA 95634
(530) 333-4475
bheald@nature.berkeley.edu
http://ecology.cnr.berkeley.edu/blodgett
http://www.cnr.berkeley.edu/for

ABSTRACTS

2003 Blodgett Forest Research Workshop

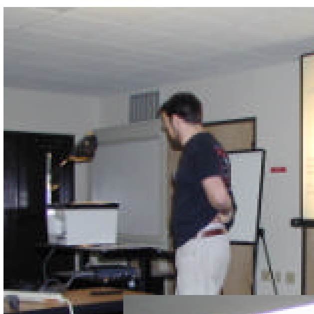
Table of Contents

RESEARCH PROJECTS LISTS

Blodgett Forest Research Workshop 2002











Wildlife Response to Fire and Fire Surrogate Treatments at Blodgett Forest

Andrew Amacher and Reginald H. Barrett

ADDRESS OF LEAD AUTHOR:
Department of Environmental
Science, Policy, and Management
University of California, Berkeley, CA
94720-3110

ABSTRACT

We report on data obtained during the summer of 2001 and 2002 and provide a pre-treatment picture of the status of terrestrial vertebrates on each of 12 Fire and Fire Surrogate (FFS) plots. Sample plots were Blodgett Forest compartments divided into 3 treatments (with a control) replicated 3 times: fire only, mechanical only, and mechanical plus fire. Bird abundance was sampled via variable-radius, circular plots. Bird foraging was sampled by focal animal observations. Bird productivity was sampled by monitoring nest success. Small mammals were detected with live traps and larger mammals by camera traps. Herptofauna were sampled by time-area counts.

PHOTOS

Above:
LIVE TRAP SAMPLE

Right:
WILDLIFE BIRD SAMPLING INVENTORY

Photos by Bob Heald

EFFECTS OF FIRE AND FIRE SURROGATE TREATMENTS ON LEAF LITTER INVERTEBRATES:
Initial results from a pre-treatment study in a western Sierra Nevada mixed conifer forest

Kyle Apigian, Donald L. Dahlsten, David L. Rowney, and Nadir Erbilgin

ADDRESS OF LEAD AUTHOR:
Department of Environmental Science, Policy, and Management, 201 Wellman Hall #3112, University of California Berkeley, Berkeley, CA, 94720

ABSTRACT

Leaf litter arthropods are important components of all forest ecosystems, serving as predators, detritivores, herbivores, as well as food for higher trophic levels. Some groups, such as ground beetles (Carabidae), spiders (Araneae), and ants (Formicidae) have been studied extensively and have been shown to have variable responses to disturbances such as fire and timber harvesting. The abundance and diversity of these taxa make them valuable as indicators of forest health. We performed a pre-treatment survey in the summer of 2001 and 2002 on these taxa at Blodgett Forest using pitfall traps. Three-hundred pitfall traps were placed in 12 forest compartments that, in subsequent years, will experience one of four

ARTHOPOD SAMPLES IN PITFALL TRAPS.
Photo by Kyle Apigian

treatments (timber harvesting and mastication), mechanical followed by burning treatments, or control. Five traps were placed within each of 5 randomly selected plots in each of the 12 compartments. Insects were collected in

propylene glycol over the course of five days each month, from June through September. Initial results show a high abundance and diversity of Tenebrionid beetles, Carabid beetles, ants, and spiders. We will focus our monitoring effort on these groups for post-treatment responses. Additionally, correlations with the abundance and diversity of these taxa with vegetation cover, volume of large woody debris, and various soil characteristics will be examined pre- and post-treatment.

Eleodes cordatus
(*Coleoptera: Tenebrionidae)*

The most common beetles collected in the pitfall traps at Blodgett Forest

Metrius contractus
(*Coleoptera: Carabidae)*

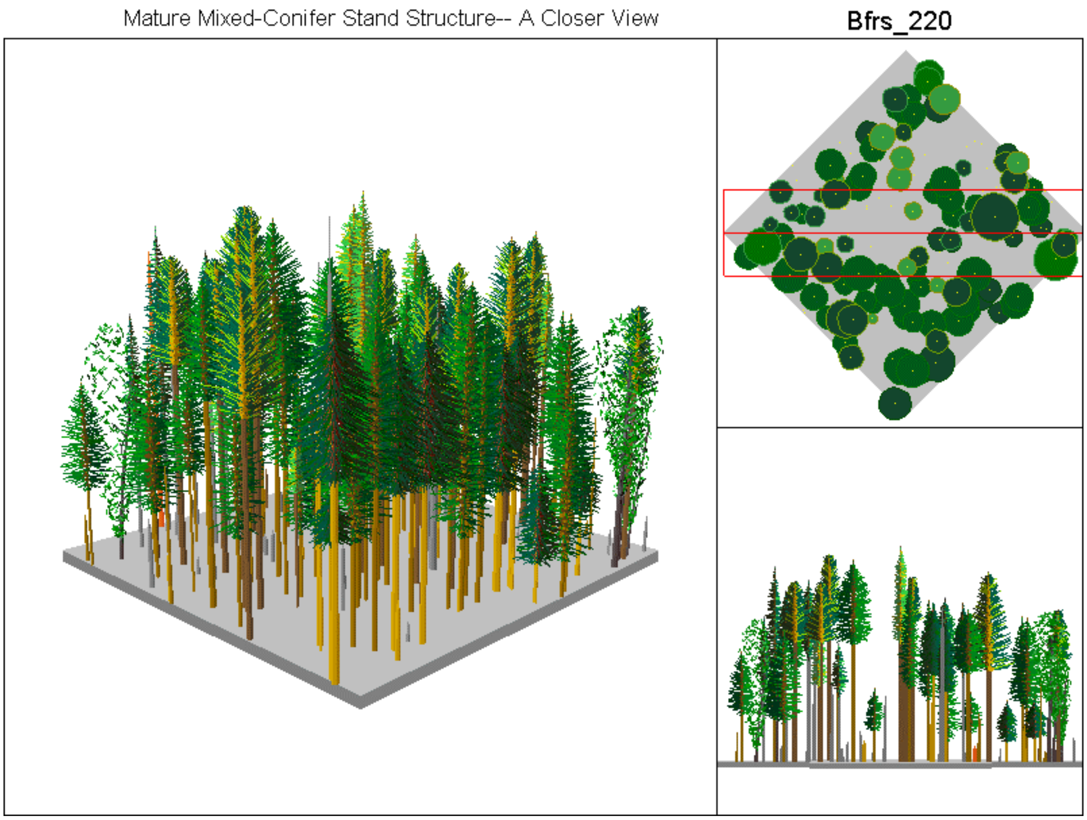
A Contrast in Vital Rates: Life Table Projections for Abies concolor and Pinus lambertiana in a Sierran Mixed Conifer Forest.

John J. Battles and Frieder G. Schurr

ADDRESS OF LEAD AUTHOR:
Dept. of Environmental Science, Policy, and Management, UC Berkeley;
UC Berkeley, Tel: 510-643-0684: E-mail: jbattles@nature.berkeley.edu

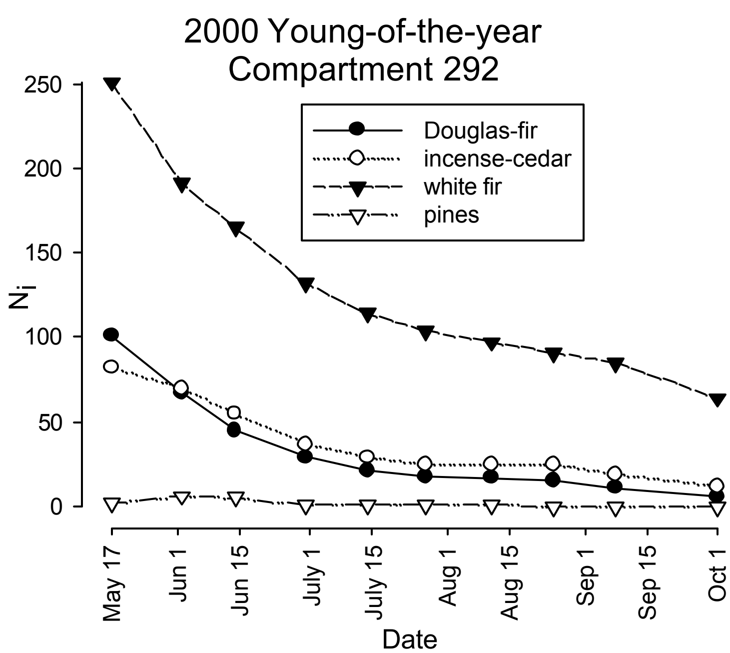
ABSTRACT

We examined the demography of Abies concolor (white fir) and Pinus lambertiana (sugar pine) in a mature mixed conifer forest in the Sierra Nevada. We constructed size-classified matrix models and then applied elasticity analysis to determine what vital rates (survival, growth, and fecundity) were the most important determinants of population change. Survival of canopy-sized white fir averaged 0.985/yr for the last 30 years. Fecundity (measured as the number of germinants produced) over the last 5 years averaged 149 germinants/canopy tree*year. The projected population growth rate for white fir was 1.007, indicative of a slowly growing population. In contrast, sugar pine was projected to decline with a growth rate equal to 0.988. Adult survival, particularly in the codominant size class, was much lower for sugar pine than white fir (0.939). Sugar pine fecundity averaged less than 10 germinants/tree*year. Changes in the sugar pine population were extraordinarily sensitive to the survival rate of canopy trees (elasticity = 0.734). The white fir population was also dependent on adult survival (elasticity = 0.512) but subcanopy tree survival was another important component (elasticity = 0.367). These projections support the contention that the Sierran conifer forests are communities currently ruled by non-equilibrium dynamics. Both fire suppression and an introduced pathogen contribute to the uncertain future of these forests.



METHODS

- Annual measurement of germination and survival)
- Repeated census of trees in marked plots
- Develop matrix population model for white fir and sugar pine
- Sensitivity analysis of demographic parameters
- Project short-term changes (80 yrs) in tree density and size-structure (Fig. 4)
- Annual measurement of germination and survival (Fig. 2)



The Effects of Prescribed Burning on Stream and Riparian Ecosystems at Blodgett Forest Research Station

Leah A. Bêche, Scott L. Stephens, and Vincent H. Resh

ADDRESS OF LEAD AUTHOR:
201 Wellman Hall, Division of Insect Biology, Department of Environmental Science, Policy and Management, University of California, Berkeley
(510) 642-5913
lrogers@nature.berkeley.edu (to be changed soon)

ABSTRACT

In areas where wildfire has been suppressed, prescribed burning can be an efficient forest management tool for fuel reduction and ecosystem restoration. However, concerns about the effects of fire on sensitive habitats, such as streams and riparian areas, have limited their use in management. Though wildfires (e.g., Yellowstone 1988) can have long-lasting effects on physical and biological features of streams and riparian areas, little is known about the effects of prescribed fire. In late October 2002, an upland and riparian plot (approx. 50 acres) was prescribed burned in the central Sierra Nevada, CA at Blodgett Forest Research Station. We have been and will continue to document changes in water quality, channel morphology, hydrology, aquatic macroinvertebrates, algal biomass, large woody debris and riparian forest community dynamics in burned and unburned first order catchments, before and after the fire, using a beyond-BACI experimental design. Multiple control and impact sites are being used to compare pre-fire and post-fire results to provide information on the: (1) effects of prescribed burning on streams and riparian zones; and (2) the recovery of streams following fire disturbance. We will present the results on the immediate effects of the prescribed fire (1 to 3 months post-fire) on riparian vegetation, water quality and periphyton.

Fire moving through riparian area near Dark Canyon Creek on October 22, 2002. The stream hydrology gage is in the foreground. **Photo by Leah Beche**

View of Dark Canyon Creek and riparian area post-prescribed fire. The stream hydrology gage is in the background
Photo by Leah Beche

Interactions Among the Root Pathogen, Heterobasidion annosum, Ponderosa Pines, Bark Beetles and Bark Beetle Associated Fungi

Pierluigi Bonello, Andrew J. Storer[1], David L. Wood[2] and Thomas R., Gordon[3]

ADDRESS OF LEAD AUTHOR:
Department of Plant Pathology
The Ohio State University
201 Kottman Hall, 2021 Coffey Road
Columbus, OH 43210
Email: bonello.2@usu.edu

ABSTRACT

In 1997, ponderosa pines (Pinus ponderosa) in two adjacent 35-year-old stands (east and west plots) at the University of California's Blodgett Forest Research Station (BFRS) were inoculated with the root rot pathogen Heterobasidion annosum. Other trees were mock inoculated, or left unwounded as controls. In the summer of 2000, a subset of the inoculated trees received a second round of inoculations in order to boost the dose of the root pathogen.

Accumulation of a phloem soluble phenolic, ferulic acid glucoside, was significantly higher in inoculated trees than in mock inoculated and control trees. The lignin content of the phloem was inversely correlated with ferulic acid glucoside content, and lignin was demonstrated to have a negative effect on the in vitro growth of two pathogenic fungal associates of bark beetles (Bonello et al. in press). Landing rates of bark beetles did not differ among inoculated, mock inoculated and control trees suggesting that host selection occurs after landing (Storer et al. in prep.). Male Ips paraconfusus ingested significantly less phloem when confined to logs cut from the base of inoculated trees compared with those confined to logs from uninoculated trees (McNee et al. in press). Therefore, despite changes in phloem biochemistry in response to inoculation with H. annosum, elevated landing rates and feeding rates did not occur, and do not

explain why diseased ponderosa pines are preferentially colonized by bark beetles.

Given that lignin reduces growth of bark beetle associated fungi in the in vitro tests, we plan on inoculating the trees with BFRS-home grown bark beetle associated fungi, and compare resistance of the ponderosa pines to these fungi in the summer of 2003. In addition we will collect addition phloem biochemistry data. We later plan to fell the trees in order to estimate the extent of root and butt-rot infection, as well as the extent of blue stain fungal infection of sapwood. We will determine the relationships between infection by bark beetle associated fungi, extent of H. annosum colonization and phenolic and lignin content of host tissues.

Bonello, P. A.J. Storer, T.R. Gordon, D.L. Wood and W. Heller. In press. Systemic effects of *Heterobasidion annosum* on ferulic acid glucoside and lignin of pre-symptomatic ponderosa pine phloem, and potential effects on bark beetle-associated fungi. Journal of Chemical Ecology.

Storer A.J., P. Bonello, D.L. Wood, W.R. McNee and T.R. Gordon. In prep. Effects of artificial inoculation of a root pathogen on the landing rates of bark beetles on ponderosa pine.

McNee, W.R., P. Bonello, A.J. Storer, D.L. Wood and T.R. Gordon. In Press. Feeding response of *Ips paraconfusus* to phloem and phloem metabolites of *Heterobasidion annosum*-inoculated ponderosa pine, *Pinus ponderosa*. Journal of Chemical Ecology.

[1] School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI 49931
[2] Division of Insect Biology, University of California, Berkeley, CA 94720
[3] Department of Plant Pathology, University of California, Davis, CA 95616

Determining tree root respiration in situ using natural 13C tracers

Weixin Cheng, Richard Susfalk, Shenglei Fu, and Dale Johnson

ADDRESS OF LEAD AUTHOR:
Department of Environmental Studies
University of California, Santa Cruz
Santa Cruz, CA 95064

ABSTRACT

Globally, rhizosphere C fluxes contribute 20-40 % of the C cycle in terrestrial ecosystems. However, the understanding of belowground carbon fluxes in forest ecosystems is generally lacking, mostly because of method limitations. For the purpose of developing a new rhizosphere method using natural 13C abundance, mixing of soil CO2 with atmospheric CO2 and lateral diffusion of various soil CO2 sources were studied by transplanting ^{13}C-enriched soils from a C_4-dominated tallgrass prairie into a mixed conifer forest. We found that surface trapped CO_2 from the non-disturbed native soils was significantly 13C-enriched primarily due to the mixing of soil CO2 with atmospheric CO2. Further more, mixing of soil CO2 sources due to lateral diffusion was also found to be a significant factor influencing the 13C abundance of soil CO2, when a naturally ^{13}C-enriched soil was transplanted into this C_3 dominated forest. Because of the significant mixing of the three main sources of CO2 (from air, native soil, and transplanted soil), our attempt to quantify the contribution of rhizosphere respiration within a forest ecosystem by transplanting ^{13}C-enriched soils into a C_3 mixed conifer stand failed at the first trial.

Avoiding these problems, a root chamber method is developed using natural isotope tracers. Preliminary tests were done using fine roots of longleaf pine and Douglas fir. Rates of rhizosphere respiration in these preliminary experiments were well within the range of reported respiration rates of excised tree roots. Respiration rates of Douglas-fir and ponderosa pine roots grown in tallgrass prairie soils were lower than in the sand-vermiculite mixture. However,

respiration rates of longleaf pine roots grown in the native wiregrass soil were significantly higher than in the tallgrass prairie soil. This suggested that a "native' soil is needed for representative measurements of rhizosphere respiration. The pros and the cons of this chamber method will be discussed.

The Seasonal Cycle of NO_2, Total Peroxy Nitrates, Total Alkyl Nitrates, and HNO_3 at the U.C. Blodgett Forest Research Station

Douglas A. Day, Diana Phillips, Michael B. Dillon, Paul J. Wooldridge, Gunnar W. Shade, Allen H. Goldstein, Ronald C. Cohen

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
Department of Chemistry
B76 Hildebrand Hall
Berkeley, CA 94720

ABSTRACT

Measurements of NO, NO_2, total peroxy nitrates, total alkyl nitrates, HNO_3, NO_y, O_3, and CO from the fall of 2000 through the end of 2001 were made at the University of California Blogett Forest Research Station (UC-BFRS). NO_2, total peroxy nitrates, total alkyl nitrates, and HNO_3 were measured using thermal dissociation – laser induced fluorescence (TD-LIF), a new technique developed at Berkeley and tested at the UC-BFRS. NO_x (NO_x = NO + NO_2), a bi-product of combustion, plays an important role in the photochemical production of ozone, a greenhouse gas and toxin to plants and animals, in the troposphere. NO_x can be converted into other reactive nitrogen (NO_y) species, removing it from the catalytic ozone production cycle. These reservoir species may be quickly deposited or transported to other regions where they may be converted back to NO_x and ensue ozone production. Understanding the partitioning among different reactive nitrogen reservoirs in addition to the loss processes in the atmosphere will help to better understand and quantify the impact that NO_x will have on ozone production on a regional and global scale. We are investigating the seasonal cycle of NO_y and the speciation thereof in addition to the seasonal variations in their relationships with CO, O_3 and various meteorological parameters at the UC-BFRS. The UC-BFRS is impacted both by clean air from the high Sierras as well of as relatively polluted air from the Sacramento Valley. This,

in combination of the full annual cycle we have observed, allows us to study a wide range of photochemical conditions.

The Goldstein Group Biosphere-Atmosphere Flux Site has been in use by researchers since 1997. In addition to the Goldstein group, researchers representing professors Ron Cohen, Ye Qi, Weixin Cheng, Lawrence Berkeley National Lab, the US Forest Service, and others, have utilized the tower and lab for research. Photo by Megan McKay

Cow manure in headwater streams: tracing aquatic insect responses to organic enrichment

Rosalie B. del Rosario, Emily A. Betts, and Vincent H. Resh

ADDRESS OF LEAD AUTHOR:
Division of Insect Biology
201 Wellman Hall
University of California
Berkeley, California 94720

ABSTRACT

When cattle graze in riparian areas, they can affect the structure of aquatic insect assemblages by adding nutrients (manure) to the stream, or by physically altering the habitat through trampling or foraging. Although cattle grazing is a well-described source of disturbance in stream habitats, the effects of manure inputs have not been previously isolated from the physical disturbance effects. We traced the fate of cow manure in headwater streams through insects representing 5 different functional-feeding groups to this introduced food source. We simulated manure enrichment from light grazing intensity and hypothesized that insects that feed directly on imported organic matter (shredders, filterers,

gatherers) would have higher assimilation rates and densities in response to manure enrichment than predators or periphyton-grazers. We expected insect responses to increase with incremental enrichment over time, and decrease with increasing distance from the manure input.

Through field experiments in 2 regions in California that differ in discharge and nutrient load (Coastal and Sierra Nevada), we

introduced manure (composed of undigested C_4 plant particles) from corn-fed cows into 7 streams that drain forests of C_3 plants. Stable carbon isotope ratios indicated all feeding groups assimilated the isotopically distinct manure. In the Coastal streams, groups assimilating the most manure were gatherers (net increase of 21% towards C_4 plant signal) and filterers (20%), while shredders (9%) assimilated the least. In the faster flowing Sierran streams, assimilation by each group was $\leq$ 9%. Temporal increases in manure uptake was detected in the Coastal mayfly gatherer Paraleptophlebia pallipes, suggesting increased manure assimilation over time. Manure uptake by insects was spatially localized within 3 m downstream of the site of manure input.

Densities of all 6 genera representing 5 functional-feeding groups were not significantly altered in response to manure-enrichment. However, the characteristically organic-enrichment tolerant chironomids increased over 5-fold in densities after 4 weeks of enrichment. The composition of chironomid genera did not shift, and insect taxa richness in the enriched treatments did not change in response to manure enrichment. In our simulation of enrichment effects, which approximated low-density grazing of 6 cows visiting each stream reach weekly for 8 weeks, we found that in the absence of physical disturbances from cattle grazing, manure is an important food source for gatherers in particular, and elicits responses from chironomids that are characteristic of organic enrichment.

CATTLE AT BLODGETT FOREST

Photo by Bob Heald

ATMOSPHERIC TEST TOWER
photo by Gunnar Schade

Observations of reactive nitrogen oxides at Blodgett Forest Research Station

Delphine K. Farmer, Rebecca S. Rosen, Diana C. Phillips, Jennifer G. Murphy, Douglas A. Day, Ronald C. Cohen

ADDRESS OF LEAD AUTHOR:
Department of Chemistry
UC Berkeley
Berkeley CA 94720

ABSTRACT

The exchange of trace nitrogen species between ecosystems and the atmosphere affects atmospheric composition and controls ecosystem nutrient availability, with potential indirect consequences for the carbon cycle and climate. At the UC Blodgett Forest Research Station, we have been measuring reactive nitrogen oxides (NO_y) and the major classes that make up NO_y namely NO_2, alkyl nitrates, peroxy nitrates, and HNO_3 using thermal dissociation-laser induced fluorescence (TD-LIF). These data have provided insight on the NO_y budget of the troposphere, processes controlling NO_y chemistry leading to ozone formation and movement of air pollution plumes from the Central Valley over the Sierra Nevada's. We further propose to use this technique in combination with the eddy correlation method to measure ecosystem and leaf scale fluxes of reactive nitrogen oxides at Blodgett Forest. These studies will directly test the hypothesis that some plants directly incorporate atmospheric nitrogen as a nutrient through leaf uptake, and lead to a greater understanding of the processes that control atmospheric nitrogen exchange.

Evolutionary ecology of a host-parasite interaction

Holly Ganz

ADDRESS OF LEAD AUTHOR:
University of California-Davis
Department of Entomology, One Shields Ave.
Davis, CA 95616

ABSTRACT

My project examines variation in host resistance and parasite performance and explores factors that contribute to the maintenance of this variation. Many species exhibit variation in their defenses against attack by pathogens, parasites, and predators. Several processes may maintain variation in host resistance to natural enemies. Life history theory predicts that evolution of host defenses depend on fitness trade-offs that optimize the costs and benefits of traits associated with defense. Observations of high levels of variation in resistance in host populations have been interpreted as evidence for such fitness trade-offs. However, genetic variation in resistance of host populations is also an underlying assumption of evolutionary theory that predicts that parasites help to maintain genetic variation and sexual reproduction in host populations. Through a series of complementary experiments, I am studying host resistance and parasite performance in the interaction between the western treehole mosquito, Ochlerotatus sierrensis and its protist parasite, Lambornella clarki (Ciliophora: Hymenostoma). In a common garden experiment in the laboratory, I am measuring resistance and virulence traits for ten California populations of Oc. sierrensis and L. clarki in order to describe variation within and between populations. This geographic survey provides an important foundation for complementary studies investigating fitness trade-offs and local adaptation. In order to address the potential for local adaptation in the interaction between Oc. sierrensis and L. clarki, I am performing reciprocal cross-infection studies within and between host and parasite populations. These studies will allow me to determine whether the parasite exhibits local adaptation (such that they perform better in local host populations compared with geographically more distant populations) and the spatial scale at which local adaptation is observed.

Characterizing the light environment in Sierra Nevada mixed-conifer forests using a spatially explicit light model

Rolf Gersonde, John J. Battles, Kevin L. O'Hara

ADDRESS OF LEAD AUTHOR:
Division of Forest Science,
Department of Environmental Science, Policy, and Management,
145 Mulford Hall, University of California, Berkeley 94720-3114
Tel.: (510) 643-2025, fax: (510) 643-5438, gersonde@nature.berkeley.edu

ABSTRACT

Successful management of uneven-aged mixed-species forests depends on balancing resource availability and resource demand of understory trees. Using the spatially explicit light model tRAYci we characterized the light environment in a multiaged mixed-conifer stand in the Sierra Nevada, California. The light model was calibrated using leaf area-sapwood area prediction equations to determine leaf area density for each tree and hemispherical photographs to correct crown representation. The model explained 80% of the

C. 321 Mixed Conifer

Photo by Bob Heald

variation in transmittance calculated from hemispherical photographs. We calculated the distribution of light micro-sites at the forest floor and vertical light profiles under the canopy and in canopy gaps. Whereas average light transmittance under the canopy did not increase with height below 15 meters, the light profile in canopy gaps showed continuous increase with height. There was little variation in light intensity received by sapling size trees, however trees in the mid- and overstory experienced a much greater range of light intensity. Translating stand structure into resource availability can enable us to explain growth dynamics of understory trees and design stocking guidelines for uneven-aged forests.

COMPARTMENT 440 SHELTERWOOD, 1999
Photo by Bob Heald

Blodgett Forest Research Station
Road Management Plan

Nadia Hamey, Robert C. Heald , Frieder Schurr, Robert A. York

ADDRESS OF LEAD AUTHOR:
Center for Forestry
College of Natural Resources
University of California, Berkeley
4501 Blodgett Forest Road
Georgetown, CA 95634
(530) 333 4475; email: nhamey@nature.berkeley.edu

ABSTRACT

Roads are a major source of erosion and sedimentation on most managed forest and ranch land (Weaver and Hagans, 1994). There are many factors which contribute to this potential road erosion, including: types and number of stream crossings, road gradient, road surface, road construction and design, precipitation amount and periodicity, water holding capacity of surrounding soil, and road usage. By carefully planning with these factors in mind, Blodgett Forest Research Station (BFRS) can economically minimize erosion and sediment transportation. This Road Management Plan (RMP) provides guidelines for constructing, reconstructing, monitoring, maintaining and closing of forest roads and log landings. The goal is to disconnect the forest road transportation system from the natural hydrological system, thereby minimizing sediment input and road water drainage to watercourses. The objectives of this Road Management Plan are to inventory, prioritize, and address road related erosion problems. Limited new road construction is anticipated, and emphasis is placed on improving and abandoning roads.

This road management plan includes the following components:

1. **History and current status of roads on Blodgett Forest**
2. **Road/Culvert Identification and Inspection/ Maintenance/ Improvement Program**: Guidelines for monitoring forest roads & culverts and establishing a maintenance priority program

3. **Road Design and construction Standards**: Guidelines for road location, design, and construction.
4. **Road Use Guidelines**: Restrictions on use of forest roads.
5. **Road Abandonment plan**: A comprehensive plan to identify and prioritize roads to be properly abandoned on the forest.

In summary, the intent of this Road Management Plan (RMP) provides a systematic program to inventory the existing roads, log landings, watercourse crossings and drainage features, provide guidelines for existing maintenance, new road construction, to improve current roads and stream crossings, and abandon high-risk & unnecessary roads in order to minimize adverse impacts of sediment transportation into local water courses.

Above: **LAYING GROUND MATS FOR EROSION PROTECTION**

Ensuring the Future: Seed Collection at Blodgett Forest

Jack Harvey, Sheryl Rambeau, and Robert C. Heald

ADDRESS OF LEAD AUTHOR:
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
(530) 333-4475 email:
jharvey@nature.berkeley.edu

Left: CLIMBING FOR CONES
photo by Jennifer Prentiss

ABSTRACT

To provide sufficient seed to meet annual planting requirements of 5,000 to 10,000 seedlings of each species, and in preparation for a possible catastrophic fire event, Blodgett Forest Research Station is committed to collect a diverse seed bank of mixed conifer commercial tree species. The seed program goal is to collect adequate native species seeds from a diverse set of individual trees representing the best genetic gene pool on Blodgett Forest Research Station for each species. To meet this goal, fire reforestation requires enough seed to grow over 260,000 seedlings of each species. Our goal is to identify 100 individuals of

each species, each representing a different family group, then collect and store their seed. After 28 years of effort, the 2002 collection reached that quota.

Seeds are taken from ripe cones collected from mature, dominant ponderosa pine, sugar pine, incense-cedar, Douglas-fir, and white fir trees on Blodgett in late summer or early fall. A cone is considered ripe when at least 90% of the embryo cavity of the individual seeds are filled. Conifers produce cones – their reproductive process – on an irregular schedule. On average, Douglas-fir and white fir produce every 4 to 6 years; incense-cedar produces every 2 to 3 years, sugar pine between 3 and 5 years, but ponderosa pine only generates cones on an average of 8 to 10 years. Sugar pine seed collection is complicated by susceptibility to white pine blister rust. Ninety-seven percent of the reproductively mature sugar pines in this area are susceptible. Blodgett has identified eight sugar pine trees that are genetically blister-rust resistant (Rr: 'half sibling single gene resistant') through seed collection and testing. As much seed as possible is collected from these resistant trees, the seedlings used for planting.

SUGAR PINE (*Pinus lambertiana*) CONES

Assisted by personnel from Blodgett Forest, a commercial cone collector spends 3-4 weeks collecting mature cones from pre-determined trees on Blodgett Forest. Tree selection is based on straight, vigorous growth with no sweeps, forks or disease defects. The typical tree chosen is between 60 and 100 years old. An average of two bushels of cones for sugar pine, Douglas-Fir, white fir and ponderosa pine are collected from each designated tree. Less volume is required for the much smaller incense-cedar cones.

The use of spurs is prohibited on any Blodgett trees, so the collector uses a throw line to reach live crowns, then free climbs to the upper third of each canopy to collect the female cones. The climber uses a long pole with lopper shears on the end to reach the branch ends and cut the cones free. White fir cones are fragile, and are caught in a small bag on the end of the loppers, as are the incense-cedar cones due to their small size. All other cones are allowed to drop to the ground, where they are gathered, sorted into bags and labeled, then sent to tree nurseries for seed extraction. For additional protection, Blodgett Forest seed banks are maintained at two separate nurseries, a California Department of Forestry and Fire Protection nursery in Davis, and the USDA Forest Service nursery near Camino. This ensures that should misfortune visit a nursery, only half the stock would be lost.

Cones from six blister rust resistant sugar pine trees were collected in 2002. These trees are carefully protected from squirrel encroachment by metal bands around the base and permanent ladders are mounted against each tree for accessibility.

above: **CONE COLLECTOR DESCENDING FROM RUST RESISTANT SUGAR PINE TREE, USING CLIMBING ROPES AND MOUNTED ALUMINUM LADDER**

Photo by Jennifer Prentiss

E

,

l.

e

iss

Branch pruning reduces stem taper in giant sequoia

Robert C. Heald, Nadia Hamey, and David Rambeau

ADDRESS OF LEAD AUTHOR:
Co-Director, Center for Forestry
College of Natural Resources
University of California, Berkeley
4501 Blodgett Forest Road
Georgetown, CA 95634
(530) 333 4475; fax: (530) 333 2012
Email: bheald@nature.berkeley.edu
http://www.cnr.berkeley.edu/forestry/
http://ecology.cnr.berkeley.edu/blodgett/

A previous publication and several BFRS Workshop abstracts have reported the remarkable potential of Giant Sequoia (Sequoiadendron giganteum) for wood production. Planted Giant Sequoia exhibit very rapid early growth. Pure Sequoia stands quickly consume available site nutrient and soil water resources resulting in early size differentiation due to varied stand density. High-density Sequoia stands grow slower in both stem diameter and height than stands with moderate to low stocking levels.

Giant Sequoia does not set annual or branch terminal buds. At Blodgett Forest Research Station (BFRS) sequoias commence stem growth in early May then begin height growth and leaf development in June. Both stem and height growth continue until soil moisture is exhausted, usually sometime in late August to early September. After growth cessation this species translocates a substantial portion of its nutrients from leaves into stem and root mass. These nutrients are returned to active new growth points the next spring coincident with initiation of leaf development.

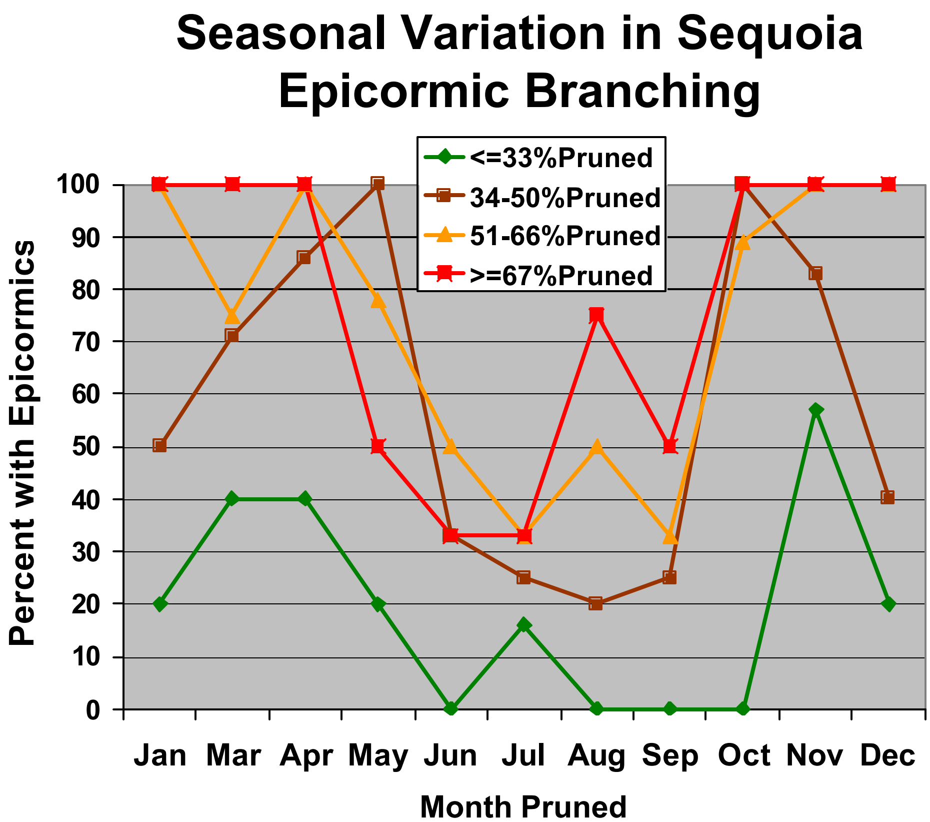
Giant Sequoia typically hold eight years of leaves and retain both live and dead branches for nearly a century, regardless of stand density. Individual trees in low to moderate density stands grow extremely fast but develop very high stem taper. Artificial pruning appears to be the only option for clear wood development short of centuries of growth.

Our initial pruning results demonstrated a strong relationship between both timing and intensity of pruning. Sequoias pruned October through May often produced epicormic branches concurrent with new leaf development on existing branches the June following pruning. Higher intensity pruning (>30% of total height) typically produced more and higher vigor epicormics than low intensity pruning. Sequoia pruned during the active leaf development period of June through September rarely produced epicormic branches.

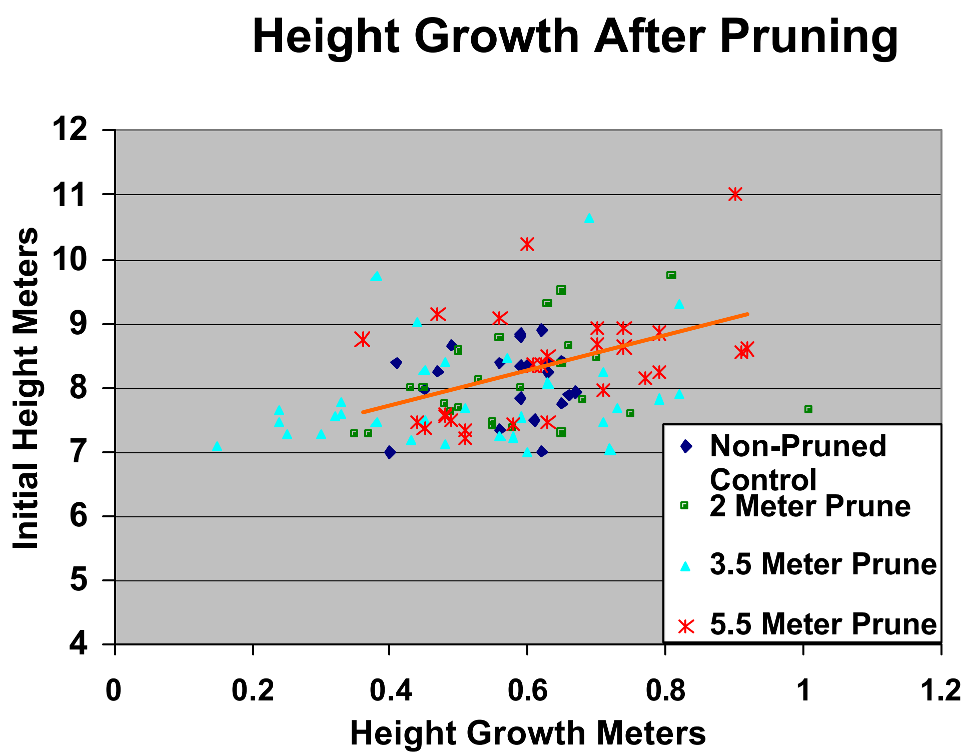
Epicormic branches produced after initial pruning continued to elongate during the second summer after pruning. Rarely were new epicormic branches created during this second growth season, regardless of the timing of initial pruning.

Pruned giant Sequoia grew comparably in height to non-pruned controls during the second season following pruning. Remarkably, intensity of pruning did not seem to effect height growth.

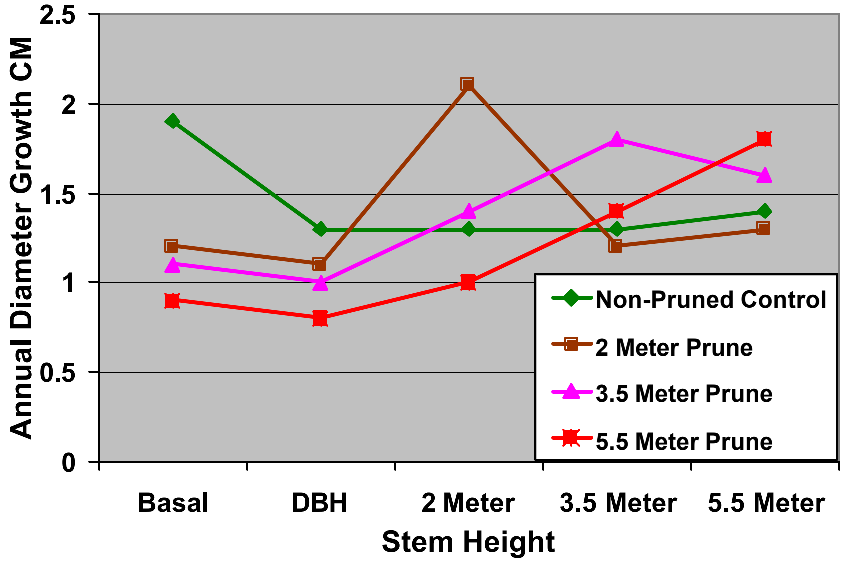
Stem diameter growth at DBH, two meters, 3.5 meters, and 5.5 meters were approximately equal in non-pruned control sequoias. Pruned sequoia grew significantly more in stem diameter at the base of remaining live crown than control trees. Pruning Giant Sequoia resulted in reduced stem taper.



Branch Collar Epicormics Before Pruning


Height Growth After Pruning
Initial Height Meters
Height Growth Meters
12
11
10
9
8
7
6
5
4
0
0.2
0.4
0.6
0.8
1
1.2
Non-Pruned Control
2 Meter Prune
3.5 Meter Prune
5.5 Meter Prune

Pruned Sequoia Stem Growth



Technological Parameters of Boles from Small Suppressed Trees

Luis M. Ibanez de Garayo

ADDRESS OF LEAD AUTHOR
University of California
Forest Products Lab
University of California, Berkeley
1301 S. 46th Streetm /bkdg, 478
Richmond, CA 94004-4603

ABSTRACT

Small diameter trees growing under suppression often have undesirable geometrical bole properties and significant differences in wood properties that depreciate their market value. Therefore, our work has been designed to obtain both types of information from the trees growing on six compartments at Blodgett. In order to acquire geometrical information of the bole of the trees, they were videotaped and a software tool is being developed to automatically acquire 3D information of the bole of trees to derive values such as taper, lean, sweep, and volume.

This process presents two novel ideas for the forest Mensuration communities: a new measurement technique and a new geometrical model for boles. Recovering 3D information from sequence of images is a classical problem among people from the robotics community but never has been used for Mensuration of trees; this problem involves several steps: image segmentation, point correspondence analysis, camera self-calibration, and Euclidean space recovery.

The second novelty consists of resuming the cloud of 3D points from the bole in a general parametric model. This goal has been achieved by using a generalized cylinder model that allows us to represent taper, leaning, and sweep of boles. The overall procedure is being designed to allow forest managers to easily acquire and summarize the geometrical parameters of trees that represent

the parameters of the population in a statistical sense, and pass this information down the forest production line to sawmill managers and engineers.

On the other hand, we collected a representative set of specimens from the trees that were also videotaped in order to analyze basic wood properties parameters such as wood density and juvenile wood. A database with information with annual ring densities is being developed to evaluate the influence of suppression on wood density: the basic hypothesis is that suppressed trees might have different early-to-late wood proportion, therefore, bulk wood density values might change.

The last objective for our work is to evaluate the extrapolation capabilities of predictive models such as CACTOS on the range of small diameter trees, and its modification, if necessary.

Predictability of ectomycorrhizal fine roots across a mixed-conifer forest

Antonio D. Izzo, Peter Kennedy, Thomas D. Bruns

Address of Lead Author
321 Koshland Hall
University of California at Berkeley
Berkeley, California, 94720-3102
(510) 643-5483
email: aizzo@nature.berkeley.edu

ABSTRACT

Fine roots act as an exchange point for nutrients and water acquisition. The ability to predict their abundance based on aboveground plant community structure is important to designing studies involving fine roots and the underground processes which rely upon them. While a number of studies have assessed this topic in monospecific stands, few have looked in mixed-species forests where varying soil conditions and root competition are likely to make fine root dynamics more complicated. We used molecular techniques (PCR and RFLP analysis) to investigate fine root predictability in Blodgett Experimental Forest –a high-diversity California mixed-conifer forest. Fine roots from 28 randomly selected stands across the Blodgett forest FSS compartments were identified and their relative abundances compared to various aboveground measures of host composition. Overall fine root distribution was found to be coarsely predictable across a one meter plot although not all aboveground measures were equally successful. The reliability of predicting belowground composition decreased as the aboveground species richness and density increased. These results suggest that predicting belowground composition is possible in mixed forests but that as forest diversity increases it is necessary to use an aboveground measure appropriate to the site features.

Total Versus Speciated Monoterpene Concentrations and Fluxes: Do Speciated Measurements Underestimate Emissions?

Anita Lee, Gunnar W. Schade, Allen H. Goldstein

ADDRESS OF LEAD AUTHOR:
University of California Berkeley
Department of Environmental Science, Policy, and Management
151 Hilgard Hall
Berkeley, CA 94720-3110

ABSTRACT

Concentrations and fluxes of speciated and total monoterpenes were measured simultaneously above a ponderosa pine plantation at Blodgett Forest, in the Sierra Nevada, CA. Speciated measurements were made using relaxed eddy accumulation (REA) coupled with a gas chromatograph with flame ionization detectors (GC-FID), and total monoterpene measurements were made using eddy covariance coupled with a proton transfer reaction mass spectrometer (PTR-MS). Ambient, in situ measurements of monoterpene concentrations and fluxes are typically limited to a few monoterpene species. Because simultaneous measurements of both total and speciated monoterpenes have never been made, it is not known whether speciated monoterpene measurements adequately represent the impact of total monoterpene emissions to the atmosphere. We present results from the first field experiments comparing simultaneous measurements of concentrations and fluxes of seven commonly emitted monoterpene species with new measurements of total monoterpene concentrations and fluxes. As all monoterpene species share the same mass, the PTR-MS, coupled with the eddy covariance technique, allowed us to make real time, in situ concentration and flux measurements of the sum of all monoterpene species in the atmosphere. These two flux measurement techniques were in good agreement on the temporal pattern of monoterpene flux, but showed that measurements of speciated monoterpenes underestimated

the flux of total monoterpenes to the atmosphere. As our GC-FID system is comparable to other speciated monoterpene concentration measurement systems typically used, the underestimation of emissions made by our speciated

VIEW OF THE FETCH FROM THE ATMOSPHERIC TOWER AT THE GOLDSTEIN RESEARCH SITE, ONION VALLEY ROAD

Photo by Gunnar Schade

measurements suggest that models based on speciated monoterpene flux measurements may be underestimating regional and global monoterpene emissions and their impacts on atmospheric chemistry.

Fine Particle Formation And Processing In A California Pine Forest

Melissa M. Lunden, Douglas R. Black and Nancy J. Brown; Gunnar W. Schade, Anita Lee and Allen H. Goldstein

ADDRESS OF LEAD AUTHOR:
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
One Cyclotron Road MS 51R0208
Berkeley, CA 94720

ABSTRACT

Secondary organic aerosols (SOA) have been estimated to contribute significantly to the total particle mass in urban areas. Their contribution to total aerosol mass in rural areas, where biogenic emissions can be of the same order of magnitude as athropogenic emissions, is not well characterized. Moreover, few studies exist where both speciated biogenic gas phase measurements have been coupled with aerosol characterization data. To study biosphere-atmosphere exchange of ozone and VOCs and their effects on SOA formation and processing, we have conducted a study at the Blodgett Forest Research Station in the Sierra Nevada Mountains of California. The research site includes automated instrumentation for the in-situ measurement of concentration and biosphere-atmosphere flux of VOCs, ozone, integrated and size resolved aerosol instrumentation, and meteorological variables.

Particle size distribution measurements indicate aerosol formation near the tower site, indicated by the appearance of nuclei mode particles (<20nm) just after noon. These particle formation events occurred in the forest, either at the site or upwind of the site. These particles are formed from a combination of biogenic processing of the anthropogenic air mass or solely by biogenic reactions. Formation events were strongly correlated with lower temperatures, with fewer observed events occurring later in the summer, and have be observed both with

and without the presence of a larger aerosol mode. Experimental yield data will be used with measured fine mode aerosol data that is coupled with meteorological data and other measured gaseous species concentrations to investigate whether oxidation of various organic precursors can account for aerosol growth. In addition, we will present modeling results to probe the competition between nucleation and condensation during particle growth, coupled with the measured VOC fluxes to understand the atmospheric fate of biogenic organic compounds and oxidation products.

Atmospheric Tower

Photo by Megan McKay

Effect of climate variability and management practices on carbon, water and energy fluxes of a young ponderosa pine plantation at the Blodgett Forest Research Station.

Laurent Misson, Megan McKay, Allen Goldstein

ADDRESS OF LEAD AUTHOR:
ESPM Department
151 Hilgard Hall
University of California, Berkeley
Berkeley, CA 94720-3110
phone: 510-643-6449 fax: 510-643-5098

ABSTRACT

Despite the range and importance of semi-arid Ponderosa pine ecosystem in the U.S., stand-scale fluxes of carbon, water and energy of these ecosystems have rarely been studied. Our research at the Blodgett Forest Research Station is advocated to better understand how these fluxes of a mid-elevation, young pine plantation vary interannually in response to climate variability, and how they are impacted by management practices such as shrub removal and thinning. Fluxes of CO_2, H_2O, and energy have been measured continuously since May 1999 by the eddy covariance method. Environmental parameters such as wind direction and speed, air temperature and humidity, net and photosynthetically active radiation (R_{net} and PAR), soil temperature, soil moisture, soil heat flux, rain, and atmospheric pressure are also monitored. This data set covers periods characterized by various levels of drought stress. Shrub was removed in the spring 1999 and a precommercial thinning of 50% of the trees was applied in the spring 2000. Our data set shows that the ecosystem CO_2 uptake decreases dramatically just following the thinning. Nevertheless, one year after thinning the CO_2 uptake is significantly enhanced before the expansion of a severe drought in the late summer 2001. Dark respiration, computed based on net ecosystem exchange (NEE) light curve, shows positive correlation with soil temperature in the range of 0 to 10 °C. For higher temperature, the relationship becomes weak

because soil temperature is then correlated with lower soil moisture content (< 30%) that may be limiting ecosystem respiration. Our data set shows that non-ordinary daily hysteretic behavior of NEE may occur: in several cases late afternoon CO_2 uptake is higher than in the early morning for equivalent PAR. An hypothesis is proposed concerning the effect of direct vs. diffuse PAR on photosynthesis.

PINE CONE PRODUCTION, PONDEROSA PINE
Photo by Gunnar Schade

Soil responses to the Fire and Fire Surrogate Study – treatment expectations, wows and woes

Emily E.Y. Moghaddas and Scott L. Stephens

ADDRESS OF LEAD AUTHOR:
Dept. of ESPM, Forest Science Div.
145 Mulford Hall, #3114
University of California
Berkeley, CA 94720-3114

ABSTRACT

The Fire and Fire Surrogate Study utilizes forest thinning and prescribed burning in attempt to create forest stand structures that reduce the risk of catastrophic wildfire. Replicated treatments consisting of mechanical tree harvest (commercial harvest plus mastication of sub-merchantable material), mechanical harvest followed by prescribed fire, prescribed fire alone, and no-treatment controls, were completed in fall 2002. Pre-treatment data of soil physical, chemical, biological characteristics were measured in 2001. Post-treatment effects will be assessed in 2003.

Emily Moghaddas using a sieve during soil sampling. ***Photo by Jason Moghaddas***

Harvesting operations may accelerate N mineralization due to microclimate changes. Skidding will increase exposure of mineral soil and soil bulk density. Prescribed fire alone

will reduce forest floor biomass. This may enhance N mineralization rates in the surface soil, while intense heat pulses may cause short-term alterations to microbial communities. Soil pH and base saturation are both expected to rise, while soil texture and compaction may remain unchanged by burning. Mechanical harvest followed by fire is expected to result in increased forest floor consumption and greater temperatures and flame residence time than those obtained by burning alone. As a result, biological and chemical effects may be more pronounced than in the fire-only treatment. Soil physical effects are expected to be similar to those in the harvest-only treatment. The presence of skid trails in all treatment units (due to past harvest activities) increases the heterogeneity of the soil environment, and may influence treatment effects.

Emily Moghaddas marking an area to collect pre-burn soil samples. ***Photo by Jason Moghaddas***

A LONG-TERM NATIONAL STUDY OF THE CONSEQUENCES OF FIRE AND FIRE SURROGATE TREATMENTS:

IMPLEMENTATION OF PRESCRIBED BURN TREATMENTS- SUCCESSES, MISTAKES, AND LESSONS LEARNED

Jason J. Moghaddas and Scott L. Stephens

ADDRESS OF LEAD AUTHOR:
Department of Environmental Science, Policy, and Management
Division of Forest Science
University of California
145 Mulford Hall #3114
Berkeley, CA 94720-3114
(510) 642-7304
moghad@nature.berkeley.edu
http://cnr.berkeley.edu/espm/directory/fac/stephens-lab

ABSTRACT

The prescribed burn treatments for the Fire and Fire Surrogate Study were implemented during the fall of 2002. In all, over 300 acres were burned in 7 compartments. Work was primarily carried out by Blodgett Forest and University of California staff and students. Assistance was also provided by the U.S. Forest Service, Growlersburg Conservation Camp (California Department of Forestry and Fire Protection), and Sierra Firestorm (a contract crew from Chico, CA). Successes and mistakes experienced during burn implementation

Above: Volunteers Tadashi Moody, Andrew Corr, Danny Fry
Photo by Jason Moghaddas

will be presented along with suggestions for improving implementation of future burns.

Above: Safety Meeting for burn participants in Vaux parking lot, morning October 21, 2002
Photo by Rosemary Stefani

Below: Small tree torching during burn, Compartment 570
Photo by Jason Moghaddas

Pruning to Reduce Blister Rust Incidence in Sugar Pine

Kevin L. O'Hara, Tudor Stancioiu, Mark Spencer, and Rolf Gersonde

ADDRESS OF LEAD AUTHOR:
Department of ESPM
207 Mulford Hall
University of California, Berkeley, 94720-3114
(510) 642-2127

ABSTRACT

Pruning of lower limbs of eastern white pine and western white pine has been an effective treatment for reducing white pine blister rust (Cronartium ribicola) infections. By removing limbs and therefore foliage, infection sites are removed, and resultant infections are substantially reduced. It is assumed that infections are more common near the ground because of higher humidity and the requirement of high humidity for spore infection in needle fascicles. No results have been reported for pruning sugar pine to reduce white pine blister rust infection.

During the summer of 2000, sugar pine trees were pruned at two study areas in California. At Blodgett trees were pruned in 7 different compartments. Two stands on Roseburg Forest Products lands near Lake Almanor were also pruned. At both study areas, trees between approximately 8 and 20 feet (2.4 - 6.1 m) tall were selected. Sample trees were required to show no visible effects of blister rust, and to be free of any other damage (animal, logging, etc.). Every alternate tree that met the sampling requirements was pruned to half its total height, but never more than 8 feet (2.4 m). Loppers were used to remove all living and dead branches to the pruning height. All needle fascicles below the pruning height were also removed. Alternate trees were unpruned. All trees were tagged and measured for height, diameter, height to base of live crown or

pruning height, and branch whorls above breast height were counted to determine breast height age.

At Blodgett, the total tree sample included 127 trees: half of which were pruned. At Lake Almanor, 156 trees were sampled: half were pruned. Our future plans with this study are to monitor sample trees for mortality effect on an annual basis. At present, we plan to complete a remeasurement in 2005 to determine growth effects of pruning and document pruning effects on blister rust mortality. This timeline may be accelerated if mortality or infection rates appear to differ between pruned and unpruned trees in our monitoring.

Left:

PRUNING

IN

PROGRESS

Modeling Ozone Uptake in Ponderosa Pine Along an Ozone Gradient in the Sierra Nevada

Jeanne A. Panek, Laurent Misson, Allen H. Goldstein

Address Of Lead Author:
Environmental Science, Policy and Management
151 Hilgard Hall
University of California, Berkeley 94720
(510) 642-9732. Email: jpanek@nature.berkeley.edu

ABSTRACT

Tropospheric ozone is a pollutant which is responsible for forest injury worldwide. It is a strong oxidant which invades foliage through stomatal pores and impairs normal physiological function. In the Sierra Nevada, ozone concentrations can be unrelated to ozone uptake. In the late summer, ozone concentrations peak, but uptake is low due to stomatal closure in response to moisture stress. Thus, concentration-based indices of ozone exposure overestimate the ozone "seen" by plants. To more accurately estimate ozone uptake in ponderosa pine (the most ozone-sensitive Sierran conifer) throughout the Sierra Nevada, we first measured gas exchange/physiology directly at 4 sites along an ozone gradient for 3 growing seasons and one winter. From this we developed and validated a model, then used the model to estimate ozone flux (ozone concentration stomatal conductance to ozone) across the Sierra Nevada and through time. With this approach, we can begin to develop cause-effect relationships between ozone stress and forest injury in pine. The uptake-modeling method is being adopted across Europe to replace current concentration-based exposure indices. This is one of very few studies attempting to model ozone flux to forests in the US, and will contribute to improving monitoring of Sierra Nevada forest health in response to ozone pollution.

Some Effects Of Compaction On Soil Physics And Tree Growth

Robert F. Powers, Senior Scientist

ADDRESS OF LEAD AUTHOR:
PSW Research Station
Redding, CA 96001

ABSTRACT

One objective of the Long-Term Soil Productivity (LTSP) experiment is to determine how harvesting disturbances affect processes controlling site productivity. Of more than 60 LTSP experiments in North America, 12 are in California, and one was established in 1994 on a loamy Cohasset soil series at Blodgett. Growth of planted trees over the first 5 years at Blodgett show no detrimental effects of surface organic matter removal totaling 451 Mg ha^{-1}, nor of soil compaction that increased bulk density by 18% and reduced total porosity by 9%. No detrimental effect of compaction is somewhat surprising, given the model of Froehlich and McNabb (1984) that tree growth declines linearly with increasing soil density. Gomez et al. (2002), studied the Cohasset loam at Blodgett along with those on two other sites with finer and coarser soil textures. We found that pine growth was reduced by compaction on the clayey soil, most likely because of a slight reduction in plant available water, sizable reduction in aeration porosity, and greater root resistance because of reduced pore size in a soil already of fine texture. However, growth was essentially unaffected on the loam (Blodgett), and increased by compaction on the sand (Fig. 1). The differing effects of compaction on growth could be explained by changes in available soil water measured in the field.

CLAY	Bulk Density (Mg m-3))	Total Porosity (m3 m-3)	Available Water (cm3 cm-3)
No compaction	1.25	0.51	0.13
Compaction	1.49	0.41	0.12
LOAM			
No compaction	0.85	0.65	0.08
Compaction	1.00	0.59	0.12
SANDY LOAM			
No compaction	1.19	0.53	0.12
Compaction	1.39	0.46	0.20

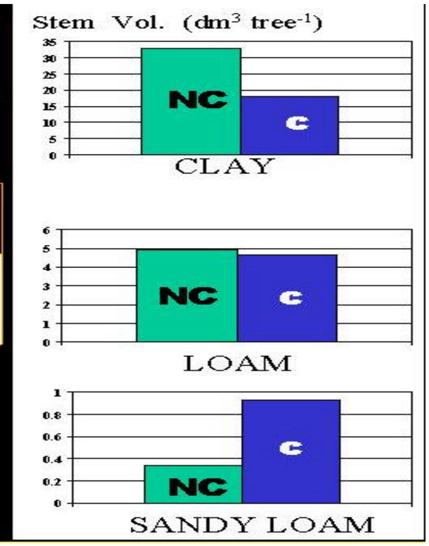


Figure 1. Effects of soil compaction (C) on soil physical properties, water availability, and tree growth for three contrasting soil textures. Soils are from Challenge (clay), Blodgett (loam) and Rogers (sandy loam) LTSP sites in California.

These findings are supported by controlled greenhouse "least-limiting water range" experiments (Siegel-Issem, unpublished) involving the Blodgett soil and another sandy soil (Dome series) from an LTSP research site on the Sierra National Forest. In this experiment, pine seedlings were grown in soils at varying levels of bulk density, but with soil moisture levels held constant through periodic irrigation. After several weeks of growth, roots were removed and measured for their length density (cm roots cm^{-3} of soil). For the Cohasset loam, root length density (RLD) dropped linearly as soil bulk density increased beyond 1.0 Mg m^{-3}. And for a given bulk density, RLD declined linearly as soils became drier (Fig. 2). However, these bulk densities begin at--and extend well beyond--the density achieved by compaction at Blodgett. Furthermore, Fig. 2 suggests that RLD changed very little as soil bulk density rose from 1.0 to 1.1 Mg m^{-3}. Field measurements of soil water availability at Blodgett indicate that water availability was slightly improved by increasing soil bulk density from 0.85 Mg m^{-3} to 1.0 Mg m^{-3} (Fig. 1). For the sandy Dome soil, RLD also declined with increasing bulk density but the relationship with soil water content was parabolic, not linear (Fig. 2). Compared with loams, sandy soils have a higher proportion of large voids (macropores) which primarily hold air, not water. Compaction always reduces macroporosity. Therefore, compacting a sandy soil can—to a point—enhance the soil's capacity for holding plant-available water by increasing particle to particle contact. On coarse-textured soils, greater particle contact means greater water retention without a sacrifice in soil aeration.

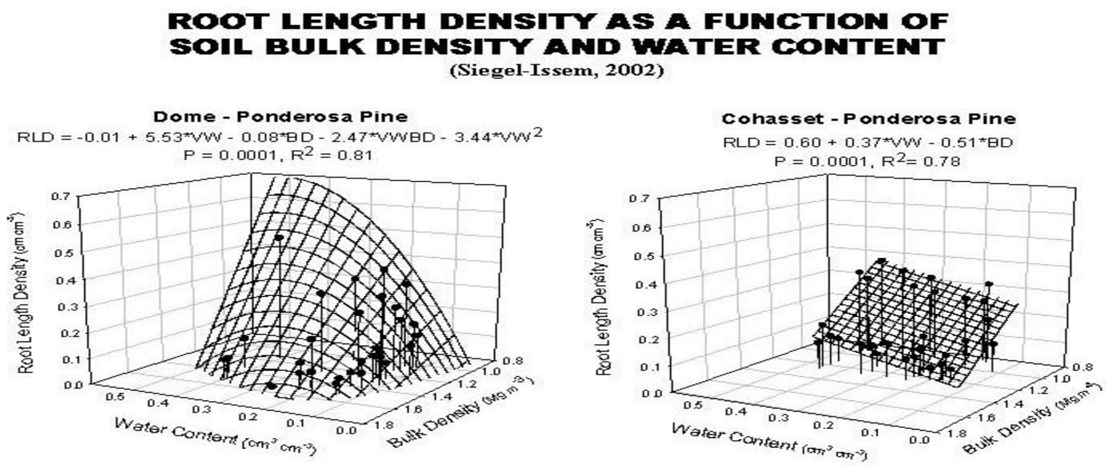


Figure 2. Least-limiting water range curves for a sand (Dome soil series) and loam (Cohasset soil series from Blodgett). Seedling root length declines with increasing soil bulk density on both soils. But the relationship between root length density and soil moisture is parabolic on the sand, linear on the loam. From Siegel-Issem M.S. thesis, Virginia Polytechnical University.

References

Froehlich, H.A., and D.H. McNabb. 1984. Minimizing soil compaction in Pacific Northwest forests. p. 159-192. In: E.L. Stone (ed.) Forest soils and treatment impacts. Proc. 6th North Am. Forest Soils Conf., Knoxville, TN. The Univ. Tennessee, Knoxville.

Gomez, A., R.F. Powers, M.J. Singer, and W.R. Horwath. 2002. Soil compaction effects on growth of young ponderosa pine following litter removal in California's Sierra Nevada. Soil Sci. Soc. Am. J. 66: 1334-1343.

Preliminary Estimates Of Biomass And Leaf Area Of Planted Giant Sequoia

Robert F. Powers, Therese M. Alves, and Robert C. Heald[1]

ADDRESS OF LEAD AUTHOR:
PSW Research Station
Redding, CA 96001

ABSTRACT

Twenty two giant sequoia were destructively sampled in April 2000 from Blodgett thinning plots in the southern end of the spacing study bounded on the west by Mutton Ck. Rd. and on the south by Little 4 Corners Rd. Trees were sectioned in the field and taken to the Redding laboratory for further analysis. Foliar mass was estimated by dividing the green crown into three sectors of equal length, measuring the basal area (BA) of each branch in each sector by metric caliper, and removing a representative branch of average BA from each sector. In the lab, sample branches were stripped of foliage and 1-sided specific leaf area was determined from subsamples using scanning imagery calibrated against targets of known size. Foliage and branch wood were then dried at 70°C to stable weights. Foliage mass (and leaf area) were then determined for each sector by the ratio

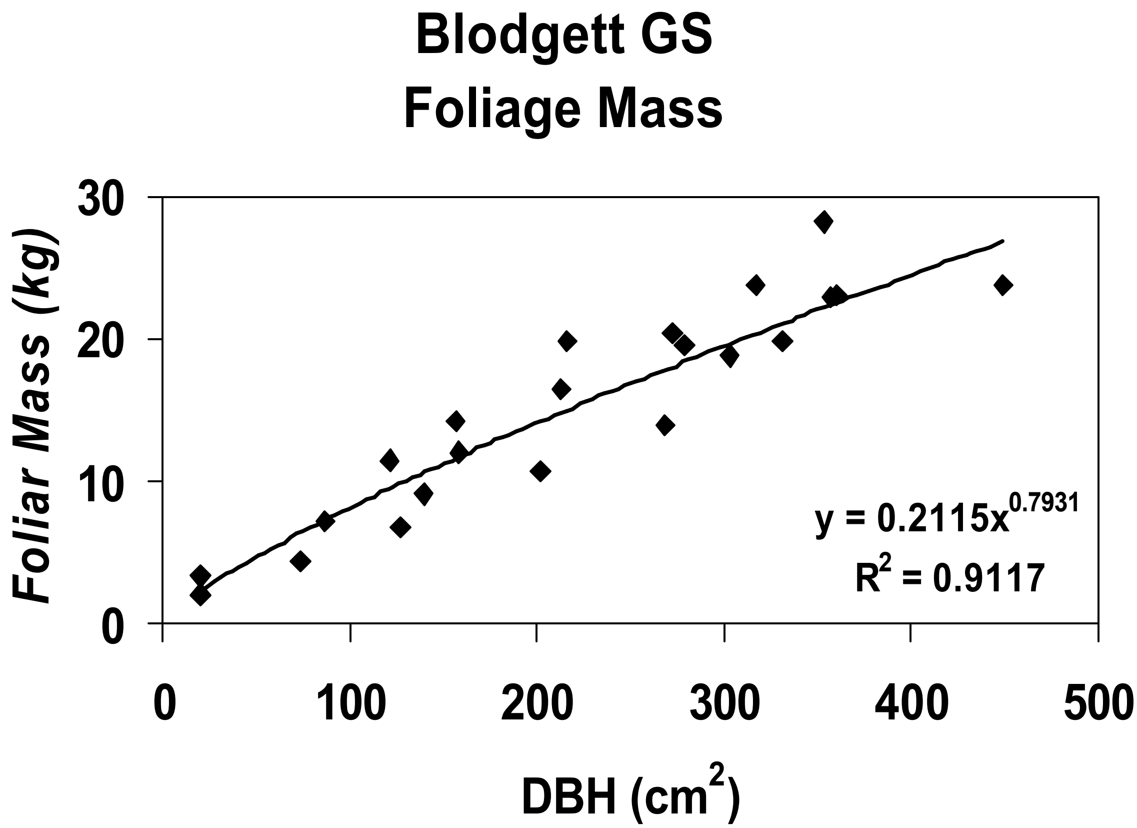
foliar mass (or area)/BA of sample branch : foliar mass (or area)/sum BA of all branches

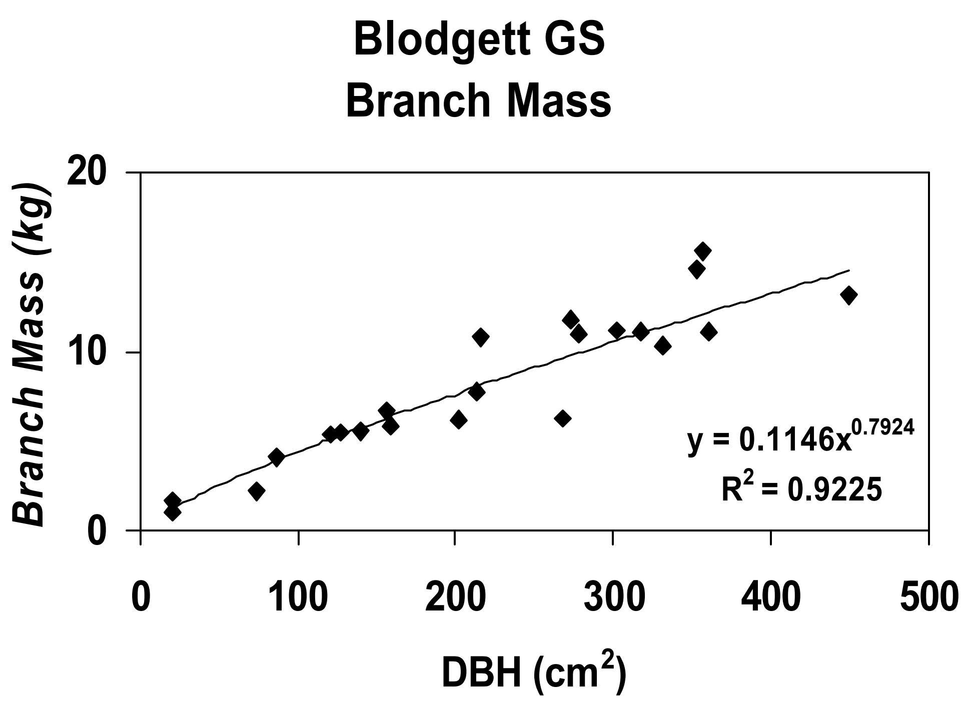
Branch mass was determined similarly. Inspection of data by sector showed no trends, so data were summed for all sectors to estimate total crown mass and leaf area for each of the 22 trees. Stem volume was estimated from field measurements of outside bark diameters and truncated cone formula. Disks were sawn at stump height, base of the live crown (usually at stump height), and mid crown. Disks were transported to the Redding lab and volumes were measured by water displacement (necessary, because lower stems often were fluted) of saran-covered pieces. Disks were then oven-dried. Heartwood radii (where heartwood seemed evident) also was measured in four directions for

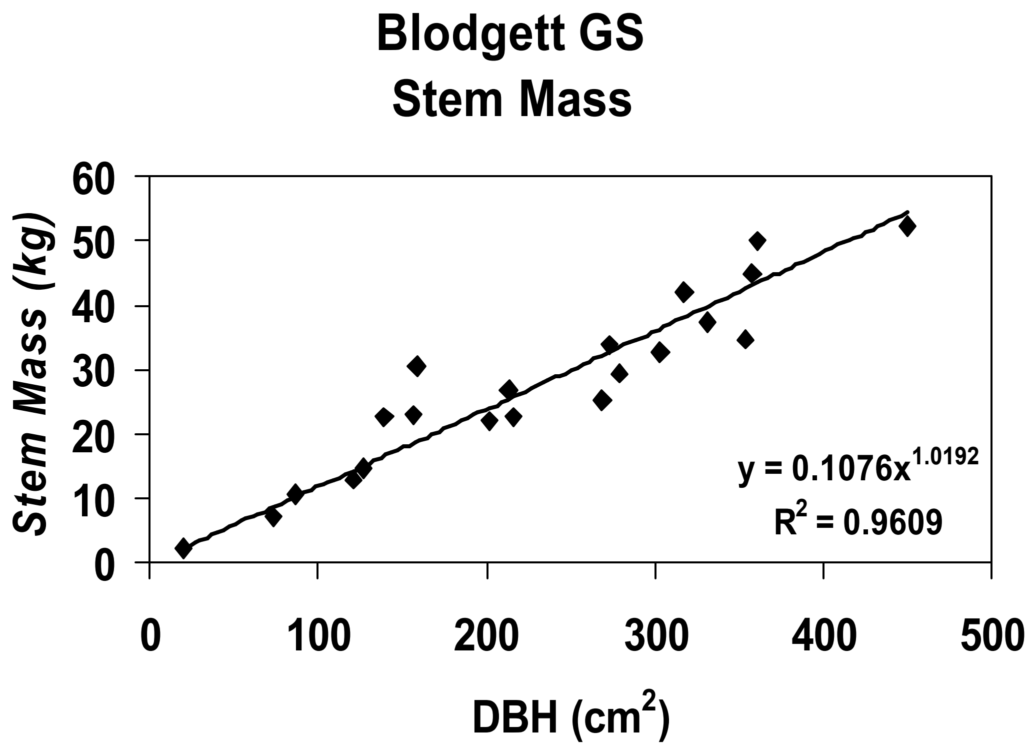
each disk following sanding and staining. Stem mass was estimated by multiplying stem volume by mass per unit volume of the disks (no density trends were evident relative to position on the stem). Tree data were then subjected to a variety of simple regression forms, and preliminary trends of best fit vs DBH^2 appear in Figs. 1A-D.

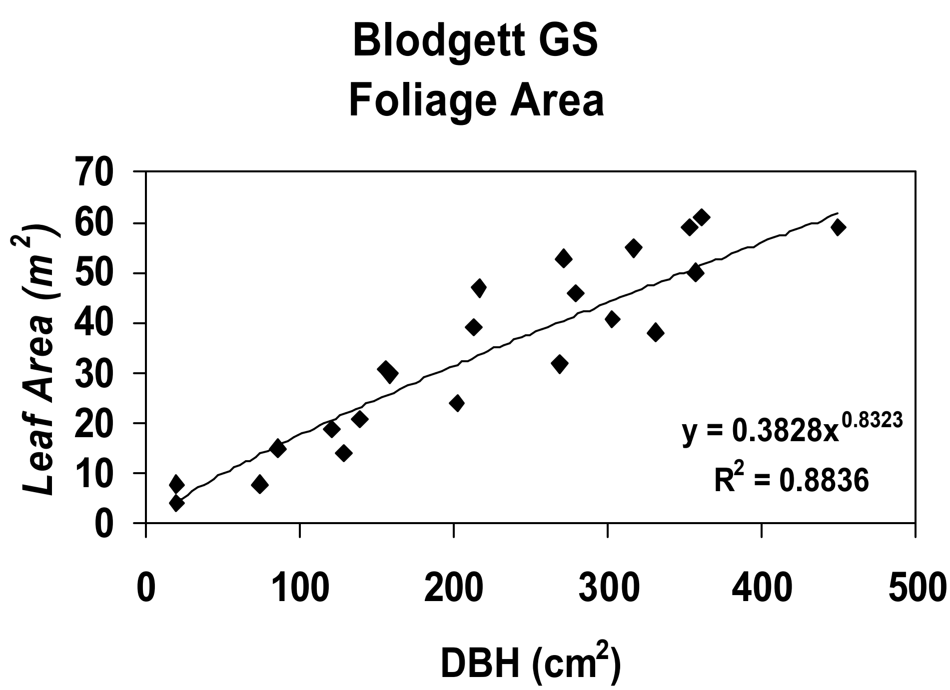
[1]University of California, Berkeley

AERIAL VIEW OF SEQUOIA STUDY
Photo by Bob Heald


Blodgett GS
Foliage Mass
Foliar Mass (kg)
0
10
20
30
0
100
200
300
400
500
DBH (cm2)
y = 0.2115x0.7931
R2 = 0.9117


Blodgett GS
Branch Mass
Branch Mass (kg)
0
10
20
0
100
200
300
400
500
DBH (cm2)
y = 0.1146x0.7924
R2 = 0.9225


Blodgett GS
Stem Mass
Stem Mass (kg)
60
50
40
30
20
10
0
0
100
200
300
400
500
DBH (cm2)
y = 0.1076x1.0192
R2 = 0.9609


Blodgett GS
Foliage Area
Leaf Area (m2)
70
60
50
40
30
20
10
0
0
100
200
300
400
500
DBH (cm2)
y = 0.3828x0.8323
R2 = 0.8836

Controlled Grazing

Jennifer K. Prentiss, William Frost,

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475; e-mail: prentiss@nature.berkeley.edu

ABSTRACT

The Sierra Nevada has a long history of livestock grazing. Archaeological surveys at Blodgett have discovered rock wall sheep pens containing artifacts dated to the 1850's. The Bacchi family is known to have grazed cattle in this area each summer from the early 1900's through early 1960's. Open range grazing has long been the norm for mid elevation forest lands on the west side of the Sierra. Many counties (including El Dorado) have open range ordinances which allow free movement of livestock unless physically restricted by the landowner, not the cattle owner.

Since the 1970's Blodgett Forest (BFRS) has had seasonal cow-yearling grazing on approximately 1,800 acres of forestland (all property south of Wentworth Springs Road) courtesy of our grazing permittee, the Carmen family. These cows and yearlings were moved from the Carmen's central valley and foothill pastures to BFRS in late May to graze in a large enclosure that simulates open range at until early October. In cooperation with the Carmen family we managed the exact dates and numbers of cattle within the fenced enclosure. Many research projects and several PhD theses have been completed as part of this program.

In order to support the Fire and Fire Surrogate Study (FFSS) the Center for Forestry has agreed to not allow open range grazing for five years. As an alternative we have selected several individual compartments to enclose with solar electric fence and conduct controlled grazing studies. This allows

researchers to conduct both the FFSS and grazing research. Continued cooperation with the Carmen family will facilitate potential future research involving grazing.

Our objective is to determine the effects of controlled grazing, and its potential for shrub management in Mixed Conifer stands of the Sierra Nevada. Sixteen cows and yearlings were held in units of approximately 10, 20, and 40 acres for between two and eight weeks. The duration was keyed to the variation in available forage. The first site contained primarily 4-year-old natural seedling shrubs, forbs and trees. Subsequent sites contained 10 to 15 year old vegetation. One site had mostly sprouting shrubs which had been masticated two years ago. The cows and yearlings were removed from each site when foraging shifted from primarily shrubs to intensive foraging on black oak sprouts (Quercus kelloggii). Pre and post grazing data on tree, shrub, and forb vegetation has been collected. Digital photographs were also taken from each plot center before and after grazing.

The preliminary results show that the cows and yearlings did substantially decrease the size of the shrubs without any damage to the tree regeneration. The preferred feed was grasses and sedges followed in time by deer brush (Ceanothus integerrimus) and mountain whitethorn (Ceanothus cordulatus), but greenleaf manzanita (Arctostaphylos patula), whiteleaf manzanita (Arctostaphylos viscida), and bull thistle (Cirsium vulgare) commonly showed signs of grazing. We intend to continue this study next season.

left: Horsemen preparing to move cattle

Left: Cattleman Pete Carman helping direct cows into an enclosure

Below left and right: Vegetation measurement plots

Pre – grazing **Post - grazing**

Center for Forestry Outreach Program

Jennifer K. Prentiss, Bill Frost, and Robert C. Heald

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475; e-mail: prentiss@nature.berkeley.edu

ABSTRACT:

With over 3.8 million people in California, and more arriving every day, it is not surprising that we have a growing urban interface. As increasingly more people move into the foothills and mountains of the Sierra Nevada it becomes imperative that we interact with these people. We need to provide them information on water, soil, wildlife, pests and diseases, and vegetation management necessary to administer their lands in a healthy sustainable fashion.

University of California Cooperative Extension (UCCE), Department of Natural Resources outreach arm, has the primary responsibility for this role. With advisors located in 50 counties across the state, UCCE has the ability to disseminate information to communities throughout California. The UCCE office for El Dorado County, located in Placerville, is home to three advisors who cover agriculture, natural resources, and youth development. The Natural Resource Advisor for El Dorado County, William Frost, has taken the position of Program Leader, Natural Resources, for the State. This change in roles left a large gap in meeting our communities' outreach needs.

The Center for Forestry (Center) in coordination with UCCE was able to allocate some of the resources earmarked for Mr. Frost's position to a half time outreach position stationed in El Dorado County, at Blodgett Forest Research Station. This position, created in August 2002, will be funded for two years with the intention of demonstrating the value of a full time UCCE Natural Resource

Advisor at Blodgett Forest. We will present the outcome of the first six months of this cooperative effort, and our goals for the next 18 months.

PRELIMINARY 6 MONTH RESULTS:

The outreach forester has spent much of her first few months supporting events that were scheduled prior to her arrival, and creating an outreach plan that will guide the number and frequency of events in the months to follow. From August 2002 to February 2003 she has completed:

- 8 tours for approximately 180 people (groups ranged from local school district administrators, to a group of Forestry Consultants from New Zealand, to a group of 30 retired residents of a nearby community).
- 7 professional presentations reaching approximately 600 people (venues ranged from the Tahoe Cattleman's Association to the Western University Forest Managers Meeting).
- 8 posters (Mixed Conifer Plantation Growth, Giant Sequoia Density, Grazing at BFRS, and several others).
- Other administrative duties such as documenting appropriate tours for various age and skill levels, facilitating meetings, writing grants, attending meetings, and working with media.

GOALS FOR NEXT 18 MONTHS:

- Assist researchers in development of outreach material specific to their study (posters, tour stop information, etc.)
- Connect visitor groups with the variety of research conducted at the Center.
- Translate management activities at Center properties to researchers and visitors.
- Make research results more readily available for use by UC classes and for Center properties management.
- Increase quality of outreach material while reducing cost.
- Improve local public image of Center properties.
- Reduce outreach workload on Center forestry and administrative staff.
- Provide forestry technical support to local UCCE staff.

OBJECTIVES FOR NEXT 18 MONTHS:

The outreach plan for the upcoming 18 months include:

- 2003 Research Workshop – February 7-8, 2003
- Open House – Scheduled for May 9-10, 2003
- Update all Center web pages and post many posters on the WEB with Carrie Salazar.
- Update all Center hand outs.

- Participate in a workshop on ID and Management of Forest Insects and Diseases (Spring 2003 – by USFS)
- Lead approximately 25 more forest tours (high school groups, college groups, conservation groups, local landowners, natural resource professionals, and local politicians).
- Give presentations to at least 20 local community organizations such as the Georgetown Rotary Club, El Dorado County Master Gardeners, High Sierra RC&D, Georgetown Sons in Retirement, Georgetown Fire Department, Sierra College, American River College, and UC Davis.
- Create at least 20 more posters (one for each center property, Goldstein tower, update FFSS, vegetation inventory, road management plan, fuel treatments, snag retention and recruitment, forest certification, arch sites, and all other research projects on the forest).
- Update all compartment summary sheets (summary of management practices, vegetation, fuels, and wildlife specific to each compartment).
- Develop a 1 page, quarterly document on emerging local forestry issues.
- Facilitate discussion on management of Pilot Creek falls.
- Create a color photo ID book for Sierra Nevada Trees / Flora and Fauna found on BFRS.
- Gather information on other local research (USFS spotted owl survey, SPI Goshawk survey).
- Write grant applications.
- Hold a workshop on Sierra Nevada Silviculture (Fall 2003)
- Hold a workshop on forest certification (Fall 2003)
- Hold a workshop on the Fire and Fire Surrogate Study (Spring 2004)
- Hold a workshop on Flora and Fauna of the Sierra Nevada (Spring 2004)

If researchers have any suggestions as to projects or programs you would like to see done, or ways in which I can assist you in developing outreach materials, please contact Jennifer Prentiss, Outreach Forester, Center for Forestry.

UCCE Biomass Workshop
BFRS Field Tour

Otter Creek School at Bacchi Barn

El Dorado County Harvest Fair First Place:

"Most Patriotic"

Photos by Jennifer Prentiss

Whitaker Forest Archeological Sites

Jennifer K. Prentiss, Frieder G. Schurr, Robert C. Heald,

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475; e-mail: prentiss@nature.berkeley.edu

ABSTRACT

Discovering, recording and protecting archaeological resources are some of the many land management responsibilities of Center for Forestry (Center) staff. While internal policy voluntarily commits the Center to this goal, the California Environmental Quality Act (CEQA) requires a specific process be followed whenever projects require a permit from a state or local agency. For example, all Timber Harvest Plans (THP) require a complete archeological survey of the proposed harvest area and surrounding lands, a records search of recorded and potential sites through a regional information center, notification of appropriate local Native American tribal representatives, and review by a state archaeologist. Several Center staff foresters have advanced training and State Certification to conduct surveys and prepare reports. Throughout the 1999 and 2000 field seasons, Center foresters conducted extensive field surveys at Whitaker Forest and searched the Woodbridge Metcalf files deposited in the U.C. Bancroft library. In 2001 Jennifer Prentiss completed the archeological records for the known sites at Whitaker Forest in preparation for submitting a THP.

Whitaker Forest proved to be exceptionally rich in both Historic and Prehistoric archaeological resources. We had knowledge of several historic sites from administrative documents, however we still needed to locate and properly record them. Many of the prehistoric sites were discovered during field surveys. There were also several prehistoric artifacts that were discovered and recorded.

Site layering and conflict among written notes and oral remembrances complicated work. For example, the Hyde Mill site (a 1870s pioneer sawmill) that overlays a prehistoric bedrock mortar and possible Native American camp, was itself obscured by a historic 1930s Youth camp which had been partially obliterated by contemporary erosion control research. Incredibly, despite 13 decades of extensive use by pioneers and tens of thousands of youth campers, Center foresters recovered obsidian flakes and a mano from the surface of this site.

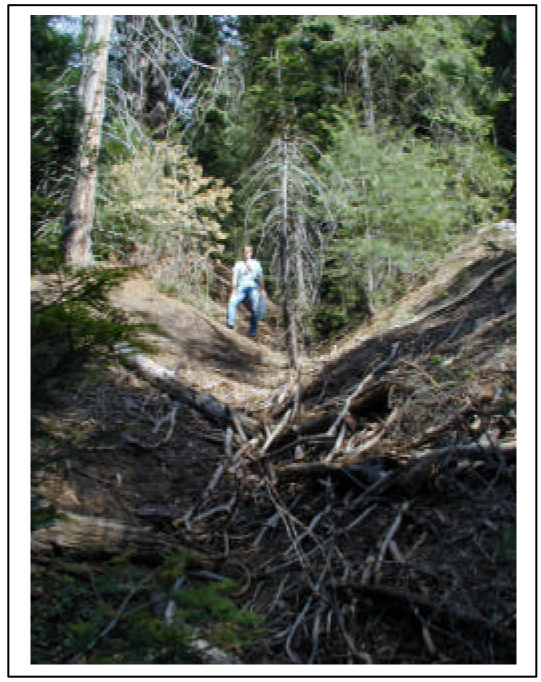
Two pioneer gravesites had conflicting location records. The original wood head markers were carefully protected from vandalism and weathering by winter storage inside a structure. Casual file notes indicated their initial removal was done to protect them from prescribed fire research, however these notes described locations that conflicted with the remembrances of some frequent Whitaker Forest visitors. A short spur road reconstructed circa the mid 1990's further complicated the issue.

Extensive portions of Whitaker site records and artifacts will be on display during this workshop. Please remember the records are confidential and the artifacts protected by state law. While both Whitaker and Blodgett Forests have extensive archaeological records, we are certain that future research and management activity will uncover new information. Please join us in protecting these important keys to understanding our past. Leave all historic and prehistoric artifacts intact and in the place you chance to discover them in the forest. Promptly notify a Center forester. We will share the results of our subsequent investigations and credit you with the find when filing the record.

Right:
Mano (Native American Acorn)
From Whitaker Camp Site

Whitaker Camp Bedrock Mortar
Acorn Grinding Station

han
Ash stored in this tree.



Log Chute

Georgetown, 'Pride of the Mountains'

Sheryl Rambeau

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475; e-mail: srambeau@nature.berkeley.edu

ABSTRACT

The discovery of a gold nugget in Coloma in January of 1848 set off a Gold Rush that abruptly altered a nation's history as thousands of gold seekers poured into the California territory in pursuit of the precious metal. From a primarily Spanish-speaking, placid, agrarian province, the California territories boomed into a bustling population as gold seekers scrambled for treasure. Directly above the initial discovery site, two river forks flowed around a chunk of geography that came to be called the "Georgetown Divide". Miners searching for the source of the placer nuggets found in the lower elevations moved into these hills and eventually settled in the community that would be called Georgetown.

The first important discovery on the Georgetown Divide was made by six Oregonians in July 1849. The lucky miners struck color in an area they called Hudson Gulch, just northeast of present day Georgetown, where they found riches beyond their imaginings. It is estimated they were taking over 300 pounds of gold per week from the gulch.

After word of the rich claim leaked out, hordes of gold hunters followed their lead. A New York based group, led by George Phipps and John Cody, set out in the autumn of 1849 to look for their own bonanza. The expedition followed creeks uphill, naming them as they progressed. Where the main stream divided, the group split, John Cody to follow Manhattan Creek to establish a base

camp at 'John's Town', later called Garden Valley. George Phipps and his party made their way up Empire Creek and settled into a base camp at the headwaters. The soon-to-be thriving community was named 'George's Town'.

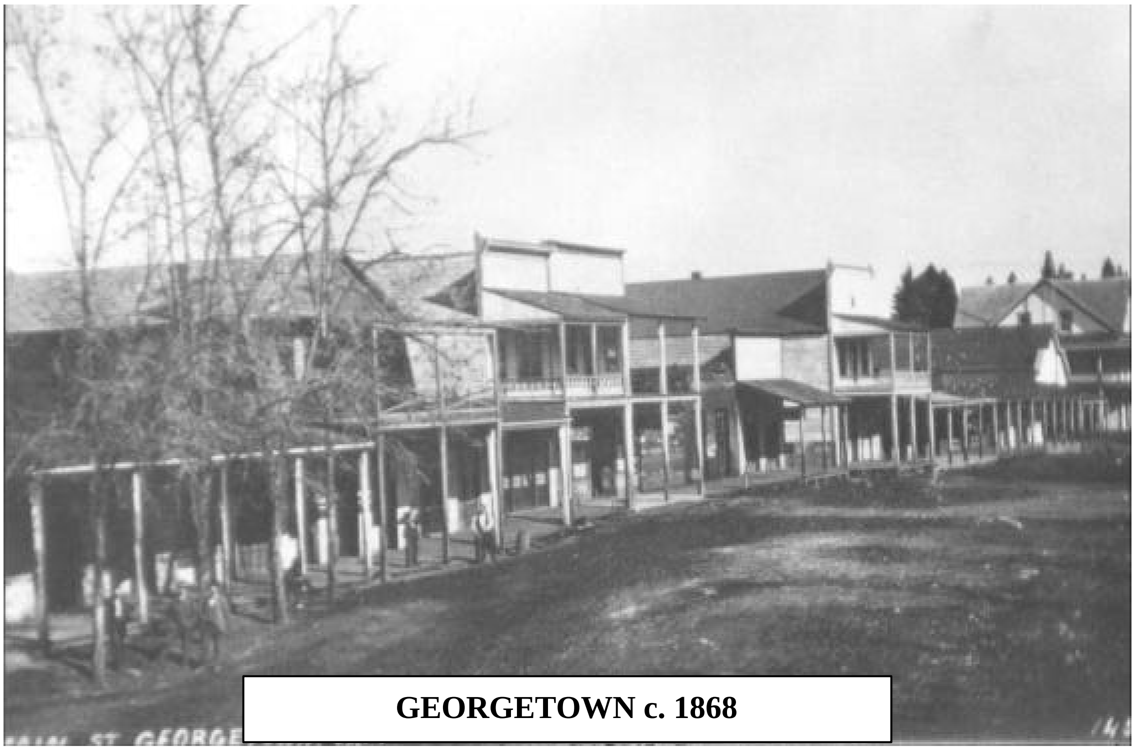
Others naturally followed the success of the Oregon and New York groups, and it was estimated that by December, 1849, there were 462 people living in George's Town, with a tributary population in the immediate vicinity of over 5,000, 99% of them male. In the first fifteen years, over $4.25 million in gold was taken out of the immediate Georgetown area. At modern gold prices, that represents over $130 million. Some parts were so richly mineralized that claims were limited to 15 square feet.

The original townsite in Empire Canyon gradually evolved into a supply center for the expanding population on the Divide. A dozen permanent structures, constructed of logs, shakes and canvas, had appeared by January 1850.

An accident with photography equipment started a major fire in July 1852 in a saloon at the town center. The fire spread quickly throughout the entire village. When the flames subsided, only two buildings were still standing and both had sustained serious damage. A town meeting was held that same night and three local men were designated to draw up reconstruction plans. They recommended a new town site be established, slightly uphill and at right angles to the old. The new Main Street was to be constructed 100 feet in width and cross streets 120 feet wide, as a fire prevention tactic. Construction was to begin at Gamblers' Gulch, cross Sacramento Street (now Highway 193) and extend to Orleans Street. Prior traders and hotelkeepers got first choice of the newly designed lots. Actual street width was later scaled to the present size, but the layout is still unique in gold mining towns.

The oldest surviving building in Georgetown is the Shannon Knox house, built on the corner of main and Sacramento Streets in 1852 by carpenter Shannon Knox. That building survived all subsequent fires in the town.

The newly designed Georgetown began to grow, and by 1853, there were 6 families living here, with schooling for the children and a practicing town doctor. Georgetown was the logical link between Placerville, Auburn and the multiple mining camps scattered throughout the area, situated in the middle of



GEORGETOWN c. 1868

the multiple small settlements. It was a distributing point for supplies, mining equipment, and travel, and gradually became the commercial hub for the region, even lending the town's name to the entire geographical description, the Georgetown Divide.

The town continued to grow and expand, in spite of the ever-present threat of fire consumption. Georgetown survived, and rebuilt each time, after fire spread through the entire town in 1856, 1858, 1869, 1873 and 1889. The major losses in the 1869 blaze prompted new buildings utilizing brick instead of frame construction, in an attempt to limit damage. The brick buildings held up well through the next two alarms, but conditions contributed to major losses in 1897. Heat and gusting winds fanned the June conflagration and exhausted firefighters. Unfortunately, the flames eventually reached basement storage mid-point in the business district where dynamite was kept. The resulting explosion demolished any buildings still standing.

THE FIRE OF 1897 (American Hotel far right)

The town was rebuilt, yet again, but never really reached the prosperity level and size it had been before the 1897 disaster. Expanded mining capabilities sparked a mini-Gold Rush in the mid 1930s. Technology allowed re-opening and deepening of many of the original gold mines in the area, but gold was considered a nonessential metal at the beginning of US involvement in World War II and the majority of the mines were closed and have not been reopened.

After the war, economics dictated a return to the huge stands of lumber in the high country, and logging became a primary activity. It was not unusual through the 1950s and 1960s to see back to back loaded log trucks traveling through town. At one point, there were 14 small lumber mills operating on the Georgetown Divide. Georgetown Lumber Company, on Wentworth Springs Road just above Camp Chiquita, was churning out an average 75,000 board feet per day.

GEORGETOWN 1952

Eventually logging, too, scaled back, local mills closed and Georgetown set out to attract the next mini-boom – tourism. With recreation fairly close, and urban work centers not so very far away, Georgetown has evolved into a non-industrial community, offering a "rural atmosphere" and a few basic necessities for living.

Through multiple disastrous fires, good and bad economic phases, Georgetown has persevered. The once booming mining camp has stabilized into a small rural community nestled in the Sierra Nevada, and while it may never again achieve the size and bustle that started it, it remains an important link in California history, and a place of pride.

A Brief History of Blodgett Forest

Sheryl Rambeau

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475; e-mail: srambeau@nature.berkeley.edu

ABSTRACT

The population of the Georgetown Divide expanded as a direct result of the 1849 Gold Rush, as miners converged on the rich Mother Lode, looking for treasure. In the 1850s, the Mother Lode was probably the most populous area in California, with over 40,000 miners active in the area, and another 40,000 enroute. Gold deposits became less obvious the higher the miners climbed, so the populace didn't expand as extensively into the upper elevations. However, structures, mills, reinforcement for deepening mine shafts – all needed lumber, a commodity readily available at those higher elevations. Early settlers often described the towering sugar pines and huge Douglas-fir trees that stretched as far as the eye could see.

Eventually mining declined, while lumbering steadily grew in importance. American River Land and Lumber Company organized in 1889 and began removing the huge sugar pines growing at 4000 and 5000 feet elevations. A small sawmill, Barklage Mill, was set up on Bacon Creek adjacent to current Blodgett Forest headquarters. Some narrow gauge railroad grades, built originally for logging, have been converted on Blodgett to roads.

Lumbering, like mining, saw ups and downs and in turn, the expansive lumber tracts were eventually taken up by El Dorado Lumber Company, then C. D. Danaher Pine Company. Michigan-California Lumber Company was organized

in 1918 by John W. Blodgett, a Michigan lumber baron. "Mich-Cal' acquired and worked thousands of acres east of Quintette, removing millions of board feet of lumber, and built Pino Grande saw mill just south of current Blodgett boundaries.

Camp One Logging Camp, located on upper Mutton Creek. Photo c. 1909

In July 1933, Michigan-California's Chief Forester, Major Swift Berry, approached Berry's alma mater, the University of California, Berkeley, with an offer: Michigan-California would give 2680 acres of young growth conifer forest near the lumber company's Pino Grande mill site to the University to be used for "investigations in the management of second-growth forests and also as a demonstration area to show what the various methods of forest treatments look like". The University accepted the land, and the property was named Blodgett Forest, for Michigan-California's president. The U.S. Forest Service donated an office building [now known as Guest House] and ranger cabin [currently Headquarters House] for use on the site, and Blodgett Forest Research Station was born.

Assistant Professor of Forestry Percy M. Barr took over management duties in 1934 and immediately began to develop a research program focusing on ecology and stand growth. Barr spent the next twenty years preparing inventories and installing simple ecological and growth studies. Grad student Henry J. Vaux spent the summer of 1935 cruising the property, the first University sponsored inventory of the land. According to Vaux, there "wasn't a respectable tree on the place", which averaged less than 6 residual old growth trees per acre measuring over 24 inches in diameter.

When Michigan-California Lumber harvested along Blodgett's western borders, it was suggested to Dean Henry Vaux in 1956 that the timber then growing on Blodgett could be harvested and sold for profit. Sale receipts were retained by the department and used to support research and administration at the property.

Lecturer in Forestry Rudolf F. Grah assumed management in 1958 and implemented the compartment system, dividing the forest into compartments clearly defined by management style and geographical features.

Herbert C. Sampert was next to take the helm and became the first resident manager in 1960. He directed forest operations April to late fall and taught a forest harvesting class during the winter. Under Sampert, Blodgett became an operating forest, both facilities and programs expanding. Timber harvest became an annual event and was incorporated into research activities. Additional research was encouraged and promoted. An internal road system and a water supply system were designed and built. A small two or three person summer staff was hired routinely, to expand forest management activities. The headquarters complex was expanded and Berkeley forestry classes were encouraged to visit Blodgett Forest as part of their curriculum. By the late 1960s, Blodgett had well established research in silviculture, entomology, and remote sensing.

The University purchased 160 private acres (located inside Blodgett boundaries) from the Bacchi family in 1963, adding Bacchi Meadow and Bacchi

Barn to the forest. Compartment divisions were revised in 1975 to reflect Uneven-Aged, Even-Aged, and Reserve forest management studies.

Sampert died suddenly in April of 1976, and Assistant Manager Robert C. Heald was promoted to the manager's position.

Heald continued and expanded forest operations. He added Young Growth Reserves, Group Selection, Even-Age plantations, and Shelterwoods to management techniques. Alternative timber harvesting techniques were explored and integrated into research activity. The forest baseline data expanded to include over 1,000 permanent plots, including vegetation, fuel, snags, wildlife, stream physical and biological conditions, and weather measurements.

Left:

Shelter-Wood

Example

Photo by

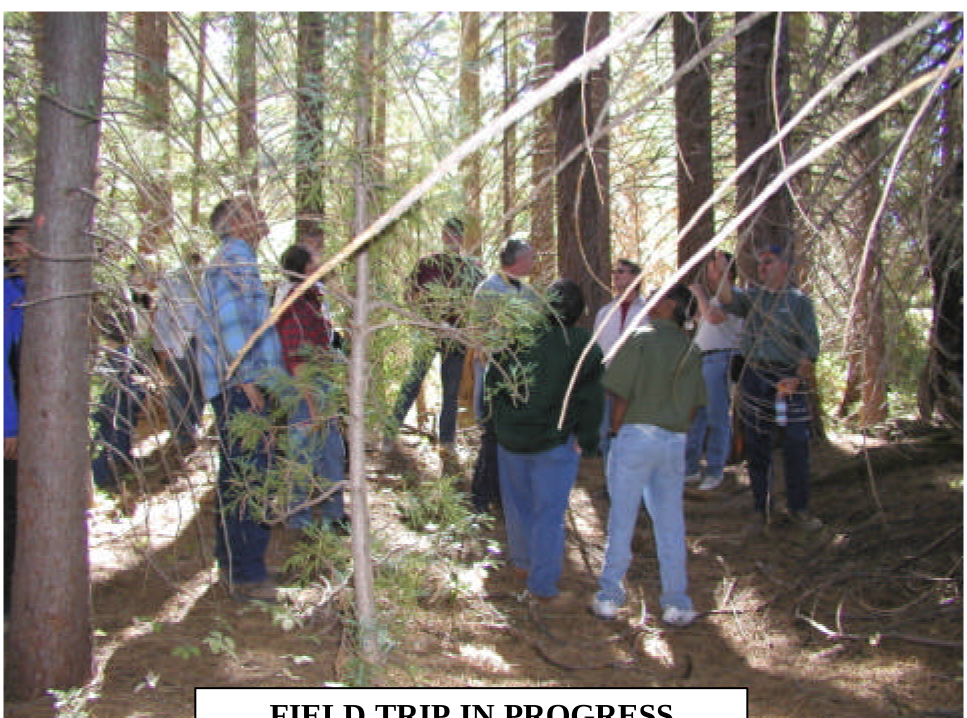
Heald developed a comprehensive forest inventory, using computer based storage and retrieval. A geographic informational and monitoring system was developed in the mid 1980s.

Research has been expanded to include forest cultural activities such as site preparation, planting, broadcast burning, fuel hazard reduction, tree improvement, pruning, fertilization, cone collection, and seedling collection, and now includes wildlife, grazing, tree growth, forest succession, harvesting costs, thinning and spacing of commercial conifers, genetics, soil ecology and nutrient cycling, conifer and oak regeneration, prescribed fire, and atmospheric effects. In-depth archaeological information is part of the forest database.

An additional 1400 acres was added to the holdings in 1999 when California Wildlife Conservation Board deeded the land known as the Pilot Creek Property to the university. A Forest Operations Plan for this land has been designed and implementation is expected to be underway within a short time.

Heald expanded meeting, office, and work facilities through new construction and remodeling of existing structures. Staffing is now year-round, facilitating continuous research and outreach. Classes and workshops are planned, professional and lay groups are encouraged to visit to see silvicultural techniques and results. By 2001, more than two thousand visitors visited Blodgett annually.

University restructuring in 1998 added four other remote forest properties to Heald's responsibilities under the new Center for Forestry, an organization directly responsible to the College of Natural Resources. Blodgett Forest Research Station continues to be the University's "crown jewel" and demonstration forest, the site of many diverse research operations.



FIELD TRIP IN PROGRESS

Mineralogical Control of Aggregate-Protected Carbon in a Northern California Conifer Stand

Craig Rasmussen and Margaret S. Torn

ADDRESS OF LEAD AUTHOR:
Soil Science Graduate Group
Land, Air and Water Resources Department
University of California, Davis
Email: crasmussen@ucdavis.edu
(530) 752-0144

ABSTRACT

Forest systems have the potential to act as sinks for atmospheric carbon dioxide. It is important to understand the factors governing organic carbon (C) protection and turnover in these systems if they are to be managed as C sinks. We investigated the role of soil mineralogy as a control of aggregate-protected C. Soil pedons were sampled on granitic and andesitic parent materials in 80 year old ponderosa pine plantations. Soil samples were analyzed for total C and N, pH and clay content. Clay mineralogy in the <2-µm fraction was determined by X-ray diffraction (XRD) and selective dissolution (SD). Total pedon C and clay data indicate that andesitic soils contain more C than granitic soils (19.6 vs. 12.8 kg m^{-2}) and slightly more clay (166 vs. 135 kg m^{-2}). XRD diffractograms found very little difference in the crystalline clay species between the andesitic and granitic pedons. SD data shows greater free iron oxides in the andesite vs. granite soils (30.0 vs 18.1 kg m^{-2}), slightly greater short range order iron oxy-hydroxides (0.7 vs. 0.5 kg m^{-2}) and short range order aluminunosilicates. We plan to separate soils into aggregate size fractions using wet sieving procedures. Clay mineralogy and C content will be measured within each size fraction. Aggregate fractions will also be analyzed for radiocarbon content in order to determine which fractions contain the most stable pool of C. It is expected that the andesitic soils will contain a greater proportion of water stable

microaggregates (250-53 μm) and that this aggregate fraction will contain the most stable pool of C. We hypothesize that this enhanced aggregate C protection is a function of iron oxy-hydroxide and short range order aluminosilicates acting as aggregate binding agents. The results will provide insight as to the potential of parent material specific management procedures for enhanced C storage in California forest plantation systems.

WebApps at the Center for Forestry: 30 years and 1 gigabyte of data at your fingertips

http://ecology.cnr.berkeley.edu/

Carrie Salazar, Frieder Schurr, John Battles

ADDRESS OF LEAD AUTHOR:
University of California
Center for Forestry
140 Mulford Hall
Berkeley, California 94720

ABSTRACT

http://ecology.cnr.berkeley.edu/ In this presentation, we debut the online version of the Center for Forestry's environmental databases. The feature attraction – the Blodgett Forest Digital Database. During the last year, we have worked to upgrade the informatics infrastructure of Blodgett and the other forest research stations. This effort was motivated by the fact that not only was high quality monitoring and experimental data being collected at an unprecedented rates but also the requests for information and for data access were overwhelming our capacity to meet the demand.

For example, at Blodgett Forest there is an unique and dynamic synergy underway. Professional managers, biologists, and physical scientists are working together to address an absolutely vital question: Does a managed forest respond anything like the well-studied model ecosystems to environmental change? This attempt to study the complexity of ecosystem processes in a realistic field setting requires the informational depth and breadth contained in the digital database.

Funded by a grant from UC's Division of Agriculture and Natural Resources, the current web-based system represents the first of three objectives. During the last year, we concentrated on designing the software and data

management framework. In parallel, we screened, documented, and reorganized the weather and vegetation data that now populates the sites. Our goal was to provide access to the detailed raw data as well as relevant, easy-to-find summaries of key forest attributes. This year we are focusing on expanding the core records backwards in time to incorporate older long-term data into the new format. We are also constructing a system to make it easy for researchers to share their own, non-proprietary data with the Blodgett community. To succeed we need your help. Check out the "WebApps" and then come to the Symposium with suggestions to make the informatics more useful and more relevant.

Historical Weather Databases

1990-2001 Comprehensive Weather Data
1990-2001 Monthly Temperature Averages
1962-2001 Average Daily Highs and Lows
1994-2002 Monthly Relative Humidity Daily Highs and Lows
1961-2001 Daily Precipitation

Vegetation Database

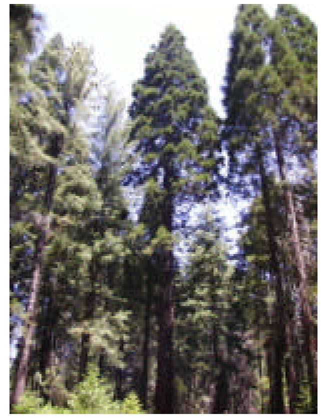
Access Vegetation Database (Registration required)
Vegetation Data Thesaurus

Maps and Reports

Compartment Inventory Reports and Maps

Center for Forestry Ecology Server | Center for Forestry | Terms and Conditions | Feedback
 | **Last Modified:** 11/29/2002 12:46:32
Page Title: Blodgett Forest Research Station Interactive Web Databases
URL: http://ecology.cnr.berkeley.edu/blodgett/

Whitaker Forest Operations Update



Frieder G. Schurr

ADDRESS OF LEAD AUTHOR:
University of California, Berkeley
College of Natural Resources
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634

ABSTRACT

Whitaker Forest is a 320 acre property managed by the Center for Forestry in Tulare County. It is located entirely within the Redwood Mountain Grove of Ancient Giant Sequoia and borders both King's Canyon National Park and the Giant Sequoia National Monument. This property gives the Center a unique opportunity to perform management and research activities related to ecosystem manage and restoration in this rare forest type.

During the past four years the Center has completed several projects at Whitaker Forest. A forest wide inventory was completed in 1999 which included measurements of live and dead vegetation, wildlife, and detailed inventories of all the remaining ancient (>300 year old) giant sequoia trees and stumps.

In 2000 and 2001 a complete archeological survey was completed on the property. During the same period, a Timber Harvest Plan was developed for the forest. The plan objective was thin out the lower and middle story canopy layers which had become overcrowded due to the past century of fire suppression efforts in the state. The plan also allowed for the creation of 20 small openings in the forest ranging from 1/8 to 1 acre in size. Finally, the plan addressed several problems that were impacting the streams on the property. Proposed solutions ranged from abandoning roads and failed stream crossings in and near the streams to building a bridge over the main stream to replace an existing ford that provided the only access to the west end of the property.

Harvesting operations began in the fall of 2001 and were completed in the fall of 2002. Operations were scheduled late in the season to minimize impacts on the soil and wildlife resources. Early fall operations avoided interference with the nesting and nursing periods of most of the local wildlife species and minimized potential soil compaction issues by operating during dry soil conditions.

The openings that were created during the harvesting operations will be used for a research project looking at the regeneration requirements for Giant Sequoia. Intense measurements were taken in each opening before harvesting operations began. These measurements included taking hemispherical photographs that will be used to determine the quantity of light present at the forest floor before and after tree removal.

Post harvest inventories of the harvested areas will be taken during the summer of 2003. Other work this year will include the replacement of several stream crossing culverts to a size that will be able to handle a 100-year return interval flood event. Three failed stream crossings will also be removed.

The harvest operation removed a total of 1.4 million board feet of timber. Most of this was white fir (60%) followed by incense-cedar (30%). Only about 10% of the volume came from ponderosa and sugar pine. No giant sequoia was removed. The 1999 inventory showed a total standing volume of 18.4 million board feet on the property.

Right: HEEL BOOM LOADER STACKING LOGS IN A LANDING ON WHITAKER FOREST

California Spotted Owl Ecology in the North-Central Sierra Nevada

Mark Seamans, R.J. Gutierrez, and Michelle Crozier
ADDRESS OF LEAD AUTHOR:
Department of Fisheries, Wildlife and Conservation Biology
University of Minnesota, 200 Hodson Hall,
1980 Folwell Avenue, St Paul, MN 55108

ABSTRACT

We began studying the population ecology of the California spotted owl in 1986. The proximate goal of the study is to estimate baseline demographic parameters for spotted owls in the north-central Sierra Nevada. The ultimate goal is to understand why this population varies both spatially and temporally. To help us gain insight into the mechanisms that lead to population variability, we have also conducted many affiliated studies. These include studies on prey, habitat, sex and stress hormone levels, and genetics. Our empirical results indicate spotted owls in the north-central Sierra Nevada have mean survival and reproductive rates comparable to other spotted owl populations. However, although the overall rate of population change indicates that this population was stable over the study period, annual estimates of population rate of change have been linearly declining, suggesting that this population increased at the beginning of the study but is now declining.

We have conducted habitat use studies at three spatial scales: micro-site (e.g., area immediately around a roosting owl), stand, and landscape. All indicate the owl prefers areas with mature forest characteristics such as the presence of large (>76cm dbh) trees, a high degree of vertical structure (multi-storied), and high (>80%) canopy closure. In addition, at the stand and landscape scale, the presence of a large tree component is a good predictor of owl versus non-owl habitat in forests that may lack other mature forest characteristics. A current research theme of ours is to link owl demographic rates to habitat quality and examine how spatial and temporal changes in habitat affect individual survival, reproduction, and recruitment.

Bark beetle landing rates as indicators of future tree mortality

Daniel T. Stark, Andrew J. Storer[1], David L. Wood[2], Scott L. Stephens[2]

ADDRESS OF LEAD AUTHOR:
Division of Forest Science
Division of Insect Biology
University of California
Berkeley, CA 94720

ABSTRACT

The landing rates of bark beetles will be monitored using sticky traps on trees in the fire and fire-surrogate study treatment compartments and these rates will be correlated with future bark beetle activity on individual trees and in stands. Three ponderosa pines (Pinus ponderosa) and three white firs (Abies concolor) are selected from each of three plots chosen randomly from within each of the four treatments for a total of 36 ponderosa pines and 36 white firs. Trees with no symptoms or signs of bark beetle infestation or root disease closest to the plot centers are chosen. Conditions for each tree are rated and recorded. Two 61cm x 31cm sticky traps are hung at a random cardinal direction at a height of 1.3-m on each of the selected trees. Bark beetles are collected from these traps every two months during the flight period from spring to late fall each year until Summer 2005.

Studies in 2002: In May, traps were hung in the control, fire only, and mechanical plus fire treatment compartments. For this trapping period, the prescribed fires had not been implemented. Thus, the catch in 3 cut and 6 uncut compartments were compared. Bark beetles and other beetles were removed from traps in August and September and were identified in the field to family or to genus. Collected specimens were brought to the lab for identification. Bark beetles collected included Dendroctonus spp, Scolytus spp, Ips spp, Pityophthorus spp, Pseudohylesinus spp, Hylastes spp., Hylurgops spp, and Gnathotrichus spp. Other beetles collected included beetles in the families

Platypodidae and Cleridae, and weevils in the genus Cossonus spp (Curculionidae). All other insects were left on the trap and will be sorted in the lab to at least family level. Mean trap catches for August and September 2002 are summarized in Table 1. These preliminary data suggest that at the 2002 population levels of these insects, host selection may be occurring prior to landing.

Table 1. Mean number of beetles caught per trap from the control, fire only, and mechanical plus fire treatments on *Pinus ponderosa* and *Abies concolor* for August and September 2002.

August 2002							
88 d.f.	*Pinus ponderosa*		*Abies concolor*				
Species	Mean	SE	Mean	SE	t	P	Sig
Dendroctonus spp.	0.022	0.022	0.000	0.000	1.00	0.320	
Scolytus spp.	0.133	0.051	0.636	0.225	2.29	0.024	*
Ips spp.	0.244	0.101	0.045	0.032	1.91	0.059	
Pityophthorus spp.	1.511	0.582	0.250	0.126	2.67	0.008	*
Hylastes spp.	0.378	0.097	0.341	0.092	0.32	0.753	
Gnathotrichus spp.	0.089	0.043	0.023	0.023	1.37	0.170	
Hylurgops spp.	0.000	0.000	0.045	0.032	1.43	0.156	
Cossonus spp.	0.467	0.126	0.159	0.065	2.30	0.024	*

September 2002							
140 d.f.	*Pinus ponderosa*		*Abies concolor*				
Species	Mean	SE	Mean	SE	t	P	Sig
Dendroctonus spp.	0.028	0.020	0.000	0.000	1.42	0.156	
Scolytus spp.	0.014	0.014	0.486	0.181	3.30	0.001	**
Ips spp.	0.014	0.014	0.000	0.000	1.00	0.319	
Pityophthorus spp.	0.486	0.283	0.069	0.030	1.88	0.062	
Hylastes spp.	0.097	0.040	0.014	0.014	1.97	0.051	
Gnathotrichus spp.	0.083	0.038	0.056	0.034	0.60	0.551	
Hylurgops spp.	0.000	0.000	0.000	0.000	0.00	1.000	
Cossonus spp.	0.153	0.051	0.125	0.048	0.43	0.664	

[1] School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI 49931
[2] University of California, Berkeley, CA 94720

The Effects of Fire and Fire Surrogate Treatments on Insects and Pathogens in Sierran Mixed Conifer Forests: Preburn Data.

Daniel T. Stark, Andrew J. Storer [1], David L. Wood [2], and Scott L. Stephens[3]

ADDRESS OF LEAD AUTHOR:
Division of Forest Science
Division of Insect Biology
University of California
Berkeley, CA 94720

ABSTRACT

The Fire-Fire Surrogate Study (FFS) is a national, multi-disciplinary study funded by the Joint Fire Science Program (USDI-USDA). The objective of the study is to quantify the short- and long-term effects of fire and fire surrogate treatments on a range of disciplines. At Blodgett Forest Research Station located in El Dorado County, CA, entomological and pathological data have been collected in Summer 2001 (pre-treatment) (Figure 1 and Figure 2) and in Summer 2002 (post-thinning, pre-burn) for bark beetles, defoliators, scale insects, other insects, root diseases, mistletoes, rusts and other diseases. Categorical data were obtained from the twenty 0.04-hectare plots in all treatment areas, and 360-degree scans were taken from the center of each plot to identify symptomatic trees outside of the plot area. In addition, all stumps in the 0.04-hectare plots in the mechanically treated areas were visually inspected for signs and symptoms of root disease and infestation by insects.

The incidence of tree mortality in all of the treatment areas in 2001 and 2002 was very low. In the case of trees identified as fading in the 360 degree scans, sugar pines (Pinus lambertiana) were killed by mountain pine beetle (Dendroctonus ponderosae), ponderosa pines (P. ponderosae) by red turpentine beetle (D. valens) and/or western pine beetle (D. brevicomis), and white fir (Abies concolor) by the fir engraver (Scolytus ventralis). In Summer 2002, recently fading trees were found across treatments in eight of the twelve

treatment areas. No root diseased stumps were evident in the stump survey. Many ponderosa pine stumps had been infested by red turpentine beetle, and it is anticipated that the population of this beetle will increase as a result. Post-treatment data will be collected annually starting in late Summer 2003 and continue as part of the national FFS study.

Table 1. Number of trees with symptoms or signs of bark beetle infestation from each plot of all treatments of the FFSS and numbers of recently faded trees from the 360-degree scans taken from each plot center of all treatments of the FFSS. Pretreatment data collected in Summer 2001.

Treatment plots	Fading trees in 360 degree scans			Symptoms/signs in 0.04 hectare		
	Sugar pine	Ponderosa pine	White fir	White fir	Sugar pine	Ponderosa pine
Control	3/26	2/76	18/299	2	2	3
Mechanical	0/47	1/20	5/301	0	0	4
Fire	2/36	0/43	102/341	1	1	1
Mech. + fire	0/48	0/110	0/289	3	0	5

Table 2. Number of trees symptomatic for diseases from each plot of all treatments of the FFSS. Pretreatment data collected in Summer 2001.

Treatment	White pine blister on black oak	Dwarf mistletoe on ponderosa pine	Leafy mistletoe rust on sugar pine	Western gall rust on white fir
Control	5/299	2/80	1/76	0/26
Mechanical	33/301	4/48	0/20	1/47
Fire	26/341	4/25	2/43	0/36
Mech. + fire	0/289	3/106	1/110	0/48

[1] School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI 49931
[2]Division of Insect Biology, University of California, Berkeley, CA 94720
[3] Division of Forest Science, University of California, Berkeley, CA 94720

Calibrating a model of seedling recruitment for riparian pioneer tree species on the lower Tuolumne River, CA

John C. Stella, Bruce K. Orr[1], John J. Battles[2], and Joe R. McBride[2]

ADDRESS OF LEAD AUTHOR:
Stillwater Sciences
Department of Environmental Science, Policy, and Management
University of California
Berkeley, CA

ABSTRACT

River regulation in California's Central Valley has created artificially stable inter- and intra-annual hydrologic conditions, resulting in decreased peak flows, increased summer base flows, and reduction of physical processes such as scour and sediment deposition. Riparian pioneer tree populations that evolved with pre-regulation cycles of flooding and summer drought show evidence of decreased recruitment after dam construction and altered topographic distributions relative to bank elevation and proximity to the channel. We use a combination of observational and experimental studies to calibrate a conceptual model of hydrogeomorphic and phenological factors affecting cottonwood and willow recruitment on the lower Tuolumne River, which has been regulated by major dams since 1923. Critical unknowns that this research addresses include length of seed release and viability period, bank elevation corresponding to seedling desiccation and scour thresholds, maximum seedling root growth and survivable rate of water table decline, and field conditions of water table dynamics and soil moisture availability. The studies are designed to provide quantitative information necessary for several riparian restoration approaches, including reconfiguring individual floodplain sites to maximize recruitment success and prescribing flow releases to increase recruitment throughout a river corridor. A major goal of this research is to allow land and water managers to

model the most cost-effective scenarios to restore natural recruitment processes in Central Valley riparian woodlands.

[A portion of this work was conducted at Russell Research Station, Lafayette, California, part of the Center for Forestry.]

[1]Stillwater Sciences
Berkeley, CA
[2] Department of Environmental Science, Policy, and Management,
University of California, Berkeley, CA.

Fire Regimes of Mixed Conifer Forests in the Northern Sierra Nevada, California

Scott L. Stephens and Brandon M. Collins[1]

ADDRESS OF LEAD AUTHOR
Department of Environmental Science, Policy, and Management
Division of Forest Science
University of California
145 Mulford Hall #3114
Berkeley, CA 94720-3114
(510) 642-7304; email: stephens@nature.berkeley.edu
http://cnr.berkeley.edu/espm/directory/fac/stephens-lab

ABSTRACT:

The cultural history of the northern Sierra Nevada is diverse and it has directly influenced the process of wildland fire. Dendrochronology was used to quantify past fire regimes in mixed conifer forests and the land-use history was also examined to assist in the analysis of past fire occurrence. Historic management activities, particularly railroad logging, limited the number of fire scar samples available. Fire was a common ecosystem process until approximately 1900 and the median fire return interval of 6-10 years is similar to those found in mixed conifer forests in the southern Cascades and southern Sierra Nevada. The seasonality of past fires in the northern Sierra Nevada differs from that reported elsewhere with the majority of fires occurring in latewood. There is a general trend of increasing latewood and growing season fires as you move south from the southern Cascades to the southern Sierra Nevada. Superposed epoch analysis determined large fire years were significantly correlated to droughts the year of the fire, and in some cases, to a significantly wet year before the fire year. Significant drought years have been correlated to large-scale fires in the southern Sierra Nevada but this has not been reported in the southern Cascades. Information from this study can assist in the definition of desired conditions or trends for the mixed conifer forests of the northern Sierra Nevada.

Above: The morning after control burn on Compartment 292, October 2002
Photo by Rosemary Stefani

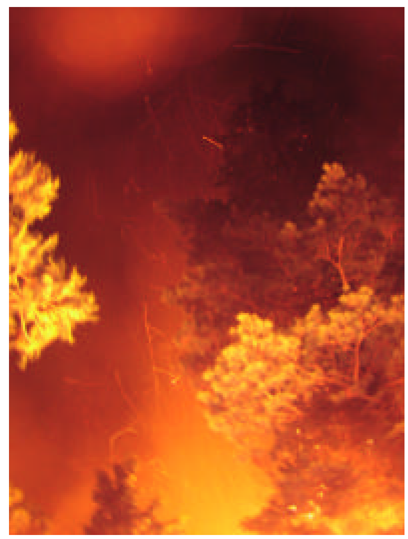
[1]Colorado State University
College of Natural Resources
Department of Forest Sciences
131 Forestry Building
Fort Collins, CO 80523-1470
Phone: (970) 491-6911
Fax: (970) 491-6754; email: Brandon.Collins@ColoState.EDU

A LONG-TERM NATIONAL STUDY OF THE CONSEQUENCES OF FIRE AND FIRE SURROGATE TREATMENTS:

TREATMENT EFFECTS ON SURFACE AND GROUND FUELS- A PRELIMINARY ASSESSMENT

Scott L. Stephens and Jason J. Moghaddas

ADDRESS OF LEAD AUTHOR:
Department of Environmental Science, Policy, and Management
Division of Forest Science
University of California
145 Mulford Hall #3114
Berkeley, CA 94720-3114
(510) 642-7304
stephens@nature.berkeley.edu
http://cnr.berkeley.edu/espm/directory/fac/stephens-lab



ABSTRACT:

One of the primary objectives of the Fire and Fire Surrogate Study is to quantify the initial effects of 4 fire and fire surrogate treatments (control, mechanical, mechanical plus fire, and fire only) on several core response variables within the disciplines of (a) vegetation, (b) fuels and fire behavior, (c) soils and forest floor, (d) wildlife, (e) entomology, (f) pathology, and (g) economics & utilization. The goals of the fuels component of the Fire and Fire Surrogate study at Blodgett Forest are to: 1) Quantify changes in ground fuel loading (litter and duff) in response to the four treatments implemented for the Fire and Fire Surrogate Study, 2) Quantify changes in surface (1, 10, 100, & 1000 hour) fuel loading pre-treatment and in response to treatments implemented, 3) Model potential fire behavior in response to the four treatment types. We will present and discuss preliminary results from ground and surface fuels data for all Fire Surrogate treatments at Blodgett Forest.

Leah Rogers Beche doing ignition work in white thorn as part of the prescribed burn aspect of the Fire and Fire Surrogate Study, October 2002. **photo by Jason Moghaddas**

Professor Scott Stephens during the fall prescribed burn operations. **Photo by Jason Moghaddas**

Burning California black oak snag, Compartment 292.
Photo by Rosemary Stefani

Instrumentation from the Goldstein Biosphere-Atmosphere Flux Site measured the stmospheric smoke from the burns.
Photo by Megan McKay

Completed!! All units burned, wrap up done, rains due.
Photo by Sheryl Rambeau

A LONG-TERM NATIONAL STUDY OF THE CONSEQUENCES OF FIRE AND FIRE SURROGATE TREATMENTS:

PRE-TREATMENT STAND CONDITIONS- HOW SIMILAR ARE THE TREATMENT UNITS?

Scott L. Stephens, John J. Battles and Jason J. Moghaddas

ADDRESS OF LEAD AUTHOR:
[1]Department of Environmental Science, Policy, and Management
Division of Forest Science
University of California
145 Mulford Hall #3114
Berkeley, CA 94720-3114
(510) 642-7304
stephens@nature.berkeley.edu
http://cnr.berkeley.edu/espm/directory/fac/stephens-lab

ABSTRACT:

One of the primary objectives of the Fire and Fire Surrogate Study is to quantify the initial effects of fire and fire surrogate treatments (control, mechanical, mechanical plus fire, & fire only) on several core response variables within the disciplines of (a) vegetation, (b) fuels and fire behavior, (c) soils and forest floor, (d) wildlife, (e) entomology, (f) pathology, and (g) economics & utilization. The goals of the vegetation component of the Fire Surrogate Study at Blodgett Forest are to: 1) Quantify changes in overstory vegetation characteristics (Species composition, DBH, height, height to crown base, productivity, regeneration, & mortality) pre-treatment and in response to the four treatments implemented for the Fire and Fire Surrogate Study and 2) Quantify changes in understory vegetation characteristics (species diversity, percent cover) pre-treatment and in response to treatments implemented for the Fire and Fire Surrogate Study. Measurements will be repeated (2003 & 2004) on 20 1/10th-acre circular sample plots located within in each treatment unit. We will present pre-treatment vegetation data and discuss similarities/dissimilarities of pre-treatment vegetation structure and composition.

Effects Of Fire And Fire Surrogate Treatments On Activity Levels Of Wood Infesting Insects

Andrew J. Storer, David L. Wood[1], Daniel T. Stark[1] and Scott Stephens[2]

ADDRESS OF LEAD AUTHOR:
School of Forest Resources and Environmental Science
Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931
Email: storer@mtu.edu

ABSTRACT

The fire and fire surrogate study is designed to investigate the effects of prescribed fire and mechanical treatments on a wide range of ecological parameters. Treatment areas of at least 10 hectares receive either mechanical treatment, prescribed fire, a combination of fire and mechanical treatment, or no treatment (control). One effect of the treatments is anticipated to be elevated activity levels of phloem and xylem infesting insects in treatments that produce higher levels of dead and dying trees. The phloem and xylem feeding insects that infest dead and dying trees include the longhorned beetles (Coleoptera: Cerambycidae) and the metallic wood boring beetles (Coleoptera: Buprestisdae), the larvae of which are roundheaded wood borers and flatheaded wood borers respectively, as well as others such as horntails or woodwasps (Hymenoptera: Siricidae). To determine the activity levels of these insects, flight intercept traps were placed in various treatment areas of the fire and fire surrogate study. These traps act as baffles and intercept flying insects that are collected in a cup at the base of the trap. Traps were unbaited, and therefore did not select for particular insect taxa.

In 2002, traps were placed in the burn only treatment areas, mechanical and fire treatment areas and control areas. Five traps were used in each treatment area and trap locations were determined at random and placed

outside of the 420m^2 monitoring plots established in a grid in each treatment area. For this trapping period, the prescribed fires had not been implemented. Traps were emptied every two weeks from mid-June to late-August.

Of the wood infesting insects, longhorned beetles were trapped most frequently (approximately 0.35 per trap per two week trapping period). In June, there was a higher mean number of longhorned beetles trapped in untreated areas (fire only and control) than in mechanically treated areas approaching significance (P=0.054). Untreated areas would have had a limited amount of breeding material available in the form of naturally dead, dying or broken woody material. Part of the mechanical treatment involved mastication of coarse woody debris which would have included debris from the mechanical treatments as well as some of the naturally dead, dying and broken material. The mastication may have resulted in lower emergence of longhorned beetles due to desiccation of woody breeding material. Other wood infesting taxa were rare in the traps.

In 2003, ten traps will be placed in all of the treatment areas at the beginning of the field season and will be monitored continually throughout the summer. This will enable sampling of wood infesting insects after the fall 2002 burns. Comparisons will be made between the three treatments and the control. In addition, species determinations of all wood infesting insects found in the traps will be made.

[1] Division of Insect Biology, University of California, Berkeley, CA 94720
[2] Division of Forest Science, University of California, Berkeley, CA 94720

Separating root respiration from soil respiration in a ponderosa pine plantation in the Sierra Nevada

Jianwu Tang, Ye Qi

ADDRESS OF LEAD AUTHOR:
Department of Environmental Science, Policy, and Management
University of California at Berkeley
Berkeley, California 94720

ABSTRACT:

Partitioning soil respiration into autotrophic and heterotrophic respiration is of critical importance for building process-based carbon models since these components respond differently to abiotic and biotic drivers and have different spatial and temporal variations. To remove the influence of root autotrophic respiration from total soil respiration, we dug a trench 20 cm wide and 120 cm deep around a 3m *3m plot in a ponderosa pine plantation in the Sierra Nevada. We cut all roots within the trench, lined the trench with polyethylene sheets to prevent any new root extending into the plot, and refilled the soil back to the trench. We measured soil CO2 efflux in the trenched plot as well as two non-trenched plots using an LI-6400 photosynthesis system with a soil chamber between August 2001 and October 2002. In the non-trenched plots we have 18 sample locations, each with different influences from roots. We found daily mean soil respiration peaked in May-June at about 3.8 $\mu molm^{-2}s^{-1}$, and then decreased to 1.6 $\mu molm^{-2}s^{-1}$ in the winter. Soil heterotrophic respiration had a similar seasonal variation, peaking in the early summer at about 3.0 $\mu molm^{-2}s^{-1}$ and dropping down to 1.2 $\mu molm^{-2}s^{-1}$ in the winter. Autotrophic respiration peaked in June-July at 1.4 $\mu molm^{-2}s^{-1}$ and decreased into the winter at 0.67 $\mu molm^{-2}s^{-1}$. The ratio of autotrophic respiration to total soil respiration varied with seasons, ranging from 0.11 to 0.40 and peaking in September. By conducting multivariate regression with two independent variables, soil temperature and moisture, we estimated seasonal patterns of heterotrophic respiration and autotrophic

respiration. Autotrophic respiration is strongly influenced by tree physiology and phenology as well as temperature. By doing spatial analysis, we found autotrophic respiration negatively correlates to the accumulation of distances between measurement locations and tree locations.

MEASURING CO^2 FLUX, USING A LICOR
(This researcher isn't inconvenience by snowfall!)

photo by Jianwu Tang

Quantifying the Importance of Belowground Plant Allocation for Sequestration of Carbon In Soils

Margaret S. Torn, Todd Dawson[1], Julia Gaudinski[1], Jeff Bird[1] and Stefania Mambelli[1]

ADDRESS OF LEAD AUTHOR:
Center for Isotope Geochemistry
Lawrence Berkeley National Laboratory
One Cyclotron Road MS 90-1116
Berkeley, CA 94720
(510) 495-2223; fax: (510) 486-7070
email: mstorn@lbl.gov

ABSTRACT

The recent DOE road map for Carbon Sequestration Science highlights the potential for sequestration by increasing plant allocation of C to belowground biomass and thus reducing decomposition losses. However, to design or evaluate such strategies, we must greatly improve measurements of the rates of C allocation belowground and the subsequent residence times of carbon in the root and soil system.

We propose to fill essential gaps in quantifying the efficacy of sequestration through belowground plant allocation by: (1) Quantifying the stocks and lifetime of live fine and coarse roots; (2) Determining the lower bound of NPP "pumped" into soil carbon through these roots; (3) Comparing leaf and root decomposition including rates, microbial communities and humification products; (4) Characterizing the turnover times of soil organic matter pools, and (5) Tracking the partitioning of recent plant photosynthate to rapidly lost root respiration and exudate mineralization, and more slowly lost root tissues and soil organic matter (SOM).

Our approach takes advantage of several new methods (radiocarbon analysis of roots and SOM, ^{13}C tracking of decomposition products, and isotope-

label PLFA analysis). The radiocarbon method in particular allows direct determinations of root age, a measure not currently possible with any other technique. At four northern latitude forest research stations, including Blodgett Forest, we will make comparisons of belowground allocation sequestration potential based on species and forest type, including deciduous vs. conifer and re-growing vs. mature managed forests.

Preliminary results include the following: (1) Temperate tree fine roots live on order of 2 y-10 y, and age varies with root branching order. (2) The common assumption that roots live 1 y likely results in overestimating belowground NPP. (3) Tree roots decompose more slowly than needles or leaves in first year, regardless of soil depth
(4) For sequestration, these results imply that the same amount of primary productivity leads to more C storage if it is allocated to roots rather than to leaves or needles.

Ultimately this work should allow us to develop a template for more rapid assessment of the best ecosystems and species to target for future carbon sequestration efforts.

1Department of Integrative Biology
University of California, Berkeley

EFFECTS OF FIRE AND FIRE SURROGATE TREATMENTS ON FISHER HABITAT

Richard L. Truex and William J. Zielinski

ADDRESS OF LEAD AUTHOR:
USDA Forest Service
Pacific Southwest Research Station
2480 Carson Rd., Placerville, CA 95667.

ABSTRACT:

The fisher (Martes pennanti) historically occurred throughout mid-elevation forests of the Sierra Nevada but currently appears to be limited in distribution to the southern Sierra from Yosemite National Park south to the Greenhorn Mountains. The population's isolation, size and association with mature forest conditions have raised concern for its long-term viability. Prominent among the factors influencing fisher population viability in the southern Sierra Nevada is the risk of catastrophic fire. Land management activities implemented to reintroduce fire as an ecological process may ultimately benefit the fisher population by reducing the likelihood of large fires.

There are, however, short-term risks associated with these activities (e.g., loss of large snags and logs) and accordingly a need to better understand how land management activities will affect fisher habitat. During 2001 we initiated research at the Blodgett Forest Research Station (BFRS) and Sequoia-Kings Canyon (SEKI) Fire and Fire Surrogate (FSS) Treatment Study sites to examine the short-term effects of several management activities on fisher habitat quality. At the each site, 10 plots within each treatment unit will be sampled before and 1 year after treatment. Changes in fisher habitat suitability will be assessed using a Resource Selection Function developed for fisher in California.

To date we have collected pre-treatment data at all treatment units at BFRS (3 mechanical, 3 fire, 3 mechanical plus fire, 3 control) and at SEKI (3

spring burn, 3 fall burn, 3 control). Post-treatment sampling has been completed for the mechanical and mechanical plus fire treatments at BFRS and the fall burn sites at SEKI. Sampling will be completed during 2003. Data analysis will occur during 2003 and 2004.

Differential responses of radiata pine clones to western gall rust

D.R. Vogler, B.B. Kinloch, W.J. Libby, and F.W. Cobb

ADDRESS OF LEAD AUTHOR:
Research Geneticist
Institute of Forest Genetics
USDA, FS, Pacific Southwest Research Station
1100 West Chiles Road
Davis, CA 95616-6138
(530) 758-6350; fax (530) 758-1070

ABSTRACT

The western gall rust fungus (Peridermium harknessii) infects some 21 North American pine species, causing branch and stem galls that can lead to stunting or death of the host, particularly when young. California coastal pines, especially Pinus muricata and P. radiata, are commonly infected in the wild. A large 1982 planting of P. radiata at Russell Reservation - representing individuals from the five native populations, mainland/island hybrids, and Australia/New Zealand selects - produced evidence of considerable variation in susceptibility to P. harknessii. We selected putatively susceptible, intermediate, and resistant individuals from all seven populations, propagated cuttings from donor hedges stored at Gill Tract, and outplanted them at Russell Reservation in a blocked, replicated design at four plantations separated by up to 1/8th mile. Rooted cuttings of the same selected clones were also challenged in greenhouse experiments with P. harknessii single-gall isolates of coastal and inland California origin. Little difference in susceptibility was observed among clones in greenhouse tests. Field trials at Russell, however, yielded dramatic differences among clones, with

BISHOP PINE INFECTED WITH WESTERN GALL RUST
photo by Det Vogler

resistant individuals having few or no galls directly adjacent to susceptible individuals with thousands of galls. Relative ranking of clones for susceptibility was similar between the 1982 and 1988 experiments.

RADIATA PINE
photo by Bob Heald

A Study of the Microbial Diversity of Air in a Longitudinal Transect of California

Wendy Wilson

ADDRESS OF LEAD AUTHOR:
BioDefense Division
Biology and Biotechnology Research Program
Lawrence Livermore National Laboratory
P.O. Box 808, L-369
Livermore, CA 94550

ABSTRACT

Knowledge of the naturally occurring, or background microorganisms present in air is crucial in helping to understand the effect of background microorganisms on pathogen signature detection in environmental samples. We have used a custom designed small subunit rDNA (SSU) GeneChip to study the airborne microorganisms in a longitudinal transect of California from the ocean to the Sierra Mountains at 38N latitude.

We collected 48 air samples; 24 in cities and 24 in rural areas to assess the diversity of microorganisms found in air between distinct geographical regions and between areas where human activity is present and not present. Microscopic counts revealed that city samples contained an average of 2.1 times more bacteria/m^3 of air than rural samples (1.5×10^5 vs. 7.0×10^4 bacteria/m^3) except for the valley rural site which experienced high dust generating winds and contained 1.5 times more microorganisms than it's city site (1.4×10^5 vs 9.5×10^4 bacteria/m^3). Extracted air sample DNA was amplified using universal SSU primers cCOMPLong and PC5B. The 120 bp product sequences representing the air microorganisms were hybridized to the SSU GeneChip microarray for identification based on comparison to sequences in the Ribosomal Database Project. The high G+C gram (+) bacteria and the Bacillus-Lactobacillus-Streptococcus group were present in all transect samples.

The Proteobacteria subdivision was missing in the coastal rural samples and was less prevalent in rural samples in general. The Clostridium and relatives subdivision was only seen on one filter in the central valley city location. Fungi and plant pollen were also present in these samples, but the Streptophyta subdivision (plants, moss, liverworts) was not present in the mountain samples, which were collected at snowmelt.

Living on the edge: A positive edge-effect for group selection boundary trees

Robert A. York, John J. Battles, and Robert C. Heald

ADDRESS OF LEAD AUTHOR:
151 Hilgard Hall
Berkeley, CA 94720
(510) 643-2450
email: ryork@nature.berkeley.edu

ABSTRACT:

Compared to a single, large clearcut, a collective of group selection cuts has a higher edge-to-interior ratio. This comparatively high amount of edge area has been of concern for forest managers considering implementing the group selection regime. The concern is founded on the fact that within group edge areas, a negative edge effect on seedling growth usually occurs varying with species, group size, and within group location. Negative edge effects on seedling survival and height growth in 12 experimental group selection openings harvested at Blodgett Forest Research Station in 1996 have been confirmed by previous studies. When the reduction of seedling growth is considered as a tradeoff with the surrounding border trees of the matrix, however, it can be viewed as a positive edge effect on large tree growth.

To quantify the positive edge effect, if any, we used increment cores to measure the radial growth of trees surrounding group openings and of trees from the matrix forest between the groups. Five year mean annual growths of trees surrounding the openings were higher after the harvest compared to before the harvest for all group sizes (0.1 ha, 0.3 ha, 0.6 ha, 1.0 ha) and for all species (PP, IC, WF, DF). In contrast, growth of matrix trees did not change during the same time period. The amount of growth response is a function of tree size and pre-harvest competition.

BLODGETT WORKSHOP 2003: PRESENTATIONS AGENDA

FRIDAY, February 7, 2003

10:00 a.m. (Vaux Center)

Bob Heald: Welcome to Center for Forestry, Blodgett Forest

10:05 a.m.

Don Dahlsten/Allen Goldstein: Welcome to 2003 Workshop

10:20 a.m.

Frieder Schurr: "Center Properties, management and activities"

10:25 a.m.

Sheryl Rambeau: "Georgetown, An Historical Overview"

10:45 a.m.

Carrie Salazar, Frieder Schurr, John Battles**:** "WebApps at the Center for Forestry: 30 years and 1 gigabyte of data at your fingertips"

11:05 a.m.

Jennifer K. Prentiss, Frieder G. Schurr, Robert C. Heald**:** "Whitaker Forest Archeological Sites"

11:20 a.m.

Scott L. Stephens and Brandon M. Collins: "Fire regimes of mixed conifer forests in the northern Sierra Nevada"

11:40 a.m.

Jason J. Moghaddas and Scott L. Stephens**:** "A Long-Term National Study of the Consequences of Fire and Fire Surrogate Treatments: Implementation of Prescribed Burn Treatments Successes, Mistakes, and Lessons Learned"

12:00 p.m.

LUNCH-Meeting House

1:20 p.m.

Leah A. Beche, Scott L. Stephens, and Vincent H. Resh**:** "The Effects of Prescribed Burning on Stream and Riparian Ecosystems at Blodgett Forest Research Station"

1:40 p.m.

Pierluigi Bonello, Andrew J. Storer, **David L. Wood** and Thomas R. Gordon**:** "Interactions Among the Root Pathogen, *Heterobasidion annosum*, Ponderosa Pines, Bark Beetles and Bark Beetle Associated Fungi"

2:00 p.m.

Robert A. York, John J. Battles, and Robert C. Heald**:** "Living on the edge: A Positive Edge-Effect for Group Selection Boundary Trees"

2:20 p.m.

Robert C. Heald, **Nadia Hamey**, and Dave Rambeau: "Branch Pruning Reduces Stem Taper in Giant Sequoia"

2:40 p.m.

Rolf Gersonde, John J. Battles, Kevin L. O'Hara**: "**Characterizing the light environment in mixed-conifer forests using a spatially explicit light model"

3:00 p.m.

BREAK

3:20 p.m.

Melissa M. Lunden, Douglas R. Black and Nancy J. Brown; Gunnar W. Schade, Anita Lee and Allen H. Goldstein**: "**Fine Particle Formation and Processing in a California Pine Forest"

3:40 p.m.

Delphine K. Farmer, Rebecca S. Rosen, Diana C. Phillips, Jennifer G. Murphy, Douglas A. Day, Ronald C. Cohen**: "**Observations of reactive nitrogen oxides at Blodgett Forest Research Station"

4:00 p.m.

Laurent Misson, Megan McKay, Allen Goldstein**:** Effect of climate variability and management practices on carbon, water and energy fluxes of a young ponderosa pine plantation at the Blodgett Forest Research Station"

4:20 p.m.

Jianwu Tang, Ye Qi**:** "Separating root respiration from soil respiration in a ponderosa pine plantation"

4:40 p.m.

Goldstein/Dahlsten: Discussion

5:00 - 7:00 p.m.

POSTER SESSION/INTERACTIVE DISPLAYS/RECEPTION/ Vaux Center

7:00 p.m.

DINNER Meeting House

SATURDAY, February 8, 2003

7:30 a.m.

BREAKFAST Meeting House

8:30 a.m. (Vaux Center)

John J. Battles and Frieder G. Schurr**:** "A Contract in Vital Rates: Life Table Projections for *Abies concolor* and *Pinus lambrtiana* in a Sierran Mixed Conifer Forest"

8:50 a.m.

Jennifer K. Prentiss, **William Frost:** "Controlled Grazing"

9:10 a.m.

Andrew Amacher and Reginald H. Barrett**:** "Wildlife Response to Fire and Fire Surrogate Treatments at Blodgett Forest"

9:30 a.m.

Andrew J. Storer, David L. Wood, **Daniel T. Stark** and Scott Stephens**:** "Effects of Fire and Fire Surrogate Treatments on Activity Levels of Wood Infesting Insects"

9:50 a.m.

Margaret S. Torn, Todd Dawson, Julia Gaudinski, **Jeff Bird** and Stefania Mambelli: "Quantifying the Importance of Belowground Plant Allocation for Sequestration of Carbon in Soils"

10:10 a.m.

BREAK

10:40 a.m.

Weixin Cheng, Richard Susfalk, Shenglei Fu, and Dale Johnson**:** "Determining tree root respiration in situ using natural 13C tracers"

11:00 a.m.

Craig Rasmussen and Margaret S. Torn**: "**Mineralogical Control of Aggregate-Protected Carbon in a Northern California Conifer Plantation"

11:20 a.m.

D. R. Vogler, B. B. Kinloch, W. J. Libby, and F. W. Cobb**:** "Differential responses of radiate pine clones to western gall rust"

11:40 a.m.

Holly Ganz: "Evolutionary ecology of a host-parasite interaction"

12:00 p.m.

Mo Mei Chen: Blister Rust interaction in pine and oak forests

12:20 p.m.

CLOSING DISCUSSION: All

12:30 p.m. **LUNCH-Meeting House**