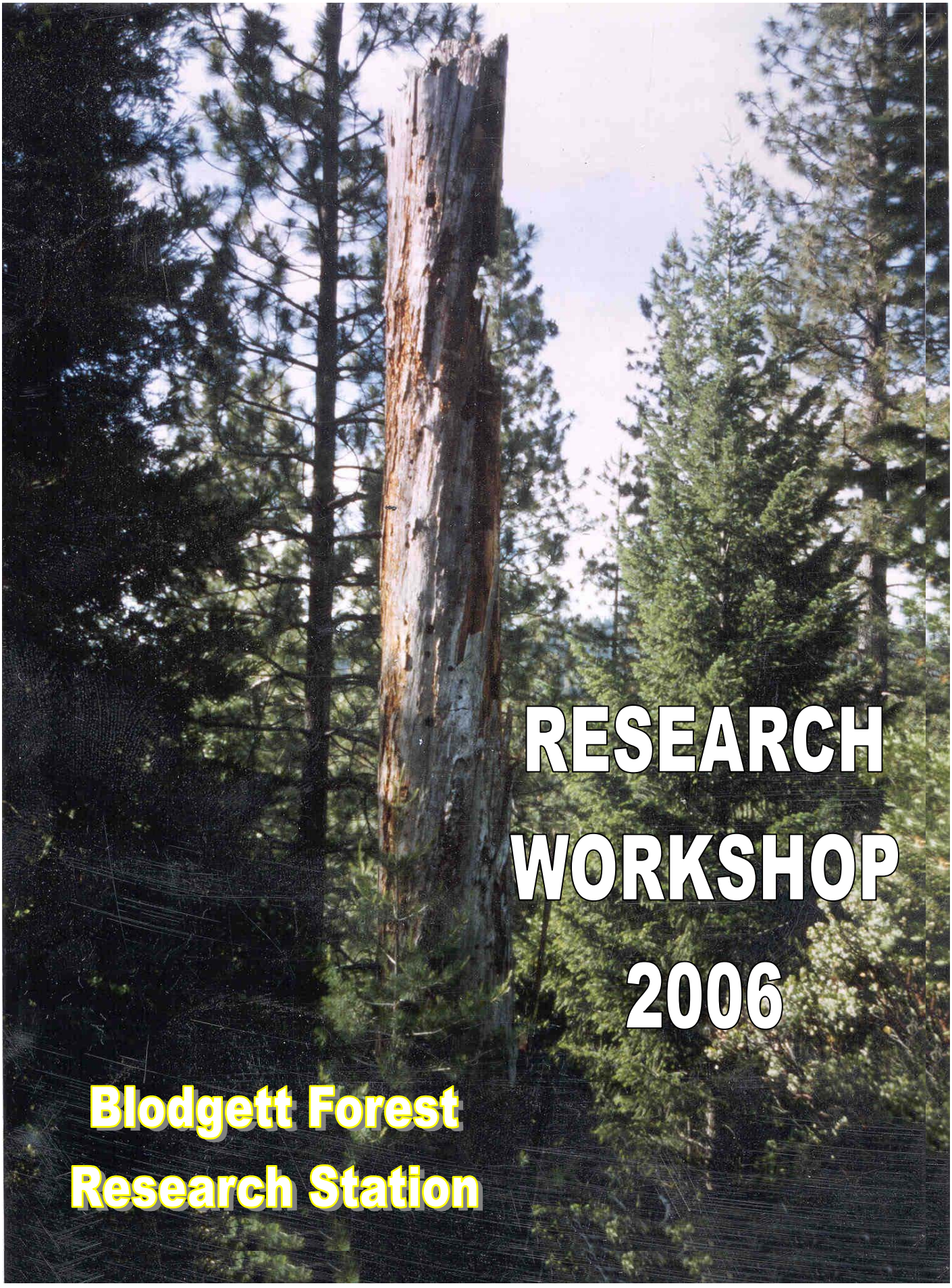

RESEARCH
WORKSHOP
2006
Blodgett Forest
Research Station

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

Ongoing research at Center sites aim to provide knowledge to improve management of young growth mixed conifer / oak forests, in such a manner that basic air, water, soil and biological resources are conserved. 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 in a duplicable manner, useful for small private landowners, industrial, state and federal forests.

In addition to silviculture activities, Center resources are available for educational workshops, tours and 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 Reservation (Contra Costa County)**
- **Whitaker Forest (Tulare County)**

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

Blodgett Forest Research Station
4501 Blodgett Forest Road
Georgetown, CA 95634
(530) 333-4475
bheald@nature.berkeley.edu
freschur@nature.berkeley.edu
ryork@nature.berkeley.edu
srambeau@nature.

BLODGETT FOREST'S MISSION

Blodgett Forest's principal responsibilities are to provide a location where forest and wildland research may be conducted in a managed forest environment and to demonstrate a wide range of sustainable forest management techniques. The Forest is divided into separate management areas (compartments). These compartments are split into three broad management styles allowing for a broad spectrum of stand conditions: Even-aged (40%), Uneven-aged (40%), and Reserve (20%).

RESEARCH AT BLODGETT

Researchers from all affiliations are encouraged to submit proposals to conduct research projects at Blodgett. New proposals are examined carefully before being accepted to minimize impacting other projects and management activities already underway at the forest. Projects may be rejected if they have the potential to have a large negative impact on the environment or the long term management goals of the forest. However, the vast majority of projects are accepted and these cover a very wide range of environmental and management topics.

FOREST MANAGEMENT AT BLODGETT

Blodgett grows seven main tree species: Ponderosa Pine, White Fir, Douglas' Fir, Sugar Pine, Incense Cedar, Giant Sequoia, and Black Oak. Land management ranges from no human manipulation to intensive even-aged systems. Cultural activities are ongoing.. They include site preparation after harvest, planting, vegetation control (chemical, manual, and mechanical), thinning, and pruning. Some stands also receive regular prescribed fire treatments. When possible, only Blodgett grown seeds are planted on the station. Currently, Giant Sequoia seeds are obtained from the Center for Forestry's Whitaker Forest Research Station.

Water Quality is also a major concern at the station. Blodgett maintains a comprehensive stream inventory that looks at channel condition/impacts, riparian vegetation, water chemistry, water temperature and a variety of other factors. Roads are routinely surveyed to identify and repair potential sedimentation sources before they become significant and all culverts are maintained annually to ensure proper function

HARVESTING AT BLODGETT

Harvesting at Blodgett is done primarily by ground based methods and occurs every year as part of the Forest's silvicultural management practices. An average of 2 million board feet is cut annually. Sustainable timber harvesting is the primary source of Blodgett's operating budget and is the driving force generating the wide range of stand conditions available to researchers.

BLODGETT FOREST RESEARCH STATION

2006 RESEARCH WORKSHOP

February 3-4, 2006

CO-ORDINATORS

JOHN J. BATTLES
Co-Director
Center for Forestry

REGINALD H. BARRETT
Professor
Wildlife Biology & Management

ABSTRACT PRESENTATIONS

ABSTRACTS

2006 Blodgett Forest Research Workshop

Table of Contents

Effects of Fire and Mechanical Fuel Treatments on Avian Nest Survival in a Mixed-Conifer Forest

AUTHORS: Andrew J. Amacher, Reginald H. Barrett, and Scott L. Stephens

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

ABSTRACT:

Fire was a natural historical component of California coniferous forests. In the absence of fire, current forests are much denser, have higher fuel loads, and have been invaded by fire-intolerant species. Restoration of forests by fuel reduction can be achieved through both prescribed fire and mechanical treatments (fire "surrogates"). Research was conducted at Blodgett Forest Research Station, located near Georgetown, California, from 2001-2004. Twelve mixed-conifer stands (15-25 hectares each) with similar stand structure, composition and management histories were selected randomly from a set of

Cassin's Vireo nestlings. Photo by Andy Amacher

available stands. Each selected stand was randomly assigned to 4 treatment groups:

control (no manipulation), prescribed fire only, mechanical only (both thinning and mastication combined), and mechanical/fire combined. Nest searching/monitoring was conducted within each replicate from 2001-2004. Data were analyzed using the logistic exposure model (Shaffer, 2004) and PROC GENMOD in SAS (SAS, 2000). Each nest with a known fate (success or failure) was analyzed using nest-site variables (i.e. canopy cover, nest height, etc.), classification variables (i.e. treatment, year, etc.) and interval-specific variables (date and age of nest at each check). In this analysis, only models with one variable were examined. For the Cassin's Vireo (*Vireo cassinii),* the model including year received the most weight (AIC weight = 0.69). For the American Robin (*Turdus migratorius*), the model including nest substrate type (hardwood or conifer) received the most support (AIC weight = 0.57). Models involving the Dark-eyed Junco (*Junco hyemalis)* were less conclusive. Individual models including canopy cover, group status (nest in group selection unit or the matrix), and nest substrate type all had AIC weights between 0.10-0.20. Future analyses will examine more complex models.

American Robin nest. Photo by Andy Amacher

Limits to tree height: within-crown structural and physiological gradients *in Sequoiadendron giganteum*

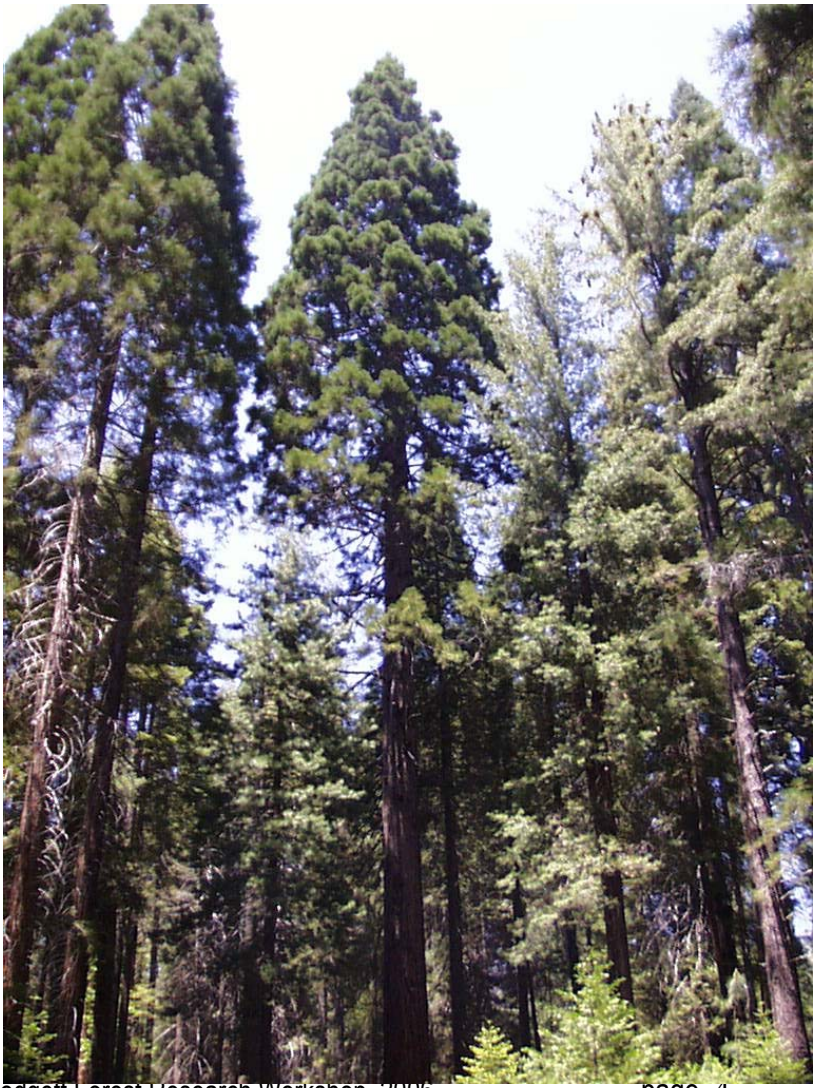
AUTHORS: Anthony Ambrose, Steve Sillett, George Koch, Robert Van Pelt, Chris Earle, Marie Antoine, Jim Spickler, Cameron Williams and Todd Dawson

LEAD AUTHOR ADDRESS:
Department of Integrative Biology
UC Berkeley
ambrose@berkeley.edu

ABSTRACT:

Giant trees are treasured throughout the world for their aesthetic, ecological, and commercial values. However, knowledge of the factors regulating the physiological performance, growth, and response to environmental change of the largest and tallest tree species remains limited. In the summer of 2005, we commenced a study at the Whitaker Forest Research Station to examine how biophysical constraints influence the maximum potential height and size of giant sequoia (Sequoiadendron giganteum), the largest and 5th tallest tree species on Earth. Current research supports the view that constraints and trade-off's involved with water delivery to the treetop play a primary role in reducing and eventually stopping height growth as trees grow taller. The basis for the decline in height growth may be a decrease in carbon gain of leaves due to greater stomatal limitation of photosynthesis at the treetop. Altered leaf structure with increased height may also play an important role in constraining photosynthesis by limiting the supply of CO2 to sites of carboxylation within the leaf. Finally, other components of carbon balance, most notably respiration, likely change in importance as gravitational constraints on photosynthesis increase toward the treetop. We quantified within-crown gradients of structural and physiological traits in S. giganteum trees of different heights and sizes in order to gain insights into the relative importance of different mechanisms likely constraining physiological performance in this species. Study trees were accessed using rope-based arborist techniques. Study tree heights ranged from 54.5 to 90.9 m, while diameters (DBH) ranged from 145 to 617 cm. Leaf water potential decreased

with height, with some evidence of a mid-day depression. Leaf mass per unit area (LMA) increased with height in all trees, ranging from 326 to 943 g m-2. Preliminary analyses of gas exchange data indicate that the tops of taller trees have lower mean and maximum photosynthetic rates (A), stomatal conductance (gs), and leaf intercellular CO2 pressure (ci) than the tops of shorter trees. Additionally, preliminary visual assessment of treetop wood cores indicates that taller trees may experience a greater degree of inter-annual variation in tree ring growth, potentially due to higher drought sensitivity. Preliminary results generally support the hypothesis that decreased water potential at the tops of tall trees directly and indirectly reduces carbon gain and height growth. Detailed analyses of leaf morphology, gas exchange, stable carbon isotopes, and tree rings are on-going. Additional structural and physiological measurements and analyses are scheduled for the summer of 2006.



LEFT:
Giant Sequoia stand at Whitaker Forest
File photo

Particle fluxes over a ponderosa pine plantation

AUTHORS: Brad Baker and Allen Goldstein

LEAD AUTHOR ADDRESS:
CSUS Department of Chemistry
6000 J Street
Sacramento, CA 95819

ABSTRACT:

Atmospheric aerosols can affect visibility, climate, and health. To understand these effects, sources, sinks, and processing of atmospheric particles must be quantified. Particle fluxes were measured continuously over a 15 year-old ponderosa pine plantation in the foothills of the Sierra Nevada from mid July to the end of September in the year 2005. It is believed that fluxes of very reactive hydrocarbons from plants to the atmosphere have an impact on production and growth of atmospheric particles.

Two condensation particle counters (CPCs) were located near the top of a 12 m measurement tower, several meters above the top of the tree canopy. Particle count data was collected at 10 Hz and particle fluxes were determined using the eddy covariance method. For three weeks, the two instruments operated under similar conditions. Subsequently, a set of diffusion screens was added to the inlet of one of the CPCs such that the lower particle size limit for detection was increased to a diameter of approximately 40 nm. The other CPC counted particles with minimum diameters of 3 nm.

During the first three weeks of the experiment, concentration and flux measurements from the two instruments agreed very closely. Particle concentrations showed a distinct diurnal pattern with minimum daily average concentrations of 2000 particles cm^{-3} occurring at dawn, and average daily maximum concentrations of 5700 particles cm^{-3} occurring at dusk. The evening increase of particle number corresponded to the arrival of polluted air from the Sacramento region. During the day, deposition of particles to the forest canopy (daytime average of 5.8×10^6 particles m^{-2} s^{-1}) was generally observed.

After adjusting the lower particle size detection limit for one CPC, concentrations and fluxes of particles under 40 nm could be examined by subtracting the data of one CPC from the other. On average, the fraction of particles under 40 nm increased from less than 20% at dawn to more than 50% at dusk; indicating that air coming from the Sacramento region was enriched in smaller, newly formed aerosol. Figure 1 shows the daily average diurnal fluxes for both CPCs. Daily average deposition fluxes of particles under 40 nm were 1.0×10^7 particles m^{-2} s^{-1}. Much of this flux was due to large deposition fluxes during the final three weeks of the experiment. Deposition of particles above 40 nm averaged 1.0×10^6 particles m^{-2} s^{-1}. Deposition velocities for the particles under 40 nm were typically between 1 and 10 mm s^{-1}. There was no clear relationship observed between gas-phase fluxes of VOCs in the vicinity of the tower and the particle fluxes or particle concentrations.

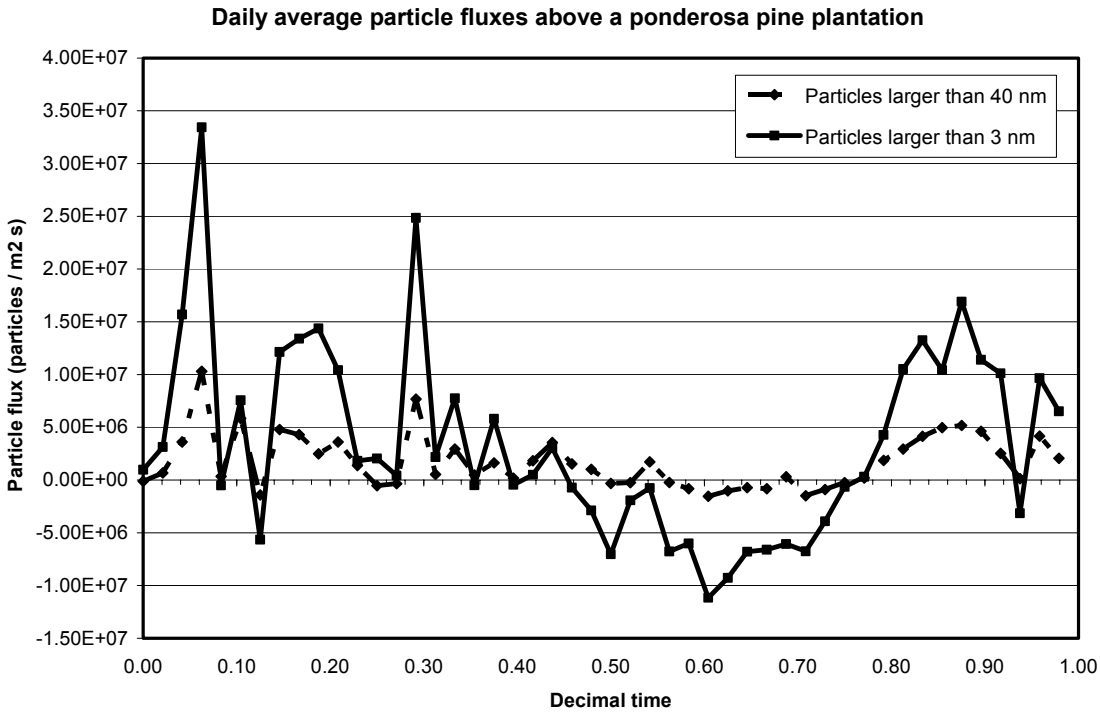


Figure 1: Daily average diurnal fluxes for particles larger than 40 nm (solid line) and for all measured particles (above 3 nm; dashed line). It is apparent that most of the observed daytime flux is due to particles between 3 and 40 nm.

Climate Change Impact on Forest Resources

AUTHORS: John J. Battles[1,2], Timothy Robards[1,3], Adrian Das[1], Kristen Waring[1,2], J. Keith Gilless[1], Frieder Schurr[2], John LeBlanc[2], Gregory Biging[1], and Clara Simon[1]

AUTHORS' ADDRESS:

[1] Department of Environmental Science, Policy, and Management. UC Berkeley. 137 Mulford Hall, Berkeley, CA 94720-3114

[2] Center for Forestry, UC Berkeley. 4501 Blodgett Forest Road, Georgetown, CA 95634

[3] California Department of Forestry and Fire Protection. PO Box 944246, Sacramento, CA 94244-2460

ABSTRACT:

We evaluated the climate change impacts on the productivity, health, and value of a forest for a specific region in California – the Sierran mixed conifer timberbelt. We adapted an industry standard planning tool to forecast 30-yr tree growth and timber yields for forest stands in El Dorado County under a changing climate. Our model projections were constrained by structural and demographic data from the Blodgett Forest Research Station in El Dorado County in order to represent a realistic range of legal management regimes employed on private and governmental forests in the region. Conifer tree growth was reduced under all downscaled climate change scenarios. For the most extreme case (GFDL A2), productivity in mature stands (a status representative of approximately 20% of the federal forest in the region) was reduced by 18% by the end of the century. The reductions in yield were more severe (31%) for pine plantations -- a management regime common among industrial landowners in the region. Based on the relationship between mortality risk and growth, the reductions in growth projected under the climate change scenarios explored here generally led to moderate increases in the vulnerability of the tested species (white fir, *Abies concolor)* to non-catastrophic (i.e., not fire) causes of mortality. The most severe decrease in survival probability occurred under the GFDL A2 scenario. By the end of the century, median survival probability had decreased from the baseline rate of 0.997 yr^{-1} to 0.982 yr^{-1}. Given the results of the climate-adjusted growth scenarios presented in this report, the economic impacts are likely to be negative, in the form of reduced harvest revenues to landowners, reduced employment and income in timber harvesting and processing, reduced indirectly generated income and employment in rural counties, and reduced

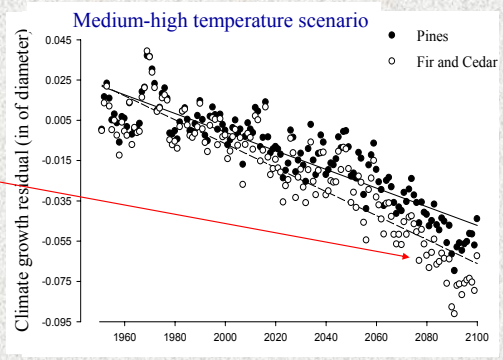
Timber Yield Tax revenues distributed to counties. The complexity of disease and insect interactions in forest ecosystems will limit the accuracy of predictions regarding the responses of specific pathogen and pests to climate change. However, a current concern in El Dorado County is the recent range expansion of pitch canker disease to the Sierran forests. Pitch canker is believed to be limited primarily by environmental conditions; these conditions may be changing in its favor in the Sierras, where most timber species are susceptible to this devastating non-native pathogen.

Climate impact on tree growth

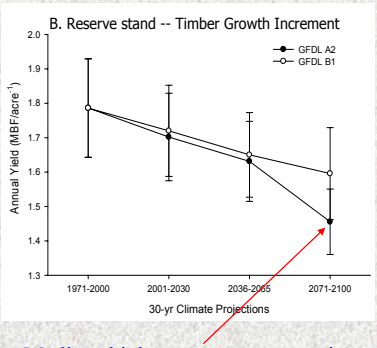
Tree growth predictors:

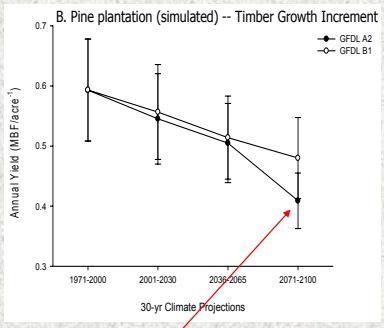
summer temperature
winter rainfall

By 2100, impacts more severe for fir and cedar than for pines



Timber yield





Medium-high temperature scenario
18% reduction in yield by 2100

Medium-high temperature scenario
30% reduction in yield by 2100

(Note: Current stumpage value: ~$325/MBF)

Management to achieve forest sustainability: An assessment based on the long-term record from Blodgett Forest - Participatory Research and Outreach Element

AUTHORS: John Battles, Gary Nakamura, Frieder Schurr and Robert York

LEAD AUTHOR ADDRESS:
1851 Hartnell Avenue
Redding, CA 96002
nakamura@nature.berkeley.edu
530 224-4902

ABSTRACT:

The overall study -

This study is an evaluation of how 6 different management regimes enhance or diminish the sustainability of Blodgett Forest.

The 6 management systems are:

Ecological reserve – no harvest or management other than fire suppression since c. 1920.
Even-aged, clear cut – harvested and regenerated, 1964 and 2003
Even-aged, overstory removal – harvested 1970 to 2003
Even-aged, shelterwood – harvested and regenerated, 1979 to 1997
Uneven-aged, single tree selection – 10-year harvest cycle, 1970 to present
Uneven-aged, group selection – 10% harvest on 10-year cutting cycle, 1970 to present

Our measure of forest sustainability is a subset of the Montreal Process criteria and indicators (Montreal Process 2004, www.mpci.org). We focus on five of the seven criteria that specifically address the productive capacity and environmental status of the forest. For each criterion, we will focus on two indicators that are appropriate at the stand level. The stand was chosen as the most appropriate scale because management activities are typically applied at the stand level. We selected indicators based upon relevance to the criterion and feasibility for immediate quantification:

Criterion 1: Conservation of biological diversity
Indicators: a) Plant diversity; b) Habitat classification

Criterion 2: Maintenance of productive capacity
Indicators: a) Total growing stock; b) Annual removal compared to growth

Criterion 3: Maintenance of forest health
Indicators: a) Fire risk; b) Pest and pathogen damage

Criterion 4: Conservation of soil and water resources
Indicators: a) Soil compaction; b) Labile nutrient pool

Criterion 5: Maintenance of forest carbon storage
Indicators: a) Biomass pool; b) Trends in biomass flux

The participatory research and outreach element of the study -

Forest sustainability has social, political, and economic contexts for evaluating the biophysical characteristics cited above. Fire risk or the balance between early and late seral species habitat at a specific place and time can be informed but not decided by science. Participatory research makes explicit the assumptions, qualifications, methods, and limitations of the research, increasing the understanding and credibility of the research. Research results are never absolutely conclusive or comprehensive for all forest types and conditions, all management goals. Research results are added to the existing understandings of practitioners and must be applied by them to specific, on-the-ground situations. Participatory research brings the potential users of the research results into the research process early, while parameters to be measured and methods are being developed.

A September 28, 2005 meeting of forest practitioners interested in forest sustainability was held at Blodgett, to consider and comment on the criteria and indicators being used to characterize forest sustainability, and the methods we were using to measure the indicators. A synthesis in the form of a common text document has been developed, with comments by participants.

Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone (Blodgett Forest Research Station)

AUTHORS: Leah A. Bêche, Scott L. Stephens, Vincent H. Resh

LEAD AUTHOR ADDRESS:
Department of Environmental Science, Policy & Management
137 Mulford Hall
University of California
Berkeley, CA 94720-3114 USA.
Email: leah@nature.berkeley.edu
Telephone: (510) 642-5913
Facsimile: (510) 642-7428

ABSTRACT:

Concerns about the effects of fire on ecologically sensitive habitats have limited the use of prescribed fire in the management of forest riparian areas. Using a beyond-BACI (Before-After-Control-Impact) experimental design, we examined the effects of a 26-ha prescribed fire that burned upland and riparian areas of a first-order watershed, and compared this to five unburned sites examined from 1 to 7 years pre-fire and 1 year post-fire. We monitored pre- and post-fire riparian vegetation, large woody debris, sediment, water chemistry, periphyton, and benthic macroinvertebrates. We analyzed changes in riparian vegetation and macroinvertebrate communities using multi-response permutation procedure (MRPP) and multivariate ordination. The prescribed fire in the riparian zone was patchy in terms of intensity, consumption, and severity; it consumed 79% of the pre-fire fuel in the riparian zone, 34% of the total surface fuel, and 90% of the total ground fuel. The prescribed fire significantly reduced percent cover of surface vegetation and plant taxa richness in comparison to unburned sites but not plant diversity (Simpson's 1-*D*). Community composition of understory riparian vegetation changed post-fire, most likely as a result of the reduction in taxa richness and cover. Riparian tree mortality (>11.5 cm DBH) was only 4.4%, and there was no change in canopy cover post-fire. In contrast, regeneration was reduced post-fire, as indicated by the number of small trees (< 7.6 m) one-year after the fire (2003, 10.0 ± 12.6 trees m^{-2}, mean ± standard deviation), compared to pre-fire (2001, 55.5 ± 79.1 trees m^{-2}), mostly as a result of a reduction in

trees < 0.3 m height. The prescribed fire had no effect on large woody debris volume and recruitment, or fine sediment in pools (V*). Post-fire, there were increases in some water chemistry parameters (SO_4^-, total P, Ca^{2+}, and Mg^{2+}) and a decrease in periphyton biomass; however, these changes were short-term, and recovery occurred in < 1 year. Macroinvertebrate community composition (based on MRPP) but not density, richness, or diversity was affected 10–19 d post-fire; composition recovered within 1 year. The trends observed in this study examining multiple abiotic and biotic parameters suggest that this prescribed fire either had no or short-lasting (<1 year) impacts on Dark Canyon Creek and its riparian zone. The limited observed impacts are at least partially a result of the small portion (<20%) of the watershed area burned, moderate topography, the low- to moderate-severity of the fire, and the relatively low precipitation (and thus, stream flow) that occurred post-fire.

Microbial Communities as Biochemical Inputs to Forest Soil Humification Processes

AUTHORS: Jeffrey A. Bird[1], Eoin Brodie[2], William R. Horwath[3], Richard Higashi[3], Teresa W. Fan[4], and Mary K. Firestone[1]

AUTHORS' ADDRESS:
[1]University of California, Berkeley
[2]Lawrence Berkeley National Laboratory
[3]University of California, Davis
[4]University of Louisville

ABSTRACT:

While microorganisms are known to be involved in humification processes, little information exists on how microbes regulate the conversion of plant material into humic substances. An often-overlooked influence of soil microorganisms on C stabilization processes is that their bodies, or biomass, are primary building blocks in the formation of humic substances. Since microbial communities can differ substantially in their biochemical composition and metabolic capacities across ecosystems, we are investigating whether soil microbial community composition influences rates of humification and the amount and stability of humic substances formed. This research will follow the fate of ^{13}C-labeled microbial bodies from four groups (fungi, gram-positive bacteria, gram-negative bacteria and actinomycetes) in a temperate and a tropical forest soil. The fate of ^{13}C microbial litter will be tracked for 5 years by measuring total recovery, utilization by indigenous microbial communities and their biomarker components, conversion to CO_2, and ultimately humification products. The macromolecular biochemical composition of the starting substrates and the fate of added ^{13}C substrates in humic substances will be determined over the course of the field study using the complementary tools of ^{13}C/^{1}H NMR spectroscopy and pyrolysis GC/MS. The resulting data set will identify key characteristics of the microbial community that influence humification processes and its products, thereby substantially increasing our understanding of the mechanisms involved in C stabilization and sequestration.

In the initial 1.5 y of the four-year project, our accomplishments include: (1) Established field sites (Blodegtt Forest and Puerto Rico), installed microcosms and

automated soil climate sensor systems; completed initial soil sampling and analyses (2) Cultured, isolated, screened, and identified microbial isolates from soils. (3) Selected, characterized, and ^{13}C-labeled 27 microbial isolates (4) Characterized *in situ* bacterial, archael, and fungal microbial community composition from field soils. In 2006, substrates will be applied to our established plots at Blodgett Forest.

Systematic variation within the crowns of three conifers and the use of needle dry weight to predict surface area.

AUTHORS: Ralph Boniello IV and Joe R. McBride

LEAD AUTHOR ADDRESS:
Department of Environmental Science, Policy and Managemen
University of California, Berkeley
145 Mulford Hall, Berkeley, CA 94720
boniello@nature.berkeley.edu

ABSTRACT:

The time-intensive nature of leaf-level ecophysiological measurements requires that sample sizes be small, thereby restricting measures to a very small percentage of the crown. Measures are expressed as a function of leaf surface area and subsequently scaled to the crown or canopy level. However, both physiological and morphological variation exists in tree crowns that may influence these measures. Studies suggest that the ratio of needle area to needle dry weight, or specific leaf area (SLA), provides an estimate of physiological capacity in leaves. Needle length, width, thickness, and dry weight were measured to examine inter- and intra-specific differences in morphology within the crowns of ponderosa pine, Douglas-fir, and white fir. The data was used to assess the SLA within the crowns to examine whether systematic variation exists according to needle age class, vertical canopy position, or aspect. Our finding suggest that needle age class and vertical canopy position are significant sources of variation within crowns, though the extent to which differs between species. Needle dry weight provides an estimate of needle surface area among all species, and these correlations are improved when needles are compartmentalized by age. Future work will compare the morphological variability within the crowns of these species to measured physiological variability, with the goal of relating needle structure and function.

Biogenic VOC Emissions Measured by Solid Phase Microextraction (SPME) Fibers, Proton Transfer Reaction Mass Spectrometry (PTR-MS), and In-situ Gas Chromatography (GC)

AUTHORS: Nicole C. Bouvier-Brown, Rupert Holzinger, Katrin Palitzsch, and Allen H. Goldstein

LEAD AUTHOR ADDRESS:
140 Mulford Hall #3110
Berkeley, CA 94720
nbouvier@nature.berkeley.edu

ABSTRACT:

Chemical ozone loss due to reactions with biogenic VOCs has been shown to dominate ozone flux measured at Blodgett Forest, a coniferous forest in the Sierra Nevada Mountains of California. Here we report recent efforts to measure the specific biogenic VOCs involved in this chemistry at Blodgett Forest. During summer 2005, we enclosed branches of Ponderosa pine, manzanita, and ceanothus species and made VOC emission measurements by proton transfer reaction mass spectrometry (PTR-MS), solid phase microextraction (SPME) on fibers followed by direct injection into a gas chromatograph with an ion trap mass spectrometer (GC-ITMS), and by in-situ GC with a flame ionization detector (GC-FID). Zero air, with ambient CO_2 concentrations, flowed through a 2-chamber system. The chamber placed directly over the branch had a 20 second residence time, and was immediately followed by a reaction chamber with a 2 minute residence time. The PTR-MS and GC-FID measurement cycled between each of the two chambers and the zero air supply. SPME fibers (65 □m PDMS/DVB field portable) were used to sample the branch chamber. Sesquiterpene, monoterpene, and oxygenated primary emissions were identified. The SPME fibers were particularly useful for detecting sesquiterpenes which are typically difficult to measure due to their high reactivity in the forest canopy and losses in sampling lines. Comparisons of SPME fiber data with PTR-MS and GC-FID data for sesquiterpenes (m/z 205), 4-allylanisole (m/z 149), and monoterpenes (m/z 137) will be presented to assess the actual emission rates and the complimentary information provided by each measurement approach.

Soil heating and potential biological damage during burning of masticated residues

AUTHORS: Matt Busse, Ken Hubbert, Carol Shestak, Gary Fiddler, Eric Knapp, and Robert Powers

LEAD AUTHOR ADDRESS:
USDA Forest Service
Pacific Southwest Research Station
Redding, CA.
mbusse@fs.fed.us

ABSTRACT:

Masticating understory shrubs and trees is an important fuel-reduction tool for lowering fire risk in California forests. The resulting layer of woody residues reflects the mass and areal distribution of standing fuels, and may produce a considerable soil heat pulse if fire is introduced. Whether such burning, as accomplished recently on the Fire Surrogate Study plots at Blodgett Experimental Forest, leads to lethal temperatures and unwanted biological damage is not well understood. Thus, we measured soil temperature profiles during controlled burns of masticated residues to evaluate the importance of soil characteristics (texture, moisture) and fuel conditions (loading, moisture) in regulating the heat pulse. The Cohasset soil from the Blodgett area was one of several soil types compared in this study. Maximum soil temperature and heat duration exceeded lethal thresholds in all soils with moderate to high fuel loads when soil moisture content was low. As a consequence, we are developing a soil heating model based on empirical data to predict heat profiles, fine-root mortality, and microbial community response during burning. Independent variables in the model include soil texture, soil moisture, soil depth, fuel load, fuel size class, and fuel moisture. The model will help forest managers when preparing burn prescriptions by answering the following questions: (1) will soil temperatures on a burn unit exceed the biological threshold? (2) how long and to what soil depth will temperatures remain lethal? (3) What are the critical fuel and soil moisture contents needed to limit soil heating? (4) How much spatial variation in soil heating can be expected?

SAMPLING COAST REDWOOD WOOD QUALITY

AUTHORS: Wade Cornell[1], Bill Libby[2] and Charles Sorensson[3]

AUTHORS' ADDRESS:
[1]Diversified Forests
247 Forest Hill Rd.
Henderson 1008, New Zealand
[2] Professor Emeritus, Forestry & Genetics
University of California, Berkeley
[3] Wood Scientist
Horizon2
Te Teko, New Zealand

ABSTRACT:

This report describes a thus-far successful wood-sampling technique. Twenty clones sampled in 2002 had scored best among 223 clones on an index of growth, form and early survival after 11 years on site at Russell Reservation, Lafayette, California. In 1999, cuttings from them had been sent to New Zealand for propagating, further testing, and operational deployment of the best of them. Thus, their wood properties were of interest. Two of redwood's most valuable traits are the durability and dimensional stability of its heartwood. However, there is disturbing evidence that 13% or more of young-growth redwood's heartwood is not satisfactorily durable, and less quantified reports indicate that some worrisome proportion of its boards are not dimensionally stable. Variability in specific gravity and in heartwood color and pattern were also investigated in this first study.

In October 2002, we sampled wood from 3 random seedlings and the 20 top-ranked clones after 14 years on site at Russell. We also sampled 5 essentially random clones plus 3 seedlings after 9 and 16 years on site, respectively, near Henderson, New Zealand.

At Russell, we felled 17 trees from the 4 clones with 10-to-24 copies at Russell, and milled short cants from their lower boles. The other 16 clones had only 3-to-6 copies at Russell. Not wanting to fall any of these, we devised a method to extract a substantial wood sample without seriously (we hoped) affecting the continued growth of the tree.

Using a chain saw with a regular (non-safety) chain, so that the tip would engage the wood, we extracted "windows" measuring about 8 cm wide by 40 cm high cut bark-to-bark through the center of the bole in an east-west direction, between about 1 and 1.5 m above ground level. These windows and cants were shipped to Horizon2 and Forest Research labs in Te Teko and Rotorua, New Zealand, for wood analyses.

We were concerned that the "windowed" trees would snap off in wind events, and at least one storm the following winter tested this with high north-to-south winds. As of early 2006, no "windowed" trees have broken off at the wound site, all are growing well, and some of the wounds are nearly closed over by cambial growth from the north and south edges of the vertical cuts.

A second set of analyses was initiated with samples taken in September 2005. This second study pairs samples of a different set of 14 essentially random clones growing at both Henderson and Russell, after 12 and 17 years on site, respectively.

In this second study, four major questions are addressed for each wood property:

(1) How important is variation among clones in this random set?

(2) How important is local environmental variation?

(3) How important are the major environmental differences between Henderson and Russell?

(4) Are there important clone-by-major-environment interactions?

Stay tuned. Data such as these become ever more valuable as the clones at these sites become older and larger.

Spatial and temporal variability of soil microbial decomposition-derived CO_2 efflux at two contrasting Mediterranean ecosystems

AUTHORS: Curiel Yuste J.[1], Misson L. [1], Tang J. [2], Goldstein A. [1], Baldocchi D. [1]

AUTHORS ADDRESS:
[1]Department of Environmental Science, Policy, and Management, 107 Hilgard Hall, University of California at Berkeley, Berkeley, CA 94720, USA;
[2]Department of Forest Resources, University of Minnesota, 1530 Cleveland Avenue, St. Paul, Minnesota 55108, USA

ABSTRACT:

So far, the response of the microbial community to the ongoing climatic changes and the indirect climate change-induced changes in the chemical composition of the plant detritus are not well understood. However, the response of the microbial communities to these fast changes has important implications for understanding the biogenic feedbacks to the atmosphere. We developed two parallel experiments to study which environmental factors control the strong spatial and temporal variability inherent to soil microbial decomposition-derived CO_2 efflux. These experiments were carried out at two representative ecosystems of the Californian landscape, an oak-savanna located in the Sacramento valley and a ponderosa pine plantation located in the foothills of the Sierra Nevada. Soil respiration was continuously assessed at both sites using a soil CO_2 gradient measurement system and periodically assessed using non-steady-state through-flow chamber methodology. The spatial distribution of annual grasses and trees in the oak savanna landscape enabled the partition of autotrophic and heterotrophic components of the soil CO_2 flux during periods when the annuals were dead. Trenching methodology was used in the pine ponderosa stand as a third way to partition the flux. A second parallel set of experiments aimed to study the spatial and temporal variation of the microbial decomposition response under controlled conditions. Intact soil cores were collected at both sites at two different seasons, summer and fall. Two water treatments (current field soil moisture and field capacity) were exposed to temperature changes that

simulated a typical diurnal cycle while soil CO_2 flux was measured at each temperature. Total C and N, labile/recalcitrant organic C evolution was also assessed. Our results suggest that acclimation of microbial communities to climatic pressures may play a very important role in the rates of soil respiration and the sensitivity of soil respiration to controlling factors such as temperature and water.

A Dendroecological Approach to Understanding Tree Mortality: A Study of Two Tree Species in the Sierra Nevada

AUTHORS: Adrian Das[1], John Battles[1], Nathan L. Stephenson[2], and Phillip J. van Mantgem[2]

AUTHORS ADDRESS:
[1]University of California at Berkeley
Department of Environmental Science, Policy, and Management
137 Mulford Hall
Berkeley, CA 94720-3114.
adas@nature.berkeley.edu, jbattles@nature.berkeley.edu
[2]USGS Western Ecological Research Center
Sequoia-Kings Canyon Field Station, 47050 General's Highway #4, Three Rivers, CA 93271.
nstephenson@usgs.gov, pvanmantgem@usgs.gov

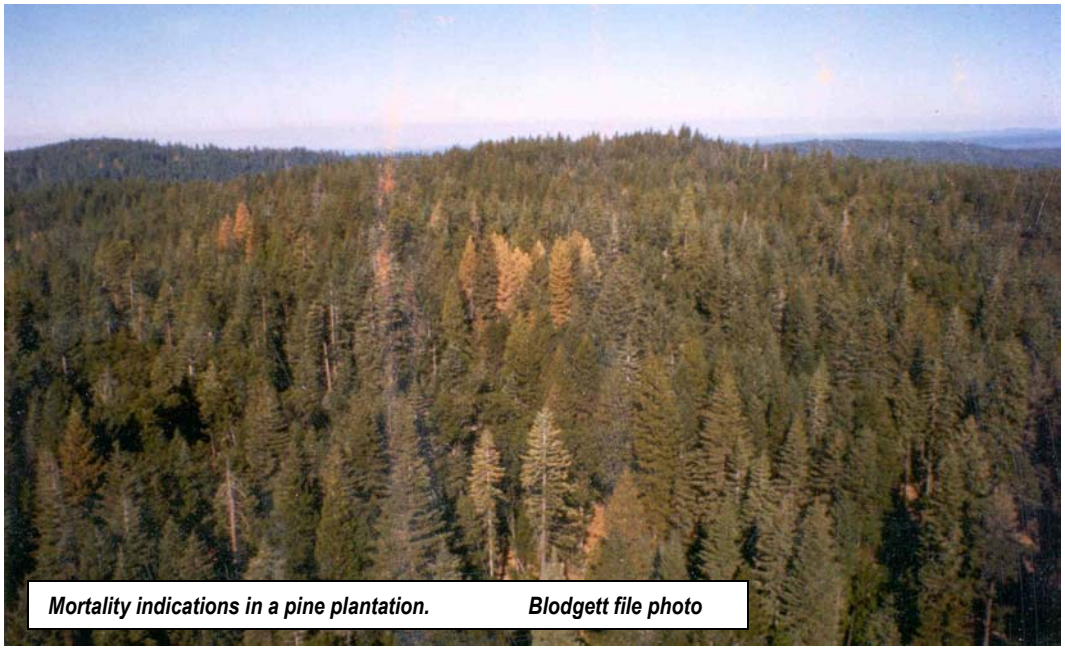
ABSTRACT:

Forests today face many novel stressors, and if we are to understand how forests will change, we must improve our understanding of how trees die. Yet one of the most difficult challenges in studying long-lived organisms is quantifying the process that leads to their mortality.

While typical approaches focus on average recent growth, our analysis incorporates additional growth measures, allowing the possibility that other aspects of a tree's history may influence future survival.

We examined mortality for *Abies concolor* and *Pinus lambertiana* by developing logistic models using three parameters obtained from tree rings: average growth, growth trend, and counts of abrupt growth declines.

For *Pinus lambertiana*, the addition of growth trend and counts of abrupt declines improved overall prediction (78.6% dead correctly classified, 83.7% live correctly classified) compared to average growth alone (69.6% dead correct, 67.3% live correct). For *Abies concolor*, counts of abrupt declines and using longer time intervals improved overall classification (trees with DBH>=20 cm: 78.9% dead correct, 76.7% live correct vs. 64.9% dead correct, 77.9% live correct; trees with DBH<20 cm: 71.6% dead correct, 71.0% live correct vs. 67.2% dead correct, 66.7% live correct). In general, abrupt declines improved live tree classification.



Mortality indications in a pine plantation. *Blodgett file photo*

External validation of *Abies concolor* models showed that these models functioned well at stands not used in model development, and development of size-specific models demonstrated important differences in mortality risk between saplings and larger trees. Population-level mortality risk models were developed, and these models generated realistic mortality rates at two other sites.

Our results support the contention that the cumulative record of growth is a superior predictor of mortality compared to simpler measures. In particular, average recent growth alone may not adequately capture mortality probability, potentially leading to poor predictions under changing climate conditions.

A further goal of this project is to assess the vulnerability of Sierran conifer forests to exotic pathogens. As the models we have developed considered mortality from all causes, including attack by exotic disease agents, we have begun work to translate these models into tools for assessing stand susceptibility to attack by exotic pathogens. Incorporating our data and complementary data from additional sites, we have used our models to create distributions of survival probabilities (Vulnerability Profiles). More vulnerable sites or sites with higher intrinsic mortality rates should show distributions that are shifted toward lower survival probabilities. We are developing this approach with reference to our "model" exotic pathogen system, *Pinus lambertiana* with *Cronartium ribicola*.

Response to Host Volatiles by Native and Introduced Populations of *Dendroctonus valens* (Coleoptera: Scolytidae) in North America and China

AUTHORS: N. Erbilgin, N.E. Gillette, J.D. Stein, J.H. Sun, D.R. Owen, R. Campos Bolaños, L.D. Merrill, K.F. Raffa, S. Mori, T. Méndez Montiel, and D.L. Wood

LEAD AUTHOR ADDRESS:
140 Mulford Hall
Division of Insect Biology,
Environmental Science, Policy and Management
University of California, Berkeley, CA 94720
erbilgin@nature.berkeley.edu

ABSTRACT:

Bark beetles (Coleoptera: Scolytidae) have specialized feeding habits, commonly colonizing only one or a few closely related host genera in their geographical ranges. Monoterpenes are the dominant source of volatiles in conifers and have been shown to attract many bark beetle species. The red turpentine beetle, *Dendroctonus valens* LeConte, has a very broad geographic distribution in North America and it exploits volatile cues from a wide variety of pines in selecting its hosts. Semiochemicals have been investigated for *D. valens* in North America and in its introduced range in China, yielding apparent regional differences in response to various host volatiles. Testing host volatiles as attractants for *D. valens* in its native and introduced ranges provides an opportunity to test whether geographic separation promotes local adaptation to host compounds and to explore potential behavioral divergence in native and introduced regions. Furthermore, understanding the chemical ecology of host selection facilitates development of semiochemicals for monitoring and controlling bark beetles. Our objectives were to investigate the responses of *D. valens* to various monoterpenes across a wide range of sites across North America and one site in China, and to develop optimal blends or single-component lures for monitoring populations of *D. valens* throughout its Holarctic range. Semiochemicals were selected based on previous work with *D. valens*: (*R*)-(+)-α-pinene, (*S*)-(-)-α-pinene, (*S*)-(-)-β-pinene, (*S*)-(+)-3-carene, a commercially available lure (1:1:1 ratio of (*R*)-(+)-α-pinene:(*S*)-(-)-β-pinene:(*S*)-(+)-3-carene), and a blank control. At the release rates used in our study, (+)-3-carene was the most attractive monoterpene tested throughout its native and introduced range, confirming results from Chinese studies. The importance of monoterpenes in host location behavior of *D. valens* and other bark beetles is discussed.

Observations of fluxes and mixing ratios of the reactive nitrogen oxides at Blodgett Forest

AUTHORS: Delphine K. Farmer, Paul J. Wooldridge, Chika Minejima, and Ronald C. Cohen

LEAD AUTHOR ADDRESS:
Department of Chemistry,
University of California, Berkeley 94720
(510) 642-8001
dfarmer @ nature.berkeley.edu

ABSTRACT:

Using thermal dissociation-laser induced fluorescence (TD-LIF) coupled to eddy covariance, we measured mixing ratios and fluxes of NO_2, total peroxy and peroxy acyl nitrates, total alkyl and multifunctional alkyl nitrates, and nitric acid semi-continuously from June 2004 to June 2005 above a mid-elevation Ponderosa pine plantation in the Sierra Nevada mountain range, CA. The net flux of NO_{yi} is upward during the summer and downward during the winter. The summertime results are counter to traditional thinking of biosphere-atmosphere NO_y exchange, and appear to be driven by within-canopy chemistry resulting from chemistry following ozone - volatile organic compound reactions. These measurements also constitute the first measurements of fluxes of alkyl or multifunctional alkyl nitrates, and the first eddy covariance measurements of nitric acid.

Nighttime chemistry at Blodgett Forest was further probed by measurements of NO_3 and N_2O_5 using a new instrument during September 2004. Further measurements using this instrument are expected to reveal insight into nocturnal chemistry in the upcoming spring and/or summer.

Sap flow measurements for ponderosa pine, manzanita and ceanothus at Blodgett Forest, California

AUTHORS: Joshua B. Fisher, Laurent Misson, Allen H. Goldstein

LEAD AUTHOR ADDRESS:
Department of Environmental Science, Policy & Management
University of California at Berkeley
137 Mulford Hall, #3114
Berkeley, CA 94720-3114, USA

ABSTRACT:

Evapotranspiration is a major component in the processes and models of ecosystem water balance, net primary productivity, global climate change, floods and droughts, and irrigation. The above-canopy eddy flux tower at Blodgett Forest captures total evapotranspiration for a young ponderosa pine stand; a below-canopy eddy flux tower captures soil evaporation plus shrub transpiration (Goldstein et al., 2000). The numerical difference between these two measures represents tree transpiration, yet this does not represent a direct measurement of transpiration, nor can it partition the transpiration difference into the tree and shrub components. Further, structural influences to the water flux (i.e., height, diameter-at-breast-height, leaf area index) can only be inferred from the eddy flux measurements. We provide direct measurements of five ponderosa pine trees, three manzanita (*Arctostaphylos* spp.) and two *Ceanothus* spp. shrubs at Blodgett Forest in the Sierra Nevada Mountains of California with sap flow probes following the heat ratio method (Burgess et al., 2001). Each sap flow probe set is designed as a heater, an upstream temperature sensor, and a downstream temperature sensor inserted into the xylem. The heater emits a pulse of heat at a set time interval (i.e., 30 minutes), and the temperature sensors capture that pulse as it moves within the transpiring xylem sap. We calculate a sap velocity and scale-up to the whole plant; low and reverse rates of sap flow can be measured with this method. We can also scale-up the individual plant measurements to the eddy flux footprint based on the representative sample from which the plants were selected. A number of interesting observations have been made. Trees transpire at night, when it is assumed that photosynthesis and hence

stomata shut down (eddy flux towers may not capture these observations due to low wind speeds at night). Transpiration is still high well into the summer long after the rainy season is completed. We also found dissimilar temporal patterns of transpiration dependent on plant size class and species. Further, very little is known on water use by shrubs. Thus, these data provide the first observations of sap flow patterns in shrubs, especially valuable for forest management practices with the objective to remove shrubs based on the assumption that shrubs compete for water and nutrients that would otherwise go to the trees.

ABOVE: Data logger boxes and wires extending into the canopies. Phot by Josh Fisher

LEFT:
Sap flow sensors in a tree.
Photo by Josh Fisher

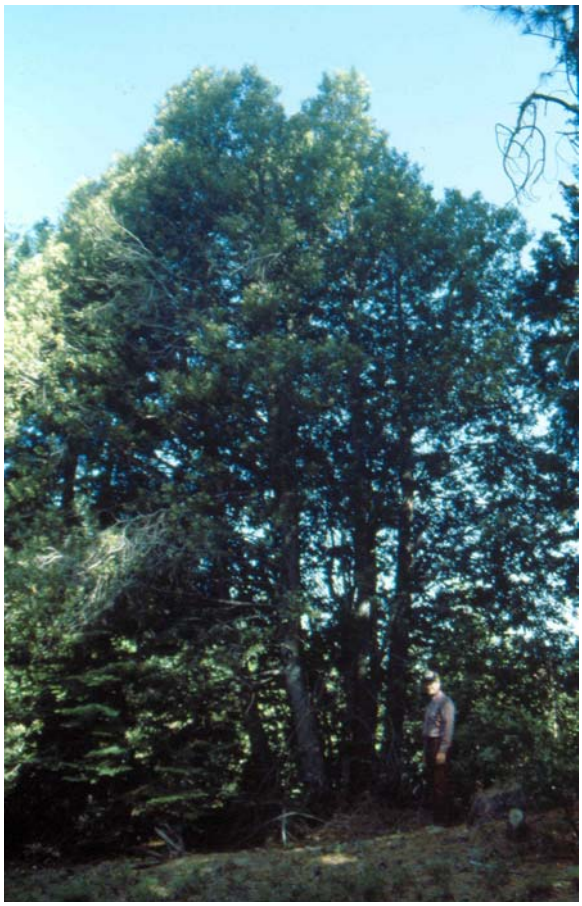
BELOW:
Sap flow sensors in a Manzanita shrub.
Photo by Josh Fisher

Variation in susceptibility of tanoak to sudden oak death at the population and species levels

AUTHORS: Katherine Hayden and Matteo Garbelotto

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

ABSTRACT:



LEFT: Young growth tan-aok stand. Blodgett file photo

Tanoak (*Lithocarpus densiflora*) is among the hosts most susceptible to the pathogen *Phytophthora ramorum*. Up to 70% of trees in a stand may be infected, with correspondingly high rates of mortality. Since the entire range of tanoak is considered to be at high risk for infestation, understanding tanoak resistance to *P. ramorum* is critical for predicting the long-term outcome for this ecologically, if not economically, important tree species. To that end, we assayed trees from five tanoak populations throughout the tree's geographic range for partial resistance to *P. ramorum*. We found significant differences in resistance among individuals and among populations, with most of the variance residing among individuals. We are currently conducting a common garden study to determine whether resistance is heritable, and field studies to establish if laboratory-observed resistance leads to differential outcomes in the field. Together, the answers to these questions will shed light on tanoak's potential for an evolutionary response to this newly emergent pathogen.

Seasonal variability of monoterpene emission factors for a Ponderosa pine plantation in California

AUTHORS: R. Holzinger, A. Lee, M. McKay, A.H. Goldstein

AUTHOR ADDRESS:
University of California at Berkeley
Department of Environmental Science, Policy & Management
Berkeley, CA 94720 USA
R. Holzinger (holzing@nature.berkeley.edu)

ABSTRACT:

Monoterpene fluxes have been measured over an 11 month period from June 2003 to April 2004. During all seasons ambient air temperature was the environmental factor most closely related to the measured emission rates. The monoterpene flux was modeled with the exponential relation suggested by Tingey et al. (1980) and Guenther et al. (1993); a basal emission of 1.0 μmol h^{-1} m^{-2} (at 30˚C, based on leaf area) and a temperature dependence (β) of 0.12 $˚C^{-1}$ reproduced measured summer emissions well but underestimated spring and winter measured emissions by 60-130%. The total annual monoterpene emission may be underestimated by ~50% when using a model optimized to reproduce monoterpene emissions in summer. The long term dataset also reveals an indirect connection between non-stomatal ozone and monoterpene flux beyond the dependence on temperature that has been shown for both fluxes.

Table 1. Mean monoterpene flux (modeled and measured) in μmol m^{-2}_{leaf} h^{-1}.

	all	spring 2003	spring 2004	summer	Summer excluding rain event	rain event	winter	winter excluding first snow event	first snow event
Modeled	0.37	0.36	0.21	0.51	0.53	0.29	0.06	0.06	0.05
Measured	0.48	0.83	0.39	0.56	0.55	0.64	0.11	0.10	0.21
# number of data	710	97	44	403	375	28	166	144	16
%-difference	31	134	89	9	5	121	87	61	333

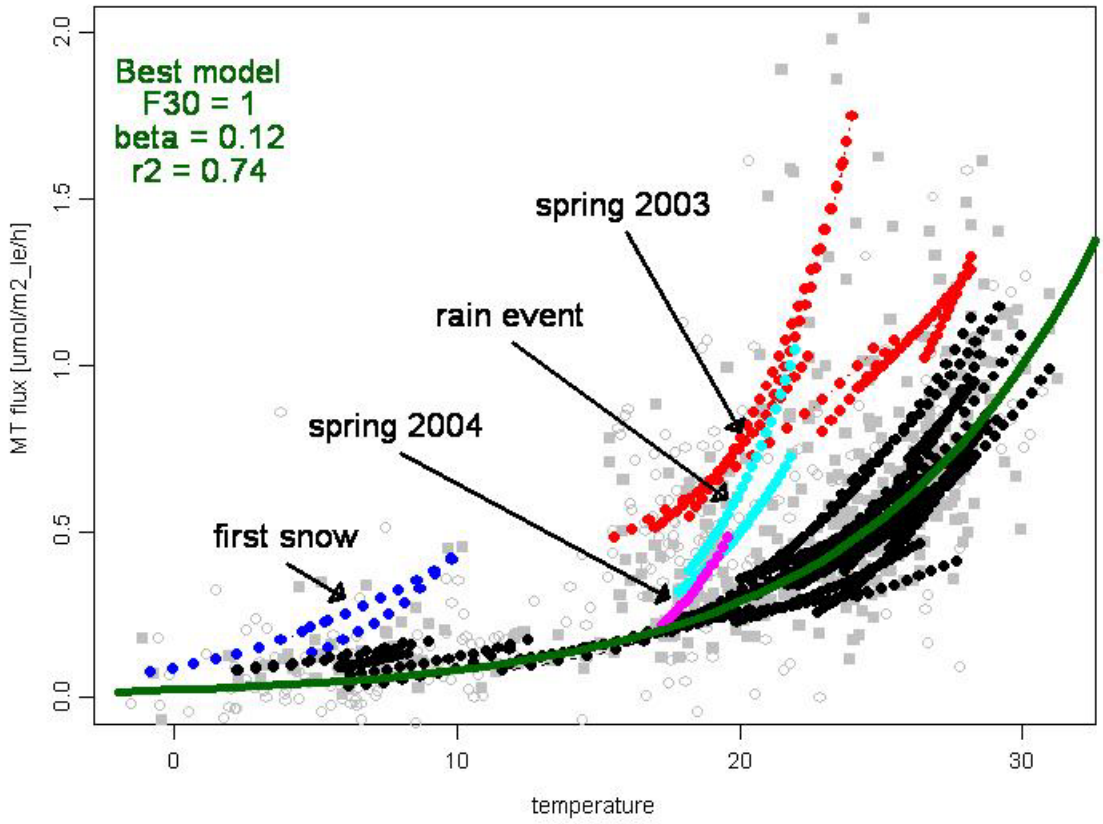


Figure 1. Measured monoterpene flux (grey symbols) and model results. All results from short time period modeling are included. The best overall model for our site (represented by the green line) is well correlated with measurements (r^2=0.74).

References

Guenther, A. B., Zimmerman, P. R., Harley, P. C., Monson, R. K., and Fall, R.: Isoprene and Monoterpene Emission Rate Variability - Model Evaluations and Sensitivity Analyses, J. Geophys. Res., 98(D7), 12609-12617, 1993.

Tingey, D. T., Manning, M., Grothaus, L. C., and Burns, W. F.: Influence of Light and Temperature on Monoterpene Emission Rates from Slash Pine, Plant Physiology, 65(5), 797-801, 1980.

Identification of the Mycorrhizal Associates of the Understory Plants *Pyrola picta* and *Pyrola aphylla*.

AUTHORS: Nicole Hynson[1], Valerie Wong[1] & Thomas Bruns
[1] These authors contributed equally to this work.

AUTHORS ADDRESS:
Department of Environmental Science Policy and Management
University of California, Berkeley, CA 94720-3102

ABSTRACT:

Myco-heterotrophic plants have been studied since the discovery of mycorrhizal fungi, but the evolutionary origins of these plants remain unknown. In a classical mycorrhizal interaction, plants trade photosynthates with their associated fungi and receive mineral nutrients in return. However, some non-photosynthetic plants cheat this mutualism. Myco-heterotrophic plants depend on their mycorrhizal associates for not only mineral nutrients but also carbon that the fungus acquired from an unrelated photosynthetic plant.

The most well studied group of myco-heterotrophs, the Monotropoideae, are all non-photosynthetic and obligate on specific fungal species. However, monotropes likely descended from generalist photosynthetic plants in the Pyroloid group. To address whether mycorrhizal specificity and loss of photosynthesis are contingent upon each other, we are studying the fungal associates of a pair closely related plants, *Pyrola picta* and *P. aphylla* (Ericaceae), that are photosynthetic and non-photosynthetic, respectively. *P. picta* may be a facultative myco-heterotroph partially dependent on fungal-mediated carbon transfer, while *P. aphylla* appears to be obligately dependent on mycorrhizal fungi to meet its nutritional needs. If *P. aphylla* and *P. picta* associate with the same broad range of fungi, we can conclude that photosynthesis is lost prior to specialization.

To test these hypotheses, we will identify the mycorrhizal fungi associated with *P. picta* and *P. aphylla* in Blodgett Experimental Forest. We are "baiting" the fungi associated with *P. aphylla* using buried packets containing *P. aphylla* seeds in three plots: *P.*

aphylla, *P. picta*, and a control plot containing neither species. We harvest the seed packets and examine them for germination. As many myco-heterotrophic plants germinate only in the presence of their specific fungal associates, this enables visual assessment of colonization by a fungal associate. After 13 months, no seeds have germinated. We have also collected root samples from *P. picta* for molecular identification of its associated mycorrhizae. We have collected aerial plant parts from plots containing *P. picta*, *P. aphylla* and other myco-heterotrophic plants for stable isotope analysis to determine the trophic status of both *Pyrola* species. This work will further elucidate the ecology of myco-heterotrophic plants and gain insight into how mycorrhizal networks remain robust to exclude cheaters.

Tree mortality patterns following replicated prescribed fires in a mixed conifer forest

AUTHORS: Leda Kobziar, Jason Moghaddas, Scott Stephens

LEAD AUTHOR ADDRESS:
ESPM Department, McBride Lab, Ecosystem Science Division
137 Mulford Hall #3114
UC Berkeley, Berkeley CA 94720

ABSTRACT:

During the late fall of 2002, we administered three burns in replicated mixed conifer forest sites at the Blodgett Research Forest in the north-central Sierra Nevada. Eight months later, we measured fire-induced injury and mortality in 1300 trees. Using logistic regression, an array of crown scorch, stem damage, fuels distribution and consumption, and fire behavior variables were examined for their influence on tree mortality.

ABOVE: Post-burn, 2002. ***photo by Jason Moghaddas***

In Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco), white fir (Abies concolor Gord. & Glend), and incense-cedar (Calocedrus decurrens [Torr.] Floren.), smaller trees with higher total crown damage had higher mortality. Smaller diameters and denser canopies best predicted mortality in ponderosa pine (Pinus ponderosa Dougl. ex P. & C. Laws), which constituted much of the dominant stratum. Consumption of duff and bark char severity increased model performance for white fir, and incense-cedar and black oak (Quercus kelloggii Newb.), respectively. In tanoak (Lithocarpus densiflorus (Hook. & Arn.) Rehder), lower total crown damage resulted in higher mortality rates, ranging from 20-60% mortality at 60-85% crown damage. When entered as a requisite variable into the logistic regression model along with tree diameter and consumption of large (>7.6 cm) rotten downed woody debris, fire intensity was a significant predictor in overall tree mortality. White fir mortality models resembled each other between sites, while incense-cedar did not, suggesting that species in replicated sites responded to similar burns differently. Our results provide actual fire behavior data which can be incorporated in mortality prediction models, and can be used to design prescribed burns for targeted reduction of tree density in mixed conifer forests.

Influences of canopy photosynthesis and summer rain pulses on root dynamics and soil respiration in a young ponderosa pine forest.

AUTHORS: Laurent Misson[1], Alexander Gershenson[2], Jianwu Tang[3], Ralph Boniello[1], Megan McKay[1], Weixin Cheng[3], Allen Goldstein[1]

AUTHOR ADDRESSES:
[1]Department of Environmental Science, Policy and Management
151 Hilgard Hall
University of California, Berkeley
Berkeley, CA 94720-3110
Phone: (510)-643-6449
Fax: (510)-643-5098
[lmisson@nature.berkeley.edu]
[2] Department of Environmental Studies,
UC Santa Cruz,
Santa Cruz, CA, 95064
[3] Department of Forest Resources
University of Minnesota
1530 Cleveland Ave N
St Paul, MN 55108

ABSTRACT:

The first objective of this paper is to make the link between the seasonality of fine root dynamics and soil respiration in a ponderosa pine (*Pinus ponderosa* P.& C. Lawson) plantation located in the Sierra Nevada of California. The second objective is to better understand how canopy photosynthesis influences fine root initiation, growth and mortality in this ecosystem. We compared CO_2 flux measurements with aboveground and belowground root dynamics. Fine root growth initiation coincided with tree stem thickening and shoot elongation, preceding new needle growth. Root, shoot, and stem growth in the spring was simultaneous with the increase of canopy photosynthesis. Initial growth rate of fine roots was the highest and their growing period was the shortest compared to the other components. Both above and belowground components accomplished 90% of their growth by the end of July, and the growing season lasted ~80 days. The time period for optimal growth is short at our site due to low soil temperature during the winter, and soil water stress during summer. Large rates of photosynthesis were observed following unusual late summer rains, however tree growth did not resume. The autotrophic contribution to soil respiration was 49% over the whole season, with daily contributions ranging between 18% and 87%. Increases in soil and ecosystem

respiration were observed during spring growth; however the largest variation in soil respiration occurred during summer rain pulses when no growth was observed. Both the respiration pulses magnitude and persistence were positively correlated with the amount of rain. These pulses accounted for 16.5% of soil respiration between day 130 and 329.

In conclusion, one of our hypotheses was that fine root development at our site is a high priority and is tightly coupled to canopy photosynthesis and available soil water. This hypothesis was partially supported and mainly holds for the first part of the vegetation period when increases in photosynthesis and root growth were coincident. We found that the time period for optimal root growth is short at our site due to low soil temperature during the winter and soil water stress during summer. High rates of photosynthesis were observed following summer rains during the second part of the vegetation period when temperature was optimal, but root growth did not resume and mortality rates did not decrease. It is likely that fine root dynamics is controlled by both environmental variables (mainly soil temperature and water content) and endogenous factors (mainly carbohydrate supplies and phenological signals). Our second hypothesis was that fine roots exert a major control over the seasonal patterns of soil respiration, and that such control is most apparent when roots are actively growing. This hypothesis was also partially confirmed because increases in soil and ecosystem respiration corrected for temperature variations were observed during the active root growing period. This provides evidence for a direct link between canopy photosynthesis and ecosystem and soil respiration. However, increases in respiration during root growth were relatively small. The largest variation in soil respiration at our site occurred during unusual rain pulse events in the summer, while root growth did not resume. Such increases can mostly be attributed to the stimulation of heterotrophic respiration. However, the activity of these heterotrophs was highly dependent on the earlier soil inputs of fresh labile carbon by the roots. This provides evidence for an indirect link between canopy photosynthesis, root growth and soil respiration.

Fire and Fire Surrogate Treatment Effects on Soils

AUTHOR: Emily Moghaddas

AUTHOR ADDRESS:
USDA Forest Service
Mt. Hough Ranger District
Plumas National Forest
39696 Highway 70
Quincy, CA 95971
emoghaddas@nature.berkeley.edu

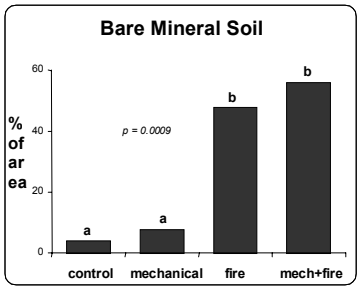
ABSTRACT:

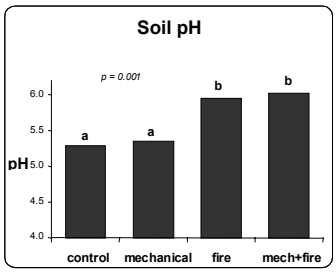
The objectives of this research are to examine the ecological consequences of fire and fire surrogate FFS) treatments as they pertain to the soil and forest floor. The four FFS treatments consist of 1) untreated control, 2) prescribed fire, 3) commercial harvest followed by understory mastication (mechanical treatment), and 4) commercial harvest followed by understory mastication and prescribed fire (mechanical-plus-fire treatment). Soil Cover protects against erosion, buffers against temperature extremes, and acts as a mulch to reduce moisture loss. The fire and mechanical-plus-fire treatments significantly increased the amount of bare mineral soil. Needledrop during the first winter added substantial cover to the burned stands. Soil pH is a foundation of soil chemistry and nutrient availability. Soil pH increased following the burn treatments due to ash accumulation on the ground surface. Soil Nitrogen is often limiting in forest ecosystems. While most soil N occurs as part of organic molecules, plants uptake N in inorganic form as nitrate and ammonium. The microbial community plays a key role in converting organic N into inorganic, available forms. Following the treatments, no differences were detected in total soil N among treatments. However, the fire treatments increased inorganic N. This effect was stronger in the mechanical-plus-fire treatment. The release of inorganic N following fire may result in short-term increases to site productivity.

Skid trails generally moderated fire effects. Fire effects such as increased soil pH and increased base saturation were significantly greater in burned undisturbed areas than in skid trails. Due to reduced fuels in skid trails, the amount of direct heating and combustion was greatly reduced. Following fire, skid trails had greater total soil carbon

than undisturbed areas. Soil bulk density samples from harvested stands were significantly greater in skid trails compared to undisturbed ground. Soil bacterial communities were examined using the Biolog system. Culture plates containing 95 different carbon sources were inoculated with soil samples. Utilization of the different carbon sources was measured over time. Soils from skid trails had consistently lower carbon utilization rates than those from undisturbed areas.

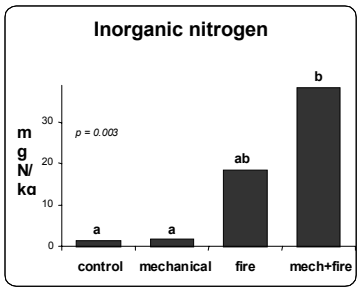
Soil Cover protects against erosion, buffers against temperature extremes, and acts as a mulch to reduce moisture loss. The fire and mechanical-plus-fire treatments significantly increased the amount of bare mineral soil. Needledrop during the first winter added substantial cover to the burned stands

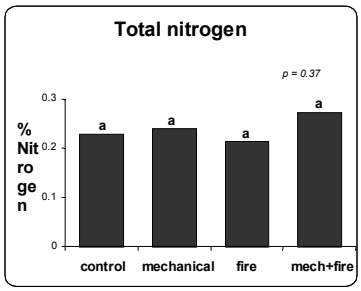




Soil pH is a foundation of soil chemistry and nutrient availability. Soil pH increased following the burn treatments due to ash accumulation on the ground surface.

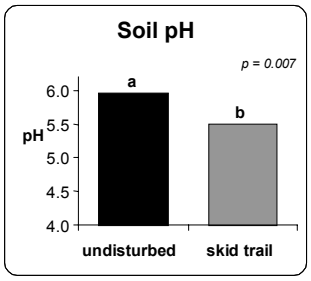
Soil Nitrogen is often limiting in forest ecosystems. While most soil N occurs as part of organic molecules, plants uptake N in inorganic form as nitrate and ammonium. The microbial community plays a key role in converting organic N into inorganic, available forms. Following the treatments, no differences were detected in total soil N among treatments. However, the fire treatments increased inorganic N. This effect was stronger in the mechanical+fire treatment. The release of inorganic N following fire may result in short-term increases to site productivity.

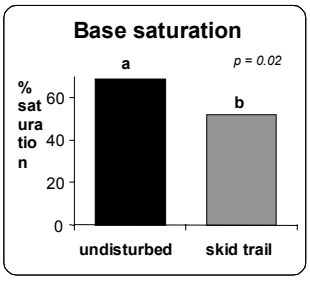


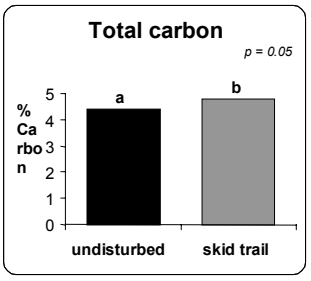


How did skid trails influence fire treatment effects?

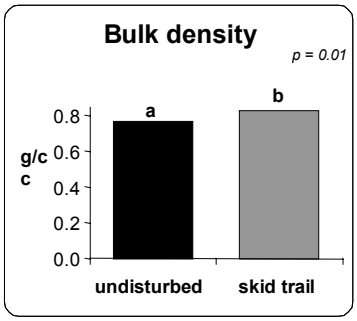
Skid trails generally moderated fire effects. Fire effects such as increased soil pH and increased base saturation were significantly greater in burned undisturbed areas than in skid trails. Due to reduced fuels in skid trails, the amount of direct heating and combustion was greatly reduced. Following fire, skid trails had greater total soil carbon than undisturbed areas.

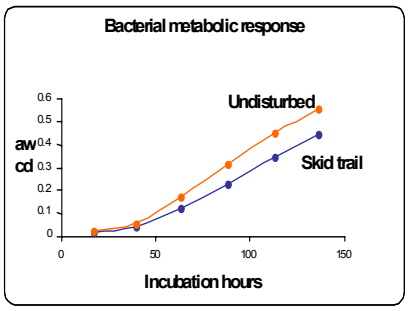






Soil bulk density samples from harvested stands were significantly greater in skid trails compared to undisturbed ground.





Soil bacterial communities were examined using the Biolog system. Culture plates containing 95 different carbon sources were inoculated with soil samples. Utilization of the different carbon sources was measured over time. Soils from skid trails had consistently lower carbon utilization rates than those from undisturbed areas.

Effects of Planting Density upon 20-year old Giant Sequoia, Ponderosa Pine and Douglas-fir in the Sierra-Nevada.

AUTHOR: Galen Peracca and Kevin O'Hara

ADDRESS OF LEAD AUTHOR:
Environmental Science, Policy and Management
151 HIlgard Hall
Berkeley, CA 94720-3110
510-643-2025
galen@nature.berkeley.edu

ABSTRACT:

Relationships between growing space per tree and tree growth components (DBH, height, live crown ratio, height-diameter ratio and tree volume) were studied in three single-species 20-year-old Nelder plots in the Sierra Nevada. Study species included ponderosa pine (*Pinus ponderosa* (P. & C. Lawson)), Douglas-fir (*Pseudotsuga menziesii var. menziesii* (Mirb.) Franco) and giant Sequoia (*Sequoiadendron giganteum* (Lindl.) Bucholz)). Spacing distance between trees increased from 0.54 to 5.42 m, which converts to 0.38 to 38.18 m² growing space per tree using Thiessen polygons to represent area per tree. Relationships between growing space and tree height, tree diameter and live crown were all significant and showed increasing trends at lower densities, as expected. Height: Diameter ratios were high at close spacing and decreased with increasing growing space. Volume growth per tree increased while per hectare volume growth decreased with increased spacing as anticipated, exhibiting some species-specific patterns of interest. Results provide important information on spacing response in Sierra conifers.

A State of the Forest Report, Blodgett Forest Research Station 2006

AUTHOR: Frieder G. Schurr

AUTHOR ADDRESS:
Center for Forestry
4501 Blodgett Forest Road
Georgetown, CA 95634
530-333-4475
freschur@nature.berkeley.edu

ABSTRACT:

Research:

The Center for Forestry and Blodgett Forest Research Station are currently in the middle of a transition and reorganization period which began last January and will continue for the next year. The current Director for the Center in charge of Properties, Bob Heald, retired last June but has continued on in this position at greatly reduced time through at least 2006. Current on site management at Blodgett, Baker, Russell, and Whitaker's Forest Research Station are jointly handled by Frieder Schurr and Rob York. All parties wishing to do research at these forests should submit proposals to the directors through Sheryl Rambeau at Blodgett Forest for review and approval. If approved, arrangements should be made to meet with either Rob or Frieder on site. Exact field locations must be approved on site so that appropriate restrictions and protections can be established before any work begins.

Currently there are 51 active research projects at Blodgett with another 11 active projects at the other three stations. The 2005 summer field season went smoothly with only a few minor issues that were resolved quickly. Several researchers from a variety of organizations were active at Blodgett for part or all of the summer season. Neither housing nor equipment were an concern thanks to the cooperation and early requests made by the research community. Please continue to let us know of any anticipated needs as early as possible to keep things running as smoothly in 2006!

Operations:

We completed another successful harvest in 2005 continuing our commitment to sustainable forest management using a variety of silvicultural systems to ensure a wide range of forest conditions available for use by the research community. This year we harvested approximately 2 million board feet of timber which is right at the annual average of the harvests over the last 40 years. We are anticipating a slightly lower harvest for 2006 at 1.7 million BF. Units to be cut include compartments 50, 110, 410, and 530 and 580. We will also be establishing a new age class of group openings in three of the 12 Fire & Fire Surrogate Study Compartments (180, 380, and 570). Thanks to all the FFS researchers who realize the importance of continuing the management operations in these units even as they continue with their research.

New in 2006:

We have just hired a new field forester who will be in charge of all "in the field" management operations at the Centers forest properties. Ken Somers comes to us with a long history of exemplary forest management qualifications. Ken's presence will give Frieder more time to concentrate on maintaining and disseminating the wide variety of information that is collected at the Center's properties.

We are looking forward to a great 2006 season. Please let us know if there is anything we can do for you to make your research experience with us better.

Ecology of the Spotted Owl in the North-Central Sierra Nevada

AUTHORS: Mark Seamans, R. J. Gutiérrez, William J. Berigan, and Sheila A. Whitmore

AUTHORS' ADDRESS:
University of Minnesota
Department of Fisheries, Wildlife, and Conservation Biology
St Paul, MN 55108

ABSTRACT:

We used a capture/recapture study design to study population ecology of the California spotted owl (*Strix occidentalis occidentalis*). Our 925 km^2 study area was between Georgetown, CA, and the western shore of Lake Tahoe. Since 1986, we have conducted over 15,000 surveys and captured and uniquely marked 268 territorial and 285 juvenile California spotted owls. From this data we are able to estimate annual rates of survival, fecundity, and population change. Estimates of annual survival varied by age-class and by sex: male annual survival = 0.81 [SE = 0.05] for 1 and 2-year-olds, and 0.85 [SE = 0.02] for owls ≥3 years-old; female annual survival = 0.77 [SE = 0.06] for 1 and 2-year-olds, and 0.80 [SE = 0.02] for owls ≥3 years-old. Annual fecundity (number of female young fledged per female) followed an alternating year pattern (i.e. a year with high fecundity was usually followed by a year with low fecundity, and visa versa). Annual rate of population change from 1991-2005 followed a quadratic pattern; annual estimates indicated an increasing population at the beginning of the study, dropped below a sustainable level during the middle of the study, and appear to have returned to a sustainable level in the past few years. Average annual rate of population change was 1.007 (SE=0.029).

We have implemented ancillary research on spotted owl food habits, competitors, predators, physiology, habitat requirements, genetics, disease, and disturbance to provide insight into why this population varies over space and time. This information is used by individuals and agencies for better management of California spotted owls. For example, we initiated a West Nile Virus study in 2004, testing owls and their prey for this virus. We have yet to document West Nile Virus on our study area. In 2005 we initiated a

behavioral experiment to examine the effect of the Forest Service management plan on spotted owl foraging ecology. This study involves harvesting timber according to management guidelines in treatment sites and comparing the response of owls in these sites with owls in control sites using radio-telemetry. Results from the behavioral experiment can potentially be incorporated into the Forest Service adaptive management strategy for vegetation and wildlife in the Sierra Nevada. In addition, we continue to follow habitat changes in space and time, and their effects on spotted owls.

California Spotted Owl
(Strix occidentalis occidentalis

Refining the Attractant bait for the California Fivespined Ips, *Ips paraconfusus*

AUTHORS: Steven J. Seybold[1], Jana C. Lee[2], Pavel Jiros[1], Shakeeb M. Hamud[1], Eugenel Espiritu[2], Dezene P.W. Huber[3], and David L. Wood[4]

AUTHORS ADDRESS:
[1]Chemical Ecology of Forest Insects, Pacific Southwest Research Station, USDA Forest Service
[2]Department of Entomology, University of California Davis
[3]Ecosystem Science and Management, University of Northern British Columbia
[4]Division of Insect Biology, Department of Environmental Science, Policy, and Management, University of California Berkeley

ABSTRACT:

The California fivespined ips, *Ips paraconfusus* Lanier, is an important bark beetle in California forests, occurring on ponderosa and sugar pine at Blodgett Forest. The beetle is distributed in California and Oregon, and has a wide host range on pines. With increased trade, *I. paraconfusus* may be transported to other parts of North America or other countries and establish there as a pest. Our objectives were to refine the attractant bait for *Ips paraconfusus* for pest management in California and for early detection of this potentially invasive beetle in other areas (e.g., Australia, Chile, Europe, or New Zealand).

Males produce a synergistic blend of (4*S*)-(−)-ipsenol, (4*S*)-(+)-ipsdienol, and (1*S*,2*S*)-(−)-*cis*-verbenol (measured in chloroform) in a 100:10:2 ratio. The commercial bait from Phero Tech Inc. includes (+)-ipsdienol but differs from the natural pheromone with 83%-(–)-*cis*-verbenol and racemic ipsenol [50%-(+), 50%-(–)] in a 2:1:3 ratio. Ideally the commercial bait should mimic the naturally occurring pheromone, but more cost-effective baits use racemic blends, which are easier to produce than pure enantiomers. Therefore, we tested the specificity of the beetle's responses to the enantiomeric blends of ipsdienol, *cis*-verbenol and ipsenol separately in three field trials.

To optimize the enantiomeric blend of ipsdienol, we used baited funnel traps in four blocks at Blodgett Forest in August and September 2004. Seven treatments included

ipsdienol in various blends [racemic 1X and 2X, (+)-1X, (–)-1X] while keeping 83%-(–)-*cis*-verbenol and racemic ipsenol constant, conophthorin alone, conophthorin with (+)-ipsdienol & *cis*-verbenol & ipsenol, and an unbaited trap (Table 1). Conophthorin was tested as a possible flight interruptant. We found that treatments with (+)-ipsdienol were attractive, while (–)-ipsdienol and conophthorin interrupted flight. Therefore, we recommend that the commercial bait continue to use (+)-ipsdienol, and repellent products might include (–)-ipsdienol and conophthorin.

To optimize the enantiomeric composition of *cis*-verbenol, five treatments were tested in July-August 2005: *cis*-verbenol in blends [83%-(–), (+), and (–)] or absent while keeping (+)-ipsdienol and racemic ipsenol constant in each treatment, and an unbaited trap. Treatments with (–)-*cis*-verbenol were attractive and there was a higher response to 83%-(–)-*cis*-verbenol vs. (–)-*cis*-verbenol likely due to a ~4-fold higher release rate between the two commercial products. *Ips paraconfusus* appears non-responsive to (+)-*cis*-verbenol suggesting that a mixed enantiomeric blend (in commercial bait) is effective.

To optimize the enantiomeric composition of ipsenol, six treatments were tested in August-September 2005: ipsenol in blends [racemic 1X and 2X , (+)-1X, (–)-1X] or absent while keeping (+)-ipsdienol and 83%-(–)-*cis*-verbenol constant in each treatment, and an unbaited trap. Treatments with (–)-ipsenol were attractive, (+)-ipsenol was not attractive nor interruptive, and the treatment with 2X racemic ipsenol captured twice as many beetles as did the commercial blend with 1X racemic ipsenol. This suggests that using twice as much racemic ipsenol (2X) can substantially improve the commercial bait.

Future research will include a more controlled study of the enantiomeric composition of *cis*-verbenol, and vary the three-component ratio in tandem and separately.

Table 1. Progression of experiments to demonstrate the enantiospecific response of the California fivespined ips, *Ips paraconfusus*, to pheromone components, Blodgett Forest Research Station, El Dorado Co., California, 2004-2005 (Seybold et al., unpublished data).

Experiment	Dates	Goals	Treatments[1]	Outcomes
1	27 Aug. – 22 Sept., 2004	Optimize the enantiomeric composition of ipsdienol Test interruption by conophthorin	Ipsdienol in various blends [racemic 1X and 2X, (+)- 1X, (–)-1X] while keeping 83%-(–)-*cis*-verbenol and racemic ipsenol constant in each treatment, conoph-thorin alone, conophthorin added to (+)-ipsdienol & *cis*-verbenol & ipsenol, unbaited trap (7 treatments)	Treatment with (+)-ipsdienol attractive; with (–)-ipsdienol not attractive; racemic 1X and 2X partially attractive due to interruption by (–)-ipsdienol; conophthorin interruptive
2	28 July – 12 Aug., 2005	Optimize the enantiomeric composition of *cis*-verbenol	*cis*-Verbenol in blends [(+), (–), and 83%-(–)] or absent while keeping (+)-ipsdienol and racemic ipsenol constant in each treatment, unbaited trap (5)	Treatments with (–)-*cis*-verbenol attractive; with (+)-*cis*-verbenol weakly attractive; higher response to 83%-(–)-*cis*-verbenol vs. (–)-*cis*-verbenol due to a higher release rate
3	12 Aug. – 19 Sept., 2005	Optimize the enantiomeric composition of ipsenol	Ipsenol in blends [(+)-1X, (–)-1X, racemic 1X and 2X] or absent while keeping (+)-ipsdienol and 83%-(–)-*cis*-verbenol constant each treatment, unbaited trap (6)	Treatments with (–)-ipsenol attractive; with (+)-ipsenol not attractive, racemic 2X is most economical and effective form of ipsenol in the experiment
Future Directions	2006	Test varying ratios of ipsdienol, *cis*-verbenol and ipsenol	Ipsdienol, *cis*-verbenol, ipsenol in 10:2:100 ratio to mimic natural pheromone, and in varying component ratios, unbaited trap	

[1] All materials from Phero Tech, Inc. unless otherwise indicated. For all enantiomeric mixtures of ipsdienol, 1X release rates are 0.11 mg/day. 83%-(–)-*cis*-Verbenol release rate is 0.3-0.6 mg/day at 25°C, and (+)- and (–)-*cis*-verbenol rates are 0.08 mg/day at 20°C (ChemTica, Internacionale S.A.). For all enantiomeric mixtures of ipsenol, 1X release rates are 0.22-0.24 mg/day. Racemic conophthorin release rate is 3.0 mg/day.

The Effects of Fire and Fire Surrogate Treatments on Insects and Pathogens in Sierran Mixed Conifer Forests: Initial Evidence of Elevated Bark and Ambrosia Beetle Activity in Fire Treated Areas

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

AUTHORS ADDRESS:
[1] Division of Ecosystem Science, University of California, Berkeley, CA 94720
[2] School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI 49931
[3] 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 variables in various scientific discipline areas. At Blodgett Forest Research Station located in El Dorado County, CA, entomological and pathological data were collected in Summer 2001 (pre-treatment), Summer 2002 (post-thinning, pre-burn), Summer 2003 (post-treatment), and late Spring 2005 (2 year post-treatment) for the following insect and disease conditions: red turpentine beetle, *Dendroctonus valens*, western pine beetle, *D. brevicomis*, mountain pine beetle, *D. ponderosae*, fir engraver, *Scolytus ventralis*, pine engraver beetles, *Ips* spp., defoliators, scale insects, root diseases (annosus root and butt rot, *Heterobasidion annosum* and blackstain, *Leptographium wageneri*), mistletoes (true and dwarf), rusts (white pine blister rust, *Cronartium ribicola*, western gall rust, *Peridermium harknessii*, and Incense-cedar rust, *Gymnosporangium libocedri*), and other diseases (true fir needle cast, *Lirula abietis-concoloris*, and Elytroderma disease, *Elytroderma deformans)*. Categorical data were obtained from 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. Scans were limited to a distance of 30 meters in all treatments in the post-treatment collection to account for increased visibility

in the mechanical treatments. In Summer 2002, 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.

In Summer 2003, preliminary analysis of categorical data in the fire treated compartments, particularly the fire and mechanical treatments, reveal light- to heavy-attack by the red turpentine beetle on both ponderosa and sugar pines, and increased incidence of western and mountain pine beetle on ponderosa and sugar pines, respectively, (data are currently being analyzed). Additionally, elevated activity of ambrosia beetles seems to be occurring on scorched white firs in these fire treatments, based on the abundance of visible frass. From the scan data, preliminary analyses further suggests increased mortality levels of trees in the 11.4 to 25.4 cm (4.5 to 10 in) diameter class in the fire treated compartments. Primary and secondary beetle presence on these trees were confirmed in Summer 2004 (based on gallery and exit hole identification). Although both primary and secondary beetles utilized these trees, mortality was most likely attributable to fire. These trees will be mapped to follow trends in future tree mortality. Final post-treatment data were collected in late Spring 2005 to capture tree mortality from Summer 2004. Long term monitoring of these treatment areas is anticipated as part of the national FFS study.

Bark beetle landing rates as indicators of future tree mortality

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

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

ABSTRACT:

The landing rates of bark beetles were monitored using sticky traps on trees in the fire and fire-surrogate study (FFS) treatment compartments. Three ponderosa pines (*Pinus ponderosa*) and three white firs (*Abies concolor)* were selected from each of three plots chosen randomly within each compartment assigned to the four treatments for a total of 36 ponderosa pines and 36 white firs per treatment. Trees with no symptoms or signs of bark beetle infestation or root disease closest to the plot centers were chosen. Conditions for each tree were rated and recorded. One 61cm x 31cm sticky trap was hung at a random cardinal direction at a height of 1.3-m on each of the selected trees. Bark beetles have been collected from these traps monthly during the flight period from Spring to late Fall each year from Spring 2002 through Fall 2005. 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. Preliminary analyses suggest that host selection may be occurring prior to landing. These data will be correlated with core variable data on bark beetle induced mortality and activity on individual trees and in stands to determine if landing rates can be used as indicators of future tree mortality.

Proposed Re-introduction of Prescription Fire as Part of Managing the Center for Forestry Property: Russell Reservation

AUTHORS: Dr. Scott Stephens and Dr. Rick Everett

AUTHOR ADDRESS:
Wildland Fire Lab
Environmental Science, Policy and Management
College of Natural Resources
University of California at Berkeley
137 Mulford Hall MC 3114 Berkeley, CA 94720
stephens@nature.berkeley.edu, everett@nature.berkeley.edu

ABSTRACT:

As a 280 acre Lands Reserve within the Center for Forestry Properties, the Russell Reservation property is a mix of coniferous research plantations, California coastal scrub and Oak woodland vegetation nestled in the Briones Hills area 12 miles east of the UC Berkeley campus. This property adjoins the East Bay Municipal Utilities District (EBMUD) properties, East Bay Parks Briones Regional Parks, and the cities of Pleasant Hill, Lafayette, Orinda, and small private holdings.

California's native vegetation is keyed into fire as the primary mode of natural disturbance and successional agent. Fire, then, is an anticipated portion of ecosystem dynamics for the vegetation, both native and plantation, contained within the bounds of the Russell Reservation. Numerous research plots containing high stocking levels of coniferous species exist within the property. These tracts have existed beyond the termination of the related research. As such, these areas have progressed to a overstocked condition, and are developing high and potentially dangerous levels of fuels loads. The Russell Reservation has not been exposed to damaging fire behavior during the period of available records. However, large fires have occurred nearby in identical native vegetation, and in similar Wildland-Urban Interface (WUI) areas, including the 1923 Berkeley and 1991 Oakland fires.

Prescription fire treatments are proposed as a test bed to demonstrate the feasibility of including fire as an essential part of managing University lands at the Russell Reservation. This form of fire management provides an excellent template for

demonstration of Fire-Safe Practices in a local vegetation type. Lowering on-site fuel loads and increasing the heterogeneity of fuels in the area provides a much-needed hazard reduction in an area laced within the WUI concerned. Overall stand health, growth potential, and better site preparation for future studies are all outcomes of re-introduction of fire into this management scenario.

BELOW: Setting a prescribed burn. ***Photo by Rob Scott, US Forest Service***

The Effects of Fire and Fire Surrogate Treatments on Vegetation, Surface Fuels, and Potential Fire Behavior in Western Coniferous Forests

AUTHORS: Dr. Scott L. Stephens[1] and Jason J. Moghaddas[2]

AUTHORS ADDRESS:
[1]Assistant Professor Wildland fire science
University of California
Department of Environmental Science, Policy, and Management
209 Mulford Hall
Berkeley, CA 94720-3114
(510) 642-7304, stephens@nature.berkeley.edu
[2]Fire Ecologist
Plumas National Forest
39696 Highway 70
Quincy, CA 95971
(530) 283-7672, jmoghaddas@fs.fed.us

ABSTRACT:

Modification of potential fire behavior is a central management focus in western coniferous forests. Managers must manage vast forested landscapes effectively within complex financial, political, and social frameworks while concurrently providing for ecosystem values. The principles of fuel reduction which can modify fire behavior are recognized by managers and scientists, though quantitative desired conditions for fuel treatments are not readily available to planning teams for use in designing and evaluating different fuel treatments on both public and private lands. The Fire and Fire Surrogate Study has quantified the initial effects of fire and fire surrogate treatments on a number of response variables, including vegetation structure, fuel loading, and potential fire behavior. We will present results of the effects of mechanical, fire only, and a combination of these treatments on potential fire behavior from 5 western Fire and Fire Surrogate Study Sites. These sites include Blodgett Forest Research Station, embedded in the El Dorado National Forest, Sequoia and Kings Canyon National Park, the Goosenest Experimental Forest, adjacent to the Klamath National Forest, the Hungry Bob Site, within the Wallowa-Whitman National Forest, Oregon, and the Lubrecht Site, dominated by ponderosa pine near Missoula, Montana. Results from the Fire and Fire Surrogate Study

treatments will help managers succeed in effectively implementing fuel treatments at a landscape level.

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

AUTHORS: Margaret S. Torn[1], Todd Dawson[2], Julia Gaudinski[2], Jeffrey Bird[2], and Stefania Mambelli[2]

AUTHORS ADDRESS:
[1]Lawrence Berkeley National Laboratory, Berkeley, California
[2]University of California, Berkeley

ABSTRACT:

Sequestering carbon (C) in terrestrial ecosystems is a potential approach to reducing the buildup of atmospheric CO_2. Soil is the most effective sequestration reservoir for C in many ecosystems because of the long turnover time of soil organic matter (SOM) compared to most plant tissues, and because of less inter-annual variability or disturbance-driven losses. Beginning in 2001, we have been conducting a multi-investigator project—centered at Blodgett but also using other temperature forests--to fill critical gaps in belowground plant-soil carbon cycling. Our objectives at Blodgett include: (1) quantifying the stocks and lifetime of fine roots and determining the lower bound of NPP "pumped" into soil carbon through fine roots; (2) comparing the sequestration efficiency of leaf and fine-root inputs, including litter decay, humification, and SOM products; (3) characterizing the turnover times of SOM pools. We are using a variety of isotopic techniques, such as ^{14}C analysis of roots and SOM and dual-label ($^{13}C/^{15}N$) litter traced into the microbial community, and SOM fractions, and CO_2.

Our results to date include: (1) Fine roots must be considered as (at least) two populations, short-lived (< 1 yr) and longer lived (2-20 yr). (2) C allocation to fine roots versus leaves enhances C stabilization in soil in the short term because fine roots live longer and decompose 2 times more slowly than leaves (regardless of soil depth). (3) The differences in C storage and turnover time at the Blodgett sites are explained by the influence of parent material on soil chemistry, and in particular reactive aluminum and iron, which influence both organo-metal complexes and aggregate stability. (4) Longer-

term implications of plant allocation are unclear because differences in initial litter decomposition between roots and leaves may not portend the trend in storage as SOM. Moreover, altering plant allocation patterns or locking up nutrients in sequestered OM may influence the plant's ability to acquire belowground and aboveground resources, which may in turn feedback to alter productivity and long-term C sequestration. At Blodgett Forest, our focus during the next 5 years will be to assess if the initial (0 to 2 y) trends in greater C stabilization from belowground C persist over the longer-term (5 to 10 y); and if soil depth becomes more important during later period of C stabilization in soil.

EFFECTS OF FIRE AND FIRE SURROGATE TREATMENTS ON FISHER HABITAT

AUTHORS: Richard L. Truex[1], William J. Zielinski[1], and Frederick V. Schlexer[2]

AUTHORS ADDRESS:
[1]USDA Forest Service, Sequoia National Forest, 1839 South Newcomb St., Porterville, CA 93257 (RLT)
[2]USDA Forest Service, Pacific Southwest Station, 1700 Bayview Dr., Arcata, CA 95521 (WJZ, FVS).

ABSTRACT:

We examined the short-term effects of Fire and Fire Surrogate (FFS) treatments on fisher (*Martes pennanti*) habitat at 2 FFS sites in California's Sierra Nevada from 2001 – 2004. The fisher has recently experienced considerable range reduction throughout the Sierra Nevada and appears to require certain habitat elements associated with mature forest conditions (e.g., dense canopy, large trees). Potential resource conflicts exist between maintaining habitat to support viable fisher populations in the Sierra Nevada and meeting fuels reduction and vegetation management projects needed to protect mountain communities and reduce the likelihood of large-scale catastrophic fires.

Blodgett Forest Research Station (BFRS) was the primary FFS site in the Sierra Nevada, and compared the effects of mechanical, prescribes fire, and mechanical followed by prescribed fire on various resources. The second FFS site was located at Sequoia-Kings Canyon National Park (SEKI) and was a satellite site focusing on the timing of prescribed fire, comparing early season burns to late season burns. At each site, three replicates of each treatment and 3 control replicates were randomly assigned to treatment units ranging in size from ~15 – 30 ha. Within each of these treatment units we randomly selected 10 of the established FFS plots to collect habitat data in a manner consistent with recently published research describing habitat selection by fisher in California. We collected habitat data prior to and following treatment implementation to assess treatment effects on fisher habitat suitability, as well as select habitat variables assumed important to fisher.

We assessed habitat suitability using Resource Selection Functions developed from radio-telemetry research and track plate surveys conducted in California from 1993-1997. We compared the differences in predicted probability of resource use (a surrogate for habitat suitability) before and after treatment implementation and concluded that (1) FFS treatments resulted in significant short-term reduction in resting habitat suitability for resting and on average canopy closure and (2) effects on foraging habitat were generally not significant. At BFRS the mechanical and mechanical plus fire treatments had the greatest effect on habitat suitability, while at SEKI late season burns had greater impact on habitat suitability than did early season burns. We provide several suggestions that may be used by land managers to mitigate the negative short-term effects on resting habitat for fisher associated with canopy reduction resulting from fuels management projects. Revisiting the FFS sites 5 and 10 years following treatment implementation will provide the opportunity to assess potential habitat improvement following the initial, short-term reduction in habitat quality.

Mixed conifer stand development

AUTHORS: Kristen M. Waring and Kevin L. O'Hara

LEAD AUTHOR ADDRESS:
Center for Forestry
137 Mulford Hall #3114
University of California, Berkeley, CA 94720-3114
kristen.waring@nature.berkeley.edu
510-643-2025

ABSTRACT:

Potential changes in forest ecosystems following the introduction of a new insect or pathogen are frequently dramatic, negatively impacting one or more tree species and altering long-term ecological processes. Management of forests impacted by such species is complicated because the underlying stand dynamics may change. It is therefore critical to understand potential stand development patterns both before and after pest invasion. White pine blister rust (WPBR) is caused by a fungal pathogen and attacks all five-needled white pines in North America. The sugar pine component of the Sierra Nevada mixed-conifer forests was first impacted by WPBR in the early 1900's and continues to suffer dieback and mortality as a result of pathogen infection. The objective of this study was to describe stand development patterns in the mixed-conifer forests with and without the pathogen present. Six sites in the Sierra Nevada were selected for sampling, including Blodgett Forest. In each study stand, three plots were located, either centered around a live, healthy sugar pine or a recently (<10 years) dead sugar pine. Patterns of stand development in even-aged stands followed general patterns of shade tolerance. Ponderosa pine and sugar pine were most frequently found in the upper canopy layers, with Douglas-fir and white fir found in all canopy positions. Incense-cedar was most frequently found in the lowest canopy positions. In multiaged stands, all species were found in all canopy positions; however, ponderosa and sugar pine were rarely found in the lowest canopy positions. Spatial distribution of neighboring trees determines which trees are best positioned to take advantage of available growing space following sugar pine mortality. Treatments in these stands to encourage sugar pine survival and growth into the upper canopy positions should remove more shade tolerant competitors and increase light in the lower canopy.

Western gall rust impacts on radiata pine tree growth and form

AUTHORS: Kristen M. Waring[1], Robert A. York[2] and William J. Libby[3]

AUTHORS ADDRESS:
[1]Center for Forestry
137 Mulford Hall #3114
University of California
Berkeley, CA 94720-3114
Ph: 510.643.2025
Fax: 510.643.5438
kristen.waring@nature.berkeley.edu

[2]Center for Forestry, UC Berkeley
4501 Blodgett Forest Rd
Georgetown, CA 95634

[3]28 Valencia Rd
Orinda, CA 94563

ABSTRACT:

We examined the impact of western gall rust on tree volume, growth, and stem form over time in a common garden experiment established in 1988. Trees were planted on an 8x8 tree grid at 2 metre spacing and exposed to western gall rust inoculum already present at the site. Gall counts from 1993 were used as an index of rust infection and compared to 2001 tree morphology measurements. Trees were grouped by genetic origin for analysis: mainland, island, New Zealand / Australia selects, and mainland-island hybrids. Trees from island populations showed the fewest number of galls, while the mainland population had the highest. Volume growth was reduced in trees with higher levels of western gall rust infection. Likewise, stem form tended to be lower in trees with more galls and often reduced overall merchantability of the tree. Radiata pine populations exhibit varying levels of resistance to western gall rust, with volume and stem form impacted accordingly. Tree breeders could capitalize on the resistance already present in the New Zealand / Australia selects population and relatively easily incorporate it into current breeding programs.

TWO UNDESCRIBED SPECIES OF NEARLY EYELESS BEETLES DISCOVERED AT BLODGETT FOREST

AUTHOR: Kipling W. Will

AUTHOR ADDRESS:
UC, Berkeley
ESPM Dept
Insect Biology Division and Essig Museum of Entomology

ABSTRACT:

As part of my larger taxonomic and systematic revision of species in the *Hypherpes* complex of *Pterostichus* (Coleoptera: Carabidae) I have recently discovered a number of undescribed species in the *Le[tferpmoa* clade. Two of these beetles are *only* known from five specimens, all collected in the upper portion of Bacon Creek near the Blodgett researchers' cabins. I have searched in similar habitat in Blodgett and near Blodgett but have not found these beetles elsewhere. As the site where they are known to occur is a high-use area subject to modification, I hope to enlist the help of any Blodgett researchers that might be able to look for these beetles over the course of the season and more broadly in the Georgetown Divide region. These beetles are found under large, deeply embedded rotten logs where the soil is moist and water-table high. Their habitat is shaded, with thick vegetation. If they behave similar to their near relatives they are seasonally active with slight increase in adult activity in the fall and a larger level of adult activity in spring, corresponding to snowmelt and until June. The highly reduced state of the compound eyes, relatively narrow and parallel-sided form and small size (5-7mmlong) of these beetles is consistent with a largely soil-dwelling life history.

LEFT:
Pterostichus (Leptoferonia) "blodgetti"

RIGHT: Pterostichus (Leptoferonia) "pemphredo" n.sp.

Regeneration of giant sequoia (*Sequoiadendron giganteum*) in experimental gaps: Implications for restoration of a long-lived pioneer species

AUTHORS: Robert A. York, John J. Battles, Frieder G. Schurr, Robert C. Heald

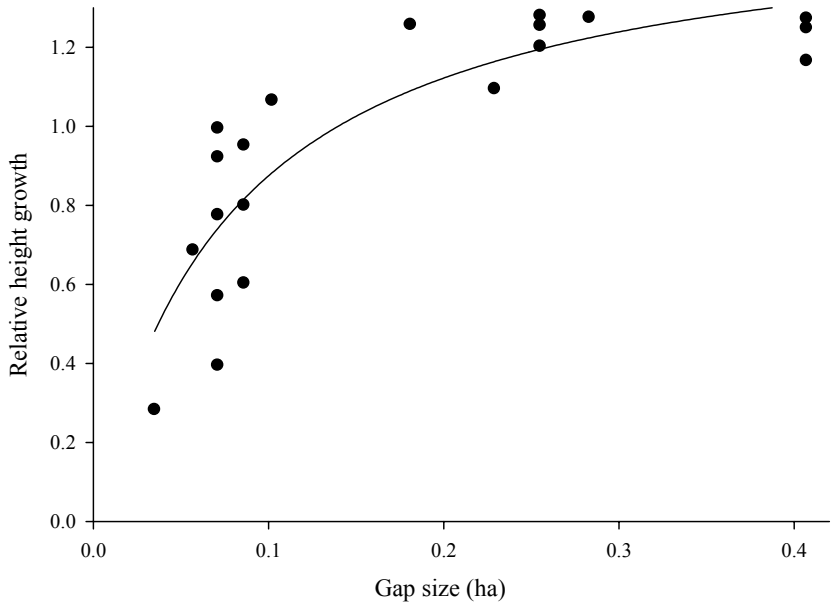
LEAD AUTHOR ADDRESS:
Center for Forestry
4501 Blodgett Forest Research Station
Georgetown, CA 95634

ABSTRACT:

Recovery from the greatly altered conditions of fire-dependent ecosystems will depend on near-term management decisions that seek to actively restore desired conditions. In giant sequoia groves, a key component of restoration is the initiation of giant sequoia cohorts. We designed this experiment to find the effects of gap size, position within gap, and substrate on giant sequoia germination, seedling survival, and early growth. Twenty circular gaps ranging in size from 0.05 to 0.4 ha were created at Whitaker's Forest Research Station in the southern Sierra Nevada range. Seeds and seedlings were planted along north-south transects across the gaps on paired transects of ash and bare mineral soil substrates. Using a model selection procedure, an asymptotic relationship between gap size and seedling growth was the best model with good support. Growth leveled off or diminished considerably at around 0.2 ha for both ash and soil substrate seedlings (see attached Figure). Seed germination and seedling survival was influenced very little by gap size. Within gaps, seedling size was influenced considerably by all factors considered. Seedlings that were planted in the ash substrate near the south-central portions of gaps were the biggest. Seedling mortality was highest in north-central gap positions, while substrate had relatively little influence on mortality. Germination occurred slightly more frequently on ash substrates near gap centers, but low overall germination led to model selection ambivalence. The initiation of a fast-growing cohort was best achieved in this case with >0.2 ha gaps that had ash substrates and seedlings planted near gap centers. Long-lived pioneer species such as giant sequoia present a unique challenge to comparably short-lived managers and restorationists. Intense disturbances must be a part of the prescription, the results of which will not be realized

for centuries. The success and efficiency of these restoration treatments can likely be improved by incorporating results from this and similar studies into current designs, but an active adaptive management strategy is necessary for testing uncertainties and improving long-term restoration.

Figure. Gap size–seedling growth relationship for giant sequoia in experimental gaps at Whitaker's Forest Research Station, CA. Symbols are gap-level means from the 2nd year after planting.



BLODGETT FOREST RESEARCH PROJECTS

2/1/2006

KEY: **PROPOSED** **ACTIVE** **COMPLETE** DENIED WITHDRAWN ABANDONED

BFRS PROJECT NO.	STATUS	PRINCIPAL INVESTIGATORS	BEGIN DATE	COMPLETE DATE	PROJECT TITLE
BF06-02 SC	Proposed	Steven S. Cliff Tony VanCuren	Feb-06	Jun-06	Size-Segregated and Time-Resolved Atmospheric Particulate Sampling for the Suppression of Precipitation Experiment (SUPRECIP-2)
BF06-01 JH	**ACTIVE**	James Hudson	Feb-06	Apr-06	Surface CCN Measurements in SUPRECIP 2
BF05-10HK	Complete	Harry Kaya Ed Lewis	Jul-05	Jul-05	Collection of Termite species, genera *Reticulitermes* and *Zootermopsis*
BF05-09RG	Complete	Robert Graham Derek MacKenzie	Jun-05	Jun-05	Charcoal Content in California Ecosystems
BF05-08JB	**ACTIVE**	John Battles Adrian Das	May-05	Sep-05	A Dendroecological Approach to Tree Mortality in the Sierra Nevada
BF05-07TB	**ACTIVE**	Tom Bruns Nicole Hynson	May-05	May-05	Identification of the Mycorrhizal Associates of the Understory Plant *Pyrola picta f. aphylla*
BF05-06RG **refer 91-4**	**ACTIVE**	R. J. Gutierrez Mark Seamans Michelle Crozier	Apr-05	Aug-06	Spotted Owl Monitoring and Demography
BF05-05FS **refer 96-9**	**ACTIVE**	Frieder Schurr Rob York Robert Heald	Jan-05	Oct-05	Snag dynamics in the mixed conifer forest - management implications
BF05-04RY **refer 82-2**	**ACTIVE**	Rob York Kabir Peay Robert Heald	Jan-05	Oct-05	Effect of Ceratocystis wagneri disease centers on new conifer plantations

BF05-03RH **refer 88-5**	**ACTIVE**	Robert Heald Robert A. York Frieder Schurr	Jan-05	Oct-09	Mixed Conifer Regeneration
BF05-02AG	**ACTIVE**	Allen Goldstein Laurent Misson	Jan-04	Jan-07	Carbon exchange in a Ponderosa Pine Plantation: Strategies of water use, seasonality of plant physiology, & the impact of aerosols on photosynthesis
BF05-01AG	**ACTIVE**	Allen Goldstein Rupert Holzinger Anita Lee Megan McKay	Jun-05	Oct-07	Extending the use of PTR-MS for new measurements of volatile organic compounds and their oxidation products - Phase II
BF04-11SS	Complete	Steven J. Seybold Joyce Sakemoto	Oct-04	Oct-04	Population ecology of endosymbiotic bacteria in *Ips* (orthotomicus) *latidens*
BF04-10BK	Abandoned	Bruce Kirkpatrick Melody Meyer	Oct-04	Jun-06	Understanding mechanisms of cold therapy for Pierce's disease of grapevine"
BF04-09KO **refer BF01-34H**	Complete	Kevin O'Hara Galen Peracca	Sep-04	Nov-04	Nelder plot spacing trials for 20 year old giant sequoia, white fir, Douglas-fir, and ponderosa pine
BF04-08MG	Abandoned	Matteo Garbelotto Kabir G. Peay	Jul-04	Sep-06	Environmental and genetic factors associated with the spread of Blackstain root disease
BF04-07MG	**ACTIVE**	Matteo Garbelotto Katy Hayden	Jul-04	Sep-06	Ecology and epidemiology of sudden oak death: Host-pathogen interactions
BF04-06DW	**ACTIVE**	David L. Wood	Aug-04	10/1/2004 Extenstion requested	Regional Variation in Fungal Symbionts & Behaviorial Chemistry of *Dendroctonus valens* (Red Turpentine Beetle)

BF04-05SS	**ACTIVE**	Steven J. Seybold David L. Wood Shakeeb Hamud Dezene Huber	Aug-04	Oct-05	Refinement of the Aggregation Pheromone of the California Fivespined Ips, ps paraconfusus
BF04-04KO	~~With-drawn~~	Kevin O'Hara Galen Peracca	Jul-04	Sep-04	Stand development following creation of shaded fuel breaks in the Sierra Nevada mixed conifer type
BF04-03WC	Complete	Weixin Cheng Feike Dijkstra	Jun-04	Jun-04	Soil collection for Priming Effect on Ponderosa pine seedlings
BF04-02KW	Complete	Kipling Will Cheryl Barr	Jun-04	Jun-04	Survey of California Insects and Spiders
BF04-01MF	**ACTIVE**	Mary K. Firestone William Horwath Richard Higashi Teresa W. Fan Jeff Bird	Apr-04	May-10	Microbial Communities as Biochemical Inputs to Forest Soil Humification Processes
BF03-06SS	Complete	Scott Stephens Marco Hille Lars Schmidt	Jun-04	Aug-04	Tree mortality after fire: the influence of duff consumption, bole damage and crown scorch
BF03-05DW	Complete	David L. Wood Pierluigi Bonello Thomas Gordon	Mar-03	Dec-04	Mechanisms of host selection by pine bark beetles
BF03-04JB	**ACTIVE**	John Battles	Mar-03	Sep-10	Managing the consequences of exotic forest pests: Learning from white pine blister rust (*Cronartium ribicola*) impace on sugar pine (*Pinus lambertiana*)
BF03-03JB	**ACTIVE**	John Battles	Mar-03	Sep-04	Tree demography in the Sierran mixed conifer forest: Determinants of success under a novel disturbance regime
BF03-02DR	**ACTIVE**	David Rizzo Allison Wickland	Jan-03	Sep-05	Distribution and Dynamics of *Phytophthora ramorum* at Blodgett Research Forest

BF03-01KO	Complete	Kevin O'Hara Kristen Baker	Jan-03	Aug-04	Forest Stand Structure, Development & Response to Invasion by Exotic Pathogens
BF02-11KO	Complete	Kevin O'Hara Rolf Gersonde	Sep-02	Oct-02	Stocking guidelines for uneven-aged Sierra Nevada mixed-conifer forests
BF02-10NR	Complete	Nancy Rappaport Amanda Roe Felix Sperling	Jul-02	Aug-02	Taxonomy and Identifiction of coneworms (*Dioryctria: Lepidoptera: Pyralidae*) in the Western United States
BF02-09DS	Abandoned	Scott Stephens	Jul-03	Nov-08	Mechanisms and probability of fire scar formation in Sierra Nevada mixed conifer tree species
BF02-08JM	Complete	Joe McBride Ralph Boniello	Jul-02	Dec-03	Carbon and Water Response of Sierran Conifers to Seasonal Drought
BF02-07WF	**ACTIVE**	William Frost Robert Heald	Jun-02	10/2002 Extension requested	Controlled grazing for suppression of shrub species
BF02-06AS	**ACTIVE**	Andrew Storer Dave Wood	May-02	Oct-05	Activity of bark and wood infesting and other insects detected by passive trapping in the fire fire-surrogate treatment areas
BF02-05WW	Complete	Wendy Wilson Gary Anderson Ron Pletcher	Apr-02	Jul-02	A Study of the Microbial Diversity of Air in a Longitudinal Transect of California
BF02-03WS	Complete	Wendy Silk Kyaw Tha Paw U Angela Cheer	Mar-02	Oct-02	Coupling among environmental variables and spatial and temporal structure in plant canopies.
BF02-02SS	Complete	Scott Stephens Jason Moghaddas	Feb-02	Oct-03	Fire Hazard and Silvicultural Systems: 25 Years of Experience from the Sierra Nevada

BF02-01D	Complete	Hugh Dingle Holly H. Ganz	Jan-02	May-02	Local adaptation in a host-parasite interaction
BF01-26O	Complete	Kevin O'Hara Bjorn Hannel Rolf Gersonde	Mar-01	Sep-02	Diameter growth response of shelterwood trees
BF01-25O	Complete	Kevin O'Hara Robert Heald Rolf Gersonde Mark Spencer Tudor Stancioiu Nadia Hamey Jennifer Heald Rob York Kristen Baker	Mar-01	Sep-03	Single-tree Selection for Shade Intolerant Species
BF01-24H **refer 82-3**	**ACTIVE**	Robert C. Heald	Jan-02	Dec-04	Nelder Biomass Spacing Study
BF01-23D **refer 87-1**	Complete	Don Dahlsten Nadir Erbilgin	Jan-87	Jan-04	Response of *Ips paraconfusus* parasitoids to host tree and associated fungal factors
BF01-22D **refer 84-4**	Complete	Don Dahlsten Nadir Erbilgin	Jun-84	Jan-04	Attraction of predators, parasites of economic important bark beetles Calif. To Pheromones
BF01-21S	**ACTIVE**	Scott Stephens Jason Moghaddas	Jun-01	Dec-04	An Assessment of treatment effects on Ground and Surface Fuels
BF01-20S	**ACTIVE**	Scott Stephens Emily Greinke	Jun-01	Dec-04	An Assessment of treatment effects on Forest Soils, Litter, and Duff
BF01-19D **refer 84-03**	Complete	Don Dahlsten Kyle Apigian David Rowney Deanna Simon	Jul-84	Jan-04	Nest site selection for mountain (MC) & chestnut backed chickadees (CBC)

BF01-18G	**ACTIVE**	Ye Qi Allen Goldstein Weixin Cheng	Jan-02	12/1/2003 extension requested	Controls of Canopy Activities on Roots and Soil Carbon Dynamics in a Young Ponderosa Pine Forest
BF01-17B	**ACTIVE**	Frank Beall Robert Heald William J. Libby	Nov-01	Jun-03	Giant Sequoia as a planted and plantation species
BF01-16S	**ACTIVE**	Scott Stephens John Battles Jason Moghaddas	Jun-00	Dec-04	An Assessment of treatment effects on Overstory and Understory Vegetation
BF01-15S	Complete	Scott Stephens Brandon Collins Jason Moghaddas	Jun-00	Jun-02	Development of a Fire History for Blodgett Forest
BF01-14B	Complete	Reg Barrett Andy Amacher	Jun-00	Sep-04	Fire and Fire Surrogate Study, Impact on Wildlife
BF01-13B	Complete	Tom Bruns Antonio Izzo	Jul-01	Jul-03	Effect of fire and thinning on ectomycorrhizal diversity
BF01-12D	**ACTIVE**	Todd Dawson Margaret Torn Jeffery Bird Julia Gaudinski	Jun-01	Sep-10	Quantifying the importance of belowground plant allocation for sequestration of carbon in soils
BF01-11W	Complete	Dave Wood Andrew Storer Daniel Stark	Aug-01	Oct-02	Insects and Diseases in the Fall Burn Units 520 and 292
BF01-10H	Complete	Bruce Hartsough Stuart Chalmers	Jul-01	Oct-01	Economics of FFS Operations
BF01-09B	Complete	Nancy J. Brown Melissa Lunden Douglas Black	Aug-00	Oct-02	Biogenic Secondary Organic Aerosol Formation Above a Western Pine Forest

BF01-08W	**ACTIVE**	Dave Wood Andrew Storer Daniel Stark	May-01	Sep-05	Fire-Fire Surrogate Study: Insects and Diseases
BF01-07D	Complete	Don Dahlsten Kyle Apigian David Rowney Nadir Erbilgin	May-04	Aug-04	Effects of prescribed fire and fire surrogate treatments on ground beetles and spiders in Blodgett Forest
BF01-06S	Complete	John R. Shelly Luis M. Ibanez	Jul-01	Aug-03	Economical evaluation of the Fire surrogate treatments at Blodgett Forest
BF01-05Y	~~With-drawn~~	Louis Yang	Jun-01	Jul-01	Habitat Selection, mutualism, predation and metapopulation dynamics; a multilevel investi- gation of the phylloplane arthropod communities
BF01-04W	Abandoned	Paul Wennberg Karena McKinney Ron Cohen	May-01	Oct-01	Measurements of Nitric Acid in the Atmospheric Boundary Layer by Chemical Ionization Mass Spectrometry (CIMS)
BF01-03T	Complete	Richard Truex William Zielinski	May-01	11/1/2003 Extension requested	Fisher Habitat at FFS Treatment Units
BF01-02R	Complete	Vince Resh Scott Stephens Leah Beche	Mar-01	Oct-04	Prescribed burning impacts on riparian and stream environments
BF01-01R	Complete	Elizabeth Reinhardt Joe Scott	Mar-01	Jul-01	Quantifying Canopy Fuels in Conifer Forests
BF00-09B	**ACTIVE**	Robert C. Heald David Rambeau	Sep-00	Oct-03	Sequoia Pruning Timing Study
BF00-08	Complete	Annie Baron Rosemary Carey	Aug-00	Oct-00	PNV Vegetation Surveys for Tan Oak

BF00-07	Complete	Tara Barrett Kevin O'Hara Frieder Schurr	Jul-00	Jul-01	The validity of computer-generated images for representing forest structure
BF00-06	Complete	Allen Goldstein Robert S. Evans	Jun-00	Aug-00	Ameriflux Intercomparison
BF00-05	Complete	Wayne Getz Don Miller	Jun-00	Jul-00	Dimorphic apterae on *Tamalia coweni*
BF00-04	**ACTIVE**	John Battles Robert C. Heald	Apr-00	Oct-10	Species Adjacency Study
BF00-03	Complete	Kevin O'Hara Rolf Gersonde	Apr-00	Jun-04	Sapwood-leaf area prediction equations for mixed conifer stands
BF00-02	Complete	M. Judith CharlesReggie Spaulding Vince Seaman Tom Cahill	Mar-00	Jun-01	Isoprene photooxication products: a comparison of laboratory data to field measurements
BF00-01	**ACTIVE**	Scott Stephens Robert C. Heald Reg Barrett Don Dahlsten Kevin O'Hara Dave Wood M. Garbelotto Emily Greinke Bruce Hartsough Andrew Storer Frank Beall	Apr-00	Nov-10	A Study of the Consequences of Fire & Fire Surrogate Treatment
BF99-09	**ACTIVE**	Kevin O'Hara	Mar-00	Sep-09	Pruning to Reduce Infection of White Pine Blister Rust in Sugar Pine
BF99-08	Complete	Weixin Cheng Roger F. Walker Dale W. Johnson Rick Susfalk.	Aug-99	Jun-01	Rhizosphere Respiration & Root Demography in Forest Ecosystems
BF99-07	Complete	Vincent Resh Emily Betts Rosalie del Rosario	Jun-99	Oct-99	Comparison of the effects of cow manure and other food sources on the growth rates of aquatic insects

BF99-06	**ACTIVE**	William Horwath Robert Powers	May-99	Sep-04	The influence of understudy vegetation on cargon sequestration in managed forests
BF99-05	Complete	Kevin O'Hara Rolf Gersonde	May-99	Aug-99	Stand structure and development of mixed species single cohort stand
BF99-04	**ACTIVE**	Ronald C. Cohen Paul Wooldridge Michael Dillon Douglas Day Erin Conlisk Rebecca Rosen Timothy Bertram	Jan-99	9/4/2004 Extension requested	*In situ* Measurements of Nitrogen Oxides (Concentrations & Fluxes) Over a Sierra Nevada Ponderosa Pine Plantation
BF99-03	Complete	Ricki Kartes Jenifer Padgett Dionne Gruuer	May-99	Sep-99	Ozone Monitoring
BF99-02	Complete	Louise Fortmann Barbara Allen-Diaz Peter Walker	Jun-99	Sep-99	The Effect of Changes in Landholding Patterns and Land Use on Vegetation in Hardwood Rangelands
BF99-01	Complete	Ken Hobson Patric Walsh	Jun-99	Sep-99	Development of attractants for longhorn and bark beetle trapping
98-14	Complete	Ron Cohen Joel Thornton Paul Woodridge	Jul-98	Jul-01	Ozone Production over a Ponderosa Pine Plantation
98-13	Complete	John Battles	Jun-98	Jun-04	Early Detection of Neighboring Plants: Survival & growth of Trees
98-12	Complete	Allen Goldstein Brad Baker	Jul-98	Jul-99	Fluxes of Volatile Organic Carbon to the Atmosphere from a Ponderosa Pine Plantation
98-11	**ACTIVE**	Rob York Robert C. Heald	Apr-99	Oct-10	Incense-cedar Growing Stock Level Study
98-10	Complete	Ye Qi Jianwu Tang	Jun-98	Jun-01	Energy, Water, and Carbon balance in a managed Ecosystem

98-09	Complete	Vince Resh Rosalie del Rosario	May-98	Sep-99	Cow Pats as Exogenous Organic Matter: Influences on Aquatic Invertebrate Communities
98-08	Complete	Bill McKillop Bruce Krum Chris Hipkin	May-98	Jun-01	California Timber Supply – Statewide Growth Model Validation
98-07	Complete	Ed Stone Bruce Krumland Janet Cavallero	Apr-98	Jun-00	Growing Space Model
98-06	Complete	Wayne M. Getz Don Miller	Jun-98	Sep-98	Alternative Life History Strategies on the Manzanita Leaf-Gall Aphid, *tamalia cowani*
98-05 **refer 87-09**	**ACTIVE**	David L. Wood Andrew J. Storer	Apr-98	9/1/2002 Extension requested	Long Term Survival & Pines of Known Resin Pressure in 1961-5
98-04	Complete	Allen Goldstein Dennis Gray	Jun-98	Oct-00	Environmental Controls over Emission of Methylbutenol from Ponderosa Pine
98-03	**ACTIVE**	Robert C. Heald	Mar-98	Jun-08	Shelterwood Regeneration of Planted R_R Sugar Pine
98-02	Abandoned	Greg Gilbert Cajun James	Apr-98	Jun-99	Edge Effects: Microclimatic Pattern and Biological Responses in Fragmented Forests
98-01	Complete	John McColl Emily Greinke	Apr-98	Oct-99	Site Characterization of Selected Ecological Factors in SMC forests
97-12	Complete	D. L.Wood Thomas Gordon Andrew J. Storer Pierluigi Bonello	Sep-97	Dec-03	Bark Beetle Feeding Stimulants in California Host Pines and Non-Host Conifers

97-11	Complete	John McCollBarbara Cade-Menum	Aug-97	Aug-00	A comparison of P and C forms in forests of two climatic regimes
97-10	Complete	John Battles Anna Levin	Jun-97	Sep-99	Effects of Group Selection cutting on Mycorrhizal Abundance and Diversity
97-9	Complete	Lynn Huntsinger Barbara Allen-Diaz Kate Rassbach	Jun-97	Jul-97	Resampling of Compartment 301; Shrub and Tree Growth in Grazed versus ungrazed areas
97-8	Complete	Richard Dodd Nasser Kashani	Jul-97	Sep-97	Oak Hybridization among California black oaks
97-7	**ACTIVE**	William Libby	May-97	Jun-01	Giant Sequoia - Ceanothus interaction
97-6	Complete	Ignacio Chapela Matteo Garbelotto	Jun-97	Nov-97	Field Inoculation of heterobasiolion annosum in White Fir
97-5	Complete	Allen Goldstein Jeanne Panek	May-97	Nov-02	Impacts of ozone and nitrogen deposition on forest physiological function in the Sierra Nevada Mountains, CA
97-4	Complete	David L. Wood Tom Gordon Pierluigi Bonello Andrew J. Storer Dan Stark	May-97	9/2003 Extension requested	Mechanisms by which root disease-induced changes in Ponderosa Pine physiology affect bark beetle behavior
97-3	Complete	T.N. Narasimhan Lucas W. Paz Carrol Williams	May-97	Sep-98	Impact of Clearcutting on Soil- Water Characteristics; Role of compaction & organic matter removal on permeability & moisture capacity 512

97-2	Complete	Stanley Scherr David Kaplow	Apr-97	Apr-97	Collection & Propagation of Taxus brevifolia & Tarreya california
97-1	Complete	Allen Goldstein Alex Guenther	May-97	Oct-00	Biogenic Hyrdocarbon Emissions from a Sierra Nevada Ponderosa Pine Plantation
96-9	Complete	Tara Barrett Robert C. Heald Frieder G. Schurr	Jul-96	Jul-97	Snag dynamics in the mixed conifer forest - management implications
96-8 **refer BF05-05**	**ACTIVE**	Rob York John Battles Robert C. Heald	Aug-96	Sep-06	Group Selection Opening Size Effect on Residual Tree Growth
96-7	Complete	Tara Barrett Frieder Schurr	Jul-96	Jul-97	Forest vegetation classification for management planning; integrating air photo delineation with permanent inventory plots
96-6	Abandoned	Lenny Vincent Ev Schlinger	May-96	May-96	Acrocerid parasites of the California turret Spider - *Atypeides riversi*
96-5	Complete	Nathan M. Schiff	May-96	May-97	Phylogenetic Reconstruction of the Symphyta using DNA Sequence Characters
96-4	Complete	John Battles Robert C. Heald Barbara Allen-Diaz Reg Barrett Ayn Shlisky	Jun-97	Sep-97	Relationships between Forest Management Practices and Plant Diversity
96-3	Abandoned	Paul D. Anderson James Houpis James Pushnik	Oct-96		Influence of soil moisture & competition on response of forest vegetation to Ozone exposure
96-2	Denied	Rick Karban Anurag Agrawal	Apr-96	Aug-96	Costs & Benefits of Induced Resistance in Wild Radish

96-1	**ACTIVE**	Robert C. Heald Rob York	Jan-96	Jul-07	Group Selection Opening Size Effect on Tree Growth
95-8	**ACTIVE**	Robert C. Heald Frieder G. Schurr Ryal Gregoire Jennifer Heald	Jul-95	Aug-55	Mixed Conifer Plantation Pruning Study
95-7	Complete	David Smethhurst	Dec-95	Dec-96	Land Vegetation Changes as Result of Land Ownership
95-6	Complete	Peng Gong Ruiland Pu	Jun-96	Oct-98	Hyperspectral Data Analysis for Forest Species Recognition
95-5	Complete	John Battles Anna Levin	Jun-97	Jun-05	Mixed Conifer Forest Ecological Assessment
95-4	Complete	Vince Resh Rosalie Leach	Jun-94	Sep-99	Survey of Aquatic Invertebrates in BFRS streams
95-3	Abandoned	Ken Cullings Tom Parker Bill Stoll	Oct-95	Mar-99	Mycorrhizal community structure & specificity of symbiotic relationships
95-2	Complete	Fred Euphrat	Apr-95	Sep-97	Water Shed Assessment
95-1	Complete	Greg Biging	Mar-95	Oct-95	Cumulative Impact Assessment
94-4	Complete	William E. Frost Robert C. Heald Fred Euphrat	Jan-95	Jun-01	Water Quality & Livestock Grazing on Forestland
94-3	Abandoned	Randy Dahlgren Robert Northup	Nov-94	Jan-95	Edaphic Regulation of Pine Phenolic Content
94-2	Complete	Thomas D. Bruns Lee Taylor	Sep-94	Nov-95	Epiparasitism in Achlorophylous Orchids
94-1	Complete	John Helms Robert C. Heald Craig Olson	May-95	Dec-99	Group Selection in Regeneration Study
93-4	Abandoned	Joe McBride	Oct-93	Dec-94	Distribution of Pacific Yew
93-3	Complete	Wayne Getz Don Miller	Jul-93	Oct-97	Sociality on the Manzanita Leaf-gall Aphid, Tamalia coweni

93-2	Complete	Charles Turner	Jul-93	Dec-94	Biocontron of Bull Thistle (Cirsinne vulgare)
93-1	**ACTIVE**	Reg Barrett	May-93	Dec-08	Survey Methods for Terrestrial Vertebrates in California
92-5	**ACTIVE**	Robert Powers John Mcoll	May-92	Dec 03 extension requested	Long Term Soil Productivity Study
92-4	Abandoned	R. D. Westfall	Apr-92		Genetic & Demographic Consequences of Catastrophic Epidemics in Sugar Pine
92-3	Complete	Jennifer Harden Tom Black	Sep-92	Sep-94	Soil Carbon Recovery from Disturbance
92-2	Complete	D. Lee Taylor Tom Bruns	Jul-92	?	The Erdophytic Fungus of Coral Root Orchid
92-1	Complete	Mary L. Reid	Apr-92	Sep-92	Colonization Patterns & Processes in Ips paraconfusus
91-5	Complete	Don Dahlston Tom Eager	Apr-91	Sep-92	Relationship Between Ips bark beetles & R. Their natural enemies
91-4 **refer BF05-06**	**ACTIVE**	Rocky Gutierrez Mark Seamans	Apr-91	Sep-04	Spotted Owl Inventory
91-3	Complete	Marty Wilt Steve Hart	Oct-91	Dec-93	Seasonal & Inter. Variation of Tax. Diter. In Taxus brevifolia
91-2	Complete	Mark Harmon Steve Hart	Jun-90	Jun-96	Long-Term Intersite Experiments of Leaf & Root Decomposition
91-1	Abandoned	Larry Davis	Jun-90	May-00	Stand Structure Development in Managed Group Selection Cuts
90-2	Complete	Scott Tyler W. W. Miller	Jul-90	Aug-90	Macropore Infiltration & Its Impact on Nutrient Cycling
90-1	Complete	Alan Gertler John Watson	Jul-90	Jul-90	Receptor Modeling of Acidic Air Pollutants to Forest Reg., Sierra Nevada

89-2	**ACTIVE**	Robert Heald	Apr-89	Dec-09	Giant Sequoia Growing Stock Levels
89-1	Complete	Marcel Rejmanek	Sep-89	Dec-93	Effects of Interspecific Completion on Sequoia Dendron
88-5 **refer BF05-03**	**ACTIVE**	Rob York R. C. Heald F. G. Schurr	May-92	Oct-02	Mixed Conifer Regeneration
88-4	Complete	Marcel Rejmanek	Dec-88	Dec-92	Effect of Bull Thistle (CIVU) on Ponderosa Pine
88-3	Abandoned	James Houpis	Oct-88	Jun-89	Carbohydrate translocation branch autonomy in Pinus ponderosa saplings.
88-2	Abandoned	L. Davis Pam Muick	Nov-89	Dec-93	Managing black oak in uneven-aged mixed conifer stands
88-1	Complete	Edward C. Stone	Apr-88	Dec-93	White Fir Root Regeneration Capacity
87-11	Abandoned	David A. Dyer	Mar-88	Nov-93	Whitethorn Ceanothus Evaluation Study
87-10	Complete	John Miles	Nov-87	Dec-94	Prototype Yarder Residue Collection
87-9	Complete	Dave Wood	Apr-87	Dec-94	Bark Beetles as Indicators of Stress in Ponderosa Pine
87-8	Complete	M. Firestone	Mar-87	Dec-93	Process Controls & Nitrogen Trans. in Terr. Ecosyst.
87-7	Complete	Barbara Allen	Feb-77	Dec-94	Forage Production & Utilization on Forest Range
87-6	Abandoned	Joe R. McBride	Jun-87	Sep-87	Fire History Dating
87-5	Abandoned	Larry Davis Scott Holmen	Apr-87	Apr-97	Tree/Brush Competition Demonstration
87-4 **refer 89-2**	**ACTIVE**	Robert C. Heald	Sep-87	Oct-02	Giant Sequoia Growing Stock Level Study
87-3	Complete	Richard Dodd	Apr-87	Dec-89	Differential Cambial Response to Applied Auxin in Douglas Fir

87-2	Complete	Richard Dodd	Apr-87	Dec-87	Periodicity of Cambial Activity & Shoot Growth in Douglas Fir & Incense Cedar
87-1 **refer BF01-23D**	Complete	D. L. Dahlsten	Jan-87	Jun-04	Response of Ips paraconfusus parasitoids to host tree & associated fungal factors
86-7	Complete	Edward C. Stone	May-86	Dec-86	A conceptual framework for predicting & controlling tree growth as a function of asym-metrical growing space
86-6	Complete	Marcel Rejmanek	Jul-86	Dec-93	Mechanisms of interactions between woody weeds & planted conifers
86-5	Complete	B. Allen Robert C. Heald	Apr-85	Dec-94	Forage production utilization & management on mixed-conifer plantations
86-4	Complete	Fields W. Cobb	Aug-84	Dec-93	Epidemiology & stand-site factors associated w/white pine blister rust on Blodgett Forest & control/management recommendations
86-3	Complete	John G. Kie	Jun-86	Sep-89	Habitat use by cattle & forage selection within habitats
86-2	Complete	J. R. Parmeter	May-86	Oct-88	Can fir engraver beetle Scolytus ventralis successfully feed on Abies concolor, without Tricholsporium endobioticum
86-1	Complete	J. R. Parmeter	Oct-83	Oct-88	Epidemiology of fir canker
85-9	Complete	R. C. Heald F. G. Schurr	Jul-85	Dec-93	Description & Dynamics of Uneven-Aged Stands
85-8	Complete	J. R. Anderson	Feb-85	Jun-86	Biological Response of Mosquitoes with Lambornella clarki
85-7	Complete	J. R. Parmeter	Jun-85	00-01-05	Field studies of Fomes annosus in true fir

85-6 **refer 88-05**	Complete	R. C. Heald F. G. Schurr B. Allen-Diaz	Oct-85	Jan-00	Mixed conifer plantation study
85-5	Complete	Lenny Vincent	Jul-85	Sep-85	Field ecology of Atypoides riversi, Calif. Turret Spider
85-4 **refer 86-1**	Complete	Mark Schultz	Oct-83	Jun-85	Epidemiology of fir canker, late 1985
85-3 **refer 86-2**	Complete	J. R. Parmeter	Jul-85	07-00-87	Can fir engraver beetle Scolytus ventralis successfully feed on white fir Abies concolor without Tricholsporium endobioticum
85-2	Complete	J. G. McColl	Jul-85	Dec-99	Organo-aluminum interactions in soil solutions of forested ecosystems
85-1 **refer 87-6**	Complete	Joe McBride	Jun-85	Jun-85	Chemical composition of tree rings following fires
84-7	Complete	Tara Barrett	Jun-83	Dec-00	Mathematical programming to compare uneven-age & even-aged management systems for forest ownership
84-6	Complete	James Bartolome	Aug-84	Dec-93	Effects of cattle grazing on a regenerating seed tree cut
84-5	Complete	John A. Helms	May-85	Jan-88	Productivity of coniferous forests as influenced by enhanced CO2
84-4 **refer BF01-22D**	Complete	D. L. Dahlsten	Jun-05	Dec-99	Attraction of Predators, Parasites of Economic Important Bark Beetles Calif. to Pheromones
84-3 **refer BF01-19D**	Complete	D. L. Dahlsten	Jul-84	Jan-04	Nest site selection for mountain (MC) & chestnut backed chickadees (CBC)
84-2	Abandoned	Robert Martin	May-84	Aug-85	Mortality of tanoak seedlings subjected to various levels of fuel consumption
84-1	Complete	John Miles	May-84	Oct-90	Residue Collection Study

83-7	Complete	R. Martin	Sep-83	Dec-93	A preliminary investigation of feasibility of pre-harvest burning for shrub control
83-6	Complete	David L. Wood	Jul-85	Dec-93	Host selection behavior of Dendroctonus valens & other bark beetles attacking ponderosa
83-5 **refer 84-6**	Complete	J. Bartolome L. Huntsinger	Jan-83	Jan-84	Cattle Grazing Effects on a Regenerating Shelterwood
83-4	Complete	L. S. Davis	Jun-83	Dec-04	Costs, fuel characteristics, wildlife habitat & aesthetics resulting from different pre-commercial thinning methods
83-3	Complete	Michael Morrison Robert Heald	May-83	Dec-93	The use of "high-cut" stumps by cavity nesting birds
83-2	Complete	E. C. Stone	Jun-83	Jun-83	Determination of the accuracy, bias, & precision of a method being developed for estimating volume & growth of structural-aggregations
83-1 **refer 87-8**	Complete	E. A. Paul	Jul-83	Jun-87	Process controls & nitrogen transformations in terrestrial ecosystems
82-5	Complete	Michael Morrison	Sep-82	Dec-92	Avian Habitat Models
82-4	Complete	John Helms	Jun-83	Dec-88	Effect of brush competition on physiology & growth of regeneration
82-3 **refer BF01-24**	Complete	John Helms	Jun-82	Dec-93	Conifer spacing study
82-2 **refer BF05-04**	**ACTIVE**	Fields Cobb Robert C. Heald Tina Popenuck	Apr-81	Jun-04	Effect of Ceratocystis wagneri disease centers on new conifer plantations
82-1	Abandoned	Paul Violett	Jun-83	Nov-83	Blodgett Forest fuel management plan

81-5	Complete	Herman Spieth	Jan-81	Dec-86	Systematic Collection of Native Drosophila & Their Larval Substrates
81-4	Complete	John Helms	May-81	Dec-93	Shelterwood microclimate & regeneration
81-3	Complete	Paul Zinke	May-81	Dec-88	Assessment of fertility problems inherent in site preparation at Blodgett Forest
81-2	Complete	Steve Radosevich	00-00-76	Dec-93	Shrub-Conifer Competition, Phase II White Fir & Phase I PP
81-1 **refer 97-7**	Complete	William Libby	Mar-81	Dec-94	Giant Sequoia--Ceanothus interaction
80-1	Abandoned	Don Gasser	Jan-80	Dec-80	Relationship between spacing & quantity & quality of output in ponderosa pine plantations
78-2	Complete	Reg Barrett	Feb-80	Feb-81	Survey methods for wildlife management problems in California
77-6	Complete	William Libby	Jan-77	Dec-89	White fir seed source
77-5	Complete	D. L. Dahlsten	Jan-78	Jan-92	Survey of endemic orgyia pseudotsugata populations of white fir in California
77-4	Complete	D. L. Wood	Jan-77		Classification, bionomics, ecology & control of bark beetles infesting California
77-3	Complete	D. L. Dahlsten			Biological Control of Forest Insects
77-2 **refer 87-7**	Complete	James Bartolome Barbara Kosco	Jan-77	Jan-85	Forage production & utilization on forest range
77-1	Complete	Edward Stone D. L. Dahlsten R.C. Heald	Jan-77	Oct-88	Silvicultural treatment of ponderosa pine aggregations to reduce probabilities of bark beetle caused tree mortality
NA-84-1	Complete	Don Gasser	May-84	Oct-85	Removal of Pre-Commercial Thinnings

NA-85-1	Denied	W. B. McHenry	Jun-85	Jun-85	Res. Control of Shrub Chinquapin with Pre-Site Preparation Herbicide Application
NA-85-2	Denied	W. B. McHenry	Jun-85	Sep-85	Shrub Control Efficacy of New Herbicides
87-12	Denied	Fields W. Cobb	Sep-86	Jul-89	Control of Blister Rust with a Systemic Fungicide

RUSSELL STATION RESEARCH PROJECTS LIST

2/1/2006

KEY: **PROPOSED** **ACTIVE** **COMPLETE** DENIED WITHDRAWN ABANDONED

BFRS PROJECT NO.	STATUS	PRINCIPAL INVESTIGA-TORS	BEGIN DATE	COM-PLETE DATE	PROJECT TITLE
RR06-01 TG	**ACTIVE** **Refer RR99-01** **Refer RR99-02**	Tom Gordon	??	??	Monitoring the development of pitch canker
RR05-02 WC	**ACTIVE**	Wade Cornell William Libby Charles Sorensen	Aug-05	Sep-05	Assessment of heritability of *Sequoia sempervirens* wood properties analysing the same clones grown in different environments
RR05-01	**ACTIVE**	Todd Dawson Anthony Ambrose ?? Santiago	Dec-05	Feb-06	??
RR04-02L	**ACTIVE**	Bill Libby	Jun-82	??	Extension: Redwood Inbreeding Study
RR04-01B	**ACTIVE**	Dennis Baldocchi Theresa Krebs Michelle Kim	Feb-04	Dec-05	The Seasonality of Leaf Nitrogen and Photosynthetic Capacity with Respect to Environmental Drivers
RR03-04L	**ACTIVE**	Bill Libby	1989	Sep-03	Average 14 year Performances of Kuser redwoods

RR03-03DB	Complete	Dennis Baldocchi Theresa Krebs	Apr-03	Sep-03	Rigidity and Plasticity Among Quercus Species
RR03-02SS	Complete	Scott Stephens	May-03	Dec-03	Bark thickness in Monterey pine from diverse populations
RR03-01W	**ACTIVE**	David L. Wood Steven J. Seybold Andy Graves	Mar-03	Jun-03	Geographic Variation in the Respose of the Red Turpentine Beetlw, *Dendroctonus valens*, to alpha-and beta-Pinene
RR02-03D	**ACTIVE**	Stephen Welter	Jul-02	Oct-03	Evaluation of UV effects on the stability of semiochemicals within microencapsulated formulations
RR02-02M	Complete	Richard Dodd William Libby Vladimir Douhovnikoff	Mar-02	Dec-02	The Molecular genetics of *Sequois sempervirens* and the development of a redwood gene bank
RR02-01M	Complete	Joe McBride John Battles John Stella	Feb-02	Oct-02	San Joaquin Basin Riparian Model: Russell Field Studies
RR01-02B	Complete	Dave Burger John Church	Apr-01	Sep-01	Microcalorimetric Measurement of *Sequoia semperviren* and *Sequoia giganteum*
RR01-01G	Complete	Thomas R. Gordon D. Dekker-Robertson Detlev Vogler	Apr-01	Jul-01	Testing for a relationship between pitch canker susceptibility and western gall rust susceptibility
RR00-03	**ACTIVE**	Bill Karavakas Barbara Romanowicz	Oct-00	Dec-05	Seismic Observatory
RR00-02	Complete	Toni Withers Melody Keena	May-00	Jul-00	Survival & Development of the nun moth, *Lymantria monacha L.* And the gypsy moth, *Lymantria dispar* on New Zealand improved strains of *Pinus radiata*
RR00-01	**Proposed**	**Sharon Fleming Patsy Kauffman**	**??**	**??**	**Growing Grounds at Russell Tree Farm**
RR99-04	Complete	Leo Blitz William J. Welch	Dec-99	Jan-03	A small array of antennas for radio astronomy

RR99-03	Abandoned	Susan Jean Frankel Thomas Gordon Paul Stover	Sep-99	Jun-00	Inheritance of pitch canker resistance in Monterey pines of known parentage
RR99-02	**ACTIVE** **Refer RR06-01**	Tom Gordon Det Vogler	Sep-99	Jun-05	Observation plots for monitoring development of pitch canker
RR99-01	**ACTIVE**	Tom Gordon Bill Libby	Jun-99	Jun-05	Field Tests for resistance to gall rust and pitch canker

WHITAKER FOREST RESEARCH PROJECTS LIST

2/1/2006

KEY: **PROPOSED** **ACTIVE** **COMPLETE** DENIED WITHDRAWN ABANDONED

WF PROJECT NO.	STATUS	PRINCIPAL INVESTIGATORS	BEGIN DATE	COMPLETE DATE	PROJECT TITLE
WF05-03MC	Proposed	Michael Caterino Stelios Chatzimanolis	Apr-06	Oct-06	A funistic and phylogeographic survey of California Beetles
WF05-02TD	**ACTIVE**	Todd Dawson Anthony Ambrose Stephen Sillett George W. Koch	Jul-05	Aug-05	Examination of within-crown physiological gradients and height growth potential in *Sequoiadendron giganteum*
WF05-01RG	Complete	Robert Graham Derek MacKenzie	Jun-05	Jun-05	Charcoal Content in Californian Ecosystems
WF01-02RY	**ACTIVE**	Rob York John Battles Robert C. Heald Frieder Schurr	May-01	Dec-09	Restoration of Giant Sequoia with gap-based silviculture
WF01-01FB	Abandoned	Frank Beall Robert Heald William J. Libby	Nov-01	Jun-03	Giant Sequoia as a planted and plantation species
WF00-01	**ACTIVE**	Thomas D. Bruns Martin Bidartondo	May-05	Sep-05	Mycorrhizal ecology of the Monotropoideae

WF99-05	**ACTIVE**	Robert C. Heald Frieder G. Schurr John Battles Kevin O'Hara	Jun-99	Sep-09	Restructuring of Ancient Sequoia Forest Components and Function
WF99-04	**ACTIVE**	Reg Barrett	Jun-99	Sep-09	Survey Methods for Terrestrial Vertebrate in California
WF99-03	Complete	Martin Cody [UCLA]	1992	??	[Viola lobata]
WF99-02	Complete	Martin Cody [UCLA]	1992	??	[Moss on logs, tree trunks and rocks]
WF99-01	Complete	Martin Cody [UCLA]	1992	??	[Smilacina recemosa]