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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*, Plaintiffs, v. MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*, Federal Defendants, and TUOLUMNE COUNTY ALLIANCE FOR RESOURCES & ENVIRONMENT, *et al.*, Defendant-Intervenors, and CALIFORNIA SKI INDUSTRY ASSOCIATION, Defendant-Intervenor, and QUINCY LIBRARY GROUP, *et al.*, Defendant-Intervenors.	No. CIV-S-05-0205 MCE/GGH **DECLARATION OF PETER A. STINE**

I, Peter A. Stine, declare as follows:

1. I am the Research Program Manager of the Sierra Nevada Research Center, a research unit of the Pacific Southwest Research Station of the U.S. Forest Service. I have a Bachelor of Science degree in Forestry and Conservation from the University of California, Berkeley, a Master of Science degree in Wildland Resources Science from the same institution, and a Ph.D. in Biogeography from the University of California, Santa Barbara.

2. I have 28 years of experience in research, resource management, and conservation science. My first 15 years of professional experience was primarily in endangered species management for the U.S. Fish and Wildlife Service, covering a wide variety of endangered and threatened species issues in Oregon, Hawaii, and California. I then moved into a research management role with the Biological Resources Division of the U.S. Geological Survey for about five years. In that role, I managed a research program devoted to science support for various Department of Interior agencies, including the Fish and Wildlife Service, National Park Service, and Bureau of Land Management.

3. The last eight years of my career have been as the Research Program Manager for the Sierra Nevada Research Center. In this role, I direct a research program intended to provide science support for land management activities in the Sierra Nevada Ecoregion, including the 11 National Forests in the Sierra Nevada.

4. In my current position, it is important for me to identify the key information needs and to devise means for initiating, executing, and reporting on specific research projects that target these information needs. I work with a staff of 10 scientists and about 40 technical and administrative support staff to carry out this research program. We work closely with collaborating scientists from academic institutions and other government agencies to bring the best and most appropriate expertise to bear on a given problem.

5. Our research program focuses on forest function and health, conservation of biological diversity, climate and landscape change, water and watershed processes, and institutional and policy processes. We perform research in all areas, and have some 30 active research projects addressing key issues such as California spotted owl (*Strix occidentalis occidentalis*) demography, habitat selection by the Pacific fisher (*Martes pennanti*), forest and

watershed response to various kinds of fuels reduction treatments, fire behavior response to landscape fuels management strategies, and changes in vegetation composition and structure due to climate change.

6. A significant part of my role as the director of our research program is to identify and develop the opportunities to aggregate the findings of our work and develop synthetic understandings of this information that can inform management decisions. Much of the focus of our research efforts in the past two to three years has been to synthesize our understanding of research on forest ecology and sensitive species habitat, and examine how Sierra Nevada ecosystems and their components (including wildlife) respond to forest management and ongoing climate change.

7. At the heart of our synthesis of research findings on forest ecology and management in the Sierra Nevada is the concept of managing a complex and dynamic landscape in a holistic manner. That is to say, an ecosystem such as a mixed conifer forest is a compilation of countless component parts, all interacting with each other and with the physical environment in which they are found. There are certain critical features of that landscape that tend to be most influential in determining the outcome of these ecological interactions. In the Sierra mixed conifer forest, availability of soil moisture drives the annual primary productivity, and fire is the primary periodic force that can cause fundamental changes in vegetation cover (SNEP 1996). The central tenant in our synthesis of scientific findings is to manage to retain, or more typically, restore the integrity and functionality of the ecosystem.

8. Over a century of human use and occupancy of the Sierra Nevada, combined with fire suppression, has changed the structure and composition of most mixed conifer forests. What were once forest stands generally characterized by large, primarily shade intolerant species such as pines and black oak in low densities, have been usurped by very dense stands of small to intermediate sized trees (for purposes of this discussion I define small trees as less than 20" dbh and intermediate trees as 20"-30" dbh), largely shade tolerant species such as white fir and incense cedar (Taylor 2004, North et al. 2007). These contemporary forests are vulnerable to large and severe fires as well as drought stress and severe insect infestations or disease. A management response to this situation is warranted, involving removal of some of the small and intermediate-

sized trees, depending on the current conditions within a stand. I believe that such management will, on the whole and over time, improve rather than degrade ecological conditions in the mixed conifer forests of the Sierra Nevada. Treatments such as we are discussing are most likely to have an adverse impact, if they have any at all, at the time of the action and shortly thereafter. As time progresses the possible negative effects of the treatments attenuate and the beneficial effects begin to reveal (e.g. as understory vegetation grows in or canopies fill out). It is important to recognize the spatial and temporal relationships of the anticipated treatments across the landscape. If treatments are spread out over space and time this should ameliorate any near term negative effects endured on the immediate site of the treatment.

9. The tacit assumption in this approach is that maintaining or restoring the structure, composition and function of the system will best serve its total component parts. There currently is risk to certain species that have had their habitats especially altered in recent decades of land management activities, including fire suppression. With specific respect to spotted owls, marten, and fisher -- species that use the features of old forest (large trees, damaged trees, snags, large downed logs) -- it is clear that these critical features are in short supply on current landscapes (Bouldin 1999). Over a century of high-grade logging, removal of damaged or dying trees, and removal of snags have significantly reduced the availability of this structure (i.e. the platforms or cavities on or in trees that provide suitable substrate for nest or den/rest sites) so vitally important to these species (Verner et al. 1992, Zielinski et al. 2004). Additionally, such structure continues to be lost by severe wildfires, as well as insect and disease outbreaks. Any approach that intends to restore forests to a condition that will continue to support the species that require such structure must take explicit steps to recruit this structure back into the system. Also important is the need to protect the remaining structure from catastrophic wildfire and/or extensive insect and disease outbreaks.

10. Restoration of mixed conifer forests is predicated on several key considerations:

a) First we must be aware of the changing climate and the influence that it is likely to have on forest dynamics. It appears quite likely that western U.S. mixed conifer forests today, and increasingly in the future, will be subject to warming temperatures and an increasing proportion of the precipitation coming in the form of rain rather than snow (Westerling et al. 2006, Millar et al.

2007). The consequence of this to mixed conifer forests is increasing drought stress (and the disease and insects outbreaks that can accompany this) and longer fire seasons. Resilient forests will be those that can cope with these conditions (van Mantgem and Stephenson 2007). Therefore, a management regime that allows for judicious and selective reductions of forest stand density to cope with increasing drought stress from climate change can help facilitate the restoration and resilience of Sierra Nevada mixed conifer forests. b) Fire is the prevailing force that shapes these forests (McKelvey et al. 1996, Fites-Kaufman et al. 2007, Stephens at al. 2007). We cannot avoid the presence of fires but we can make forests more resilient when a fire passes through an area. Increasing scientific evidence suggests that historic forests subject to active fire regimes were inherently patchy, resulting in forests comprised of patches of trees (sometimes dense), patches of shrubs, and patches of open areas (North et al. 2007). We believe that this natural heterogeneity was both a result of the patchy nature of fire effects and, in turn, resulted in breaking or interrupting the intensity of subsequent fire as it moved through the landscape. Furthermore, there is mounting evidence that this natural heterogeneity created diverse and productive habitat for the wildlife community, including species that use "old-forest" conditions as well as those that use other kinds of habitat found in forests (Carey 2003, Coppeto et al. 2006, Innes et al. 2007). Therefore, a management regime that provides for the creation of heterogeneous conditions across the landscape – including open areas, shrub areas, and forested areas – can help facilitate the restoration of mixed conifer forests. c) Natural topography, i.e. position on slope (e.g. bottoms of drainages vs. upper slopes), and aspect towards sunlight, are simple but important features of the landscape that influence vegetation type, density, soil development and moisture, and vulnerability to fire (Minnich et al. 1995, Barbour et al. 2002, Taylor and Skinner 2004, Hessburg et al. 2005, North et al. 2007. We believe that topographic variation found in mountainous terrain such as the Sierra Nevada also influences and creates more patchiness on the landscape. Some areas, such as bottoms of drainages or north facing slopes are much more likely to support dense vegetation and high canopy cover than other areas such as ridge tops or south facing slopes. Therefore, a management regime that allows sufficient latitude for forest managers to tailor treatments based on the specific topographic position of forest stand can help facilitate the restoration of mixed conifer forests.

d) In order to restore mixed conifer forests into a resilient condition, capable of sustaining or recreating the structure, composition, and function of a productive and diverse system, we need to move conditions from the current predominance of dense stands of small to intermediate trees (i.e., trees approximately 10" to 30" in diameter) towards conditions characterized by: landscape heterogeneity, an appropriate mix of patches of trees, shrubs, and openings, a higher proportion of larger trees, damaged or deformed trees, and snags, and a shift in species distribution from current dominance of the white fir and incense cedar towards a higher proportion of ponderosa and sugar pine and black oak. Making this transition will require maintenance of remnant stands of large or intermediate sized trees and multi-layered canopies in some locations while treating other patches by cutting some trees 20-30" in diameter and reducing canopy cover below 50%, not only around communities, but throughout the Sierra Nevada. The concept we advocate is landscape heterogeneity that contains an appropriate mixture of all these conditions.

11. The current Forest Service management regime for the Sierra Nevada involves taking some risk in treating forests in the form of cutting some small and intermediate sized trees (i.e., trees up to 30" in diameter). These trees represent the recruitment cohorts for creating the desired structure of future forests including the large, damaged, deformed trees that will provide some of the most important wildlife habitat features needed. However, it is feasible to institute silvicultural strategies that ensure the protection of remnant stands of large and some intermediate sized trees to enable protection/recruitment of this large tree structure, while still harvesting some small and intermediate sized trees. This is because most current stands have far more trees in these two size classes than we would expect in a restored forest such as described above. For example, North et al. (2007) found that historic stands (i.e. reconstruction of stands in 1865 that were subject to active fire regimes) of mixed conifer at the Teakettle Experimental Forest (Sierra National Forest) had approximately 4 trees per acre in both the 10-20" and 20-30" size classes. In 2000, after over 100 years of no fire and without any logging (due to the experimental forest status), these forests had an average of approximately 35 and 16 trees per acre in these two size classes respectively. Clearly there can be variability from stand to stand and considerable care needs to be taken in determining appropriate treatments for restoration purposes. Nonetheless, treatment prescriptions to achieve restoration objectives in many contemporary forests can remove

a relatively large proportion of the small tree cohort (largely the ladder fuels in current forests) and some proportion of the intermediate tree cohort, especially focusing on the white fir and incense cedar, and be consistent with the forest restoration strategy described above. Again, goals for restoration will target maintaining or developing dense stands in some locations, especially in the bottoms of drainages or on north facing slopes thus, from a purely ecological restoration perspective, little to no timber cutting would be appropriate in those locations. Furthermore some stands have different distributions within these size classes and care needs to be taken to ensure we are able to recruit large trees from current cohorts of small to intermediate trees.

12. Maintaining or encouraging the development of largely continuous dense canopy cover across the landscape is inconsistent with our current view of what Sierra mixed conifer forests did and should look like. This is not to say that patches (of varying sizes) of dense, multi-layered canopies are not desirable or should not be provided. I reiterate that a resilient and diverse forest does indeed contain some proportion of dense forest, especially likely under certain topographic conditions such as bottoms of drainages. This kind of habitat is known to be crucial to certain wildlife species and is part of the diversity inherent in mixed conifer forests. However, it is not the only kind of habitat that should be provided across a mixed conifer landscape.

13. The statements and opinions provided above are based on my perspective as a research scientist who focuses on the function, perpetuation, and restoration of ecological systems in the Sierra Nevada. I recognize that most of the mixed-conifer forest in the Sierra Nevada is managed for multiple purposes, some of which may be in tension with purely ecological goals. I realize that social, economic, or human safety reasons will be considered by land managers in striking the proper management balance for these forests. My declaration is intended to provide an overview of some key ecological issues being addressed by my research team, and to emphasize that from a purely ecological perspective, an active management response is warranted to address the concerns discussed throughout this declaration.

14. Any management response, including doing nothing, has associated risk to a number of elements in these forests. It is a significant challenge to balance that risk and optimize chances of achieving all objectives. While some risk is unavoidable, managers can limit the risk while maximizing the learning at each phase or increment of management action. Instituting and

continuing a carefully measured treatment strategy combined with a structured adaptive management approach will create the optimum balance of risk taking and learning. I believe that without such an approach land managers will forever be limited by a lack of knowledge.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed this __19th___ day of October, 2008.

/s/ Peter Stine
(Original signature retained by attorney Barclay Samford)

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PETER STINE -- CURRICULUM VITAE

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Ph.D. Geography, University of California at Santa Barbara, 1995
M.S. Wildland Resources Science, University of California, Berkeley, 1977
B.S. Forestry and Conservation, University of California, Berkeley, 1975

FIELDS OF INTEREST:

Biogeography
Endangered species ecology
Community ecology
Ecological monitoring
Conservation biology
Geographic Information Systems
Wildland resource management
Landscape Ecology

RECENT EMPLOYMENT:

2000-Present
Research Program Manager, Sierra Nevada Research Center, Pacific Southwest Research Station, Forest Service

1999-2000
Ecologist, US Geological Survey, Biological Resources Division, Western Ecological Research Center, Sacramento, CA

1997-1999
Research Manager, US Geological Survey, Biological Resources Division, Western Ecological Research Center, Davis, CA

1995 - 1997
Ecologist, California Science Center, National Biological Service, Sacramento, CA

1992-1995
Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Carlsbad, CA

FIELD EXPERIENCE:

Yosemite National Park (black bear ecology research)
Everglades National Park (alligator ecology research)
Endangered species management in Oregon and Washington (bald eagles, peregrine falcons, Columbian white-tailed deer, Oregon silverspot butterflies, etc.)
Endangered bird recovery program in the Hawaiian Islands and other U.S. territories in the western Pacific region (field surveys, recovery planning, new refuge planning); species include all endemic Hawaiian forest birds, green sea turtle, Hawaiian monk seal
Endangered species management in southern California; includes listing, recovery, land acquisition for new refuges; species include desert tortoise, least Bells vireo, California gnatcatcher, Coachella Valley fringe-toed lizard, Stephens kangaroo rat, California sea otter, California least tern, various species of plants
Vegetation mapping using remotely sensed data and GIS
Ecoregional assessments
Regional conservation planning
Habitat Conservation Plans and Recovery Plans

CURRENT RESEARCH:

Fire and Fuels Management, Landscape Dynamics, and Fish and Wildlife Resources; an

Integrated Research Study in the Northern Sierra Nevada
Development of a Node to the National Biological Information Infrastructure in collaboration with scientists at U.C. Davis
Investigating alternative land use/habitat conservation strategies using GIS and optimization modeling
Assessment of several methods of estimating canopy cover in coniferous forests of the Sierra Nevada
Effects Analysis Methods for Assessing Potential Impacts of Land Management to Species at Risk

PROFESSIONAL SOCIETIES:

- Ecological Society of America
- American Ornithologists
- Society for Conservation Biology

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*,

Plaintiffs,

v.

MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*,

Federal Defendants,

and

TUOLUMNE COUNTY ALLIANCES FOR RESOURCES & ENVIRONMENT, *et al.*,

Defendant-Intervenors,

and

CALIFORNIA SKI INDUSTRY ASS'N,

and

QUINCY LIBRARY GROUP, *et al.*,

Defendant-Intervenors.

Case No.: CIV-S-05-0205 MCE/GGH

DECLARATION OF JOSEPH W. SHERLOCK

I, Joseph W. Sherlock, declare as follows:

1. I have a Bachelor of Science degree in Forest Resource Management from Southern Illinois University (1977). I have worked in forest management for over thirty-one years, with experience in the north central hardwoods, central Rocky Mountains, and the forests within the Pacific Southwest Region of the Forest Service (California, Hawaii, and Pacific Trust territories). I am the Assistant Regional Silviculturist for the Pacific Southwest Region, USDA Forest Service, in Vallejo, California. I have served in this position for approximately five years. I am an expert in the silviculture[1] of Sierra Nevada forests. I served as the silviculturist on the 2004 Framework interdisciplinary team (USDA Forest Service 2004). I spent twenty-five years working in a variety of roles, primarily as a silviculturist, on the Stanislaus National Forest. I am trained in observing forest health conditions and prescribing management treatments to maintain healthy forests. I have observed the condition of Sierra Nevada forests through major drought and bark beetle events in the late 1970's and 1990's. I have been a certified silviculturist in this Region since 1983. In 1990, I attained the expert credential of being certified as a Regional Forester's Representative for Silviculturist Certification.

2. The forests of the Sierra Nevada depend on winter rain and snow to make it through the long, dry summer. Water is the primary limiting factor to tree growth in the Sierra Nevada (Millar 1996; Miller and Urban 1999). In forest stands with a high density of trees, increased water stress, amplified during drought, increases the susceptibility of individual trees and stands of trees to mortality factors, including bark beetles (Ferrell 1996). Bark beetles are commonly recognized as the most important tree killing agents in coniferous forests (Furniss and Carolyn 1977). While their presence and impacts are a normal part of forest dynamics, when bark beetle populations reach very high numbers in expansive, dense forests, their effects are dramatic, and can adversely affect wildlife habitat and increase fuel loads.

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[1] Silviculture, as applicable within the Forest Service, is the practice of establishing and culturing forests to meet various multiple-use objectives.

Figure 1 – Widespread tree mortality due to successful bark beetle attack of drought-stressed trees.

3. The effective suppression of wildfire and favorable precipitation from 1890 through 1960 has enabled a significant number of new trees to become established. These large numbers of trees now compete for the limited amount of soil moisture available. The competition is especially intense in dense stands of trees. When struggling for soil moisture, bark beetles and other stressors can often overwhelm a tree's defenses, resulting in local or widespread mortality (Ferrell 1996). Figure 1, above, illustrates an example of widespread mortality caused by bark beetles.

4. With each passing season, as the trees within a stand increase in size, the need for moisture increases. Even when rain and snow arrive in average amounts, the level of stress continues to build, making it harder and harder for the growing trees to thrive. While this stress could be partially offset by the death of individual trees, the extent and size of individual trees that die do not sufficiently mitigate the increase in drought stress.

5. Annual rain and snow amounts vary. Below average years are especially difficult for trees already struggling to share limited soil moisture. These drought years tip the scales in favor of bark beetles, and the number of dead trees increases, often covering large acreages.

When these drought years begin to run one after another, widespread tree mortality results, affecting all tree sizes. The past six years of drought have caused high levels of tree mortality on more than six million acres of forest in California (USDA Forest Service, Forest Health Protection, Aerial Survey Data). Figure 2 illustrates mortality of large diameter Jeffrey pine caused by Jeffrey pine beetle, in the Sierra Nevada, south of Lake Tahoe.

Figure 2 - Large diameter Jeffrey pine mortality.

6. The future climate is expected to be warmer, with longer summers. This will make it even harder for dense forests to persist. Over three million acres in California are currently susceptible to bark beetle-caused tree mortality, with most of the acreage in the Sierra Nevada. About one third of the Sierra Nevada forests are now so dense that sustained drought is likely to trigger high levels of tree mortality. Figure 3, below, illustrates an area where bark beetles had killed many white fir trees, and that was later impacted by wildfire. The vast

acreages recently killed in the mountains of southern California may offer a glimpse of a potential future for the Sierra Nevada.

Figure 3 - White fir trees killed by the fir-engraver beetle during 1987-1992 drought period, then burned in 1994 by the Crystal Fire. Location: Truckee Ranger District, Tahoe National Forest.

7. Unable to increase rain and snow levels, the only way forest managers can improve the health of forests is to reduce the number of trees fighting for the most important limiting resource, water. Figure 4, below, shows a collection of measurements made within the Stanislaus National Forest, located north of Yosemite National Park, in the Sierra Nevada. The bars represent a density measure commonly used in forestry, known as the Stand Density Index (SDI). It is an index that characterizes how crowded trees are within a stand. The value can be compared to a maximum value to assess the level of competition that the trees are experiencing. The higher the number, the greater the potential for mortality, due to tree stress. Individual plots that are above the self-thinning threshold line (approximately 55% of the maximum) on the graph are susceptible to increasing levels of mortality, primarily due to successful bark beetle attack. (I've estimated the 55% threshold value, as maximum SDI values are species-specific, and these are mixed species plots.) A large percentage of the plots indicate that they are predisposed to bark beetle-caused mortality. When considering that Oliver has identified an SDI

value of 230 as a bark beetle-caused threshold for ponderosa pine, the number of plots at risk increases (Oliver 1995).

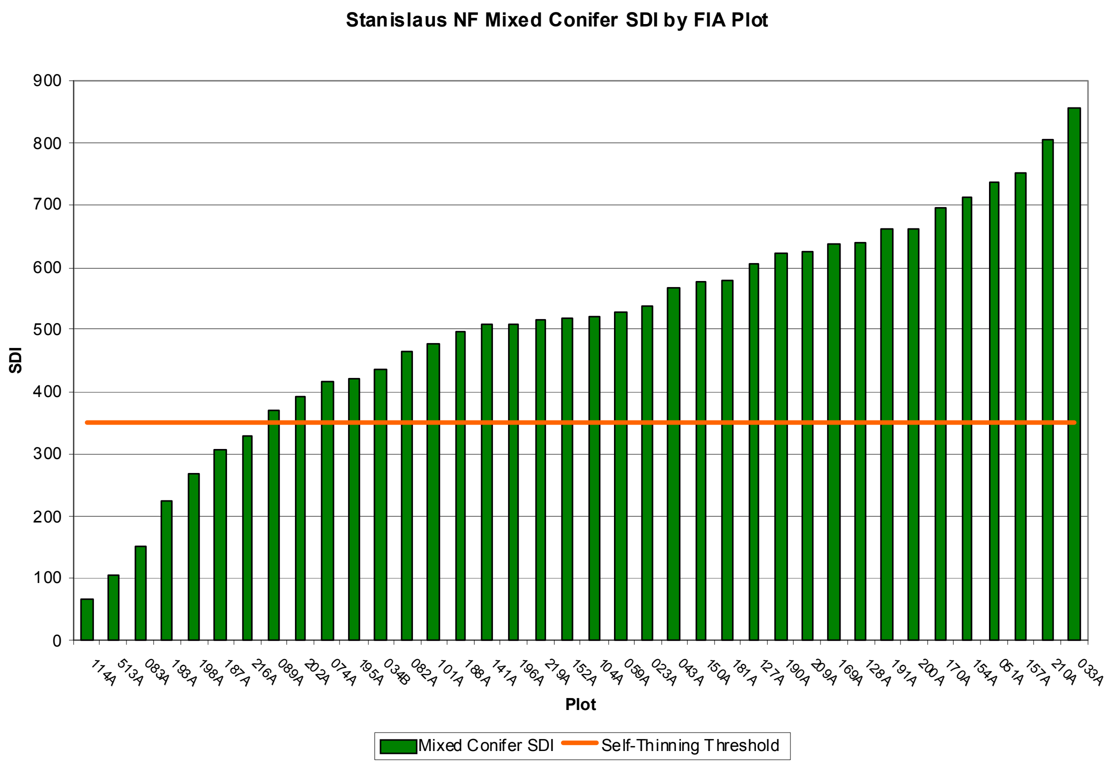

Figure 4 - Stanislaus NF Mixed Conifer SDI values compared to an estimated 55% of maximum density threshold, where the maximum density threshold represents the point at which there is imminent risk of mortality from bark beetle attacks. Each Plot number represents stand data gathered from a different location in the forest.

8. The 2004 Framework and the silvicultural prescriptions crafted to implement it are designed to meet multiple objectives. The ability to remove selected trees up to 30 inches provides for the flexibility needed to remove enough trees to allow the remainder to thrive. Assertions that trees greater than 12", 16", or 20" should not be removed because they are not essential to fuel hazard reduction fail to recognize the potential necessity of removing such trees for other purposes, such as reducing the risk of extensive mortality from bark beetle attacks.

9. The level of thinning in a given stand to reduce the risk of bark beetle infestation needs to be significant enough to offer a real advantage to the remaining trees. Not only does the number of trees removed need to be significant, but so does the size of removed trees, so that the water resource being made available is enough to provide increased vigor to the remaining trees. As many of the stands in the Sierra Nevada have numerous trees larger than 30 inches, removing

trees in the 20-30 inch range is often appropriate, to shift the available water to the remaining trees.

10. In order to sustain the desired advantage to residual trees in a thinned stand, thinning needs to remove enough competition so that annual growth does not immediately return the stand to the overly-dense condition management sought to correct. From an operational standpoint, density should be reduced so that it does not reach the self-thinning level for approximately two decades. This timeframe may vary, depending on other resource considerations and/or capabilities.

11. The following graphs, Figures 5 and 6, illustrate the implementation of two 2004 Framework projects on the Eldorado National Forest. Each bar represents the number of trees of a certain diameter. The different colors within some of the bars indicate which trees would be

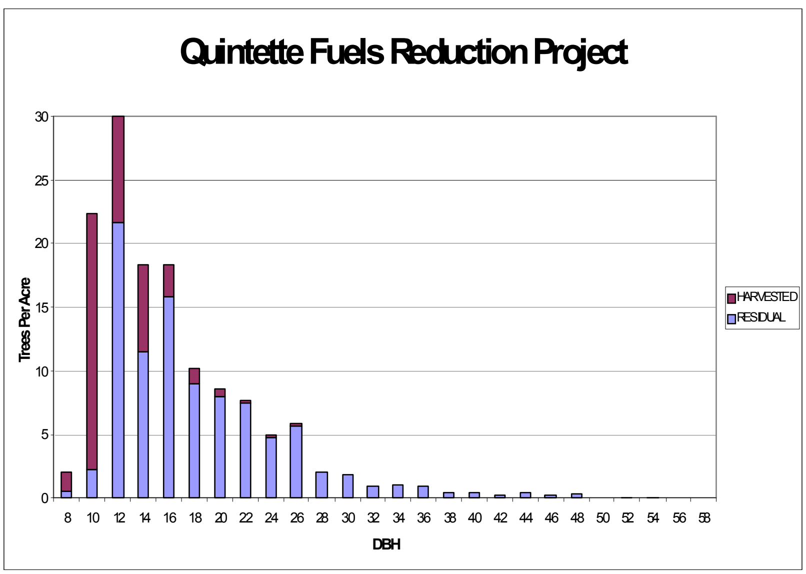

Figure 5 Number of harvested and remaining trees by diameter.

removed ("Harvested" in graph; purple in color) and which would remain ("Residual" in graph; blue in color). In Figure 5, the largest tree to be removed is in the 26-inch diameter class, and the remaining tree sizes will range from less than 8 inches to 48 inches. In Figure 6, the largest tree to be removed is in the 30-inch diameter class, and the remaining tree sizes will range from less than 8 inches to 58 inches. These two examples illustrate, among other things that removing trees that are 20"-30" in diameter under the 2004 Framework for forest health purposes does not necessarily lead to the removal of all the largest trees in the stand. Indeed, treatments such as these generally serve to *protect* the largest trees in the stand, which often greatly exceed 30" in diameter.

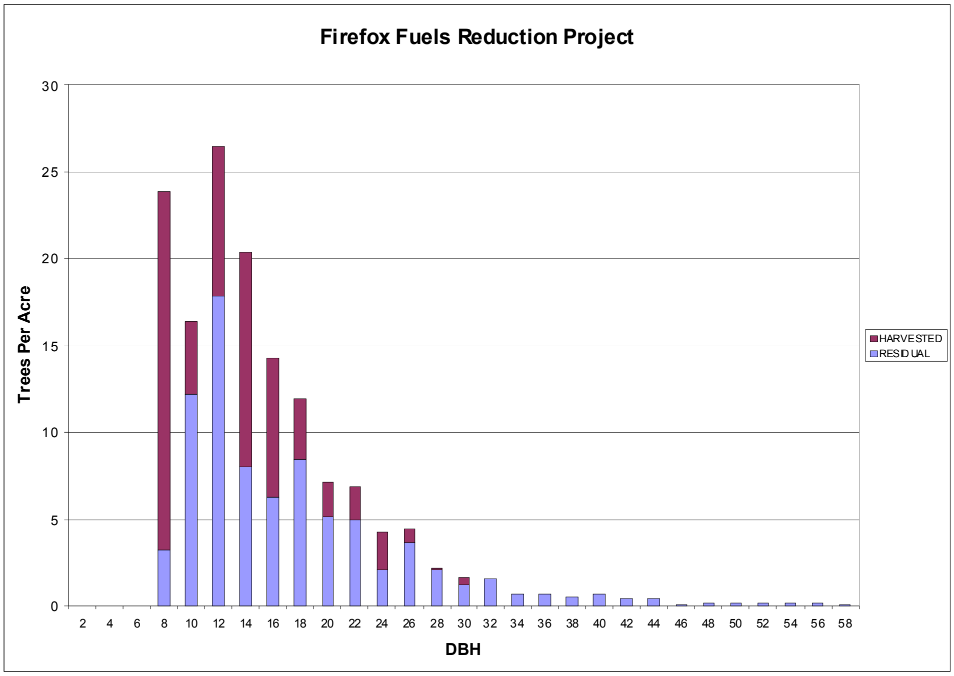

Figure 6 - Number of harvested and remaining trees by diameter.

12. The 2004 Framework allows for the removal of selected medium-sized trees to provide more soil moisture to the upper canopy trees. Substantial evidence exists to describe the extent and potential of tree mortality, including large tree mortality, from overly dense stands (Fettig 2005; Smith 2005; Barbour and others 2002; Guarin and Taylor 2005; Ferrell et al. 1994; Guarin & Taylor, 2005; CA Forest Pest Conditions Reports 1960-2007). Given adequate resources, Sierra Nevada conifers have the potential to live for several centuries. While inter-tree competition for resources is not the only factor that influences susceptibility to mortality, it is the component that managers can influence. Activities like commercial thinning can reduce the number of competing trees to a level that reduces tree mortality.

13. Forest stands within the Sierra Nevada commonly include a wide range of tree sizes. A selection of current diameter distributions from several National Forests is shown in Figure 7. As Figure 7 indicates, there are millions of trees over 30" in the Sierra Nevada. These trees are generally restricted from cutting under the 2004 Framework, and may be protected by the types of forest health and fuel reduction treatments allowed by the 2004 Framework.

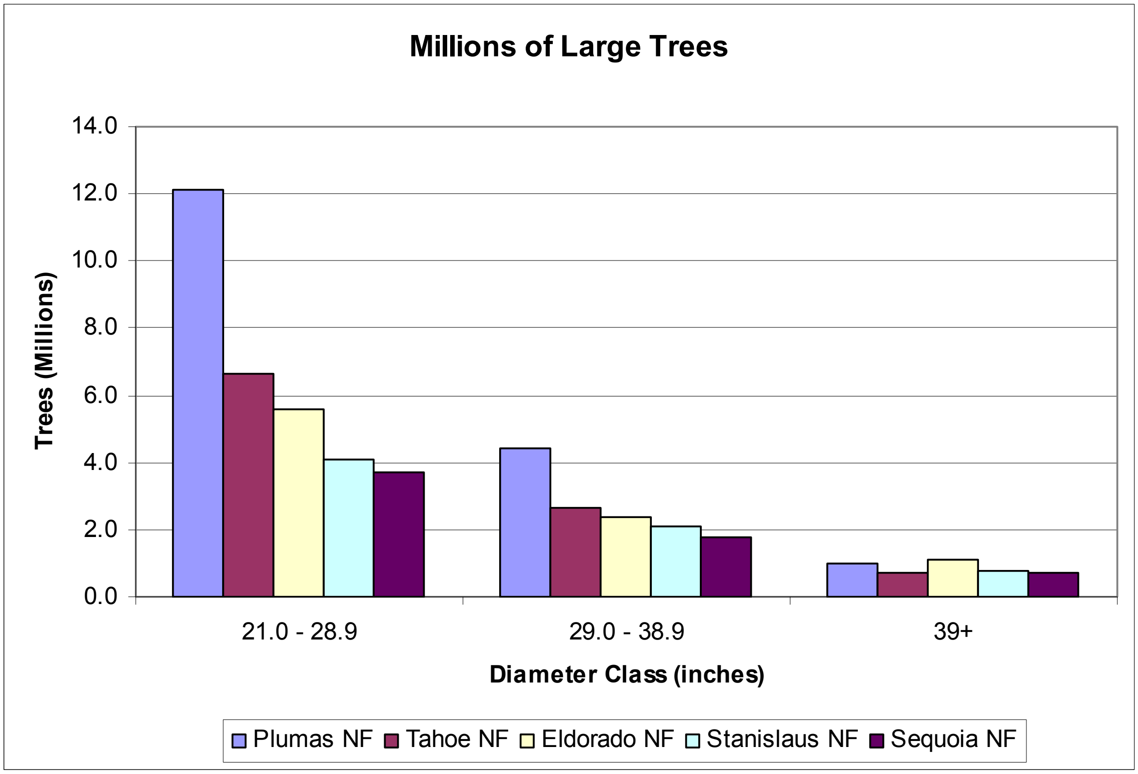

Figure 7 - Millions of large trees by diameter class for selected National Forests

14. A silvicultural prescription designed solely to reduce fuel hazards may differ from one designed to improve forest health by reducing the risk of drought-induced mortality from bark beetles. Fuel hazard reduction focuses first on surface fuel, then on ladder fuel, and, lastly, on upper canopy fuel. In some cases, especially near communities, canopy fuel is reduced, by separating tree crowns, to provide a safe and effective area for suppressing wildfire. In contrast, to improve the vigor of the remaining trees competing for water in an overly dense stand, a manager needs to decrease the number of competing trees, often including larger trees that may not pose a risk from a fire and fuels perspective. Numerous studies confirm that reductions in density lead to increased vigor for the remaining trees (Zhang 2005, Zhang 2006a, Zhang 2007, Zhang 2006b, Oliver 2005, Oliver 1988).

15. Additionally, it should be noted that excessive accumulations of dead trees increase fuel loads, and, if the effects of bark beetle-caused mortality are widespread, landscape-scale increases in fuel hazards would occur, as had occurred after the 1987-1992 drought (Ferrell 1996).

16. The 2004 Framework allows for much needed flexibility when reducing tree numbers and increasing tree vigor. The ability to remove competing trees that can range up to 30” in diameter allows thinning to have significant biological advantages over the common 12” or 20” limits that are common in the 2001 Framework. These 2001 Framework limitations often prevent the removal of sufficient trees to provide for a real advantage to the remaining trees, since the density of the medium-sized trees remains too high. The current conditions of so many forested acres in the Sierra Nevada are such that merely removing only the smallest trees would not be enough to allow the remaining trees to thrive, especially as they face warmer temperatures and longer summers, as predicted under current climate change models.

17. Finally, I have reviewed the proposed project-level remedy standard, regarding limiting future treatments in CWHR habitat types 5M, 5D, and 6. As this standard will not apply to the Wildland Urban Intermix zone or to fuelbreaks (including DFPZs), this standard will not undermine the 2004 Framework's ability to facilitate the improvement of forest health in these areas. Many areas outside of the WUI and fuelbreaks will remain at risk of density-related mortality, underscoring the importance of having this remedy be only temporary. I would not recommend long-term application of this standard, as there will likely be instances where treatments in CWHR types 5M, 5D, and 6 are appropriate for improving forest health, even if they change the CWHR classification of a stand.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed this 24th day of October, 2008.

/s/ Joseph W. Sherlock
(Original signature retained by attorney Barclay Samford)

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REFERENCES:

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Joseph W. Sherlock -- Curriculum Vitae

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EDUCATION

1977 Bachelor of Science, **Forest Resource Management**, Southern Illinois University, Carbondale, Illinois

WORK EXPERIENCE

Assistant Regional Silviculturist. (January 2004 to Present)
USDA Forest Service, Pacific Southwest Region, Ecosystem Management Staff, Regional Office.

- Serve as staff specialist in support of silvicultural activities, program planning and development, training and oversight. Provide continuing education related to silvicultural practices. Serve as a Regional Forester's Representative for Silviculturist Certification, evaluating candidates and authorizing certifications. Participate as cadre member on the Stewardship and Fireshed Assessment Cadre (Strategic Decision Support) as the Silviculturist. Represent staff in National Forest Plan revision process, providing support and analysis. Serve as co-lead on Forest Fuel/Vegetation Management Program Reviews. Provide data steward services related to the Forest Activity Tracking System (FACTS) database. Serve on the National FACTS Training cadre. Represent agency silviculturists on the National FACTS GIS Development Team.

Staff Officer (Detail) (October 2007 to January 2008)
Lake Tahoe Basin Management Unit, USDA Forest Service, Pacific Southwest Region.

- Serve as staff officer for fuel, fire, vegetation, and urban lot management. Develop budgets in support of the goals assigned to the Management Unit. Supervise staff, providing direction and oversight. Develop and maintain effective relationships with local, state, and federal agencies in support of program development and implementation.

Silviculturist (Detail) (July 2003 to January 2004)
USDA Forest Service, Pacific Southwest Region, Regional Office.

- Serve as a staff specialist to the Sierra Nevada Interdisciplinary Team (IDT) with responsibilities in program direction for silvicultural activities. The activities include timber stand prescriptions, reforestation, timber stand improvement, insect and disease control and maintenance and revision of timber management input to the Sierra Nevada Framework Amendment.

Resource Management Program Area Leader (July 1988 to July 2003)
USDA Forest Service, Pacific Southwest Region, Stanislaus National Forest, Mi-Wok District.

- Staff Officer for the sale planning, preparation, administration, reforestation, wildlife, and hydrology programs timber management, wildlife, botany, and hydrology programs on the Ranger District. Supervise staff, providing direction and oversight. Develop and implement yearly budgets.

Reconnaissance Forester (May 1979 to July 1988)
USDA Forest Service, Pacific Southwest Region, Stanislaus National Forest, Mi-Wok Ranger District.

- Performed a variety of typical forest management tasks, primarily silviculture prescription writing in support of the timber sale and reforestation programs. Led and developed the environmental analysis of related projects.

Forester (June 1978 to May 1979)
USDI Bureau of Land Management, Medicine Bow Resource Area, Wyoming District.

- Performed forest inventory and timber sale preparation duties.

Forestry Technician (October 1977 to June 1978)
USDA Forest Service, Eastern Region, Shawnee National Forest.

- Established permanent plots, meeting Forest Survey standards, and related inventory and planning work in support of the development of the Forest Plan.

OTHER EXPERIENCES AND QUALIFICATIONS

Certifications

- R5 Certified Silviculturist (1983)
- Regional Forester's Representative for Silviculturist Certification (1990)

Memberships

- Society of American Foresters (1974 to present)

Other Related Roles

- Society of American Foresters, Mother Lode Chapter President (1990-1993)
- Society of American Foresters, National Convention Program Committee (1991)

AWARDS

- Pacific Southwest Region Silviculturist of the Year for 1989-1990
- Stanislaus National Forest Timber Management Employee of the Year in 1992

PUBLICATIONS

Bahro, B., Barber, K.H., Sherlock, J.W., Yasuda, D.A. 2007. Stewardship and fireshed assessment: a process for designing a landscape fuel treatment strategy. In Powers, R.F., tech ed. Restoring fire-adapted ecosystems: proceedings of the 2005 national silviculture workshop. Gen. Tech. Rep. PSW-GTR-203. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. pp 41-54.

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*, Plaintiffs, v. MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*, Federal Defendants, and TUOLUMNE COUNTY ALLIANCES FOR RESOURCES & ENVIRONMENT, *et al.*, Defendant-Intervenors, and CALIFORNIA SKI INDUSTRY ASS'N, and QUINCY LIBRARY GROUP, *et al.*, Defendant-Intervenors.	Case No.: CIV-S-05-0205 MCE/GGH **DECLARATION OF NANCY GRULKE**

I, Nancy Grulke, declare as follows:

1. I have a B.A. with Honors in Botany from Duke University, and a Ph.D. in Botany from the University of Washington. I am a plant ecophysiologist with 20 years of experience in assessing forest health and drought stress in the pine-dominated, mixed conifer forests of the southern Cascade Range, east and west side Sierra Nevada, Transverse and Peninsular Ranges of southern California, and northern Baja, California. In the last two years, I have been asked to speak about forest health in California 20 times, specifically on the linkage between air pollution and drought stress increasing forest susceptibility to bark beetle outbreaks, tree mortality, and subsequent forest susceptibility to wildfire. The audiences have been public lands resource managers, academic departments, the public, and several international scientific congresses. I am the Principal Investigator of a nationally competed research project to define the mechanism by which drought stress increases Jeffrey pine susceptibility to bark beetle success in the Sierra Nevada. My curriculum vitae is attached.

2. A key issue facing scientists and land managers in the western U.S. is how to restore or maintain forest health so that individual trees and forest stands are less susceptible to mortality from drought, disease, insects, air pollution, and fire. As discussed in further detail below, based on my professional experience and familiarity with the scientific literature, I believe that to maintain long term forest health in the Sierra Nevada, it is appropriate in some cases to remove intermediate-sized trees (20” to 30” in diameter) and reduce canopy cover below 50% to improve tree survival under current climate conditions. The ecological rationale for removing intermediate-sized trees and reducing canopy cover becomes even more compelling when climate change is considered.

3. Grulke et al. (2009) presents a case study of the effect of air pollution, drought, bark beetle attack, mortality, and increased susceptibility to wildfire in the mixed conifer forest.

Although the study was focused on the San Bernardino National Forest (SBNF), the structure and function of the mixed conifer forest there is similar to that across much of the Sierra Nevada. The mixed conifer zone in the SBNF also shares similar climate, land management history, and recreational pressures with that of the Sierra Nevada. The exception is that the SBNF was logged sooner (late 1800s vs. early 1900s), had more air pollution (20 years before the Sierra Nevada), and has had more human impact, earlier, than the Sierra Nevada. The population growth adjacent to the central Sierra Nevada (5 upwind counties) is now similar to what the population in the Los Angeles Basin was 40 years ago (Staszak et al., 2007). As population increases and the forests continue to densify in the Sierra Nevada, the fate of the unhealthy forests in the SBNF likely foreshadows the future (in 20 to 40 years) of the mixed conifer forests in the Sierra Nevada under current climatic conditions, and likely sooner if climate change predictions are realized. Forest condition and management needs in the SBNF therefore provide a useful point for comparison, learning, and management in the Sierra Nevada.

4. Drought is common in the Sierra Nevada. In years of 80% of average precipitation or less, yellow pines (ponderosa and Jeffrey) in the SBNF and Sierra Nevada experience moderate drought stress and exhibit a reduction in needle and branch elongation growth, and reduced carbon storage. In years of 60% of average precipitation or less, pines in the SBNF and the Sierra Nevada experience severe drought stress and exhibit reductions in growth, significant reductions in carbon storage (and reduced carbon and energy available for defense), and disruption of cell function. During a year of severe drought stress, needles are sloughed to reduce water loss from those needles (SBNF: Grulke and Balduman 1999; Sierra Nevada: Grulke et al., 2003). For yellow pines in the mixed conifer forests in the SBNF, moderate to severe drought stress occurs 46% of the years on record. In the mixed conifer forests in the Sierra Nevada, drought occurs 40 to 44% of the years on record (physiological data: Grulke, unpublished, taken

in 2007; precipitation data obtained from the National Weather Service online data base for the Sequoia, Inyo, and Tahoe National Forests).

5. Drought decreases the amount of water available per tree for growth and survival. Although some dense stands may support higher density because trees have access to more ground or spring water, these can dry up in a severe drought year. Even though mature conifers use the water they access more efficiently than younger trees, as mature trees continue to grow, more water is required per tree simply from greater total leaf area (giant sequoia: Grulke et al., 1994; ponderosa pine: Grulke and Retzlaff 2001). When multiple years of severe drought is followed by a year of acute drought, trees of all size classes die (Fig. 1).

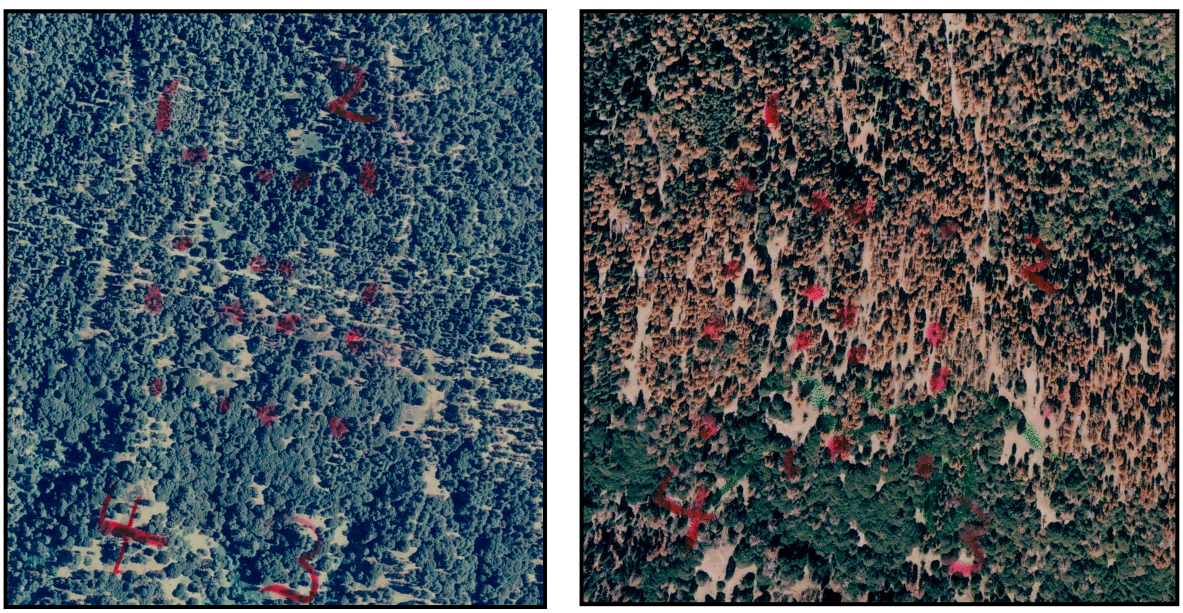

Fig. 1. Aerial photos were taken in the same location in 1994 (left, before drought) and 2004 (right, after drought) in the western San Bernardino Mountains. A chronic drought (1999-2001) and an acute drought (2002) cumulatively resulted in significant mortality of pole size and larger tree size classes. Mortality in 8 one hectare plots sample (from the photographs) was 50% at this location (includes areas outside of the picture).

6. Stand density, forest health, and forest susceptibility to wildfire are intimately linked. Trees in close proximity to one another compete intensely for resources, especially water in a drought year, and, as a result, have reduced canopy health. For example, ponderosa and Jeffrey pine trees both have reduced canopy health if another mature pine is within 2.5 m, using any of the three canopy health assessment tools in use in California (Ozone Injury Index, Miller

et al., 1996; Forest Pest Management, Pronos et al., 1989; or multivariate statistical assessment, Grulke & Lee's (1997) and Grulke et al. (2003)). Competition that results in reduced canopy health reduces energy, carbon, and other resources for tolerance or defense against threats, specifically, drought and bark beetle. Multiple years of severe drought increase tree mortality from drought alone, and from drought and bark beetle success combined.

7. Higher stand density may be sustainable with moderate drought stress in the northern, west side Sierra Nevada, but categorically, this may not apply to central or southern Sierra Nevada, where there is greater evaporative demand. An example of the effect of a single acute low precipitation year occurred in 2007 on the Inyo National Forest when total annual precipitation was 33% of a 60 year precipitation record (Grulke, unpubl. field data). In that forest, drought stress in Jeffrey pines was exceptionally severe in a dense stand. Jeffrey pines in a thin stand 1 km away on the same slope aspect exhibited less severe drought stress. Jeffrey pines on the Sequoia National Forest (east of the Sierra Nevada) and the Tahoe National Forest also experienced severe drought stress (both Forests received total annual precipitation in 2007 that was ~60% of the medium or long term average precipitation record) based on the physiological definitions given above. We are monitoring these stands carefully for increase in bark beetle attack and mortality.

8. We expect a net decrease in water availability in the Sierra Nevada under most of the global climatic models because of the way precipitation will be distributed seasonally, and because greater air temperatures increase evaporation from soil and plant surfaces. Finer resolution hydrological models of the western U.S. indicate: 1) some areas with increasing precipitation and some areas with decreasing precipitation in the Sierra Nevada over the last 40 years (Mote et al., 2006; Ragonda et al., 2005); and 2) significant increases in air temperature (Mote et al., 2005). Air temperature increases alone are sufficient alone to increase drought.

Greater air temperatures with greater water holding capacity will result in a net decrease in water available to plants (2007 IPCC Report), i.e., increased tree drought stress.

9. Van Mantgem & Stephenson (2007) demonstrated an increase in the mortality rate of conifers in Yosemite, Sequoia, and Kings Canyon National Parks, as assessed from two decades of research involving 21,000+ trees. They attributed the tree mortality to climate change. Mortality increased from a background of 3%, to 9% over the last two decades. Decadal mortality rate was 3% in mesic microsites and 15% in xeric microsites (moisture status of trees defined in Grulke et al. (2003)) in Sequoia National Park for 90 Jeffrey pine trees (Grulke, 1998 through August 2008 unpubl. data). The cause of Jeffrey pine mortality in this study was completely attributable to successful bark beetle attack (John Pronos and John Wenz (US Forest Service Pathologist and Entomologist, respectively, both retired in 2007), field survey completed in 2006).

10. Thinning is needed in some dense stands to reduce risk of tree mortality due to inter-tree competition, drought stress, and bark beetle outbreak under current climate conditions. In some dense stands with a current canopy cover of 90%, almost all trees are larger than 20” in diameter. For example, 9 such stands on the east side of the Sierra Nevada are the focus of currently funded research I am conducting. Depending on the microenvironment and the density of the stand, it may be appropriate to harvest trees over 20” and/or reduce canopy cover less than 50% to allow the removal of a sufficient number of trees to reduce competition, promote tree health, reduce the level of drought stress experienced, and reduce tree mortality from both drought stress and bark beetle outbreaks. In the absence of thinning in areas where excessive tree mortality occurs due to drought and/or successful beetle attack, habitat for wildlife that depends on live trees will be lost, whether it is by drought stress, beetle outbreaks, or fire.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed this __20th___ day of October, 2008.

/s/ Nancy Grulke
(Original signature retained by attorney Barclay Samford)

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Grulke NE, Johnson R, Jones D, Monschein S, Nikolova P, Tausz M 2003 Variation in morphological and biochemical O_3 injury attributes of Jeffrey pine within canopies and between microsites. Tree Physiology 23:923-929.

Grulke NE, Miller PR 1994 Change in physiological characteristics from seedlings to mature trees in giant sequoia: implications for response to current and future levels of atmospheric pollutants. Tree Physiology 14:659-668.

Grulke NE, Paine T, Minnich R, Chavez D, Riggan P, Dunn A 2009 Air pollution increases forest susceptibility to wildfire. Pgs. 365-403, In: Bytnerowicz, A., Arbaugh, M., Riebau, A, Andersen, C. eds. Wildland Fires and Air Pollution. Developments in Environmental Science, Vol. 8, The Hague, Netherlands: Elsevier Publishers.

Grulke NE, Retzlaff WA 2001 Changes in physiological attributes from seedlings to mature ponderosa pine. Tree Physiology 21:275-286.

Mote PW 2006 Climate driven variability and trends in moutnatin snowpack in western North America. Journ11 of Climatology 19:6209-6220.

Mote PW, Hamlet AF, Clark MP, Lettenmaier DP 2005 Declining mountain snowpack in western North America. Bulletin of the American Meteorological Society 86:39-49.

Intergovernmental Panel on Climate Change (IPCC) 2007 http://www.ipcc.ch/ipccreports/tp-climate-change-water.htm

Regonda SK, Rajagopalah B, Clark M, Pitlick J 2005 Seasonal shifts in hydroclimatology over the western United States. Journal of Climatology 18:372-384.

Staszak J, Grulke NE, Prus-Glowacki W 2007 Air pollution-driven genetic change in yellow pine in Sequoia National Park. Environmental Pollution 149:366-375.

van Mantgem PJ, Stephenson NC 2007 Apparent climatically induced increase in tree mortality rates in a temperate forest. Ecological Letters 10:909-916.

Nancy Elizabeth Grulke - Curriculum Vitae
Research Plant Ecophysiologist (GS-435-14/8)
USDA Forest Service
Pacific Southwest Research Station
4955 Canyon Crest Drive
Riverside, CA 92507
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951-680-1556

POSITIONS HELD:

Project Leader, Forest Health and Disturbance, 11/06- present

Director Representative, Riverside Fire Lab, 10/07-9/08

Visiting Professor, Institute of Plant Physiology, University of Graz, Austria; 10-12/01; 11-12/02; co-taught graduate level course in '01: Physiological responses to environmental stress (with Dr. Michael Tausz)

Senior Research Associate, Institute of Arctic Biology, Fairbanks, University of Alaska, 5/95 to present

Sabbatical, Forest Health Indicators Program: Risk Assessment, National Health and Environmental Effects Laboratory, U.S. Environmental Protection Agency, Corvallis, OR, 1/97 to 1/98

Research Plant Physiologist 13/1 (80% research), and Science Coordinator for 5 state region (20% administration), USDA FS Pacific Global Change Program, Corvallis, OR, 9/91 to 9/96

Associate Professor (Courtesy Appointment), Department of Forest Science, Graduate Courses taught: Photosynthetic Techniques; Gas exchange techniques from leaf to ecosystem; Oregon State University, 3/92 to 1/98

Research Plant Physiologist 12/1 (100% research), Pacific Southwest Research Station, Riverside, CA, 3/89 to 8/91

Post-doctoral Research Associate, giant sequoia response to O_3 exposure, Pacific Southwest Research Station, Riverside, CA, 5/88 to 3/89

Post-doctoral Research Associate, effects of elevated CO_2 on ecosystem C balance, Systems Ecology Research Group, San Diego State University, 12/86 to 5/88

Research Associate I, Institute of Arctic and Alpine Research, University of Colorado, 3/84 to 12/88

Adjunct Assistant Professor of Biology, Montana State University, Plant Physiology, Biology Department, Winter quarters 1984, 1985

Post-doctoral Research Associate, stress physiology, vegetation ecology, soil chemistry and morphology, College of Forest Resources and Botany Department, University of Washington, 8/83 to 12/83; 5/84 to 9/84; 5/85 to 9/85

Teaching Assistantships, 1/79 through 6/83, 12 qtrs: Plant Physiology (5x), Plant Ecology (2x), Ecophysiology, Reproductive Biology of Flowering Plants, Plant Diversity, Biology (2x), Botany Department, University of Washington.

Research Assistantships, summers from 6/79-6/83, stress physiology and population dynamics of grasses, polar desert, Botany Department, University of Washington

Research Assistant, summers 75 & 76 in northern Alaska, soil morphology and chemistry, Institute of Polar Studies, Ohio State University

Research Assistant, summer 74 in the Bahamas, soil chemistry and mangrove distribution, Tufts University

Research Assistant, summer 73 in Colorado, meteorology and vegetation ecology, Institute of Arctic & Alpine Research, University of Colorado

EDUCATION:

- 1983 Ph.D., Botany, University of Washington, Seattle, WA
- B.Sc., Honors in Botany, Duke University, Durham, NC
- H.S. Diploma, Valedictorian (of 700), Berea High School, Berea, OH

RESEARCH INTERESTS:

Ecophysiological and life historical characteristics of plant species; Whole plant and ecosystem response to environmental stressors (ozone exposure, elevated temperature, drought) and enhancers (N deposition, CO_2 enrichment); Empirical modeling of physiological processes to environmental influences; Basic science approach used in solving applied problems; Ecophysiological research experience with grasses, forbs, shrubs, and all age classes of coniferous, evergreen broadleaf, and deciduous trees; Ecological research experience in the polar desert (Canada), arctic tundra (Alaska), boreal forest (Alaska, Maine), subalpine forests (Colorado), temperate coniferous forests and mediterranean oak woodlands (California, Oregon, Italy), temperate beech forest (Bavaria), and subtropical scrublands (Bahamas);

GRANTS AWARDED:

2007 Defining the mechanism between tree drought stress and successful bark beetle attack in Jeffrey pine. USDA NRI CSREES, PI: N Grulke; co-PIs: S Seybold, B Demmig-Adams, W Adams, D Rizzo, $347K for 3 yrs.

2005 Microbial links between short and long-term soil C cycles – comparing isotopes in SOM fractions, microbial biomarkers, and heterotrophically respired CO_2. PIs: W Silver, S Trumbore, N Grulke. Kearney Foundation, $49K for 1 yr.

2005 The role of ozone in water balance of plants acclimated to CO_2-enriched environments (soybean, loblolly pine). PI. Internal Competitive Grants Program, $15K, 1 yr.

2001 Genetic assessment of yellow pine populations in Sequoia National Park. PIs: N Grulke, T Ledig, W Prus-Glowacki; Koscuisko Foundation, $16K, 1 yr, for fellowship study for Ph.D. student Jacek Stascak.

2000 Stability of naturally- and anthropogenically-disturbed upland tundra surfaces. PI: R Sletten, with NG, K Glew; NSF Polar Programs, $57K, 1 yr

1998 Does N deposition mitigate foliar O_3 injury in Jeffrey pine? Long-term intensive site research in Sequoia National Park. PI, with M Arbaugh, A Bytnerowicz, M Fenn, P Padgett, M Poth; PRIMENET, joint funding from EPA and NBS: $283K, 3 yrs

1997 Variability of water use efficiency for 4 conifers along a large latitudinal gradient. PI; National Biological Survey: $13K, 1 yr

1994 Calibration and survey of proxy characteristics to determine O_3-induced damage at the individual tree and population level. PI, with C Rose; Environmental Research Laboratory, EPA, DW 12936801: $430K, 3 yrs

1994 Effect of elevated CO_2 and soil temperature on a model white spruce ecosystem. PI; USDA FS Pacific Global Change Research Program: $90K, 2 yrs

1992 Identifying genetic vs. environmental components of ponderosa pine response to a strong O_3 gradient. PI; Environmental Research Laboratory, EPA, DW12934530: $238K, 2 yrs

1991 Ecophysiology of 4 species of mixed conifer. PI; Sequoia National Park, Global Change Program: $7K, 1 yr

1991 Effects of elevated CO_2 on carbon assimilation, water use efficiency, and RUBP activity of half-sib families of ponderosa pine. PI, with S Sparks, J Johnson, A Bytnerowicz, D Crowley; Southern California Edison: $42K, 1 yr

1990 Effects of canopy-level O_3 fumigation on giant sequoia; PI, with PR Miller; National Park Service, Air Quality Office: $95K, 1 yr

1989 Ecophysiology of 6 age classes of giant sequoia. PI, with PR Miller; National Park Service, Air Quality Office: $37K, 1 yr

1989 Interactive effects of elevated atmospheric CO_2 and O_3 on net photosynthesis, dark respiration, and quantum efficiency of ponderosa pine. PI, with J Hom; Regional Office of Forest Service: $55K, 1 yr

1983 Treeline Dynamics in the Front Range, Colorado. Sigma Xi Grant-in-Aid of Research: $250, 1 yr

1977 Treeline Dynamics in the Front Range, Colorado. Duke University Grant for Undergraduate Research: $250, 1 yr

PUBLICATIONS:

Journal articles:

Handley T, Grulke NE 2008 Interactive effects of O_3 exposure on California black oak (*Quercus kelloggii* Newb.) seedlings with and without nitrogen amendment. Environmental Pollution 156:53-60.

Staszak J, Grulke NE, Prus-Glowacki W 2007 Air pollution-driven genetic change in yellow pine in Sequoia National Park. ***Environmental Pollution*** 149:366-375.

Grulke NE, Paoletti E, Heath RL 2007 Chronic vs. short term acute O_3 exposure effects on nocturnal transpiration in two Californian oaks. ***TheScientificWorld*** (2007) 7(S1):134-140. DOI 10.1100/tsw.20007.33

Paoletti E, Bytnerowicz A, Andersen C, Augustatitis A, Marco F, Grulke N, Gunthardt-Goerg M, Innes J, Johnson D, Karnosky D, Luangjame J, Matyssek R, McNulty S, Muller-Starck G, Musselman R, Percy K 2007 Impacts of air pollution and climate change on forest

ecosystems: emerging research needs. ***TheScientificWorld*** (2007) 7(S1):1-8. DOI 10.1100/tsw.207.52

Tausz M, Grulke N, Weiser G 2007 Plant defense and avoidance from ozone under global change. **Environmental Pollution** 147:525-531.

Grulke, N.E., Paoletti, E., Heath, R.A. 2007 Comparison of calculated and direct measurements of foliar O_3 uptake in crop and native tree species. ***Environmental Pollution*** 146:640-647.

Grulke NE, Neufeld HS, Davison AW, Chappelka A 2007 Stomatal behavior of O_3-sensitive and –tolerant cutleaf coneflower (*Rudbeckia laciniata* var. *digitata*) Great Smoky Mountain National Park. ***New Phytologist*** 173:100-109.

Grulke NE, Paoletti E 2005 New system to deliver desired O_3 concentrations in leaf-level gas exchange measurements: results for Holm oak near a CO_2 spring. ***Phyton*** (Austria) 45:21-31.

Grulke NE, Dobrowolski W, Mingus P, Fenn ME 2005 California black oak response to N-amendment at an N-saturated site. ***Environmental Pollution*** 137:536-545.

Paoletti E, Grulke NE 2005 Does living in elevated CO_2 ameliorate tree response to ozone? A review on stomatal responses. ***Environmental Pollution*** 137:483-493.

Preisler H, Grulke NE, Esperanza A, Bytnerowicz A 2005 Analyzing effects of forest fires on diurnal patterns of ozone concentrations. ***Phyton*** 45:33-39.

Grulke NE, Alonso R, Nguyen T, Cascio C, Dobrowolski W 2004 Stomata open at night: implications for pollutant uptake in ponderosa pine. ***Tree Physiology*** 24:1001-1010.

Staszak J, Grulke NE, Prus-Glowacki W 2004 Genetic differences of *Pinus ponderosa* trees tolerant and sensitive to O_3 exposure. ***Water, Air, Soil Pollution*** 153:3-14.

Grulke NE, Johnson R, Jones D, Monschein S, Nikolova P, Tausz M 2003 Variation in morphological and biochemical O_3 injury attributes of Jeffrey pine within canopies and between microsites. ***Tree Physiology*** 23:923-929.

Grulke NE, Johnson R, Esperanza A, Jones D, Nguyen T, Posch S, Tausz M 2003 Canopy transpiration of Jeffrey pine in mesic and xeric microsites: O_3 uptake and injury response. ***TREES*** 17(4):292-298.

Grulke NE, Preisler H 2003 Un approccio statistico per stimare l'assorbimento di ozono e valutare gli effetti di stress idrico e ozono sulla fotosintesi di un pino mediterraneo. (A statistical model of O_3 uptake and application to test the effects of O_3 and drought stress on assimilation in mediterranean pine.) ***Monti e Boschi*** LIV(1):41-46.

Arbaugh M, Bytnerowicz A, Grulke N, Fenn M, Poth M, Temple P, Miller P 2003 Photochemical smog effects in mixed conifer forests along a natural gradient of ozone and nitrogen deposition in the San Bernardino Mountains. ***Environment International*** 29:401-406.

Tausz M, Herbinger K, Posch S, Grulke N 2002 Antioxidant status of *Pinus Jeffreyi* needles from mesic and xeric microsites in early and late summer season. ***Phyton*** (Austria) 42:201-207.

Grulke NE, Preisler H, Rose C, Kirsch J, Balduman L 2002 Evaluating the role of drought stress on ozone uptake in ponderosa pine. ***New Phytologist*** 154: 154:621-632.

Grulke NE, Preisler H 2002 A statistical approach to estimate ozone uptake of ponderosa pine in a mediterranean climate. ***Environmental Pollution*** 119(2):163-175.

Bytnerowicz A, Tausz M, Alonso R, Jones D, Johnson R, Grulke N 2002 Summer-time distribution of air pollutants in the Sequoia National Park, California. ***Environmental Pollution*** 118:187-203.

Andersen CP, Grulke NE 2001 Complexities in understanding ecosystem response to ozone. ***Health and Ecological Risk Assessment*** 7(5):1169-1182.

Grulke NE, Retzlaff WA 2001 Changes in physiological attributes from seedlings to mature ponderosa pine. ***Tree Physiology*** 21:275-286.

Grulke NE, Andersen CP, Hogsett WE 2001 Seasonal changes in carbohydrate pools of ponderosa pine in stands under differing environmental stress. ***Tree Physiology*** 21:173-184.

Retzlaff WA, Arthur MA, Grulke NE, Weinstein DA, Gollands B, Grulke NE 2000 Use of a single-tree simulation model to predict the effects of ozone and drought on a white fir tree. ***Tree Physiology*** 20:195-202.

Grulke NE, Balduman L 1999 Deciduous conifers: high nitrogen deposition and ozone exposure effects on ponderosa pine. ***Water, Soil, Air Pollution*** 116:235-248.

Grulke NE, Andersen CP, Fenn MP, Miller PR 1998 Ozone exposure and N deposition reduces root biomass in ponderosa pine across the San Bernardino Mountains, California. ***Environmental Pollution*** 103:63-73.

Grulke NE, Lee EH 1997 Assessing ozone-induced foliar injury in ponderosa pine. ***Canadian Journal Forest Research*** 27:1658-1668.

Grulke NE, Miller PR, Scioli D 1996 Response of giant sequoia canopy foliage to experimentally manipulated levels of atmospheric ozone. ***Tree Physiology*** 16:575-581.

Grulke NE 1995 Distribution of Phippsia algida and autosuccession in the polar semi-desert. ***Arctic Alpine Research*** 27(2):172-179.

Oechel WC, Cowles S, Grulke NE, Hastings SJ, Lawrence B, Prudhomme T, Riechers G, Vourlitis G 1994 *In situ* acclimation of net CO_2 flux to elevated CO_2: limits to CO_2 fertilization in a natural ecosystem. ***Nature*** 371:500-505.

Grulke NE, Miller PR 1994 Change in physiological characteristics from seedlings to mature trees in giant sequoia: implications for response to current and future levels of atmospheric pollutants. ***Tree Physiology*** 14:659-668.

Oechel WC, Jenkins M, Hastings SJ, Riechers GH, Grulke NE, Vourlitis G 1993 CO_2 release to the atmosphere from arctic tundra ecosystems: possible positive feedbacks to climate change. ***Nature*** 361:520-523.

Grulke NE, Hom JL, Roberts SW 1993 Elevated CO_2 response of 2 full-sib families of ponderosa pine. ***Tree Physiology*** 12:391-401.

Oechel WC, Riechers GH, Lawrence WT, Prudhomme TI, Grulke NE 1992 CO_2LT, a closed null balance system for long term *in situ* ecosystem manipulation and measurement of CO_2 level, CO_2 flux, and temperature. ***Functional Ecology*** 6:86-100.

Grulke NE, Riechers GH, Oechel WC, Hjelm U, and Jaeger C 1990 Carbon balance of tussock tundra under ambient and elevated atmospheric CO_2. ***Oecologia*** 83:485-494.

Grulke NE, Bliss LC 1988 Comparative life history characteristics of two High Arctic grasses, N.W.T. ***Ecology*** 69(2):131-143.

Grulke NE, Bliss LC 1985 Environmental control of the prostrate growth form in two high arctic grasses. ***Holarctic Ecology*** 8:204-210.

Grulke NE Bliss LC 1985 Growth forms, carbon allocation, and reproductive strategies of high arctic saxifrages. ***Arctic Alpine Research*** 17(3):241-250.

Grulke NE, Bliss LC 1983 A note on winter seed rain in the High Arctic. ***Arctic Alpine Research*** 15(2):261-265.

Book chapters:

*Pataki DE, Randerson JT, Sang Wenwen, Herzenach MK, Grulke NE The isotopic composition of plants and soils as biomarkers of pollution. Chapter, In: ***Isoscapes***, proceedings. 34 pgs.

*Grulke NE 2009 Interactive effects of climate and wildland forest on forests and other ecosystems – Section III synthesis. Pgs. 457-467, In: Bytnerowicz, A., Arbaugh, M., Andersen, C., and Riebau, A.,eds. Wildland fires and air pollution. ***Developments in Environmental Science***, Vol. 8, The Hague, Netherlands: Elsevier Publishers.

*Grulke NE, Paine T, Minnich R, Chavez D, Riggan P, Dunn A 2008 Air pollution increases forest susceptibility to wildfire. Pgs. 365-403, In: Bytnerowicz, A., Arbaugh, M., Riebau, A, Andersen, C. eds. Wildland Fires and Air Pollution. ***Developments in Environmental Science***, Vol. 8, The Hague, Netherlands: Elsevier Publishers.

Grill D, Pfanz H, Lomsky B, Bytnerowicz A, Grulke NE, Tausz 2005 Physiological responses of trees to air pollutants at high elevation sites. Pgs 37-44, In: K Omasa, LJ deKok, J Barnes (eds) Plant Responses to Air Pollution and Global Changes. ***Ecological Studies***. Berlin: Springer Verlag.

Grulke NE 2003 Physiological basis of ozone injury assessment in Sierra Nevadan conifers. In: Bytnerowicz A, Arbaugh M, Alonso R. Assessment of ozone distribution and its effects on Sierra Nevada ecosystems. ***Developments in Environmental Science*** 2:55-81. Elsevier Publishers, The Hague, Netherlands.

Grulke NE 1999 Physiological responses of ponderosa pine to gradients of environmental stressors. In: Miller PR, McBride J (eds) Oxidant Air Pollution Impacts in the Montane Forests of Southern California: The San Bernardino Mountain Case Study. ***Ecological Studies*** 134:126-163. NY:Springer-Verlag.

Hahn SC, Oberbauer SF, Gebauer R, Grulke NE, Lange OL, Tenhunen JD 1996 Aboveground carbon and nutrient pools in the Imnaviat Creek Wilderness. In: Reynolds JF, Tenhunen JD (eds.) Landscape Function and Disturbance in Arctic Tundra. ***Ecological Studies*** 120:109-128. Berlin: Springer Verlag.

Weber J, Grulke NE 1995 Effects of air pollution on stem growth. Pgs. 343-364, In: B Gartner (ed) Stems and Trunks in Plant Form and Function. NY: ***Academic Press***.

Bytnerowicz A, Grulke NE 1992 Physiological effects of air pollutants on western forests. In: Olson R, Binkley D, Bohm M (eds) The Response of Western Forests to Air Pollution. ***Ecological Studies*** 97:183-234. NY: Springer-Verlag.

Technical Reports:

*Grulke NE, Paine T, Minnich R, Riggan P 2008 A link between air pollution and forest susceptibility to wildfire: a case study for the San Bernardino Mountains. Proceedings, Assessment of Threats to Forest Health, July 11-13, 2006. Boulder, CO. Portland, OR: ***PNW-GTR***: 10 pgs. (*in press*). http://www.forestencyclopedia.net/p/p3350

Grulke NE, Paoletti E 2005 Direct measurements of foliar ozone uptake in crop and tree species. Proceedings, UNECE Working Group on Regulatory Limits to O_3 Flux to Vegetation, Obergurgl, Austria, Nov 15-17, 2005. 6 pgs. http://www.uni-graz.at/pphwww/miarb/Mike/Obergurgl/Abstracts/

Garner J, Lewis T, Hogsett W, Andersen C, Lefohn A, Karnosky D, Nannini M, Grulke N, Adams R, Heath R, Runeckle V, Chappelka A, Massman W, Musselman R, Woodbury P 2006 Chapter 9: Environmental Effects on vegetation and ecosystems. In: Air Quality Criteria for Ozone and related Photochemical Oxidants, Vol. 1 (of III), National Center for Environmental Assessment, Research Triangle Park, NC. Environmental Protection Agency 600/R-05/004aF, February 2006; 30 pp.

Grulke NE, 2000 An analysis of short-, medium-, and long-term O_3 exposure in influencing stomatal conductance of ponderosa pine. Proceedings, IUFRO Working Group 7.04, Internat'l Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, April 2000, Houghton, MI: Michigan Technical University, 6 pp.

Grulke NE, Miller PR, Leininger TD 1998 Effect of ozone exposure on seasonal gas exchange of five western conifers. USDA Forest Service, Albany, CA: ***PSW-GTR***-164:229-238.

Grulke NE 1998 The role of early, late, and whole season ozone exposure in photosynthetic decline of ponderosa pine. Proceedings, Air Waste Manag Assoc, Paper No. 98-TA37.05. Pittsburgh, PA: Air Waste Manag Assoc, 18 pp.

Grulke NE, Miller PR, Ottmar R, Poth M, Riggan P 1998 Exchanges of gases and aerosols between atmosphere and terrestrial ecosystems. In: Bytnerowicz A (tech coor) Atmospheric and Biospheric Interactions and Energy in the Pacific Region of the United States, Mexico, and Brazil. USDA Forest Service, Albany, CA: ***PSW-GTR***-161:5-12.

Bytnerowicz A, Fenn M, Ferguson S, Grulke N 1998 Nutrient cycles and energy flows. In: Bytnerowicz A (tech coor) Atmospheric and Biospheric Interactions and Energy in the Pacific Region of the United States, Mexico, and Brazil. USDA Forest Service, Albany, CA: ***PSW-GTR***-161:13-20.

Fenn M, Grulke NE, Miller PR 1998 Plant responses to climate and air pollution changes. In: Bytnerowicz A (tech coor) Atmospheric and Biospheric Interactions and Energy in the Pacific Region of the United States, Mexico, and Brazil. USDA Forest Service, Albany, CA: ***PSW-GTR***-161:21-26.

Miller PR, Grulke NE, Stolte K 1995 Air pollution effects on giant sequoia ecosystems. USDA Forest Service, Albany, CA: ***PSW-GTR***-151:90-99.

Bell E, Grulke NE 1990 Global climate change and forest management. Pgs. 1-7, In: Proceedings, Forest Vegetation Management, Conference, November 7-9, Sacramento, CA.

Grulke NE, Miller PR, Wilborn RD, Hahn S 1989 Photosynthetic response of giant sequoia seedlings and rooted branchlets of mature foliage to ozone fumigation. Pg. 429-442, In: Olson RK, Lefohn AS (eds) Effects of Air Pollution on Western Forests. Transactions, Air Pollution Cont Assoc, No. 16. Pittsburgh, PA: Air and Waste Manag Assoc.

Bliss LC, Grulke NE 1988 Revegetation in the High Arctic: Its role in reclamation of surface disturbance. Pgs. 43-55. In: Kershaw, P (ed.) Northern Environmental Disturbances. Occasional Publ. No. 24, Boreal Institute for Northern Studies. Edmonton, Alberta.

INTERNATIONAL INVITED PRESENTATIONS:

2008 Plasticity in ecophysiological traits of western U.S. conifers along elevational and latitudinal gradients: implications for response to environmental uncertainty. Invited, Keynote Address, 23rd IUFRO Conference for Specialists in Air Pollution Effects on Forest Ecosystems, Murten, Switzerland, Sept, 2008. Pg. 73, In: Schaub, M., Kaennel Dobbertin, M., Steiner, D. (eds) 2008. Air Pollution and Climate Change at Contrasting Altitude and Latitude, 23rd IUFO Conference for Specialists in Air Pollution and Climate Change Effects on Forest Ecosystems, Murten, Switzerland, 7-12 Sept 2008. Abstracts. Birmensdorf, Swiss Federal Research Institute WSL. 162. pp.

2006 Air pollution increases forest susceptibility to wildfires. IUFRO Pre-conference Symposium, Air pollution and wildfires. Also presented at SUNY ESF Spring Seminar Series, below.

2005 Plant defense and avoidance from ozone under global change. IUFRO World Conference, Working group 7.04, Session 065, 12th August, Brisbane, Australia (co-author with M Tausz presenting).

2005 Strong oxidants induce aberrant stomatal behavior. Organized oral session, Ecological Society of America, 7th August, Montreal, Quebec.

2004 Physiological responses of trees to air pollutants at high elevation sites. Plant Responses to Air Pollution and Global Changes. Tokyo, Japan (co-authored with D. Grill presenting)

2004 Analyzing effects of forest fires on diurnal patterns of ozone concentrations. Plant Responses to Air Pollution and Global Changes. Tokyo, Japan. (co-author with A Bytnerowicz presenting)

2004 Stomatal behavior in high O_3 and CO_2: a review and case example from a thermal springs. 21st International Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, Environmental Stressors Working Group, 7.04, IUFRO, Oulu, Finland (co-author with E Paoletti presenting)

2004 Physiological basis of ozone injury. 5th Joint Meeting, Western Forest Insect and Western International Forest Disease Work Conference, San Diego, CA

2001 The effect of O_3 uptake and drought stress on carbon acquisition of ponderosa pine. University of Munnich, Germany.

2001 Modeling O_3 uptake and the effect of environmental stressors on carbon acquisition of ponderosa pine. University of Vienna, Austria.

2001 Deciduous conifers: response of ponderosa pine to high O_3 exposure and high N deposition. Autumn Symposium Series, University of Graz, Austria.

2001 Topics in physiological stress responses to O_3 exposure. Invited graduate level course co-taught with Dr. Michael Tausz, seven 2 h lectures. University of Graz, Austria

2000 An analysis of short-, medium-, and long-term O_3 exposure in influencing stomatal conductance of ponderosa pine. 19th Internat'l Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, Environmental Stressors Working Group, 7.04, International Union of Forestry Research Organizations, Houghton, MI

1999 Seasonal changes in carbohydrate pools of ponderosa pine in stands under differing environmental stressors. 2nd Internat'l Symp., Dynamics of Physiological Processes in Woody Roots, Nancy, France

1998 Changes in below- and aboveground growth in ponderosa pine across a pollution gradient in southern California. 18th Internat'l Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, Environmental Stressors Working Group, 7.04, International Union of Forestry Research Organizations, Edinburgh, Scotland

1995 Seasonal changes in sensitivity of 5 conifers to air pollution. Air Pollution Workshop, Cuernavaca, Mexico

NATIONAL OR REGIONAL INVITED PRESENTATIONS:

2008 Ozone effects on Sierran ecosystems. Sequoia and Kings Canyon Research Workshop, 4 September 2008. Porterville, CA.

2008 Effects of ozone on Sierran conifers. National Public Radio interview, June 2, 2008, Grass Valley, CA. (invited panelist), podcast: http://www.capradio.org/programs/insight/default.aspx?showid=4785&programid=10

2008 A link between air pollution, tree drought stress, and bark beetle outbreaks in southern California. Forest Leadership Team meeting, Sequoia National Forest, June 19, 2008, Kernville, CA. (invited oral presentation).

2008 A link between air pollution, tree drought stress, and bark beetle outbreaks in southern California. Forest Leadership Team meeting, San Bernardino National Forest, April 17, 2008. (invited oral presentation).

2008 A link between air pollution, tree drought stress, and bark beetle outbreaks in southern California. Forest Leadership Team meeting, San Bernardino National Forest, April 17, 2008. (invited oral presentation).

2008 Implications of global change for management of mid elevation Californian forests. Regional forest Leadership Meeting (CA-wide), April 2, Sacramento.

2008 A link between air pollution, tree drought stress, and bark beetle outbreaks in southern California. Sierra Ozone Summit, June 3, 2008, Grass Valley, CA. (invited oral presentation).

2008 Air pollution increases forest susceptibility to wildfires in southern California. International Symposium on Fire Economics, Planning, and Policy, 30 April, 2008, San Juan, Puerto Rico.

2007 Air pollution increases forest susceptibility to wildfires. Fall Colloquium, Department of Environment, Population, and Organismal Biology, University of Colorado, Boulder, CO. Dec 14, 2007.

2007 A link between air pollution, tree drought stress, bark beetle infestation, and forest susceptibility to wildfires. California Pest Council, Woodland, CA Nov 14, 2007

2007 Effects of global change on the phenology of arctic plants. USGS, Tucson, AZ, April, 2007.

2006 Air pollution increases forest susceptibility to wildfires. Environmental Sciences and Forestry, State University of NY, Syracuse. Spring Seminar Series, March 28, 2006. Also presented at the following venues:

- Fire Caucus, July 25, 2006, USDA Forest Service, western-wide meeting on fire science, Seattle, WA
- USGS, National Biological Survey, Aug 28, 2006, Oakland, CA
- Forest Health Symposium, Sept 12, 2006; San Bernardino National Forest, San Bernardino, CA.
- Biology Department Seminar, Oct 27, 2006: California State University, Pomona, CA

2006 Air pollution-driven genetic change in yellow pine in Sequoia National Park. Symposium, Air Pollution Research in our National Parks. Air Pollution Workshop, Charlottesville VA

2006 Developing a tool to remotely sense tree canopy health using near-surface fire planes. Environmental Sciences and Forestry, GIS working group, State University of New York, Syracuse, March 27, 2006.

2004 The effects of O_3 and [O_3 + drought] on morphological and biochemical canopy attributes in Jeffrey pine. 36^{th} Air Pollution Workshop Symposium on CO_2 and pollutant interactions, Rhineland, WI

2003 Hot topics in O_3 injury assessment. O_3 working group, FHM Annual Meeting, Monterey, CA

2002 Physiological responses of ponderosa pine to O_3: implications for Monterey pine. Monterey Pine Conservation Consortium, Hearst Castle, CA.

2002 A statistical approach allowing cross-site comparisons of biological response to cumulative O_3 exposure or flux. Workshop on determining critical pollutant loads. November 13-15, Riverside, CA

2001 Ozone effects on giant sequoia. Spring Symposium, Biology Department, California State University, Los Angeles.

1999 Deciduous conifers: high N deposition and O_3 exposure effects on ponderosa pine in the Transverse Range, California. Spring Symposium, Biology Department, San Diego State University.

1999 Ponderosa pine response to environmental stressors: are there differences across tree age classes? Ponderosa Pine Symposium, US EPA, Corvallis, OR

1998 The role of early, late, and whole season O_3 exposure in photosynthetic decline of ponderosa pine. Air Waste Management Assoc, 14-18 June, San Diego, CA

1998 The effect of drought stress and N deposition in modifying ponderosa pine response to high O_3 exposures. Air Pollution Workshop, Boone, NC
1997 Atmospheric pollution as a disturbance vector in forest ecosystems. Spring Seminar Series, Dept. of Forest Science, Oregon State University, Corvallis, OR
1996 Ecophysiology of six age classes of giant sequoia: implications for response to atmospheric pollution. Health of Ecosystems, Fall Seminar Series, UC Davis
1996 Correlation of morphological, physiological, and nearest neighbor characteristics with visible O_3 injury in ponderosa pine. Air Pollution and Climate Change Effects of Forest Ecosystems, International Symposium, Joint meeting of US-Eastern European Scientific Communities, Riverside, CA
1995 Tree-age class differences in physiological characteristics. Ozone Program, Spring Seminar Series, Environmental Research Laboratory, EPA, Corvallis, OR
1994 Variability in CO_2 flux from upland tundra. Joint FS-NOAA Workshop on Global Change and the Boreal Forest, Boulder, CO
1992 2 to 2,000 yrs: Scaling up in Giant Sequoia. Department of Forestry, Fall Seminar Series on Canopy Processes, University of Washington, Seattle, WA
1991 Vegetation response to CO_2 enrichment. Joint FS-NOAA Workshop on Atmospheric Exchanges in the Arctic, Boulder, CO
1980 Ecosystems and their use in SW Alaska. Smithsonian Institute, Washington, DC

PROFESSIONAL ACTIVITIES:

2009 Host, NE-1013 USDA Annual Project Meeting, Ozone effects on plants and ecosystems. Riverside, CA.
2008 Speaker, "Emerging threats to ecosystem health," Water, Air, and Soil Program, Program Review, Washington Office, 24-26 April, 2008. Invited.
2006 Field tour of ozone injury in Sequoia National Park for the working group, 7.01, Air pollution and climate change effects on forest trees. Bi-Annual IUFRO meeting, Riverside, CA
2006 Organization and summary of poster session, Bi-Annual IUFRO meeting, Riverside, CA
2005 Co-chaired Organized Oral Session with Howie Neufeld, Effects of ozone, from molecular to landscape level. Ecological Society of America, Montreal, Quebec.
2004 Symposium chair, Interactions of elevated CO_2 and O_3. Pre-workshop Symposium, 36^{th} Air Pollution Workshop, Rhinelander, WI
2004 Field tour of ozone injury in Sequoia National Park for the working group, NA1150, O_3 effects on forests and agricultural systems. (D Grantz, Local Coordinator, Kearney Agricultural Station, CA)
2004 Western National Park Service Panel to set ozone critical levels, Riverside, CA
2003 Panel Manager, USDA NRI Managed Ecosystem Panel, 95 proposals.
2002 Chair, Workshop: Pollution as a vector of community change. Ecological Society of America Annual Meeting, Tuscon, AZ
2002 Scientific panel review member, US EPA Watersheds, Washington, DC; presented 20 proposals
2001 Session chair, N deposition effects on terrestrial ecosystems, 5th Internat'l Symposium, Responses of Plants Metabolism to Pollution and Global Change, Pulawy, Poland.
2001 Chair, Workshop, "The role of background pollution in interpreting forest ecosystem response to CO_2 enrichment," Ecological Society of America Annual Meeting, Madison, WI
1999 Scientific panel review member, US EPA Ecosystem Health, Washington DC; presented 20 proposals

1999 Scientific panel review member, NSF Polar Programs, Arlington, VA; presented 3 modeling proposals representing $5 mil research (all 3 were funded)
1998 Chair, Air Pollution Workshop, Boone, NC
1998 Scientific panel review member, Western DOE Program (WESTGEC), Davis, CA; presented 8 proposals
1998 Scientific panel review member, NSF Polar Programs, Arlington, VA; presented 10 proposals
1995 Session chair, Atmospheric Deposition to Forest Canopies, Air Pollution Workshop, Cuernavaca, Mexico

OFFERED PRESENTATIONS & ABSTRACTS AT PROFESSIONAL MEETINGS:

*2008 Stomatal responses of European beech to short term chronic and acute O_3 concentrations, 23rd IUFRO Conference for Specialists in Air Pollution Effects on Forest Ecosystems, Murten, Switzerland, Sept, 2008. Pg. 87, In: Schaub, M., Kaennel Dobbertin, M., Steiner, D. (eds) 2008. Air Pollution and Climate Change at Contrasting Altitude and Latitude, 23rd IUFO Conference for Specialists in Air Pollution and Climate Change Effects on Forest Ecosystems, Murten, Switzerland, 7-12 Sept 2008. Abstracts. Birmensdorf, Swiss Federal Research Institute WSL. 162. pp.
*2008 Ozone amplifies short-term water loss from mature trees by slowing down stomatal dynamics. Pg. 37, In: Schaub, M., Kaennel Dobbertin, M., Steiner, D. (eds) 2008. Air Pollution and Climate Change at Contrasting Altitude and Latitude, 23rd IUFO Conference for Specialists in Air Pollution and Climate Change Effects on Forest Ecosystems, Murten, Switzerland, 7-12 Sept 2008. Abstracts. Birmensdorf, Swiss Federal Research Institute WSL. 162. pp.
*2008 Comparison of ozone fluxes as determined above-canopy, at the canopy and the leaf level in a mixed beech/spruce stand. Pg. 110, In: Schaub, M., Kaennel Dobbertin, M., Steiner, D. (eds) 2008. Air Pollution and Climate Change at Contrasting Altitude and Latitude, 23rd IUFO Conference for Specialists in Air Pollution and Climate Change Effects on Forest Ecosystems, Murten, Switzerland, 7-12 Sept 2008. Abstracts. Birmensdorf, Swiss Federal Research Institute WSL. 162. pp.
2008 Defining a mechanistic link in Jeffrey pine among stand thinning, drought, and risk of mortality from Jeffrey pine beetle, *Dendroctonus jeffreyi*. Managed Ecosystems Program Director Meeting, May 19, 2008, Madison, WI. (poster presentation by Seybold).
2008 Defining a mechanistic link in Jeffrey pine among stand thinning, drought, and risk of mortality from Jeffrey pine bettle, *Dendroctonus jeffreyi* Hopkins. 59th Annual Western Forest Insect Work Conference, April 7-10, 2008, Boulder, CO (offered poster presentation).
2008 A link between air pollution, tree drought stress, bark beetle outbreaks, and wildfire in southern California. Air Pollution Workshop, April 8, 2008, Raleigh, North Carolina (offered poster presentation).
2008 Air pollution increases forest susceptibility to wildfires in southern California. International Symposium on Fire Economics, Planning, and Policy, 29 April-2 May, San Juan, Puerto Rico.
2008 Effects of elevated CO_2 and O_3 on gas exchange characteristics of loblolly pine. 40th Annual Air Pollution Workshop, 7-12 April, 2008, Raleigh, NC.
2008 Effect of elevated CO_2 and O_3 on stomatal responsiveness to dynamic light conditions in European beech and loblolly pine. USDA Working Group, NE-1013, 15-16 May, Auburn, Alabama.

2007 Air pollution increases forest susceptibility to wildfires in southern California. Forest Health Monitoring meeting, 1/30-2/1, San Diego, CA. Abstract and poster presentation.
2007 Effects of 8 years of N amendment on canopy health of Jeffrey pine in mesic and xeric microsites. Ecological Society of America, August 6, 2007, San Jose, CA.
2006 A link between air pollution and forest susceptibility to wildfires in southern California. Assessment of Risk of Threats to Forest Health. USDA FS (and cooperators) meeting, July 11-13, 2006, Boulder, CO. **Also given**: Fire Caucus Meeting, USDA FS, Seattle, WA, July 25-26, 2006; **Also given**: USGS brown bag lunch seminar, Menlo Park, CA, August 28, 2006
2005 First direct measurements of foliar ozone uptake in crop and native tree species. 5th Meeting, EU-ECE Workshop, Critical levels of O_3. Obergurgl, Austria 15-19 November. **Also given**: Air Pollution Workshop, Charlottesville, VA, April 12-14, 2005.
2004 California black oak response to N-amendment at an N-saturated site. 21st International Meeting for Specialists in Air Pollution Effects on Forest Ecosystems, Environmental Stressors Working Group, 7.04, International Union of Forestry Research Organizations, Oulu, Finland
2004 Stomatal response of Holm oak to ozone spikes in ambient and long term elevated CO_2. 36th Air Pollution Workshop on CO_2 and pollutant interactions, Houghton, MI
2003 Tree ring indices and isotope signatures of *Pinus ponderosa* related to historic O_3 changes outside Los Angeles. America Geophysical Union, December, San Franscisco, CA.
2003 Tree-level N limitation at an N-saturated site: an example from California black oak. Ecological Society of America (ESA) Annual Meeting Abstracts 88(90), Savanna, Georgia; and CEA-CREST 4th Annual Environmental Science Conference, May 30-31, Pasadena, CA.
2003 Carbon sequestration in mixed conifer forests in the San Bernardino Mountains Exposed to O_3 and chronic nitrogen deposition. 10th North American Forest Soils Conference, July 20-24th, Saulte Ste. Marie, Ontario, Canada
2003 Source of variability in field assessments of O_3 injury in western conifers. Forest Health Management (FHM) Annual meeting, Monterey, CA
2003 A statistical tool for identifying biological threshold responses to O_3 exposure or uptake. FHM Annual meeting, Monterey, CA
2002 Why are the stomata of ponderosa pine open at night? ESA, Tuscon, AZ
2002 Environmental control of stomatal behavior: PPFR, VPD, and O_3? ESA, Tuscon, AZ
2001 Canopy transpiration of Jeffrey pine in mesic and xeric microsites: implications for O_3 uptake and biological response. 5th Internat'l Symposium, Responses of Plants Metabolism to Pollution and Global Change, Pulawy, Poland.
2001 Modeling O_3 uptake and the effect of environmental stressors on carbon acquisition of ponderosa pine. University of Florence, Italy; poster session, Air Pollution Workshop, Riverside, CA
2001 Simulating ninety-five years of O_3 exposure on ponderosa pine. Transactions, Illinois Academy of Sciences, 94:88. 93rd Annual Meeting, Illinois State Academy of Science, MacComb, IL, April 20-21, 2001.
2001 Canopy transpiration of Jeffrey pine in xeric and mesic microsites. ESA, Madison, WI
1999 Deciduous conifers: high nitrogen deposition and O_3 exposure effects on ponderosa pine in the Transverse Range, California. ESA, Spokane, WA
1998 Ozone exposure and N deposition reduces root biomass in ponderosa pine. ESA, Baltimore, MD
1997 Mechanisms of ponderosa pine response to O_3 uptake. ESA, Albuquerque, NM
1996 Response of a simple white spruce ecosystem to elevated CO_2. Air Pollution Workshop, Raleigh, NC

1995 Age-class differences in physiological response of ponderosa pine and implications for effects of environmental stresses. ESA, Snowbird, UT

1995 Individual tree O_3 uptake by mature giant sequoia and ponderosa pine; Air Pollution Workshop, Cuernavaca, Mexico.

1994 Growth and allocation of Douglas fir seedlings in response to CO_2, temperature, and nitrogen. ESA, Knoxville, TN

1993 Physiological characteristics of species of the mixed conifer zone along a large latitudinal gradient. ESA, Madison, WI

1993 Change in physiological characteristics from seedlings to mature trees in giant sequoia: implications for response to current and future levels of atmospheric pollutants. Proceedings, International Union of Forest Research Organizations (IUFRO) workshop, Ecophysiology and Canopy Processes, Viterbo, Italy

1991 Elevated CO_2 response of 2 full-sib families of ponderosa pine. ESA, San Antonio, TX

1991 Effects of recent and predicted global change on arctic ecosystems. ESA, San Antonio, TX

1991 Chronic and acute O_3 exposure of giant sequoia at canopy level. ESA, San Antonio, TX

1990 Seasonal photosynthetic response of five western conifers to O_3 fumigation. ESA, Toronto, Canada

1989 Photosynthetic response of giant sequoia seedlings and rooted mature cuttings to O_3 fumigation. ESA, Toronto, Canada; also presented at the Air Pollution Control Association, Anaheim, CA

1988 Seasonal response of ecosystem flux of Alaskan tussock tundra to elevated CO_2, and experimental manipulations of light, CO_2, and temperature. ESA, Davis, CA

1988 Plant reproductive strategy and population dynamics in response to seasonal elevated CO_2. ESA, Davis, CA

1986 Primary plant succession and soil development on an upland tundra surface. ESA, Syracuse, NY

1984 Comparative life history strategies of two high arctic grasses. ESA, Fort Collins, CO

1982 Drought tolerance of two high arctic grass species. AAAS, Arctic Division, Fairbanks, AK

1982 Demography of *Phippsia algida* in a heterogeneous microenvironment. ESA, State College, PA

1982 Population dynamics of saxifrages in the High Arctic. 11th Arctic Workshop, INSTAAR, University of Colorado, Boulder, CO

1981 Ecology of two high arctic grass species. 10th Arctic Workshop, INSTAAR, University of Colorado, Boulder, CO

1979 Vegetational regeneration 50 yrs after fire at treeline in the Front Range, CO. 52nd Annual Meeting, Northwest Science Association, Bellingham, WA

SOCIETIES:

- Member, Ecological Society of America since 1982
- Active participant in IUFRO, Working Group 7.04 since 1994
- Air Pollution Workshop participant since 1989; Elected Chair in 1998 & 2009
- Air Pollution Workshop Steering Committee: 1996-1998; 2007-2010;
- American Association of Plant Physiologists, member 1982-1988
- Member, American Association for the Advancement of Science, member 1982-2007

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*, Plaintiffs, v. MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*, Federal Defendants, and TUOLUMNE COUNTY ALLIANCES FOR RESOURCES & ENVIRONMENT, *et al.*, Defendant-Intervenors, and CALIFORNIA SKI INDUSTRY ASS'N, and QUINCY LIBRARY GROUP, *et al.*, Defendant-Intervenors.	Case No.: CIV-S-05-0205 MCE/GGH **DECLARATION OF CHRISTOPHER J. FETTIG**

I, Christopher J. Fettig, declare as follows:

1. I hold a Bachelor of Science degree in Forestry and Master of Science degree in Entomology[1] from Virginia Polytechnic Institute and State University, and a Doctorate of Philosophy degree in Entomology from The University of Georgia. Since 2001, I have been employed as a Research Entomologist at the Pacific Southwest Research Station, USDA Forest Service. My research program has three major emphases: (1) determination of the effects of mechanical fuel treatments and prescribed fire on forest health, (2) development of chemical, silvicultural, and semiochemical-based monitoring and management tactics for bark beetles, and (3) determination of the role of semiochemicals in the behavior of bark beetles.

2. To date, I have authored or co-authored over 90 publications on various aspects of forest health and made over 110 presentations at technical and scientific meetings. I was awarded the Forest Service Chief's Early Career Scientist Award in 2005 and the President's Early Career Award for Scientists and Engineers in 2006. I am the Entomology Discipline Leader for the Fire and Fire Surrogate Study (www.frames.nbii.com) and hold editorial positions at the scientific journals Forest Science and Forest Ecology and Management. In 2006, I led a team of scientists that reviewed the state of our knowledge on the effectiveness of vegetation management practices for mitigating the negative impacts of insects on forest ecosystems. This effort resulted in publication of a peer-reviewed synthesis based on examination of 498 scientific publications (Fettig et al. 2007), and serves as the basis for much of my declaration. I have attached an abbreviated version of my Cirriculum Vitae (the complete version is approximately 50 pages).

3. I have reviewed the standards and guidelines for both the 2001 and 2004 Sierra Nevada Framework decisions, and offer the following based on my experience studying the

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[1] Entomology is the scientific study of insects.

effects of fuel management treatments on forest health, particularly in reference to bark beetle infestations. My central thesis is that silvicultural prescriptions specifically designed for reducing wildfire intensity, severity, and extent (i.e., reduction of surface fuels, increasing the height to live crown, decreasing crown density and retaining large trees of fire-resistant species; Agee and Skinner 2005) differ from those implemented for reducing stand susceptibility to bark beetle attack. In the latter case, crown or selection thinning (i.e., removal of larger trees in the dominant and codominant crown classes) may be required to achieve target threshold stand densities, residual tree spacing, and significant reductions in the abundance of preferred hosts necessary to reduce stand susceptibility to bark beetle attack.

4. Preferred hosts of bark beetles are often stressed, larger-diameter trees that contain abundant food resources for significant brood production (Amman 1972, Shrimpton and Thomson 1985). Bark beetles are a large and diverse group of insects consisting of approximately 550 species in North America, but relatively few (less than 12 species) cause large amounts of tree mortality in the Sierra Nevada. Since bark beetles are intimately associated with their host trees, defining terms like "larger diameter" is beyond the scope of this declaration. However, "larger diameter" trees generally refer to those trees in the dominant or co-dominant classes in a given stand, meaning the larger trees that dominate the overstory. In the Sierra Nevada, these trees may be as small as 10" dbh (diameter at breast height) in lodgepole pine stands or several times larger in ponderosa pine stands. Trees 20"-30" dbh, which appear to be an important difference between the 2001 and 2004 Framework decisions, are often prime targets for bark beetles (see below).

5. Bark beetles are commonly recognized as important tree mortality agents in western coniferous forests. The last decade has seen unprecedented levels of tree mortality in spruce forests of south-central Alaska and the Rocky Mountains, lodgepole pine forests of western Canada and the Rocky Mountains, pinyon-juniper woodlands of the southwestern U.S.,

and ponderosa pine forests of Arizona and California. In all cases, bark beetle epidemics were a significant contributing factor. Today, about 8% (23.5 million hectares) of U.S. forests are classified at risk to insect and disease outbreaks (defined as >25% of stand density will die in the next 15 years) (Krist et al. 2007). California is the highest ranked among all U.S. states for risk of bark beetle-caused tree mortality (Krist et al. 2007, p. 55; Fig. 1), the majority of which is concentrated in the Sierra Nevada.

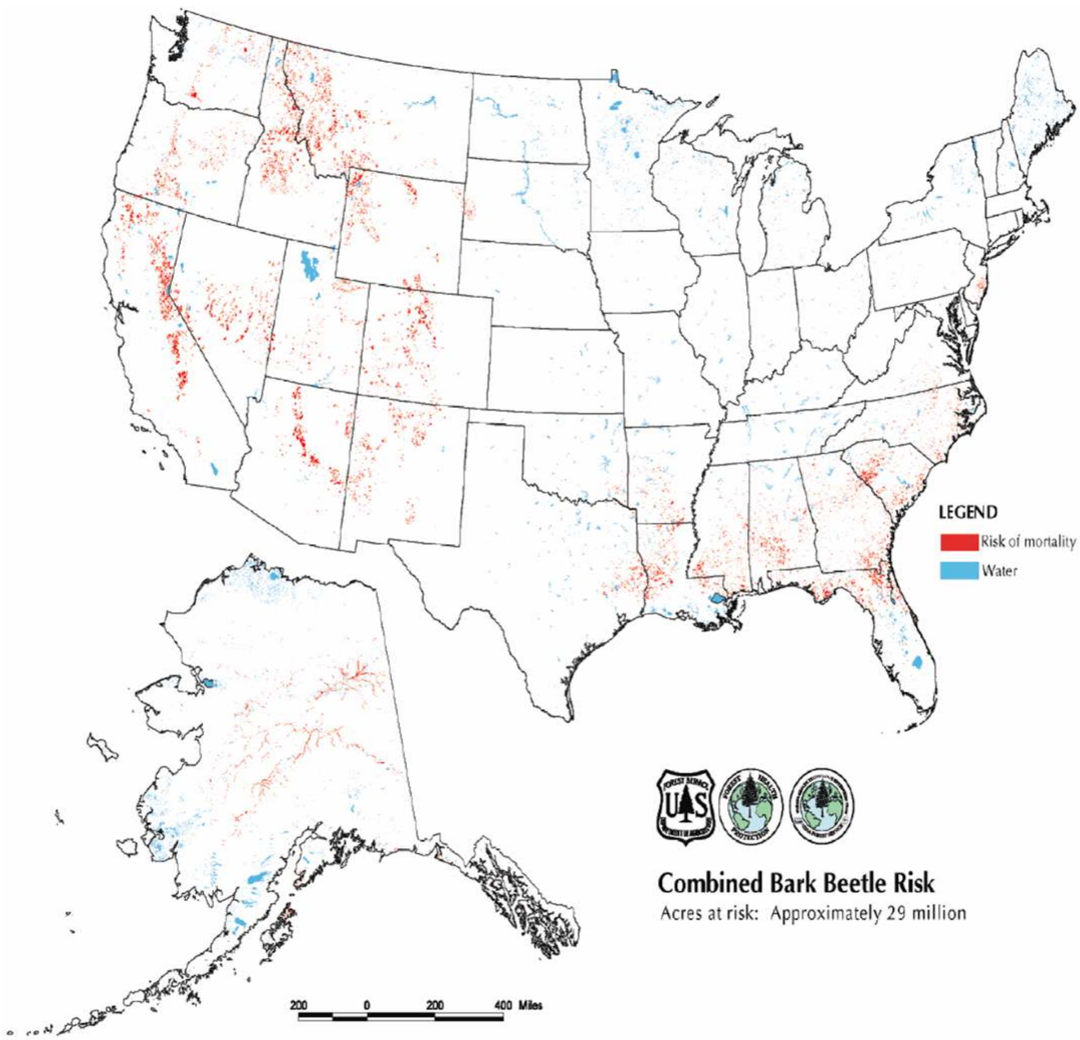

Figure 1. Much of the risk of tree mortality in the western U.S. is attributed to bark beetle infestations.

6. Most notable in the Sierra Nevada are outbreaks of the western pine beetle, mountain pine beetle, Jeffrey pine beetle, pine engraver, and fir engraver. Depending on the bark beetle species and numerous other factors (Fettig et al. 2007), the extent of tree mortality

may be limited to small spatial scales (e.g., small groups of trees) or impact extensive areas (e.g., greater than 9 million hectares), such as recently observed in lodgepole pine forests of British Columbia, Canada (Westfall and Ebata 2008). In California, the amount of tree mortality attributed to western pine beetle reached unprecedented levels a few years ago, when approximately 61,000 hectares were impacted (USDA Forest Service 2002).

7. Native tree-killing bark beetles are a natural component of forests and impact forest ecosystems in variety of ways. Some impacts are perceived as beneficial to forest health (e.g., nutrient cycling), while others are considered detrimental. Typically, this varies based on the scale and magnitude of their impact and the specific tree species and size classes that are affected. Among other impacts, bark beetle attacks reduce tree growth and hasten decline, mortality, and subsequent replacement by other tree species. Infestations may impact timber production, water quality and quantity, fish and wildlife populations, recreation, grazing capacity, biodiversity, endangered species, and cultural resources (Mattson 1977, Coulson and Wunneburger 2000, Fettig et al. 2007). Managing and predicting the impacts of bark beetles on forests requires an understanding of the normal conditional states of the forest and of individual stands that comprise the forest. Climate change may exacerbate bark beetle impacts as short-term effects on forest ecosystems, primarily their structure and composition, will be manifested through increased frequency and severity of disturbances, such as bark beetle outbreaks (Bentz et al. 2008).

8. Individual trees utilize growth factors, such as sunlight, water, nutrients, temperature, oxygen, and carbon dioxide until one or more factors become limiting. Therefore, a forest contains a certain amount of intangible growing space, which varies spatially and temporally. Fettig et al. (2007) concluded that recent changes in forest structure and composition caused by natural processes and management practices have led to increased competition among trees for growing space (i.e., largely due to overstocking), thereby increasing their susceptibility to bark beetles.

9. Factors such as stand density, tree diameter, and host density are consistently identified as primary attributes associated with bark beetle infestations (Fettig et al. 2007). For example, Craighead (1925) and Miller (1926) were among the first to demonstrate that slower growing ponderosa pines were more susceptible to western pine beetle attack. Further investigations (Person 1928, 1931) indicated that western pine beetle exhibits a preference for trees 20”-30” dbh, which led to development of a classification system for rating ponderosa pine susceptibility to western pine beetle (Keen 1936; this and related works reviewed by Miller and Keen 1960). Since that time, a considerable amount of effort has been devoted to the identification of tree and stand conditions associated with bark beetle attack in western coniferous forests. Most of this work has occurred outside the Sierra Nevada (e.g., in the Intermountain and Rocky Mountain regions), but results are generally applicable to similar cover types growing in the Sierra Nevada.

10. In the Southern Cascades of California, Fettig et al. (2008) found a significant correlation between trees per hectare and percentage of trees killed by bark beetles, and between the percentage of pine trees killed by bark beetles and basal area[2], trees per hectare, and stand density index (SDI)[3]. And, while no significant correlations were found between measures of stand density and the percentage of white fir killed by the fir engraver in one study (Fettig et al. 2008), Ferrell et al. (1994) reported a significant positive relationship between fir engraver-caused tree mortality and white fir basal area during an extended drought in the Lake Tahoe Basin. Oliver (1995) reported that the density of even-aged stands of ponderosa pine in California was controlled by mountain and western pine beetle-caused tree mortality, and that bark beetle-caused tree mortality created a limiting (maximum) SDI of 365. He also concluded that Sartwell's threshold of 34 m^2/hectare (Sartwell and Steven 1975), above which ponderosa pine stands are most susceptible to mountain pine beetle attack, appears to be a reasonable

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[2] Basal area is a measure of the cross-sectional area of trees at breast height.

[3] SDI is a measure of average stand density, based on the relationship between numbers of trees and tree size.

average value for California. Overall, the literature clearly supports the notion that the more trees there are in a given area, the higher the probability that significant amounts of bark beetle-caused tree mortality will occur (Fettig et al. 2007).

11. One of the first published accounts of thinning to reduce mountain pine beetle damage in ponderosa pine was based on the supposition that trees would be less likely to succumb to attack if their vigor was increased by removing competition from surrounding trees (Eaton 1941). Furthermore, Fiddler et al. (1989) showed that thinning significantly reduced the amount of ponderosa pine mortality caused by mountain pine beetle in northeastern California. No tree mortality occurred in stands of <9 m^2/hectare of basal area, which is consistent with the optimal stocking level of 11m^2/ hectare described by Oliver (1979, 1995).

12. In their synthesis, Fettig et al. (2007) discussed why thinning is effective for reducing the occurrence of bark beetle infestations. Contrary to popular thought, the effectiveness of thinning is not solely limited to reducing tree competition, increasing residual tree vigor, and thus decreasing stand susceptibility to bark beetle attack. Thinning not only affects the vigor of residual trees (which is still very important), but also the physical environment within these stands. Increased temperatures and windspeeds are common within thinned stands, and may accelerate the development of certain bark beetle species and force them to overwinter in stages that are more susceptible to freezing, or cause air turbulence that disrupts pheromone plumes (Thistle et al. 2004, 2005) used for recruiting other beetles of the same species during initial phases of host tree colonization (i.e., most bark beetles produce aggregation pheromones that concentrate individuals in sufficient quantities to overwhelm tree defenses). A lack of beetle recruitment to each tree often results in unsuccessful attacks and tree survival. Others have stated that thinning strategies to reduce stand susceptibility to bark beetle attack must address residual inter-tree spacing (Geiszler and Gara 1978). In British Columbia, Whitehead and Russo (2005) suggested increases in resin production (i.e., a measure of host vigor) were not as important in reducing mountain pine beetle-caused tree mortality at the stand

level as reductions in the number of initiated attacks, which is more likely associated with inter-tree spacing.

13. It is important to note that thinning conducted principally for reducing stand susceptibility to bark beetle attack (i.e., which concentrates on the abundance and distribution of preferred hosts) requires different prescriptions than for reducing fire hazard (i.e., which concentrates on removal of surface and ladder fuels). Larger trees within a single species are generally more fire-resistant (Regelbrugge and Conard 1993); however, tree diameter is positively correlated with the likelihood of bark beetle attack for several species (Fettig et al. 2007). Therefore, while the removal of large diameter trees may not be necessary for fuel reduction purposes in most stands, it may directly reduce the susceptibility of individual trees and stands to bark beetle attack.

14. For example, the mountain pine beetle usually selects the largest trees in the stand (Amman 1978), and therefore harvesting of larger diameter trees may be desired for reducing stand susceptibility to bark beetle attack. Therefore, to reduce the susceptibility of a stand to bark beetle attacks, it may be appropriate to harvest trees greater than 10" dbh in lodgepole pine stands or 20"-30" dbh in ponderosa pine stands. Furthermore, prescribed fire is commonly used to reduce the accumulation of surface and ladder fuels (Agee and Skinner 2005), but sub-lethal heating of critical plant tissue can stress trees, which then are more susceptible to bark beetle attack (Parker et al. 2006), although the effect may be short lived (Breece et al. 2008, Fettig et al. 2008).

15. A variety of vegetation management practices are available to prevent bark beetle infestations from occurring when properly instituted at appropriate spatial and temporal scales. Review of existing bodies of empirical and anecdotal evidence concerning variations in host susceptibility to bark beetle infestation by thinning leads me to several conclusions: (1) Factors involving stand density are consistently associated with the occurrence and severity of

bark beetle infestations. Management to reduce stand susceptibility to bark beetles must address factors related to stand density, and in some cases, target stand densities may be lower than target stand densities for fuels management; (2) Tree diameter is positively correlated with bark beetle attack for several bark beetle species. Management to reduce stand susceptibility to bark beetles may require removal of larger diameter trees than those aimed solely at fuels management; (3) Host density is positively correlated with bark beetle attack. Management to reduce stand susceptibility to bark beetles may require removal of tree species (e.g., ponderosa pine) that are generally more fire tolerant; and (4) Forested landscapes that contain little heterogeneity promote the creation of large contiguous areas susceptible to similar insect outbreaks. Efforts to prevent undesirable levels of bark beetle-caused tree mortality at the landscape level must account for the spatial distribution of both cover types and stand ages. In many areas, treatments should be implemented to increase heterogeneity.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge. Executed this 22nd day of October, 2008.

/s/ Christopher J. Fettig
(Original signature retained by attorney Barclay Samford)

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Fettig, C.J., K.D. Klepzig, R.F. Billings, A.S. Munson, T.E. Nebeker, J.F. Negrón, and J.T. Nowak. 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle outbreaks in coniferous forests of the western and southern United States. Forest Ecology and Management 238:24-53.

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EDUCATION

B.S. FOREST MANAGEMENT (1993)
Virginia Tech University, Blacksburg, VA

M.S. ENTOMOLOGY (1996)
Virginia Tech University, Blacksburg, VA

PH.D. ENTOMOLOGY (1999)
The University of Georgia, Athens, GA

RECENT EMPLOYMENT

PRINCIPAL RESEARCH ENTOMOLOGIST (2007-CURRENT)
Sierra Nevada Research Center, Pacific Southwest Research Station, USDA Forest Service, Davis and Placerville, CA

My research program has three major emphases: (1) determination of short and long-term implications to forest health of mechanical fuel treatments and prescribed fire in the large-scale restoration of fire-adapted forest ecosystems; (2) development of chemical, silvicultural and semiochemical-based monitoring and management tactics for native and exotic forest insect pests, primarily bark beetles; and (3) determination of the role of semiochemicals in the behavior of bark beetles of economic importance.

PRINCIPAL RESEARCH ENTOMOLOGIST AND PROJECT LEADER (2006-2007)
Chemical Ecology and Management of Western Forest Insects, Pacific Southwest Research Station, USDA Forest Service, Albany, Davis, and Placerville, CA

RESEARCH ENTOMOLOGIST AND ACTING PROJECT LEADER (2005-2006)
Chemical Ecology and Management of Western Forest Insects, Pacific Southwest Research Station, USDA Forest Service, Albany, Davis, and Placerville, CA

RESEARCH ENTOMOLOGIST (2001-2006)
Chemical Ecology and Management of Western Forest Insects, Pacific Southwest Research Station, USDA Forest Service, Davis and Placerville, CA

SELECT RECENT AWARDS

CHIEF'S EARLY CAREER SCIENTIST AWARD for "your outstanding contributions to the understanding of the interactions of insects and fire on forest health and the importance of semiochemicals on the behavior and management of tree-killing bark beetles. Your efforts are of vital importance and contribute directly to ecosystem sustainability", Washington, DC, 2005.

USDA FOREST SERVICE MERIT AWARD for efforts associated with "The Effectiveness of Vegetation Management Practices for Mitigating the Impacts of Insects on Forest Ecosystems: A Science Synthesis", Washington, DC, 2006.

PRESIDENT'S EARLY CAREER AWARD FOR SCIENTISTS AND ENGINEERS (PECASE) for "your exceptional leadership in scholarship, service and education", The White House, Washington, DC, 2006. PECASE is the highest honor bestowed by the U.S. government on outstanding scientists and engineers beginning their independent careers.

USDA FOREST SERVICE EXTRA EFFORT AWARD for "outstanding leadership representing the Chemical Ecology and Management of Western Forest Insects (PSW-4502) unit", Albany, CA, 2007.

OTHER NOTABLE

Dr. Fettig currently serves as Associate Editor for *Forest Science*, Special Editor for the forthcoming Special Issue on the Fire and Fire Surrogate study in *Forest Science* and is a Member of the Editorial Board of *Forest Ecology and Management*. He also serves as *Entomology Discipline Leader* for the National Study of Fire and Fire Surrogate (FFS) (http://frames.nbii.gov), a team of federal, state, university, and private land managers and scientists working to provide better information on the consequences of using fire and fire surrogate treatments for fuel reduction and forest restoration. To date, he has made >110 presentations and published >90 papers, and has received 38 extramural grants totaling >$1.3 million.

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*,

Plaintiffs,

v.

MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*,

Federal Defendants,

and

TUOLUMNE COUNTY ALLIANCES FOR RESOURCES & ENVIRONMENT, *et al.*,

Defendant-Intervenors,

and

CALIFORNIA SKI INDUSTRY ASS'N,

and

QUINCY LIBRARY GROUP, *et al.*,

Defendant-Intervenors.

Case No.: CIV-S-05-0205 MCE/GGH

DECLARATION OF DONALD K. GOLNICK

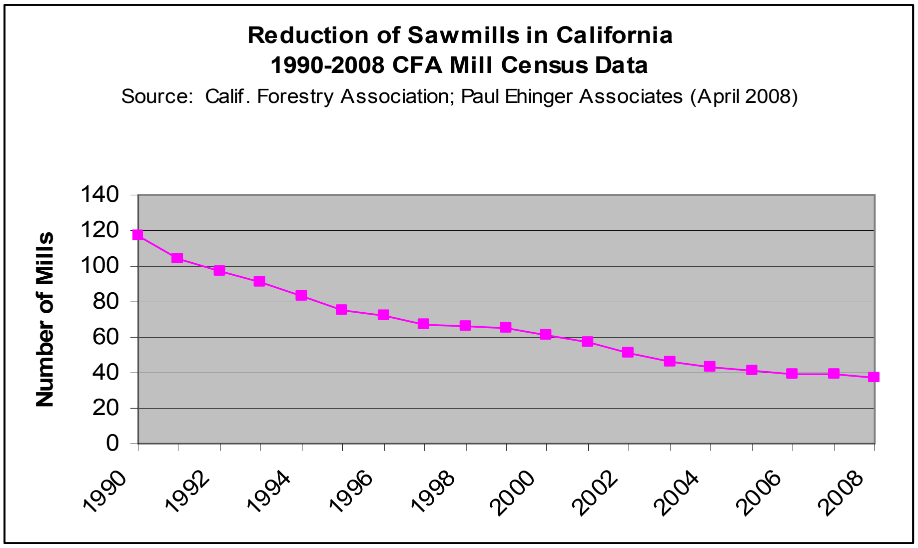
I, Donald K. Golnick, declare as follows:

1. I am the Timber Programs Section Head for the Pacific Southwest Region of the Forest Service, in Vallejo, California. I have served in this position for approximately six years. Previously, I served in a variety of forest management positions on the Six Rivers National Forest, Plumas National Forest, and the Alaska Region of the Forest Service. I have over 30 years experience in silviculture, forest planning, sale preparation and planning, forest measurements, logging engineering, and timber valuation. I earned my Bachelor's degree in Forestry from the University of Minnesota. I have advanced training in Forest Ecology, Silviculture, and Logging Systems Engineering. I have compiled the information in this declaration from various sources including the Forest Service's State and Private Forestry branch, Forest-level timber management personnel, and several industry sources.

Sawmill Status and Trends

2. As displayed in Figure 1, below, a total of 84 wood products mills and factories have closed in California since 1989 (Paul F. Ehinger & Associates, April 2008). There remain 37 mills in operation (see Exhibit 1, attached). Since 1992, 27 mills that processed Sierra Nevada timber have closed down. Primary industry employment went from over 40,000 workers in the late 1980's to about 25,000 in 2000, a decline of nearly 40 percent; primarily because of reduced timber availability (Morgan, Todd A. et al, 2004).

Figure 1:



Recent Sierra Nevada Mill Closures

3. Since 2001, there have been 8 mill closures in the Sierra Nevada (Table 1, below). In addition, one small log mill converted to a cedar fencing plant, which resulted in a loss of infrastructure to process small logs from the Stanislaus National Forest. In 1993, the California Spotted Owl (CASPO) Environmental Assessment (EA) listed 25 sawmill communities (Section IV, Pg. 48). Today, only 8 saw mills and 2 cedar fencing mills conduct business in the Sierra Nevada.

Table 1: Sierra Nevada Mill Closures from 2001 – 2007 (Paul F. Ehinger & Associates, April 2008)

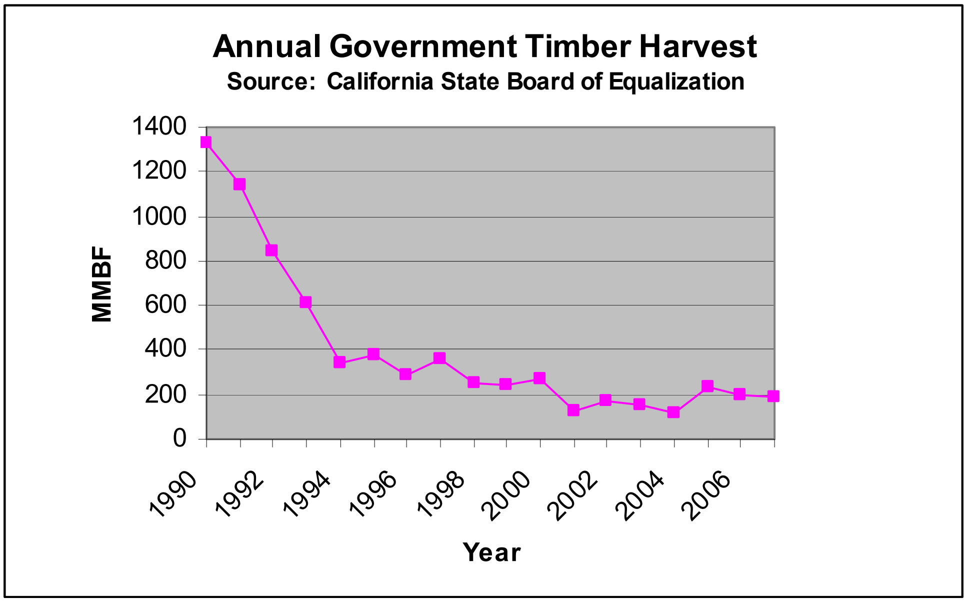
Year	Company
2001	Big Valley Lumber Co. (Bieber)
	Shasta Paper Co. (Anderson)
	Sierra Pacific Ind. (Loyalton)
2002	Cal Cedar Products (Stockton)
	Wisconsin-California (Anderson)
2003	Wetsel-Oviatt (Eldorado)
2004	Sierra Pacific Ind. (Susanville)
2007	Sierra Cedar Products (Marysville)

Trends in Forest Service Timber Volume

4. Restricted timber availability, particularly on federal lands, has exerted a major influence on California's forest products industry, and has been a significant factor in the loss of

sawmills in California (Morgan et al. 2004,). As displayed in Figure 2, below, harvests from federal timberland in California have declined more than 80 percent since 1990.

Figure 2:



5. During the period from 1988 to 1993, the average volume of timber offered for sale by the Forest Service was 879 million board feet per year. From 1994 to 2000, timber offered from the Sierra Nevada National Forests dropped to an average of 353 million board feet per year. This 60 percent decrease was a result of 1993 guidelines restricting timber harvest to protect California spotted owl habitat. The 2001 Framework proposed an additional 70 percent reduction by 2010, to 33 million board feet plus salvage (2001 Framework FEIS Volume 1).

6. Many mills that did rely heavily on Forest Service timber are no longer in business. However, there are a few remaining producers where the availability of Forest Service timber is important to their firm's future, such as the sawmill/biomass facility located in Terra Bella, California.

Biomass/Bioenergy Status and Trends

7. California biomass energy facilities provide an outlet for the low-grade woody biomass generated during forest health and fuels management projects, which is generally too

low in quality to be processed by a sawmill (see Exhibit 2, attached). Bioenergy facilities provide a valuable outlet for disposal of woody biomass, and a clean alternative to disposal of fuels by open burning. Beginning in 1978, the Public Utilities Regulatory Policy Act encouraged the development of renewable energy resources, such as biomass for electrical power generation. By 1990, 61 bioenergy facilities were developed within the state. Ensuing changes in federal and state energy regulations, reductions in timber harvest levels, sawmill closures and reductions in availability of biomass were largely responsible for closure of 29 of these plants. Currently, 30 bioenergy facilities operate in California producing 600 megawatts of power. These 30 facilities consume 5 million bone dry tons of forest, urban, and agricultural biomass each year (Bruce Goines, Forest Service, State and Private Forestry). We estimate that about 14 of these facilities get a significant source of supply from the Sierra Nevada forests.

New Biomass Processing Infrastructure

8. A number of investors are in the planning stages of building facilities to convert woody biomass to usable products. These are summarized below:

Table 2: Proposed New Biomass Processing Infrastructure (Bruce Goines, USFS State & Private Forestry)

Name	Location	Timeframe	Bone Dry Tons/yr	Raw material supply
Bear Mountain Forest Products	Sonora/ Jamestown area	2009	20,000	USFS, (Stanislaus NF)
Enligna US	Port of Sacramento	2009	200,000	Urban, agricultural, private timberlands, USFS (Stanislaus, Tahoe, Eldorado)
California Wood Shavings	Jamestown	2008-2009	70,000 (max)	USFS (Stanislaus NF)

Importance of Infrastructure to Forest Service Land Management

9. Timber sales can be an important tool to meet landscape level fuel reduction and forest health objectives. Where vegetation targeted to be removed has enough commercial value, timber sales can be used to capture this value and invest it in needed fuel reduction work. By reinstating the 2001 Framework, the objective of providing timber outputs is eliminated. As a

result, forests will be only be producing sporadic, economically-marginal timber sales. The March 2003 Sierra Nevada Forest Plan Amendment Review stated that the 2001 Framework would not support the active and successful timber and biomass industries that are so important to the success of any fuel management and forest health strategy (USDA Forest Service, March 2003).

10. The forest health crisis at Lake Arrowhead, in southern California, and subsequent catastrophic wildfire in 2003, is just one example of what can happen when the infrastructure that could have proactively solved a forest health problem no longer exists. The San Bernardino National Forest struggled to dispose of thousands of acres of bark beetle- and drought-killed timber. Due to the lack of timber industry infrastructure, much of this material was left standing dead, and subsequently burned in a wildfire. Due to the lack of a local industry, a good deal of otherwise merchantable timber could not be harvested because the cost of hauling was prohibitive. The Terra Bella sawmill/biomass facility was over 200 miles away. Commercial size trees that could have been manufactured into consumer products were burned in piles, sold as firewood, chipped for soil amendments, utilized by pallet manufacturers, or, as displayed in Figures 3 and 4, burned in air curtain destructors (ACD).[1] Only the largest and most valuable trees were shipped over 200 miles to the nearest sawmill.

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[1] An ACD is a single stage, air sealed incinerator. Burning timber in an ACD is accomplished by providing a very high velocity curtain of air over an earthen fire box (or one with refractory walls).

Figure 3: Disposing of bark beetle and drought killed timber in an Air Curtain Destructor, San Bernardino NF

Figure 4: Disposing of forest vegetation in a Air Curtain Destructor, Lake Tahoe Basin Management Unit

Reinstating the 2001 Framework would in all likelihood result in additional mill and biomass plant closures

11. The estimated annual outputs from the 2001 Framework projected a green timber sale program from all plan forests at 33 million board feet (plus salvage) and 172,000 bone dry tons of biomass (FEIS Volume 1, Sierra Nevada Forest Plan Amendment-page 41-summary). Furthermore, the management review of the 2001 Framework completed in March 2003 concluded that given the projected costs of implementing the 2001 Framework under current and future budget scenarios, only about half of the anticipated annual work would actually be done (USDA Forest Service, March 2003). This level of program is so insignificant, that in all likelihood it would result in additional loss of infrastructure.

12. The Sierra Forest Products mill in Terra Bella, California is especially susceptible; historically, a significant portion of their wood supply came from the Sequoia and Sierra National Forests. According to mill sources, the mill currently employs about 230 individuals (on site and in the woods). This mill infrastructure, and the associated employment, may be lost if the Forest Service were required to revert to the 2001 Framework.

13. The 30 biomass facilities described previously consume approximately 5 million bone dry tons of forest, urban and agricultural biomass each year. Sierra Nevada National Forests provide 10-15% of this biomass (Bruce Goines, Forest Service, State and Private

Forestry) to about 14 of these facilities. Because of the largely isolated locations of most of these facilities (see Exhibit 2, attached), and limited alternative sources of biomass, any reduction in volumes would result in a corresponding reduction in renewable generation capacity, and possibly the closure of the more isolated facilities. The California biomass facilities located in Burney, Chester, Loyalton, Quincy, Sonora, Terra Bella, Westwood and maybe others, would in all likelihood suffer by reversion to the 2001 Framework. Forest biomass is currently the most expensive fuel for the power plants, and the market structure will not support transport of much more than 30 - 50 miles from the forest to the biomass power plant (see Exhibit 2) (Bruce Goines, Forest Service, State and Private Forestry).

14. The 2001 Framework optimistically projected an annual output of around 172,000 bone dry tons, which is approximately 325,000 – 575,000 tons short of current use. The plans for the new biomass infrastructure that investors are currently looking at developing could be in jeopardy because of insufficient raw material from the National Forests, particularly if the Forest Service is required to revert to the 2001 Framework. All of these facilities will be dependent upon the biomass being removed from the woods and available for their use. Volumes of biomass available will be directly affected by diameter limits and the corresponding market value of harvested material that can subsidize biomass removal. Reductions in timber harvest levels, which would result from reversion to the 2001 Framework, could potentially preclude these ventures from investing in California. The 2004 Framework is projected to supply, on an annual basis, 329 million board feet of sawlogs and over 7 million bone dry tons of biomass (USDA Forest Service, 2004). If implemented to the extent projected in the 2004 Framework SEIS, the 2004 Framework would be more than 5 times better than the 2001 Framework in terms of the amount of material available to support the remaining industry and associated employment.

Shift from a Timber Contract Generating Receipts to a Service Contract Dependent on Appropriated Funds

15. Without a viable wood products and bio-energy industry in California, the acres treated to improve forest health and reduce hazardous fuel conditions would be significantly reduced because of the increased expense of treatment. Without the commercial use of the product, the material resulting from treating forest stands may become a disposal issue, as displayed in Figure 5**.**

Figure 5: Material resulting from vegetation treatments that would need to be disposed of if commercial sawmills and biomass facilities are not available.

16. Further, absent a commercial infrastructure, appropriated dollars would have to be used to cover the cost of fuel reduction and forest health treatments, which could normally be borne by the commercial value of the forest products. Treatment costs for fuel reduction may vary from $600 - $2,000/acre or higher for ground-based logging systems (Economic Analysis: Quintette Fuel Reduction Project). Logging using cable systems and helicopters, as is sometimes required on very steep or sensitive terrain, would cost considerably more. In addition, a disposal expense may be incurred to remove the material to a disposal location for burning or placement in a landfill. This cost could range from several hundred dollars to approximately $2,500 dollars per acre, if removed in log form and deposited in a landfill (based on an economic analysis by Air Burners, LLC). Fuels reduction treatment costs on forests (i.e., Lake Tahoe Basin Management Unit, San Bernardino National Forest) that utilize service contracts generally vary

between $1,600 to $2,500/acre, and sometimes higher. Taking such a service contract based approach across the Sierra Nevada would result in budgets that would have to be 3 to 8 times larger than we currently receive. If budgets stay the same, it would likely result in about a 66% to 75% reduction in the number acres that could be treated.

Increased Transportation Costs to Remove Fuels or Move Timber Products for Processing

17. Fewer sawmill facilities equates to longer distances to haul material from the National Forest to a manufacturing or bio-energy facility. These longer haul distances and the increasing cost of transportation has reduced the economic viability of many projects on the National Forests.

18. For example, the Camino mill is essential to the successful implementation of the Eldorado National Forest's timber, fuels, vegetation, and transportation programs under current funding levels (Mike Grimm, Eldorado National Forest Vegetation Program Manager). The loss of the Camino mill would result in an immediate increase in log hauling cost of approximately $25 per hundred cubic feet (CCF), due to a two-hour increased log haul to the next closest mill. Based on average stumpage bid values over the last five years, this increased hauling cost would have the following effects on the Eldorado National Forest vegetation and fuels management programs (assuming no change in funding):

a. Average stumpage value would be reduced from $60.17 per CCF to $35 per CCF (Eldorado National Forest Appraisal Data).

b. Fuel reduction accomplishments would decrease by over 8,000 acres per year.

c. Sales with high proportions of small diameter pine, such as plantation thinning, would not be economically viable timber sales.

d. Less raw material would go to the next closest mill or biomass plant, which could lead to further declines in infrastructure and additional losses of associated jobs.

e. With the loss of mills, competition would be reduced, likely resulting in further decreases in bid values.

Increased Contract Claims and Loss of Investments in Existing Projects

19. There about 9 projects in the Region where decisions have been made-pending appeal and about 61 projects that have passed the appeal period but where contracts have not yet been awarded. Reinstatement of the 2001 Framework could result in the loss of the investments made in these projects.

20. Reinstating the 2001 Framework would in all likelihood result in extensive contract claims to the Forest Service on existing contracts. As of June 2008, the Region had about 88 or more unfinished contracts with total remaining harvest volume of around 70 million board feet. As a result of a contract suspension due to a court injunction, purchasers could file claims for any unrecovered expenditures arising directly from performing the contract that were rendered unrecovered due to delay or interruption. Furthermore, some purchasers could be entitled to liquidated damages for lost profits as a result of contract terminations or long suspensions. The dollar impact of such potential claims is difficult to quantify, but could range from tens to hundreds of millions of dollars. The Region's contract claims database has 58 claims dealing with out-of-pocket expenses, contract suspensions/cancellations, and operations delay. The average claim amount was $838,874. The total is $48 million.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed this 22nd day of October, 2008.

/s/ Donald K. Golnick
(Original signature retained by attorney Barclay Samford)

____

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REFERENCES:

California timber Harvest Statistics 1978 - 2007. California State Board of Equalization @ www.boe.ca.gov/proptaxes/timbertax.htm.

Morgan, Todd A.; Keegan, Charles E., III; Dillion, Thale; Chase, Alfred L.; Fried, Jeremy S.; Weber, Mare N. 2004. California's forest products industry: a descriptive analysis. Gen. Tech. Rep. PNW-GTR-615. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Staion. 55 p.

USDA Forest Service Pacific Southwest Region. 2003. Sierra Nevada Forest Plan Amendment. Management Review and Recommendations. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. March 2003. R5-MB-012. 169 p.

USDA Forest Service. 1993. California Spotted Owl Sierran Province Interim Guidelines Environmental Assessment, Decision Notice, and Finding of No Significant Impact. USDA Forest Service. Pacific Southwest Region. San Francisco, CA. January 1993. 444 pages.

USDA Forest Service. 2004. Sierra Nevada Forest Plan Amendment. Final Supplemental Environmental Impact Statement, Record of Decision. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. January 2004. R5-MB-046. 169 p.

EXHIBIT 1:

California Forest Products Industry
Primary Manufacturers Currently in Operation

1. Agwood Mill & Lumber *[redwood]*, Ukiah
2. Berry's Sawmill *[redwood]*, Cazadero
3. Big Creek Lumber Co. *[redwood]*, Davenport
4. Collins Pine Co. *[dimension/boards]*, Chester
5. Evergreen Pulp *[pulp]*, Samoa
6. Hambro Forest Products *[particle board]*, Crescent City
7. Harwood Products *[cutting/export]*, Branscomb
8. Humboldt Flake Board *[particle board]*, Arcata
9. J.H. Baxter *[preserve]*, Weed
10. Mad River *[redwood]*, Arcata
11. Mendocino Redwood *[redwood]*, Ukiah
12. Pacific Lumber Co. *[redwood]*, Scotia
13. Pacific Lumber Co./Britt Fence *[redwood]*, Arcata
14. R.J.S. Lumber Co. *[redwood]*, Philo
15. Redwood Empire *[redwood]*, Cloverdale
16. Roseburg Forest Products *[veneer]*, Weed
17. Schmidbauer Lumber Co. *[dimension/board]*, Eureka
18. Shasta Green *[cutting/export]*, Burney
19. Sierra Cedar Products *[cedar]*, Marysville
20. Sierra Forest Products *[dimension/boards]*, Terra Bella
21. Sierra Pacific Ind. *[dimension/boards]*, Anderson
22. Sierra Pacific Ind. *[cutting/export]*, Arcata
23. Sierra Pacific Ind. *[dimension/boards]*, Burney
24. Sierra Pacific Ind. *[dimension/board]*, Camino
25. Sierra Pacific Ind. *[dimension/boards]*, Central Valley/Redding
26. Sierra Pacific Ind. *[dimension/boards]*, Lincoln
27. Sierra Pacific Ind. *[cedar]*, Oroville
28. Sierra Pacific Ind. *[dimension/boards]*, Quincy
29. Sierra Pacific Ind. *[dimension/boards]*, Chinese Camp
30. Sierra Pacific Ind. *[dimension/boards]*, Standard/Sonora
31. Sierra Pine *[particle board]*, Martell
32. Sierra Pine *[particle board]*, Rocklin
33. Simpson Timber Co. *[redwood]*, Korbel
34. Simpson/ Redwood *[redwood]*, Orick
35. Sound Studs *[stud]*, Anderson
36. Timber Products Co. *[veneer]*, Yreka
37. Trinity River Lumber Co. *[dimension/boards]*, Weaverville
38. Willits Redwood *[redwood]*, Willits

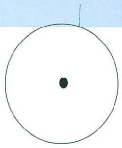
Source: California Forestry Association; Paul F. Ehinger and Associates (July 2007)

EXHIBIT 2:

BIOMASS ENERGY:

Producing Renewable Energy, While Lowering the Risk of Wildfire and Reducing Greenhouse Gases

Location	#Facilities	Net MW
Anderson	1	50
Burney	3	50.5
Chester	1	12
Chinese Station	1	25
Delano	1	50
Dinuba	1	11.5
Fairhaven	1	17.5
Firebaugh	1	25
Fresno	1	25
Lincoln	1	5
Loyalton	1	10
Mecca	1	47
Mendota	1	25
Oroville	1	18
Quincy	1	12.5
Rocklin	1	25
Scotia	1	19
Sonora	1	03.5
Stockton	1	04.5
Terra Bella	1	09.5
Tracy	1	18.5
Wendel	1	30
Westwood	1	12
Williams	1	25
Woodland	1	25
TOTAL	27	556



Approximately 30 miles radius: A rough representation of an economic haul distance without additional incentives to process and transport biomass waste from agricultural, landfill, industrial and in-woods sources.

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IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF CALIFORNIA
SACRAMENTO DIVISION

SIERRA FOREST LEGACY, *et al.*, Plaintiffs, v. MARK REY, in his official capacity as Under Secretary of Agriculture, *et al.*, Federal Defendants, and TUOLUMNE COUNTY ALLIANCE FOR RESOURCES & ENVIRONMENT, *et al.*, Defendant-Intervenors, and CALIFORNIA SKI INDUSTRY ASSOCIATION, Defendant-Intervenor, and QUINCY LIBRARY GROUP, *et al.*, Defendant-Intervenors.	No. CIV-S-05-0205 MCE/GGH **DECLARATION OF JO BRIDGES**

I, Jo Bridges, declare as follows:

1. In my current position, I am Deputy Director of Ecosystem Planning for the Pacific Southwest Region of the U.S. Forest Service. In this position, I supervise the Regional forest plan program leader, who is responsible for managing the forest plan revision efforts for the region. I have held my position for 2 years, 10 months. Prior to that time, I have served as a district ranger in Colorado for 13 years, forest planning and resource officer for 4 years, and coordinator of public involvement for national forest programs in the Forest Service headquarters in Washington, D.C. for 2 years. I have also served on a forest planning team as a linear program analyst, interdisciplinary team leader, and forest planner. My academic background includes a B.A. in Political Science and an M.A. in Environmental Administration, both from the University of California at Riverside. I am preparing this declaration as part of my official duties in my current role.

2. The Pacific Southwest Region is in the process of revising all Sierra Nevada Forest Plans and the status is as follows. There are two forest plan revisions underway: the Lake Tahoe Basin Management Unit is currently collaboratively preparing a proposed forest plan; and the Modoc National Forest is completing a draft Comprehensive Evaluation Report (CER) and anticipates public review of this first step in forest plan revision this winter. The Sequoia National Forest has been scheduled to begin revision, but is currently involved in an intensive public effort to establish a new Giant Sequoia National Monument management plan. Focus on this effort has resulted in a delay of their forest plan revision. It is expected that the Sequoia National Forest will complete a CER this fiscal year and have a completed plan by 2011.

3. Under our current schedule we expect the Plumas, Lassen, and Tahoe National Forests to substantially develop their CER's during fiscal year 2009, followed by 1-2 years of forest plan preparation. The Eldorado, Stanislaus, and Sierra National Forests are expected to begin their CER's in 2010, with forest plans completed by 2012. The Inyo National Forest is expected to begin one year later, completing by 2013.

4. The National Forests are now developing forest plans under the 2008 planning rule, which directs a different process and product from the rule that was in place when the current revision schedule was developed. The current schedule is being reviewed and is likely to

be accelerated in light of the increasing regional leadership interest in updating forest plans.

Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct. Executed this __19th___ day of October, 2008.

/s/ Jo Bridges
(Original signature retained by attorney Barclay Samford)
____

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