Statement of
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Field hearing on the Sierra Nevada Forest Plan: Protecting Communities, Water, Wildlife and Forests in the Sierra Nevada

Jackson, California

Chairman McInnis, distinguished members of the committee, it is a privilege to have the opportunity to present my testimony to you today.

The United States Forest Service (USFS) lands in the Sierra Nevada and Southern Cascades are incredible national treasures. These lands provide clean water, recreational opportunities, timber, oxygen, forage, and spiritual values. I believe everyone at this hearing is connected to these lands in multiple ways.

The USFS has been engaged in large-scale land management planning in this region since 1990. The first guidelines developed during this period were the Interim California Spotted Owl Guidelines. They were forecasted to last for only 1-3 years. At the end of this period a full land management plan for all USFS lands in this region was expected to have been finished.

During the last 7 years we have seen the USFS develop 2 more Environmental Impact Statements for this region. The first was developed under the Clinton administration and a record of decision was signed a couple of weeks before the Bush administration took office. Shortly after the new administration came into office a review of this decision was implemented. This resulted in the development of a Draft Supplemental Environmental Impact Statement. Public comments were accepted, and about 1 month ago, the USFS released the Final Supplemental Environmental Impact Statement. It should be noted that the previous USFS plan (Sierra Nevada Framework) really was not given a chance to succeed or fail. Although several USFS Region 5 line officers have stated that it was too cumbersome and included many contradictions, it was not implemented at any significant scale.

The time, effort, and resources devoted to these multiple plans have been very large. There are real fire and ecosystem issues that need to be addressed in this region but we continue to spend enormous amounts of time and energy in the planning phase. This period has also resulted in tremendous debates from environmental groups, timber companies, recreational users, livestock managers, and the public. This debate continues to the present.

Today I will present a discussion of wildland fire issues in the Sierra Nevada and Southern Cascades. This will include a discussion of fire hazards in the forests of this region, landscape fuel treatment designs, issues concerning the urban wildland intermix (UWI), and probably most important of all, the need for a comprehensive strategy to implement a land management plan in this region.

Reduction of Potential Fire Behavior in Mixed Conifer, Ponderosa Pine, and Jeffrey Pine Forests

The ponderosa pine, mixed conifer, and Jeffrey pine forests in this region have been modified over the last century because of fire suppression, livestock grazing, timber harvests, and possibly changes in climate. The results include a general deterioration in forest ecosystem integrity and an increased probability of large, high-severity wildfires.

Such conditions are prevalent nationally, especially in forests that once experienced short-interval (< 15 years), low to moderate-severity fire regimes.

Along with increased fire hazards these forests also have multiple ecosystem problems. Fire suppression and selective harvests have increased the abundance of shade tolerant tree species such as white fir and incense-cedar. In many areas past harvests have removed most of the largest trees. Shade intolerant species such as California black oak have declined over the last century. This species has been identified as crucial for many wildlife species in this region. Other shade intolerant species such as ponderosa pine and giant sequoia have declined as well.

The need for restoration is clear. Less clear are the desired future conditions for these diverse forests and what should be done to achieve and maintain them. The recent tree mortality in the forests in southern California remind us that ecosystems are constantly changing and in some cases, the outcome of these changes are not desirable. We must develop the ability to restore and maintain the forests of this region.

Fuels reduction is the central theme in the current USFS management plan. The objective of such treatments should be a reduction of potential fire behavior, not simply the reduction of forest fuels. Fire behavior is a function of fuels, weather, and topography. Fuels are the major fire behavior component that can be directly affected by management. Local climate conditions can also be influenced by treatments resulting in tradeoffs between reducing canopy cover and opening up stands that increases air temperatures and wind speeds, and decreases relative humidity and fuel moisture contents.

Wildland fuels are separated into four groups (ground, surface, ladder, crown) and each has a different potential to influence fire behavior. Ground fuels include the duff and litter on the soil surface and they do not usually contribute to wildfire spread or intensity. Surface fuels include all dead and down woody materials, grasses, other herbaceous plant materials, and short shrubs, and these are often the most hazardous fuels in forests that have been influenced by 100 years of fire suppression. Ladder fuels are small trees or tall shrubs that provide vertical continuity from surface fuels to the crowns of tall tress. Crown fuels are those in the overstory.

Reducing surface fuels will limit the intensity of fires, provide a higher probability of controlling wildfires, and allow more of the forest to survive when it does burn. Thinning treatments can be directed to effectively reduce ladder and crown fuels. However, if logging residues (activity fuels) are left on site, this can result in potential fire behavior that is more extreme or similar to the untreated forest. Fuels treatments in forests that once experienced frequent, low-moderate intensity fire regimes must focus on surface, ladder, and then crown fuels. Surface fuel reduction cannot be an afterthought of fuel treatments in these forests, it must be the central objective. The current USFS plan does not place enough emphasis on surface fuels. Instead it concentrates on ladder and crown fuels and this is a mistake. It is an example of good intentions that simply misses the mark.

An excellent example of this principle occurred at the Blacks Mountain Experimental Forest located in the Southern Cascades, an area covered by the present USFS management plan. A wildfire burned several experimental units 2 years ago that had been designed to investigate the impacts of forest harvesting on several ecosystem elements. Blacks Mountain is primarily a ponderosa pine forest and it is in the surrounded by the Lassen National Forest.

The treatments that were burned by the wildfire included low diversity alone, low diversity followed by prescribed fire, high diversity followed by prescribed fire, and controls. The high diversity treatment consisted of a thinning from below and all large overstory trees were retained. The low diversity treatments consisted of an overstory removal (all large trees harvested) followed by lop and scatter of the activity fuels and then a whole tree harvesting of the sub-merchantable trees. The whole tree harvest removed the majority of the ladder fuels and left no additional activity fuels.

When the wildfire entered the high diversity unit that had also been prescribe burned, it transitioned from a high severity crown fire to a very low intensity surface fire in about 200 feet. The treated forest almost stopped the wildfire in this unit. In the low diversity unit that had been prescribed burned a similar change in fire behavior occurred, from a severe crown fire to a low intensity surface fire in less than 200 feet. When the wildfire moved into the low diversity unit that had not been prescribe burned, the wildfire changed from a serve crown fire to a severe surface fire. The severe surface fire burned the majority of the unit and this killed approximately 60-80 percent of the trees. The wildfire burned in this unit because the activity and natural fuels were sufficient to carry the wildfire. If this treatment had also left the sub- merchantable trees on the ground as activity fuels, I am sure the whole unit would have experienced almost complete mortality. This occurred even though canopy cover, crown bulk density, and ladder fuels were very low in the low diversity units. Trees were widely spaced by the low diversity treatment and no crowns were overlapping. It simply provides more support that the target of almost all fuel treatments in mixed conifer, ponderosa pine, and Jeffrey pine forests must be the surface fuels. I would also add that the control units that were burned by the wildfire were totally destroyed, further reinforcing that effective treatments are needed to reduce fire hazards in these ecosystems.

Removal of moderately sized trees (20- 30 inches in diameter) can produce revenue and wood products for California, but in the majority of cases, it will not significantly reduce potential fire behavior. Removal of trees of this size will only reduce canopy bulk density and this will have a small affect on potential fire behavior in most forest stands. The target of fuels projects must be the surface and ladder fuels.

Since fire hazard reduction has never been the main objective of USFS land management, we have no large-scale research or demonstration projects to support such a management philosophy. There simply are no places to go in California or elsewhere, to get information on the trade-offs (economic, social, ecological) of large-scale management treatments designed to reduce potential fire behavior and improve forest sustainability. The final USFS plan selected for this region will be able to address this key issue if a

strong monitoring and adaptive management strategy is included. This portion of the current plan needs significant improvement.

Landscape Treatments Designed to Reduce Fire Behavior

The use of Strategically Placed Area Treatments (SPLAT's) and Defensive Fuel Profile Zones (DFPZ's) can be used in a landscape strategy to reduce potential fire behavior. SPLAT's are a system of overlapping area fuel treatments designed to minimize the area burned by high intensity head-fires in diverse terrain and may be an effective strategy to reduce landscape fire behavior in large, heterogeneous areas. Human-caused fires commonly occur near transportation corridors (highways, roads, trails), campgrounds, and urban areas, making it possible for fire managers to forecast areas of higher ignition potential. DFPZ's placed near areas of high human-caused ignitions can be used to decrease the probability of large, high-severity fires, by improving suppression efficiency. Installation and maintenance of these structures (SPLAT's and DFPZ's) at appropriate spatial scales should reduce landscape forest fire area and severity.

This area of the current USFS management plan should be substantially expanded to include both stand level and landscape level analysis of proposed fuels treatments. It may be true that the models used in the USFS analysis do not allow such work but there are methods that can be employed. At the stand level (20-50 acres) the computer programs NEXUS or Fuels Management Analyst (FMAPlus) can be used to compare the crown fire performance of different treatments. At the watershed scale FARSITE and/or FLAMMAP can be used to test different spatial arrangements of treatments and how they will impact wildfire severity and size. FARSITE will also allow for suppression modeling to determine if fuel treatments will improve suppression efficiency.

To reduce potential fire behavior at the landscape scale will require partnerships with private industry. Infrastructure such as biomass utilization plants and sawmills are part of the solution. Without this infrastructure the current fire hazard problems would be much more difficult to solve.

The forests in the Sierra Nevada and Southern Cascades have diverse ownerships. To produce effective landscape fire behavior strategies will require the cooperation of federal, state, and private land owners. If the USFS only treats their land without coordination and cooperation of the other land owners, the overall strategy will not meet the desired objective.

Urban-Wildland Intermix

Land management agencies throughout the country are increasingly aware of the difficulties of managing in the urban-wildland intermix. This is a very complicated landscape with homes, subdivisions, and towns all mixed into or adjoining wildland areas. The number of people who choose to live in this area continues to increase and many wildland fire agencies such as the California Department of Forestry and Fire Protection, believe this is the area where their fuels treatments should be focused.

I believe this area requires partnerships between home owners and the public or private groups that have responsibility for the adjoining wildlands. DFPZ's can be created in the urban wildland intermix to allow for more effective and safe suppression activities when wildfires are moving from the wildlands toward homes or from the homes into the wildlands.

Private home owners share responsibility in this area. Homes must be built with combustion resistant roofs and siding materials. Defensible space must be created around each structure to increase the probability that it will survive a wildfire. Fine fuels and needles must be removed annually from roofs and around houses to reduce the chance of spot fire ignition during wildfires. To be successful in this area, a shared partnership must occur between the private land owners and managers of the adjoining wildlands. Currently most of the debate is focusing on what large land managers must do to reduce risk but an equal amount of responsibility rests on the private side of the intermix. Counties and states must take action to ensure that individual home owners reduce their potential for catastrophic fire. To date, most of the counties in the Sierra Nevada and Southern Cascades have not addressed this absolutely critical issue. This is beyond the scope of the current USFS plan but it is a critical step in this process.

Implementation Strategy, Monitoring, and Adaptive Management

There presently is a diversity of opinions between environmental groups, commodity interest groups, the State, and others, on what actually should be done to reduce potential fire behavior in federal forests in this region. Mechanisms should be created to encourage participants to interact and reach agreements. Principles that can assist in this interaction include 1) locate projects in areas with substantial agreement on restoration objectives, 2) reflect and celebrate accomplishments in order to build relationships, trust, and support, 3) create an extensive, well designed adaptive management program to learn from management actions, and 4) create an all party monitoring process to assure credible post-treatment data and analysis. The monitoring and evaluation program should be directed by a non-federal group to ensure independence.

My present position as a fire science professor at the University of California, Berkeley, has introduced me to many different groups and people that are incredibly engaged in the this region. I have met with hundreds of people over the last 2 years in reference to the Sierra Nevada and Southern Cascades, and I believe a comprehensive strategy must be developed by which a decision can be implemented.

I believe the USFS should choose 3 areas of National Forest lands from this region to begin work outlined in the final modified decision. If properly designed, the 3 areas could allow for a broad discussion on the effects of different fuel treatments with a diverse group of people. This group could include environmental groups, commodity use groups, forest service staff, state of California personal, university and federal scientists, and the public. The main objective of the monitoring and evaluation will be to determine if the fire and wildlife habitat goals were obtained.

The size of each area should be relatively large (possibly several sub-watersheds, an area of approximately 50,000-100,000 acres). One could be place in the southern, central, and northern areas that this plan addresses. Since we have almost no information on the effects of fire hazard treatments on any aspect of the ecosystem, these areas can be used to develop an information base for future work. I think it is essential that scientists from the University of California (Berkeley and Davis campuses) be included in such a program along with the California Department of Forestry and Fire Protection and the USFS Pacific Southwest Research Station. The existing California Cooperative Ecosystem Science Unit could facilitate this partnership between the USFS and the University of California. The monitoring and evaluation program should be headed by a non-federal agency and this would benefit the USFS.

The present Administrative Study in the Quincy Library Group (QLG) area could provide some of this information but the selection and layout of the treatment areas would have to be modified to accommodate this goal. Presently the activities planned focus on DFPZ's and group selection. At a minimum, it should be changed to include SPLAT's without any DFPZ's or groups in some of the Treatment Units. We must learn how effective SPLAT's and DFPZ's are and what changes to key ecosystem processes occur with their installation and maintenance.

There currently exists tremendous variability in forest structure within the federal lands of the Sierra Nevada and Southern Cascades. With such diverse current conditions it is impossible to produce one methodology to restore and sustain all of these areas. Prescribed fire is one very important tool that land managers can use to reduce potential fire behavior and increase sustainability. Mechanical methods coupled with prescribed fire are another effective method in reducing potential fire behavior. Carefully designed mechanical methods may also be effective in reducing potential fire behavior but they will not be successful in simulating the full ecosystem processes of fire, and should probably be limited in their spatial extent. We need a diverse set of tools to design ground-based treatments to restore and maintain the vast forests in this region. All treatments that manipulate vegetation must evaluate their impacts on potential fire behavior.

The final plan must include the fiscal commitments necessary to support adaptive management and monitoring. The present plan comes up very short in this important area. It essentially says that we have the answer to the present problems and now we are going to implement it at very large spatial scales. Unfortunately, I think this is a prescription for more fighting and lawsuits. Using an approach where everyone that chose to engage in the process could be a partner and learn would be a much better approach. Adaptive management and all party monitoring is a key step in this process.

Thank you for the opportunity to speak to you today.

Resume

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EDUCATION

Ph.D. Wildland Resource Science, *University of California, Berkeley,* 1995.

Graduate study, Departments of Land, Air and Water Resources and Biological and Agricultural Engineering, *University of California, Davis,* 1988-1991. (hydrology, soil science, plant sciences)

M.S. Bio-Engineering, *California State University, Sacramento*, 1988.

B.S. Electrical Engineering, *California State University, Sacramento*, 1985.

CURRENT RESEARCH PROJECT ABSTRACTS

Fire and Fire Surrogate Treatments for Ecological Restoration. 2000-present. Stephens, and other UC faculty. Current coniferous forests in California and other parts of the nation are denser and more spatially uniform, have many more small trees and fewer large trees, and have much greater quantities of forest fuels than did their presettlement counterparts. The results include a general deterioration in forest health and sustainability, and an increased probability of large, high-severity wildfires. The need for large increases in the use of restorative management practices is clear. Less clear, however, is the appropriate balance among silvicultural cuttings, mechanical fuel treatments, and prescribed fire. What components or processes are changed or lost, and with what effects, if fire "surrogates" such as cuttings and mechanical fuel treatments are used instead of fire, or in combination with fire? This is area that this research project will concentrate by installing and monitoring a national network of fire and fire “surrogate” experiments. States included in the network include California, Oregon, Washington, New Mexico, Arizona, Montana, South Carolina, Ohio, North Carolina, Alabama, and Florida. Stephens is the principal investigator on the Sierra Nevada research site located at the University of California Blodgett Research Forest. This is currently the largest national fire science project in the United States. (http://www.CNR.Berkeley.EDU/fire-surrogate-study/)

Ecological Effects of Fire and Silviculture Treatments in the Stanislaus National Forest. 2000-present. Leda Kobziar (graduate student), Stephens, O'Hara. Pine plantation establishment is common throughout the nation, as the most effective means of reforestation after wildfire. Plantations cover nearly 400,000 acres in the Modoc, Lassen, Plumas, Tahoe, El Dorado, Stanislaus, Inyo, Sierra and Sequoia National Forests. Very high fire hazards are present in and around many of these plantations, due to a high success rate in replanting and dense post-fire brush growth, low summer fuel moisture content, and steep, mountainous terrain. This study will be to contrast the effects of 5 different methods in mitigating fire hazards including 1) cut to length harvesting-slash and existing fuels crushed and left on site, 2) whole tree harvesting-whole trees removed to landing and biomassed, existing fuels crushed and left on site, 3) mastication of trees and shrubs-slash and existing fuels left on site, 4) cut to length harvesting followed by prescribed fire, 5) whole tree harvesting followed by prescribed fire, and 6) control. In achieving the primary objective, several secondary objectives will be addressed including the effect of the treatment on (1) fire hazard reduction, (2) vegetation response, (3) fire behavior and, (3) costs and benefits.

Ecological Diversity in Chaparral Following Prescribed Fire and Mastication in Varying Seasons. 2000-present. Jennifer Potts (graduate student), Stephens, and McBride. High severity wildfires are very common in chaparral. The urban-wildland intermix adds to the complexity of chaparral management because of increased ignitions from people and the potential for high losses of life and property. Prescribed fire has been the most commonly used technique for the reduction in fuel loads in chaparral. The effects of the season of prescribed fire is not understood in chaparral. Burning when soil moistures are high may have a negative impact on obligate seeding species, there is even less information on the effects of mechanical fuel treatments (mastication and chipping). The objective of this study is to contrast the efficacy of prescribed burning with mechanical methods in reducing fire hazard in chaparral. In achieving the primary objective several secondary objectives will be addressed including the effect of the season of treatment on (1) fire hazard reduction, (2) recovery of vegetation, (3) resurgence of fuels, and (4) costs of the different treatments. The experiment will occur at the Bureau of Land Management Cow Mountain Recreation Area and will use a complete randomize design with replication (4 replicates for prescribed fire treatments including winter, spring, and fall burns, 3 replicates for mechanical treatments including mastication and chipping).

Fire History, Climate, and Corresponding Forest Structure in Coniferous Forests Under Unmanaged Fire Regimes, 1997-present. Stephens. One large, mixed conifer ecosystem exists in western North America where logging has never occurred and a policy of fire suppression was never initiated, this area is in the Sierra San Pedro Martir (SSPM). This forest is composed of mixed conifer forests and shrublands of the Californian floristic province that occur nowhere else in Mexico. The SSPM is unique within the California floristic province in that its open forests are still influenced by lightning ignited fires. This research project has collected quantitative information on fire history and what types of forest structures (live tree densities, fuel loads, snag densities) that exist in a mixed conifer forest that has a disturbance regime which has not been effected by management, with the exception of livestock grazing. Regeneration patterns (clumped, random, uniform) are being investigated using spatial statistics in a 4 ha. area that has been stem mapped and each tree above 5 cm DBH bored. Regeneration occurrence is also being investigated to determine if climate and/or fire occurrence is correlated with establishment.

Reconstructing Late Holocene Changes in Climate, Vegetation, and Fire Regimes in the Sierra San Pedro Martir Mountains, Mexico, through Microfossil Analysis, 2001-present. Evett, Stephens. Project will reconstruct large scale changes in vegetation and fire regime that have occurred in the coniferous forest in the Sierra San Pedro Martir from a couple of thousand years to the present. Sediment samples from several promising chronologically stratified sites have been obtained. From each layer of sediment a chemical extracting method is used to separate a variety of microfossils that are identified and counted microscopically to provide insight into the paleoenvironment at the time of deposition. Fossil pollen, when preserved, provides valuable evidence of the presence and extent of a wide range of vegetation, particularly trees. Opal phytoliths, microscopic bodies of silica that are deposited in plants and released into the soil as they decay, are very useful for determining the nature of understory vegetation, particularly grasses. Diatoms record changes in the hydrologic regime of the sediment. Changes in the concentration of macro and microscopic charcoal indicate long-term changes in the fire regime.

The Eastern Sierra Nevada and the Sierra San Pedro de Martir, 2002-present. Stephens. High severity wildfires are common in pine forests of the western United States. Many have suggested this is primarily due to changes in stand structures and composition from past logging and systematic fire suppression of the last century. There is currently debate on appropriate target conditions for fire hazard reduction and forest restoration. This is due to the lack of unmanaged forests that could serve as references in the western US. The pine-dominated, mixed conifer forests of the Sierra San Pedro Martir (SSPM), Mexico, have not experienced logging and systematic fire suppression. The SSPM is unique within the California floristic province in that its forests are still regularly influenced by fires similar to those that once occurred throughout the western United States. The mixed conifer forests of the SSPM may provide information on reference conditions for forests that prehistorically experienced frequent, low to moderate intensity fires. This information could be used to help develop target stand conditions for reducing the fire hazard in large portions of California and Nevada mixed conifer forests. The objectives of this project are to compare climate, fire history, and stand structures of coniferous forests of the Sierra San Pedro Martir with similar forests of the eastern Sierra Nevada.

Landscape Scale Effects of Prescribed Natural Fire Programs in Three Wilderness Areas, 2002-present. Moody (graduate student), Stephens. In the early 1970's, the National Park Service and the Forest Service introduced the Prescribed Natural Fire (PNF) program [now called the Wildland Fire Use (WFU) Program] in several wilderness areas, in efforts to restore fire as a natural ecosystem process. The Sugarloaf-Roaring River region of the Sequoia-Kings Canyon National Park, the Illouette Creek Basin in Yosemite, and the Gila Wilderness in New Mexico were among the first areas in which naturally ignited fires have been allowed to burn under prescribed conditions, as long as they do not threaten life or property. Synthesis of ground and GIS analyses will help determine how WFU policies have affected forest processes and resiliency, as indicated by forest and fire characteristics. This may lend information to today's debates about roadless area management and ecosystem restoration.

Stand Structure and Fire History in a Native Monterey Pine Forest, 2002-present. Stephens, Piirto (cal Poly State University). Monterey pine is an interesting species that has a crown stored seed back (closed cone) but lives on the coast of California where crown fires may be rare. This study has investigated the age structure and fire history of the Ano Nuevo Monterey pine forest

near Santa Cruz. The goal is to determine if tree ages are clumped around one or more fire events or if the stands exhibit multiple age characteristics. The history of fire will also be determined over the last 100 years using dendrochronlogy. Sampling has been relatively extensive in Cal Poly's Swanton Pacific Ranch Research Station. Age structure of coast live oak and Douglas-fir will also be investigated in this Monterey pine forest.

Fire History and Climate of the Transverse and Peninsular Ranges of Southern California, 2002-present. Stephens, Everett, Skinner. The USFS recently released the Southern California Mountains and Foothill Assessment for the Cleveland, San Bernardino, Angeles, and Los Padres National Forests. This assessment identified fire management as one of its important goals but only one published fire history study is available to assist in plan development. The single fire history study did not use cross-dating and had a very limited spatial extent. Information on past fire season was not obtained. Lack of comprehensive information makes it extremely difficult to understand past fire dynamics in this large, diverse area. The objective of this project is to collect, cross-date, and analyze fire history information from the Cleveland, San Bernardino, Angeles, and Los Padres National Forests in southern California. The interaction of climate and past fires will also be examined.

Landscape Fuel Treatment Effectiveness in the Plumas and Lassen National Forests, 2001-present. Stephens. The goal of this project is to determine how landscape level fuels and silvicultural treatments affect potential fire behavior and effects. Past management activities including fire suppression, harvesting, and livestock grazing have changed the structure of many coniferous forest in the western United States, particularly those that once experienced frequent, low to moderate intensity fires. Changes in climate over the 20th century also have influenced present ecosystem structure. Restoration of these ecosystems is a common goal but there currently is limited information of the effects of such treatments, particularly at the landscape scale. This project will link remotely sensed data to ground based data at the watershed scale (17,800-32,000 ha). Spatially explicit fire effects models will be developed to evaluate the effectiveness of the different treatments.

PROFESSIONAL SOCIETY MEMBERSHIPS

International Association of Wildland Fire
Society of American Foresters
Association for Fire Ecology – Vice President
California Botanical Society
Northwest Science Association

HONORS

University of California Regents Fellowship, 1992-1993
University of California Department of Forestry and Resource Management Fellowship, 1991-1992
Department of Defense Engineering Scholarship, 1982-1985
Tau Beta Pi, National Engineering Honor Society

Xi Sigma Pi National Forestry Honor Society

CERTIFICATION

Wildland Fire Fighter Certification, 1991. Received certification as a federal wildland fire fighter, also certified in the operation of chainsaws. Continue to obtain annual training when research involves the use of prescribed fire.

PUBLICATIONS

Peer Reviewed

Stephens, S.L., M.A. Finney, and H. Schantz. 2004. Bulk density and fuel loads of ponderosa pine and white fir forest floors: impacts of leaf morphology. Northwest Science (in press)

Stephens, S.L., T. Meixner, M. Poth, B. McGurk, and D. Payne. 2004. Prescribed Fire, Soils, and Stream Water Chemistry in a Watershed in the Lake Tahoe Basin. International Journal of Wildland Fire (in press).

Stephens, S.L., and B. M. Collins. 2004. Fire regimes of mixed conifer forests in the north-central Sierra Nevada at multiple spatial scales. Northwest Science (in press).

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Stephens, S.L. 1997. Fire History of a Mixed Oak-Pine Forest in the Foothills of the Sierra Nevada, El Dorado County, California. Symposium on Oak Woodlands: Ecology, Management, and Urban Interface Issues. USDA Forest Service General Technical Report-PSW GTR-160, pp 191-198.

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Elliott-Fisk, D.L, T.C. Cahill, O.K. Davis, L.Duan, C.R. Goldman, G.E. Gruell, R. Harris, R. Kattelmann, R. Lacey, D. Leisz, S. Lindstrom, D. Machida, R.A. Rowntree, P. Rucks, D.A. Sharkey, **S.L. Stephens**, D.S Ziegler. 1996. Lake Tahoe Case Study. Sierra Nevada Ecosystem Project. Addendum (Davis: University of California, Centers for Water and Wildland Resources). pp. 217-276.

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Stephens, S.L. 1999. Fire hazard mitigation in coniferous forests to improve sustainability. Proceedings of the 20th Forest Vegetation Management Conference. Redding California.

Martin, R.E., and **S.L. Stephens**. 1998. Prehistoric and Recent Fire Occurrence in California. Proceedings of the Fire in California Ecosystems: Integrating Ecology, Prevention, and Management Conference. International Association of Wildland Fire, Fairfield, WA.

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Stephens, S.L., Gordon, D., Martin, R.E.. 1993. Combustion characteristics of domestic vegetation found in the urban/wildland interface of California. Society of American Foresters, Proceeding of the 12th International Conference on Fire and Forest Meteorology, Jekyl Island, Georgia. pp. 565-571.

Follow-Up Address

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