November 21, 2016

Mary D. Nichols, Chair
Members of the Board
California Environmental Protection Agency
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Subject: CARB 2030 Target Scoping Plan Up-Date: Natural and Working Lands

Dear Chairperson Nichols, Members of the Board, and Staff;

Please accept the following 2030 Target Scoping Plan Comments on behalf of Sequoia ForestKeeper (SFK). On 8 August 2016, SFK presented oral comments and submitted written comment in the form of Recommendations for Reducing Air Pollution to the EJ Advisory Committee of the California Air Resources Board (See EXHIBIT A pasted at the end of this comment letter). These recommendations are appropriate for reducing climate impacts to disadvantaged communities, natural and working lands, croplands, and urban forest lands.

Sequoia ForestKeeper, its' Board of Directors, staff, and members are deeply disappointed with the vagueness of the 2030 scoping Plan documents, which make submitting substantive comments impossible and requires the submission of many more comments that might in the end not be relevant. The plan need to be revised to outlaw clear-cutting, group selection, biomass removal, and post-fire logging; techniques that have already devastated the Sierra Nevada where they have been allowed on public lands and are allowed on private lands. The current inventories for soils and forests are inconsistent in their timeframes, which makes comparisons and analysis difficult across different watersheds and landscapes. The strategic use of limited mechanical thinning immediately surrounding communities to protect people from fire may be necessary, but destructive logging techniques miles from communities have no place on our public lands and certainly should not be considered when reducing climate change and drought are primary and at issue.

The plan also needs strong standards and guidelines to ensure that logging does not destroy the large, contiguous home ranges that wildlife need to survive, especially rare species like the California spotted owl, Pacific fisher, and black-backed woodpecker.

A. <u>The Massive Die-off of Trees throughout the Sierra Nevada Must be Considered by the Plan when Proposing Removal of Live Trees – Trees that could be genetically adapted to surviving drought</u>

The models for vegetation are relying on the FIA Report plots throughout California that are old, some of which are selected by Sierra Pacific Industries and are unavailable to the public for observation, and most predate California's severe drought and massive die-off of trees.

Over the last few years, as a result of the drought in California, many thousands of trees in the Sierra Nevada in fisher habitat areas. The Forest Service has surveyed and NASA has confirmed that more than 66 million trees in the Southern Sierra Nevada have died. NASA also predicts that this massive die-off will continue for at least two more years.

Forest conditions in the Sierra Nevada have dramatically changed, bringing the business as usual timber extraction practices of the past into question for the future. Some models used forest condition from 2012, which indicates that the analysis of impacts using these old data would fail to consider the recent drought-related, four-year tree mortality and the range of enabled thinning treatments that might be proposed on the Pacific fisher or the cumulative effects of that tree mortality on the remaining trees in the forest, the Pacific fisher, the California Spotted owl, or Northern Goshawk.

This massive die-off of trees has negatively affected habitat for Pacific fishers and other old-forest dependent species. Because the cumulative effects from the various treatments enabled by the Plan combined with the massive tree die-off will have significant adverse effects on the forest ecosystem, the Pacific fisher, California Spotted owl, Northern Goshawk, and other old-forest species. The Plan must consider restarting the process, so these combined impacts are considered in all of the alternatives before proceeding with implementation of a Plan.

Also, the Plan must seriously consider that trees still living after California's worst drought in 1,200 years may produce offspring that are genetically adapted to surviving drought. Destroying the chance to have offspring that can regenerate forests despite climate change would be a tragedy that the Plan must avoid. We can't log our way out of this problem, and we certainly can't do it by logging live trees.

B. <u>The Plan should Consider the Fact that Science Does Not Support Removing Insect-Infested Trees</u>

If the Plan proposes removing insect infested trees/snags, the Plan must provide a scientific basis for the number of snags to leave in the forest and the plan must be based on the ecological functions of snags. There are many types of snags and each performs a different function in an ecosystem. Snags can't be counted as if they were coke cans on a shelf. As biologists will know, snags can be standing, down, large, small, of various species, and in various stages of decomposition. They should not be uniformly spaced around the forest like candles on a cake

nor should they be all in one corner of a survey plot and then averaged in with the other plots, so it appears there are snags throughout the surveyed area. Additionally, after a serious drought/insect infestation event, the forest responds in positive ways – insectivorous species thrive. Standing dead trees may be the tallest structure the forest will have for many decades. Within a year, likely sooner than the highly flammable slash a thinning project will create can be burned, the dead needles and smaller branches of the dead trees will shed and the dead trees will become less flammable. Science indicates that most dead trees outside of the 200 feet surrounding structures should be left standing.

There is no evidence that removing a tree infected with beetles after it has died will decrease the infection rate to other trees. Additionally, logging dead and diseased trees can spread the problem. Some beetles, such as Ips, can incubate in piles of logging slash and spread more rapidly than had the tree been left standing. Botanists have recommended methods to avoid spreading bark beetle. These include not cutting diseased trees unless it is mid-summer, pulling slash away from any living tree, and covering slash piles with black tarps to increase the heat in the pile.

A recent compilation of data by leading scientist in the Pacific Northwest has found that "[b]y dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change. In light of these findings, we recommend a precautionary approach when designing and implementing forest management policies intended to reduce wildfire hazard and increase resilience to global [climate] change." Miegs et al. (2016). "In addition, by dampening subsequent burn severity, insect outbreaks could buffer rather than exacerbate some fire regime changes expected due to global change (e.g., climate warming, drought, invasive species (Littell et al. 2010, Ayres et al. 2014)) and forest response to land use (e.g., fire exclusion, timber harvest, livestock grazing (Hessburg et al. 2000))." *Id.*

All trees that must be removed should be surveyed for any active nesting or dens the same season as the cutting will occur – preferably just prior to the planned cutting. No cutting or treatment should be allowed near meadows during fawning or nesting season.

C. Forest Plan WUI Size is Not Supported by Science and Science Supports Treating the Home Ignition Zone and the 200 feet immediately Surrounding Homes to Protect Communities

Forest Service Fire Science indicates that treating the home and the 200 feet immediately surrounding the structure (the home ignition zone) can protect the structure from wildfire. (See below and Reducing the wildland fire threat to homes: Where and how much? Author: Cohen, Jack D. 1999 http://www.treesearch.fs.fed.us/pubs/5603). Treating farther from the structure than 200 to 300 feet causes unnecessary resource damage and can actually increase fire danger.

The Plan must follow the best U.S. Forest Service fire science. Proposing to thin the forest in the Wildland Urban Interface (WUI) that extends for more than a mile from structures, would damage the forest habitat and the species in the forest that managers are charged with protecting. If the Plan proposes to thin beyond 300 feet from structures, the Plan must provide any science that proves that WUI treatments beyond 300 feet from the structures could be effective.

Otherwise, the Plan would ignore the science that shows that treatments beyond 300 feet from homes are not effective in protecting structures.

Some of the responsibility for protection of privately owned structures must be borne by the private property owner. Just as those who build homes on shorelines accept the risks of high seas eroding or undercutting their structures because they love living by the ocean, so must those who chose to live surrounded in Sierra Nevada forests accept the risk that accompanies living in an ecosystem that not only burns recurrently, but must burn if it is to survive as a forest.

Science support treatments limited to the Home Ignition Zone (HIZ). The Forest Service's own Jack Cohen (Jack D. Cohen, Research Physical Scientist, Fire Sciences Laboratory, PO Box 8089, Missoula, MT 59807 406-329-4821 (fax) 406-329-4825 jcohen@fs.fed.us), has shown that the Home Ignition Zone – the 200 to 300 feet immediately surrounding homes, is where mechanical fuel treatments should be implemented to protect homes. The Home Ignition Zone treatments can be the mechanically-treated safezone that anchors prescribed fire treatments that would then be implemented beyond the HIZ and into the WUI to protect homes.

However, the Forest Service, State, and Counties should investigate measures that would assist private property owners to not only be aware of things they can do to make their homes less likely to ignite in a fire, but also actively seek sources of funding such as grants for property owners that would give financial assistance to replace flammable roofing and siding with flame resistant materials. Many studies show that homes with these and other fire-wise building methods often survive fire. The cost of providing financial assistance to private property owners would be more than offset by the costs of replacing homes and in providing assistance to families after their homes and possessions have been destroyed. *See*, also *Safe At Home*, NRDC's study, conducted with a former California State Fire Marshall, of preparing Sierran communities for wildfire, https://www.nrdc.org/sites/default/files/safe.pdf.

In summary, the plan should treat the 200 to 300 feet immediately adjacent to private structures and important access routes.

If the Plan is proposed to protect homes and the fire-adapted forests that managers are charged with protecting, the Plan should adopt ways for much of the billions of taxpayer dollars spent each year suppressing fires to be used for fire-proof or fire-resistant roofing and siding for homes built in and adjacent to these fire-adapted forests.

D. If Fire Suppression is Proposed, the Plan Must Provide Science to show Fire Suppression Reduces Fire Danger and Prevents Climate Change

Forest managers continue business-as-usual fire suppression even though science indicates that these fire-adapted forests require fire to sustain all of the native species that inhabit the forests.

Forest managers would not have to waste billions of dollars annually and endanger the lives of firefighters by suppress fires in these fire-adapted forests that are ignited miles from structures supposedly to protect structures in communities, if the Plan would instead define treating the Home Ignition Zone.

E. Forest Plan Must Provide Science to Prove that Thinning/Logging Reduce Fire Danger because Timber Production Conflicts with Need to Sequester Carbon in the Ground and to Combat Climate Change by Reducing the Burning of Fuels that cause Climate Change

Thinning and logging are not restoration. The Plans must provide scientific research or data to show that thinning and logging could be considered restoration and must consider the scientific research that shows that thinning and logging are harmful to the ecosystem.

Forest managers wrongly assert that it has "protected" forests by logging the largest trees and removing canopy cover, which makes forests hotter and dryer, more susceptible to surface winds, and causes more flammable bushes to grow where the trees once stood, all of which increase fire danger. (See Fire Weather: A Guide for Application of Meteorological Information to Forest Fire Control Operations Mark J. Schroeder Charles C. Buck USDA Agriculture http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1013&context=barkbeetles)

Because the U.S. Forest Service is mandated to do commercial logging on public lands by The Multiple Use Sustained Yield Act, it actively promotes increased logging of both live and dead trees. The Forest Service wrongly assert that more logging is needed to reduce the fire risk. But, if that were true, after a century of logging, the forests should be fireproof.

If the Plan advocates for widespread logging of snag forest habitat, and generally described snag forest habitat mainly as "fuel" and commodities, the position of the Plan would be opposed by and in conflict with the overwhelming and growing consensus of scientists who oppose snag forest logging as one of the most ecologically destructive of all forest management practices. The vast majority of scientific evidence has found that this rare and unique forest type as highly important wildlife habitat, not "fuel". *See* Forest and Fire Science Synthesis available at http://johnmuirproject.org/wp-content/uploads/2014/12/ForestAndFireScienceSynthesisApr2015.pdf). Moreover, in September of 2015, over 260 scientists sent a letter to President Obama and Congress opposing proposals to conduct more snag forest logging on federal public lands, noting that "'complex early seral forest,' or 'snag forest,' is quite simply some of the best wildlife habitat in forests". Over 260 scientists sent a letter to the U.S. Senate and President Obama urging them to oppose two public lands logging bills, being promoted by the timber industry and their supporters in Congress. This letter is available at http://johnmuirproject.org/2015/09/over-260-scientists-urge-senate-dont-pass-post-fire-logging-bills/. Many native wildlife species that depend on patches of snags (standing dead trees)—both small and large—from either drought/native-beetles or fire, and many of these species are now at risk due to habitat loss and destruction from fire suppression and the logging of this "snag forest habitat". On 9 August 2016, Dr. Chad Hanson sent a letter to Governor Jerry Brown on the science regarding Snag Forests and Fire Severity and Fire Spread, is incorporated herein, in its entirety, by reference. *http://johnmuirproject.org/wp-content/uploads/2016/09/HansonLetterToGovBrownOnSnagsAndFireWithAppxAAugust_9_2016.pdf*.

"What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another." ― Chris Maser, Forest Primeval: The Natural History of an Ancient Forest (2001). Chris Maser traces the growth of an ancient forest in Oregon's Cascade

Mountains from its fiery birth in the year 987 to the present. A unique biography of an ecosystem.

F. The Plan Must Provide Science to Show that Past Thinning and Logging Have Made Forests More Resilient to Drought to Justify More Thinning

We believe that previous thinning could not have done anything to prevent the drought-related mortality. The drought-related mortality as similar to extreme fire weather in that there is really nothing human intervention can do to mitigate its effects.

If the Plan proposes more thinning and logging to make forest landscapes resilient to drought and climate change, the Plan must provide evidence in the form of research to show that past logged and thinned areas have become more resilient to California's extended drought. California's drought and climate change created the massive die-off of trees in the southern Sierra Nevada. Before the public can be convinced that continuing to implement thinning and logging promoted by the Plan could make the Sierra Nevada forests more resilient to drought and climate change, irrefutable scientific proof of the survivability of past thinned and logged forests to drought and climate change must be provided. The Plan must provide detailed maps and the GIS shapefile/feature class data and metadata of past logging, thinning, and subsequent plantation units overlaid with NASA's one-meter resolution satellite images of the tree die-off to show how effective past thinning and logging has been in the die-off areas.

We doubt very seriously that such proof could be provided.

G. The Plan Must Protect Old Forest Trees to Sequester More Carbon and Counteract Climate Change

Mature forests in colder climes may continue to store more carbon than they emit, thereby helping to deflect global warming. Whether logging or clearing land for agriculture, the bulk of the world's forests have fallen to crops, cattle, or younger trees. According to some estimates, less than 10 percent of forests worldwide can be considered old growth, or undisturbed for more than a century. And that is not just a tragedy for the plants and animals that require mature forests—it is also a tragedy for the world's climate, according to a study published in Nature: **Rate of tree carbon accumulation increases continuously with tree size** (click link for article).

> Forests are major components of the global carbon cycle, providing substantial feedback to atmospheric greenhouse gas concentrations[1]. Our ability to understand and predict changes in the forest carbon cycle—particularly net primary productivity and carbon storage—increasingly relies on models that represent biological processes across several scales of biological organization, from tree leaves to forest stands[2, 3]. Yet, despite advances in our understanding of productivity at the scales of leaves and stands, no consensus exists about the nature of productivity at the scale of the individual tree[4, 5, 6, 7], in part because we lack a broad empirical assessment of whether rates of absolute tree mass growth (and thus carbon accumulation) decrease, remain constant, or increase as trees increase in size and age. Here we present a global analysis of 403 tropical and temperate tree species, showing that for most species mass growth rate increases

continuously with tree size. Thus, large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree. The apparent paradoxes of individual tree growth increasing with tree size despite declining leaf-level[8, 9, 10] and stand-level[10] productivity can be explained, respectively, by increases in a tree's total leaf area that outpace declines in productivity per unit of leaf area and, among other factors, age-related reductions in population density. Our results resolve conflicting assumptions about the nature of tree growth, inform efforts to understand and model forest carbon dynamics, and have additional implications for theories of resource allocation[11] and plant senescence[12].

(N. L. Stephenson, *et al.* **Nature 507, 90–93 (06 March 2014) doi:10.1038/nature12914** - 15 January 2014)

Average Stand Age from Forest Inventory and Analysis (FIA) Plots Do Not Describe Historical Fire Regimes in Ponderosa Pine and Mixed-Conifer Forests of Western North America **(**PLoS ONE · May 2016)
https://www.researchgate.net/publication/303374032

1) The FIA stand age variable does not reflect the large range of individual tree ages in the FIA plots: older trees comprised more than 10% of pre-stand age basal area in 58% of plots analyzed and more than 30% of pre-stand age basal area in 32% of plots.
2) Recruitment events are not necessarily related to high-severity fire occurrence. Because the FIA stand age variable is estimated from a sample of tree ages within the tree size class containing a plurality of canopy trees in the plot, it does not necessarily include the oldest trees, especially in uneven-aged stands.

Thus, the FIA stand age variable does not indicate whether the trees in the predominant size class established in response to severe fire, or established during the absence of fire. FIA stand age was not designed to measure the time since a stand-replacing disturbance. Quantification of historical "mixed-severity" fire regimes must be explicit about the spatial scale of high-severity fire effects, which is not possible using FIA stand age data.

Increasing wood production as trees age is a mechanism underlying the maintenance of biomass accumulation during forest development and the carbon-sink capacity of old-growth forests. (Increasing wood production through old age in tall trees, (Stephen C. Sillett, et.al. (2009) http://www.sciencedirect.com/science/article/pii/S037811270900872X)

Allowing entire old-growth forests to thrive, by maintaining a closed canopy, moist forest without interference by management treatments that would interrupt their continued accumulation of carbon, is the best, science-based way to manage forests to maintain old growth forest characteristics and carbon sequestration and combat climate change.

H. Biomass Extraction Should NOT be Specified in the Plan due to Impacts to the Ecosystem, Air, and Climate

Continuing to extract biomass from forests cannot sustain soil because removing biomass removes soil nutrients for growing future forests, removes the smaller materials and therefore causes subsequent fires to burn larger materials, thus causing more intense fires, and prevents the greatest levels of carbon sequestration from taking place in the forests. Biomass removal should not be enabled by the Plan because the cumulative impact of removing biomass must been adequately considered over the life of the Plan, which would be damaging to forest species, their habitat, and climate change.

Opening the forest canopy causes the sun to shine on the forest floor, causes the forest to become hot and dry, causes brush to grow where the trees once stood, and causes surface winds to increase, which all increase, not decrease, fire risk, removes some sequestered carbon from the forest, and jeopardize the trees that are already struggling. Opening the forest canopy would also jeopardize the old-growth species that are already on the brink of extinction, including the Pacific fisher, California Spotted owl, Northern goshawk, and a host of frog and salamanders, as well as other reptiles.

I. The Environmental Analysis for all Forest Treatments, including, but not limited to Biomass Removal, Fuels Treatment, and Burning, Must Disclose the Effects On and Contribution to Climate Change

The Plan must discuss and analyze how proposed treatments will potentially emit CO2, Methane, and other Greenhouse Gas emissions (GHG's), that may contribute to climate change, including the carbon emitted from the vehicles and equipment used for fuel reduction treatments, as well as felling, stacking, slash treatments, and biomass collection, hauling from the forest, and burning outside the forest in a power or heat generating facility or prescribed burning. The environmental analysis must disclose what efforts will be taken to mitigate these emissions.

A recent article by Mitchell et al. (2009) describes tradeoffs for managing for carbon storage (a valid goal in any forest management action) versus fuels reduction. That study suggests that, with the exception of some xeric ecosystems (not present in the Sierra), "fuel reduction treatments should be forgone if forest ecosystems are to provide maximal amelioration of atmospheric CO2 over the next 100 years." *Id.* at 653. For that reason, each alternative to the Plan should discuss and analyze carbon emissions from implementation, and the no-action alternative should also provide information about the potential for carbon storage from foregoing project implementation.

Depro et al., 2007, found that eliminating logging would result in massive increases in Carbon sequestration. "Our analysis found that a "no timber harvest" scenario eliminating harvests on public lands would result in an annual increase of 17–29 million metric tonnes of carbon (MMTC) per year between 2010 and 2050—as much as a 43% increase over current sequestration levels on public timberlands and would offset up to 1.5% of total U.S. GHG emissions." (Depro et al., 2007 abstract)

Moreover, Mitchell et al. (2009) found the amount of net carbon released into the atmosphere, on an acreage basis with small diameter thinning for fuel reduction (if used for biomass), puts more carbon into the atmosphere than an average fire, on an acreage basis:

> Our simulations indicate that fuel reduction treatments in these ecosystems consistently reduced fire severity. However, reducing the fraction by which C is lost in a wildfire requires the removal of a much greater amount of C, since most of the C stored in forest biomass (stem wood, branches, coarse woody debris) remains unconsumed even by high-severity wildfires. For this reason, all of the fuel reduction treatments simulated for the west Cascades and Coast Range ecosystems as well as most of the treatments simulated for the east Cascades resulted in a reduced mean stand C storage. One suggested method of compensating for such losses in C storage is to utilize C harvested in fuel reduction treatments as biofuels. Our analysis indicates that this will not be an effective strategy in the west Cascades and Coast Range over the next 100 years.

Mitchell et al., 2009 abstract.

In any case, the environmental analysis must disclose the emissions from fuel reduction treatments, associated slash treatments, and biomass collection, hauling, and burning/incineration or prescribed burning for each action alternative. For this, the Washington Office of the Forest Service, for instance, has generated specific direction on how to discuss climate change effects in a National Environmental Policy Act (NEPA) analysis. See *Climate Change Considerations in Project Level NEPA Analysis* (Jan. 13, 2009) (available at http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf). That document specifically mentions fuel reduction projects in the types of projects that should disclose direct effects on climate change:

- The effect of a proposed project on climate change (GHG emissions and carbon cycling). Examples include: short-term GHG emissions and alteration to the carbon cycle caused by hazardous fuels reduction projects, GHG emissions from oil and gas field development, and avoiding large GHG emissions pulses and effects to the carbon cycle by thinning overstocked stands to increase forest resilience and decrease the potential for large scale wildfire.

Id. at 2. To assist in disclosing these effects, the Forest Service provides tools that can help managers determine the direct contributions of GHG emissions from project burning or treatments. *Id.* at 5 (*FOFEM 5.5, Consume 3.0,* and the *Forest Vegetation Simulator*). Because the Forest Service has tools or models to effectively calculate emissions, the Plan must disclose these emissions for each of the action alternatives in order to reduce GHG emissions in California that are globally cumulative.

Moreover, the analysis should account for and quantify (as part of the cumulative effects analysis) not only the emission from prescribed burning on-site and the emissions from any biomass that is removed from the project area and later burned or incinerated off-site, but also the contribution of emissions from transporting this material for off-site burning, and the contribution of emissions from the off-site burning, planning, and implementing the project by the agency, a contractor, and/or other agent that implements such projects.

This holistic approach to account for GHG emission is necessary to provide managers and the public with the kind of information to make informed choices between alternatives and to

mitigate for climate change, and to consider and assess the larger picture of GHG contributions from all projects that may contribute GHG emissions.

J. The Plan Must Disclose and Consider the Impact from Mechanical Equipment Use and Biomass Extraction on Forest Soils, Mycorrhizal Fungi networks, Streams, and Watersheds

Mechanized fuel treatments and biomass removal treatments incur ecological costs by damaging soils, vegetation, and hydrologic processes, as proponents of fuel reduction treatments have acknowledged (e.g., Allen et al., 2002; Graham et al., 1999; 2004; Agee and Skinner, 2005). Mechanical fuel reduction treatments typically involve the same suite of activities as logging, with the same set of impacts to soils, runoff, erosion, sedimentation, water quality, and stream structure and function. These effects, their mechanisms, and their aquatic impacts have been extensively and repeatedly documented across the West (e.g., Geppert et al., 1984; Meehan, 1991; USFS et al., 1993; Rhodes et al., 1994; CWWR, 1996, USFS and USBLM, 1997a; c; Beschta et al., 2004). Watershed damage ultimately translates into aquatic damage.

The collateral impacts of fuel treatments and biomass removal actions are of considerable concern due to the existing aquatic context. Across the West, aquatic systems are significantly and pervasively degraded (Rieman et al., 2003; Beschta et al., 2004). As a result, many populations of aquatic species, including most native trout and salmonids, have undergone severe contractions in their range and number and remaining populations are now imperiled and highly fragmented (Frissell, 1993; USFS and USBLM, 1997a; Kessler et al., 2001; Behnke, 2002; Bradford, 2005). Additional damage to watersheds and aquatic systems reduces the prospects for the protection and restoration of imperiled aquatic species (USFS and USBLM, 1997c; USFWS, 1998; Karr et al., 2004).

In addition, snags and logs provide enriched soil microsites for seedling establishment, in part because they are centers of biological activity for mycorrhizal fungi and nitrogen-fixing bacteria (Maser & Trappe 1984), reduce erosion by acting as physical barriers to soil movement (Franklin et al. 1985), provide cover for small mammals that disseminate mycorrhizal spores into disturbed areas (Maser et al. 1978, Tallmon & Mills 1994), and exhibit higher water-holding capacity that aids seedling survival during drought (Harvey et al. 1989, Amaranthus et al. 1989a).

Shrubs and hardwoods directly facilitate the re-establishment of conifer seedlings by providing access to mycorrhizal fungi, nitrogen-fixing bacteria and bacteria that stimulate root-tip production (summarized in Perry 1994). Research in the Siskiyous has shown that survival and growth of tree seedlings established in disturbed areas depends on their ability to quickly establish links with their below-ground microbial symbionts, especially on infertile soils or in climatically stressed environments (Amaranthus et al. 1987, Perry et al. 1987). Nutrients also cycle faster in soils near hardwoods than in the open, a reflection of greater biological activity. Both controlled and field studies have shown that Douglas-fir survive and grow better in proximity to shrubs and hardwoods than in the open (Horton et al. 1999, Amaranthus & Perry 1989a,b; Amaranthus et al. 1990; Borchers & Perry 1990, Wilson 1982). Perry (1994) also reports that the relative inflammability of Pacific madrone and several other hardwoods may actually protect small conifers from fire.

The research report *Impacts of forest harvesting on biological processes in northern forest soils*, Marshall, VG - Forest Ecology and Management [For. Ecol. Manage.]. Vol. 133, no. 1-2, pp. 43-60. 1 Aug 2000, found at: http://www.sciencedirect.com/science/article/pii/S0378112799002972, indicates that, "Harvesting directly affects these processes through the reduction and redistribution of organic matter, compaction, changes in plant cover, and modification of microclimate, all of which affect the distribution, composition and activity of the soil biological communities. Changes over the longer-term are less obvious because of gradual recovery of most biological components with canopy closure. Although the relationships among floral composition, faunal diversity and sustained soil fertility are not always clear, there are indications that a simplified soil biological system will adversely affect nutrient cycling, tree growth, and forest health. Destruction of mycorrhizae, essential for the establishment of coniferous seedlings, can lead to serious reforestation problems. It is therefore prudent to discourage any qualitative or quantitative changes in the soil biota."

"Although preliminary, our studies suggest that the degree to which mycorrhizal networks facilitate regeneration establishment increases with disturbance or drought stress, in keeping with the stress-gradient hypothesis of facilitation." (*The foundational role of mycorrhizal networks in self organization of interior Douglas fir forests* by Suzanne W. Simard (2009) http://www.sciencedirect.com/science/article/pii/S0378112709003351)

"Mycorrhizal networks, defined as a common mycorrhizal mycelium linking the roots of at least two plants, occur in all major terrestrial ecosystems. This review discusses the recent progress and challenges in our understanding of the characteristics, functions, ecology and models of mycorrhizal networks, with the goal of encouraging future research to improve our understanding of their ecology, adaptability and evolution. We focus on four themes in the recent literature: (1) the physical, physiological and molecular evidence for the existence of mycorrhizal networks, as well as the genetic characteristics and topology of networks in natural ecosystems; (2) the types, amounts and mechanisms of interplant material transfer (including carbon, nutrients, water, defence signals and allelochemicals) in autotrophic, mycoheterotrophic or partial mycoheterotrophic plants, with particular focus on carbon transfer; (3) the influence of mycorrhizal networks on plant establishment, survival and growth, and the implications for community diversity or stability in response to environmental stress; and (4) insights into emerging methods for modelling the spatial configuration and temporal dynamics of mycorrhizal networks, including the inclusion of mycorrhizal networks in conceptual models of complex adaptive systems. We suggest that mycorrhizal networks are fundamental agents of complex adaptive systems (ecosystems) because they provide avenues for feedbacks and cross-scale interactions that lead to self-organization and emergent properties in ecosystems." (*Mycorrhizal networks: Mechanisms, ecology and modelling* by Suzanne W. Simard, et al, http://www.sciencedirect.com/science/article/pii/S1749461312000048)

Dr. Simard was interviewed on the July 30, 2016 Radiolab Podcast Articles http://www.radiolab.org/blogs/radiolab-blog/, titled *From Tree to Shining Tree*. Dr. Simard discussed the results of some of the research on Mycorrhizal networks in the forest:

Mycorrhizal networks of fungi and tree roots are a hidden world beneath your feet as busy and complicated as a city at rush hour.

Massive mat of intertwining roots was found with different colors and shapes of roots. Following clearcuts, Dr. Simard noticed that there was a healthier community of trees before one species was removed. Birch was removed and Douglas fir died. Radioactive gas was injected and absorbed into separate trees. A Giger counter found the radioactive tags. Dr. Simard discovered that trees were sharing their food underground. One tree connected to 47 other trees in the network. The biggest trees in the network were the hub of the food communication network.

The tree has sugar that the fungus needs and the fungus has minerals that the tree needs. Carbon is the sugar that builds the tree, but this fungus has the minerals that the tree needs. The fungus removes water and mineral nutrients that the tree needs. The tree gets most of its minerals and moisture from the fungus. The tree and fungus exchange mineral nutrients and sugar. 20 to 80% of the sugars produced by the tree are sent to the fungus.

Warning signals are sent by the trees using chemicals to warn other trees of the invasion of insect beetles. Trees also being injured by climate change or drought transfer their carbon and nutrients to other trees. Sick trees give up their food, which goes to the needs of the forest, to neighboring members of the forest through the Mycorrhizal network. There is an intelligence in these plants and fungus network.

A borax-based fungicide is conventionally proposed as an application to 'cut trees' to prevent the spread of annosus root disease. The Plan must consider the impacts to mycorrhizal networks from the application of fungicides in forest ecosystems.

These impacts to soils, Mycorrhizal Fungi networks, streams, and watersheds from these biomass removal project must be acknowledged and added to the existing damage and foreseeable future damage from past and future treatments in the forest to provide an accurate assessment of the adverse effects of biomass removal projects.

K. Treatments that Allow Any Additional Erosion are Unacceptable

Treatments that use either commercial or non-commercial activities to thin ladder fuels, restore species composition to those present before fire suppression and logging, and increase the resiliency of stands of trees to drought, insects, and fire may release sediments downstream because heavy equipment on slopes up to 35% and greater have a risk of soil erosion, and loss of soil to erosion, which is unacceptable.

No additional erosion or sediment flow into down-stream watersheds would be considered acceptable. All sediment flows into streams is cumulative and eventually contributes to causing reservoirs like Isabella Reservoir to fill with sediment, as it has. The U.S. Army Corps of Engineers is now spending hundreds of millions of taxpayer dollars to restore the Isabella Reservoir because the Forest Service implements biomass removal projects, in the mountains

above the reservoir, which cause soil erosion and sedimentation that cumulatively impact the Kern River watershed, and which the agency considers to be "acceptable."

L. Because much of the Sierra Nevada Forests are Habitat for Pacific Fisher, Pacific Fisher Tolerance to the Rate of Treatments must be Considered in the Plan

The Plan must cite to, quote from, and consider the Southern Sierra Fisher Conservation Strategy and the new science, the Zielinski et al. (2013b) Fisher Tolerance Study http://www.sequoiaforestkeeper.org/pdfs/comment_letters/wishon/Ex._D-Zielinski_et_al_2013b_%20tolerance_paper.pdf, which concludes that managers must factor in the extent and rate of logging, thinning, and restorative treatments, including prescribed fire, to determine whether fishers can tolerate the planned activities, also ensuring that habitat connectivity is maintained.

According to the Zielinski et al. (2013b) Fisher Tolerance Study, fisher occupation of larger habitat areas begins dropping quickly when restorative treatments, which include fuel reduction thinning, prescribed fire, or pre-commercial (hand) thinning, exceed a rate of about 13% in 5 years, or an average of about 2.6% per year. Fisher use was lowest in areas where the rate of treatments was only slightly higher, that is, when 3.5% of the area has been disturbed each year. In other words, as the rate of treatment increases from 2.6% of a larger area per year, the fisher's use of the area declines, with data showing the lowest use when an area was treated at 3.5% per year. The Zielinski et al. (2013b) Fisher Tolerance Study concludes that treatment rates which exceed the 2.6% per year "may put fisher habitat and fisher use of these areas at risk."

Zielinski et al. (2013b) noted that although fishers showed no aversion to including treated areas within their home ranges, Garner (2013) http://sequoiaforestkeeper.org/pdfs/comment_letters/wishon/Ex._E-Garner_2013.pdf found that "fishers avoided using treated areas when resting and foraging." *Id.*

Projects must be reconsidered where there is a constricted corridor in the Fisher's Core Habitat, and the proposed treatments in this corridor may cut off fisher movement through the corridor. As discussed above in Zielinski et al. (2013b), Garner (2013) found that "fishers avoided using treated areas when resting and foraging." When an entire corridor is proposed for treatment, meaning there is a likelihood that fishers will completely avoid use of this corridor after treatment, which will completely sever the movement of fishers through the corridor for an extended period of time, which would have a devastating effect on foraging, reproductive behavior, and genetic diversity of the fishers, the management agency must reconsider or rethink implementations of such a project. In essence, if movement through a corridor is severed, it would cut-off and genetically isolate the fisher population in the fisher's already limited range.

The Plan must analyzed the extent or rate of forest-plan-enabled treatments that could be implemented based on the management plan, which include fuel reduction thinning, prescribed fire, or pre-commercial (hand) thinning, and the connectivity of habitat for fishers. Failure to consider this significant new information in light of the range of treatments and prescribed fire acres and acres of other treatments could endanger the viability of the Pacific fisher and other old forest dependent species.

M. The Plan Must Consider Forest Species of Conservation Concern and Consider Evidence of Rarity, if Plan would Cause Habitat Alteration

The Plan must have other than a cavalier attitude toward protecting old-growth dependent species and must utilize the latest science to be proactive in protecting habitat for many Sierra Nevada species. T**he American Pika** (*Ochotona princeps*) is absence from 15% of their historic sites due to climate change? [1] **The mountain beaver** (*Aplodontia rufa*) has suffered range contraction and is no longer found on the Los Padres National Forest but has been observed on the Sequoia National Forest. This rare rodent along with the **North American Porcupine** are important prey species for Pacific fisher even though they girdle commercial conifers and have been deliberately extirpated from their range in the Sierra Nevada. These species should be protected and returned to the forests of the Southern Sierra Nevada. Until Sequoia ForestKeeper accessioned two specimens of **The Sierra flying squirrel** (*Glaucomys sabrinus lascivus*) with the Museum of Vertebrate Zoology in 2016, no specimens had previously been recorded south of Quaking Aspen and the species was assumed to be extinct in the southern Sierra. The assumption on subspecies is troubling as only two northern flying squirrels have had their DNA analyzed and those are both from the Great Lakes region. Assumption without knowledge is not science. The Northern Inyo and Sierra National Forests both should protect habitat for endangered **Wolverine** (*Gulo gulo*) as the range of this elusive predator may expand to reoccupy its historic habitat. **All communally roosting bat species** must be protected from habitat disturbance and white-nosed bat syndrome. Additionally the **white-tailed jackrabbit** (*Lepus townsendii townsendii*) and **the Sierra Nevada snowshoe hare** (*Lepus americanus tahoensis*) are rare and little studied in the Sierra Nevada. Species that are rare but have been insufficiently studied should not be precluded from consideration just because there is not enough information. This is exactly why species should be considered, to add to the body of knowledge and to prevent extirpations and potential extinctions at the species or subspecies level. Many more species of wildlife should be considered.

N. The Plan Must Consider All Existing Water Resources and Water Uses, including Wells, Diversions, Withdrawals, and Development Projects, that could be Depriving the Forest Ecosystem and Causing Tree Mortality

Is the massive die-off of trees in the Sierra Nevada being caused only by the drought and climate change, or is the die-off being exacerbated by the limited water supply in the Sierra because of the granitic structure of the mountains where water is found in isolated fracture pockets where tree roots must penetrate to reach the needed water supply when surface water flows are intermittent? Fractured rock aquifers drain when connected water resources below the impoundment are removed. Water wells in the Sierra Nevada are located and placed using fracture drilling techniques. Forest managers must consider the anthropogenic uses of water in the forests, including, but not limited to, water wells, water diversions, water withdrawals, and water developments that serve people who have established in forested areas of California. How are these anthropogenic uses of water impacting the available water for growing forests and

[1] Stewart J.A.E., Perrine J.D., Nichols L.B., James H., Millar C.I., Goehring K.E., Massing C.P., & Wright D.H. (2015), Revisiting the past to foretell the future : summer temperature and habitat area predict pika extirpations in California. Journal of Biogeography, 42:880–890.

maintaining the forest species? These human uses of forest water must be identified, their flows determined and totaled, and the cumulative extracted water volume considered along with drought and climate change. Should these extractions be permitted to continue at the expense of the needs of the forest which is California's major location for sequestering carbon?

Global climate change will likely lead to water resource shortfalls. According to the CEC document http://www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-F.PDF, "there is a disquieting preponderance of simulations that become significantly drier during the twenty-first century." Also, "The incidence of years with very low spring snowpack and associated low soil moisture in late spring and early summer occur much more frequently."

According to the CEC document *Using Future Climate Projections to Support Water Resources Decision Making in California* at http://www.energy.ca.gov/2009publications/CEC-500-2009-052/CEC-500-2009-052-F.PDF, "The 30-year trend indicates that the fraction of annual runoff occurring from April through July decreases from about 35% for the historical base scenario (historical conditions with no increase in air temperature) to about 15% for the +4°C scenario."

After thinning stands of mature trees, to increase heterogeneity and resilience, and after hand thinning stands of smaller trees, the temperature of forest fuels and forest air will increase, the moisture level of forest fuels decreases, and the relative humidity in the understory decreases, it stands to reason that surface and groundwater resources could also be impacted by the removal of these materials. It therefore stands to reason that the Plan should provide a comprehensive inventory of surface and groundwater resources of water in the watersheds of any project area where trees are proposed for removal as a way to establish a baseline for assessing the impacts of the project on forest resources. These inventories and an analysis of water resources must be considered in the environmental analysis, especially now that we are in a prolonged drought period in California. This water balance must be specified in order to be able to determine if sufficient water is available to cope with the increased forest temperatures that would result following tree removal.

The Plan must therefore consider how unlogged forests retain water before allowing forest management in California to approve tree removal. The Plan must consider whether commercial logging is an appropriate treatment since commercial logging would cause the forest to become hot and dry and allow surface winds to increase, all of which would exacerbate wildfire.

If the Plan proposes to restore and maintain the forest ecosystem so it is resilient to the effects of wildfire, drought, disease, and other disturbances, the Plan must include an assessment of and documentation to show all water wells, water diversions, water withdrawals, and water developments that utilize water in the watersheds involved in the Plan area in order to establish a baseline of available water for making a decision as to what can be done to protect the forest ecosystem from drought, and whether commercial thinning would be effective, since there is a drought and there is a die-off of millions of trees in the Plan area, and since thinning would cause the forest understory to become hotter and dryer, and would allow moisture-robbing surface winds to increase.

Managing forest ecosystems and clearing fire prone vegetation runs counter to common sense by exposing soils and understory vegetation to desiccating conditions. Removing forest biomass to supposedly reduce fire danger runs counter to making the forest resilient to climate change because opening the forest canopy to winds or the drying heat of the sun results in drying out the layers of moisture-holding duff, small trees, and down woody material, especially in the Sequoia National Forest, which receives relatively little moisture due to its geographic location in the Southern Sierra, essentially surrounded on three sides by desert, and the prevailing weather patterns.

Water vapor in the air comes almost entirely from three sources: Evaporation from any moist surface or body of water, evaporation from soil, and transpiration from plants. Plants have large surfaces for transpiration; occasionally they have as much as 40 square yards for each square yard of ground area. Transpiration from an area of dense vegetation can contribute up to eight times as much moisture to the atmosphere as can an equal area of bare ground.

Relative humidity is most important as a fire-weather factor in the layer near the ground, where it influences both fuels and fire behavior. The relative humidity that affects fuels on the forest floor is often quite different from that in the instrument shelter, particularly in unshaded areas where soil and surface fuels exposed to the sun are heated intensely, and warm the air surrounding them. This very warm air may have a dew point nearly the same or slightly higher than the air in the instrument shelter, but because it is much warmer, it has a much lower relative humidity. Vegetation moderates surface temperatures and contributes to air moisture through transpiration and evaporation – both factors that affect local relative humidity. A continuous forest canopy has the added effect of decreasing surface wind speeds and the mixing that takes place with air movement. The differences in humidity between forest stands and open areas generally vary with the density of the crown canopy. Under a closed canopy, humidity is normally higher than outside (the closed canopy) during the day, and lower at night. The higher humilities are even more pronounced when there is a green understory. While temperature and moisture distribution in the layer of air near the ground are important in fire weather because of their influence on fuel moisture, the distribution of temperature and moisture aloft can critically influence the behavior of wildland fires.

Cumulative impacts that remove trees up to 30 inch diameter and larger that results in opening the canopy and causes the sun to shine where the trees once stood heats and dries forest materials and soil and causes flammable brush to grow where the less flammable tree trunks once stood. Sequoia ForestKeeper's teams of environmental graduate summer interns have repeatedly observed and documented in Sequoia the inverse relationship between canopy cover and ground cover. When forest canopy increases, groundcover decreases: when forest canopy decreases, groundcover increases. (See Fire Weather and other research that indicates the same.)

Much of this is known and is discussed in the US Forest Service's Publication FIRE WEATHER . . . A Guide For Application Of Meteorological Information To Forest Fire Control Operations, by Mark J. Schroeder, Weather Bureau, Environmental Sciences Administration, U.S. Commerce Department and Charles C. Buck, Forest Service, U.S. Department of Agriculture U.S. Government Printing Office: 0-244:923, first published in May 1970. Reviewed and approved for reprinting August 1977, Stock No. 001-000-0193-0 / Catalog No. A 1.76:360 (available at

http://gacc.nifc.gov/nwcc/content/products/intelligence/Fire_Weather_Agriculture_Handbook_360.pdf).

Congress recognized that managing natural resources in National Forests was "highly complex" and enacted the Forest and Rangeland Renewable Resources Planning Act. The Act requires that the Forest Service develop an inventory of "present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services." In addition the Act requires that all forest management activities to be preceded by a "comprehensive assessment" of environmental and economic impacts in order to create a management plan that is consistent with MUSYA and NEPA. Congress emphasized the "fundamental need" for the management plans to "protect and, where appropriate, improve the quality of soil, air, and water resources." Developing an inventory of surface and groundwater resources and an assessment of the environmental impacts on surface and groundwater including potential impacts of groundwater use on surface water resources, is an integral step in ensuring that a management plan protects the water quality.

O. Ecological Restoration Principles – Restoration with Fire and Without Tree Removal – Should be Considered and Analyzed as An Alternative that Enables Nature to Recover from the effects of Continued Drought and Climate Change

The Plan should not rely on mechanical methods for ecological restoration and maintenance. Instead, fire should be used as the primary tool for restoration, as suggested in both the California Spotted Owl and Fisher Conservation Strategies. Moreover, the Plan should not overstate the need for ecological restoration to create resiliency from drought, and native insects and diseases, which are natural processes that should be preserved rather than eliminated.

Thinning of medium and large diameter trees (12-30" dbh) should not be permitted for the purpose of ecological restoration to prevent natural stresses from competition. Tree competition, caused primarily by increases in stand density, is a natural process which induces other natural process that deal with this density, such as native insect- and disease-caused tree mortality. These processes, in turn, produce structural forest elements that are vital for wildlife—snags. While the removal of trees to reduce this natural competition may prevent the death of a small number of large trees, it would also prevent the creation of some of the most important elements in the forest ecosystem—snags—for the perpetuation of certain wildlife species, including California spotted owls, various woodpeckers, and countless other species. It is well-documented that these species need abundant large snags at a certain densities in order to thrive. Even the artificial method of increasing the number of snags by girdling trees will not create as diverse a variety of snags for these species as will natural snag recruitment. And while the cutting or removal of trees to prevent competition-induced stresses may be good for the remaining trees, it prevents natural snag recruitment that helps perpetuate a number of key wildlife species.

For a Plan that promote resilience as a goal, it is important to understand that resilience is not a process. Instead, it is a characteristic, which results from the continued perpetuation of natural processes, including competition. The perpetuation of the forest ecosystem is not the same as the perpetuation of the lives of all of the larger trees in that ecosystem. This means that we need some of these large trees to die at a rate that can sustain certain wildlife species. This also means

that we need an assortment of tree species in differing growth stages to replace the larger trees when they die. Competition mortality will result in large snag recruitment beyond what silviculturalists may want in a forest that is 'managed' to produce maximum growth.

Even if the Plan allows tree cutting a few of the larger trees for ecological restoration or to reduce safety hazards along roads, these tree boles should be retained in the forest as large down woody material. Ecological restoration provides an opportunity to restore forest areas with large down woody material for soil nutrients, wildlife (especially for Pacific fishers and herpetofauna), and to maintain ecological functions.

Leaving a large number of downed logs will not increase fire risk. The Forest Service's own science clearly concludes that large logs (defined by the 2001 Sierra Nevada Forest Plan Amendment as being over 12 inches in diameter) are essentially irrelevant to fire behavior. And tree boles over 12 inches in diameter that the agency says it needs to fell for ecological restoration would not create any significant fire hazard if left standing. Operability for prescribed fire management should not be an issue when leaving these large tree boles as down logs. In fact, the 2004 Sierra Nevada Framework http://www.fs.usda.gov/detail/r5/landmanagement/planning/?cid=stelprdb5349922 standards takes large down logs into consideration, stating that managers should design prescribed burn prescriptions and techniques to minimize the loss of large down material.

The Plan should use the reintroduction of fire as the primary tool for ecological restoration and should prohibit the thinning of larger trees to reduce fire risk, just as the National Park Service has done with the use of natural process of prescribed and fire use fires for the past 40 years managing the Sequoia and Kings Canyon National Parks. The Plan should limit manual and mechanical methods that prepare the forest for the reintroduction of fire to the cutting of only some trees 8-10 inches dbh and smaller. As the Sequoia and Kings Canyon National Parks ("SEKI") has found, "cutting trees up to and including 8" in diameter has proven effective in fuels reduction in SEKI." SEKI demonstrated the effectiveness of their prescribed fire treatments that showed dramatically different and beneficial burn result from the Rough Fire compared to the devastating result of the fire in Sequoia National Forest where thinning is the primary management treatment. After fire is reintroduced into stands where only some trees up to 8" in diameter were removed, natural processes can perpetuate, making future thinning applications for ecological maintenance unnecessary.

P. <u>The Plan must Consider the Impacts of continuing to Allow in Forests Heat sources like Campfires, Cigarette smoking, and Vehicles without Spark Arrestors or shielded Mufflers off paved roads, since Human-caused Fires are Now the Norm and Lightning-caused Natural Wildfires are infrequent</u>

Thousands of acres of forests and chaparral habitats were burned, hundreds of people were displaced, several people were killed, thousands of homes were incinerated with millions of dollars spent in suppression costs, and countless environmental losses occurred as a result of human-caused fires in 2015 and 2016. Heat sources, whether from flames from a campfire, or embers from a tossed cigarette, or sparks from an engine with a nonfunctional spark arrestor, or sparks from a bullet that bounces off a rock, or sparks from the rotating blade of a road clearance

weed cutter that strikes a rock – they are all examples of human-caused fires that must be addressed.

Lightning-caused natural fires in forested habitats generally ignite near the top of a tree and slowly burn down the tree because heat rises, so the fire is not easily spread down to the ground where most lightning fires could eventually be extinguished due to the cool environment below the trees where small fuels are less abundant. Human-caused fires, on the other hand, generally start at ground level and burn quickly up because heat rises and rising heat creates wind conditions that carry and accelerate the fire's spread.

Due to the changing climate, the drought, and the frequency of expensive human-caused fires, the forest managers should place Public Service Announcements (PSA's) in multiple languages and in every media outlet and through every organization that operates in California to get the word out about ways to reduce GHG's, climate change, and forest fires. Preventing human-caused forest fires would benefit every American. At a minimum, forest managers should consider prohibiting with the Plan all camp fires and smoking in camping areas and impose severe financial penalty for smoking and fires in forested areas.

The Plan must consider an analyze the Cumulative Impacts of human-caused forest fires to forest ecosystem and forest species, to air quality, and to climate change.

Q. <u>The Cumulative Impacts of Grazing Allotments on Public Lands Must be Considered given the Methane Produced and the Significant and Historic Climate Changing Impacts to Riparian and Meadow Resources where Carbon is Stored</u>

The Plan old inventory data, but there is a conspicuous-absence of forest land data after the – pre-drought data. Livestock production and utilization of forage resources by livestock introduce and spread invasive species that increase wildfire intensity and conflict with the need to combat climate change.

Livestock grazing contributes to the spread of cheatgrass. There are two primary reasons. First, preferential grazing of native perennial grasses by livestock gives cheatgrass a competitive advantage in the struggle to obtain water, nutrients and space for growth. Second, and perhaps the most important factor contributing to the spread of cheatgrass is soil disturbance, in particular, livestock trampling of biological crusts.

Biological crusts, which cover the soil surface in between native bunchgrasses, make it difficult for the seeds of cheatgrass to successfully germinate and grow. Biological crusts also contribute nitrogen to soils, and can act as a mulch reducing soil moisture losses due to evaporation — both of which enhance survival of native bunchgrasses.

Cumulative cattle-associated methane emission values for California during 2013 have been released by the California Air Resources Control Board. Approximately 1,911,000,000 pounds of cattle-associated methane were released into the atmosphere in 2013 -- 997,000,000 pounds by way of enteric emissions and 914,000,000 pounds by way of manure-related emissions. Using the IPCC AR5th 20-year interval methane GWP, the carbon dioxide equivalent (CO2e) value associated with this mass of methane is comparable to an amount of carbon dioxide that

would be annually released by 19.1 coal-fired electricity generation (CFEG) plants that would then trap heat in the atmosphere for 20 years before being sequestered. Using an IPCC AR5th 100-year interval methane GWP, the CO2e value associated this mass of methane is comparable to an amount of carbon dioxide that would be annually released by 6.36 CFEG plants that would then trap heat in the atmosphere for 100 years before being sequestered.

Three recent studies [2] have documented linkage between heightened greenhouse gas emission levels, increased atmospheric heat, and the high pressure ridge that has formed and persisted in the Pacific Ocean, known colloquially as the "Ridiculously Resilient Ridge" (RRR). This RRR high pressure ridge has been responsible for re-routing Pacific storm activity well to the north of California over the last few years.

Of the three studies noted above, one has also linked these three phenomena with rapid Arctic heating and decline in Arctic sea ice. The Wang study, which did not assert a link to rapid Arctic warming, noted that "there is a traceable anthropogenic warming footprint in the enormous intensity of the anomalous ridge during winter 2013–2014 and the associated drought." Finally, John P. Holdren, President Obama's senior science director, has argued powerfully that climate change should be considered one of the drought's major contributors. This statement can be accessed at: https://www.whitehouse.gov/sites/default/files/microsites/ostp/critique_of_pielke_jr_statements_on_drought.pdf.

These findings were predicted in peer-reviewed scientific literature over ten years ago by Sewall and Sloan (2004). (For a full explanation and some thoughts on Sewall and Sloan's theory from prominent climatologists, see this 2014 article.) Moreover, anthropogenic climate change has already increased the probability that more megadroughts will occur in California. Ault et al. (2014) conclude:

> In the current generation of global climate models, the risk of a decade-scale drought occurring this century is at least 50% for most of the greater southwestern United States and may indeed be closer to 80% ... The probability of multidecadal megadrought is also high: the likelihood of a 35-yr event is between 10% and 50% depending on how much climate change is realized during the coming century. The probability of even longer events (50-yr, or "permanent," megadrought) is non-negligible (5%–10%) for the most intense warming scenario (p. 7545).

[2] The first study demonstrating this linkage was published by Stanford University researchers on September 29, 2014 (co-authors Diffenbaugh, Swain, Rajaratnam, et alia) in a supplement to the Bulletin of American Meteorological Society. The study was summarized extensively in the Stanford Report issue of September 30, 2014. http://news.stanford.edu/news/2014/september/drought-climate-change-092914.html. The second study demonstrating this linkage was published in Environmental Research Letters, Jan 6, 2015, and coauthored by Rutgers Professor Jennifer Francis and Stephen Vavrus. The title of the study is "Evidence for a wavier jet stream in response to rapid Arctic warming." (Source: http://iopscience.iop.org/1748-9326/10/1/014005). The third study was authored by Wang, S.-Y. (Simon Wang), Larry Hipps, Robert Gillies, and Jin-Ho Yoon, and is summarized in Fire and Ice—California Drought and "Polar Vortex" in a Changing Climate, Science and Technology Infusion Climate Bulletin NOAA's National Weather Service, 39th NOAA Annual Climate Diagnostics and Prediction Workshop St. Louis, MO, 20–23 October 2014.]

Such megadroughts, if they occur, will undoubtedly exacerbate the water shortages and species extinction that are already afflicting California. (Cook, 2015; Diffenbaugh et al. 2015).

This assessment is also consistent with the argument presented in the recently-published study by Kevin Trenberth et al. (2015), which emphasizes how the impact of human-induced warming has affected the climate system's thermodynamic state and consequently intensified major climatic events in recent years. Trenberth et al. also summarize the Diffenbaugh et al. (2015) study in a manner that highlights how anthropogenic warming has already increased the odds of increased drought risk and drought risk severity:

Another very recent example is the California drought beginning in 2012. Whereas one study found no significant trends in winter precipitation in recent decades, another [the Diffenbaugh et al. 2015 study] pointed out the critical role of the record high annual mean temperatures in combination with record low annual mean precipitation for 2013 which led to increased evapotranspiration and more intense drought. The combination of these had impacts on water shortages, vegetation and agriculture, and increased wildfire risk. The odds of this combination have increased with human-induced climate change and anthropogenic warming has increased drought risk (footnote numbers removed). [Kevin Trenberth et al. (2015)]

We also note for the record that the U.S. Geological Survey just released a study: "Temperature Impacts on the Water Year 2014 Drought in California" by Shraddhanand Shukla et al. (http://onlinelibrary.wiley.com/wol1/doi/10.1002/2015GL063666/abstract), which finds that high heat has multiple damaging effects during drought, increasing the vulnerability of California's water resources and agricultural industry. Not only does high heat intensify evaporative stress on soil, it has a powerful effect in reducing snowpack, a key to reliable water supply for the state. In addition to decreased snowpack, higher temperatures can cause the snowpack to melt earlier, dramatically decreasing the amount of water available for agriculture in summer when it is most needed. "If average temperatures keep rising, we will be looking at more serious droughts, even if the historical variability of precipitation stays the same," Shukla said. "The importance of temperature in drought prediction is likely to become only more significant in the future."

Thus, the best available science demonstrates that continued GHG emissions in the present and near future are likely to further accelerate the warming of the planet generally and heating of the Arctic in particular. Such heating will likely increase the probability that more high pressure ridges will form in the Pacific. These high pressure ridges will then likely continue steering Pacific storm activity around (but not through) California in the future, thus aggravating the California drought. This best available science also indicates that GHG-associated global warming is likely to intensify the duration and severity of such future droughts and the adverse impacts associated with such projected future droughts.

The comparison of alternatives is "the heart" of the review process, and a range of reasonable alternatives should be presented and analyzed. The courts have cautioned against constructing a purpose and need so narrowly as to exclude other alternatives. *Simmons v. United States Army Corps of Engineers*, 120 F.3d 664, 666 (7th Cir. 1997). Because the Plan scoping documents frequently reference the USDA-FS, Forest Service, and Forest Service inventories, it appears that Federal lands will be subject to decisions of this planning process, so the Plan should have purpose and need such that it does NOT pre-ordain the outcome of the NEPA analysis.

The Plan needs to consider a range of alternatives that are different. These must include current management (i.e. no change in season) and No Grazing alternatives to provide the environmental background, so that the baseline for comparison of action alternatives is fully described and so that the effects of cattle grazing on all of the public resources can be fully understood. We propose one other alternative that analyzes and considers the impacts of livestock-caused downcutting in meadows from continued grazing in those meadows, the impacts to forest resources and increased fire threat from the introduction of invasive grasses and removal of brush due to livestock grazing, and the impacts from livestock on air quality and greenhouse gas forcing that exacerbates climate change.

Congress recognized that managing natural resources in National Forests was "highly complex" and enacted the Forest and Rangeland Renewable Resources Planning Act. The Act requires that the Forest Service develop an inventory of "present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services." In addition the Act requires that all forest management activities to be preceded by a "comprehensive assessment" of environmental and economic impacts in order to create a management plan that is consistent with MUSYA and NEPA. Congress emphasized the "fundamental need" for the management plans to "protect and, where appropriate, improve the quality of soil, air, and water resources." Developing an inventory of air quality and soil quality for each meadow and at locations where salt licks are placed to attract livestock, would be appropriate places to monitor for air and soil quality in order to assess the conditions in the air and of the soil when compared with the conditions in other un-grazed areas. Surface and groundwater resources in the area of meadows and streams exiting meadows should also be part of an assessment of the environmental impacts on surface and groundwater including potential impacts from livestock grazing and would be an integral step in ensuring that the Plan protects the water quality of the Sierra National forest lands.

R. The Plan Should Protect Limited Special Habitats Areas - Botanical Areas - Geological Areas - Scenic Byways and - Historical Landmarks

The Plan should protect Limited Special Habitats. Sequoia National Forest, for an instance, has many special habitats that that should be protected as areas of foot traffic only to reduce exposure of these areas to heat sources that could initiate human-caused fire, to invasive species that could out-compete the native species, and to heavy equipment that could excessively disturb the soil.

The Plan must consider high biodiversity areas for special treatment. The following special botanical habitats must be protected by being allowed to naturally adjust to the changing conditions without intrusion by motorized and non-motorized mechanical vehicles. Management should mirror those of the National Park Service, which manages the Sequoia groves in Sequoia and Kings Canyon National Parks by natural processes.

Botanical Areas
Sequoia National Forest lands which have high concentrations of rare and endemic plants (usually associated with atypical geology and unusual soil types) are designated as Botanical Areas (BAs).

1. The 780 acre **Baker Point BA** is a granite bedrock peak with sweeping views, many rare plants, and an historic lookout tower.

2. The 4,190 acre **Freeman Creek Grove BA** contains the Freeman Creek Giant Sequoia Grove, the easternmost grove of giant sequoias and considered to be among the most recently established. Part of the grove is underlain by a three million year old volcanic basalt flow.

3. The 500 acre **Slate Mountain BA** is unique because of its abundance of four different rare plants. It sits on the rocky northern summit of Slate Mountain and is comprised of pre-cretaceous metamorphic and meta-sedimentary rocks surrounded by granitic rocks. Nearly 95 percent of the total population of Twisselmann's buckwheat occurs on Slate Mountain.

4. The 446 acre **Bald Mountain BA** is geologically unique and is underlain by pre-cretaceous meta-sedimentary rocks (made up of layered rock deposits). This mountain not only offers one of the best views in the southern Sierra Nevada, but also an opportunity to experience the unique plant assemblages that occur here.

5. The 860 acre **Ernest C. Twisselmann BA** is located on the Kern Plateau. It is named after a local rancher and lay botanist whose herbarium is still maintained in the Kern River Ranger District office. The area is characterized by a subalpine coniferous ecosystem with a diverse mix of foxtail, limber, western white, Jeffrey, and lodgepole pine, and red and white fir. Many plants found here are in their southernmost location in the Sierra Nevada.

6. The 270 acre **Inspiration Point BA** is located in the northern Piute Mountains and offers spectacular views of the Lake Isabella Reservoir, Kern River Valley, Greenhorn Mountains, and Kern Plateau. The common rock types are metamorphic with mafic schist and gneiss and a large prominent limestone ridge. Floristics is very unusual in this BA with limber pine (a subalpine tree) growing with pinyon pine. (Sequoia National Forest assessment published in December 2013) [The Piute Fire from 2008, destroyed almost the entire BA.]

7. The 860 acre **Bodfish Piute Cypress BA** is also located in the Piute Mountains. It is underlain by soils derived from mafic igneous gabbro and hornfels. This BA supports the largest grove of the endemic Piute cypress, which is only found in 13 small groves surrounding Lake Isabella. [The 2010 Canyon Fire burned with crown fire through a significant part of the BA and the BLM RNA.]

Geological Areas

1. The 40 acre **Packsaddle Cave Geological Area** is located approximately 15 miles north of Kernville, California, and was designated for its special geologic features. The cave consists of a large room-like passage, with minor rooms at the rear. The Kern Canyon Fault, recently determined to be an active fault, runs through this geological area.

2. The 3,500 acre **Windy Gulch Geological Area** is located in the Giant Sequoia National Monument and contains a number of outstanding formations, including caves and marble roof pendants. Mesozoic granitic rocks are the dominant rock type and consist of several plutons approximately 100 million years old. The metamorphic rocks are known as the Kings Terrain. The most extensive of these are the Lower Kings River, Kaweah River, and Tule River roof pendants. The Lower Kings River roof pendant includes the Boyden Cave roof pendant, whose marble contains several caves including Boyden Cave and Church Cave.

Forest Service Scenic Byways

- **Kings Canyon Scenic Byway** was designated in 1990 as a National Forest Scenic Byway for scenic beauty and recreational value. The byway is popular year around; however the majority of the use is in the summer months. The road into the canyon from the Hume Lake turnoff is closed during the winter months. This road receives high visitor use because it is the only access to Cedar Grove in Kings Canyon National Park, and use is expected to increase in the future. The road condition is good and more interpretive signs will be installed in 2014. Graffiti and vandalism have increased in the last several years, based on staff observation in 2013.

  For more detailed information on scenic byways see the August 2, 2013 snapshot of the Sequoia National Forest Living Assessment Chapter 15, lines 823-839

Historical Landmarks

1. The **Walker Pass National Historic Landmark** includes approximately 111 acres of federal lands on the Sequoia National Forest, as well as the Bureau of Land Management Caliente and Ridgecrest Resource Areas. Walker Pass was designated a national register property and national historic landmark on July 4, 1961. Walker Pass is named after Joseph Rutherford Walker and his use of the pass for actions that contributed significantly to the exploration and settlement of California by the United States of America in the years 1834, 1843, and 1845.

2. **Moses Mountain** is a candidate for national landmark designation. The Sequoia National Forest is coordinating with the National Park Service in on site landmark evaluation studies.

Kings River Special Management Area

The 49,000 acre **Kings River Special Management Area** (KRSMA) includes five miles of wild and scenic river (segment 2), plus an additional 13 miles of the river (segment 1) that was not designated Wild and Scenic. The special management area falls in two national forests, the Sequoia National Forest and the Sierra National Forest.

The portion of the KRSMA on the Sequoia National Forest is bounded on the north by the Kings River and within the Giant Sequoia National Monument. The area is generally

steep with brush and grass covered canyons, 1,000 feet to 5,000 feet in elevation, not very accessible, and provides great opportunities for solitude. Native American use and needs may preclude some interpretation. Existing off highway vehicle routes are not passable. Management challenges include risks associated with wildfire aggravated by extremely steep slopes.

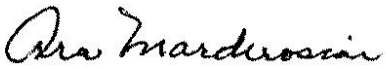
The Kings River Special Management Area receives low use in most areas, but moderate use along the river and on the trail to the Boole Tree. This trend is expected to continue, based on staff observation 2013. The Kings River offers whitewater recreation opportunities. The Sierra National Forest manages the boating permits for outfitters and guides. The demand for recreation opportunities associated with the river is expected to continue and expand into the future.

These special areas in Sequoia National Forest (Limited Special Habitats Areas - Botanical Areas - Geological Areas - Forest Service Scenic Byways and - Historical Landmarks) are examples of some forest areas that should be protected by the Plan as areas of foot traffic only to reduce exposure of these areas to heat sources that could initiate human-caused fire, to reduce invasive species that could out-compete the native species, and to eliminate heavy equipment that could excessively disturb the soil of these special habitat areas of high biodiversity.

CONCLUSION

The Plan must be crafted to not degrade rather but restore our forests. We urge you to respond to and incorporate our concerns, issue a Plan for review that serves the public and wildlife, not timber, ranching, or energy interests.

Respectfully submitted,



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Attachment: Exhibit A - Recommendations for Reducing Air Pollution to CARB EJ Advisory Committee 8-August-2016

8 August 2016 **Exhibit A**

Environmental Justice Advisory Committee
P.O. Box 2815
Sacramento, CA 95812

RE Recommendations for Reducing Air Pollution to EJ Advisory Committee

Dear Committee Members:

The California Global Warming Solutions Act of 2006, (AB 32; Stats. 2006, chapter 488) calls for the Air Resources Board (ARB or Board) to convene an Environmental Justice Advisory Committee (Committee), to advise the Board in developing the Scoping Plan, and any other pertinent matter in implementing AB 32. It requires that the Committee be comprised of representatives from communities in the State with the most significant exposure to air pollution, including, but not limited to, communities with minority populations or low-income populations, or both (AB 32; Part 7. Miscellaneous Provisions Section 38591). On January 25, 2007, the Board appointed the first Environmental Justice Advisory Committee to advise it on the Initial Scoping Plan and other climate change programs. To advise the Board on the 2013 Scoping Plan Update, ARB solicited nominations and reconvened a new Committee on March 21, 2013. Committee meetings are open to the public and include a public comment period.

The California Supreme Court has written, "the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties." California courts have ruled, "the greater the existing environmental problems are, the lower the threshold should be for treating a project's contribution to cumulative impacts as significant."

The ARB has an opportunity and an obligation to remedy this egregious and life-threatening pollution condition that affects the health of many residents. The ARB should include strong policies and performance standards that help to clean our dirty air.

On 28 July 2016, I attended the Environmental Justice Advisory Committee (EJAC) local community meeting in Bakersfield. I provided oral recommendations on the four areas of interest discussed at the meeting by presenting three, brief oral comments.

This written comment, in addition to documenting the recommendations that were presented orally, also includes my recommendations for solar panels for mobile homes and at RV parks to benefit low-income people, concerns about bad air quality in the San Joaquin Valley, the need for more meaningful farmland conversion arrangements, and expanded recommendations related to forest and land management practices to minimize impacts of mechanized equipment, to retain insect-infected trees and other biomass in place, and to generally manage forests according to known science that fosters forest moisture, reduces wildfires, and sequesters carbon to reverse global warming, which will benefit all California residents.

First, my three oral comments at the workshop in Bakersfield

(1) **In answer to the stated objective of EJAC is to determine how to differently manage forests to reduce Greenhouse gasses (GHGs) and increase carbon storage**, I stated that forests must be managed as closed canopy forests. Maintaining closed canopy forests, rather than logging, will increase forest moisture, and decrease forest temperature and surface winds, which will all reduce severe wildfires and increase carbon sequestration.

(2) **In response to a presenter's statement that the California Public Utilities Commission (CPUC) is charged with considering impacts, of its decisions, to individuals in disadvantaged communities in order to not create barriers to the use of energy efficiency**, I stated that the CPUC's decision to allow power companies to charge customers who generate solar power a grid connect fee that increases the minimum monthly charge for power to $10, which would be a dis-incentive to invest in solar panels for individuals in disadvantaged communities.

(3) **Written and oral comment on Short-Lived Climate Pollutant Reduction Strategy** were submitted on behalf of Jan Dietrick, MPH, Steering Committee, Ventura County Climate Hub, Ventura, CA 805.746.5365, Todd Shuman, Senior Analyst, Wasteful Unreasonable Methane Uprising, Camarillo, CA 805.987.8203, and Sequoia ForestKeeper, Kernville, CA, which included three recommended actions for methane emissions reduction to achieve 80% reduction below current levels by 2030:
(A) **A robust fee or fine on unburnt, uncaptured methane emissions of $4700/CH4 ton** (in 2007 US dollars) paid by emitters,
(B) **A rapidly decreasing mandatory cap on allowable methane emissions** from all sources, and
(C) **Discontinuation of subsidies on animal products**.

A more complete explanation of (A) the robust fee or fine on unburnt, uncaptured methane emissions of $4700/CH4 ton is available in a letter, dated November 23, 2015, to California Governor Jerry Brown and Mary Nichols, Chair of California Air Resources Board, which is attached and found along with other comment letters on the Sequoia ForestKeeper website www.sequoiaforestkeeper.org and directly at this link:
http://www.sequoiaforestkeeper.org/pdfs/climate_change/151123-2_SFK_et_al_CARB_Methane_Fee_Based_on_Shindell_2015.pdf

We have submitted other comments and recommendations about methane and water use to the State Water Resources Control Board and California Air Resources Board. The links to locate and download comments are pasted below.

The California Air Resources Board is attempting to regulate carbon emission without addressing the methane contribution of the livestock industry or the carbon emitted by burning biomass. Sequoia ForestKeeper: Ara Marderosian, Wasteful Unreasonable Methane Uprising: Todd Shuman, and Ventura County Climate Hub: Jan Dietrick outline their concerns in this comment letter.

Attachments to the above letter:
Climate impact of beef: an analysis considering multiple time scales and production methods without use of global warming potentials. RT Pierrehumbert {Grass fed vs feedlot Eshel Pierrehumbert 2015}
Letter from Center for Biological Diversity and Climate Change Law Foundation to CARB on their Proposed Short-Lived Climate Pollutant Reduction Strategy and Draft Environmental Analysis, May 26, 2016. {16 05 26 Final CBD SLCP Strategy comments}
New use of global warming potentials to compare cumulative and short-lived climate pollutants. Myles R. Allen, et al. {Allen et al on SLCP GWP 2016}
Offsetting methane emissions — An alternative to emission equivalence metrics. A.R. Lauder, et al. {Lauder et al 2012}
Short-Lived Climate Pollution. R.T. Pierrehumbert {Pierrehumbert on SLCPs}
SFK letter from November 25, 2015 to California Governor Jerry Brown and Mary Nichols, Director of the California Air Resources Board, for a methane emissions fee or fine on uncaptured or unburned methane.

http://www.sequoiaforestkeeper.org/comments_to_sqf_and_other_agencies.aspx
http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/
State Water Board Drought Year Water Actions
2015 Public Comments / Objections / Protests / Petitions for Reconsideration
Comments / Objections / Protests Regarding January 23, 2015 Temporary Urgency Change Petition and Petitions for Reconsideration of Order Approving Temporary Urgency Change for the Central Valley and State Water Projects
Comments/Objections/Protest/Petitions for Reconsideration Submitted After April 6, 2015
Sequoia ForestKeeper and Wasteful UnReasonable Use Ara Marderosian, Todd Shuman, Mike Hudak, & Jan Dietrick 04/13/2016
Sequoia ForestKeeper and Wasteful UnReasonable Use Ara Marderosian, Todd Shuman, Mike Hudak, & Megan Gallagher 10/14/2015
Sequoia ForestKeeper and Wasteful UnReasonable Use Ara Marderosian, Todd Shuman Mike Hudak, & Megan Gallagher 08/16/2015
Sequoia ForestKeeper Ara Marderosian et al. 07/06/2015
Sequoia ForestKeeper Ara Marderosian et al 06/19/2015
WURU Press Release Todd Shuman 06/19/2015

Additional Recommendations Based on EJAC Presentations on Transportation, Energy, Ag, and Working Lands, and Public Comments made During the 28 July 2016 Meeting

ARB Should Investigate PV Solar Distributed Generation and EV Access Projects for Low-Income Households, Especially Over Mobile Home and RV Parks in EJ Communities to Provide Shade for Cooling as well as Power

Given the seriousness of the global warming issue, EJAC and the California ARB should be addressing the issue with Plan objectives, policies, performance criteria, and specific, feasible

implementation measures, measures that address criteria pollutant emissions as well. Here are a number of possible, feasible implementation and mitigation measures:

- In order to encourage the use of non-polluting electric vehicles (EVs), the ARB should include a policy to require new projects to include quick charge Level 3 EV charging facilities. Projects adjacent to highways should install multiple fast charge facilities that could reduce pollution by encouraging intercity EV travel. See http://www.wind-works.org/cms/index.php?id=84&tx_ttnews%5Btt_news%5D=3401&cHash=ae60686195244d8cb5d31cad14e4aa92.
- In order to encourage the use of non-polluting electric vehicles, the ARB should require new commercial projects and hotels to include EV charging facilities.
- In order to encourage the use of non-polluting electric vehicles, the ARB should require parking lots in all communities to include dedicated EV parking with solar panel covered parking spaces to shade the vehicles while charging them.
- Green building measures might include passive solar design and a requirement that buildings be at least 25% more energy efficient than Title 24 standards current when permits are pulled.
- Satisfy LEED Silver standards on hotel and the commercial buildings.
- Design features to reduce Vehicle Miles Traveled (VMT). Such features might include adjacent bus stops and/or other public transportation and should include bicycle-friendly features. The ARB should commit to increased pedestrian and bicycle connectivity.
- A requirement that new structures contain solar photovoltaics (PV) and solar water heating. As a result of a settlement of a recent Sierra Club lawsuit with Tulare County regarding their General Plan Update, 20% of new housing in Tulare County will contain solar PV. The Rio Bravo Ranch project in Bakersfield will build solar PV into 25% of the new residences. Every kilowatt of solar PV power offsets about a ton per year of global warming gasses that would otherwise have been produced by a fossil fuel-fired power plant (according to Environment California Research and Policy Center in a publication entitled *The Economics of Solar Homes in California*).
- A requirement that residences, mobile homes, and manufactured homes built without rooftop solar PV should be pre-wired for solar PV.
- A requirement that each new residence and manufactured home contain a Level 2 EV charging station, relatively inexpensive when wired during construction. In order to reduce vehicle emissions, the use of electric vehicles (EVs) should be encouraged.
- A requirement for partial funding of an area energy efficiency program creating equivalent reductions in carbon emissions.
- A requirement that new home or commercial projects partially subsidize public transportation in order to reduce area VMT.
- A condition that parking lots be covered and that parking lot roofs contain solar PV.
- Adopt a policy that funds covered roofs containing PV Solar panels for residents in mobile home and RV parks in EJ disadvantaged communities to provide these residents with power and shade that would reduce trailer temperatures by 15 degree below ambient.
- Stop the policy that requires residents in RV parks to move their RV out onto the streets every six months for four days sometimes jeopardizing stable tenancy in the park.
- Parking management measures that promote walking and transit use.

- A requirement that developers and counties retrofit solar PV on existing area buildings. Retrofitting existing area buildings with solar PV would effectively offset emissions associated with county and project operations in much the same way as the San Joaquin Valley Air Pollution Control District (SJAPCD) uses Indirect Source Rule (ISR) funds to fund offsite projects to offset criteria pollutants associated with development projects.
- A requirement that developers contribute funding for area solar PV incentives. Most solar PV incentive programs use funding rebates to encourage PV construction.
- A requirement that developers contribute a GHG fee to an air pollution control district like the SJVAPCD to be used to fund projects that would reduce GHG emissions elsewhere. This could be built in to a criteria pollutant Voluntary Emission Reduction Agreement (VERA) as the Air District has suggested in the past.
- The Bay Area Air Quality Management District (BAAQMD) has assembled a list of potential general plan policies and mitigation measures that the ARB could incorporate in its plan. These may be found in the following document between pages 98 and 110 at the website http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Draft_BAAQMD_CEQA_Guidelines_May_2010_Final.ashx.

The ARB should address each of these measures in order to determine its feasibility and effectiveness in reducing or offsetting the GHG and criteria pollutant emissions associated with setting standards for Reducing Air Pollution.

Air Quality

The southern San Joaquin Valley fights it out every year with Los Angeles for having the worst air pollution in the nation. See the American Lung Association report at http://www.lung.org/our-initiatives/healthy-air/sota/city-rankings/most-polluted-cities.html . Nearby Bakersfield is ranked either first or second for having the dirtiest air in the nation. Since our extreme air pollution affects the health of many residents, the ARB should thoroughly and seriously address the issue of air quality in all of its aspects.

Additionally, California has nonattainment designations for various federal and state air quality standards, including extreme nonattainment for the ozone 8-hour standard. Existing regulatory requirements at the federal, state, and local levels have been lacking in addressing these very serious air quality issues.

The ARB should include a goal to reduce Vehicle Miles Traveled (VMT). Reducing VMT would have benefits to air quality, climate change, and circulation impacts and would be consistent with AB 32 and SB 375 requirements. In order to help implement this goal, we suggest adopting a graduated traffic impact fee for new residential projects. It should be graduated in the sense that the fee is directly proportional to the distance from the project to the nearest major city, thus encouraging infill and lower VMT. Ultimately, the ARB should consider allowing only in-fill development – build up not out - to preserve open space, forest wildlife habitats, chaparral wildlife habitats, desert wildlife habitat, and food-growing farmlands.

While many projects in the San Joaquin Valley will be subject to the Air District's ISR rule, we note that ISR offsets less than half the air pollution associated with a new project. Given the very serious nature of air pollution in the San Joaquin Valley, air pollution associated with projects should be

required by the ARB to be thoroughly and completely mitigated.

A number of southern San Joaquin Valley developers (including the West Ming project and the Old River Ranch project, both in Bakersfield) have agreed to participate in an Emissions Reduction Program (VERA) through the SJVAPCD. The City of Bakersfield has required a zero emissions agreement of a number of development projects. Through this program, developers promise to completely offset the emissions associated with their project through onsite design features and offsite pollution reduction projects. Participation in such a program has, therefore, been shown to be clearly feasible and effective in reducing air quality impacts to zero, both project-specific impacts and, hence, cumulative impacts, since zero project-specific impact could not add to the cumulative impact.

CEQA requires that "public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects."

FARMLAND CONVERSION

The ARB should require development projects on farmland to pay an Agricultural Land Impact fee for use by a land conservancy entity operating to conserve agricultural land. The fee should be set at higher than one-to-one and perhaps as high as three times the value of the developed farmland in order to first discourage farmland for development and second to acquire similar quality farmland for conservation easement.

- The ARB should include a performance standard that specifies the ratio of preserved mitigation farmland to converted farmland. In order to ensure that CEQA requirements for future projects are met, the Plan should include a policy that the ratio be higher than one-to-one; i.e., that more than one acre of equally good, equally at risk farmland be preserved via conservation easements for every acre of farmland converted.
- The ARB should include a performance standard that specifies the quality of the preserved replacement mitigation land. There is little point in placing an unnecessary conservation easement on farmland that is so far away from urban areas that there is little or no development pressure on it. Preserving farmland that does not need to be preserved, that is under no development pressure and will almost certainly remain farmland even without a conservation easement, does not compensate for the loss of currently producing farmland. The ARB Plan should require that replacement land have similar conservation easement value as that of the converted farmland.
- The ARB should include a policy that requires that a need for a new project be demonstrated and that substantial evidence for this need demonstration be given before approval for farmland is converted to urban use. i.e., if the surrounding urban area contains high numbers of vacant or foreclosed homes, or there is no available and uncommitted drinking water source to support more development, or the air pollution levels in the area are already high, then there would seem to be no need for further development.
- The ARB should include a policy that requires converted farmland to be contiguous to existing urban use and services.

- In order to ensure that the mitigation is administered by a competent organization, the ARB should include a policy that the "land conservancy entity" be accredited by the Land Trust Accreditation Commission. See http://www.landtrustaccreditation.org.
- In order to reduce overall per capita land consumption, the ARB should include goals, policies, and specific implementation measures that would first focus development up in already developed urban areas and second increase the efficiency of development and thereby reduce the pressure to convert farmland to non-agricultural uses.

Forest Biomass removed for Energy Pollutes, Prevents Sequestration, and is Uneconomical

Continuing to extract biomass from forests cannot sustain soil because removing biomass removes soil nutrients for growing future forests, removes the smaller materials and therefore causes subsequent fires to burn larger materials, thus causing more intense fires, and prevents the greatest levels of carbon sequestration from taking place in the forests. Biomass removal should not be enabled by the plan because the cumulative impact of removing biomass has many environmental consequences.

Opening the forest canopy causes the sun to shine on the forest floor, causes the forest to become hot and dry, causes brush to grow where the trees once stood, and causes surface winds to increase, which all increase, not decrease, fire risk, removes some sequestered carbon from the forest, and jeopardize the trees that are already struggling. Opening the forest canopy would also jeopardize the old-growth species that are already on the brink of extinction, including the Pacific fisher, California Spotted owl, Northern goshawk, and a host of frog and salamanders, as well as other reptiles.

North et al. (2009) is an unpublished and non-peer-reviewed report often cited and relied upon by the Forest Service and other agencies for most fuel reduction, ecosystem restoration, and forest health actions, including biomass removal from forested areas. But the North et al. (2009) report did not mean to use the word "remove" to suggest commercial logging of mature trees up to, or over, 20 inches in diameter—as opposed to simply "removing" a given mature live tree from competition with other larger trees by turning it into a large snag or downed log.

Indeed, the authors of North et al. (2009), on page 24 of that report, specifically discuss the potential removal of trees over 10-16 inches in diameter "for socioeconomic purposes" such as "generating revenue" or "providing merchantable wood for local sawmills." Nowhere do the authors of North et al. (2009) specifically recommend "removal" of mature trees (as opposed to snag creation or downed log creation) for strictly ecological purposes, or offer a single citation to any ecological study concluding that some mature trees must be removed from the forest ecosystem, as opposed to being left as live trees, converted into large snags, or converted into large downed logs.

Forest Biomass Removal: The Environmental Analysis for all Forest Treatments, including, but not limited to Biomass Removal, Fuels Treatment, and Burning, Must Disclose the Effects On and Contribution to Climate Change

The ARB should require that environmental analysis for all forest management projects must discuss how proposed treatments will potentially emit CO2, Methane, and other GHG's, that may contribute to climate change, including the carbon emitted from the vehicles and equipment used for fuel reduction treatments, as well as felling, stacking, slash treatments, and biomass collection, hauling from the forest, and burning outside the forest in a power or heat generating facility or prescribed burning. The environmental analysis must disclose what efforts will be taken to mitigate these emissions.

A recent article by Mitchell et al. (2009) describes tradeoffs for managing for carbon storage (a valid goal in any forest management action) versus fuels reduction. That study suggests that, with the exception of some xeric ecosystems (not present in the Sierra), "fuel reduction treatments should be forgone if forest ecosystems are to provide maximal amelioration of atmospheric CO2 over the next 100 years." *Id.* at 653. For that reason, each alternative should discuss and analyze carbon emissions from implementation, and the no-action alternative should also provide information about the potential for carbon storage from foregoing project implementation.

Depro et al., 2007, found that eliminating logging would result in massive increases in Carbon sequestration. "Our analysis found that a "no timber harvest" scenario eliminating harvests on public lands would result in an annual increase of 17–29 million metric tonnes of carbon (MMTC) per year between 2010 and 2050—as much as a 43% increase over current sequestration levels on public timberlands and would offset up to 1.5% of total U.S. GHG emissions." (Depro et al., 2007 abstract)

Moreover, Mitchell et al. (2009) found the amount of net carbon released into the atmosphere, on an acreage basis with small diameter thinning for fuel reduction (if used for biomass), puts more carbon into the atmosphere than an average fire, on an acreage basis:

> Our simulations indicate that fuel reduction treatments in these ecosystems consistently reduced fire severity. However, reducing the fraction by which C is lost in a wildfire requires the removal of a much greater amount of C, since most of the C stored in forest biomass (stem wood, branches, coarse woody debris) remains unconsumed even by high-severity wildfires. For this reason, all of the fuel reduction treatments simulated for the west Cascades and Coast Range ecosystems as well as most of the treatments simulated for the east Cascades resulted in a reduced mean stand C storage. One suggested method of compensating for such losses in C storage is to utilize C harvested in fuel reduction treatments as biofuels. Our analysis indicates that this will not be an effective strategy in the west Cascades and Coast Range over the next 100 years.

Mitchell et al., 2009 abstract.

In any case, the environmental analysis must disclose the emissions from fuel reduction treatments, associated slash treatments, and biomass collection, hauling, and burning/incineration or prescribed burning for each action alternative. For this, the

Washington Office of the Forest Service has generated specific direction on how to discuss climate change effects in a National Environmental Policy Act (NEPA) analysis. See *Climate Change Considerations in Project Level NEPA Analysis* (Jan. 13, 2009) (http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf). That document specifically mentions fuel reduction projects in the types of projects that should disclose direct effects on climate change:

- The effect of a proposed project on climate change (GHG emissions and carbon cycling). Examples include: short-term GHG emissions and alteration to the carbon cycle caused by hazardous fuels reduction projects, GHG emissions from oil and gas field development, and avoiding large GHG emissions pulses and effects to the carbon cycle by thinning overstocked stands to increase forest resilience and decrease the potential for large scale wildfire.

Id. at 2. To assist in disclosing these effects, the Forest Service provides tools that can help managers determine the direct contributions of GHG emissions from project burning or treatments. *Id.* at 5 (*FOFEM 5.5, Consume 3.0,* and the *Forest Vegetation Simulator*). Because the Forest Service has tools or models to effectively calculate emissions, it must disclose these emissions for each of the action alternatives, and so should State and other agencies operating in California in order to reduce GHG emissions in California that are globally cumulative. In addition, the guidance document suggests that the NEPA document include a qualitative effects analysis. *Id.* Such an analysis should include the cumulative effects, quantified in an "individual, regional, national, global" context. *Id.* at 6.

Finally, the guidance suggests that NEPA provides direction on how managers should respond to comments raised during project analysis regarding climate change:

1. Modify alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration by the Agency.
3. Supplement, improve, or modify the analysis.
4. Make factual corrections.
5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the Agency's position and, if appropriate, indicate those circumstances that would trigger agency reappraisal or further response.

Id. at 8. At the very least, because any project that proposes biomass removal includes fuel reduction treatments and burning that will contribute GHG emissions, the EIS must include an acknowledgment of carbon emissions and must provide a response to this issue.

Moreover, the analysis should account for and quantify (as part of the cumulative effects analysis) not only the emission from prescribed burning on-site and the emissions from any biomass that is removed from the project area and later burned or incinerated off-site, but also

the contribution of emissions from transporting this material for off-site burning, and the contribution of emissions from the off-site burning, planning, and implementing the project by the agency, a contractor, and/or other agent that implements such projects.

Our experience with projects proposed by the Forest Service in Sequoia National Forest since 2009 is that no project analysis has utilized these guidelines, despite their importance in determining the impacts to climate change.

This holistic approach to account for GHG emission is necessary to provide managers and the public with the kind of information under NEPA to make informed choices between alternatives and to mitigate for climate change, and to consider and assess the larger picture of GHG contributions from all projects on the national forests that may contribute GHG emissions.

Disclose the Impact from Mechanical Equipment Use on Forest Soils, Streams, and Watersheds

Mechanized fuel treatments and biomass removal treatments incur ecological costs by damaging soils, vegetation, and hydrologic processes, as proponents of fuel reduction treatments have acknowledged (e.g., Allen et al., 2002; Graham et al., 1999; 2004; Agee and Skinner, 2005). Mechanical fuel reduction treatments typically involve the same suite of activities as logging, with the same set of impacts to soils, runoff, erosion, sedimentation, water quality, and stream structure and function. These effects, their mechanisms, and their aquatic impacts have been extensively and repeatedly documented across the West (e.g., Geppert et al., 1984; Meehan, 1991; USFS et al., 1993; Rhodes et al., 1994; CWWR, 1996, USFS and USBLM, 1997a; c; Beschta et al., 2004). Watershed damage ultimately translates into aquatic damage.

The collateral impacts of fuel treatments and biomass removal actions are of considerable concern due to the existing aquatic context. Across the West, aquatic systems are significantly and pervasively degraded (Rieman et al., 2003; Beschta et al., 2004). As a result, many populations of aquatic species, including most native trout and salmonids, have undergone severe contractions in their range and number and remaining populations are now imperiled and highly fragmented (Frissell, 1993; USFS and USBLM, 1997a; Kessler et al., 2001; Behnke, 2002; Bradford, 2005). Additional damage to watersheds and aquatic systems reduces the prospects for the protection and restoration of imperiled aquatic species (USFS and USBLM, 1997c; USFWS, 1998; Karr et al., 2004).

These impacts to soils, streams, and watersheds from these biomass removal project must be added to the existing damage and foreseeable future damage from past and future treatments in the forest to provide an accurate assessment of the adverse effects of biomass removal projects.

Science Does Not Support Removing Insect-Infected Trees to Reduce Fire Danger

Biomass removal projects often claim insect-infected trees must be removed from the forest to reduce the fire danger. Proposals of this type must provide a scientific basis for the number of snags to leave in the forest and the snag removal enabled by the project must consider and be based on the ecological functions of snags. There are many types of snags and each performs a different function in an ecosystem. Snags can't be counted as if they were coke cans on a shelf. As biologists will know, snags can be standing, down, large, small, of various species, and in various stages of decomposition. They should not be uniformly spaced around the forest like candles on a cake nor should they be all in one corner of a survey plot and then averaged in with the other plots, so it appears there are snags throughout the surveyed area. Additionally, after a serious drought/insect infestation event, the forest responds in positive ways – insectivorous species thrive. Standing dead trees may be the tallest structure the forest will have for many decades. Within a year, likely sooner than the highly flammable slash a biomass removal project will create can be burned, the dead needles and smaller branches of the dead trees will shed and the dead trees will become less flammable. Science indicates that most dead trees outside of the 200 feet surrounding structures should be left standing in place.

There is no evidence that removing a tree infected with beetles after it has died will decrease the infection rate to other trees. Additionally, logging dead and diseased trees can spread the insect infection problem. Some beetles, such as Ips, can incubate in piles of slash and spread more rapidly than had the tree been left standing. Forest Service Botanists have recommended methods to avoid spreading bark beetle. These include not cutting diseased trees unless it is mid-summer, pulling slash away from any living tree, and covering slash piles with black tarps to increase the heat in the pile.

A recent compilation of data by leading scientist in the Pacific Northwest has found that "By dampening subsequent burn severity, native insects could buffer rather than exacerbate fire regime changes expected due to land use and climate change. In light of these findings, we recommend a precautionary approach when designing and implementing forest management policies intended to reduce wildfire hazard and increase resilience to global change." "In addition, by dampening subsequent burn severity, insect outbreaks could buffer rather than exacerbate some fire regime changes expected due to global change (e.g., climate warming, drought, invasive species (Littell et al 2010, Ayres et al 2014)) and forest response to land use (e.g., fire exclusion, timber harvest, livestock grazing (Hessburg et al 2000))." See Miegs et al. (2016).

All trees that must be removed should be surveyed for any active nesting or dens the same season as the cutting will occur – preferably just prior to the planned cutting. No cutting or treatment should be allowed near meadows during fawning season.

When biomass removal projects propose to concurrently protect communities in the Wildland Urban Interface (WUI), some of the responsibility for protection of privately owned structures must be borne by the private property owner. Just as those who build homes on shorelines accept the risks of high seas eroding or undercutting their structures because they love living by the ocean, so must those who chose to live surrounded in Sierra forests accept the risk that

accompanies living in an ecosystem that not only burns frequently, but must burn if it is to survive as a forest.

Science support treatments limited to the Home Ignition Zone (HIZ). The Forest Service's own Jack Cohen (Jack D. Cohen, Research Physical Scientist, Fire Sciences Laboratory, PO Box 8089, Missoula, MT 59807 406-329-4821 (fax) 406-329-4825 jcohen@fs.fed.us), has shown that the Home Ignition Zone – the 200 to 300 feet immediately surrounding homes, is where mechanical fuel treatments should be implemented to protect homes. The Home Ignition Zone treatments can be the mechanically-treated safezone that anchors prescribed fire treatments that would then be implemented beyond the HIZ and into the WUI to protect homes.

However, the Forest Service, County, and State should investigate measures that would assist private property owners to not only be aware of things they can do to make their homes less likely to ignite in a fire, but also actively seek sources of funding such as grants for property owners that would give financial assistance for replacing flammable roofing and siding with flame resistant materials. Many studies show that homes with these and other fire-wise building methods often survive fire. The cost of providing financial assistance to private property owners would be more than offset by the costs of replacing homes and in providing assistance to families after their homes and possessions have been destroyed. See, also Safe At Home, Natural Resources Defense Council's study, conducted with a former California State Fire Marshall, on preparing Sierran communities for wildfire, attached.

In summary, the ARB should require that community protection projects should be scaled down to treat only the 200 feet immediately adjacent to private structures as well as important access routes, not miles from homes.

Biomass Removal Projects that Allow Any Additional Erosion are Unacceptable

Biomass removal projects that use both commercial and non-commercial activities to thin ladder fuels, restore species composition to those present before fire suppression and logging, and increase the resiliency of stands of trees to drought, insects, and fire may release sediments downstream because heavy equipment on slopes up to 35% and greater have a risk of soil erosion, and loss of soil to erosion, which is unacceptable.

No additional erosion or sediment flow into down-stream watersheds would be considered acceptable. All sediment flows into streams is cumulative and eventually contributes to causing reservoirs like Isabella Reservoir to fill with sediment, as it has. The U.S. Army Corps of Engineers is now spending hundreds of millions of taxpayer dollars to restore the Isabella Reservoir because the Forest Service implements biomass removal projects, in the mountains above the reservoir, which cause soil erosion and sedimentation that cumulatively impact the Kern River watershed, and which the agency considers to be "acceptable."

Consider All Existing Water Uses and Water Resources

Is the massive die-off of trees in the Sierra Nevada being caused only by the drought and climate change, or is the die-off being exacerbated by the limited water supply in the Sierra because of the granitic structure of the mountains where water is found in isolated fracture pockets where tree roots must penetrate to reach the needed water supply when surface water flows are intermittent? Water wells in the Sierra Nevada are located and placed using fracture drilling techniques. Forest managers must consider the anthropogenic uses of water in the forests, including, but not limited to, water wells, water diversions, water withdrawals, and water developments that serve people who have established in forested areas of California. How are these anthropogenic uses of water impacting the available water for growing forests and maintaining the forest species? These human uses of forest water must be identified, their flows determined and totaled, and the cumulative extracted water volume considered along with drought and climate change. Should these extractions be permitted to continue at the expense of the needs of the forest which is California's major location for sequestering carbon?

Global climate change will likely lead to water resource shortfalls. According to the CEC document http://www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-F.PDF, "there is a disquieting preponderance of simulations that become significantly drier during the twenty-first century." Also, "The incidence of years with very low spring snowpack and associated low soil moisture in late spring and early summer occur much more frequently." According to the CEC document *Using Future Climate Projections to Support Water Resources Decision Making in California* at http://www.energy.ca.gov/2009publications/CEC-500-2009-052/CEC-500-2009-052-F.PDF, "The 30-year trend indicates that the fraction of annual runoff occurring from April through July decreases from about 35% for the historical base scenario (historical conditions with no increase in air temperature) to about 15% for the +4°C scenario."

After thinning stands of mature trees, to increase heterogeneity and resilience, and after hand thinning stands of smaller trees, the temperature of forest fuels and forest air will increase, the moisture level of forest fuels decreases, and the relative humidity in the understory decreases, it stands to reason that surface and groundwater resources could also be impacted by the removal of these materials. It therefore stands to reason that forest managers should provide a comprehensive inventory of surface and groundwater resources of water in the watersheds of any project area where trees are proposed for removal as a way to establish a baseline for assessing the impacts of the project on forest resources. These inventories and an analysis of water resources must be considered in the environmental analysis, especially now that we are in a prolonged drought period in California. This water balance must be specified in order to be able to determine if sufficient water is available to cope with the increased forest temperatures that would result following tree removal.

The ARB must therefore consider how unlogged forests retain water before allowing forest management agencies in California to approve tree removal. The ARB must consider whether commercial logging is an appropriate treatment since commercial logging would cause the forest to become hot and dry and allow surface winds to increase, all of which would exacerbate wildfire.

If a proposed project is to restore and maintain the forest ecosystem so it is resilient to the effects of wildfire, drought, disease, and other disturbances, the EIS must include an assessment of and

documentation to show all water diversions, withdrawals, and developments that utilize water in the watersheds involved in the project area in order to establish a baseline of available water for making a decision as to what can be done to protect the forest ecosystem from drought, and whether commercial thinning would be effective, since thinning would cause the forest understory to become hotter and dryer, and would allow moisture-robbing surface winds to increase.

Managing forest ecosystems and clearing fire prone vegetation runs counter to common sense by exposing soils and understory vegetation to desiccating conditions. Removing forest biomass to supposedly reduce fire danger runs counter to making the forest resilient to climate change because opening the forest canopy to winds or the drying heat of the sun results in drying out the layers of moisture-holding duff, small trees, and down woody material. This is especially true in the Sequoia National Forest, which receives relatively little moisture due to its geographic location in the Southern Sierra, essentially surrounded on three sides by desert, and the prevailing weather patterns.

Water vapor in the air comes almost entirely from three sources: Evaporation from any moist surface or body of water, evaporation from soil, and transpiration from plants. Plants have large surfaces for transpiration; occasionally they have as much as 40 square yards for each square yard of ground area. Transpiration from an area of dense vegetation can contribute up to eight times as much moisture to the atmosphere as can an equal area of bare ground.

Relative humidity is most important as a fire-weather factor in the layer near the ground, where it influences both fuels and fire behavior. The relative humidity that affects fuels on the forest floor is often quite different from that in the instrument shelter, particularly in unshaded areas where soil and surface fuels exposed to the sun are heated intensely, and warm the air surrounding them. This very warm air may have a dew point nearly the same or slightly higher than the air in the instrument shelter, but because it is much warmer, it has a much lower relative humidity. Vegetation moderates surface temperatures and contributes to air moisture through transpiration and evaporation – both factors that affect local relative humidity. A continuous forest canopy has the added effect of decreasing surface wind speeds and the mixing that takes place with air movement. The differences in humidity between forest stands and open areas generally vary with the density of the crown canopy. Under a closed canopy, humidity is normally higher than outside (the closed canopy) during the day, and lower at night. The higher humilities are even more pronounced when there is a green understory. While temperature and moisture distribution in the layer of air near the ground are important in fire weather because of their influence on fuel moisture, the distribution of temperature and moisture aloft can critically influence the behavior of wildland fires.

Cumulative impacts that remove trees up to 30 inch diameter and larger that results in opening the canopy and causes the sun to shine where the trees once stood heats and dries forest materials and soil and causes flammable brush to grow where the less flammable tree trunks once stood. Sequoia ForestKeeper's teams of environmental graduate summer interns have repeatedly observed and documented in Sequoia the inverse relationship between canopy cover and ground cover. When forest canopy increases, groundcover decreases: when forest canopy decreases, groundcover increases. (See Fire Weather and other research that indicates the same.)

Much of this is known and is discussed in the US Forest Service's Publication FIRE WEATHER . . . A Guide For Application Of Meteorological Information To Forest Fire Control Operations, by Mark J. Schroeder, Weather Bureau, Environmental Sciences Administration, U.S. Commerce Department and Charles C. Buck, Forest Service, U.S. Department of Agriculture U.S. Government Printing Office: 0-244:923, first published in May 1970. Reviewed and approved for reprinting August 1977, Stock No. 001-000-0193-0 / Catalog No. A 1.76:360 (available at http://gacc.nifc.gov/nwcc/content/products/intelligence/Fire_Weather_Agriculture_Handbook_360.pdf).

Congress recognized that managing natural resources in National Forests was "highly complex" and enacted the Forest and Rangeland Renewable Resources Planning Act. The Act requires that the Forest Service develop an inventory of "present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services." In addition the Act requires that all forest management activities to be preceded by a "comprehensive assessment" of environmental and economic impacts in order to create a management plan that is consistent with MUSYA and NEPA. Congress emphasized the "fundamental need" for the management plans to "protect and, where appropriate, improve the quality of soil, air, and water resources." Developing an inventory of surface and groundwater resources and an assessment of the environmental impacts on surface and groundwater including potential impacts of groundwater use on surface water resources, is an integral step in ensuring that a management plan protects the water quality in California's forests.

Because much of the Sierra Nevada Forests are Habitat for Pacific Fisher, the Thresholds for cumulative restorative treatments, like Biomass removal, should not exceed, on average, 2.6% of Pacific fisher habitat per year (or 13% over a 5-year period) to Prevent Putting fisher habitat and fisher use of the areas at risk.

The types of treatments are referred to in Zielinski et al. (2013b) (Exhibit E) as restorative, which include fuel reduction thinning, prescribed fire, or pre-commercial (hand) thinning. Zielinski et al. (2013b) suggest that fishers occupy habitat at the highest rates where restorative treatments "are applied at rates that do not exceed about 13% of an area in 5 years …." or 2.6 % per year. See p. 825.

Zielinski et al. (2013b) noted that although fishers showed no aversion to including treated areas within their home ranges, Garner (2013) (Exhibit F) found that "fishers avoided using treated areas when resting and foraging." *Id.*

If cumulatively Project treatments are likely to exceed this 2.6% average treatment acreage per year, proposed treatments "may put fisher habitat and fisher use of these areas at risk." *Id.* The Forest Service must therefore rethink its course of treatments in the fisher's habitat.

Projects must be reconsidered where there is a constricted corridor in the Fisher's Core Habitat, and the proposed treatments in this corridor may cut off fisher movement through the corridor. As discussed above in Zielinski et al. (2013b), Garner (2013) (Exhibit G) found that "fishers avoided using treated areas when resting and foraging." When an entire corridor is proposed for treatment, meaning there is a likelihood that fishers will completely avoid use of this corridor

after treatment, which will completely sever the movement of fishers through the corridor for an extended period of time, which would have a devastating effect on foraging, reproductive behavior, and genetic diversity of the fishers, the management agency must reconsider or rethink implementations of such a project. In essence, if movement through a corridor is severed, it would cut-off and genetically isolate the fisher population in the fisher's already limited range.

Ecological Restoration Principles – Restoration Without Tree Removal

The management agencies should not place too much reliance on mechanical methods for ecological restoration and maintenance. Instead, fire should be used as the primary tool for restoration, as suggested in both the California Spotted Owl and Fisher Conservation Strategies. Moreover, agencies should not overstate the need for ecological restoration to create resiliency from drought, and native insects and diseases, which are natural processes that should be preserved rather than eliminated.

Thinning of medium and large diameter trees (12-30" dbh) should not be permitted for the purpose of ecological restoration to prevent natural stresses from competition. Tree competition, caused primarily by increases in stand density, is a natural process which induces other natural process that deal with this density, such as native insect- and disease-caused tree mortality. These processes, in turn, produce structural forest elements that are vital for wildlife—snags. While the removal of trees to reduce this natural competition may prevent the death of a small number of large trees, it would also prevent the creation of some of the most important elements in the forest ecosystem—snags—for the perpetuation of certain wildlife species, including California spotted owls, various woodpeckers, and countless other species. It is well-documented that these species need abundant large snags at a certain densities in order to thrive. Even the artificial method of increasing the number of snags by girdling trees will not create as diverse a variety of snags for these species as will natural snag recruitment. And while the cutting or removal of trees to prevent competition-induced stresses may be good for the remaining trees, it prevents natural snag recruitment that helps perpetuate a number of key wildlife species.

For proposed actions that promote resilience as a goal, it is important to understand that resilience is not a process. Instead, it is a characteristic, which results from the continued perpetuation of natural processes, including competition. The perpetuation of the forest ecosystem is not the same as the perpetuation of the lives of all of the larger trees in that ecosystem. This means that we need some of these large trees to die at a rate that can sustain certain wildlife species. Competition mortality will result in large snag recruitment beyond what silviculturalists may want in a forest that is 'managed' to produce maximum growth.

Even if the project allows tree cutting a few of the larger trees for ecological restoration or to reduce safety hazards along roads, these tree boles should be retained in the forest as large down woody material. Ecological restoration provides an opportunity to restore forest areas with large down woody material for soil nutrients, wildlife (especially for Pacific fishers), and to maintain ecological functions.

Leaving a large number of downed logs will not increase fire risk. The Forest Service's own science clearly concludes that large logs (defined by the 2001 Sierra Nevada Forest Plan

Amendment as being over 12 inches in diameter) are essentially irrelevant to fire behavior. And tree boles over 12 inches in diameter that the agency says it needs to fell for ecological restoration would not create any significant fire hazard if left standing. Operability for prescribed fire management should not be an issue when leaving these large tree boles as down logs. In fact, the 2004 Framework standards takes large down logs into consideration, stating that managers should design prescribed burn prescriptions and techniques to minimize the loss of large down material.

Forest management agencies should use the reintroduction of fire as the primary tool for ecological restoration and should prohibit the thinning of larger trees to reduce fire risk, just as the National Park Service has done with the use of natural process of prescribed and fire use fires for the past 40 years managing the Sequoia and Kings Canyon National Parks. Agencies should limit manual and mechanical methods that prepare the forest for the reintroduction of fire to the cutting of only some trees 8-10 inches dbh and smaller. As the adjacent Sequoia and Kings Canyon National Parks ("SEKI") has found, "cutting trees up to and including 8" in diameter has proven effective in fuels reduction in SEKI." SEKI demonstrated the effectiveness of their prescribed fire treatments that showed dramatically different and beneficial burn result from the Rough Fire compared to the devastating result of the fire in Sequoia National Forest where thinning is the primary management treatment. After fire is reintroduced into stands where only some trees up to 8" in diameter were removed, natural processes can perpetuate, making future thinning applications for ecological maintenance unnecessary.

Human-caused Fires are Now the Norm – Lightning-caused Natural Wildfires are infrequent

Thousands of acres of forests and chaparral habitats were burned, hundreds of people were displaced, several people were killed, thousands of homes were incinerated with millions of dollars spent in suppression costs, and countless environmental losses occurred as a result of human-caused fires in 2015 and 2016. Heat sources, whether from flames from a campfire, or embers from a tossed cigarette, or sparks from an engine of a nonfunctional spark arrestor, or sparks from a bullet that bounces off a rock, or sparks from the rotating blade of a county-manned road clearance weed cutter that strikes a rock – they are all examples of human-caused fires that must be addressed.

Lightning-caused natural fires in forested habitats generally ignite near the top of a tree and slowly burn down the tree because heat rises, so the fire is not easily spread down to the ground where most fires would eventually be extinguished due to the cool environment below the trees where small fuels are less abundant. Human-caused fires generally start at ground level and burn quickly up because heat rises and rising heat creates wind conditions that carry and accelerate the fire's spread.

The ARB research report from 18 April 2016 titled, *Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of Volatile Organic Compounds,* (Contract No. 11-315) prepared by Principal Investigator Professor Allen H. Goldstein from the University of California Berkeley, points to the air pollution from forest fires as being a significant sources.

Due to the changing climate, the drought, and the frequency of expensive human-caused fires, California should place Public Service Announcements (PSA's) in multiple languages and in every media outlet and through every organization that operates in California to get the word out about ways to reduce GHG's, climate change, and forest fires. Preventing human-caused forest fires would benefit every Californian, including residents of EJ disadvantaged communities. Also, the ARB should prohibit all camp fires and smoking in camping areas and impose severe financial penalty for smoking and fires in forested areas.

Distributed Clean PV Solar on Rooftops

Distributed Clean Energy has six key energy efficiency measures that are recommended for immediate action. The following specific reasons are provided as to why:
(1) Reduce the distance needed for transmission and distribution of power to decrease transmission losses that will reduce the need for fuel to generate power, improve air quality, and reduce impacts to the global climate and (2) improve grid stability and reliability. Distributed clean energy (3) involves the entire community in energy solutions, and (4) reduces transmission impacts and (5) reduces disruptive transmission bottlenecks.

Most of these benefits of Distributed Clean Energy reduce reliance on transmission of electricity over long distances. The reduced average distance needed for moving electricity over transmission and distribution lines means that less infrastructure is needed to move power around the grid. This can save a lot of money; developing a single long-distance transmission project costs hundreds of millions to billions of dollars. Transmission can also have significant environmental impact. It requires a cleared corridor potentially extending for hundreds of miles. Transmission lines can cause wildfires, and by one estimate may kill 130 to 170 million birds per year in the US.

Large remote renewable energy projects may depend upon transmission lines that can take a decade to permit and construct. Because local, small-scale projects can be built relatively quickly, and normally don't need transmission, and Distributed Clean Energy can speed up conversion to renewable energy.

Distributed Clean Energy provides economic development opportunities, inner city jobs, and increased urban tax collections. It also supports grid reliability, which can be important where natural disasters, such as earthquakes and ice storms, disrupt long distance transmission lines.

One major advantage of Distributed Clean Energy is that it reduces or avoids the energy losses that occur in the transmission and distribution grid. Electrical resistance in wires and other grid components converts electric energy into heat that escapes into the atmosphere. In the US an average of 6.5% of electricity is "lost" in the power grid; over a year that would amount to approximately 260 terawatt-hours—roughly the amount of electricity consumed by the entire state of California.

This is the energy price we pay for generating electricity in one place and sending it off to be

consumed in another place. The available and affordable way to avoid this energy loss in the power grid is first to reduce the overall consumption of electricity, and then to produce electric power where it is consumed.

A paper called "*Community Power"* describes the benefits of distributed power generation and the fallacy of unbalanced, permissive favoritism towards centralized solar development in lieu of more balanced, socially, technologically, economically and democratically beneficial, distributed, localized renewable resources. The link to the "*Community Power"* paper that describes the benefits of distributed power generation can be downloaded at: http://www.localcleanenergy.org/Community-Power-Publication.

Respectfully submitted,

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Attachment: (instead link included below)
November 23, 2015, to California Governor Jerry Brown and Mary Nichols, Chair of California Air Resources Board http://www.sequoiaforestkeeper.org/pdfs/climate_change/151123-2_SFK_et_al_CARB_Methane_Fee_Based_on_Shindell_2015.pdf