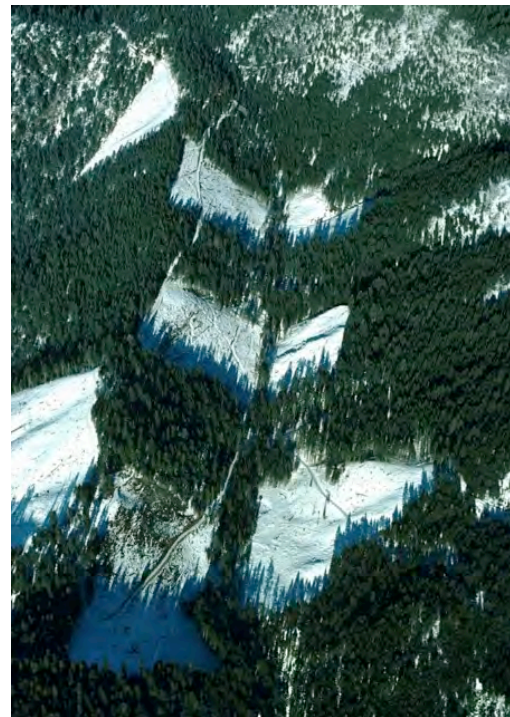


**SCIENTIFIC EVALUATION OF THE GIANT SEQUOIA NATIONAL MONUMENT
MANAGEMENT PLAN AND FINAL ENVIRONMENTAL IMPACT ASSESSMENT**

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Executive Summary – the 328,315 Giant Sequoia National Monument is a crown jewel of the Southern Sierra region and an opportunity for the Forest Service to showcase science-based stewardship as directed by the monument’s authorizing proclamation. The monument is home to 44% of all remaining giant sequoia groves, contains regionally essential old-growth forests, biologically diverse meadows and unique oak woodlands that support scores of fish and wildlife, including many found nowhere else on earth. The monument’s authorizing proclamation redirects Forest Service management from multiple use – the predominant paradigm on most Forest Service lands – to protection and restoration of the monument’s “objects of interest” (e.g., broadly defined as scenic landscapes, rivers, iconic species, rare species, unique ecosystems), as the predominant use. While the Forest Service has made great strides in its approach to the monument’s management, considerable improvement is needed to bring the monument management plan up to the standards of its authorizing proclamation, particularly with respect to the monument’s *protection* and *restoration* mandates.

Three standards of evaluation were used to document deficiencies in the monument management plan and Final Environmental Impact Statement (FEIS): (1) proclamation consistency review; (2) science consistency review; and (3) comprehensive review of management approaches. Based on these standards, Forest Service management of the monument represents four incompatibilities with the monument’s proclamation:

1. *Widespread livestock grazing (~15,757 “head months” of livestock are permitted to graze on ~ 218,000 acres [two-thirds] of the monument’s grassland, chaparral, open forest, and riparian meadows) is occurring without sufficient protection/restoration measures – while grazing is permitted under the monument’s proclamation and existing laws and policies, it is impacting the monument’s objects of interest through soil compaction, altered channel morphology and riparian communities, elevated fuel hazards, and spread of invasives among others and the monument management plan presents numerous inconsistencies with the protection and restoration mandates of the proclamation.*
2. *Extensive fuel reduction treatments (one-fourth of the monument will receive mechanical fuel treatments within a combined 1.5 mile Wildland-Urban Interface zone) will reduce habitat for objects of interest and there is a lack of sufficient ecologically based alternatives - tree removal standards do not meet the intent of best science as the preferred management alternative provides insufficient justification for the 20 in dbh cap for westside forests vs. smaller caps known to be effective in reducing hazardous fuels and narrower buffer widths for the WUI that would more comprehensively reduce impacts of large mechanical fuel reduction measures on objects of interest.*
3. *Extensive roads network (822 miles) impacts the monument’s hydrology, facilitates the spread of invasive species, increases the probability of human-caused wildlife ignitions, and fragments fish and wildlife habitat yet few remedial measures are provided for specific objects of interest – the Forest Service has yet to provide sufficient analysis of the minimum roads necessary*

in the monument pursuant to its own road inventory policies and how road impacts will be minimized to meet the protection/restoration mandates for the objects of interest.

4. *Combined effects of climate change along with historical and ongoing land-use stressors (logging, roads, livestock) present unprecedented threats to the objects of interest* and the cumulative effects analyses are deficient with respect to NEPA.

The Forest Service should adopt four measures to improve the monument's management compliance:

1. *Conduct road-specific and cumulative impacts analysis of the road network* to provide more appropriate remedial measures for specific objects of interest such as seasonal road closures (for fire ignition concerns) and greater attention to road obliteration to reduce the road effect zone (area over which roads impacts specific objects).
2. *Provide more detailed analysis of impacts of fuel treatments on objects of interest* using more comprehensive models, a broader range of small diameter tree removals, and narrower WUI buffers that assess relative tradeoffs in wildlife habitat loss from mechanical fuel treatments vs. fire risk reduction benefits.
3. *Tighten restrictions on livestock grazing to reduce impacts to the objects of interest*, including use of large exclosures and livestock reductions in sensitive areas such as meadows, seeps, riparian areas, bogs, and rare plant communities (e.g., blue oak woodlands).
4. *Prepare the objects of interest for combined effects of climate change and land-use stressors* through identification and protection of climatic refugia (enduring

landscape features and areas with microclimatic conditions such as north-facing old growth, intact areas, shaded riparian areas), manage for landscape connectivity to enable climate-forced wildlife migrations into refugia through road closures and road obliterations, and reduce management stressors by moving toward light-touch (Park Service like) management overtime.

The Forest Service has the legal authority to implement more protective measures aimed at the monument's objects of interest as granted by the authorizing proclamation, which clearly states that the *predominant use* in the monument is *protection* and *restoration* and thus all other uses must be compatible or secondary. This places multiple uses and socio-economic considerations below the monument's protection/restoration standard. The Forest Service would improve its compliance to the monument's proclamation by a more thorough analysis of competing uses (direct, indirect, and cumulative) in the monument to better preclude or modify those uses deemed incompatible with the monument's protection/restoration mandates.

1.0 INTRODUCTION

1.1. *Understanding scale and context in forest planning* – scale and context are widely used in forest planning and ecosystem management approaches; many conservation biology and landscape ecology textbooks have been written about this topic (see Groom et al. 2006 for example). Understanding scale and context through nested or multi-scaled analyses is also fundamental to cumulative impact analyses as required under the National Environmental Policy Act (NEPA). In the case of the Giant Sequoia National Monument, assessing context in forest planning matters as the integrity of the monument depends on management within and adjacent to its borders. An understanding of context also is vital for setting the monument apart from other Forest Service lands. Thus, because of the monument's regional and global importance it should be managed with a precautionary approach as guided by best science and the monument's authorizing proclamation.

1.2. *Global and regional monument context* - the 328,315-acre Giant Sequoia National Monument is embedded within the 13.1 million-acre Sierra Nevada Conifer ecoregion. This ecoregion is widely regarded as one of the most diverse temperate coniferous forests in the world as reflected by an extraordinary range of habitat types (i.e., beta diversity) distributed along topo-edaphic gradients, exceptional levels of endemic plants, and high species richness for many taxonomic groups (Ricketts et al. 1999). Adding to the region's global distinctiveness is about half of California's estimated 7,000 vascular plant species, ~ 60% of California's total vertebrate species, and some of the highest levels of mammal endemism in North

America (Ricketts et al. 1999). Notably, areas with high concentrations of endemic species (endemic foci) are “hot spots” of conservation attention because the restricted distribution of endemics makes them highly vulnerable to site specific and cumulative habitat losses. The southern Sierra region, where the monument more specifically lies, has the highest concentration of endemics in the Sierra’s and therefore is an area of elevated conservation attention. This was generally recognized in the monument’s proclamation that described the area’s outstanding features as *objects of scientific interest* (herein referred to as objects of interest) ranging from iconic species like giant sequoia (*Sequoiadendron giganteum*) to diverse ecosystem types like old-growth forests and meadows and numerous landscape and aquatic features. In sum, the management of the monument’s objects of interest is directed by specific proclamation mandates that require the Forest Service to place the “*proper care and management of the objects to be protected*” above all other uses. This shift from multiple use (the dominant paradigm on most non-monument Forest Service lands) to protection and restoration is the standard by which the monument’s management plan will be evaluated throughout this document.

1.3. *Regional and local land-use stressors* - against this back-drop of national and global significance, the Sierra Nevada ecoregion has experienced wide-spread and intensive logging (high grading of massive trees, pre- and post-fire clearcut logging), road building, mining, ex-urban sprawl, hydroelectric development, fire suppression, and livestock grazing that have cumulatively degraded and fragmented

all but about a quarter of the region's forests and watersheds (Ricketts et al. 1999). Because of the large human footprint, every acre of intact, old-growth forest, native plant communities, undammed rivers, and unroaded landscapes takes on greater significance, particularly as a reference condition for measuring the efficacy of restoration actions and as refugia for climate-forced wildlife migrations.

The monument includes a similar land-use footprint reflective of its surroundings but has a proclamation mandate to protect and restore its objects of interest. This mandate represents a unique rallying call for the Forest Service to showcase its outstanding natural and cultural amenities properly stewarded. Clearly, the Forest Service has made great strides in its approach to management of the monument area over the years as reflected by gradual improvements from the days of rampant logging to the final management plan and associated FEIS. Can the agency do better? Is the preferred alternative in the FEIS the best way to comply with the monument's proclamation? How can the Forest Service use monument management strategies to showcase science-based stewardship in one of the nation's premier conservation areas? These questions are the focus of this evaluation.

Notably, while most of the region's giant sequoia's were logged decades ago (beginning ca. 1856), the last remaining ~ 75 remnant groves occur in the Kings Canyon - Sequoia and Yosemite National Parks (just to the north), Giant Sequoia National Monument (33 groves on 27,830 acres; although the monument represents a larger area necessary to protect all of the diverse objects), and a few scattered

groves on private and tribal lands. With ~44% of the total “population” of giant sequoia, the monument is an important cog in the regional distribution of this iconic species. However, a long history of controversy surrounds the monument’s management before its designation (e.g., Mediated Settlement Agreement [MSA] 1990, 1988 Sequoia National Forest Management Plan and related 2001/2004 plan amendments and associated litigation), much of which continues today as reflected by conflicts over road access vs. protection of the monument’s objects, authorized livestock grazing vs. impacts to the monument’s objects, and extensive mechanical fuel treatments to reduce fire risks vs. reduced habitat of closed-canopy dependent objects of interest (e.g., California spotted owl, *Strix occidentalis occidentalis*).

Approximately one-fourth of the monument’s land base (>75,000 acres) is proposed for extensive mechanical fuels treatment within the Wildland-Urban Influence (WUI) Defense (1/4 mi buffer) and Threat Zones (1.25 mi buffer) and the Tribal Fuels Treatment Area. Although views on fire are gradually shifting, the Forest Service has treated fire by attempting to mimic the lower severities of the mixed severity fire regime that, however, once included significant patches of high severity fire essential for giant sequoia grove establishment and regeneration. Ongoing suppression aimed at stopping large fires that historically (and still do) produced characteristic landscape heterogeneity is proposed through widespread mechanical fuel treatments designed to lower the susceptibility of the monument’s ecosystems to high severity burns (a form of fire suppression in itself). Although there are desired social and cultural benefits in reducing risks to crown-fire damage of giant sequoia from high severity fires, this particular conifer is among the most fire

resistant trees in the world – capable of surviving even the most intense fires – even young sequoias are known to survive fires that reach their crowns (Stephens and Finney 2002). In addition, traditional views on high severity fire as a destructive force that it is presumed to be increasing in frequency and extent have been challenged more recently (Odion and Hansen 2006, 2008).

Of even greater consequence to the monument objects and its ecological integrity; however, is the extensive livestock grazing (see Section 3) and roads network (see Section 5), each of which challenges the Forest Service’s ability to comply with the protection and restoration mandates. The Forest Service only marginally addresses these ecosystem stressors in planning and thus a more detailed assessment (including cumulative impacts) is warranted as discussed below.

Climate change is also creating unprecedented and top-down drivers of biodiversity decline that warrant more attention by the Forest Service in meeting the proclamation’s protection and restoration mandates (Section 6). A combination of passive (removing stressors such as obliterating roads and placing tighter restrictions on livestock grazing) and active management when properly directed can help build resilient (ability to rebound to pre-disturbed conditions) and resistant (ability to withstand disturbance) ecosystems in the monument and both approaches need further determination of their compatibility with the monument’s protection and restoration mandates. In particular, the Forest Service could do more (be more explicit) in prioritizing active management for use primarily in degraded

areas (e.g., plantations) with the long-term goal (e.g., decadal depending on ecosystem type, level of degradation, etc.) of eventually maintaining ecosystem processes via light touch management and monitoring overtime (**more of a long-term process goal needs to be emphasized over structural management**).

While the Forest Service has made important strides in addressing these context and place-based issues, there remain inconsistencies with the proclamation mandates due to an overemphasis on structural management and lack of clarity on long-term process management that create incongruences (see below) with the agencies' interpretation of its legal responsibilities.

1.4. Project Overview and Objectives - this evaluation examines the need for the Forest Service to implement stricter guidelines for complying with the monument's proclamation through modification of the monument's vision as reflected in the final monument management plan. For instance, there is a need for a more comprehensive and definitive overarching statement with clearly defined goals that demonstrate more precisely how the Forest Service will manage the monument to maintain or restore ecosystem integrity (the ability of an ecosystem to support and maintain a balanced, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats within a region; Karr and Dudley 1981; Karr 1992) as a performance measure. Timelines for putting degraded ecosystems on a trajectory toward restored integrity would also be helpful. Although the Forest Service and National Park Service operate under different mandates, the monument's management plan should strive for

compatibility to the comparable national park ecosystems of high ecological integrity in order to minimize contrast with the surrounding landscapes and better coordinate management across jurisdictions. This is because when it comes to ecological integrity and protection/restoration of the objects of interest, context matters and thus approaches that differ widely between ownerships (e.g., national park vs. monument on diameter caps on tree removal, road density standards, grazing intensity) are likely to trigger cumulative impacts within the monument and its surroundings. The Forest Service dismisses this as an alternative for consideration in the FEIS when it should have been fully analyzed and contrasted with the preferred alternative so the public can better track whether the agency is complying with the proclamation.

Notably, using three decades of fire severity data, Miller et al. (2012) documented that the proportion and size of high severity patches within Yosemite National Park were operating within historic bounds compared to surrounding national forests that had larger fires of higher severity. Because the Forest Service has placed such a high priority on fuel treatments for fire risk reduction it would be prudent for the agency to more fully examine cumulative impacts to the objects of interest as a result of differing and uncoordinated management actions between agencies as they relate to fuels and other factors such as roads and livestock. The Forest Service could better meet the proclamation's protection and restoration mandates by more comprehensive analysis of approaches (e.g., fuel treatments) carried out in the nearby national parks in comparable ecosystem types as a supplemental reference

(in addition to historic conditions) for gauging the efficacy of adaptive management within a larger regional context. This would improve the cumulative effects analysis, which must take into account management impacts (both positive and negative) within the surroundings and how they differ. The agency should not outright dismiss this as an alternative for monument management as it would better help set the vision for the monument using comparable contemporary reference conditions and coordinated actions as supplemental to the pre-1875 baseline that the agency has set forth in its restoration objectives.

In sum, the specific objectives of this science evaluation were to review the final monument management plan and related documents to determine if they: (1) are compatible with the monument's authorizing proclamation (proclamation consistency review); (2) make use of best available science, including addressing uncertainties and precautions in protecting the objects of interest (science consistency review); and (3) properly address the broad suite of monument objects of interest consistent with the proclamation (comprehensive monument management review).

2.0 PROCLAMATION MANDATES AND STANDARD OF EVALUATION

2.1 Evaluation of the monument's management plan - this evaluation of the monument's management interprets the intent of the monument's proclamation and its mandate to the Forest Service that *protecting* and *restoring* the objects of scientific interest *shall* take precedence over any other considerations (i.e. "*shall be*

the dominant reservation”). The use of the term “*shall*” comports a high level of compliance needed to meet the intent of the proclamation. The objects of interest specifically called out in the proclamation include:

- towering giant sequoias, the world’s largest trees (also the greatest concentration of giant sequoia groves in the world);
- a great belt of coniferous forest, jeweled with mountain meadows;
- bold granitic domes, spires, and plunging gorges texture the landscape;
- an exemplary number of habitats within a relatively small area;
- a diverse array of plants and animals, many of which are rare or endemic to the southern Sierra Nevada (including 200 rare plant species);
- limestone caverns and unique paleontological resources tens of thousands of years old, including many Native American traditional sites;
- plant communities ranging from low-elevation oak woodlands and chaparral to high-elevation subalpine forest;
- numerous meadows and streams that provide an interconnected web of habitat for moisture-loving species;
- mid-elevation forests dominated by massive conifers arrayed in a complex landscape mosaic;
- one of the last refugia for Pacific fisher in California; and
- habitat for great grey owl, American marten, northern goshawk, peregrine falcon, spotted owl, and a number of rare amphibians.

In order to ensure that the Forest Service complies with the proclamation’s mandate to protect and restore “*the rich and varied landscapes*” of the monument, it is vital that the

monument management plan strictly adheres to the proclamation's emphasis on protection and restoration of species specific and ecosystem-based objects of interest; that is, a predominant approach that emphasizes interconnectedness and *integrity* of all species and communities across the landscape and the processes that have sustained them is vital to a science-based vision for the monument.

2.2. Deficiencies in monument vision – although the FEIS and monument management plan include management strategies with measureable targets, there remains a noticeable gap in the overall vision that lacks clearly defined short and long-term performance measures for the predominant use, in particular, use of a reference or baseline condition for restoring ecosystem integrity overtime (10, 50, 100 years, etc.). The Forest Service vision in the monument management plan is more of an accounting of monument elements and it is unclear how the agency intends on addressing competing uses (e.g., livestock grazing, roads for access vs. impacts to objects) which are carried forward from prior planning and represent an incompatibility with the monument's protection and restoration mandates (see Sections 4.0 and 5.0). The absence of a more proclamation-specific vision for the monument's ecosystems and how the agency will address competing uses will make it difficult for the Forest Service to evaluate the efficacy of adaptive management if it does not have a clear vision of how degraded ecosystems will be restored over time and a more definitive process for minimizing incompatible uses.

Here are some examples of where the Forest Service remains inconsistent with the intent of the proclamation:

- Use of “*suitability*” criteria that determine whether the land is suitable for a particular use rather than *compatibility* of uses (monument management plan, p. 35).
- Emphasis on how livestock contribute to the *social and economic sustainability* of the area (monument management plan, p. 7) rather than whether livestock grazing in its current form is compatible with the proclamation’s protection/restoration overriding mandates.
- Livestock grazing is to be maintained and managed for *sustainable, healthy rangelands that contribute to local economies and improved watershed conditions* (Monument management plan, p. 25) – this particular statement conflicts with the protection/restoration mandates of the monument and implies a *sustainability* objective for grazing that does not exist in the proclamation nor is backed by best science (see Section 3).

In sum, statements like these are prevalent in the monument management plan and FEIS and they will compromise the ability of the Forest Service to meet its proclamation mandates. The agency, therefore, has yet to put forth a preferred alternative for the monument that is the best set of strategies for maintaining the diverse array of objects of interest by enabling or restoring similar processes and conditions that shaped and sustained the monument’s ecosystem integrity. Clearly the Forest Service’s vision is challenged by the degraded state of some of the monument’s objects and long timelines needed to restore them, as well as a changing climate (see Section 6). However, the

Forest Service needs to adopt a more comprehensive protection and restoration program with more clearly articulated performance measures tied to the proclamation mandates and not to multiple use management in order to bring the monument management plan into compliance with the proclamation mandates.

2.3. Relevant Proclamation Mandates - evaluation of the monument management plan was based on whether it complied with the proclamation's mandates, which were grouped as follows:

Protection Mandates:

- “ *that there are hereby set apart and reserved as the Giant Sequoia National Monument, for the purpose of **protecting** the objects identified in the above preceding paragraphs.....*” (emphasis added)
- “*Prior to issuance of the management plan, **existing roads and trails may be closed or altered to protect** the objects of interest in the monument, and motorized vehicle use will be permitted on trails until but not after December 31, 2000. (emphasis added).*”

Compatible and Proper Care Mandates:

- “*....which is the smallest area **compatible** with the **proper care and management** of the objects to be protected as identified in the above preceding paragraphs.”(emphasis added)*

Ecological Restoration Mandates:

- “*These forests need restoration to counteract the effects of a century of fire suppression and logging.*”

- *“Outstanding opportunities exist for studying the consequences of different approaches to mitigating these conditions and restoring natural forest resilience.”*
- *“Removal of trees, except for personal use fuel wood, from within the monument area may take place only if **clearly needed for ecological restoration and maintenance** or public safety.” (emphasis added)*
- *“No **portion** of the monument **shall** be considered to be **suited for timber production**, and no part of the monument **shall** be used in a calculation or provision of a sustained yield of timber from the Sequoia National Forest.” (emphasis added)*

Water Quantity Mandates

- *“There is hereby reserved, as of the date of this proclamation and subject to valid existing rights, **a quantity of water sufficient** to fulfill the purposes for which the monument is established. (emphasis added)*

2.4. *Compatible Use as a Standard of Proclamation Compliance* - the concept of compatible use management should be a standard by which Forest Service actions are gauged and performance measures adopted. Relevant case law (TWS vs U.S. Fish & Wildlife Service, 316 F.3d 913) defines "*compatible use*" as a "*wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere from the fulfillment of the mission of the System or the purposes of the refuge.*" The Refuge Act permits uses within a Refuge only if they "*are compatible with the major purposes*" for which the area was

established (16 U.S.C. § 668dd(d)(1)(A)). Further, the Refuge Act defines "compatible use" as a use that "*will not materially interfere from the fulfillment of the mission of the System or the purposes of the refuge*" (16 U.S.C. § 668ee(1)). Notably, the monument's proclamation carries a higher standard than even the National Wildlife Refuge compatibility determination, which, in this case, was based on a recreation rather than a protection mandate. Interpretation of case law and best science supports the notion that stressors such as roads, livestock, and inappropriate fuel treatments may materially interfere with the fulfillment of the monument's proclamation mandates. The lack of a compatibility analysis is a major deficiency in the monument's management plan as noted in the following sections.

3.0. LIVESTOCK GRAZING AS AN INCOMPATIBLE USE

*"Laws, regulations, and policies pertaining to administration by the Department of Agriculture of **grazing permits** and timber sales under contract as of the date of this proclamation on National Forest System lands within the boundaries of the monument shall continue to apply to lands within the monument."* (Proclamation, emphasis added)

3.1. *Continuation of status quo grazing as an incompatible use* - grazing occurs on ~218,000 acres (two-thirds) of the monument's grassland, chaparral, open forest, and riparian meadows where there are 22 permitted allotments and ~15,757 "head months" of livestock permitted (Chapter 2 in the FEIS). Although the monument's proclamation continues existing uses governed by applicable laws, regulations, and management plans, continuation of grazing carried over from prior forest plan amendments (2004 Sierra

Forest Management Plan amendment) has set up an inherent conflict of interest with the protection/restoration mandates of the proclamation and this incompatibility was not sufficiently examined in the monument’s management alternatives. The Forest Service perpetuates this conflict in the following statement from Chapter 1 of the Monument’s FEIS:

Chapter 1 – “How Issue 12 is addressed: This issue of livestock grazing will be responded to in the same way in each of the alternatives. The Clinton proclamation is clear that the current policy for livestock grazing can continue in the Monument, including providing forage in areas suitable for grazing to qualified livestock operators. Assessment of the management situation did not *indicate any need to change grazing* in the Monument and the alternatives do not include any recommendations for change. The analysis of environmental consequences in Chapter 4 discusses the effects of livestock grazing on Monument resources (emphasis added).”

In stating that there is *no need for any change to grazing practices*, the Forest Service has not analyzed an appropriate range of NEPA alternatives, including alternatives that reduce grazing through restrictions in use (e.g., reduced number of cattle, changes in duration, frequency, intensity, seasonality of use), and through protective measures such as increased fencing and large grazing enclosures in uplands and riparian areas. In doing so, the Forest Service carries forward from prior plans the notion that livestock are compatible with restoration and protection, despite overwhelming evidence to the contrary (see below).

In general, livestock represent an incompatible use not only with the protection and restoration of the monument’s objects of interest but also the agencies’ emphasis on managing for *resilient* ecosystems in the face of climate change, the requirement of ensuring a *sufficient quantity of water* for the objects of interest, and the need for containment of invasive species; these

cumulative effects are insufficiently analyzed in the monument's NEPA alternatives as well as how allocation of water for livestock will compete with that of the monument's objects of interest.

3.2. *Studies of grazing impacts need to be in new NEPA alternatives* – summarized here and sent under separate documentation is a new synthesis on grazing and climate change (Beschta et al. 2012) documenting that livestock are a much more pervasive stressor on public lands in the West than any other stressor, including fire. To summarize, the following conclusions and statements paraphrased (references were removed for brevity) from Beschta et al. are particularly germane to the need for a comprehensive assessment of grazing impacts in the monument and should be analyzed in a new NEPA alternative:

- Historical and on-going ungulate use has affected soils, vegetation, wildlife, and water resources on vast expanses of public forests, shrublands, and grasslands across the American West in ways that are likely to accentuate any climate impacts on these resources. *Although the effects of ungulate use vary across landscapes, this variability is more a matter of degree than type (emphasis added).*
- The combined effects of ungulates (domestic, wild, and feral) and a changing climate present a pervasive set of stressors on public lands, which are significantly different from those encountered during the evolutionary history of the region's native species. The intersection of these stressors is setting the stage for fundamental and unprecedented changes to forest, arid, and semi-arid landscapes in the western US and increasing the likelihood of alternative stable states. Thus, public-land management needs to focus on restoring and maintaining

structure, function, and *integrity (emphasis added)* of ecosystems to improve their *resilience (emphasis added)* to climate change.

- Because livestock use is so widespread on public lands in the American West, management actions directed at ecological restoration (e.g., livestock removal, substantial reductions in numbers or length of season, extended or regular periods of rest) need to be accomplished at landscape scales. Such approaches, often referred to as *passive (emphasis added)* restoration, are generally the most ecologically effective and economically efficient for recovering altered ecosystems because they address *the root causes of degradation (emphasis added)* and allow natural recovery processes to operate. Furthermore, reducing the impact of current stressors is a “no regrets” adaptation strategy that could be taken now.
-various studies and reviews have concluded that the most effective way to restore riparian areas and aquatic systems is to exclude livestock either temporarily (with subsequent changed management) or long-term. Recovering channel form and riparian soils and vegetation by reducing ungulate impacts is also a viable management tool for increasing summer base flows [**note – this last point about base flows is especially relevant to the monument’s proclamation mandate requiring a sufficient quantity of water for the objects of interest and needs to be analyzed in a new NEPA alternative with lower grazing levels – specifically, how are grazing activities altering the monument’s hydrological processes (e.g., stream run-off, percolation of water through soils, spring hydrological maintenance, ground water seepage to sequoia groves, diversion of water for livestock, etc.)?**].

- Therefore, addressing the *underlying* (emphasis added) causes of degradation should be the first priority for effectively restoring altered public-land ecosystems **[note – the Forest Service fails to address underlying causes of livestock grazing particularly the spread of invasive weeds by cattle and instead simply transfers the grazing program over from the 2004 plan amendment without a compatible use analysis).**
- Removing domestic livestock from large areas of public lands, or otherwise significantly reducing their impacts, is consistent with six of the seven approaches recommended for ecosystem adaptation to climate change. Specifically, removing livestock would (1) protect key ecosystem features (e.g., soil properties, riparian areas); (2) reduce anthropogenic stressors (3) ensure representation (i.e., protect a variety of forms of a species or ecosystem); (4) ensure replication (i.e., protect more than one example of each ecosystem or population); (5) help restore ecosystems; and (6) protect refugia (i.e., areas that can serve as sources of “seed” for recovery or as destinations for climate-sensitive migrants).
- Public land managers have rarely used their authority to implement landscape-scale rest from livestock use, lowered frequency of use, or multi-stake-holder planning for innovative grazing systems to reduce impacts.
- ...reducing ungulate impacts and restoring degraded plant and soil systems may also assist in mitigating any ongoing or future changes in regional energy and carbon cycles that contribute to global climate change. Simply removing livestock can increase soil carbon sequestration since grasslands with the greatest potential for increasing soil carbon storage are those that have been depleted in the past by

poor management. Riparian area restoration can also enhance carbon sequestration.

- large areas of BLM and FS lands should become free of use by livestock and feral ungulates to help initiate and speed the recovery of affected ecosystems as well as provide benchmarks or controls for assessing the effects of “grazing versus no-grazing” at significant spatial scales under a changing climate. Further, large areas of livestock exclusion allow for understanding potential recovery foregone in areas where livestock grazing is continued [**note – this particular recommendation is essential for effectiveness monitoring as emphasized in the monument’s management plan and is necessary for establishing experimental controls in adaptive management approaches**].
- While lowering grazing pressure rather than discontinuing use might be effective in some circumstances, public land managers need to rigorously assess whether such use is *compatible (emphasis added)* with the maintenance or recovery of ecosystem attributes such as soils, watershed hydrology, and native plant and animal communities. In such cases, the contemporary status of at least some of the key attributes and their rates of change should be carefully monitored to ascertain whether continued use is consistent with ecological *recovery (emphasis added)*, particularly as the climate shifts.
- Regarding areas where livestock exclusion is recommended – these include (1) rare ecosystem types (e.g., perched wetlands) or locations with imperiled species (e.g., aspen stands and understory plant communities, *endemic species with limited range – emphasis added*), including fish and wildlife species adversely

affected by grazing and at-risk and/or listed under the ESA; (2) non-use areas located in representative ecotypes so that actual rates of recovery (in the absence of grazing impacts) can be assessed relative to resource trend and condition data in adjacent areas that continue to be grazed; (3) watersheds and other large areas that contain a variety of ecotypes to ensure that major ecological and societal benefits of more resilient and healthy ecosystems on public lands will occur in the face of climate change; (4) areas where ungulate effects extend beyond the immediate site (e.g., wetlands and riparian areas impact many wildlife species and ecosystem services with cascading implications beyond the area grazed); and (5) localized areas that are easily damaged by ungulates, either inherently (e.g., biological crusts or erodible soils) or as the result of a temporary condition (e.g., recent fire or flood disturbances, or degraded from previous management and thus fragile during a recovery period).

- Such comparisons [*to non-use areas*] are crucial if scientists and managers are to confirm whether managed systems are attaining restoration goals and to determine needs for intervention, such as reintroducing previously extirpated species. Unfortunately, testing for impacts of livestock use at landscape scales is hampered by the lack of large, ungrazed areas in the western US.
- Current livestock or feral ungulate use should continue only where stocking rates, frequency, and timing can be demonstrated, in comparison with landscape-scale reference areas, exclosures, or other appropriate non-use areas, to be *compatible* (*emphasis added*) with maintaining or recovering key ecological functions and native species complexes.

In addition to the findings of Beschta et al. (2012), California Partners in Flight have raised serious concerns regarding relaxed standards for grazing and its potential impact to the endangered Willow Flycatcher (*Empidonax traillii*) and riparian and meadow lands in the monument (sent under separate documentation). Similar to concerns raised in this evaluation, these scientists are calling on the Forest Service to prioritize meadows and riparian areas for protection from grazing yet this is lacking in NEPA alternatives for the monument.

3.3. Monument management strategies are deficient with respect to livestock grazing impacts - the Forest Service has provided an inadequate assessment of cumulative effects originating from the combination of ongoing livestock grazing and accelerating climate change, which, as the available evidence presented in Beschta et al. (2012) and concerns expressed by California Partners in Flight, are likely to conflict with the agencies' ability to fulfill the proclamation's protection and restoration mandates. In particular, many of the grazing strategies proposed in the FEIS and monument management plan are vague with respect to the objects of interest, rely on carrying forward inadequate grazing provisions from the 2004 plan amendment and MSA (1990), lack specific objectives or direction for scientific study and adaptive management related to assessing impacts to the full array of objects of interest, omit any discussion of the impacts of livestock grazing on long-term carbon sequestration potential of ungrazed lands, and provide inadequate safeguards for limiting cattle damage to hydrological processes and ground water infiltration rates that could impact giant sequoia groves. Chief among the

recommendations of this evaluation is the need for the Forest Service to analyze grazing as a stressor – incompatible use – for each of the objects of interest before it reaches a determination on how best to manage grazing in the monument given competing monument proclamation directives (i.e., continuation of grazing vs. protection).

As a component of grazing impacts, the Forest Service has not adequately examined livestock and other stressors (e.g., roads) as vectors of invasive species spread. There are specific policies and directives referenced in the monument management plan that direct the agency to control invasive weeds yet a lack of attention to livestock-related weed containment provisions as follows:

- Executive Order 13122 and Invasive Species 64 FR 6183 directs the Forest Service to “*prevent and control the introduction and spread of invasives,*” yet the monument management plan carries forward inadequate grazing provisions from the 2004 Sierra Nevada Forest Plan Amendment and MSA (1990) that will continue the spread of invasives as cattle are a know vector of weed spread (see Beschta et al. in press).
- Forest Service Handbook Chapter 2081.03 directs the agency to *identify control and containment measures for invasives from ground-disturbing activities* – while this includes cattle (and roads for that matter), the agency continues its status quo grazing that will play a role in furthering the spread of invasives in the monument.

Finally, the Forest Service should analyze grazing in combination with climate change as multiple stressors in the monument (Beschta et al. 2012). In particular, projected

increases in winter flooding (see Section 6.1) require extensive no-grazing riparian buffers and restored channel morphology to increase resilience (a stated goal of the monument management plan) to anticipated high peak flows in the face of climate change.

4.0. EXCESSIVE FUEL TREATMENTS AS AN INCOMPATIBLE USE

*“These giant groves and the surrounding forest provide opportunity to understand the **consequences of different approaches** to forest restoration.” (Proclamation, emphasis added).*

4.1. Role of fire as a keystone process –fire has shaped the ecosystems within the Giant Sequoia National Monument and its surroundings for millennia. It is an important driver of ecosystem heterogeneity as reflected by the diverse array of plant communities and seral stages in the monument, and continued fire (especially patches of high severity) is vital to giant sequoia regeneration (Stephenson 1991, 1996). Since the mid 19th century, grazing and fire suppression have combined to reduce fire frequencies, high-grade logging has removed most fire resistant large conifers (see Miller et al. 2009 for altered fire effects), and an extensive road network has increased the risk of uncharacteristic fire ignitions that compromise the monument’s integrity and resilience to climate change. However, despite these land-use effects and concerns raised by Miller et al. (2009) regarding increased severity, fire ostensibly has not increased in severity (Box 1), meaning the Forest Service can adopt a more precautionary approach to its fuel treatments.

Box 1. The Forest Service bases fire concerns on Miller et al. (2009) who reported increased fire intensity in Sierra Nevada forests since 1984. However, this study did not include 40% of the fire intensity data available at the time the study was conducted, nor a methodology explaining why some data were excluded. Hanson and Odion (revision in review 2012) conducted the first comprehensive assessment of fire intensity since 1984 in the Sierra Nevada, using 100% of available fire intensity data, and, using Mann-Kendall trend tests (a common approach for environmental time series data), found no increasing trend in high-intensity fire proportion, area, mean patch size, or maximum patch size. These authors also checked for serial autocorrelation in the data, and found none, and used pre-1984 vegetation data (1977 Cal-Veg) in order to completely include any conifer forest experiencing high-intensity fire in all time periods since 1984 (the accuracy of these data at the forest strata scale used in the analysis was 85-88%). The results of Hanson and Odion are consistent with *all* other recent studies of fire intensity trends in California's forests that have used all available fire intensity data, including Collins et al. (2009) in a portion of Yosemite National Park, Schwind (2008) regarding all vegetation in California, Hanson et al. (2009) and Miller et al. (2012) regarding conifer forests in the Klamath and southern Cascades regions of California, and Dillon et al. (2011) regarding forests of the Pacific (south to the northernmost portion of California) and Pacific Northwest (references in Hanson and Odion, in review).

4.2. *Problems with hazard fuel and fire risk reduction approaches* - The Forest Service's approach to hazard fuel and fire risk reduction in the monument is limited to the fire return interval departure concept – that is, the degree of fire return interval departure (FRID) from a presumed historic baseline condition. The assumption as it applies to the monument is that the greater the departure from baseline, the more likely the objects will be “lost” due to “uncharacteristically” severe fires. For example, the agency states in Chapter 2 of the FEIS: “.....*one of the most immediate consequences of these changes is increased hazard of wildfires of a severity that was rarely encountered in pre-Euroamerican times* (emphasis added; Volume 1 p. 66). And while the argument for increased fuel loadings in the monument is a cogent one, due to a long history of suppression, grazing, and logging (especially plantations), some researchers have questioned the use of FRID in predicting the likelihood of severe fires at site-specific scales. For instance, Odion and Hansen (2006, 2008) analyzed fire severity in three large fires (1999) in the Sierra's in terms of whether the condition class approach of FRID accurately predicted observed fire severity classes. They found that condition class was not able to accurately predict patterns of fire severity and recommended more comprehensive assessments of existing disturbance regimes to determine whether they are indeed outside historic bounds. In addition, prehistoric fires in the region have been described as being patchy intense fires (sometimes predominant) within a matrix of low intensity fire where the frequency and relative area of intense fires varied overtime (Stephenson et al. 1991). Notably, as the summer climate increasingly becomes drier from climate change (Section 6), one would expect fire behavior to be less responsive to

altered fuel profiles and more driven by extreme weather events related to global climate forcings.

The Forest Service relies on the use of FRID in its analysis of fire risks to prescribe extensive fuel reduction treatments with a diameter limit on tree removals (20 in cap on westside forests) and a large (approximately one-fourth of the monument) WUI buffer where mechanical fuel treatments are to be applied. There is no discussion of uncertainty in fire projections related to FRID and limitations of fuel treatments in (a) encountering and influencing a fire within a short window (~10 years) of reduced fuels (e.g., 2 to 7.9% probability of treated areas encountering moderate or severe fires within the treatment window, Rhodes and Baker 2008) and (b) the increasing role of climate in fire behavior and how that might limit the efficacy of fuel treatments. This particular concern (b) would warrant more careful placement of fuel reduction measures closer to homes where research has shown fire risk reduction measures to be particularly effective (Cohen 2000).

Further, the agencies' approach to fire management is fuel-centric and ignores the importance of road-related ignition sources that may be at least as big a problem in uncharacteristically severe fires as hazard fuels. Thus, there is an insufficient range of NEPA alternatives in the FEIS for minimizing impacts of roads on uncharacteristic fire ignitions associated with road access. The Forest Service therefore needs to analyze the effects of varying amounts of road closures and road obliteration on reducing fire ignitions in the monument.

Although the Forest Service analyzed smaller diameter limits (caps) on tree removal than the preferred (e.g., Alternative C uses 8 in dbh cap and Alternative D uses 12 in dbh, vs. Alternative B [preferred] that uses a 20 in dbh limit), the agency's preferred alternative needs improvement on diameter limits in order to be based on best science of giant sequoia regeneration and fire history in the area. For instance, Martinson and Omni (2003) provide a meta-analysis on fuel treatment efficacy concluding that treatments are most effective when the *smallest* trees are removed. Therefore, the selection of a 20 in cap is not the smallest tree removal cap compared to Alternatives C and D that may better meet the science on fuel reductions as described by Martinson and Omni (2003).

Removal of smaller trees also would better meet the intent of the proclamation that directs the Forest Service to consider “*opportunity to understand the **consequences of different approaches** to forest restoration.*” Thus, the Forest Service should adopt the tree removal standards of Martinson and Omni (2003) to better meet the monument's proclamation: “*removal of trees, except for personal use fuel wood, from within the monument area may take place only if **clearly** (emphasis added) needed for ecological restoration and maintenance of public safety*” (proclamation p. 24097).

Further, the use of a 20 in dbh cap would encourage commercial logging sales in the monument and conflict with the timber production mandate in the monument's proclamation:

- “No *portion* of the monument *shall* be considered to be suited for timber *production*, and no part of the monument *shall* be used in a calculation or provision of a sustained yield of timber from the Sequoia National Forest.”
(emphasis added)

The Forest Service further raises concerns about the potential for commercial timber sales in the monument as reflected in the following management plan statements:

- “A number of restoration projects are likely to remove some form of biomass. The biomass removal may be in the form of burning on site, or production of secondary products such as wood chips, *lumber*, or *other wood products*”
(monument management plan, p. 79).”

4.3. *Vague tree removal criteria* - several of the tree removal criteria are vague (unenforceable standards) and do not meet the proclamation requirement of a clear need for tree removal. Here are some examples of where the tree removal standards in the monument management plan (p. 79) appear to be arbitrarily based:

- Criterion R1 – *if keeping one or more trees on site would cause unacceptable fuel accumulation and fire severity effects...* - it is unclear what constitutes an unacceptable fuel and fire severity effect for a **single tree**.
- Criterion R2 (resilience) – *if keeping one or more trees on site would create a vector for disease infestations at levels higher than currently known endemic*

outbreaks – it is unclear how the agency will determine if the removal of a **single tree** will trigger a pandemic (there is no science to support this criterion).

- Criterion F1 (tree felling) – *if maintaining one or more standing trees on site would deplete moisture, light, or nutritional resources essential to health and survival of plant communities or forests* – how will the Forest Service determine whether a **single tree** will meet this criterion and what does tree or forest health really mean?
- Criterion F2 (regeneration) – *if maintaining one or more trees would adversely affect regeneration, longevity, or growth of giant sequoia and other desired tree species* – how will the Forest Service determine whether a **single tree** will meet this criterion?
- Criterion F3 (heterogeneity) – *if maintaining one or more trees would adversely affect heterogeneity* - how will the Forest Service determine whether a **single tree** will meet this criterion and at what scale (canopy gap, stand, landscape)?

To better clarify its intent, the Forest Service needs to develop more rigorous criteria and performance metrics along with more sophisticated decision-support tools for assessing fuel treatment tradeoffs to objects of interest. For instance, Scheller et al. (2011) evaluated relative risks of habitat loss from fuel reductions vs. severe fires on Pacific fisher (*Martes pennanti pacifica*) in the Sierra using decision-support tools. These researchers coupled fisher habitat models with fire risk models

designed to assess relative costs (habitat loss) and benefits (risk reduction) of fuel reductions. The Forest Service should use coupled models like this to examine the broad array of small diameter caps (8, 12, 20 in) and to better balance the need to lower hazardous fuels vs. the need to protect specific objects from fuel-reduction related habitat losses. Decision-support tools also can be aggregated for multi-species and would better allow the agency to assess relative risks of different fuel reduction treatments for a broad array of objects of interest. This would also allow the agency to more effectively comply with the protection and tree removal mandates in the proclamation using best science and sophisticated modeling tools. Likewise, decision-support tools could be used to assess the tradeoffs between narrower WUI buffers that were dismissed (e.g., park service WUI buffer) to better balance protection of the object with fuel reductions and the literature on home ignitability (Cohen 2000). As it stands, the agency has not provided an adequate assessment of the relative costs (loss of habitat) to objects of interest in the monument from the combination of tree removals and excessively large WUI buffers.

Finally, there are ambiguous standards in the preferred alternative related to the cap on thinning of 20 inches by forest types. No map or specific estimate of westside vs. eastside forest area affected by this standard is provided and it is impossible for the public to evaluate how much of the monument's land base falls outside the 20 in dbh cap in the eastside forests.

5.0. EXCESSIVE ROAD NETWORK AS AN INCOMPATIBLE USE

*“No new roads or trails will be authorized within the monument **except** to further the purposes of the monument.” (emphasis added, Proclamation)*

*“Prior to the issuance of the management plan, **existing roads and trails may be closed or altered to protect** the objects of interest in the monument, and motorized vehicle use will be permitted on trails until but not after December 31, 2000.” (emphasis added, Proclamation)*

5.1. *Proposed monument alternative perpetuates road problems* – although the Forest Service has deferred for 2 years a travel analysis plan (TAP) to determine the *minimum necessary transportation system* (see objectives for transportation system in the FEIS, p. 124), numerous statements in the FEIS pertaining to roads appear to contradict the monument’s protection and restoration objectives by perpetuating the status-quo on road building and over-emphasizing access exemptions in the proclamation as follows (emphasis added):

- *For Alternative B, the majority of the currently designated road and trail system would be available for use, **retaining access similar to current levels for dispersed recreation, private ownerships, and management activities.... This alternative emphasizes opportunities for creating loop trails and roads, with the potential for the construction of new roads for developed recreation facilities and loop driving opportunities** (Chapter 2, p. 81).*
- *Base **proposals for new roads on the need to provide access to recreation***

opportunities, other public use, or management activities, as appropriate to the purposes of the Monument (strategies for transportation system, p. 123) [note – this particular statement appears to elevate road building above the protection/restoration mandates in the monument by reversing the order of how it appears in the proclamation – e.g., the proclamation (see above) begins with no new roads and ends with the exemption clause while this begins with new roads and ends with appropriate purposes clause].

- *Emphasize opportunities for creating loop roads where feasible and appropriate (strategies for transportation system, p. 123) [note: it is impossible to assess what “where feasible and appropriate” means without a comprehensive and cumulative impacts analysis of roads and whether creating loop roads is necessary to protect and restore the objects of interest – this again appears to place road building above the monument’s protection mandates).*
- *The plan will provide for and encourage continued public and recreational access and use consistent with the purposes of the monument (Chapter 2, p. 125) [note – no analysis of increased (encouraged) access on objects of interest is provided and the Forest Service again places access above protection/restoration mandates].*

In order to provide a more appropriate balance between access and protection/restoration mandates, the Forest Service needs to conduct a comprehensive analysis of the individual and cumulative impacts of **each road** on the objects of interest to ensure the future TAP is compatible with protection and restoration mandates, which it has not done for the

monument's management plan. This includes a literature review of road-related impacts and roads as a potential ignition source of uncharacteristic fires in the monument. And while the management plan will permit motorized and non-motorized mechanized vehicle use on designated roads and trails (Chapter 2, p. 125), this is not a substitute for a road-by-road and cumulative analysis of impacts to the objects of interest as required under recent Forest Service regulations (see Section 5.3).

5.2. Road impacts: a synthesis – because the Forest Service has not provided a detailed analysis of road impacts on the monuments objects in the FEIS, which it must do to be in compliance with the proclamation and NEPA, literature on road-related impacts is summarized herein for inclusion in a future monument's TAP. A more complete database with over 22,000 citations is available from Wildlands CPR and also should be consulted by the agency (see <http://wildlandscpr.org/bibliographic-database-search>)

In sum, roads may directly or indirectly impact wildlife populations and/or ecosystem process as follows:

- dispersal bottlenecks for sensitive species, thereby fragmenting populations (Trombulak and Frissell 2000, Heilman et al. 2002)
- dispersal conduits for invasive species (e.g., Gelbard and Harrison 2003)
- impediments to hydrological properties and processes, particularly changes in drainage patterns and stream morphology (e.g., higher peak flows of streams and rivers, more localized flooding events, floodplain alterations -- see Eaglin and Hubert 1993, Roth and Erickson 1996, Haskins and Mayhood 1997-- also on

moist slopes inadequate culvert size, location, or number causes a higher and lower water table upslope and downslope, respectively (Stoeckeler 1965)

- degradation of fish habitat (well documented, see Henjum et al. 1994)
- mass wasting events and slope instability (particularly road building on steep slopes)
- poaching, over-hunting, trapping and wildlife collisions - Lalo (1997) estimates more than 1 million vertebrates nation-wide are killed each day by collisions with vehicles
- alteration of fire patterns (e.g., increased risk of arson due to human access exacerbated by roads; DellaSala et al. 1995)
- soil and water pollution, air pollution, particularly a build up of nitrous oxides in soils and streams that has been associated with the spread of exotics (Schowalter 1988, Tyser and Worley 1992)
- erosion, sedimentation of streams, edge effects, over collecting of rare plants and animals, and the elimination of snags for firewood or road safety (Noss and Cooperrider 1994).

In forested ecosystems, roads result in cumulative impacts (i.e., chronic disturbances), which when combined with other anthropogenic disturbances, reduce habitat suitability for many species (special feature on roads in *Conservation Biology* 2000 Volume 14 and Trombulak and Frissell 2000). Wilcove et al. (1998) suggested that “**roads are the single greatest impact to the movement of sensitive species**” and Forman and Hesperger (1996) concluded “**roads cause more effects and have a greater cumulative**

effect than vehicles” (emphasis added). In particular, the ecological effect of roads is much larger than the area cleared for roads, extending a ¼ mile out on either side of a road (so called road-effect zone; Forman and Hesperger 1996, Forman and Alexander 1998). The Forest Service in its TAP for the monument should analyze the road effect zone.

In summary, road density (e.g., mi/mi²) is a useful index of the road-effect zone because it integrates many ecological effects of roads and vehicles on flows and movements of wildlife across the landscape. In addition, the ratio of road density to stream density and intersection of roads with stream crossings are important indicators of the functionality of hydrological processes and particulate matter flows (Coe 2006). Because roads both remove wildlife habitat directly and dissect the remaining natural patches into residual small patches, they are a significant contributor to habitat fragmentation (Reed et al. 1996). Obviously, while roads per-se do not kill wildlife or start forest fires, they are associated (i.e., an indicator) with many types of human-caused changes in landscape dynamics and wildlife dispersal that can accumulate over a given area. The Forest Service would do well to include this type of review in its monument TAP as best science on road impacts. In addition, it should provide detailed monitoring on effects of road closures and obliteration on objects of interest as studies have shown road decommissioning/obliteration has net benefits to aquatic and terrestrial ecosystems (see <http://www.wildlandscpr.org/road-riporter/road-reclamation-measuring-success>).

Notably, the Sequoia National Forest has decommissioned only “*about 3 to 6 miles*” of roads in the monument (FEIS, Chapter 2). This is a surprisingly poor showing on road decommissioning given the clear directive from the monument proclamation on roads.

While the term “decommissioning” is used in the monument management plan and FEIS it is unclear how this will be implemented in the monument as it could involve anything from a mere paper exercise that removes a road from the formal road inventory system to complete deconstruction of the road prism and recontouring of the slopes (plus all culverts and water bars removed). The agency should clearly define this term as the complete obliteration of the road including pulling culverts, recontouring slopes, and allowing for natural (or aided) revegetation of native plants on the former road surface.

In addition, it is unclear as to whether the Forest Service intends to treat roads and transportation management in its TAP through “storage and storm-damage risk reduction” (SDRR). Storage applies to roads that are being left on the system, but are being closed and “stored” for future use. In these instances, the agency is theoretically treating the road system for hydrological impacts but the road itself is not being decommissioned. SDRR also refers to roads that the agency will keep open to use but need mitigation to reduce impacts (upgrade of culverts, water bars and other types of drainages to reduce sediment delivery to streams). The Forest Service should clearly define its intent with regard to decommissioning using the best science and best practices as summarized by Wildlands CPR (<http://www.wildlandscpr.org/node/4188>). The agency’s TAP should be consistent with the monument’s proclamation protection and

restoration mandates and raise the bar on road decommissioning well above the inadequate 3 to 6 miles already decommissioned in a monument with 822 miles of roads. With this in mind, Alternative C provides a higher performance measure for ameliorating road impacts than the preferred alternative and the Forest Service should revisit this decision in light of the new information presented in this evaluation (see Section 5.3) and in the Wildlands CPR report.

5.3 Minimum transportation analysis – although the Forest Service has delayed the TAP for the monument until 2014 and is required to produce one by 2015 on all National Forest lands, the agency should follow the November 10, 2010 directive from the Chief’s Office – Travel Management, Implementation of 36CFR, Part 212 Subpart A (36 CFR 212.5 (b)) in providing a thorough science-based analysis of the monument’s road network to reach a determination on the *minimum* road density that is *ecologically* and *fiscally sustainable*. This should involve analysis of the *direct, indirect, and cumulative impacts* of the monument’s roads on objects of interests and fire ignition probabilities. To minimize conflicts over incompatible uses, the burden of proof for maintaining a road vs. obliterating it should rest on whether it is needed to protect or restore the objects of interest as the predominant monument use.

In particular, the agency should consult the TAP process along with Forest Service Manual 7712 and Forest Service Handbook 7709.55 to identify the minimum road system as well as roads that are no longer needed and should be obliterated or converted to other uses, such as trails, for all Maintenance Level (ML) 1-5 roads. As defined in the

agencies' travel management policy, the minimum road system is *“the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plans to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, [and] to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning and maintenance.”*

The minimum roads analysis must at least include: (1) a map of recommended minimum road system; (2) list of unneeded roads; (3) list of key issues and incompatibilities between roads and objects; (4) prioritized list of risks and benefits to monument objects; (5) prioritized list of opportunities for addressing those risks and benefits; (6) prioritized list of actions or projects to implement the minimum road system; (7) list of proposed changes to current travel management, including proposed deletions and any consideration for new roads must meet the intent of the proclamation's protection and restoration mandates before moving forward; and (8) clear standards on road decommissioning and road storage objectives. In addition, the Forest Service should include an implementation plan for protecting and restoring monument objects related to a schedule of road closure, road maintenance, and road obliteration activities.

In sum, the monument TAP needs to be based on best science to weigh and prioritize the risks and benefits of each road in the monument to comply with the proclamation and is necessary for the Forest Service to develop informed decisions about how to balance recreation and access to the monument with ecological and fiscal responsibilities of road

maintenance. The Forest Service should include this information in its NEPA analysis of alternatives (and cumulative effects) and re-examine the range of alternatives in the monument based on the TAP and a *minimum* roads network plan. As it stands, its impossible for the public to determine whether the range of alternatives provided by the FEIS on roads will sufficiently minimize direct, indirect, and cumulative impacts to objects of interest in the monument.

Paraphrased below are specific recommendations developed by The Wilderness Society for TAPs that are pertinent to the monument's management:

- *Accurate identification of the baseline transportation system* – an essential starting point for determining the minimum necessary roads is an accurate and field-verifiable map of the current road system along with a documented history of the roads network. The Forest Service should perform a records search to field-verify each route and to uncover any discrepancies in the baseline assessment (i.e. an accuracy assessment).
- *Documented impacts (including literature review) of minimum road system on objects of interest* – this should include best practices for protection and restoration of aquatic and terrestrial connectivity, reduction of fragmented and altered wildlife habitat; analysis of impacts to T&E species; water quality and quantity from roads; and identification of wildlife migration corridors for enabling climate-forced wildlife migrations (see above literature review as an example).
- *Effect of minimum road system on probability of anthropogenic fire ignitions* – this is important for developing comprehensive fire management approaches

beyond just fuels. The Forest Service should be more proactive in reducing uncharacteristic ignitions through seasonal road closures and road obliterations that would better protect and restore the monument's objects of interest.

- *Compliance with state water quality standards* – a determination of which roads are most likely to hinder attainment of water quality standards in the monument is needed to comply with state water quality regulations, the Clean Water Act (section 303 d), and the monument's proclamation regarding a sufficient quantity of water for the objects of interest.
- *Prioritize expected access to show relative importance of roads for access and rank roads to effectively balance benefits and needs* – this will aid the Forest Service in determining which particular roads are most important for access and which ones are needed to reduce impacts to the objects of interest.
- *Identify specific opportunities (methods) for implementing the road standards within the monument* – once the TAP is completed, a site-specific determination needs to be conducted for project-level implementation.

Also submitted below are recommendations for Subpart A Analysis Categories for a TAP developed by Wildlands CPR that need to be included in transportation alternatives to be in compliance with the proclamations protection/restoration mandates:

Recommendations for Subpart A Analysis Categories, Factors and Questions

Ecological Analysis Recommendations

The following categories show important ecological issues and factors that should be part of the travel analysis process:

- Terrestrial Habitat Condition
 - Impacts/potential impacts to important wildlife (rare, sensitive, threatened or endangered species, in particular)
 - Fragmentation impacts/potential impacts of individual roads to relatively intact habitat (e.g. how isolated is the road, does it bisect an otherwise unroaded area)
 - Impacts/potential impacts to rare plant habitat
 - Impacts/potential impacts to wildlife migration and/or connectivity
 - Consistency with specified/scientifically identified road and motorized route density limits
 - Presence/density of non-native or invasive species
- Aquatic Habitat Condition
 - Past, current and potential future sediment delivery to water bodies, including chronic sedimentation and potential episodic mass wasting events (e.g. soil erodibility, steepness of terrain, percent grade of road, number of stream crossings)
 - Impacts/potential impacts to aquatic connectivity (e.g., blocked, collapsed, undersized, or misplaced culverts)
- Water Quality
 - Compliance with state water quality standards
 - Impacts/potential impacts to municipal watershed
 - Impacts/potential impacts from hydrologic connectivity between the stream and road system
- Climate change
 - Impacts/potential impacts of the transportation system on terrestrial and aquatic habitat/species, and potential for this to be exacerbated by climate change
 - Potential for road reclamation and stormproofing to contribute to restoring aquatic and terrestrial connectivity, thereby potentially increasing resiliency to climate change

Access Analysis Recommendations

Road access affects important resource management and social factors such as cultural and recreational issues. Guidance for travel analysis should include specific considerations listed below. Additionally, given that most forests have produced Motor Vehicle Use Maps, it's important that the guidance include direction that roads displayed on these maps does not necessarily mean they have a high recreational value.

- Identify existing management and public use patterns.
 - Who are the user groups that are using the roads? (e.g. hikers, bikers, hunters, tribes, special use permit holders, off-road vehicle riders, etc.)
 - What roads are identified as the highest and lowest priorities by which user groups?
 - Consider seasonal changes in usage – some roads may be used more or less depending on the season and the activity that the road facilitates.
 - What roads provide access for important natural resource management activities or access to private inholdings, and at what level are they utilized?
 - What roads are needed to provide access to developed and primitive recreational facilities? Are there alternative roads available to those locations?

- Identify and prioritize expected resource management access needs.
 - What resource management activities are projected within the next 20 years and which roads are required to provide access for that management?
 - The guidance should make clear that not all roads should have the same priority, and should caution against bias.
 - How will climate change and other expected stressors affect management access needs; prioritize road access accordingly.

- Identify alternative access opportunities
 - When multiple roads access the same recreational facilities or resource management areas, identify the one(s) most utilized and close (if needed for future management) or decommission the others.
 - When ranking recreational road access benefits, consider whether trails in the area provide the same or better recreational experiences.
 - Prioritize converting roads to non-motorized trails and motorized routes instead of decommissioning in limited and specific instances where there is stakeholder interest and capacity to provide appropriate maintenance for such travelways. Take into account the initial treatments for such conversions, ensuring it is fully mitigated and no longer functions as a road from an ecological perspective.

- Identify user conflicts exacerbated by roads.
 - Where are road-related impacts like noise, chronic sedimentation and habitat fragmentation among other disturbances affecting the quantity, quality, or type of both consumptive and non-consumptive recreational uses in the area?
 - Does the area have special characteristics, like Inventoried Roadless Areas, Wilderness Study Areas, Recommended Wilderness Area or designated Wilderness Areas that are affected by roads?
 - Determine impacts/potential impacts to cultural resources in the area (e.g., resources are at risk of human-related damage because they are located within 300 meters of an open or closed road, illegal use off-road is common in area with high cultural value)

Fiscal Analysis Recommendations

Direct Costs

- For each individual maintenance level (ML) determine direct road maintenance costs per mile of road.
 - Use existing road condition surveys to inform modeling of projected and actual maintenance expenditures
 - Include fixed costs - also called operational costs (e.g. collecting and maintaining road related data, engineering/planning, contract administration)

Indirect Costs

- Use the appropriate scale¹ to determine indirect road costs, including increased management/mitigation costs due to ecological impacts
 - Include fixed/operational costs (e.g. providing public road information, project planning, office support, etc.)
 - Include cost estimates for current and future mitigation needs
 - Estimate how much money is saved by preventing future ecological damage through road decommissioning and closures.²

Maintenance Level Reductions

- Fully analyze direct and indirect costs for reducing the status of a road from one ML to another (e.g. moving a road from ML3 (passenger vehicle) to ML2 (high-clearance vehicle) status)
 - Include costs for physical treatments used to reduce traffic levels and mitigate ecological impacts

Cost Comparisons

- Compare costs for closing, storing, or decommissioning a road on the ground.
 - Estimate road closure and/or storage costs, both the initial treatment and re-opening since these roads supposedly would be needed for future use.
 - Account for long term savings from road decommissioning such as avoided maintenance costs, and mitigation costs as well as expenditures avoided to re-open a closed and/or stored road.

Economic Efficiency/Cost-Benefit Analysis³

- Determine the economic value of both increases and decreases to ecosystem services resulting from the road system.
- Incorporate ecological and other passive values.

¹ The scale must be that at which significant effects occur. If increasing the scale of analysis changes the conclusion, the scale is too small. If differences in choices are not measurable at a specific scale, the scale is too large. The sensitivity of conclusions to changes in scale should be examined.

² The Averted Expenditure Method is one way to calculate this savings.

³ Economic efficiency analysis measures net economic benefit to society in aggregate, including non-marketed and external costs and benefits, without regard for who gains and who loses.

- Use the most appropriate method to ensure the measurement of ecological impacts or improvements.⁴

Ensure Neutrality

- Assess every road individually, whether it is open or closed, to determine whether it should remain on the system. (Some closed roads may need to be upgraded, some currently open roads may need to be decommissioned.)
- Use a zero-based accounting method to determine future maintenance needs. Do not assume that every road currently being maintained should remain on the system.
- Fully analyze present and future costs of closing/storing roads versus physically reclaiming roads to determine fiscal outcomes.

Public Involvement

The guidance memo states, “Although the TAP does not include a National Environmental Policy Act (NEPA) decision, we expect line officers to engage the public in the process, which should involve a broad spectrum of interested and affected citizens, other State and Federal agencies, and tribal governments.” This requirement may be confusing to both managers and members of the public who are used to traditional NEPA notices and comment periods along with public meetings. Therefore, the Region One guidance should provide clear direction addressing this issue, including options and ideas for how to best engage the public under different circumstances (e.g. meetings with individual stakeholders as opposed to large public meetings). Foremost, before each forest engages the public, the ecological and base fiscal analyses should be completed in order to best communicate current impacts and budget burdens from the existing road system. Then each forest can have maps and data to help determine priorities for access. Below we provide some specific recommendations:

- Each forest should *proactively* identify and meet with a broad spectrum of user groups rather than relying on feedback from user-groups who “self-select” to engage.
- When requesting information and feedback from user groups, require that they prioritize which roads are most and least important for their particular recreational or forest product collection interests. Also have them identify the priority recreation destinations that the roads of interest are used to access. Make clear that interested parties cannot declare all access needs as equal, because the FS cannot keep all roads on the system.
 - This will assist in determining the relative importance of various roads and interests to users, as opposed to soliciting a broad “wish list”.
 - Knowing the priority destinations will allow consideration of alternate access opportunities when ecological and/or fiscal considerations identify a high priority to close or decommission a road.

⁴ Contingent valuation is one of many approaches that has been used to determine passive values and can be measured through the “willingness to pay or other methods. The Forest Service should identify the appropriate method.

6.0 INSUFFICIENT ANALYSIS AND PREPARATION FOR CLIMATE CHANGE

6.1 Climate change and land-uses as unprecedented impacts – the Forest Service summarizes recent studies on already documented climate impacts and future climate change projections relevant to the monument and the Sierra Nevada region. In general, climate change already is affecting the region via increases in mean annual temperatures (1.5 to 3° F) over the last century, decreases in frequency of nighttime freezes and hard frosts during the growing season, declines in mean annual precipitation in lower elevations, shifts toward more rain and less snow, earlier peak stream flows, recession of glaciers, non-fire related mortality of adult trees in low to mid elevations, and range shifts in wildlife. Many of these effects are likely to worsen by century's end due to accelerated global climate change with most climate models projecting an increase in mean annual temperature of 4 to 9° F, slight reductions in annual precipitation (although there are higher degrees of uncertainty in predicting precipitation change), drier summers, decreases in snow pack in the Southern Sierra, increased rain at the expense of snow, lower spring-summer stream flow, increase in winter flooding potential, and a projected shift in the climate niche of plant communities to a climate favoring hardwoods over conifers and grasslands over woodlands (lower elevations). Increase in fire activity due primarily to drier summers and water stress at lower elevations is also likely to impact the monument's objects.

6.2. *Need for up-to-date climate vulnerability assessments* – the Forest Service defers an analysis of climate vulnerability to a yet-to-be completed climate vulnerability assessments underway for the three “early adopter” (of the 2012 forest planning rule) National Forests (Sierra, Sequoia, Inyo) and only qualitatively compares NEPA alternatives for their ability to prepare monument objects for climate change. The FEIS and monument plan provide vague guidance on how to prepare the monument’s objects for climate change and no quantitative analysis of how the alternatives differ in regard to climate change effects. In addition, there are numerous deficiencies in the FEIS with respect to climate change preparation, including: (1) while the alternatives are qualitatively evaluated based on maintaining and restoring connectivity, there is no specific connectivity analysis for objects of interest to differentiate alternatives; (2) no carbon sequestration analysis is provided (**despite a requirement to do so under the forest planning rule 2012**) for management actions related to livestock grazing and fuels reduction and the Forest Service assumes a net carbon sequestration benefit from fuels reduction without providing documentation or a carbon life cycle analysis to support this claim; and (3) the Forest Service claims that all alternatives include aggressive measures for containing invasive species, yet there is no analysis to back this claim especially given that many of the proposed management actions actually will increase the spread of invasives through known vectors of weed spread such as road-related access and transport, livestock grazing, and access for extensive fuel treatments.

There are several existing policies related to climate change planning that are also ignored in the FEIS and monument management plan but are germane to planning for climate change on all National Forest units including:

- *Executive Order 13514 requires the Forest Service to reduce greenhouse gas emissions from activities within the planning unit* - no analysis of the effects of monument actions on emissions is provided in the monument's proposed transportation measures.
- *USDA Strategic Plan 2010-15 Strategic Goal 2* – provides guidance to ensure that National Forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing water resources – while the monument management plan and FEIS include provisions for ecosystem resilience it is unclear how these provisions relate to specific objects of interest and their ability to resist and be resilient to climate change, particularly with some land-use stressors that will be increasing in intensity (e.g., mechanical fuels reduction). In addition, there are no specific performance measures for increasing carbon sequestration overtime, only vague (undocumented) references that thinning activities will reduce carbon flux to fire. This assumption is made with no documentation regarding how mechanical fuels reduction are expected to increase carbon stocks when, in fact, recent studies of carbon fluxes show thinning actually produces net reductions in carbon stocks relative to fire because of the large treatment-area needed to alter fire behavior (e.g., Mitchell et al. 2009, Naficy et al. 2010, Ryan et al. 2010, Campbell et al. 2011, Clark et al. 2011).

- *Forest Service Roadmap and Performance Scorecard for measuring progress to achieve USDA strategic planning goals* – the Forest Service scorecard process and related forest planning rule (2012) require the agency to conduct climate vulnerability assessments yet the agency only refers to those underway in the early adopter forests without any clear guidance of how this will be incorporated.
- *USDA Climate Science Plan December 2010* – provides clear guidance to enable clear and consistent consideration of current and potential investments in climate change science activities, yet similar guidance is lacking in the FEIS management strategies and monument management plan.
- *Forest Planning Rule (2012)* – requires planning units to identify specific risks and vulnerabilities to climate change and ecological adaptation strategies that are expected on the planning unit, and a basic analysis of the conditions and trends of carbon stocks and fluxes, including emissions influenced by management of the planning unit. No such analysis is provided in the monument management plan or accompanying FEIS.

6.3. *Compliance with Forest Service climate change policies* – in order to comply with Forest Service’s own policies on climate change, the following adaptation and mitigation measures need to be included in management of the monument and its objects of interest:

1. Conduct a monument-specific vulnerability assessment of focal terrestrial and aquatic objects using the latest adaptation science approaches (see Koopman et al. 2011 for regionally specific recommendations).
2. Conduct a connectivity analysis (as directed by the forest planning rule) of focal terrestrial and aquatic objects of interest and identify management actions that facilitate wildlife dispersal into identified climate refugia.
3. Identify climate refugia, including specific enduring features of the landscape and microsite features for the objects of interest.
4. Conduct a comprehensive spatio-temporal assessment of likely changes to plant communities resulting from the cumulative and synergistic effects of climate change (using for instance, downscaled MC1 vegetation analyses) and land uses within and surrounding the monument (**cumulative effects**).
5. Conduct a collaborative process for identifying questions, strategies, and decision-support tools for monitoring response of objects to climate change overtime, including a long-term research project with permanent plots that can be revisited overtime by researchers (this will better enable the Forest Service to comply with the proclamation's emphasis on encouraging research of the monument's objects and with adaptive management approaches).
6. In compliance with the forest planning rule (2012) and its emphasis on ecological integrity, provide specific actions that maintain ecological integrity of the monument in the face of climate change, including specific performance measures for lowering land-use stressors especially limiting

further actions to light-touch maintenance as restoration actions are completed.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The monument management plan and FEIS was evaluated using a proclamation consistency review, science consistency review, and comprehensive review of management of objects of interest to determine how far the Forest Service has moved the bar above status quo (pre-monument) management. While the agency has taken great strides in improving upon pre-monument management, there is considerable room for further improvement through more-strict adherence to the proclamation and in addressing incompatible uses from an extensive roads network, fuel treatments, livestock grazing, and climate change.

For the Giant Sequoia National Monument to rightfully take its place among other crown jewels in the Sierra Nevada region (Yosemite, Kings – Sequoia national parks), the Forest Service will need to more effectively demonstrate that it is truly up to the task of the monument's protection and restoration mandates, particularly through coordination with the Park Service on relevant management activities. To better meet the intent of the proclamation, four issue-specific recommendations are provided in response to incompatible management proposed by the Forest Service for roads, livestock, fuel treatments, and climate change preparation:

1. Conduct Road-Specific and Cumulative Effects Analysis of Roads on the Objects of Interest:

- Analyze impacts of the road prism on hydrological features (including subsurface flows) important to giant sequoia and obliterate roads that jeopardize hydrological continuity essential to grove sustainability.
- Complete a monument-specific TAP following Forest Service directives and recommendations provided by The Wildlife Society and Wildlands CPR.
- Reduce road densities in the monument based on the minimum necessary road network needed to better balance the monument's access vs. protection mandates.
- Evaluate and prioritize a range of road closure methods (seasonal closures, decommissioning), including costs and benefits to the objects of interest.

2. Perform More Detailed Analysis of Impacts of Fuel Treatments on Objects of Interest:

- Provide more sophisticated fuel models that make use of decision-support tools and the tradeoffs in fire risk reduction vs. habitat loss to each object of interest.
- Re-examine smaller diameter tree removal alternatives and narrower buffer widths for the WUI based on best science provided by Martinson and Omi (2003), defensible space management standards for home ignitability (Cohen 2000), and new guidance for location of structures and their surroundings (FEMA 2008, Syphard et al. 2012 – this particular recommendation is important as studies have shown fuel treatments

immediately surrounding structures are the most effective means for preparing homes for eventual fires – the Forest Service should place more emphasis on helping communities become fire-wise than treating wide WUI buffers as this is not the most cost effective use of limited resources for lowering fire risks to nearby structures).

- Use comparable ecosystem types from surrounding protected lands (Wilderness, Parks) as a contemporary baseline for restoring degraded areas to a standard of higher ecological integrity for the monument.
- Emphasize prescribed fire and prescribed wildlands fire to create early seral conditions and canopy gaps for sequoia regeneration over mechanical fuel treatments (see Stephenson 2003) and protect burned sites from post-fire logging to provide biological legacies for regenerating and structurally complex early seral communities.
- Conduct cumulative effects analysis of contribution of roads on human-caused fire ignitions and fire behavior.

3. Tighten Restrictions on Livestock Grazing to Reduce Impacts to Objects of Interest:

- Conduct comprehensive and cumulative impact analysis of grazing on objects of interest.
- Prioritize meadows (especially those with native plants and poor soil drainage) and other sensitive areas for grazing prohibitions.
- Create large exclosures in sensitive upland, wetland, seeps, riparian areas and other sensitive plant communities to protect objects from grazing.

- Restore floodplain resiliency to climate-change related flooding through livestock prohibitions (fencing, no grazing buffers) and recontouring of the stream channel morphology.

4. Prepare Objects of Interest for Climate Change through specific adaptation and mitigation measures:

- Conduct cumulative impact analysis of livestock grazing, roads, and fuel treatments in relation to projected climate changes (see Beschta et al. 2012).
- Implement specific strategies for reducing land-use stressors (roads, fuel treatments, livestock grazing) on objects of interest to increase resistance and resilience to climate change.
- Identify specific landscape features (enduring features) and microclimatic conditions (e.g., topo-edaphic gradients, north-facing old forests, valley bottomlands, shaded riparian areas) that can be protected as climate refugia for objects of interest.
- Identify corridors for facilitating climate-forced wildlife migrations into areas with potential suitable microclimatic conditions.
- Provide inventories of carbon sequestration and long-term carbon storage potential of monument ecosystems and carbon life cycle analysis from management activities related to fuel treatments, grazing, and the monument's transportation system pursuant to relevant Forest Service policies (Executive Order 13514, Forest Service scorecard, Forest Service Strategic Plan 2010-15, Forest Service Climate Science Plan, National

Forest Planning Rule 2012) and develop specific mitigation strategies for lowering carbon losses.

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9.0 Authors Qualifications

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