February 12, 2018

Objection Reviewing Officer
USDA Forest Service Northern Region
26 Fort Missoula Road
Missoula, MT 59804

***Sent via email to:*** **appeals-northern-regional-office@fs.fed.us**

On behalf of the Alliance for the Wild Rockies, Montana Ecosystems Defense Council, and Friends of the Wild Swan this is an Objection to the Flathead National Forest Land and Resource Management Plan (hereinafter, "Forest Plan") and its accompanying draft Record of Decision (draft ROD) and Final Environmental Impact Statement (FEIS). The Responsible Official is Chip Weber, Supervisor, Flathead National Forest (FNF).

This is also our Objection to the draft Record of Decision for the Amendments to the Forest Plans of the Lolo, Kootenai, and Helena-Lewis and Clark national forests concerning habitat management direction for the Northern Continental Divide Ecosystem grizzly bear population (hereinafter, "Grizzly Amendments"), which relies upon the aforementioned FEIS. The Responsible Officials are Christopher Savage (Supervisor, Kootenai NF), William Avey (Supervisor, Helena-Lewis and Clark NF), and Timothy Garcia (Supervisor, Lolo NF).

This is also our Objection to the Flathead National Forest Species of Conservation Concern determination and list. The Responsible Official is Regional Forester Leanne Marten.

The Alliance for the Wild Rockies (AWR), headquartered in Helena, Montana is a non-profit member-based alliance of citizens and organizations working to secure the ecological integrity of the Northern Rockies bioregion. AWR has been actively participating in public land management in Washington, Oregon, Montana, Idaho, and Wyoming for over 25 years. Montana Ecosystems Defense Council (MEDC) is a non-profit grassroots organization headquartered in Kalispell, Montana. MEDC was established in 1990 to protect and restore biological diversity, water quality and ecosystem integrity in the Northern Rockies region. Friends of the Wild Swan (FOWS) is a non-profit environmental organization that works to protect and restore fish and wildlife habitat on public lands. Adoption of the Flathead Forest Plan, Grizzly Amendments, and the Flathead National Forest Species of Conservation Concern would directly and significantly harm MEDC, AWR, FOWS and our members. MEDC, AWR, FOWS and our members stand to be directly and significantly affected by the actions authorized under the Flathead Forest Plan, Grizzly Amendments and their ROD, and implementation of the Flathead National Forest's Species of Conservation Concern. Such actions would adversely impact and harm the natural qualities of these four national forests, and would further degrade the watersheds and wildlife habitat. Individuals and members use the four national forests for quiet recreation, enjoyment of the natural world, and other forest related activities.

Selection of Forest Plan Alternative B-modified, the Grizzly Amendments Alternative 2-modified, or the Flathead NF list of Species of Conservation Concern would not be in accordance with the legal requirements of the National Environmental Policy Act (NEPA), 42 U.S.C. 4321 et seq., and its implementing regulations, the National Forest Management Act (NFMA) 16 U.S.C. 1600 et seq., and its implementing regulations, the Administrative Procedures Act, 5 U.S.C. Sec. 706, and its implementing regulations, the Multiple-Use Sustained Yield Act and its implementing regulations, the Forest and Rangeland Renewable Resources Planning Act of 1974 and its implementing regulations, the Clean Water Act, and its implementing regulations, state water quality regulations, and the Endangered Species Act (ESA) and its implementing regulations.

Within this objection, we incorporate, with permission, the objections to the Flathead Forest Plan and Grizzly Amendments by Swan View Coalition (SVC), Friends of the Wild Swan (FOWS), and Brian Peck found at:
http://www.swanview.org/reports/Brian_Peck_Forest_Plan_Objection.pdf
http://www.swanview.org/reports/FOWS_Forest_Plan_Objection.pdf
http://www.swanview.org/reports/SVC_Forest_Plan_Objection.pdf

We incorporate all of our previous comments and other communications concerning the Flathead Forest Plan and Grizzly Amendments within this Objection.

The SVC DEIS comment letters (which AWR's DEIS comments incorporated by permission) are located at: http://www.swanview.org/articles/whats-new/svcs_comments_on_draft_flathead_forest_plan/230

## INTRODUCTION

The set of Forest Service (FS) actions to which we object is a prime example of the agency lifting the lofty goals and nice-sounding words and ideas found in the 2012 Planning Rule and writing them into documents that mention those goals, words, and ideas but don't adopt any mechanism that actually implements them. With the Flathead Forest Plan and Grizzly Amendments, politics and bureaucratic priorities prevail and the interests of the public, wildlife and all other natural qualities are locked out. We wholeheartedly agree with the Swan View Coalition objection statement:

> Alternative B-modified will leave our children with an unaffordable bloated road network that cannot be adequately maintained, continues to spread noxious weeds throughout the Forest, continues to displace wildlife from essential habitats, and continues to degrade water quality and aquatic habitats through its disruption of watershed function. Its overemphasis on "active management" will fleece taxpayers to line the pockets of Forest Service employees and the timber industry through make-work projects that cause great harm to the environment and the public's ability to enjoy it.

**GRIZZLY BEAR**

We raised issues pertinent to the threatened grizzly bear in previous comments. (E.g., pp. 50, 58, and 59 of AWR 9/30/2016 draft Forest Plan/DEIS comments; p. 12 of AWR September 7, 2006 comments; incorporated SVC September 7, 2016 comments at pp. 1-2; incorporated SVC September 8, 2016 comments in their entirety; incorporated SVC September 12, 2016 comments in their entirety.)

The FS is fully aware that the USFWS is on a fast track to de-listing the Northern Continental Divide Ecosystem (NCDE) grizzly bear subpopulation from Endangered Species Act (ESA) protections. The draft Conservation Strategy was initiated to address potential delisting.

Delisting the grizzly bear invokes huge risks, yet the Flathead Forest Plan and Grizzly Amendments fall far short of being robust, scientifically sound mechanisms for assuring the NCDE and other U.S. subpopulations of grizzly bears won't take a sharp downward turn following delisting.

The 2012 Planning Rule defines Species of Conservation Concern (SCC) as: "a species of conservation concern is a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area." Although it is now listed under the ESA, under the proposed de-listing the grizzly would doubtlessly meet the SCC criteria for which "the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area." It is clear under the 2012 Planning Rule that the Regional Forester (RF) is free to arbitrarily refuse to add the grizzly bear to the SCC list. And given the RF only proposes to recognize the black swift and Clark's nutcracker as Forest Plan SCC—ignoring species such as the wolverine and fisher which truly meet SCC criteria—there's no guarantee the RF will add the grizzly bear to the list of Flathead NF SCC.

In sum, the Flathead Forest Plan has no scientifically defensible plan to protect grizzly bears. Forest Plan and Grizzly Amendment Elements are far too discretionary, vague, and ridden with loopholes. The Flathead Forest Plan itself would be far weaker than current Forest Plan/Amendment 19 protections, as explained in much detail in the SVC objection we incorporate.

Reducing roads and their impacts would benefit not only grizzly bears, but most other natural aspects of the ecosystem, as the Access Amendments[1] Draft SEIS states:

- Alternative D Modified would convert the most roads and consequently would provide the highest degree of habitat security and a lower mortality risk to the **Canada lynx**. (P. 70.)

[1] Not selected, but Alternative D would have restricted road densities the most and protected the most Core of all alternatives analyzed. (Amended forest plans for the Kootenai, Idaho Panhandle, and Lolo National Forests concerning Selkirk and Cabinet-Yaak Ecosystems Grizzly Bear subpopulation.)

- Alternative D Modified would provide a higher degree of habitat security (for **gray wolves**) than Alternative E Updated… (P. 74.)
- Alternative D Modified … could contribute to a cumulative increase in habitat security for **black-backed woodpeckers** (and **pileated woodpeckers**) because timber sales or other ground disturbing or vegetation management activities would be less likely to occur in Core Areas. Newly dead trees that support wood boring beetle populations would be less likely to be removed during vegetation management activities or by woodcutters. Alternative D Modified could provide slightly more secure habitat than Alternative E Updated. (P. 84, 112.)
- Alternative D Modified … could contribute to a cumulative increase in habitat security because timber sales or other ground disturbing or vegetation management activities would be less likely to occur in Core Areas. Snags would be less likely to be removed during vegetation management activities or by woodcutters. Alternative D Modified could provide slightly more secure habitat (for **Townsend's big-eared bats, flammulated owls, fringed myotis bats**) than Alternative E Updated. (Pp. 85, 86, 95.)
- Alternative D Modified and Alternative E Updated provide different levels of habitat security (for **peregrine falcon, fisher, wolverine**) based on the relative amount of wheeled motorized vehicle access. (Pp. 87, 89, 91.)
- Alternative D Modified, which closes the most miles of road in suitable habitat, would be the preferred alternative for the western toad. (P. 101.)
- Alternative D Modified closes the most miles of road in suitable habitat and would provide the greatest benefits for the **goshawk**. (P. 103.)
- Alternative D Modified, which closes the most miles of road in suitable habitat, would be the best Alternative for **elk**. (P. 104.)
- Alternative E Updated would provide some security and reduced vulnerability (for **moose**), but not as much as Alternative D Modified. (P. 104.)
- Although Alternative D Modified and Alternative E Updated would benefit **mountain goats**, Alternative D Modified would improve security and reduce the risk of displacement more than Alternative E Updated. (P. 109.)
- Alternative D Modified would improve security (for **pine marten**) more than Alternative E Updated. (P. 110.)

This demonstrates how habitat protections for the grizzly bear can act to conserve habitat for other species. The original (1986) Flathead Forest Plan (including Amendment 19) was not a perfect conservation strategy for the grizzly bear. However the FS's intent to significantly weaken protections for grizzly bears it in the context of possible USFWS delisting reveals the FS's overall callousness towards wildlife on this national forest.

## CANADA LYNX

We raised issues pertinent to the threatened Canada lynx in previous comments. (E.g., FOWS et al. March 2014 Citizen reVision pp. 2, 24-26; AWR September 30, 2016 comments pp. 16, 50-56; FOWS September 29, 2016 comments pp. 7-8, 23-24.)

The Forest Plan essentially adopts a previous forest plan amendment, the Northern Rockies Lynx Management Direction (NRLMD). AWR participated during the public process as NRLMD was developed, and continues to believe the NRLMD (and as adopted into the Forest Plan) does not consider the best available science nor assure viability of Canada lynx populations. (See folder entitled "NRLMD Participation".)

A major problem with the Forest Plan is that it allows with few limitations the same level of industrial forest management activities in lynx habitat that occurred prior to Canada lynx ESA listing.

Lynx winter habitat, provided only in older, multi-storied forests, is critical for lynx preservation. (Squires et al. 2010.) Winter is the most constraining season for lynx in terms of resource use; starvation mortality has been found to be the most common during winter and early spring. (Squires et al. 2010.) Prey availability for lynx is highest in the summer. (Squires et al. 2013.)

The current best science indicates that lynx winter foraging habitat is critical to lynx persistence (Squires et al. 2010), and that this habitat should be "abundant and well-distributed across lynx habitat." (Squires et al. 2010; Squires 2009.) Those authors also noted that in heavily managed landscapes, retention and recruitment of lynx habitat should be a priority. Existing openings such as clearcuts not yet recovered are likely to be avoided by lynx in the winter. (Squires et al. 2010; Squires et al. 2006a.) Squires et al. 2010 show that the average width of openings crossed by lynx in the winter was 383 feet, while the maximum width of crossed openings was 1240 feet.

During dozens of timber sale analyses over the range of forests covered by the NRLMD including the Flathead NF, the FS stated that upon field review stands initially mapped (using its databases) as lynx multistory habitat were described to be not in a structural condition that provides snowshoe hare foraging habitat (i.e., stem exclusion), and logging—usually clearcutting—was proposed in those stands. Since it turns out there's less lynx suitable habitat than the NRLMD previously assumed, the FS and USFWS need to step back and consider that range-wide Canada lynx suitable habitat was overestimated.

Squires et al. (2013) noted that long-term population recovery of lynx, as well as other species as the grizzly bear, require maintenance of short and long-distance connectivity. The Forest Plan does not include robust, scientifically-based direction to protect connectivity between Lynx Analysis Units.

Squires et al. (2013) noted in their research report that some lynx avoided crossing highways; in their own report, they noted that only 12 of 44 radio-tagged lynx with home ranges including 2-lane highways crossed them.

Kosterman, 2014 finds that 50% of lynx habitat must be mature undisturbed forest for it to be optimal lynx habitat where lynx can have reproductive success and no more than 15% of lynx habitat should be young clearcuts, i.e. trees under 4 inched dbh. This renders inadequate the agency's assumption in the NRLMD that 30% of lynx habitat can be clearcut, and that no specific amount of mature forest needs to be conserved. Kosterman, 2014 demonstrates that the NRLMD standards are not adequate for lynx viability and recovery, as is assumed by the FS.

The Forest Plan and associated ESA provisions for Canada lynx do not assure that Canada lynx and their habitats will be protected on the Flathead NF. The FS and USFWS have not utilized best available science to assure habitat protections and population recovery.

## CONSISTENCY WITH NFMA AND PLANNING REGULATION REQUIREMENTS

We raised these issues in previous comments. (E.g., MEDC et al. September 21, 2016 comments p. 2; incorporated SVC August 24, 2006 comments pp. 3, 13; AWR et al. September 7, 2006 comments p. 2-4, 5; April 2004 Citizen reVision at p. 2-5.)

The pervasive lack of connection between the FEIS and the Planning Rule is quite remarkable. There is a disturbing overall lack of substance in to protect, maintain, and restore the values expressed in the 2012 Planning Rule.

We use "ecological sustainability" as an example. The Forest Plan states:

> The forest plan provides an integrated set of management direction (or plan components) that provide for the social, economic, and **ecological sustainability** and multiple uses of the Forest's lands and resources. (Emphasis added.)

The 2012 Planning Rule includes a section at 36 CFR § 219.8 entitled "Sustainability" under which it states, "The plan must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area…". Logic and science is clear: without ecological sustainability, the dependent social and economic systems cannot sustained. Ecological sustainability is a prerequisite for social and economic sustainability.

Under Ecological Sustainability, the planning rule states:

> *Ecosystem Integrity.* The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account …(s)ystem drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of terrestrial and aquatic ecosystems on the plan area to adapt to change.

Unfortunately, the Forest Plan doesn't recognize the importance of many of these ecosystem integrity indicators, and so there are no plan components that specifically address many of them, or at best there are weak, discretionary, nonbinding and unenforceable Elements. The Forest Plan falls far short of implementing sustainability as the 2012 Planning Rule requires.

The Forest Plan offers up "coarse-filter plan components …designed to maintain or restore ecological conditions for ecosystem integrity and ecosystem diversity in the plan area." These "Coarse-filter plan components" are primarily Elements involving "Terrestrial Ecosystems and Vegetation." The FS would have one believe that managing vegetation "towards" (not even necessarily achieving) those plan components is pretty much all that's necessary for maintaining ecosystem integrity and furthermore, for meeting diversity requirements under NFMA. However the natural range of variability upon which Forest Plan components are based is not based upon best available science because the data is insufficient for defining Flathead NF reference conditions and natural range of variability. Furthermore, the effects of climate change completely invalidate what the FS plans to "move towards."

The FS lacks scientific basis for relying so heavily upon its very limited data sources for designing something as vital as Forest Plan components to maintain ecological sustainability. Reliability of the limited data set is not properly established.

Yet, the Forest Plan prescribes aggressive mechanical treatments, mostly logging but also other vegetative manipulations such as mechanical thinning and prescribed burning, to manipulate vegetation, without adequate scientific basis demonstrating the treatments would actually mimic even the retro-facing reference conditions. The FS does not use any scientifically-validated or peer reviewed metrics to describe the complex landscape patterns created predominantly by a natural process which so dominated in creating those reference conditions—wildland fire.

Therefore the FS cannot make any assurances that its management actions result in habitat conditions for wildlife that actually insure or contribute to population viability for native fish, plants, and wildlife, and which would adequately compensate for the unavoidable adverse ecological side-effects of the aggressive vegetation manipulation regime. These side effects are caused by human-caused factors (management) which are well outside the historic or natural range of variability. The FEIS simply does not view ecological damage through the same lens as it does for vegetative conditions. Here is a simple list of factors directly influencing biological diversity under the FS's management regime, and their HRVs:

| FACTOR | HRV |
|---|---|
| Road density | zero |
| Noxious weed occurrence | zero |
| Miles of long-term stream channel degradation ("press" disturbance) | zero |
| Culverts | zero |
| Human-induced detrimental soil conditions | <1% |
| Maximum daily decibel level of motorized devices | zero |
| Acres of significantly below HRV snag levels for many decades | zero |
| Roadless extent | 100% |
| Extent of veg. communities affected by exotic grazers (livestock) | zero |

Frissell and Bayles, 1996 reinforce our skepticism about the heavy emphasis on vegetative reference or historical conditions:

> From the point of view of many aquatic species, the range of natural variability at any one site would doubtless include local extirpation. At the scale of a large river basin, management could remain well within such natural extremes and we would still face severe degradation of natural resource and possible extinction of species (Rhodes et al., 1994). The missing element in this concept is the landscape-scale *pattern* of occurrence of extreme conditions, and patterns over space and time of recovery from such stressed states.

> How long did ecosystems spend in extreme states vs. intermediate or mean states? Were extremes chronologically correlated among adjacent basins, or did asynchrony of landscape disturbances provide for large-scale refugia for persistence and recolonization of native species? These are critical questions that are not well addressed under the concept of range of natural variability as it has been framed to date by managers.
>
> …The concept of range of natural variability also suffers from its failure to provide defensible criteria about **which factors ranges should be measured**. Proponents of the concept assume that a finite set of variables can be used to define the range of ecosystem behaviors, when ecological science strongly indicates many diverse factors can control and limit biota and natural resource productivity, often in complex, interacting, surprising, and species-specific and time-variant ways. **Any simple index for measuring the range of variation will likely exclude some physical and biotic dimensions important for the maintenance of ecological integrity and native species diversity.** (Emphases added.)

Hayward, 1994 states:

> Despite increased interest in historical ecology, scientific understanding of the historic abundance and distribution of montane conifer forests in the western United States is not sufficient to indicate how current patterns compare to the past. In particular, knowledge of patterns in distribution and abundance of older age classes of these forests in not available. …Current efforts to put management impacts into a historic context seem to focus almost exclusively on what amounts to a snapshot of vegetation history—a documentation of forest conditions near the time when European settlers first began to impact forest structure. …The value of the historic information lies in the perspective it can provide on the potential variation… I do not believe that historical ecology, emphasizing static conditions in recent times, say 100 years ago, will provide the complete picture needed to place present conditions in a proper historic context. Conditions immediately prior to industrial development may have been extraordinary compared to the past 1,000 years or more. Using forest conditions in the 1800s as a baseline, then, could provide a false impression if the baseline is considered a goal to strove toward.

Going hand-in-hand with this myopic focus and reliance on Vegetative forest plan components is the agency's use of the concepts "resilience" and resistance." FEIS Glossary defines "resilience" as "the capacity of an organism, community, or ecosystem to maintain or regain normal function and development following one or more disturbances" and "resistance" as "the ability of an organism, population, community, or ecosystem to remain unchanged by withstanding perturbations (such as fire or drought) without significant loss of structure or function**.**" However, the FS provides absolutely nothing that would allow anybody to actually <u>measure</u> the resilience or resistance of the ecosystem as they stand now, or measure the changes following management actions. An essential component of an operational definition is <u>measurement</u>. A simple and accurate definition of measurement is the <u>assignment of numbers to a variable</u> in which one are interested. In this case, that variables are resilience and resistance, and how the agency measures it in the ecosystem.

For now, the only way the FS has to measure changes in resilience or resistance would be, using circular reasoning, the acres treated using their theoretical approach. (Although the Forest Plan doesn't even propose monitoring resistance or resilience in its Chapter 5 Monitoring Program.)

The Forest Plan FEIS states: "(The SIMPPLLE) model was used in the forest plan revision for two purposes: to calculate the natural range of variation for vegetation conditions and to project the vegetation conditions of the alternatives across the Forest into the future for analysis in the environmental impact statement." The FEIS discloses how tenuous the Vegetation coarse filter approach is:

> The Spectrum and SIMPPLLE models are best used to provide information of comparative value; these models are not intended to be predictive or to produce precise values for vegetation conditions. Out of necessity, the models simplify very complex and dynamic relationships between ecosystem processes and disturbances (such as climate, fire, and succession) and vegetation over time and space. Though best available information, including corroboration with actual data, professional experience, and knowledge, is used to build these models, there is a high degree of variability and an element of uncertainty associated with the results because of the ecological complexity and the inability to accurately predict the timing and/or location of future events.

Despite the admitted limitations and recommendations against using the model to be predictive or set precise values for vegetation conditions, as seen in the Forest Plan and FEIS the FS went ahead and did it anyway: "(The SIMPPLLE) model was used in the forest plan revision for two purposes: to calculate the natural range of variation for vegetation conditions and to project the vegetation conditions of the alternatives across the Forest into the future for analysis in the environmental impact statement."

Regarding such models in consideration of best available science, Beck and Suring, 2011 state:

> Developers of frameworks have consistently attained scientific credibility through published manuscripts describing the development or applications of models developed within their frameworks, but a major weakness for many frameworks continues to be a lack of validation. **Model validation is critical so that models developed within any framework can be used with confidence.** Therefore, we recommend that models be **validated through independent field study** or by reserving some data used in model development. (Emphases added.)

Larson et al. 2011 state some requirements for judging the validity of modeling for predicting wildlife habitat:

> A basic objective of most habitat models is to predict some aspect of a wildlife population (e.g., presence, density, survival), so assessing predictive ability is a critical component of model validation. **This requires wildlife-use data that are independent of those from which the model was developed.** ...It is informative not only to evaluate model predictions with new observations from the original study site but also to evaluate predictions in new geographic areas. (Emphasis added.)

The FEIS does not give any indication that models they rely upon have been validated scientifically.

Doubtlessly, the FS will take the Forest Plan numbers for Desired Conditions for vegetation as drivers for timber sales and will call the logging "restoration" because some existing values for forest stands will fall outside these numbers. In this perverse archery, the number will be used as targets, the arrows will be timber sales. However, the recipients of the arrows will be the fragile fish and wildlife populations, and the public which will subsidize the logging and will have to foot the bill for fixing the inevitable unintended consequences, such as increased greenhouse gas emissions, more endangered species, etc.

The FEIS provides inadequate scientific basis for demonstrating the coarse filter approach using vegetative plan direction would "provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area" as required by the planning rule.

Other Forest Plan components written to address 2012 Planning Rule requirements fail similarly. As we state in our Introduction, the FS has merely lifted the lofty goals and nice-sounding words and ideas found in the 2012 Planning Rule and wrote them into a Forest Plan that mentions those goals, words, and ideas but doesn't adopt any mechanism that actually implements them. We offer the above discussion on ecological integrity as exemplary of the Forest Plan's failures to be responsive to the planning rule instead of showing what is missing from the Forest Plan, point-by-point from the planning rule.

**WILDERNESS AND ROADLESS AREAS**

We raised these issues in previous comments. (E.g., AWR September 7, 2006 comments pp. 15-16; incorporated SVC September 7, 2016 comments at pp. 1-2; incorporated SVC September 13, 2016 comments pp. 9, 15, 20, 25; incorporated SVC September 19, 2016 comments pp. 4, 6; FOWS et al. March 2014 Citizen reVision pp. 1, 3-5, 6-9, 18; AWR September 30, 2016 comments pp. 58; FOWS September 29, 2016 comments p. 5; April 2004 Citizen reVision at pp. 4-5, 10, 13, 20-21; FOWS August 25, 2006 comments pp. 7, 9.)

***"In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness."***

—The Wilderness Act of 1964

The process that the FS used to evaluate roadless lands for potential wilderness recommendation is of concern. The criteria were not used properly. The overwhelming public sentiment expressed in public comments on the National Roadless Rule was to maintain the wild character of these areas. There is no rational reason to manage any of the Roadless Areas in any manner that would reduce their Wilderness character and therefore diminish the chances that Congress would designate them under the Wilderness Act.

The FS fails to consider the wide body of research revealing that counties adjacent to Wilderness areas and National Parks show better economic sustainability than counties heavily reliant upon resource extraction.

## SCIENTIFIC INTEGRITY: BEST AVAILABLE SCIENCE, DATA RELIABILITY, AND MODELING VALIDITY

We raised these issues in previous comments. (E.g., AWR September 7, 2006 comments p. 5; AWR's September 30, 2016 comments pp. 1, 61-64, 71-72, 87; MEDC's September 21, 2016 comments pp. 2-3, 6.) And along with the points made on these issues made in the other Objections we've incorporated, we make the following additional points.

The FS failed to conduct a Science Consistency Review for the draft or final Forest Plan, or for the DEIS's and FEIS's analyses. The process of "Science Consistency Review" was designed by Forest Service scientists (Guldin et al. 2003, and Guldin et al. 2003b.) Guldin et al. 2003:

> ...outlines a process called the science consistency review, which can be used to evaluate the use of scientific information in land management decisions. Developed with specific reference to land management decisions in the U.S. Department of Agriculture Forest Service, the process involves assembling a team of reviewers under a review administrator to constructively criticize draft analysis and decision documents. Reviews are then forwarded to the responsible official, whose team of technical experts may revise the draft documents in response to reviewer concerns. The process is designed to proceed iteratively until reviewers are satisfied that key elements are **consistent with available scientific information.** (Emphasis added.)

In other words, the FS can <u>cite</u> all the "best available science" it wants in preparing a forest plan or amendment, but it's another matter entirely whether or not such proposals are <u>consistent with</u> the cited science. Guldin et al., 2003 suggest the review ask and answer the following four questions:

1. Has applicable and available scientific information been considered?
2. Is the scientific information interpreted reasonably and accurately?
3. Are the uncertainties associated with the scientific information acknowledged and documented?
4. Have the relevant management consequences, including risks and uncertainties, been identified and documented?

Similarly, independent scientific review team Hayes, et al., 2011 conducted a "Science Review of the United States Forest Service Draft Environmental Impact Statement for National Forest System Land Management." The reviewers considered the following three questions:

1. Does the information accurately reflect the current peer-reviewed scientific literature and understanding? If not, what is missing or incorrectly presented?
2. Based on the current peer-reviewed scientific literature and understanding: does the documentation on environmental effects adequately respond to levels of uncertainty and

> limitations? If not, please describe what is missing or incorrect, and how the documentation can be improved.
> 3. What, if any, differing viewpoints should be included that are not mentioned in the DEIS regarding the effects of alternatives on climate change, restoration and resilience, watershed and water protection, diversity of plants and animal communities, sustainable use of public lands to support vibrant communities, forest threats, and monitoring.

Nie and Schembra, 2014 recommend that the agency solicit independent feedback on it use of science:

> The 1997 (Tongass National Forest) Plan was written using an innovative process whereby scientists within the Pacific Northwest Research Station (an independent research arm of the USFS) were assembled into risk assessment panels "to assist decisionmakers in interpreting and understanding the available technical information and to predict levels of risk for wildlife and fish, old growth ecosystems, and local socioeconomic conditions resulting from different management approaches."172 In this case, "science consistency checks" were used as a type of audit to ensure that the policy and management branch writing the Tongass Plan could not misrepresent or selectively use information in ways not supported by the best available science. The process, at the very least, facilitated the consideration of best available science when writing the Tongass Plan, even if parts of the Tongass Plan were based on factors going beyond science.

Also, in response to an appeal of its 1997 forest plan revision, the Black Hills National Forest was directed by the FS Washington Office to re-evaluate their Revised Forest Plan for its ability to meet diversity and viability requirements set in existing laws, and correct any deficiencies. FS biologists "interviewed accredited scientific experts to obtain information on Region 2 sensitive species for use during the Phase I Amendment" in order to remedy deficiencies in their revised forest plan. (USDA Forest Service 2000b.) Similarly, the Boise National Forest consulted with an independent scientist to review portions of their "Wildlife Conservation Strategy" proposed to amend their revised forest plan. And a Science Consistency Review was undertaken by the FS in the process of designing the Sierra Nevada Forest Plan Amendments.

Schultz (2010) provides a critique of FS wildlife analyses, and recommends peer review of large-scale assessments and project level management guidelines, and more robust, scientifically sound monitoring, and measurable objectives and thresholds for maintaining viable populations of all native and desirable non-native wildlife species.

Given the highly controversial nature of the Flathead Forest Plan and Grizzly Amendments, it is inexcusable and unreasonable that the FS has not undertaken a Science Consistency Review process.

A scientist from the FS's Rocky Mountain Research station, Ruggiero, 2007 stated, "Independence and objectivity are key ingredients of scientific credibility, especially in research organizations that are part of a natural resource management agency like the Forest Service. Credibility, in turn, is essential to the utility of scientific information in socio-political processes." So FS itself recognizes there is a fundamental need to demonstrate the proper use of scientific information, in order to overcome issues of decisionmaking integrity that arise from bureaucratic rigidity and political pressure.

Sullivan et al., 2006 also discuss the dangers of the "Politicization of Science":

> Many nonscientists and scientists believe that science is being increasingly politicized. Articles in newspapers (e.g., Broad and Glanz 2003) and professional newsletters document frequent instances in which the process and products of science are interfered with for political or ideological reasons. In these cases, the soundness of science, as judged by those interfering, turns on the extent to which the evidence supports a particular policy stance or goal. ...Politicization is especially problematic for scientists supervised by administrators who may not feel the need to follow the same rules of scientific rigor and transparency that are required of their scientists.

Ruggiero, 2007 points out that the FS's scientific research branch <u>is distinct</u> from its management branch:

> The Forest Service is comprised of three major branches: the National Forest System (managers and policy makers for National Forests and National Grasslands), Research and Development (scientists chartered to address issues in natural resource management for numerous information users, including the public), and State and Private Forestry (responsible for providing assistance to private and state landowners). This article is directed toward the first two branches.
>
> The relationship between the National Forest System and the Forest Service Research and Development (Research) branches is somewhat hampered by confusion over the respective roles of scientists (researchers) and managers (policy makers and those that implement management policy). For example, some managers believe that scientists can enhance a given policy position or management action by advocating for it. This neglects the importance of scientific credibility and the difference between advocating for one's research versus advocating for or against a given policy. Similarly, some scientists believe the best way to increase funding for research is to support management policies or actions. But, as a very astute forest supervisor once told me, "Everyone has a hired gun…they are not credible…and we need you guys [Forest Service Research] to be credible."

The Forest Service Manual (FSM) provides direction on how to implement statutes and related regulations. FSM 4000 – Research and Development Chapter 4030 states: "To achieve its Research and Development (R&D) program objectives, the Forest Service shall ... maintain the R&D function as a **separate entity** … with clear accountability through a system that **maintains scientific freedom…**" (emphasis added).

Ruggiero, 2007 discusses the risk to scientific integrity if that separation is not maintained, that is, if politics overly influences the use of scientific research:

> This separation also serves to keep conducting science separate from formulating policy and the political ramifications of that process. The wisdom here is that science cannot be credible if it is politicized. Science should not be influenced by managers, and scientists should not establish policy. This logic keeps scientific research "independent" while ensuring that policy makers are free to consider factors other than scientific

> understandings. Thus, science simply informs decision making by land managers. As the new forest planning regulations clearly state, those responsible for land management decisions must consider the best available science and document how this science was applied (Federal Register 70(3), January 5, 2005; Section 219.11(4); p. 1059).

Darimont, et al., 2018 advocate for more transparency in the context of government conclusions about wildlife populations, stating:

> Increased scrutiny could pressure governments to present wildlife data and policies crafted by incorporating key components of science: transparent methods, reliable estimates (and their associated uncertainties), and intelligible decisions emerging from both of them. Minimally, **if it is accepted that governments may always draw on politics, new oversight by scientists would allow clearer demarcation between where the population data begin and end in policy formation** (Creel et al. 2016*b*; Mitchell et al. 2016). Undeniably, social dimensions of management (i.e., impacts on livelihoods and human–wildlife conflict) will remain important. (Emphasis added.)

In a news release accompanying the release of that paper, the lead author states:

> In a post-truth world, **qualified scientists are arm's length now have the opportunity and responsibility to scrutinize government wildlife policies and the data underlying them.** Such scrutiny could support transparent, adaptive, and ultimately trustworthy policy that could be generated and defended by governments. (Emphasis added.)

Roger Sedjo, member of the Committee of Scientists convened to advise the agency for the design of a new planning rule, expresses his concerns about the discrepancy between forest plans and Congressional allocations, imbalanced and unsustainably implemented forest plans:

> (A)s currently structured there are essentially two independent planning processes in operation for the management of the National Forest System: forest planning as called for in the legislation; and the Congressional budgeting process, which budgets on a project basis. The major problem is that there are essentially two independent planning processes occurring simultaneously: one involving the creation of individual forest plans and a second that involves congressionally authorized appropriations for the Forest Service. Congressional funding for the Forest Service is on the basis of programs, rather than plans, which bear little or no relation to the forest plans generated by the planning process. There is little evidence that forest plans have been seriously considered in recent years when the budget is being formulated. Also, the total budget appropriated by the Congress is typically less than what is required to finance forest plans. Furthermore, the Forest Service is limited in its ability to reallocate funds within the budget to activities not specifically designated. **Thus, the budget process commonly provides fewer resources than anticipated by the forest plan and often also negates the "balance" across activities that have carefully been crafted into forest plans. Balance is a requisite part of any meaningful plan.** Finally, as noted by the GAO Report (1997), fundamental problems abound in the implementation of the planning process as an effective decision making instrument. **Plans without corresponding budgets cannot be implemented. Thus forest plans are poorly and weakly implemented at best**. Major reforms need to be implemented to coordinate and unify the budget process.

(Committee of Scientists, 1999 Appendix A, emphases added) The problems Sedjo identifies as being attributable to not funding all aspects of forest planning and implementation—including monitoring—persist to this day and are evident in the Flathead Forest Plan and its planning process.

Sullivan et al. 2006 state that "Peer-reviewed literature ...is considered the most reliable mainly because it has undergone peer review." They explain:

> *Peer review*.—A basic precept of science is that it must be verifiable, and this is what separates science from other methods of understanding and interpreting nature. The most direct method of verification is to redo the study or experiment and get the same results and interpretations, thus validating the findings. Direct verification is not always possible for nonexperimental studies and is often quite expensive and time-consuming. Instead, scientists review the study as a community to assess its validity. This latter approach is the process of peer review, and it is necessary for evaluating and endorsing the products of science. **The rigor of the peer review is one way to assess the degree to which a scientific study is adequate for informing management decisions.**

Sullivan et al. 2006 contrast peer-reviewed literature with gray literature which:

> ...does not typically receive an independent peer review but which may be reviewed in-house, that is, within the author's own institution. ...Gray literature, such as some agency or academic technical reports ...commonly contains reports of survey, experimental or long-term historical data along with changes in protocols, meta-data, and the progress and findings of standard monitoring procedures.

Agency expert opinion and gray literature relied upon in this FEIS is not necessarily the same as "the best scientific information" available. Sullivan et al., 2006 discuss the concept of best available science in the context of politically influenced management:

> Often, scientific and political communities differ in their definition of best available science and opposing factions misrepresent the concept to support particular ideological positions. Ideally, each policy decision would include all the relevant facts and all parties would be fully aware of the consequences of a decision. But economic, social, and scientific limitations often force decisions to be based on limited scientific information, leaving policymaking open to uncertainty.
>
> The American Fisheries Society and the Estuarine Research Federation established this committee to consider what determines the best available science and how it might be used to formulate natural resource policies and shape management actions. The report examines how scientists and nonscientists perceive science, what factors affect the quality and use of science, and how changing technology influences the availability of science. Because the issues surrounding the definition of best available science surface when managers and policymakers interpret and use science, this report also will consider the interface between science and policy and explore what scientists, policymakers, and managers should consider when implementing science through decision making.
>
> As part of their implicit contract with society, environmental scientists are obliged to communicate their knowledge widely to facilitate informed decision making (Lubchenco

1998). For nonscientists to use that knowledge effectively and fairly, they must also understand the multifaceted scientific process that produces it.

Science is a dynamic process that adapts to the evolving philosophies of its practitioners and to the shifting demands of the society it serves. Unfortunately, these dynamics are often controversial for both the scientific community and the public. To see how such controversies affect science, note that over the last decade nonscientists have exerted increasing influence on how science is conducted and how it is applied to environmental policy. Many observers find this trend alarming, as evidenced by several expositions titled "science under siege" (e.g., Wilkinson 1998; Trachtman and Perrucci 2000).

To achieve high-quality science, scientists conduct their studies using what is known as the scientific process, which typically includes the following elements:

- A clear statement of objectives;
- A conceptual model, which is a framework for characterizing systems, stating assumptions, making predictions, and testing hypotheses;
- A good experimental design and a standardized method for collecting data;
- Statistical rigor and sound logic for analysis and interpretation;
- Clear documentation of methods, results, and conclusions; and
- Peer review.

The Committee of Scientists (1999) state:

> To ensure the development of scientifically credible conservation strategies, the Committee recommends a process that includes (1) **scientific involvement** in the selection of focal species, in the development of measures of species viability and ecological integrity, and in the definition of key elements of conservation strategies; (2**) independent scientific review of proposed conservation strategies before plans are published**; (3) **scientific involvement** in designing monitoring protocols and adaptive management; and (4) a **national scientific committee to advise the Chief of the Forest Service on scientific issues in assessment and planning**. (Emphases added.)

The FS has not disclosed the reliability of all the data used as input for the models used in planning process, or for design of Desired Conditions and other Forest Plan Elements. Since "an instrument's data must be reliable if they are valid" (Huck, 2000) this means the data must accurately measure that aspect of the world it is claimed to measure, or else the data are unreliable. Huck, 2000 states:

> The basic idea of reliability is summed up by the word consistency. Researchers can and do evaluate the reliability of their instruments from different perspectives, but the basic question that cuts across these various perspectives (and techniques) is always the same: "To what extent can we say the data are consistent?" …(T)he notion of consistency is at the heart of the matter in each case.
>
> …(R)eliability is conceptually and computationally connected to the data produced by the use of a measuring instrument, not to the measuring instrument as it sits on the shelf.

Beck and Suring, 2011 "remind practitioners that if available data are poor quality or fail to adequately describe variables critical to the habitat requirements of a species, then only poor quality outputs will result. Thus, obtaining quality input data is paramount in modeling activities."

The document, "USDA-Objectivity of Statistical and Financial Information" is instructional on the topic of data reliability.

Larson et al. 2011 state:

> Although the presence of sampling error in habitat attribute data gathered in the field is well known, the measurement error associated with remotely sensed data and other GIS databases may not be as widely appreciated.

During litigation of a timber sale on the Kootenai NF, the FS criticized a report provided by the plaintiffs, stating "(Its) purported 'statistical analysis' reports no confidence intervals, standard deviations or standard errors in association with its conclusions."

As Huck (2000) states, the issue of "standard deviations or standard errors" that the FS raised in the context of litigation relates to the reliability of the data, which in turn depends upon how well-trained the data-gatherers are with their measuring tools and measuring methodology. In other words, different observations of the same thing must result in numbers that are very similar to result in small "standard deviations or standard errors" and thus high reliability coefficients, which in turn provide the public and decisionmakers with an idea of how confident they can be in the conclusions drawn from the data.

The next level of scientific integrity is the notion of "validity." As Huck, (2000) explains, the degree of "content validity," or accuracy of the model or methodology is established by utilizing other experts. This, in turn, demonstrates the necessity for utilizing the peer review process as we discuss above.

The validity of the various models utilized in the FEIS's analyses have, by and large, not been established for how the FS utilizes them. No studies are cited which establishes their content validity, and no independent expert peer review process of the models has occurred.

Even if FS data input to a model is reliable, that still leaves open the question of the validity of analysis methodologies, including models. In other words, are they scientifically appropriate for the uses for which the FS is utilizing them? The Nez Perce-Clearwater NF's 2015 Clear Creek FEIS defines "Model" as "A theoretical projection in detail of a possible system of natural resource relationships. A simulation based on an empirical calculation to set potential or outputs of a proposed action or actions." (G-14.)

From www.thefreedictionary.com :

> Empirical – 1. a. Relying on or **derived from observation or experiment**: empirical results that supported the hypothesis. b. Verifiable or provable by means of observation or experiment: empirical laws. 2. Guided by practical experience and not theory, especially in medicine.

(Emphasis added.) So the FS acknowledges that the models are "theoretical" in nature and by calling the models "empirical" implies that they are somehow based in observation or experiment that support the hypotheses of the models. That would be required, because as Verbyla and Litaitis (1989) assert, "Any approach to ecological modelling has little merit if the predictions cannot be, or are not, assessed for their accuracy using independent data." This corresponds directly to the concept of "**validity**" as discussed by Huck, 2000: "(A) measuring instrument is valid to the extent that it measures what it purports to measure."

However, there is no evidence that the FS has performed validation of the models for the way they were used to support the FEIS's analyses. There is no documentation of someone using observation or experiment to support the models' inherent hypotheses. Ziemer and Lisle, 1993 state: "For any model or evaluation procedure, independent verification is essential. First, individual modules must be tested by comparing predicted and measured values under a variety of field conditions at differing sites. Then, functioning of the entire model must be evaluated under a wide array of field conditions. Finding an adequate model verification program is rare; however, finding unverified model predictions for important management and policy decisions is common."

The validity of habitat and other modeling utilized in land management plan development and the quality of scientific research are important topics. The documents, "USDA-Objectivity of Regulatory Information" and USDA-Objectivity of Scientific Research Information are instructional on this topic.

Larson et al. 2011 state:

> Habitat models are developed to satisfy a variety of objectives. ...A basic objective of most habitat models is to predict some aspect of a wildlife population (e.g., presence, density, survival), so assessing predictive ability is a critical component of model validation. **This requires wildlife-use data that are independent of those from which the model was developed.** ...It is informative not only to evaluate model predictions with new observations from the original study site but also to evaluate predictions in new geographic areas. (Internal citations omitted, emphasis added).

USDA Forest Service 1994b states "It is important to realize that all models greatly simplify complex processes and that the numbers generated by these models should be interpreted in light of field observations and professional judgement." (III-77.)

A 2000 Northern Region forest plan monitoring and evaluation report (USDA Forest Service, 2000c) provides an example of the FS itself acknowledging the problems of data that is old and incomplete, leading to the limitation of models the FS typically uses for wildlife analyses. In that case, the FS expert believed the data were unreliable and thus they properly questioned the validity of model use:

> Habitat modeling based on the timber stand database has its limitations: the data are, on average, 15 years old; canopy closure estimates are inaccurate; and data do not exist for the abundance or distribution of snags or down woody material… .

Another KNF project EIS (USDA Forest Service, 2007a) notes the limitations of modeling methodology the FS has relied upon for wildlife analyses:

> In 2005, the Regional Office produced a Conservation Assessment of the Northern goshawk, black-backed woodpecker, flammulated owl, and pileated woodpecker in the Northern Region (Samson 2005). This analysis also calculated the amount of habitat available for these species, but was based on forest inventory and analysis (FIA) data. FIA data is consistent across the Region and the state, but **it was not developed to address site-specific stand conditions for a project area.** In some cases, these two assessments vary widely in the amount of habitat present for a specific species. (P. 116.)

Beck and Suring, 2011 state:

> Developers of frameworks have consistently attained scientific credibility through published manuscripts describing the development or applications of models developed within their frameworks, but a major weakness for many frameworks continues to be a lack of validation. Model validation is critical so that models developed within any framework can be used with confidence. Therefore, we recommend that models be validated through independent field study or by reserving some data used in model development.

Larson et al. 2011 state:

> (T)he scale at which land management objectives are most relevant, often the landscape, is also the most relevant scale at which to evaluate model performance. Model validity, however, is currently limited by a lack of information about the spatial components of wildlife habitat (e.g., minimum patch size) and relationships between habitat quality and landscape indices (Li et al. 2000).

Beck and Suring, 2011 developed several criteria for rating modeling frameworks—that is, evaluating their validity. Three of their criteria are especially relevant to this discussion:

| | | |
|---|---|---|
| Habitat–population linkage | Does the modeling framework incorporate vital rates (e.g., production, survival), other demographic parameters (e.g., density, population size); surrogates (e.g., quality of home ranges, habitat conditions in critical reproductive habitats, presence/absence) of population demographic parameters; or does the modeling framework model habitat conditions without specific consideration of wildlife population parameters? | 0 = does not rely on population demographics or surrogates of modeled species<br>1 = relies on surrogates for population demographic parameters or framework; can utilize population demographics if desired, but is not dependent on them<br>2 = specifically relies on population demographics of modeled species |
| Scientific credibility | Has the framework gained credibility through publication of results, application of results, or other mechanisms to suggest acceptance by an array of professionals? | 0 = limited credibility<br>1 = at least 1 publication of results using this framework, or other application of the modeling framework |
| Output definition | Is the output well defined and will it translate to something that can be measured? | 1 = difficult<br>2 = moderate<br>3 = easy |

**TERRESTRIAL SPECIES DIVERSITY AND VIABILITY, TERRESTRIAL WILDLIFE HABITAT**

We raised these issues in previous comments. (E.g., AWR September 7, 2006 comments pp. 6, 7-10, 12-13; FOWS et al. March 2014 Citizen reVision pp. 1, 21-23, 26-32, 43-44; AWR September 30, 2016 comments pp. 1-2, 43-50, 56; FOWS September 29, 2016 comments p. 6-8, 9, 20-23; April 2004 Citizen reVision at pp. 5, 19-20, 22; FOWS August 25, 2006 comments pp. 1, 4-7, 8, 10-11.)

How logical and reasonable it would be to take at-risk species or species highly dependent upon components of the ecosystem that have been depleted by past logging or are otherwise known to be harmed by the management regime, create a spatial and temporal description of how the landscapes at various nested levels would look to assure those species' abundance and distribution (based on best available biological science), and then design a Forest Plan to achieve those conditions (or at least allow natural processes to create them). Instead, we have thousands of pages of documents designed to obfuscate from accomplishing anything resembling that task.

**Inadequacy of Forest Plan coarse filter/fine filter approach**

As we state in another section of this objection, the FEIS provides inadequate scientific basis for demonstrating the coarse filter approach using vegetative plan direction would "provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area" as required by the planning rule.

The FS claims, "Fine-filter plan components are designed to provide for additional specific habitat needs for native plant and animal species when those needs are not met through the coarse-filter plan components." However, the Forest Plan's fine-filter components are too minimal and would fail to protect biological diversity and species viability.

The Forest Plan FEIS states:

> There are no species-specific plan components for pileated woodpeckers because key ecosystem characteristics described in the "Affected environment" section would be provided by the implementation of coarse-filter plan components discussed in sections 3.3.3 through 3.3.8 and in section 3.7.4, subsections "Coniferous forest habitats," "Old-growth forest, very large live tree habitat, and very large dead tree habitat," and "Burned forest and dead tree habitats." The following section discusses how these plan components support key ecosystem characteristics for the pileated woodpecker".

Noon, et al. 2003 indicate there is insufficient scientific support for the Forest Plan approach: "Reliance on such 'coarse-filter' assessment techniques is problematic because there tends to be poor concordance between species distributions predicted by vegetation models and observations from species surveys."

And the Committee of Scientists (1999) recognize:

> Habitat alone cannot be used to predict wildlife populations…The presence of suitable habitat does not ensure that any particular species will be present or will reproduce. Therefore, **populations of species must also be assessed and continually monitored.**

Noon, et al. 2003 recommend implementing a fine filter approach with the coarse filter approach. However, the quality of what Noon et al. 2003 recommend far exceeds what the FS has done with the Flathead Forest Plan:

> Many rare and declining species are limited primarily by the availability of suitable habitat (Wilcove et al. 1998), and the viability of such species depends to a great extent on how much of their habitat is conserved. Population viability analysis (PVA) is an in-depth method of fine-filter assessment used to evaluate habitat loss or similar risk factors for specific species (Boyce 2002, Shaffer et al. 2002).
>
> An assessment approach that includes both coarse and fine filters and PVA was recommended by the Committee of Scientists to the US Forest Service and incorporated into the 2000 NFMA regulations (COS 1999). In addition to rare and at-risk species, the committee recommended that two groups of species be evaluated using fine filters—those that provide comprehensive information on the state of a given ecosystem (indicator species) and those that play significant functional roles in ecosystems (focal species). The latter category includes species that contribute disproportionately to the transfer of matter and energy (e.g., keystone species), structure the environment and create opportunities for additional species (e.g., ecological engineers), or exercise control over competitive dominants, thereby promoting increased biotic diversity (e.g., strong interactors). Thus, fine-filter assessments might be needed for 10 to 50 of the 200 to 1100 species typically evaluated in regional planning efforts carried out by the Forest Service and may need to include select invertebrates as well as vertebrates and plants.
>
> Formal PVAs are needed only for species in decline or at high risk or for species with such functional significance that their loss might have unacceptable ecological effects. Many methods of viability assessment exist to accommodate diverse sources and amounts of data (Beissinger and Westphal 1998, Andelman et al. 2001). All methods explicitly or implicitly require some sort of model that relates population dynamics to environmental variables, including variables affected by management. The range of available methods offers a tradeoff between complexity of analysis and generality of results.
>
> Population viability analysis is neither inherently difficult nor expensive, but it does require thoughtful model choice and construction and good judgment in the implementation of analyses. Perhaps the most demanding aspect of building realistic PVA models for assessment of alternative management scenarios is acquisition of sufficient data to yield accurate and precise parameter estimates (Beissinger and Westphal 1998). These models then permit reliable assessments of alternative management scenarios (Noon and McKelvey 1996). The choice of models and data collection methods depends in part on the life history characteristics of the species to be assessed, the quality and quantity of existing data, the time and money available for additional data acquisition, and the resolution and extent of analysis (Beissinger and Westphal 1998, Andelman et al. 2001).
>
> An expert panel convened by the National Center for Ecological Analysis and Synthesis, at the request of the Forest Service, concluded that "viability assessment is an essential component of ongoing forest management and forest planning processes. A variety of

> methods can and should be incorporated into viability assessments" (Andelman et al. 2001, p. 136). A scientifically credible approach to management of a diversity of plant and animal communities in US national forests and national grasslands combines coarse-filter and fine-filter approaches to identify conservation targets, including the judicious use of PVA for focal species and species at risk. Scientifically valid and pragmatic management does not require that the status of all species be directly assessed. But failure to detect declining species and to address the putative threats to their persistence leaves only the prohibitive provisions of the Endangered Species Act to serve as a safety net.

Andelman et al. 2001 provide this caution concerning how the Flathead NF uses historical information:

> (B)ecause existing landscapes typically differ from historical landscapes in many aspects, methods are needed to evaluate existing capabilities of the landscape to provide for species viability, and to project future probabilities that the landscape can continue to support the species.

Traill et al., 2010 discuss aspects of a fine filter approach:

> To ensure both long-term persistence and evolutionary potential, the required number of individuals in a population often greatly exceeds the targets proposed by conservation management. We critically review minimum population size requirements for species based on empirical and theoretical estimates made over the past few decades. This literature collectively shows that thousands (not hundreds) of individuals are required for a population to have an acceptable probability of riding-out environmental fluctuation and catastrophic events, and ensuring the continuation of evolutionary processes. The evidence is clear, yet conservation policy does not appear to reflect these findings, with pragmatic concerns on feasibility over-riding biological risk assessment. As such, we argue that conservation biology faces a dilemma akin to those working on the physical basis of climate change, where scientific recommendations on carbon emission reductions are compromised by policy makers. There is no obvious resolution other than a more explicit acceptance of the trade-offs implied when population viability requirements are ignored. We recommend that conservation planners include demographic and genetic thresholds in their assessments, and recognise implicit triage where these are not met.

Traill et al., 2010 and Reed et al., 2003 are published, peer-reviewed scientific articles addressing what a true "minimum viable population" would be, and how that number is typically drastically underestimated. The cumulative effects of carrying out multiple projects simultaneously across a national forest makes it imperative that population viability be assessed at least at the forestwide scale (Marcot and Murphy, 1992; also see Ruggiero et al., 1994a).

The 2012 Planning Rule requires the use of focal species—a concept that the FS cannot distinguish from the 1982 Planning Rule concept of management indicator species (MIS). Essentially, the Flathead Forest Plan adopts nothing of value concerning focal species from the 2012 Planning Rule. The Forest Plan defines **focal species as:**

> A small subset of species whose status permits inferences related to the integrity of the larger ecological system to which it belongs and provides meaningful information regarding the effectiveness of a land management plan in maintaining or restoring the ecological

> conditions to maintain the diversity of plant and animal communities in the plan area. Focal species are commonly selected on the basis of their functional role in ecosystems (36 § CFR 219.19).

Yet the FEIS discusses only the western white pine as a possible Flathead NF focal species, and the Forest Plan itself identifies exactly zero focal species.

This is inconsistent with the agency's own best available science. We look to the USDA's responses to comments on the 2012 Planning Rule to provide further explanation of how the Forest Plan ought to utilize focal species, because the definition in the planning rule is so vague. The USDA says:

> Appropriate monitoring of focal species will provide information about the integrity of the ecosystem and the effectiveness of the plan components in maintaining diversity of plant and animal communities in the plan area. In other words, focal species monitoring is used as means of understanding whether a specific ecological condition or set of conditions is present and functioning in the plan area.
>
> …Focal species …are species whose presence, numbers, or status are useful indicators that are intended to provide insight into the integrity of the larger ecological system…
>
> …Focal species monitoring provides information regarding the effectiveness of the plan in providing the ecological conditions necessary to maintain the diversity of plant and animal communities and the persistence of native species in the plan area.
>
> Monitoring for …focal species will also provide information about the effectiveness of plan components for at risk species.[2]

Essentially, this means that focal species are basically to be used as monitoring tools, to check on the effectiveness of forest plan components for maintaining "at risk"[3] species and the diversity of plant and animal communities on the Forests, and whose presence, numbers, or status as monitored are intended to provide insight into the Forests' ecological integrity.

However, not only are focal species to provide insight into the effectiveness of forest plan elements, the USDA states that they are also to <u>provide insight into the 2012 Planning Rule itself:</u>

> Focal species …are species whose presence, numbers, or status are useful indicators that are intended to provide insight into …the effectiveness of the § 219.9 provisions.

[2] How the Forest Plan might utilize focal species to conserve and recover "at risk" species is uncertain, because the USDA states that "Focal species are not intended to be a proxy for other species…" and "Focal species are not surrogates for the status of other species."

[3] Unfortunately, there is no Glossary definition of "at risk species." However, in some places the FS suggests those listed under the Endangered Species Act or those Proposed or Candidate species for listing under the ESA, as well as Species of Conservation Concern.

Those are very big shoes for a focal species to fill—perhaps that's why the Flathead NF refuses to make a genuine effort at identifying and utilizing focal species.

If identified correctly, how would the status of focal species be measured? The USDA admits the 2012 Planning Rule is vague, and largely says what is <u>not</u> required:

> …The rule does not specify how to monitor the status of focal species. …The objective is not to choose the monitoring technique(s) that will provide the most information about the focal species, but to choose a monitoring technique(s) for the focal species that will provide useful information with regard to the purpose for which the species is being monitored.
>
> …Focal species monitoring is not intended to provide information about the persistence of any individual species. The rule does not require managing habitat conditions for focal species, nor does it confer a separate conservation requirement for these species simply based on them being selected as focal species.
>
> … (P)opulation trend monitoring is not required by the final rule.

The USDA does suggest how focal species <u>might</u> be monitored: "Monitoring methods may include measures of abundance, distribution, reproduction, presence/absence, area occupied, survival rates, or others." No requirements in the Forest Plan area responsive to those suggestions.

The Committee of Scientists (1999) states:

> Given the importance of monitoring for ecological sustainability, a critical step will be to broadly define ecological attributes to include any biotic or abiotic features of the environment that can be measured. The convention has been to refer to the measured attributes as "indicator variables" under the assumption that their values are indicative of the integrity of the larger ecosystem to which they belong. The Committee adopts this definition and extends it to include the concept of focal species. These are species that fulfill the indicator criterion and provide specific insights into the biological diversity of the ecological system at different scales.

The USDA does state that there must be more than mere measurement of vegetative conditions—that a set of ecological conditions must be monitored:

> Respondents felt that monitoring habitat conditions only, specifically related to vegetation composition and structure, will not adequately address the reasons why species may or may not occupy those habitats; and that there may be other stressors unrelated to habitat that make suitable habitat conditions unsuitable for occupation by a particular species. The final rule requires monitoring the status of select ecological conditions. The concept of ecological conditions as defined in the proposed rule and the final rule includes more than vegetation composition and structure…
>
> Those ecological conditions "encompass (vegetation composition and structure) as others, including stressors that are relevant to species and ecological integrity. Examples of ecological conditions include the abundance and distribution of aquatic and terrestrial

> habitats, connectivity, roads and other structural developments, human uses, and invasive species.

The USDA also stated:

> The concept of focal species is well supported in the scientific literature and community. … The inclusion of the focal species (§ 219.19) in the monitoring section is based on concepts from the March 15, 1999, Committee of Scientists report, which recommended focal species as an approach to monitor and assess species viability.

Here is an example of the 2012 Planning Rule ignoring its own best available science. Whereas "population trend monitoring is not required by the final rule", the Committee of Scientists (1999) report disagrees. They state:

> Habitat alone cannot be used to predict wildlife populations, however. The presence of suitable habitat does not ensure that any particular species will be present or will reproduce. Therefore, populations of species must also be assessed and continually monitored.

Yet monitoring ecological conditions for focal species—habitat—is precisely what the 2012 Planning Rule says is all that's required. The Committee of Scientists (1999) states:

> An emphasis on focal species, including their functional importance or their role in the conservation of other species, combines aspects of single-species and ecosystem management. It also leads to considering species directly, in recognition that **focusing only on composition, structure, and processes may miss some components of biological diversity**.

Regarding how to go about choosing focal species, the USDA's responses to comments on the 2012 Planning Rule states:

> In some circumstances, a threatened, endangered, proposed, or candidate species, or a species of conservation concern may be the most appropriate focal species for assessing the ecological conditions required by § 219.9.
>
> The Committee of Scientists report said focal species may be indicator species, keystone species, ecological engineers, umbrella species, link species, or species of concern. Agency directives will provide guidance for considering the selection of a focal species from these or other categories. Criteria for selection may include: the number and extent of relevant ecosystems in the plan area; the primary threats or stressors to those ecosystems, especially those related to predominant management activities on the plan area; the sensitivity of the species to changing conditions or their utility in confirming the existence of desired ecological conditions; the broad monitoring questions to be answered; factors that may limit viability of species; and others.

The Committee of Scientists (1999) also suggests a pool of potential focal species:

> The key characteristic of a focal species is that its status and time trend provide insights to the integrity of the larger ecological system. The term "focal" includes several existing categories of species used to assess ecological integrity:
>
> 1) Indicator species: species selected because their status is believed to (1) be indicative of the status of a larger functional group of species, (2) be reflective of

the status of a key habitat type; or (3) act as an early warning of an anticipated stressor to ecological integrity. The presence of fish in a river is an indicator of water quality.

2) Keystone species: species whose effects on one or more critical ecological processes or on biological diversity are much greater than would be predicted from their abundance or biomass (e.g., the red-cockaded woodpecker creates cavities in living trees that provide shelter for 23 other species).
3) Ecological engineers: species who, by altering the habitat to their own needs, modify the availability of energy (food, water, or sunlight) and affect the fates and opportunities of other species (e.g., the beaver).
4) Umbrella species: species who, because of their large area requirements or use of multiple habitats encompass the habitat requirements of many other species (e.g., deer).
5) Link species: species that play critical roles in the transfer of matter and energy across trophic levels or provide a critical link for energy transfer in complex food webs. For example, prairie dogs in grassland ecosystems efficiently convert primary plant productivity into animal biomass. Prairie dog biomass, in turn, supports a diverse predator community.
6) Species of concern: species that may not satisfy the requirement of providing information to the larger ecosystem but because of public interest will also be monitored and assessed for viability. Such species include some threatened and endangered species, game species, sensitive species, and those that are vulnerable because they are rare.

The FEIS calls beaver a "key wildlife species" (this is not defined). The FEIS explains a few ecological associations between beaver and wetland-dependent species. In declining to base SCC selection on keystone species such as beaver, Forest Plan direction barely recognizes beaver:

> DC: Beavers play an important ecological role benefiting groundwater, surface water, stream aquatic habitat complexity, and adaptation to changing climate conditions.
>
> Potential strategy: Allow beavers to flood areas to maintain and regenerate hardwoods.
>
> Guideline: When beaver dams are threatening infrastructure or impairing bull trout spawning, preferred techniques that sustain beavers (e.g., using pipes to reduce water levels, notching dams to restore fish passage) should be used.

See "Science Discussion_ Beavers as a Keystone Species – A Rattlin' Blog" (https://arattlinblog.wordpress.com/2015/10/27/science-discussion-beavers-as-a-keystone-species/#more-149) for an explanation of beaver as a keystone species.

**Old Growth**

As the FEIS states, "Old-growth forest provides habitat for old-growth associated species, including invertebrates, mammals, and bird species." Green et al., 1992 state:

> Both NFMA and WO direction prescribe an ecological approach to old growth that **considers old growth as a key element in providing for biological diversity.** Old growth dependent and associated species are provided for by supplying the full range of the

> diversity of late seral and climax forest community types that make up habitat for these species. (Emphasis added.)

The Forest Plan fails to provide adequate direction recognizing old growth as a key element for maintaining and preserving biological diversity on the Flathead NF. The FEIS fails to utilize the best available science concerning old growth.

The FEIS "analysis process results in an approximation of the natural range of variation for old-growth forest as between 8 to 20 percent of the Forest, with an average of 14 percent forestwide. Refer to Trechsel (2017g) for additional information. The current amount of old-growth forest is estimated at 9.5 percent forestwide, which is within but at the low end of this approximation of the natural range of variation." We do not believe this is a correct determination nor use of best available science for several reasons. For one, Trechsel (2017g) is not listed in the References section of the FEIS. It appears to be the results of a modeling exercise, but the FEIS doesn't explain the given range in terms of error or uncertainty which might be reviewable by other scientists.

Secondly, the estimated range is lower than other scientific information. From a Kootenai National Forest analysis (Gautreaux, 1999, emphases added):

> …research in Idaho (Lesica 1995) of stands in Fire Group 4, estimated that **over 37%** of the dry Douglas-fir type was in an old growth structural stage (>200 years) prior to European settlement, approximately the mid 1800's.
>
> Based on research of Fire Group 6 in northwest Montana (Lesica 1995) it was estimated that **34%** of the moist Douglas-fir type was in an old growth structural stage (>200 yrs.) prior to European settlement, approximately the mid 1800's.
>
> Based on fire history research in Fire Group 11 for northern Idaho and western Montana (Lesica, 1995) it was estimated that an average of 26% of the grand fir, cedar, and hemlock cover types were in an old growth structural stage prior to European settlement.
>
> …fire history research in Fire Group 9 for northern Idaho and western Montana (Lesica, 1995) estimated that 19-37% of the moist lower subalpine cover types were in an old growth structural stage (trees > 200 yrs.) prior to European settlement. While this estimate is lower than suggested by Losensky's research…
>
> Lesica found an estimated 18% of the cool lodgepole pine sites was in an old growth structural stage (>200 years) prior to European settlement, approximately the mid 1800's. … This same research in Fire Group 8 in drier, lower subalpine types of Montana had **over 25%** of the stands in an old growth structural stage during the same historical period.

Lesica, 1996 states, "Results of this study and numerous fire-history studies suggest that **old growth occupied 20-50% of many pre-settlement forest ecosystems in the Northern Rockies**." (Emphasis added.) Lesica, 1996 also stated forest plan standards only requiring the retention of approximately 10% of forests as old-growth in the Northern Region "<u>may extirpate some species</u>."

This may explain why the FS decided to omit old growth management indicator species when it revised the Forest Plan: current estimates of old growth on the Flathead NF fall far below credible estimates of the historic range of old growth. Thus, the habitat proxy relied the Flathead NF upon under the original forest plan for assuring viability of many of the species discussed in this objection fails, legally and scientifically. And despite implementing its original forest plan for over 30 years, the FS failed to conduct scientifically sound population trend monitoring of wildlife species associated with old growth—thus missed an opportunity to validate the habitat proxy.

The KNF's 1987 Forest Plan included standards for protection of old growth and associated wildlife, along with its Appendix 17 (USDA Forest Service 1987a, USDA Forest Service 1987b). USDA Forest Service, 1987a states:

> Richness in habitat translates into richness in wildlife. Roughly 58 wildlife species on the Kootenai (about 20 percent of the total) find optimum breeding or feeding conditions in the "old" successional stage, while other species select old growth stands to meet specific needs (e.g., thermal cover). Of this total, **five species are believed to have a strong preference for old growth and may even be dependent upon it for their long-term survival** (see Appendix I[4]). While individual members or old growth associated species may be able to feed or reproduce outside of old growth stands, **biologists are concerned that viable populations of these species may not be maintained without an adequate amount of old growth habitat.**
>
> Wildlife richness is only a part of the story. Floral species richness is also high, particularly for arboreal lichens, saprophytes, and various forms of fungus and rots**. Old growth stands are genetic reservoirs for some of these species, the value of which has probably yet to be determined.** (Bold emphases added.)

USDA Forest Service 1987b contains a list of "species …(which) find optimum habitat in the "old" successional stage…" Kootenai National Forest, 1991 states that "we've recognized its (old growth) importance for vegetative diversity and the maintenance of some wildlife species that depend on it for all or part of their habitat." We also incorporate the IPNF's 1987 Forest Plan standards for protection of old growth and associated wildlife (USDA Forest Service 1987c) and IPNF's forestwide old-growth planning document (IPNF Forest Plan EIS Appendix 27, USDA Forest Service, 1987d) because they provide biological information concerning old growth and old-growth associated wildlife species.

USDA Forest Service 1987a considers smaller patches of old growth to be of lesser value for old-growth associated wildlife:

> A unit of 1000 acres would probably meet the needs of all old growth related species (Munther, et al., 1978) but does not represent a realistic size unit in conjunction with most other forest management activities. On the other hand, units of 50-100 acres are the smallest acceptable size in view of the nesting needs of pileated woodpeckers, a primary cavity excavator and an old growth related species (McClelland, 1979). However, **managing for a minimum size of 50 acres will preclude the existence of species which**

[4] USDA Forest Service 1987b.

> **have larger territory requirements**. In fact, Munther, et al. (1978), report that **units of 80 acres will meet the needs of only about 79 percent of the old growth dependent species** (see Figure 1). Therefore, while units of a minimum of 50 acres may be acceptable in some circumstances, <u>50 acres should be the exception rather than the rule</u>. Efforts should be made to provide old growth habitat in blocks of 100 acres or larger. …**Isolated blocks of old growth which are less than 50 acres and surrounded by young stands contribute very little to the long-term maintenance of most old growth dependent species**. (Bold emphasis added.)

The Forest Plan and FEIS does not sufficiently dealt with the issue of fragmentation, road effects, and past logging on old-growth associated species' habitat. The Flathead NF's USDA Forest Service, 2004a states:

> Forested connections between old growth patches …(widths) are important because effective corridors should be wide enough to "contain a band of habitat unscathed by edge effects" relevant to species that rarely venture out of their preferred habitats (Lidicker and Koenig 1996 and Exhibit Q-17).
>
> Timber harvest patterns across the Interior Columbia River basin of eastern Washington and Oregon, Idaho, and western Montana have caused an increase in fragmentation of forested lands and a loss of connectivity within and between blocks of habitat. This has isolated some wildlife habitats and reduced the ability of some wildlife populations to move across the landscape, resulting in long-term loss of genetic interchange (Lesica 1996, U.S. Forest Service and Bureau of Land Management 1996 and 1997).
>
> Harvest or burning in stands immediately adjacent to old growth mostly has negative effects on old growth, but may have some positive effects. Harvesting or burning adjacent to old growth can remove the edge buffer, reducing the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996). On the other hand, adjacent management can accelerate regeneration and sometimes increase the diversity of future buffering canopy.
>
> The occurrence of roads can cause substantial edge effects on forested stands, sometimes more than the harvest areas they access (Reed, et al. 1996; Bate and Wisdom, in prep.). Open roads expose many important wildlife habitat features in old growth and other forested stands to losses through firewood gathering and increased fire risk.
>
> Effects of disturbance also vary at the landscape level. Conversion from one stand condition to another can be detrimental to some old growth associated species if amounts of their preferred habitat are at or near threshold levels or dominated by linear patch shapes and limited interconnectedness (Keller and Anderson 1992). Reducing the block sizes of many later-seral/structural stage patches can further fragment existing and future old growth habitat (Richards et al. 2002). Depending on landscape position and extent, harvest or fire can remove forested cover that provides habitat linkages that appear to be "key components in metapopulation functioning" for numerous species (Lidicker and Koenig 1996, Witmer

> et al. 1998). Harvest or underburning of some late and mid seral/structural stage stands could accelerate the eventual creation of old growth in some areas (Camp, et al. 1996). The benefit of this approach depends on the degree of risk from natural disturbances if left untreated.
>
> Effects on old growth habitat and old growth associated species relate directly to … "Landscape dynamics—Connectivity"; and … "Landscape dynamics—Seral/structural stage patch size and shapes."

The revised Forest Plan contains weak protections for old growth, as it allows and even directs repeated logging in old growth, and implies that logging will help restore old growth.

The Forest Plan definition of old growth allows inclusion of stands with merely a few large, old trees retained after logging. The Flathead NF definition adopted from Green et al. omits all quantification of decadence, rot, snags, down logs, and patchy irregular canopy layers, which are habitat characteristics critical for maintaining viability of old-growth associated wildlife. These habitat components which would be depleted by proposed Forest Plan management actions, and which cannot be created by the agency's version of "restoration". Pfister et al., 2000 state:

> (T)here is the question of the appropriateness of management manipulation of old-growth stands… Opinions of well-qualified experts vary in this regard. As long term results from active management lie in the future – likely quite far in the future – considering such manipulation as appropriate and relatively certain to yield anticipated results is an informed guess at best and, therefore, encompasses some unknown level of risk. **In other words, producing "old-growth" habitat through active management is an untested hypothesis.** (Emphasis added.)

The Flathead NF has conducted no research or monitoring comparing pre- and post-logging old growth occupancy by or abundance of the wildlife species with strong biological associations with old growth. Biologically speaking, the FS refuses to check in with the real experts to see if logged old growth is still functioning as their habitat.

The FEIS states, "The statistically quantifiable and measurable key characteristics that define old-growth forest (basal area, trees per acre, d.b.h., and age) provide the means to monitor existing amounts and trends of old-growth forest over time at the broad scale and to know the reliability of the estimates." Yet the FEIS hedges on this, stating "To qualify as old-growth forest, a stand usually meets a minimum basal area and contains a minimum number of trees above a certain d.b.h. and age, which vary by habitat type groups (e.g., potential vegetation types). **However, not all old-growth forest needs to meet the minimum thresholds for these measurable criteria…**" (Emphasis added.)

The FS utilizes its Green et al. 1992 document inappropriately, in that it was never intended to set old-growth criteria as the Flathead FEIS interpretation of Green et al. does. Defining characteristics of old growth discounted by the Forest Plan are acknowledged by Green et al., 1992:

> Old growth forests encompass the late stages of stand development and are distinguished by old trees and related structural attributes. These attributes, such as tree size, canopy layers, snags, and down trees generally define forests that are in and old growth condition.
>
> Definition
> Old growth forests are ecosystems distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function.
>
> (O)ld growth is typically distinguished from younger growth by several of the following attributes:
> 1. Large trees for species and site.
> 2. Wide variation in tree sizes and spacing.
> 3. Accumulations of large-size dead standing and fallen trees that are high relative to earlier stages.
> 4. Decadence in the form of broken or deformed tops or bole and root decay.
> 5. Multiple canopy layers
> 6. Canopy gaps and understory patchiness.

Green et al., 1992 also recognize that "Rates of change in composition and structure are slow relative to younger forests." The FS fails to acknowledge that there's no science to support the implication that development of old-growth character can be accelerated.

In preparing and adopting Green et al. old growth guidelines, the FS did not use an independent scientific peer review process, as discussed by Yanishevsky, 1994:

> As a result of Washington Office directives, Region 1 established an Old-Growth Committee. In April 1992, Region 1 issued a document entitled "Old-Growth Forest Types of the Northern Region," which presented Old-Growth Screening Criteria for specific zones on Western Montana, Eastern Montana, and North Idaho (U.S.D.A. Forest Service 1992). This was an attempt to standardize criteria for classifying the variety of old-growth types across the Region. …The committee, however, executed this task without the benefit of outside scientific peer review or public input, either during or after the process (Yanishevsky 1990, Shultz 1992b). Moreover, the methodology used by the committee was unscientific and did not even include gathering field data to verify the characteristics of old-growth stands as a basis for the definition (*id.*). A former member of the Region 1 Old-Growth Committee described a "definition process" that relied heavily upon the Committee members' pre-conceived notions of the quantifiable characteristics of old-growth forests (Schultz 1992b).
>
> > The old-growth definition in its present state, without field verification of assumptions, and without addressing the issue of quality, is inadequate to scientifically describe, define, delineate, or inventory old-growth ecosystems.
>
> (*id.*) Not only did the Committee fail to obtain new field data on old-growth forest characteristics, it failed even to use existing field data on old-growth definition and

> classification previously collected for Region 1 (Pfister 1987). Quality of old growth was not addressed during the definition process. The Committee did not take into account the legacy of logging that has already destroyed much of the best old growth. This approach skewed the characteristics that describe old-growth forests toward poorer remaining examples. …It's premature for the Forest Service to base management decisions with long-term environmental effects on its Region 1 old-growth criteria, until these criteria are validated by the larger scientific community.

Yanishevsky (1994) also pointed out the inadequacy of maintaining merely "minimum" amounts of habitat such as snags and old growth.

In regards to snag numbers, the FS considers them to be non-essential for old-growth designation. The revised Forest Plan snag retention direction is inconsistent with the scientific opinion and recommendations found in Bull et al., 1997 and Lorenz et al., 2015.

**Habitat connectivity and fragmentation**
The 2012 Planning Rule requires the Forest Plan to include plan components to maintain or restore habitat connectivity. The Forest Plan does not include adequate management direction for habitat connectivity and linkage zones. The FEIS does not present an analysis of the quality of habitat in linkage zones.

Lehmkuhl, et al. (1991) state:

> Competition between interior and edge species may occur when edge species that colonize the early successional habitats and forest edges created by logging. Competition may ultimately reduce the viability of interior species' populations.
>
> Microclimatic changes along patch edges alter the conditions for interior plant and animal species and usually result in drier conditions with more available light.
>
> Fragmentation also breaks the population into small subunits, each with dynamics different from the original contiguous population and each with a greater chance than the whole of local extinction from stochastic factors. Such fragmented populations are metapopulations, in which the subunits are interconnected through patterns of gene flow, extinction, and recolonization. (Internal citations omitted.)

Lehmkuhl, et al. (1991) state:

> Competition between interior and edge species may occur when edge species that colonize the early successional habitats and forest edges created by logging (Anderson 1979; Askins and others 1987; Lehmkuhl and others, this volume; Rosenberg and Raphael 1986) also use the interior of remaining forest (Kendeigh 1944, Reese and Ratti 1988, Wilcove and others 1986, Yahner 1989). Competition may ultimately reduce the viability of interior species' populations.
>
> Microclimatic changes along patch edges alter the conditions for interior plant and animal species and usually result in drier conditions with more available light (Bond 1957, Harris 1984, Ranney and others 1981).

> Fragmentation also breaks the population into small subunits, each with dynamics different from the original contiguous population and each with a greater chance than the whole of local extinction from stochastic factors. Such fragmented populations are metapopulations, in which the subunits are interconnected through patterns of gene flow, extinction, and recolonization (Gill 1978, Lande and Barrowclough 1987, Levins 1970).

In terms of quality of habitat, the continued fragmentation of the Flathead NF is a major ongoing concern. It is documented that edge effects occur 10-30 meters into a forest tract (Wilcove et al., 1986). The size of blocks of interior forest that existed historically before management (including fire suppression) was initiated must be compared to the present condition.

Harrison and Voller, 1998 assert "connectivity should be maintained at the landscape level." They adopt a definition of landscape connectivity as "the degree to which the landscape facilitates or impedes movement among resource patches." Also:

> Connectivity objectives should be set for each landscape unit. …Connectivity objectives need to account for all habitat disturbances within the landscape unit. The objectives must consider the duration and extent to which different disturbances will alienate habitats. … In all cases, the objectives must acknowledge that the mechanisms used to maintain connectivity will be required for decades or centuries.

(Id., internal citations omitted.) Harrison and Voller, 1998 further discuss these mechanisms:

> Linkages are mechanisms by which the principles of connectivity can be achieved. Although the definitions of linkages vary, all imply that there are connections or movement among habitat patches. Corridor is another term commonly used to refer to a tool for maintaining connectivity. …the successful functioning of a corridor or linkage should be judged in terms of the connectivity among subpopulations and the maintenance of potential metapopulation processes. (Internal citations omitted.)

Harris, 1984 discusses connectivity and effective interior habitat of old-growth patches:

> Three factors that determine the effective size of an old-growth habitat island are (1) actual size; (2) distance from a similar old-growth island; and (3) degree of habitat difference of the intervening matrix. …(I)n order to achieve the same effective island size a stand of old-growth habitat that is surrounded by clearcut and regeneration stands should be perhaps ten times as large as an old-growth habitat island surrounded by a buffer zone of mature timber.

Harris, 1984 discusses habitat effectiveness of fragmented old growth:

> (A) 200-acre (80 ha) circular old-growth stand would consist of nearly 75% buffer area and only 25% equilibrium area. …A circular stand would need to be about 7,000 acres (2,850 ha) in order to reduce the 600-foot buffer strip to 10% of the total area. It is important to note, however, that the surrounding buffer stand does not have to be old growth, but only tall enough and dense enough to prevent wind and light from entering below the canopy of the old-growth stand.

Harris, 1984 believes that "biotic diversity will be maintained on public forest lands only if conservation planning is integrated with development planning; and site-specific protection areas must be designed so they function as an integrated landscape system." Harris, 1984 also states:

> Because of our lack of knowledge about intricate old-growth ecosystem relations (see Franklin et al. 1981), and the notion that oceanic island never achieve the same level of richness as continental shelf islands, a major commitment must be made to set aside representative old-growth ecosystems. This is further justified because of the lack of sufficient acreage in the 100- to 200-year age class to serve as replacement islands in the immediate future. …(A) way to moderate both the demands for and the stresses placed upon the old-growth ecosystem, and to enhance each island's effective area is to surround each with a long-rotation management area.

**Structure, function, and composition**

The 2012 Planning Rule requires the Forest Plan to include plan components to "maintain or **restore structure, function, and composition,** taking into account: …**System drivers, including dominant ecological processes, disturbance regimes, and stressors**…" The Forest Plan does not include adequate management direction for **structure, function, and composition**. The FEIS does not present an adequate analysis of for **structure, function, and composition**.

The FS has recognized that natural processes are vital for achieving ecological integrity. USDA Forest Service, 2009a incorporates "ecological integrity" into its concept of "forest health" thus:

> "(E)cological integrity": Angermeier and Karr (1994), and Karr (1991) define this as: The capacity to support and maintain a balanced, integrated, and adaptive biological system having the **full range of** elements and **processes** expected in a region's natural habitat. "…the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region." **That is, an ecosystem is said to have high integrity** if its full complement of native species is present in normal distributions and abundances, and **if normal dynamic functions are in place and working properly.** In systems with integrity, the "…capacity for self-repair when perturbed is preserved, and minimal external support for management is needed." (Emphases added.)

Noss 2001, believes "If the thoughtfully identified critical components and **processes of an ecosystem are sustained**, there is a high probability that the ecosystem as a whole is sustained." (Emphasis added.) Noss 2001 describes basic ecosystem components (emphases added):

> Ecosystems have **three basic components: composition, structure, and function**. Together, they define biodiversity and ecological integrity and provide the foundation on which standards for a sustainable human relationship with the earth might be crafted.

(Emphasis added.) Noss 2001 goes on to define those basic components:

> **Composition** includes the kinds of species present in an ecosystem and their relative abundances, as well as the composition of plant associations, floras and faunas, and habitats at broader scales. We might describe the composition of a forest, from individual stands to watersheds and regions.

> **Structure** is the architecture of the forest, which includes the vertical layering and shape of vegetation and its horizontal patchiness at several scales, from within stands (e.g., treefall gaps) to landscape patterns at coarser scales. Structure also includes the presence and abundance of such distinct structural elements as snags (standing dead trees) and downed logs in various size and decay classes.
>
> **Function** refers to the **ecological processes** that characterize the ecosystem. These processes are both biotic and abiotic, and include decomposition, nutrient cycling, disturbance, succession, seed dispersal, herbivory, predation, parasitism, pollination, and many others. Evolutionary processes, including mutation, gene flow, and natural selection, are also in the functional category.

The most complex web of biodiversity is found on the forest floor, in the organic layers of soil. Harvey et al., 1994, scratch the surface of this this ecological complexity:

> The ...descriptions of microbial structures and processes suggest that they are likely to provide highly critical conduits for the input and movement of materials within soil and between the soil and the plant. Nitrogen and carbon have been mentioned and are probably the most important. Although the movement and cycling of many others are mediated by microbes, sulfur phosphorus, and iron compounds are important examples.
>
> The relation between forest soil microbes and N is striking. Virtually all N in eastside forest ecosystems is biologically fixed by microbes... Most forests, particularly in the inland West, are likely to be limited at some time during their development by supplies of plant-available N. Thus, to manage forest growth, we must manage the microbes that add most of the N and that make N available for subsequent plant uptake. (Internal citations omitted.)

Fungi are not animals, they're not plants. Yet they perform keystone functions in the ecology of the forest. Without fungi, little of the diversity in the forest would be possible.

Simard et al., 2015 have conducted research on relationships between some fungi and plants, how nutrient transfers are facilitated by fungal networks. The authors state, "resource fluxes though ectomycorrhizal (EM) networks are sufficiently large in some cases to facilitate plant establishment and growth. Resource fluxes through EM networks may thus serve as a method for interactions and cross-scale feedbacks for development of communities, consistent with complex adaptive system theory." The FEIS fails to examine such important ecological functions, and the Forest Plan provides no assurance these functions will be maintained as the FS carries on with its narrowly informed industrial forest management regime.

"The big trees were subsidizing the young ones through the fungal networks. Without this helping hand, most of the seedlings wouldn't make it." (Suzanne Simard: http://www.ecology.com/2012/10/08/trees-communicate/.) Simard et al., 2013 state, "Disrupting network links by reducing diversity of mycorrhizal fungi… can reduce tree seedling survivorship or growth (Simard et al, 1997a; Teste et al., 2009), ultimately affecting recruitment of old-growth trees that provide habitat for cavity nesting birds and mammals and thus dispersed seed for future generations of trees." (Also see the YouTube video "Mother Tree" embedded

within the Suzanne Simard "Trees Communicate" webpage at:
https://www.youtube.com/watch?v=-8SORM4dYG8&feature=youtu.be).

Also, Gorzelak et al., 2015:

> …found that the behavioural changes in ectomycorrhizal plants depend on environmental cues, the identity of the plant neighbour and the characteristics of the (mycorrhizal network). The hierarchical integration of this phenomenon with other biological networks at broader scales in forest ecosystems, and the consequences we have observed when it is interrupted, indicate that underground "tree talk" is a foundational process in the complex adaptive nature of forest ecosystems.
>
> Complex Adaptive Systems
> Underground 'tree talk' is a foundational process in the complex adaptive nature of forest ecosystems. Since plants form the basis of terrestrial ecosystems, their behavioural interactions, feedbacks and influences are important in generating the emergent properties of ecosystems (Levin 2005). Given the connectivity inherent in the formation of MNs[5] and the impressive array of plant behavioural interactions that can be mediated through them, plant behaviour and MNs are intricately linked. In the interior Douglas-fir forests of British Columbia, seedlings regenerate within the MN of old conspecific trees. The architecture of the MN is scale-free, where hub trees are highly connected relative to other trees in the forest (Beiler et al. 2010), and this is characteristic of a complex adaptive system (Simard et al. 2013; Beiler et al. 2015). The scale of the MN is at least on the order of tens of metres (Beiler et al. 2010 ) and potentially much larger, with a single fungus sometimes spanning hundreds of hectares of forest (Ferguson et al. 2003). Recent work on the diversity of plant–fungal connections in forests revealed multiple levels of nestedness in the associations between host plants and fungal symbionts (Toju et al. 2014; Beiler et al. 2015). Each individual component (plant or fungus) of the ecosystem-wide network will, therefore, have a different potential to influence the behaviour of every other individual based on the extent, diversity and hierarchical level of its connections. As discussed above, the connections created by mycorrhizal fungi are agents for both positive (Song et al. 2010) and negative (Achatz et al. 2014) feedbacks to complex adaptive plant behaviour, which lead to self-organization of ecosystems (Simard et al. 2013; Beiler et al. 2015). Resilience is an emergent property of the interactions and feedbacks in scale-free networks (Levin 2005). Targeted loss of hub trees, however, can cross thresholds that destabilize ecosystems. Through the study of MNs, we are beginning to characterize the connections that are important to behaviour of system agents and thus ecosystem stability.

Also see Song et al., 2015; Beiler et al., 2009; and "Dying Trees Can Send Food to Neighbors of Different Species via Wood-Wide Web".

The scientists involved in research on ectomycorrhizal networks have discovered connectedness, communication, and cooperation between separate organisms. Such phenomena are usually studied within single organisms, e.g. the interconnections in humans (between neurons, sense organs, glands, muscles, and other organs) necessary for individual survival. The FEIS fails to

[5] MN = mycorrhizal network

consider the ecosystem impacts from industrial management activities on this mycorrhizal network, and the Forest Plan is written in virtual ignorance of such vital organisms, processes and components. The industrial forestry management paradigm would inevitably destroy what it fails to recognize.

**Pileated woodpecker**

A highly logical species for focal species would be the pileated woodpecker, an MIS under the 1986 Forest Plan. The FEIS states:

> Coarse-filter plan components … provide for key ecosystem characteristics for pileated woodpeckers described in the "Affected environment" section. Forestwide standard FW-STD-TE&V-03 requires retention of a minimum of two or three very large snags or live replacement trees per acre in timber harvest areas in the warm-dry, warm-moist, and cool-moist potential vegetation types (which provide pileated woodpecker habitat).

In other words, nothing but mitigations of logging impacts, which is not genuine fine filter implementation.

The Flathead NF recognizes the pileated woodpecker fits the definition of a keystone species (therefore being an appropriate focal species). USDA Forest Service 2011c states:

> Many types of disturbances, such as timber harvest, fuel reduction, road construction, blow-down, wildland fire, or insect or disease outbreaks, can affect old growth habitat and old growth associated species. This is well illustrated by **the pileated woodpecker, a "keystone" species**, which provides second-hand nesting structures for numerous old growth species such as boreal owls, kestrels, and flying squirrels (McClelland and McClelland 1999, Aubry and Raley 2002). A disturbance can reduce living tree canopy cover to levels below that needed by the pileated woodpecker's main food source, carpenter ants, forcing the pileated to forage and possibly nest elsewhere. Carpenter ants, which live mostly in standing and downed dead wood, can drastically reduce populations of species such as spruce budworm (Torgersen 1996), the most widely distributed and destructive defoliator of coniferous forests in Western North America. (Emphasis added.)

Science and logic don't support the FEIS assumption that Forest Plan implementation would be sustainable for the pileated woodpecker using only the coarse filter approach. This is partially the inadequate science the FEIS provides, and also the misuse of science.

The Forest Plan utilizes the "very large tree ($\geq$ 20 inches d.b.h.)" forest size class, meaning trees of that size are the "*predominant* diameter class of live trees" in a given stand under discussion. The Forest Plan alleges to provide for the pileated woodpecker by requiring "retention of a minimum of two or three very large snags or live replacement trees per acre in timber harvest areas in the warm-dry, warm-moist, and cool-moist potential vegetation types (which provide pileated woodpecker habitat)." Aside from not planning for long-term habitat needs of the pileated woodpecker nor considering the cumulative impacts of decades of focusing its logging on the largest trees, this ignores a necessary habitat component for pileated woodpecker habitat—trees much larger than 20" dbh.

USDA Forest Service, 1990 indicates measurements of the following variables are necessary to determine quality and suitability of pileated woodpecker habitat:

- Canopy cover in nesting stands
- Canopy cover in feeding stands
- Number of potential nesting trees >20" dbh per acre
- Number of potential nesting trees >30" dbh per acre
- Average DBH of potential nest trees larger than 20" dbh
- Number of potential feeding sites per acre
- Average diameter of potential feeding sites

McClelland and McClelland (1999) found similar results in their study in northwest Montana, with the average nest tree being 73 cm. (almost 29") dbh. The pileated woodpecker's strong preference for trees of this girth is not adequately considered in the Forest Plan. Effectively, the Forest Plan provides absolutely no commitment for leaving adequate numbers and sizes of largest trees favored by so many wildlife species.

USDA Forest Service, 1990 states, "To provide suitable pileated woodpecker habitat, strips should be at least 300 feet in width…"

B.R. McClelland has extensively studied the pileated woodpecker habitat needs. McClelland, 1985 (a letter to the Flathead NF forest supervisor) states:

> Co-workers and I now have a record of more than 90 active pileated woodpecker nests and roosts, …the mean dbh of these trees is 30 inches… A few nests are in trees 20 inches or even smaller, but the <u>minimum</u> cannot be considered suitable in the long-term. Our only 2 samples of pileateds nesting in trees <20 inches dbh ended in nest failure… At the current time there are many 20 inch or smaller larch, yet few pileateds selected them. Pileateds select <u>old</u>/old growth because old/old growth provides habitat with a higher probability of successful nesting and long term survival. They are "programmed" to make that choice after centuries of evolving with old growth.

McClelland (1977), states:

> (The Pileated Woodpecker) is the most sensitive hole nester since it requires old growth larch, ponderosa pine, or black cottonwood for successful nesting. The Pileated can be considered as key to the welfare of most hole-nesting species. If suitable habitat for its perpetuation is provided, most other hole-nesting species will be accommodated.
>
> Pileated Woodpeckers use nest trees with the largest dbh: mean 32.5 inches;
>
> Pileated Woodpeckers use the tallest nest trees: mean 94.6 feet;
>
> The nest tree search image of the Pileated Woodpecker is a western larch, ponderosa pine, or black cottonwood snag with a broken top (status 2), greater than 24 inches dbh, taller than 60 feet (usually much taller), with bark missing on at least the upper half of the snag, heartwood substantially affected by Fomes laracis or Fomes pini decay, and within an old-growth stand with a basal area of at least 100 sq. feet/acre, composed of large dbh classes.

As well as the above, we incorporate the following as best available science concerning the pileated woodpecker on the Flathead NF: Bull et al. 2007; Bull and Holthausen, 1993; Lorenz et al., 2015; Vizcarra, 2017; Hutto 2006; Spiering and Knight (2005); Bull, et al., 1990; Bull, et al., 1992; Bull et al., 1997; and Wisdom et al. 2000.

The Forest Plan includes no coherent viability strategy for pileated woodpecker protection. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain the viability of the pileated woodpecker.

**Species of Conservation Concern**

The 2012 Planning Rule defines Species of Conservation Concern (SCC) as: "a species of conservation concern is a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area." It is clear under the 2012 Planning Rule that the Regional Forester (RF) is free to arbitrarily determine the SCC list. For example, although the FEIS analysis considers the flammulated owl as an SCC, the RF only proposes to recognize the black swift and Clark's nutcracker as Forest Plan SCC, without explaining the omission.

Several species associated with forest conditions adversely affected by management were rejected from SCC and focal species list, some of them currently considered Sensitive under the original Forest Plan, some are MIS, or both. Some of these species are MIS and/or Sensitive in adjacent National Forests including the Lolo and Kootenai.

The current list of species on the Flathead NF which are both MIS and Sensitive include the bald eagle, bighorn sheep, black-backed woodpecker, boreal toad, common loon, fisher, flammulated owl, gray wolf, harlequin duck northern bog lemming, peregrine falcon, and Townsend's big-eared bat. The wolverine is MIS as well as Proposed for listing under the ESA. Other MIS are elk, mule deer, white-tailed deer, grizzly bear, Canada lynx, neotropical migratory birds, old-growth associated species, riparian habitat species, and snag/down wood habitat species.[6]

Sensitive species are defined as "those plant species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trend in numbers, density or habitat capability that would reduce a species distribution." Yet the FEIS fails to present a scientifically defensible analysis for those species that justifies the conclusion that there is no concern about a downward trend in numbers, density or habitat capability that would reduce a species distribution. For the RF to not list them as SCC is arbitrary and capricious.

**Fisher**

The fisher is a species whose historic range includes much of the Flathead NF. The FEIS identifies "Old-growth forest, very large live tree habitat, and very large dead tree habitat" as

[6] According to the Flathead NF's January 2018 Taylor Hellroaring Project Environmental Assessment, p. 3-41.

essential for fisher. Given the cumulative effects of past management activities on and surrounding the Flathead NF, such habitat components are well below the range of conditions under which the fisher evolved. The FEIS states, "Fishers are not currently known to occur on the Forest." Yet the RF arbitrarily rejected the fisher from the SCC list for the Flathead NF.

We incorporate the following as best available science concerning the fisher on the Flathead NF: Ruggiero et al. 1994b; Jones, (undated); Jones (1991); Witmer et al., 1998; Heinemeyer and Jones, 1994; Aubry et al. 2013; Olsen et al. 2014; Raley et al. 2012; Sauder 2014; Sauder and Rachlow 2014; Schwartz et al. 2013; Weir and Corbould 2010; Hayes and Lewis, 2006.

The Forest Plan includes no coherent viability strategy for fisher protection. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain the viability of the fisher.

**Pine marten**

The pine marten were MIS under the original 1986 forest plan. The FEIS fails to acknowledge the failure of the FS to monitor as required under the 1986 forest plan. Population trends were never determined. The RF arbitrarily rejected the marten from the SCC list for the Flathead NF. The pine marten is a species whose habitat is significantly altered by thinning and other active forest management (Moriarity et al., 2016; Bull and Blumton, 1999; Hargis et al., 1999; Wasserman et al., 2012; Wisdom et al. 2000; Ruggiero et al. 1994b; USDA Forest Service, 1990.

The Forest Plan includes no coherent viability strategy for pine marten. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain the viability of the pine marten.

**Northern goshawk**

The northern goshawk is or was MIS for old-growth habitat on other R-1 national forests. We incorporate the following as best available science concerning the northern goshawk on the Flathead NF: Woodbridge and Hargis, 2006; USDA Forest Service 2000b; USDA Forest Service, 2005e; Reynolds et al. 1992; Clough (2000); Crocker-Bedford (1990); Moser and Garton (2009); Hayward and Escano (1989); Wisdom et al. 2000.

The Forest Plan includes no coherent viability strategy for northern goshawk protection. The Forest Plan/FEIS fail to describe the quantity and quality of habitat necessary to sustain the viability of the northern goshawk.

**Elk**

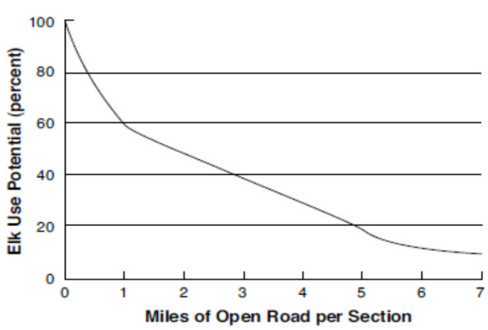
Elk were MIS under the original forest plan. Carnefix and Frissell, 2009 make a very strong scientific rationale for including ecologically-based road density standards (which are absent from the Forest Plan):

> Roads have well-documented, significant and widespread ecological impacts across multiple scales, often far beyond the area of the road "footprint". Such impacts often create large and extensive departures from the natural conditions to which organisms are adapted, which increase with the extent and/or density of the road network. Road density is a useful metric or indicator of human impact at all scales broader than a single local site because it

integrates impacts of human disturbance from activities that are associated with roads and their use (e.g., timber harvest, mining, human wildfire ignitions, invasive species introduction and spread, etc.) with direct road impacts. Multiple, convergent lines of empirical evidence summarized herein support two robust conclusions: 1) no truly “safe” threshold road density exists, but rather negative impacts begin to accrue and be expressed with incursion of the very first road segment; and 2) highly significant impacts (e.g., threat of extirpation of sensitive species) are already apparent at road densities on the order of 0.6 km per square km (1 mile per square mile) or less. Therefore, restoration strategies prioritized to reduce road densities in areas of high aquatic resource value from low-to-moderately-low levels to zero-to-low densities (e.g., <1 mile per square mile, lower if attainable) are likely to be most efficient and effective in terms of both economic cost and ecological benefit. By strong inference from these empirical studies of systems and species sensitive to humans’ environmental impact, with limited exceptions, investments that only reduce high road density to moderate road density are unlikely to produce any but small incremental improvements in abundance, and will not result in robust populations of sensitive species.

Also, the Forest Plan also lacks strong, binding standards for maintaining adequate habitat effectiveness and security cover. Christensen, et al. (1993) is a Region One publication on elk habitat effectiveness. Meeting a minimum of 70% translates to a road density of about 0.75 miles/ $mi^2$ in key elk habitat, as shown in their graph:

5. Levels of habitat effectiveness:




Motorized access via trail, road, or oversnow adversely impact habitat for the elk. Servheen, et al., 1997 indicate that motorized trails increase elk vulnerability and reduce habitat effectiveness, and provide scientific management recommendations.

Also, the FEIS fails to provide a meaningful analysis of cumulative impacts for winter conditions. Wintertime is an especially critical time for elk, and stress from avoiding motorized activities takes its toll on elk and populations.

**Owls**

We incorporate Hayward and Verner, 1994 as best available science concerning the flammulated owl, great gray owl, and boreal owl on the Flathead NF. We also incorporate Wright, et al. (1997) as best available science concerning the flammulated owl.

The Forest Plan includes no coherent viability strategy for these owl species. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain their population viability.

**Black-backed woodpecker**

The black-backed woodpecker is a primary cavity nester, and also the closest thing to MIS or focal species representing those depending upon the process of wildland fire in the ecosystem.

The Boise National Forest adopted the black-backed woodpecker as MIS in its revised forest plan in 2010:

> The black-backed woodpecker depends on fire landscapes and other large- scale forest disturbances (Caton 1996; Goggans et al. 1988; Hoffman 1997; Hutto 1995; Marshall 1992; Saab and Dudley 1998). It is an irruptive species, opportunistically foraging on outbreaks of wood-boring beetles following drastic changes in forest structure and composition resulting from fires or uncharacteristically high density forests (Baldwin 1968; Blackford 1955; Dixon and Saab 2000; Goggans et al.1988; Lester 1980). Dense, unburned, old forest with high levels of snags and logs are also important habitat for this species, particularly for managing habitat over time in a well-distributed manner. These areas provide places for low levels of breeding birds but also provide opportunity for future disturbances, such as wildfire or insect and disease outbreaks (Dixon and Saab 2000; Hoyt and Hannon 2002; Hutto and Hanson 2009; Tremblay et al. 2009). Habitat that supports this species' persistence benefits other species dependent on forest systems that develop with fire and insect and disease disturbance processes. The black-backed woodpecker is a secondary consumer of terrestrial invertebrates and a primary cavity nester. Population levels of black-backed woodpeckers are often synchronous with insect outbreaks, and targeted feeding by this species can control or depress such outbreaks (O'Neil et al. 2001). The species physically fragments standing and logs by its foraging and nesting behavior (Marcot 1997; O'Neil et al. 2001). These KEFs influence habitat elements used by other species in the ecosystem. Important habitat elements (KECs) of this species are an association with medium size snags and live trees with heart rot. Fire can also benefit this species by stimulating outbreaks of bark beetle, an important food source. Black-backed woodpecker populations typically peak in the first 3–5 years after a fire. This species' restricted diet renders it vulnerable to the effects of fire suppression and to post-fire salvage logging in its habitat (Dixon and Saab 2000).
>
> … Black-backed woodpeckers are proposed as an MIS because of their association with high numbers of snags in disturbed forests, use of late-seral old forest conditions, and relationship with beetle outbreaks in the years immediately following fire or insect or disease outbreaks. Management activities, such as salvage logging, timber harvest, and firewood collection, can affect KEFs this species performs or KECs associated with this species, and therefore **its role as an MIS would allow the Forest to monitor and evaluate the effects of management activities on identified forest communities and wildlife species.** (Emphasis added.)

We also incorporate the following as best available science concerning the black-backed woodpecker on the Flathead NF: Fire Science Brief, 2009; Lorenz et al., 2015; Vizcarra, 2017;

Wisdom et al. 2000; Hutto, 1995; USDA Forest Service 2011c; Hutto (2008); Hutto (2006); Cherry (1997); Goggans et al., 1989; Hillis et al., 2002.

The Forest Plan includes no coherent viability strategy for black-backed woodpecker. The Forest Plan/FEIS fail to describe the quantity and quality of habitat necessary to sustain black-backed woodpecker population viability.

**Wolverine**

Carroll et al. (2001b) state:

> The combination of large area requirements and low reproductive rate make the wolverine vulnerable to human-induced mortality and habitat alteration. Populations probably cannot sustain rates of human-induced mortality greater than 7–8%, lower than that documented in most studies of trapping mortality (Banci 1994, Weaver et al. 1996).
>
> … (T)he present distribution of the wolverine, like that of the grizzly bear, may be more related to regions that escaped human settlement than to vegetation structure.

Wisdom et al. (2000) offered the following strategies:

- Provide large areas with low road density and minimal human disturbance for wolverine and lynx, especially where populations are known to occur. Manage human activities and road access to minimize human disturbance in areas of known populations.
- Manage wolverine and lynx in a metapopulation context, and provide adequate links among existing populations.
- Reduce human disturbances, particularly in areas with known or high potential for wolverine natal den sites (subalpine talus cirques).

The Analysis of the Management Situation Technical Report for Revision of the Kootenai and Idaho Panhandle Forest Plans states:

> Direct mortality (related to access) from trapping, legal hunting, and illegal shooting has impacted all wide-ranging carnivores (e.g. lynx, wolverine, grizzly and black bears, wolves)…
>
> …Wolverine populations may have declined from historic levels, as a result of over-trapping, hunting, habitat changes, and intolerance to human developments. As the amount of winter backcountry recreation increases, wolverine den sites may become more susceptible to human disturbance.

In a politically motivated move, a 2013 memo from the Regional Office (USDA Forest Service, 2013c) tells FS wildlife biologists they are not allowed to arrive at effects conclusions based upon their own expertise and judgment.

We also incorporate Krebs et al. (2007); Squires et al. 2006; Squires et al. 2007; Ruggiero et al. (1994b); Ruggiero, et al. (2007); May et al. (2006); Aubry, et al. 2007; Copeland et al., 2007; Lofroth (1997); and USDA Forest Service, 1993 as best available science concerning the wolverine on the Flathead NF.

The Forest Plan includes no coherent viability strategy for wolverine. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain the viability of the wolverine.

**Boreal (Western) Toad**

We incorporate USDA Forest Service, 2003a; Montana Fish, Wildlife & Parks, 2005; and Maxell et al., 1998 as best available science concerning the boreal toad on the Flathead NF.

The Forest Plan includes no coherent viability strategy for boreal toad. The Forest Plan/FEIS fail to describe the quantity and quality of habitat that is necessary to sustain the viability of the boreal toad.

## SPECIES OF CONSERVATION CONCERN

We incorporate into this section the other sections of this Objection entitled CONSISTENCY WITH NFMA AND PLANNING REGULATION REQUIREMENTS, TERRESTRIAL SPECIES DIVERSITY AND VIABILITY, TERRESTRIAL WILDLIFE HABITAT, AQUATIC SPECIES DIVERSITY AND VIABILITY, WATER QUALITY, AQUATIC AND RIPARIAN HABITAT, PROPOSED FOREST PLAN DIRECTION IS TOO DISCRETIONARY, UNSCIENTIFIC DESIRED CONDITIONS and ADAPTIVE MANAGEMENT IN FOREST PLAN REVISION; ALSO MONITORING.

Schultz, et al., 2013 state:

> (The 2012 Planning Rule) regulations represent the most significant change in federal forest policy in decades and have sweeping implications for wildlife populations. …The new planning rule is of concern because of its highly discretionary nature and the inconsistency between its intent on the one hand and operational requirements on the other. Therefore, we recommend that the USFS include in the Directives for implementing the rule commitments to directly monitor populations of selected species of conservation concern and focal species and to maintain the viability of both categories of species. Additional guidance must be included to ensure the effective selection of species of conservation concern and focal species, and these categories should overlap when possible. If the USFS determines that the planning unit is not inherently capable of maintaining viable populations of a species, this finding should be made available for scientific review and public comment, and in such cases the USFS should commit to doing nothing that would further impair the viability of such species. In cases where extrinsic factors decrease the viability of species, the USFS has an increased, not lessened, responsibility to protect those species. Monitoring plans must include trigger points that will initiate a review of management actions, and plans must include provisions to ensure monitoring takes place as planned. If wildlife provisions in forest plans are implemented so that they are enforceable and ensure consistency between intent and operational requirements, this will help to prevent the need for additional listings under the Endangered Species Act and facilitate delisting. Although the discretionary nature of the wildlife provisions in the planning rule gives cause for concern, forward-thinking USFS officials have the opportunity under the 2012 rule to create a robust and effective framework for wildlife conservation planning.

Unfortunately, the Directives for implementing the 2012 Planning Rule failed to supplement the Rule, and no "robust and effective framework for wildlife conservation planning" exists for the Flathead National Forest. This is most evident in the FS planning for Species of Conservation Concern (SCC).

The 2012 Planning Rule requires:

> The responsible official shall determine whether or not the plan components required by paragraph (a) of this section provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area. If the responsible official determines that the plan components required in paragraph (a) are insufficient to provide such ecological conditions, then additional, species-specific plan components, including standards or guidelines, must be included in the plan to provide such ecological conditions in the plan area.

Responsible Official(s) determinations regarding SCC are not based upon best available science and are arbitrary and capricious. Since the planning rule only requires the FS to ensure viability[7] of SCC, it is of extreme importance that this be done correctly. Given that the Regional Forester has only designated two animal species as SCC —the black swift and the Clark's nutcracker— it's clear the FS is attempting to dodge practically all viability requirements of the planning rule.

As we've explained in other sections of this Objection, the combination of the Forest Plan coarse filter and fine filter approaches for wildlife and fish are scientifically inadequate and will allow population declines without any truly functioning adaptive management mechanisms in place to reverse course. As Noon et al., 2003 warned, "(the) failure to detect declining species and to address the putative threats to their persistence leaves only the prohibitive provisions of the Endangered Species Act to serve as a safety net." Yet there's little reason to expect the USFWS to provide an effective safety net, given "the agency employs a myriad of delay tactics in attempting to avoid listing species under the ESA." (Bechtold, 1999.)

Considering the Forest Plan's discretionary, nonbinding Desired Conditions (FW-DC-WL DIV), its minimal Objectives (FW-OBJ-WL DIV) and its vaguely worded Guidelines (FW-GDL-WL DIV) which might protect nesting rookeries, nest sites, or den sites if the FS happens to stumble upon them, there are no genuine, scientifically robust conservation strategies for terrestrial wildlife. The same situation exists for aquatic wildlife.

The Responsible Officials have not designated a functional aquatic or riparian[8] SCC.

The Forest Plan contains no nondiscretionary requirement to survey for any fish or wildlife species that might inhabit the Flathead National Forest, nor to even monitor their abundance or population trends.

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[7] That said, based on loophole language in the 2012 Planning Rule it could easily be argued that assuring viability even for the SCC on the Flathead or any other national forest isn't really required. We fully expect the FS to do so when challenged in court.

[8] Minor exception: The Forest Plan recognizes black swift nests are associated with waterfalls.

As a result, the Forest Plan fails to comply with NFMA requirements to maintain diversity on the Flathead National Forest.

## AQUATIC SPECIES DIVERSITY AND VIABILITY, WATER QUALITY, AQUATIC AND RIPARIAN HABITAT

We raised these issues in previous comments. (E.g., FOWS September 29, 2016 comments pp. 10-20; April 2004 Citizen ReVision pp. 10-13; MEDC September 21, 2016 pp. 4-6; March 2014 Citizen ReVision pp. 1, 17-19.)

We've incorporated FOWS other (February 8, 2018) Objection, which explains in great detail the flaws in the Forest Plan and FEIS (pp. 2-15 and attachments).

The Forest Plan weakens direction from previous Forest Plan/INFISH requirements, which did not accomplish much restoration of native fish habitats or achieve abundant populations of native fish during 22-plus years of implementation. One of the major ways the Forest Plan weakens INFISH is by opening the flood gates to allowing logging—and including logging machines—to occur in Riparian Habitat Conservation Areas (RHCAs). The Forest Plan and FEIS make it sound like such logging would be the exception. However, the FS's whole purpose for such loopholes (which emphasize "restoration" in RHCAs using, unsurprisingly, logging) is to make logging in RHCAs the rule.

Without the sufficient funding to maintain its road system in a timely manner, all the BMP implantation that can be mustered in the context of project implementation will only be a short term fix, and the road system will remain an ecological liability. The FS recognized this problem (USDA Forest Service, 2010t):

> Constructing and improving drainage structures on Forest roads is an ongoing effort to reduce road-related stream sediment delivery. Although BMPs are proven practices that reduce the effects of roads to the watershed, it is not a static condition. Maintaining BMP standards for roads requires ongoing maintenance. Ecological processes, traffic and other factors can degrade features such as ditches, culverts, and surface water deflectors. **Continual monitoring and maintenance** on open roads reduces risks of sediment delivery to important water resources. (Emphasis added.)

The FEIS fails to recognize that "continual monitoring and maintenance" is necessary following project completion.

## EXCESSIVE ROAD NETWORK, COMPLIANCE WITH THE TRAVEL MANAGEMENT RULE, AND MINIMIZATION CRITERIA

Our comments raised this issue. (E.g., AWR September 7, 2006 comments p. 12; FOWS et al. March 2014 Citizen reVision pp. 4, 7-8, 9-11; FOWS September 29, 2016 comments pp. 1, 4, 12-16, 17; April 2004 Citizen reVision at pp. 4, 5, 15-18.)

The Forest Plan and FEIS fail to meet the minimization criteria found in the Travel Management Rule (36 C.F.R. § 212 Subparts B and C) and associated Executive Orders.

The Forest Plan includes direction authorizing or sanctioning current locations of off-road and over-snow motorized and mechanized uses. It does this by incorporating the Motor Vehicle Use Map, implicitly adopting other previous decisions, and adopting Elements that in some cases allow and in other cases prohibits motorized and mechanizes uses either forestwide or in particular management areas or other geographically distinct areas.

The FEIS failed to demonstrate that it implemented or applied the Travel Management Rule/Executive Orders minimization criteria in the route designation process, consistent with the objective of minimizing impacts. The FEIS does not adequately reflect how the FS applied the minimization criteria in its motorized trail and area designations.

When designating off-road vehicle trails and areas, federal agencies are required to minimize damage to forest resources, disruption of wildlife, and user conflicts. Exec. Order No. 11,644 § 3(a), 37 Fed. Reg. 2877 (Feb. 8, 1972), *as amended by* Exec. Order No. 11,989, 42 Fed. Reg. 26,959 (May 24, 1977). The FS must locate designated trails and areas in order to minimize the following criteria: (1) damage to soil, watershed, vegetation, and other public lands resources; (2) harassment of wildlife or significant disruption of wildlife habitat; and (3) conflicts between off-road vehicle use and other existing or proposed recreational uses. 36 C.F.R. § 212.55(b)(1)-(3). *See also, WildEarth Guardians v. USFS,* 790 F.3d 920 (9th Cir. 2015).

If a travel management plan decision does not adequately reflect how the FS applied the minimization criteria in its motorized trail and area designations, the agency's decision is in violation of the Travel Management Rule and the ORV Executive Orders. The agency must demonstrate how the minimization criteria were implemented or applied in the route designation decision process, consistent with the objective of minimizing impacts. FEIS has failed to make such a demonstration on a trail-by-trail basis, and in terms of specific impacts along trails addressed in submissions and comments.

The FEIS falls short of the requirements for a proper NEPA analysis, and does not provide sufficient information to allow the Flathead NF to comply with its obligations under the Executive Orders to minimize impacts from off-road vehicle trails and areas.

In order to satisfy the Travel Management Rule, "the Forest Service must actually explain how it aimed to minimize environmental damage in designating routes." *Central Sierra Envtl. Resource Ctr. v. U.S. Forest Serv.*, 916 F. Supp. 2d 1978, 1095 (E.D. Cal. 2013); *WildEarth Guardians v. USFS,* 790 F.3d 920 (9th Cir. 2015).

In *Idaho Conservation League v. Guzman,* the Idaho district court concluded that the Forest Service must do more than just "consider" the Executive Order "minimization" criteria, as set out in 36 C.F.R. § 212.55(b). Rather, the agency must document in the administrative record how it applied the criteria in its designations on the record:

> The language "with the objective of minimizing" means that the whole goal or purpose of the exercise is to select routes in order to minimize impacts in light of the agency's other duties. Simply listing the criteria and noting that they were considered is not sufficient to meet this standard. Instead, the Forest Service must explain how the minimization criteria were applied in the route designation decisions.

766 F. Supp. 2d 2056, 1074 (D. Idaho 2011). As the court explained, "'[m]inimize' as used in the regulation does not refer to the number of routes, nor their overall mileage. It refers to the effects of route designations, i.e. the [Forest Service] is required to place routes specifically to minimize 'damage' to public resources, 'harassment' and 'disruption' of wildlife and its habitat, and minimize 'conflicts' of uses." *ICL v. Guzman* at 1073 (quoting *Ctr. for Biological Diversity v. U.S. Dept. of Interior*, 746 F. Supp. 2d 1055, 1061 (N.D. Cal. 2009)). *See also, WildEarth Guardians v. USFS,* 790 F.3d 920 (9th Cir. 2015).

The Forest Plan designates trails for motorized use that damage public resources, harass and disrupt wildlife and wildlife habitat, and perpetuate user conflicts.

By sanctioning many current routes without properly applying the Executive Order minimization criteria, the FS has acted in a manner that is arbitrary, capricious, an abuse of discretion. The FEIS fails to take a hard look at impacts from off-road vehicle trails and areas, and those impacts will significantly affect the quality of the human environment.

By the plain terms of the Executive Orders, the agency must <u>locate</u> routes to minimize impacts in the first instance. The FS can and should apply mitigation, but that should be viewed as a second step in the process.

The FS failed to minimize impacts on recommended wilderness and other inventoried roadless areas. The Forest Plan authorizes motorized access into these special areas and thereby harms their wilderness characteristics.

Also, the Forest Plan would perpetuate user conflicts. The majority of forest visitors enjoy quiet, non-motorized forms of recreation. A key element of the minimization criteria is to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses. 36 C.F.R. § 212.55(b)(3).

The Forest Plan provides no specific strategy, funding sources or design criteria to ensure effective law enforcement to address illegal motorized use. There is high probability that unauthorized routes will continue to be created, further causing conflict with non-motorized users.

The FS failed to show how it designed the routes and areas open to motorized use "with the objective of minimizing …harassment of wildlife," 36 C.F.R. § 212.55(b). The FEIS does not cite or utilize best available science concerning off-road motorized and mechanized use impacts on wildlife. Other sections of this Objection cite scientific evidence on these topics. <u>How</u> motorized access impacts on wildlife are to be minimized or avoided is not discussed in the FEIS.

The USFWS's Biological Opinion (BO) concerning the St. Joe Travel Management Project (IPNF) describes the precarious status of the endangered bull trout, the following for the St. Joe River watershed portion of the St. Joe Ranger District:

> The IDFG believes that the Coeur d' Alene Lake Basin, which includes the St. Joe River, is a stable population. However, this population is at high risk because of extremely limited numbers and/or only a few streams producing the majority of bull trout. Thus, bull trout within this core area are highly vulnerable to extirpation should a catastrophic event occur in the near future (Hardy et a1. 2010 p. 18). Because only a few streams are producing the majority of redds in the Coeur d' Alene core area, the IDGF states that it is imperative that efforts should remain in place to protect these habitats at all costs (Hardy et a1. 2010, p. 19).

The BO identifies threats to fisheries related to off-road motorized travel:

> Roads, **trails and associated crossings** at perennial streams can cause impacts to bull trout by allowing for generation of sediment to the stream (Trombulak and Frissell 2000, p 19). It has been shown that **trails can have enormous impacts on water quality, sediment yield and stream bed sedimentation** (Forest Service 2006, p. 7). In stream activities also increase the risk of crushing eggs and fry within the stream gravel (Roberts and White 1992, pA57) and have the potential to disturb spawning. Of the 27 analyzed 6th code HUCs within the St. Joe and Little North Fork Clearwater Basins, 15 HUCs have trails that cross streams. (Emphases added.)

<u>How</u> motorized access impacts on fish and aquatic and riparian habitats are to be minimized or avoided is not discussed in the FEIS.

## FOREST PLAN DIRECTION IS TOO DISCRETIONARY

We submitted comments on this issue. (E.g., MEDC September 21, 2016 comments pp. 1-2, 6-8; incorporated August 24, 2006 SVC comments pp. 2-8, 12, 13; AWR September 7, 2006 comments p. 2, 3, 4-6, 11, 16; FOWS September 29, 2016 comments Part A and pp. 7, 16; August 25, 2006 FOWS comments pp. 1, 2, 4, 9, 11; April 2004 Citizen reVision entitled "Desired Future Condition of the Bitterroot, Flathead & Lolo National Forests.")

The Forest Plan language concerning consistency with forest plan components results in very weak management direction. Generally, plan components lack strong, binding direction compelling managers to accomplish measurable outcomes in a specified timetable, feature little restraint on management discretion, or display skewed prioritization.

To be consistent with a Desired Condition or Objective, "The project or activity contributes to the maintenance or attainment of one or more desired conditions or objectives or does not foreclose the opportunity to maintain or achieve any desired conditions or objectives over the long term." The meaning of "contribute to the maintenance or attainment" of these components is not well explained. It is highly subjective and discretionary, rendering such direction to be of little practical effect. Clearly, Desired Conditions and Objectives don't compel management action nor limit management discretion.

A Guideline "is a constraint on project and activity decision-making" and would thus theoretically set limitations on management actions. However departure from the Guidelines is allowed as long as an activity "is designed in a way that is as effective in achieving the purpose of the applicable guidelines" This language renders many Guidelines discretionary and/or unenforceable, because the Forest Plan does not clearly state a purpose for most Guidelines.

A Standard "is a mandatory constraint on project and activity decisionmaking." Unfortunately, the Forest Plan has little in the way of meaningful, quantitative Standards. Protection for the various resources is not assured nor are ecological and economic sustainability.

Another Component is Suitability. The Forest Plan proclaims "Generally, the lands on the Forest are suitable for uses and management activities appropriate for national forests, such as outdoor recreation or timber, unless identified as not suitable." The criteria by which the FS has determined suitability as per NFMA and planning regulations are not objective nor do they appear to be based upon adequate site-specific data or analysis.

Although to the casual or unsuspecting reader the Forest Plan might seem to limit commercial logging in many areas because they are designated unsuitable, the Forest Plan writes the agency big loopholes to log almost everywhere outside of Wilderness. It states "Timber harvest is allowed on some lands not suitable for timber production for such purposes as salvage, fuels management, insect and disease mitigation, protection or enhancement of biodiversity or wildlife habitat, research or administrative studies, or recreation and management of scenic resources." The general public is not be aware that 100% of the logging project NEPA documents for at least the past 20 years on the Flathead National Forest have included Purpose and Need statements that claim logging is needed for salvage, fuels management, insect and disease mitigation, protection or enhancement of biodiversity or wildlife habitat or use some similarly vague justification that read like one or more of the above exceptions.

Because of the failure to include meaningful plan component direction, management actions would for all intents and purposes be directed by the political whims reflected in Congressional budget allocations, by local politicians or other entities with vested financial interests. Citizens whose legitimate public interests contrast with those of the political and financially vested would have little recourse. Land managers and members of project interdisciplinary teams, who would by far hold the most sway against political and financial interests during forest plan design and implementation have, unfortunately, little career incentive to intervene on behalf of other values, and much incentive to go along with resource extraction. And the Forest Plan reflects this "go along" attitude, reflected by how science is applied selectively and in a very biased manner.

**UNSCIENTIFIC DESIRED CONDITIONS**

We raised these issues in previous comments. (E.g., pp. 3, 4-6, and 12 of AWR September 7, 2006 comments; also pp. 2-22 of AWR September 30, 2016 comments on the Draft Forest Plan/DEIS critique Desired Conditions; and SVC August 24, 2006 comments pp. 2-3.)

One Forest Plan Element is "Desired Conditions." In regards to Desired Conditions (DCs), a site-specific project is said to be consistent with a Forest Plan if "The project or activity contributes to the maintenance or attainment of one or more desired conditions or objectives or does not foreclose the opportunity to maintain or achieve any desired conditions or objectives over the long term." The Forest Plan also states, "The Forest intends to move towards these forestwide desired conditions over the next 10 to 15 years. Some desired conditions may be very difficult to achieve in this time frame, but it is important to move towards them over time." In other words, Forest Plan DCs are to be strived for, but may never actually achieved. And there would no accountability for never achieving any of them.

The Forest Plan strategy focuses upon static DCs while de-emphasizing the natural dynamics of the ecosystem. Ultimately the Forest Plan reflects an overriding bias favoring resource extraction via "management" needed to "move toward" some selected DCs, along the way neglecting the ecological processes or "function" driving the ecosystem. Essentially the FS rigs the game, as many DCs would only be achievable by resource extractive activities. And since many DCs would have to be maintained by repeated vegetation manipulation, the <u>management paradigm is at odds with natural processes</u>—the real drivers of the ecosystem. McClelland (undated) criticizes the aim to achieve desired conditions by the use of mitigation measures calling for retention of specific numbers of certain habitat structures:

> The snags per acre approach is not a long-term answer because it **concentrates on the <u>products</u> of ecosystem processes rather than the processes themselves**. It does not address the most critical issue—long-term perpetuation of diverse forest habitats, a mosaic pattern which includes stands of old-growth larch. **The processes that produce suitable habitat must be retained or reinstated by managers. Snags are the result of these processes** (fire, insects, disease, flooding, lightning, etc.). (Emphases added.)

An abundance of scientific evidence suggests DCs be replaced with <u>desired future dynamics</u>**,** to align with best available science. Kauffman, 2004 states:

> Restoration entails much more than simple structural modifications achieved through mechanical means. Restoration should be undertaken at landscape scales and **must allow for the occurrence of dominant ecosystem processes**, such as the natural fire regimes achieved through natural and/or prescribed fires at appropriate temporal and spatial scales. (Emphasis added.)

Wales, et al. 2007 modeled various potential outcomes of fire and fuel management scenarios on the structure of forested habitats in northeast Oregon. They projected that the <u>natural disturbance scenario resulted in the highest amounts of all types of medium and large tree forests combined</u> and best emulated the Natural Range of Variability for medium and large tree forests by potential vegetation type after several decades. <u>Restoring the natural disturbances regimes and processes is the key to restoring forest structure and functionality similar to historical conditions.</u>

Hessburg and Agee (2003) state:

> Patterns of structure and composition within existing late-successional and old forest reserve networks will change as a result of wildfires, insect outbreaks, and other processes. What may be needed is an approach that marries a short-term system of reserves with a long-term strategy to convert to a continuous network of landscapes with dynamic properties. In such a system, late-successional and old forest elements would be continuously recruited, but would shift semi-predictably in landscape position across space and time. Such an approach would represent a planning paradigm shift from NEPA-like desired future conditions, to planning for landscape-scale **desired future dynamics**. (Emphasis added.)

(Emphasis added.) Likewise, Sallabanks et al., 2001 state:

> Given the dynamic nature of ecological communities in Eastside (interior) forests and woodlands, particularly regarding potential effects of fire, **perhaps the very concept of defining "desired future conditions" for planning could be replaced with a concept of describing "desired future dynamics."**

(Emphasis added.) There is plenty of support in the scientific literature for such an approach. Noss 2001, for example, believes "If the thoughtfully identified critical components and **processes of an ecosystem are sustained**, there is a high probability that the ecosystem as a whole is sustained." (Emphasis added.)

Hutto, 1995 also addresses natural processes, referring specifically to fire:

> Fire is such an important creator of the ecological variety in Rocky Mountain landscapes that the conservation of biological diversity [required by NFMA] is likely to be accomplished only through **the conservation of fire as a process**…Efforts to meet legal mandates to maintain biodiversity should, therefore, be directed toward **maintaining processes like fire**, which create the variety of vegetative cover types upon which the great variety of wildlife species depend. (Emphasis added.)

Noss and Cooperrider (1994) state:

> Considering process is fundamental to biodiversity conservation because **process determines pattern**. **Six interrelated categories of ecological processes that biologists and managers must understand in order to effectively conserve biodiversity** are (1) energy flows, (2) nutrient cycles, (3) hydrologic cycles, (4) disturbance regimes, (5) equilibrium processes, and (6) feedback effects. (Emphasis added.)

The Environmental Protection Agency (1999) recognizes the primacy of natural processes: (E)cological processes such as natural disturbance, hydrology, nutrient cycling, biotic interactions, population dynamics, and evolution determine the species composition, habitat structure, and ecological health of every site and landscape. **Only through the conservation of ecological processes will it be possible to (1) represent all native ecosystems within the landscape and (2) maintain complete, unfragmented environmental gradients among ecosystems.** (Emphasis added.)

FS researcher Everett (1994) states:

> To prevent loss of future options we need to simultaneously **reestablish ecosystem processes and disturbance effects that create and maintain desired sustainable ecosystems**, while conserving genetic, species, community, and landscape diversity and long-term site productivity.
>
> …We must address **restoration of ecosystem processes and disturbance effects** that create sustainable forests before we can speak to the restoration of stressed sites; otherwise, we will forever treat the symptom and not the problem. … **One of the most significant management impacts on the sustainability of forest ecosystems has been the disruption of ecosystem processes** through actions such as fire suppression (Mutch and others 1993), dewatering of streams for irrigation (Wissmar and others 1993), truncation of stand succession by timber harvest (Walstad 1988), and maintaining numbers of desired wildlife species such as elk in excess of historical levels (Irwin and others 1993). Several ecosystem processes are in an altered state because we have interrupted the cycling of biomass through fire suppression or have created different cycling processes through resource extraction (timber harvest, grazing, fish harvest). (Emphases added.)

Hessburg and Agee 2003 also emphasize the primacy of natural processes for management purposes:

> Ecosystem management **planning** must acknowledge **the central importance of natural processes and pattern–process interactions, the dynamic nature of ecological systems** (Attiwill, 1994), the inevitability of uncertainty and variability (Lertzman and Fall, 1998) and cumulative effects (Committee of Scientists, 1999; Dunne et al., 2001). (Emphases added.)

Harvey et al., 1994 state:

> Although usually viewed as pests at the tree and stand scale, insects and disease organisms perform functions on a broader scale.
>
> …Pests are a part of even the healthiest eastside ecosystems. Pest roles—such as the removal of poorly adapted individuals, accelerated decomposition, and reduced stand density—may be critical to rapid ecosystem adjustment.
>
> …In some areas of the eastside and Blue Mountain forests, at least, the ecosystem has been altered, setting the stage for high pest activity (Gast and others, 1991). This increased activity does not mean that the ecosystem is broken or dying; rather, it is demonstrating functionality, as programmed during its developmental (evolutionary) history.

Castello et al. (1995) state:

> Pathogens help decompose and release elements sequestered within trees, facilitate succession, and maintain genetic, species and age diversity. Intensive control measures, such as thinning, salvage, selective logging, and buffer clearcuts around affected trees remove crucial structural features. Such activities also remove commercially valuable, disease-resistant trees, thereby contributing to reduced genetic vigor of populations.

> Fire, insects & disease are endemic to western forests and are a natural process for allowing the forest to self-thin. This provides for greater diversity of plant and animal habitat than logging can achieve. In areas that have been historically and repeatedly logged there is less diversity of native plants, more invasive species, and less animal diversity.

In failing to fully analyze an alternative that recognizes the scientific basis for prioritizing natural dynamics to achieve the restoration objectives of the Forest Plan, the FS violates NEPA.

**FIRE SUPPRESSION**

Incorporated FOWS 9/29/2016 comments stated, "As has been well demonstrated by a century of fire suppression, the dampening or suppression of natural disturbance can alter forest trajectories in undesirable ways, many of which can be irreversible."

Also, incorporated 8/25/2006 FOWS comments stated: "The following are some of the decisions the AMS deemed important that still need to be addressed in the revised Forest Plan. … To what extent and where will we accommodate disturbances; to what extent and where will we try to prevent them? What is an acceptable and achievable level of fire use to help move toward ecological sustainability within the next planning period? What are the appropriate management tools available to manage after disturbance occurs and where will they be allowed?**"**

And incorporated SVC 8/24/2006 comments cited Baker et al., 2006: "The most effective restoration strategy for undisturbed mature and old-growth forests is likely a passive approach, in which fire is restored, but natural processes (from fire and other sources of mortality) accomplish gradual restoration of tree density and fuels."

Forest Plan direction outside of Wilderness includes: "human influences and actions such as fire suppression …are more evident and play a larger role in achieving desired ecological conditions." ((FW-DC-TE&V-24) And FW-DC-FIRE-07 states:

> Fuelbreaks strategically located across the Forest are designed to result in less intense fire behavior and to facilitate safe wildland fire operations. Lower tree densities and fuel loadings occur within fuelbreaks and in some portions of the wildland-urban interface, compared to forest conditions that would normally develop through natural succession. These fuels conditions are maintained over the long term through active management.

FW-GDL-FIRE-06 states, "To protect private property and other values at risk, fire management strategies should be designed to suppress wildland fires that threaten neighboring property and resources when time, assets, and prevailing conditions allow for action without undue risk to responders."

The Forest Plan also states, "The Forest's infrastructure (i.e., roads, trails, airstrips, and facilities) includes approximately 1,430 miles of open roads, approximately 2,260 miles of system trails, and four airstrips constructed to support Forest management activities such as fire suppression…"

The FEIS states, "Wildfires on the Flathead National Forest started by any source that threatens identified values are suppressed as soon as possible."

Clearly, as evidenced from the Forest Plan and the percentage of annual FS budget consumed by firefighting, continued fire suppression is to be a huge part of Flathead National Forest management.

Yet the medium- to long-term environmental impacts of the agency's fire suppression are the agency's typical rationale for conducting the vast majority of vegetation management projects, as seen in Purpose and Need statements for practically every timber sale on the Flathead for at least the past 20 years.

Cohen, 1999 recognizes "the imperative to separate the problem of the wildland fire threat to homes from the problem of ecosystem sustainability due to changes in wildland fuels" (Id.). In regards to the latter—ecosystem sustainability—Cohen and Butler (2005) state:

> Realizing that wildland fires are inevitable should urge us to recognize that excluding wildfire does not eliminate fire, it unintentionally selects for only those occurrences that defy our suppression capability—the extreme wildfires that are continuous over extensive areas. If we wish to avoid these extensive wildfires and restore fire to a more normal ecological condition, **our only choice is to allow fire occurrence under conditions other than extremes. Our choices become ones of compatibility with the inevitable fire occurrences rather than ones of attempted exclusion.** (Emphasis added.)

The Forest Plan FEIS fails to provide an adequate analysis of the cumulative effects of fire suppression, given that the FS is unable to "allow fire occurrence under conditions other than extremes." That's because the fires the FS successfully suppresses are under non-extreme conditions, which affect the forest in ways the FS wants prescribed fires to do, but which the agency has an inadequate budget to implement.

The FEIS states, "Prescribed fire is limited not only by budget but also by weather- and climate-related factors and logistical factors." Also, "Prescribed fire has been used across an average of 2,500 acres per year over the past decade." That average would result in only 37,500 acres burned via prescribed fire over the life of the Forest Plan.

Of course, under the Forest Plan the FS proposes not just prescribed fire, but other vegetation treatments (mostly logging). Although the FEIS admits the effects of such treatments are not a good substitute for wildland fire for many forest resources and values, we still read that such logging will "restore" the forests the agency simultaneously suppresses. Yet even under foreseeable agency budgets the FEIS indicates there would not even result in enough vegetation management under the agency's paradigm to "treat" the problems perpetuated by fire suppression. The FEIS states that under Alternative B-modified <u>it would take 250 years to "restore" only 398,758 acres.</u>

We want the FS and the public to become reasonably tolerant to unplanned wildland fires under some weather conditions in sensible locations, so that the ecosystem benefits can be realized. Simply stated, at the time that response to a fire is contemplated, we want decision makers to have publicly vetted documentation—for that specific area—of the benefits of the process that helps create habitat conditions for wildlife, restores forest composition, recycles soil nutrients, creates large dead logs that fall into streams forming native fish habitat, as well as many others. That will provide the public, the news media, and politicians with a fully vetted set of justifications for managing with—rather than against—the native ecosystem process of fire. We believe that such planning can and must be undertaken for sustainable forest management to evolve away from the unacceptable present situation. The FEIS fails to include an adequate programmatic analysis of FS fire suppression policies, disclosing the impacts and ecological harm that the agency will subsequently claim must be later addressed by vegetation management and fuel treatment projects across the landscape. Not to mention the enormous financial costs—also never analyzed or disclosed at any planning level.

## FAILURE TO UTILIZE BEST AVAILABLE SCIENCE

We raised these issues in previous comments. (E.g., SVC September 19, 2016 comments pp. 1-2, 4-7; AWR September 7, 2006 comments pp. 4, 5, 13, 14; FOWS September 29, 2016 pp. 1, 5-6, 11, 12, 13, 16, 20, 23; MEDC September 21, 2016 comments pp. 2, 4.) And along with the points made on these issues made in the other Objections we've incorporated, we make the following additional points.

In multiple subsections, the NFMA Rule requires that the Forest Service **identify the best scientific information, use it in preparation of the Assessment, and explain how that science was used**:

> § 219.3 Role of science in planning. The responsible official shall use the best available scientific information to inform the planning process required by this subpart. In doing so, the responsible official shall determine what information is the most accurate, reliable, and relevant to the issues being considered. The responsible official shall document how the best available scientific information was used to inform the assessment, the plan decision, and the monitoring program as required in §§ 219.6(a)(3) and 219.14(a)(4). Such documentation must: Identify what information was determined to be the best available scientific information, explain the basis for that determination, and explain how the information was applied to the issues considered.
>
> § 219.6 Assessment. (b) *Content of the assessment for plan development or revision.* In the assessment for plan development or revision, the responsible official shall identify and evaluate existing information relevant to the plan area for the following: (5) Threatened, endangered, proposed and candidate species, and potential species of conservation concern present in the plan area;

We do not agree the Assessment for the Flathead National Forest is in fact based on the best available science. Objectors and our conservation partners have submitted or cited dozens of scientific papers, but the FS has not stated why those papers are rejected as best available science. On the other hand the range of scientific information the FS does identify suggests the agency prefers to ignore scientific viewpoints which contradict its status quo resource extraction regime.

We understand it's FS policy for the Forest Supervisor to make final determination on what is best available science when the Record of Decision is signed: "(O)ther information …presented to us …up until a decision may be found to be (best available science)." (Probert, 2017.)

**TRANSPORATION AND ACCESS**

We raised these issues in previous comments. (E.g., AWR September 30, 2016 comments pp. 2, 6, 8, 14, 17, 26-33, 41-42; April 2004 Citizen reVision pp. 4, 5-6, 8; SVC September 7, 2016 comments p. 1; SVC September 12, 2016 comments pp. 1-4; SVC August 24, 2006 comments pp. 4-8, 9-11.) And along with the points made on these issues made in the other Objections we've incorporated, we make the following additional points.

Forest Service scientists Gucinski et al. (2001) identify many of the highly adverse impacts of forest roads. Concerning road density impacts on fish populations, for example, they note:

> …increasing road densities and their attendant effects are associated with declines in the status of four non-anadromous salmonid species. These species are less likely to use highly roaded areas for spawning and rearing and, if found, are less likely to have strong populations. This consistent pattern is based on empirical analysis of 3,327 combinations of known species' status and subwatershed conditions, limited primarily to forested lands administered by the Forest Service and the Bureau of Land Management.

Much of the problem is due to a general lack of funding to maintain roads and therefore prevent erosion and sediments from damaging instream aquatic habitat features. Many more impacts are because so many existing forest roads were built prior to the accumulation of empirical and scientific evidence revealing the old road designs were ecological liabilities. Undersized culverts are an example, which tend to blow out during flooding events which turn out to be not that unusual. Culverts have also been placed in a manner—or eroded to the point where—fish passage is blocked in one or both directions. Forest Service hydrologist Johnson (1995) identifies other significant hydrological liabilities of old forest roads.

To address its unsustainable and deteriorating road system, the FS promulgated the Travel Management Regulations. Subpart A directs each national forest to conduct "a science-based roads analysis," generally referred to as the "travel analysis process." The FS Washington Office, through a series of directive memoranda, instructed forests to use the Subpart A process to "maintain an appropriately sized and environmentally sustainable road system that is responsive to ecological, economic, and social concerns." These memoranda also outline core elements that must be included in each Travel Analysis Report.

The Washington Office memorandum dated March 29, 2012 (USDA Forest Service, 2012d) directed the following:

- A TAP must analyze all roads (maintenance levels 1 through 5);
- The Travel Analysis Report must include a map displaying roads that will inform the Minimum Road System pursuant to 36 C.F.R. § 212.5(b), and an explanation of the underlying analysis;

• The TAP and Watershed Condition Framework process should inform one another so that they can be integrated and updated with new information or where conditions change.

The December 17, 2013 Washington Office memorandum (USDA Forest Service, 2013b) clarifies that by the September 30, 2015 deadline each forest must:

• Produce a Travel Analysis Report summarizing the travel analysis;
• Produce a list of roads *likely not needed for future use*; and
• Synthesize the results in a map displaying roads that are *likely needed* and *likely not needed in the future* that conforms to the provided template.

The Subpart A analysis is intended to account for benefits and risks of each road, and especially to account for affordability. The TAP must account for the cost of maintaining roads to standard, including costs required to comply with Best Management Practices related to road maintenance.

The Travel Management Regulations at 36 CFR § 212.5 state:

> (b) Road system—(1) *Identification of road system.* For each national forest, national grassland, experimental forest, and any other units of the National Forest System (§ 212.1), the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. In determining the minimum road system, the responsible official must incorporate a science-based roads analysis at the appropriate scale and, to the degree practicable, involve a broad spectrum of interested and affected citizens, other state and federal agencies, and tribal governments. The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR part 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

Unfortunately, the FS has not yet properly engaged the public to create a forestwide science-based Travel Analysis Report, has not arrived at an affordable and ecologically sustainable minimum road system, and basically sanctions the status quo.

The FEIS doesn't disclose if the Forests are being managed in compliance with the Travel Management Regulations at 36 CFR § 212 Subpart A. It's clear the FS fails to take seriously its responsibilities under Subpart A because the Forest Plan and Grizzly Amendments contain no Plan Components that require a significant reduction in the forest road system or identification and implementation of the Minimum Road System, and takes no explicit direction from the Travel Management Regulations.

Subpart A requires the FS to involve the public in a scientifically based process which designates the Minimum Road System both in the analysis area and forestwide, so that unnecessary or ecologically damaging roads are targeted for decommissioning and the economic liabilities of roads are minimized.

The FEIS doesn't explain how the FS proposes to afford maintaining the road system in the Flathead NF when the funding doesn't exist, nor adequately analyze and disclose the impacts because as a result, watershed conditions will continue to deteriorate from naturally increasing erosion of roads. In other words, the FEIS fails to consider the long-term budget shortfalls for road maintenance in the project area, and doesn't analyze or disclose the ecological impacts of this ongoing situation.

A plethora of scientific information indicate the highly significant nature of departures from historic conditions that are the impacts on forest ecosystems caused by motorized travel routes and infrastructure. From the Wisdom et al. (2000) Abstract:

> Our assessment was designed to provide technical support for the ICBEMP and was done in five steps. … Third, we summarized the effects of roads and road-associated factors on populations and habitats for each of the 91 species and described the results in relation to **broad-scale patterns of road density.** Fourth, we mapped classes of the current abundance of source habitats for four species of terrestrial carnivores in relation to **classes of road density** across the 164 subbasins and used the maps to identify areas having high potential to support persistent populations. And fifth, we used our results, along with results from other studies, to describe broad-scale implications for managing habitats deemed to have undergone long-term decline and for managing species negatively affected by **roads or road-associated factors**. (Emphases added.)

Carnefix and Frissell, 2009 make a very strong scientific rationale for including ecologically-based road density standards:

> Roads have well-documented, significant and widespread ecological impacts across multiple scales, often far beyond the area of the road "footprint". Such impacts often create large and extensive departures from the natural conditions to which organisms are adapted, which increase with the extent and/or density of the road network. Road density is a useful metric or indicator of human impact at all scales broader than a single local site because it integrates impacts of human disturbance from activities that are associated with roads and their use (e.g., timber harvest, mining, human wildfire ignitions, invasive species introduction and spread, etc.) with direct road impacts. Multiple, convergent lines of empirical evidence summarized herein support two robust conclusions: 1) no truly "safe" threshold road density exists, but rather negative impacts begin to accrue and be expressed with incursion of the very first road segment; and 2) **highly significant impacts (e.g., threat of extirpation of sensitive species) are already apparent at road densities on the order of 0.6 km per square km (1 mile per square mile) or less.** Therefore, restoration strategies prioritized to reduce road densities in areas of high aquatic resource value from low-to-moderately-low levels to zero-to-low densities (e.g., <1 mile per square mile, lower if attainable) are likely to be most efficient and effective in terms of both economic cost and ecological benefit. By strong inference from these empirical studies of systems and species sensitive to humans' environmental impact, with limited exceptions**, investments that only reduce high road density to moderate road density are unlikely to produce any but small incremental improvements in abundance, and will not result in robust populations of sensitive species.**

(Emphases added.) Wisdom et al., 2000, which is considered “Best Available Science” by the revised forest plan, state in their Abstract:

> Our analysis also indicated **that >70 percent of the 91 species are affected negatively by one or more factors associated with roads.** Moreover, maps of the abundance of source habitats in relation to classes of road density suggested that road-associated factors hypothetically may reduce the potential to support persistent populations of terrestrial carnivores in many subbasins. Management implications of our summarized road effects include the potential to mitigate a diverse set of negative factors associated with roads. **Comprehensive mitigation of road-associated factors would require a substantial reduction in the density of existing roads as well as effective control of road access in relation to management of livestock, timber, recreation, hunting, trapping, mineral development, and other human activities.**

(Emphases added.) And from the article’s Major Findings and Implications:

> **Efforts to restore habitats without simultaneous efforts to reduce road density and control human disturbances will curtail the effectiveness of habitat restoration, or even contribute to its failure; this is because of the large number of species that are simultaneously affected by decline in habitat as well as by road-associated factors.**

(Emphasis added.) The Forest Plan does not require Road Management Objectives for each road, which follow from designations under the Travel Management Rule Subpart B.

The FEIS also doesn’t adequately account for the ecological or financial costs of leaving “stored” or “decommissioned” roads in a condition that is not fully restored. “Reduce” the risk is far from “eliminate” the risks and impacts.

The FS's 2001 Roadless Rule FEIS states: “The use of temporary roads may have the same long lasting and significant ecological effects as permanent roads, such as the introduction of nonnative vegetation and degradation of stream channels.” Practically all vegetation management projects nowadays include utilization of “temporary” roads, yet even though temporary roads would allegedly be decommissioned after the logging is completed, there is a likelihood that the FS would later construct another “temporary” road on these same sites for the next round of “treatments.” The Forest Plan lacks is a programmatic limitation on the use of temporary roads, so their long-term effects can be quantified.

## CARBON SEQUESTRATION AND CLIMATE CHANGE

We raised these issues in previous comments. (E.g., AWR September 7, 2006 comments p. 5; FOWS September 29, 2016 comments pp. 11, 13, 16, 20, 22-23, 31, 42, 43, 45-47, 48; SVC September 19, 2016 comments p. 13.) And along with the points made on these issues made in the other Objections we’ve incorporated, we make the following additional points.

How can our national forest be considered “suitable” for activities that contribute to—rather than reduce—the greatest threat to the Earth’s biosphere? The present level of carbon dioxide ($CO_2$) in Earth’s atmosphere is already dangerous and not sustainable by any definition of the word.

The Forest Plan direction towards unnecessary activities that would worsen the problem violates the 2012 Planning Rule's mandate to "provide for social, economic, and ecological sustainability."

The FS refused to consider scientific research and opinion that recognizes the critical challenge posed by climate change to global ecosystems and these national forests. Some politicians, bureaucrats, and industry profiteers pretend there's nothing to do about climate change because it isn't real. The FS acknowledges it's real, pretends it can do nothing, provides but a limited focus on its symptoms and—like those politicians and profiteers—ignores and distracts from the causes of climate change they enable.

The FEIS position on climate change is that the forest plans would have a miniscule impact on global carbon emissions. The obvious problem with that viewpoint is, once can say the same thing about every source of carbon dioxide and other greenhouse gas emission on earth, and likewise justify inaction as does this FEIS. In their comments on the Kootenai NF's Draft EIS for the Lower Yaak, O'Brien, Sheep project, the EPA rejected that sort of analysis, basically because that cumulative effects scale dilutes project effects. We would add that, if the FS wants to refer to a wider scope to analyze its carbon footprint, we suggest that it actually conduct such a cumulative effect analysis within the context of a NEPA document.

Former US Forest Service Chief Abigail Kimbell and Hutch Brown (in USDA Forest Service, 2017b) discuss some effects of climate change on forests:

> Even if global greenhouse gas buildups were reversed today, global temperatures would continue to rise for the next hundred years, bringing regional warming, changes in precipitation, weather extremes, severe drought, earlier snowmelt, rising sea levels, changes in water supplies, and other effects. As it is, global greenhouse emissions are still rising, exacerbating all of these long-term effects. The capacity of many plant and animal species to migrate or adapt will likely be exceeded. Ecosystem processes, water availability, species assemblages, and the structure of plant and animal communities and their interactions will change. In many areas, it will no longer be possible to maintain vegetation within the historical range of variability. Land management approaches based on current or historical conditions will need to be adjusted.

USDA Forest Service, 2017b discusses some effects of climate change on forests, including "In many areas, it will no longer be possible to maintain vegetation within the historical range of variability. Land management approaches based on current or historical conditions will need to be adjusted." The Forest Plan and its FEIS have no scientific basis for claims or assumptions that proposed vegetation "treatments" will result in sustainable vegetation conditions under likely climate change scenarios. It also fails to provide a definition of "increasing resilience" that includes metrics for valid and reliable measurement of resilience. The scientific literature even debates if the same tree species mix that has historically inhabited sites can persist after disturbances, including the types of disturbances contemplated under forest plan implementation.

Global climate change is a massive, unprecedented threat to humanity and forests. Climate change is caused by excess $CO_2$ and other greenhouse gases transferred to the atmosphere from other pools. All temperate and tropical forests, including those in the FEIS analysis area, are an important part of the global carbon cycle. There is significant new information reinforcing the need to conserve all existing large stores of carbon in forests, in order to keep carbon out of the atmosphere and mitigate climate change. The agency must do its part by managing forests to maintain and increase carbon storage. Logging would add to cumulative total carbon emissions so is clearly part of the problem, so it must be minimized and mitigated. Logging would not only transfer carbon from storage to the atmosphere but future regrowth is unlikely to ever make up for the effects of logging, because carbon storage in logged forests lags far behind carbon storage in unlogged forests for decades or centuries. And before recovery, the agency plans even more activities causing greenhouse gas emissions.

Clearly, the management of the planet's forests is a nexus for addressing the largest crisis ever facing humanity. The lack of detailed scientific discussions in the FEIS concerning climate change is far more troubling than the document's failures on other topics, because the consequences of unchecked climate change will be disastrous for food production, sea level rise, and water supplies, resulting in complete turmoil for all human societies. (For a sobering perspective, see "When Will Climate Change Make the Earth Too Hot For Humans?") Climate change is an issue as serious a nuclear annihilation (although at least with the latter we're not already pressing the button).

The FEIS fails to provide an accurate, objective analysis and disclosure of how planning, project and other FS activities affect the dynamic balance of carbon sequestration and emit greenhouse gasses. There is no Forest-level cumulative effects analysis of carbon sequestration and greenhouse gas emission over time. The same is true for the entire national forest system.

Respected experts say that the atmosphere might be able to safely hold 350 ppm of $CO_2$.[9] So when the atmosphere was at pre-industrial levels of about 280 ppm, there was a cushion of about 70 ppm which represents millions of tons of greenhouse gas emissions. Well, now that cushion is completely gone. The atmosphere is now over 400 ppm $CO_2$ and rising. Therefore the safe level of additional emissions (from logging or any other activity) is negative. There is no safe level of additional emissions that our earth systems can tolerate. We need to be removing carbon from the atmosphere—not adding to it.[10] How? By allowing forest to grow. Logging moves us away from our objective while conservation moves us toward our objective.

Mackey, et al 2013 "clarify some well-established fundamentals of the global carbon cycle that are frequently either misunderstood, or seemingly overlooked." They state: "At present some forests have carbon sequestration potential due to depletion of carbon stocks from past land use." The authors call this potential, "Reforestation of previously cleared or logged land…" They do not attribute this potential to "increasing forest resilience to disturbance" or the kind of forest "restoration" implied by the Forest Plan or this FEIS.

Mackey, et al 2013 also make the following points:

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[9] http://www.350.org/about/science.

[10] "To get back to 350 ppm, we'll have to run the whole carbon-spewing machine backwards, sucking carbon out of the atmosphere and storing it somewhere safely. … By growing more forests, growing more trees, and better managing all our forests…" (http://blog.cleanenergy.org/2013/11/26/exploringbiocarbon-tools/comment-page-1/#comment-375371)

- Avoiding and reducing land carbon emissions is therefore an integral part of any comprehensive approach to solving the climate change problem.

- In addition to deforestation, forests have been degraded by land-use activities such as logging and soil disturbance that deplete their organic carbon stocks and emit $CO_2$. Emissions from forest degradation are poorly quantified globally, but estimates indicate that they increase regional carbon emissions by nearly 50% over deforestation alone.

- The capacity of the land to remove atmospheric carbon and store it in vegetation and soil is limited to the amount previously depleted by land use.

- If the forest is allowed to develop into an ecologically mature state, the carbon stock approaches a dynamic equilibrium with prevailing environmental conditions, where respiration approximately balances photosynthesis. At this point, the depleted land carbon stock has been refilled and the sink function has gone. The mitigation value of the ecosystem resides in maintenance of the stored carbon stock.

- Ecologically mature (>200 years) and old-growth forests aged up to 800 years can continue to function as sinks. … In terms of carbon mitigation policy, the primary reason to conserve forests is the carbon stocks they contain. The idea that replacing primary forests by plantations will 'create sinks' and thereby be positive for climate mitigation is incorrect, as it fails to account for the loss of carbon stock from the primary forest. Furthermore, plantation forests store less carbon than the pre-existing natural primary forest, secondary (regenerating) natural forests or a primary forest under the same environmental conditions.

- Consistent with our understanding of the lifetime of the airborne fraction of a pulse of $CO_2$, the most effective form of climate change mitigation is to avoid carbon emissions from all sources.

Pecl, et al. 2017 "review the consequences of climate-driven species redistribution for economic development and the provision of ecosystem services, including livelihoods, food security, and culture, as well as for feedbacks on the climate itself." They state, "Despite mounting evidence for the pervasive and substantial impacts of a climate-driven redistribution of Earth's species, current global goals, policies, and international agreements fail to account for these effects. … To date, all key international discussions and agreements regarding climate change have focused on the direct socioeconomic implications of emissions reduction and on funding mechanisms; **shifting natural ecosystems have not yet been considered in detail**." (Emphasis added.)

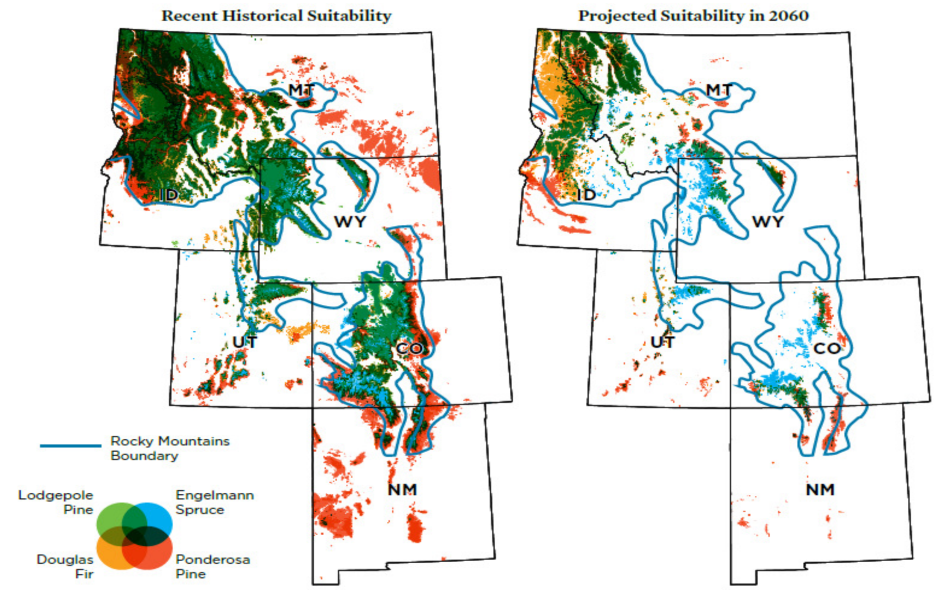
Pecl, et al. 2017 conclude:

> The breadth and complexity of the issues associated with the global redistribution of species driven by changing climate are creating profound challenges, with species movements already affecting societies and regional economies from the tropics to polar regions. Despite mounting evidence for these impacts, current global goals, policies, and international agreements do not sufficiently consider species range shifts in their formulation or targets. Enhanced awareness, supported by appropriate governance, will provide the best chance of

minimizing negative consequences while maximizing opportunities arising from species movements—movements that, with or without effective emission reduction, will continue for the foreseeable future, owing to the inertia in the climate system.

From a report by the Union of Concerned Scientists & Rocky Mountain Climate Organization (Funk et al., 2014):

FIGURE 5 AND TABLE 1. **Projected Changes in Suitable Ranges for Key Rocky Mountain Tree Species**




| Species | Current | 2060 | | |
|---|---|---|---|---|
| | Recent Historical Suitability (acres) | Projected Suitability (acres) | Net Change in Suitability (acres) | Percent Net Change |
| Lodgepole Pine | 60,474,000 | 6,065,000 | -54,409,000 | -90% |
| Ponderosa Pine | 39,842,000 | 7,771,000 | -32,071,000 | -80% |
| Engelmann Spruce | 64,651,000 | 21,999,000 | -42,652,000 | -66% |
| Douglas Fir | 53,620,000 | 22,606,000 | -31,014,000 | -58% |

The caption under Funk et al.'s Figure 5 and Table 1 states:

> Much of the current range of these four widespread Rocky Mountain conifer species is projected to become climatically unsuitable for them by 2060 if emissions of heat-trapping gases continue to rise. The map on the left shows areas projected to be climatically suitable for these tree species under the recent historical (1961–1990) climate; the map on the right depicts conditions projected for 2060 given medium-high levels of heat-trapping emissions. Areas in color have at least a 50 percent likelihood of being climatically suitable according to the models, which did not address other factors that affect where species occur (e.g., soil types). Emissions levels reflect the A2 scenario of the Intergovernmental Panel on Climate Change. For more about this methodology, see www.ucsusa.org/forestannex.

Moomaw and Smith, 2017 identify the need for forest protection to be an urgent, national priority in the fight against climate change and as a safety net for communities against extreme weather events caused by a changing climate. As those authors explain:

> Global climate change is caused by excess $CO_2$ and other greenhouse gases transferred to the atmosphere from other pools. Human activities, including combustion of fossil fuels

and bioenergy, forest loss and degradation, other land use changes, and industrial processes, have contributed to increasing atmospheric $CO_2$, the largest contributor to global warming, which will cause temperatures to rise and stay high into the next millennium or longer.

The most recent measurements show the level of atmospheric carbon dioxide has reached 400 parts per million and will likely to remain at that level for millennia to come. Even if all fossil fuel emissions were to cease and all other heat-trapping gases were no longer emitted to the atmosphere, temperatures close to those achieved at the emissions peak would persist for the next millennium or longer.

Meeting the goals of the Paris Agreement now requires the implementation of strategies that result in negative emissions, i.e., extraction of carbon dioxide from the atmosphere. In other words, we need to annually remove more carbon dioxide from the atmosphere than we are emitting and store it long-term. Forests and soils are the only proven techniques that can pull vast amounts of carbon dioxide out of the atmosphere and store it at the scale necessary to meet the Paris goal. Failure to reduce biospheric emissions and to restore Earth's natural climate stabilization systems will doom any attempt to meet the Paris (COP21) global temperature stabilization goals.

The most recent U.S. report of greenhouse gas emissions states that our forests currently "offset" 11 to 13 percent of total U.S. annual emissions. That figure is half that of the global average of 25% and only a fraction of what is needed to avoid climate catastrophe. And while the U.S. government and industry continue to argue that we need to increase markets for wood, paper, and biofuel as climate solutions, the rate, scale, and methods of logging in the United States are having significant, negative climate impacts, which are largely being ignored in climate policies at the international, national, state, and local levels.

The actual carbon stored long-term in harvested wood products represents less than 10 percent of that originally stored in the standing trees and other forest biomass. If the trees had been left to grow, the amount of carbon stored would have been even greater than it was 100 years prior. Therefore, from a climate perspective, the atmosphere would be better off if the forest had not been harvested at all. In addition, when wood losses and fossil fuels for processing and transportation are accounted for, carbon emissions can actually exceed carbon stored in wood products.

Like all forests, the Flathead is an important part of the global carbon cycle. Clear scientific information reinforces the critical need to conserve all existing stores of carbon in forests to keep it out of the atmosphere. Given that forest policies in other countries and on private lands are politically more difficult to influence, the FS must take a leadership role to maintain and increase carbon storage on publicly owned forests, in order to help mitigate climate change effects. The agency is failing to do so.

The effects of climate change have already been significant, particularly in the region. Westerling, et al. 2006 state:

> Robust statistical associations between wildfire and hydro-climate in western forests indicate that increased wildfire activity over recent decades reflects sub-regional responses to changes in climate. Historical wildfire observations exhibit an abrupt transition in the mid-1980s from a regime of infrequent large wildfires of short (average of one week) duration to one with much more frequent and longer-burning (five weeks) fires. This transition was marked by a shift toward unusually warm springs, longer summer dry seasons, drier vegetation (which provoked more and longer-burning large wildfires), and longer fire seasons. Reduced winter precipitation and an early spring snowmelt played a role in this shift. Increases in wildfire were particularly strong in mid-elevation forests. …The greatest increases occurred in mid-elevation, Northern Rockies forests, where land-use histories have relatively little effect on fire risks, and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt.

Running, 2006 cites model runs of future climate scenarios from the 4th Assessment of the Intergovernmental Panel on Climate Change, stating:

> (S)even general circulation models have run future climate simulations for several different carbon emissions scenarios. These simulations unanimously project June to August temperature increases of 2° to 5°C by 2040 to 2069 for western North America. The simulations also project precipitation decreases of up to 15% for that time period (*11*). Even assuming the most optimistic result of no change in precipitation, a June to August temperature increase of 3°C would be roughly three times the spring-summer temperature increase that Westerling *et al.* have linked to the current trends. Wildfire burn areas in Canada are expected to increase by 74 to 118% in the next century (*12*), and similar increases seem likely for the western United States.

Pederson et al. (2009) note that western Montana has already passed through 3 important, temperature-driven ecosystem thresholds.

The Pacific Northwest Research Station, 2004 recognizes "(a) way that climate change may show up in forests is through changes in disturbance regimes—the long-term patterns of fire, drought, insects, and diseases that are basic to forest development."

Depro, et al., 2008 found that ending commercial logging on U.S. national forests and allowing forests to mature instead would remove an additional amount of carbon from the atmosphere equivalent to 6 percent of the U.S. 2025 climate target of 28 percent emission reductions.

Forest recovery following logging and natural disturbances are usually considered a given. But forests have recovered under climatic conditions that no longer exist. Higher global temperatures and increased levels of disturbance are contributing to greater tree mortality in many forest ecosystems, and these same drivers can also limit forest regeneration, leading to vegetation type conversion. (Bart et al. 2016.)

The importance of trees for carbon capture will rise especially if, as recent evidence suggests, hopes for soils as a carbon sink may be overly optimistic. (He et al., 2016.) Such a potentially reduced role of soils doesn't mean that forest soils won't have a role in capture and storage of carbon, rather it puts more of the onus on aboveground sequestration by trees, even if there is a conversion to unfamiliar mixes of trees.

The FEIS defines carbon sequestration: "The direct removal of carbon dioxide from the atmosphere through biological processes such as forest growth." The IPNF Forest Plan draft EIS better explains carbon sequestration: "…the process by which atmospheric carbon dioxide is taken up by vegetation through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils."

The FS ignores $CO_2$ and other greenhouse gas emissions from other common human activities related to forest management and recreational uses. These include emissions associated with machines used for logging and associated activities, vehicle use for administrative actions, recreational motor vehicles, and emissions associated with livestock grazing. The FS is simply ignoring the climate impacts of these management and other authorized or allowed activities.

Kassar and Spitler, 2008 provide an analysis of the carbon footprint of off-road vehicles in California. They determined that:

> Off-road vehicles in California currently emit more than 230,000 metric tons — or 5000 million pounds — of carbon dioxide into the atmosphere each year. This is equivalent to the emissions created by burning 500,000 barrels of oil. The 26 million gallons of gasoline consumed by off-road vehicles each year in California is equivalent to the amount of gasoline used by 1.5 million car trips from San Francisco to Los Angeles.
>
> . . . Off-road vehicles emit considerably more pollution than automobiles. According to the California Air Resources Board, off-road motorcycles and all-terrain vehicles produce 118 times as much smog-forming pollutants as do modern automobiles on a per-mile basis.
>
> . . . Emissions from current off-road vehicle use statewide are equivalent to the carbon dioxide emissions from 42,000 passenger vehicles driven for an entire year or the electricity used to power 30,500 homes for one year.

Also, Sylvester, 2014 provides data on the amount of fossil fuel being consumed by snowmobiles in Montana, from which one can calculate the carbon footprint. The study finds that resident snowmobilers burn 3.3 million gallons of gas in their snowmobiles each year and a similar amount of fuel to transport themselves and their snowmobiles to and from their destination. Non-residents annually burn one million gallons of gas in snowmobiles and about twice that in related transportation. So that adds up to 9.6 million gallons of fuel consumed in the pursuit of snowmobiling each year in Montana alone. Multiply that by 20 pounds of carbon dioxide per gallon of gas (diesel pickups spew 22 pounds per gallon) and snowmobiling releases 192 million pounds (96 thousand tons) of climate-warming $CO_2$ per year into the atmosphere. Can we really afford this?

The FS distracts from the emerging scientific consensus that removing wood or ***any*** biomass from the forest only worsens the climate change problem. Law and Harmon, 2011 conducted a literature review and concluded:

> Thinning forests to reduce potential carbon losses due to wildfire is in direct conflict with carbon sequestration goals, and, if implemented, would result in a net emission of CO2 to the atmosphere because the amount of carbon removed to change fire behavior is often far larger than that saved by changing fire behavior, and more area has to be harvested than will ultimately burn over the period of effectiveness of the thinning treatment.

Best available science supports the proposition that forest policies must shift away from logging if carbon sequestration is prioritized. Forests must be preserved indefinitely for their carbon storage value. Forests that have been logged should allowed to convert to eventual old-growth condition. This type of management has the potential to double the current level of carbon storage in some regions. (*See* Harmon and Marks, 2002; Harmon, 2001; Harmon et al., 1990; Homann et al., 2005; Law, 2014; Solomon et al., 2007; Turner et al., 1995; Turner et al., 1997; Woodbury et al., 2007.)

Kutsch et al., 2010 provide an integrated view of the current and emerging methods and concepts applied in soil carbon research. They use a standardized protocol for measuring soil $CO_2$ efflux, designed to improve future assessments of regional and global patterns of soil carbon dynamics:

> Excluding carbonate rocks, soils represent the largest terrestrial stock of carbon, holding approximately 1,500 Pg (1015 g) C in the top metre. This is approximately twice the amount held in the atmosphere and thrice the amount held in terrestrial vegetation. Soils, and soil organic carbon in particular, currently receive much attention in terms of the role they can play in mitigating the effects of elevated atmospheric carbon dioxide ($CO_2$) and associated global warming. Protecting soil carbon stocks and the process of soil carbon sequestration, or flux of carbon into the soil, have become integral parts of managing the global carbon balance. This has been mainly because many of the factors affecting the flow of carbon into and out of the soil are affected directly by **land-management practices**. (Emphasis added.)

Moomaw and Smith, 2017 state:

> Multiple studies warn that carbon emissions from soil due to logging are significant, yet under-reported. One study found that logging or clear-cutting a forest can cause carbon emissions from soil disturbance for up to fifty years. Ongoing research by an N.C. State University scientist studying soil emissions from logging on Weyerhaeuser land in North Carolina suggests that "logging, whether for biofuels or lumber, is eating away at the carbon stored beneath the forest floor."

Moomaw and Smith, 2017 examined the scientific evidence implicating forest biomass removal as contributing to climate change:

> All plant material releases slightly more carbon per unit of heat produced than coal. Because plants produce heat at a lower temperature than coal, wood used to produce electricity produces up to 50 percent more carbon than coal per unit of electricity.
>
> Trees are harvested, dried, and transported using fossil fuels. These emissions add about 20 percent or more to the carbon dioxide emissions associated with combustion.

Harmon and Law, 2016, of Oregon State University wrote the following in a letter to members of the U.S. Senate in response to a bill introduced that would essentially designate the burning of trees as carbon neutral:

> The [carbon neutrality] bills' assumption that emissions do not increase atmospheric concentrations when forest carbon stocks are stable or increasing is clearly not true scientifically. It ignores the cause and effect basis of modern science. Even if forest carbon stocks are increasing, the use of forest biomass energy can reduce the rate at which forest carbon is increasing. Conservation of mass, a law of physics, means that atmospheric carbon would have to become higher as a result of this action than would have occurred otherwise. One cannot legislate that the laws of physics cease to exist, as this legislation suggests.

Van der Werf, et al. 2009 discuss the effects of land-management practices and state:

> (T)he maximum reduction in $CO_2$ emissions from avoiding deforestation and forest degradation is probably about 12% of current total anthropogenic emissions (or 15% if peat degradation is included) - and that is assuming, unrealistically, that emissions from deforestation, forest degradation and peat degradation can be completely eliminated.
>
> ...reducing fossil fuel emissions remains the key element for stabilizing atmospheric $CO_2$ concentrations.
>
> (E)fforts to mitigate emissions from tropical forests and peatlands, and maintain existing terrestrial carbon stocks, remain critical for the negotiation of a post-Kyoto agreement. Even our revised estimates represent substantial emissions ...

Keith et al., 2009 state:

> Both net primary production and net ecosystem production in many old forest stands have been found to be positive; they were lower than the carbon fluxes in young and mature stands, but not significantly different from them. Northern Hemisphere forests up to 800 years old have been found to still function as a carbon sink. Carbon stocks can continue to accumulate in multi-aged and mixed species stands because stem respiration rates decrease with increasing tree size, and continual turnover of leaves, roots, and woody material contribute to stable components of soil organic matter. There is a growing body of evidence that forest ecosystems do not necessarily reach an equilibrium between assimilation and respiration, but can continue to accumulate carbon in living biomass, coarse woody debris, and soils, and therefore may act as net carbon sinks for long periods. Hence, process-based models of forest growth and carbon cycling based on an assumption that stands are even-aged and carbon exchange reaches an equilibrium may underestimate productivity and carbon accumulation in some forest types. Conserving forests with large stocks of biomass from deforestation and degradation avoids significant carbon emissions to the atmosphere. Our insights into forest types and forest conditions that result in high biomass carbon density can be used to help identify priority areas for conservation and restoration.

DellaSala and Koopman, 2015 conclude:

> Wildfire is not increasing compared to historic periods – Wildfires, including very large ones, for the most part, are not increasing in western forests based on published accounts

that use historical baselines. Recent increases (past few decades) in acres burned in places (e.g., Sierra Mountains) are ostensibly due to a climate signal but even those have less fire today compared to historical times when fire was much more prevalent.

Large fires are driven more by climate than fuels – Large fires are mainly controlled by extreme weather events, and extreme events are likely to increase as the climate changes.

Most carbon is stored, not emitted, during fires – Large fires are not currently big emitters of carbon dioxide given that fine fuels, not large trees, are combusted and most carbon remains stored in dead trees on site with sequestration rapidly following re-vegetation post-fire.

Maturing natural forests are not accumulating more fuels – As the time between fires increases in mixed-severity fire systems, this is not necessarily associated with higher fire risk presumably due to shading of combustible understory plants as forests mature. Tree plantations accumulate unnaturally high fuel loads and are the biggest fire risk.

Thinned areas and fire outbreaks are unlikely to overlap – Because fires in any single location are extremely rare, the chance of thinned areas, even over large landscapes, encountering fire within the timeframe that thinning is most effective is very low. Thinning over large landscapes is a net emitter of carbon dioxide. To reduce emissions, thinning should be limited to small trees, areas nearest homes, and plantations.

Biomass is "renewable" only over long time frames while drastic greenhouse gas emissions cuts are needed over shorter time frames – There is a mismatch between the deep and immediate cuts that are needed to prevent catastrophic climate change and the emissions trajectory associated with using biomass for energy production, which immediately releases energy production, which immediately releases decades to centuries of carbon stored in forests to the atmosphere and requires many decades of regrowth to sequester that carbon again.

Biomass can produce higher CO2 emissions than coal – The amount of carbon dioxide released from woody biomass combustion per unit of energy produced is comparable to coal and much larger than oil and natural gas.

Hanson, 2010 addresses some of the false notions often misrepresented as "best science" by agencies, extractive industries and the politicians they've bought:

Our forests are functioning as carbon sinks (net sequestration) where logging has been reduced or halted, and wildland fire helps maintain high productivity and carbon storage.

Even large, intense fires consume less than 3% of the biomass in live trees, and carbon emissions from forest fires is only tiny fraction of the amount resulting from fossil fuel consumption (even these emissions are balanced by carbon uptake from forest growth and regeneration).

> "Thinning" operations for lumber or biofuels do not increase carbon storage but, rather, reduce it, and thinning designed to curb fires further threatens imperiled wildlife species that depend upon post-fire habitat.

Campbell et al., 2011 also refutes the notion that fuel-reduction treatments increase forest carbon storage in the western US:

> It has been suggested that thinning trees and other fuel-reduction practices aimed at reducing the probability of high-severity forest fire are consistent with efforts to keep carbon (C) sequestered in terrestrial pools, and that such practices should therefore be rewarded rather than penalized in C-accounting schemes. By evaluating how fuel treatments, wildfire, and their interactions affect forest C stocks across a wide range of spatial and temporal scales, we conclude that this is extremely unlikely. Our review reveals high C losses associated with fuel treatment, only modest differences in the combustive losses associated with high-severity fire and the low-severity fire that fuel treatment is meant to encourage, and a low likelihood that treated forests will be exposed to fire. Although fuel-reduction treatments may be necessary to restore historical functionality to fire-suppressed ecosystems, we found little credible evidence that such efforts have the added benefit of increasing terrestrial C stocks.

Mitchell et al. (2009) also refutes the assertion that logging to reduce fire hazard helps store carbon, and conclude that although thinning can affect fire, management activities are likely to remove more carbon by logging than will be stored by trying to prevent fire.

Forests affect the climate, climate affects the forests, and there's been increasing evidence of climate triggering forest cover loss at significant scales (Breshears et al. 2005), forcing tree species into new distributions "unfamiliar to modern civilization" (Williams et al. 2012), and raising a question of forest decline across the 48 United States (Cohen et al. 2016).

In 2012 Forest Service scientists reported, "Climate change will alter ecosystem services, perceptions of value, and decisions regarding land uses." (Vose et al. 2012.)

The 2014 National Climate Assessment chapter for the Northwest is prefaced by four "key messages" including this one: "The combined impacts of increasing wildfire, insect outbreaks, and tree diseases are already causing widespread tree die-off and are virtually certain to cause additional forest mortality by the 2040s and long-term transformation of forest landscapes. Under higher emissions scenarios, extensive conversion of subalpine forests to other forest types is projected by the 2080s." (Mote et al. 2014.)

None of this means that longstanding values such as conservation of old-growth forests are no longer important. Under increasing heat and its consequences, we're likely to get unfamiliar understory and canopy comprised of a different mix of species. This new assortment of plant species will plausibly entail a new mix of trees, because some familiar tree species in the U.S. Northern Rockies may not be viable—or as viable—under emerging climate conditions.

That said, the plausible new mix will include trees for whom the best policy will be in allowing them to achieve their longest possible lifespan, for varied reasons including that big trees will still serve as important carbon capture and storage (Stephenson et al. 2014).

Managing forest lands with concerns for water will be increasingly difficult under new conditions expected for the 21st century. (Sun and Vose, 2016.) Already, concerns have focused on new extremes of low flow in streams. (Kormos et al. 2016.) The 2014 National Climate Assessment Chapter for the Northwest also recognizes hydrologic challenges ahead: “Changes in the timing of streamflow related to changing snowmelt are already observed and will continue, reducing the supply of water for many competing demands and causing far-reaching ecological and socioeconomic consequences.” (Mote et al. 2014.)

Heat, a long-established topic of physics, plays an equally important role at the level of plant and animal physiology—every organism only survives and thrives within thermal limits. For example, Pörtner et al. (2008) point out, “All organisms live within a limited range of body temperatures… Direct effects of climatic warming can be understood through fatal decrements in an organism's performance in growth, reproduction, foraging, immune competence, behaviors and competitiveness.” The authors further explain, “Performance in animals is supported by aerobic scope, the increase in oxygen consumption rate from resting to maximal.” In other words, rising heat has the same effect on animals as reducing the oxygen supply, and creates the same difficulties in breathing. But breathing difficulties brought on by heat can have important consequences even at sub-lethal levels. In the case of grizzly bears, increased demand for oxygen under increasing heat has implications for vigorous (aerobically demanding) activity including digging, running in pursuit of prey, mating, and the play of cubs.

Malmsheimer et al. 2008 state, “Forests are shaped by climate. Along with soils, aspect, inclination, and elevation, climate determines what will grow where and how well. Changes in temperature and precipitation regimes therefore have the potential to dramatically affect forests nationwide.”

Kirilenko and Sedjo, 2007 state “The response of forestry to global warming is likely to be multifaceted. On some sites, species more appropriate to the climate will replace the earlier species that is no longer suited to the climate.”

Some FS scientists recognize this changing situation, for instance Johnson, 2016:

> Forests are changing in ways they’ve never experienced before because today’s growing conditions are different from anything in the past. The climate is changing at an unprecedented rate, exotic diseases and pests are present, and landscapes are fragmented by human activity often occurring at the same time and place.
>
> The current drought in California serves as a reminder and example that forests of the 21st century may not resemble those from the 20th century. “When replanting a forest after disturbances, does it make sense to try to reestablish what was there before? Or, should we find re-plant material that might be more appropriate to current and future conditions of a changing environment?

> “Restoration efforts on U.S. Forest Service managed lands call for the use of locally adapted and appropriate native seed sources. The science-based process for selecting these seeds varies, but in the past, managers based decisions on the assumption that present site conditions are similar to those of the past.
>
> “This may no longer be the case.”

The issue of forest response to climate change is also of course an issue of broad importance to community vitality and economic sustainability. Raising a question about persistence of forest stands also raises questions about hopes—and community economic planning—for the sustainability of forest-dependent jobs. Allen et al., 2015 state:

> Patterns, mechanisms, projections, and consequences of tree mortality and associated broad-scale forest die-off due to drought accompanied by warmer temperatures—hotter drought”, an emerging characteristic of the Anthropocene—are the focus of rapidly expanding literature.
>
> …(R)ecent studies document more rapid mortality under hotter drought due to negative tree physiological responses and accelerated biotic attacks. Additional evidence suggesting greater vulnerability includes rising background mortality rates; projected increases in drought frequency, intensity, and duration; limitations of vegetation models such as inadequately represented mortality processes; warming feedbacks from die-off; and wildfire synergies.
>
> …We also present a set of global vulnerability drivers that are known with high confidence: (1) droughts eventually occur everywhere; (2) warming produces hotter droughts; (3) atmospheric moisture demand increases nonlinearly with temperature during drought; (4) mortality can occur faster in hotter drought, consistent with fundamental physiology; (5) shorter droughts occur more frequently than longer droughts and can become lethal under warming, increasing the frequency of lethal drought nonlinearly; and (6) mortality happens rapidly relative to growth intervals needed for forest recovery.
>
> These high-confidence drivers, in concert with research supporting greater vulnerability perspectives, support an overall viewpoint of greater forest vulnerability globally. We surmise that mortality vulnerability is being discounted in part due to difficulties in predicting threshold responses to extreme climate events. Given the profound ecological and societal implications of underestimating global vulnerability to hotter drought, we highlight urgent challenges for research, management, and policy-making communities.

Moomaw and Smith, 2017 conclude:

> With the serious adverse consequences of a changing climate already occurring, it is important to broaden our view of sustainable forestry to see forests …as complex ecosystems that provide valuable, multiple life-supporting services like clean water, air, flood control, and carbon storage. We have ample policy mechanisms, resources, and funding to support conservation and protection if we prioritize correctly.

> …We must commit to a profound transformation, rebuilding forested landscapes that sequester carbon in long-lived trees and permanent soils. Forests that protect the climate also allow a multitude of species to thrive, manage water quality and quantity and protect our most vulnerable communities from the harshest effects of a changing climate.
>
> Protecting and expanding forests is not an "offset" for fossil fuel emissions. To avoid serious climate disruption, it is essential that we simultaneously reduce emissions of carbon dioxide from burning fossil fuels and bioenergy along with other heat trapping gases and accelerate the removal of carbon dioxide from the atmosphere by protecting and expanding forests. It is not one or the other. It is both!
>
> Achieving the scale of forest protection and restoration needed over the coming decades may be a challenging concept to embrace politically; however, forests are the only option that can operate at the necessary scale and within the necessary time frame to keep the world from going over the climate precipice. Unlike the fossil fuel companies, whose industry must be replaced, the wood products industry will still have an important role to play in providing the wood products that we need while working together to keep more forests standing for their climate, water, storm protection, and biodiversity benefits.
>
> It may be asking a lot to "rethink the forest economy" and to "invest in forest stewardship," but tabulating the multiple benefits of doing so will demonstrate that often a forest is worth much more standing than logged. Instead of subsidizing the logging of forests for lumber, paper and fuel, society should pay for the multiple benefits of standing forests. It is time to value U.S. forests differently in the twenty-first century. We have a long way to go, but there is not a lot of time to get there.

Much FEIS analysis for vegetation and fuels is based upon "historical (reference) conditions". Also, the FEIS states, "Managers often refer to the historic range of variation as an analogue to use in managing for tree species composition and structure." However much Forest Plan direction (e.g. the Element "Desired Conditions") is defined in terms of reference conditions or historical conditions that are invalid under scientifically accepted climate change scenarios.

As the KNF's March 2017 Galton Final Environmental Impact Statement explains:

> This analysis identifies specific disturbance processes, together with landform and other environmental elements, which have influenced the patterns of vegetation across the Decision Area. Vegetative Response Units (VRUs) were used to define and describe the components of ecosystems. VRUs are used to describe an aggregation of land having similar capabilities and potentials for management. These ecological units have similar properties in natural communities: soils, hydrologic function, landform and topography, lithology, climate, air quality, and natural processes (nutrient and biomass cycling, succession, productivity, and fire regimes).
>
> Each VRU has a characteristic frequency and type of disturbance based on its climate, soils, vegetation, animals, and other factors. Populations of native plants and animals have responded and adapted to these characteristic disturbance regimes over time (~2500 years) and the resulting vegetation patterns, processes, and structure within a historical range of

variability. These characteristic processes, patterns, and structure are termed "Reference Conditions".

It's clear that "reference conditions" (and the Desired Conditions based on reference conditions) are no longer valid conceptually as a management target. DCs are likely not achievable or sustainable. The Forest Plan and FEIS do not provide, nor cite, any discussion as to how realistic and achievable Forest Plan desired conditions are in the context of a rapidly changing climate.

In a literature review, Simons (2008) states, "Restoration efforts aimed at the maintenance of historic ecosystem structures of the pre-settlement era would most likely reduce the resilient characteristics of ecosystems facing climate change (Millar and Woolfenden, 1999)." The analysis areas have been fundamentally changed, so the agency must consider how much native forest it has fundamentally altered compared to historic conditions before prescribing "treatments". And that includes considering the effects of human-induced climate change. Essentially, this means considering new scientific information on all kinds of changes away from historic conditions.

Global warming and its consequences are effectively *irreversible* which implicates certain legal consequences under NEPA and NFMA and ESA (e.g., 40 CFR § 1502.16; 16 USC §1604(g); 36 CFR §219.12; ESA Section 7; 50 CFR §§402.9, 402.14). All net carbon emissions from logging represent "irretrievable and irreversible commitments of resources" and therefore such impacts are significant.

The Committee of Scientists, 1999 recognize the importance of forests for their contribution to global climate regulation. Also, the 2012 Planning Rule recognizes, in its definition of *Ecosystem services*, the "Benefits people obtain from ecosystems, including: (2) *Regulating services,* such as long term storage of carbon; climate regulation…"

Harmon, 2009 is the written record of "Testimony Before the Subcommittee on National Parks, Forests, and Public Lands of the Committee of Natural Resources for an oversight hearing on The Role of Federal Lands in Combating Climate Change." The author "reviews, in terms as simple as possible, how the forest system stores carbon, the issues that need to be addressed when assessing any proposed action, and some common misconceptions that need to be avoided." His testimony begins, "I am here to …offer my expertise to the subcommittee. I am a professional scientist, having worked in the area of forest carbon for nearly three decades. During that time I have conducted numerous studies on many aspects of this problem, have published extensively, and provided instruction to numerous students, forest managers, and the general public."

The FS has not taken a "hard look" at how the Forest Plan would be in accord with the agency's 2010 National Roadmap for Responding to Climate Change, which includes guidance to:

a. Assess vulnerability of species and ecosystems to climate change
b. Restore resilience
c. Promote carbon sequestration
d. Connect habitats, restore important corridors for fish and wildlife, decrease fragmentation and remove impediments to species migration.

The National Fish, Wildlife and Plants Climate Adaptation Strategy (https://www.wildlifeadaptationstrategy.gov/) describes climate change effects and emphasizes conservation of habitats and reduction of non-climate stressors to help fish and wildlife adapt.

The FEIS failed to analyze and disclose emissions of greenhouse gases from livestock grazing in FS allotments.

Nitrous oxide is a by-product generated by the microbial breakdown of nitrogen in livestock manure, is a potent greenhouse gas. And the digestion of organic material by livestock is a large source of methane emission. Methane is a far more potent substance than $CO_2$ causing climate change. Beschta et al 2012 review some of the science on livestock exacerbation of climate change:

> Livestock production impacts energy and carbon cycles and globally contributes an estimated 18% to the total anthropogenic greenhouse gas (GHG) emissions (Steinfeld and others 2006). How public-land livestock contribute to these effects has received little study. Nevertheless, livestock grazing and trampling can reduce the capacity of rangeland vegetation and soils to sequester carbon and contribute to the loss of above- and below-ground carbon pools (e.g., Lal 2001b; Bowker and others 2012). Lal (2001a) indicated that heavy grazing over the long-term may have adverse impacts on soil organic carbon content, especially for soils of low inherent fertility. Although Gill (2007) found that grazing over 100 years or longer in subalpine areas on the Wasatch Plateau in central Utah had no significant impacts on total soil carbon, results of the study suggest that ''if temperatures warm and summer precipitation increases as is anticipated, [soils in grazed areas] may become net sources of CO2 to the atmosphere'' (Gill 2007, p. 88). Furthermore, limited soil aeration in soils compacted by livestock can stimulate production of methane, and emissions of nitrous oxide under shrub canopies may be twice the levels in nearby grasslands (Asner and others 2004). Both of these are potent GHGs.

Gerber, et al., 2013 state, "Livestock producers, which include meat and dairy farming, account for about 15 percent of greenhouse gas emissions around the world. That's more than all the world's exhaust-belching cars, buses, boats, and trains combined."

Saunois et al., 2016a note "the recent rapid rise in global methane concentrations is predominantly biogenic—most likely from agriculture—with smaller contributions from fossil fuel use and possibly wetlands. …Methane mitigation offers rapid climate benefits and economic, health and agricultural co-benefits that are highly complementary to $CO_2$ mitigation." (Also see Saunois et al., 2016b; Gerber et al., 2013; and the Grist articles "Why isn't the U.S. counting meat producers' climate emissions?" and "Cattle grazing is a climate disaster, and you're paying for it" and Stanford News article "Methane from food production could be wildcard in combating climate change, Stanford scientist says".)

Ripple et al. 2014 provide some data and point out the opportunities available for greenhouse gas reductions via change in livestock policy:

- At present non-$CO_2$ greenhouse gases contribute about a third of total anthropogenic $CO_2$ equivalent ($CO_2$e) emissions and 35–45% of climate forcing (the change in radiant energy retained by Earth owing to emissions of long-lived greenhouse gases) resulting from those emissions.

- Methane (CH4) is the most abundant non- $CO_2$ greenhouse gas and because it has a much shorter atmospheric lifetime (~9 years) than $CO_2$ it holds the potential for more rapid reductions in radiative forcing than would be possible by controlling emissions of $CO_2$ alone.
- We focus on ruminants for four reasons. First, ruminant production is the largest source of anthropogenic $CH_4$ emissions (Fig. 1c) and globally occupies more area than any other land use. Second, the relative neglect of this greenhouse gas source suggests that awareness of its importance is inappropriately low. Third, reductions in ruminant numbers and ruminant meat production would simultaneously benefit global food security, human health and environmental conservation. Finally, with political will, decreases in worldwide ruminant populations could potentially be accomplished quickly and relatively inexpensively.
- Worldwide, the livestock sector is responsible for approximately 14.5% of all anthropogenic greenhouse gas emissions3 (7.1 of 49 Gt $CO_2$2e yr–1). Approximately 44% (3.1 Gt $CO_2$e yr–1) of the livestock sector's emissions are in the form of CH4 from enteric fermentation, manure and rice feed, with the remaining portions almost equally shared between $CO_2$ (27%, 2 Gt $CO_2$e yr–1) from land-use change and fossil fuel use, and nitrous oxide ($N_2O$) (29%, 2 Gt $CO_2$e yr–1) from fertilizer applied to feed-crop fields and manure.
- Globally, ruminants contribute 11.6% and cattle 9.4% of all greenhouse gas emissions from anthropogenic sources.
- Lower global ruminant numbers would have simultaneous benefits for other systems and processes. For example, in some grassland and savannah ecosystems, domestic ruminant grazing contributes to land degradation through desertification and reduced soil organic carbon. Ruminant agriculture can also have negative impacts on water quality and availability, hydrology and riparian ecosystems. Ruminant production can erode biodiversity through a wide range of processes such as forest loss and degradation, land-use intensification, exotic plant invasions, soil erosion, persecution of large predators and competition with wildlife for resources.
- Roughly one in eight people in the world are severely malnourished or lack access to food owing to poverty and high food prices. With over 800 million people chronically hungry, we argue that the use of highly productive croplands to produce animal feed is questionable on moral grounds because this contributes to exhausting the world's food supply.
- In developed countries, high levels of meat consumption rates are strongly correlated with rates of diseases such as obesity, diabetes, some common cancers and heart disease. Moreover, reducing meat consumption and increasing the proportion of dietary protein obtained from high-protein plant foods — such as soy, pulses, cereals and tubers — is associated with significant human health benefits.
- The greenhouse gas footprint of consuming ruminant meat is, on average, 19–48 times higher than that of high-protein foods obtained from plants (Fig. 2), when full life cycle analysis including both direct and indirect environmental effects from 'farm to fork' for enteric fermentation, manure, feed, fertilizer, processing, transportation and land-use change are considered.

- In terms of short-term climate change mitigation during the next few decades, if all the land used for ruminant livestock production were instead converted to grow natural vegetation, increased $CO_2$ sequestration on the order of 30–470% of the greenhouse gas emissions associated with food production could be expected.
- (D)ecreasing ruminants should be considered alongside our grand challenge of significantly reducing the world's reliance on fossil fuel combustion. Only with the recognition of the urgency of this issue and the political will to commit resources to comprehensively mitigate both $CO_2$ and non- $CO_2$ greenhouse gas emissions will meaningful progress be made on climate change. For an effective and rapid response, we need to increase awareness among the public and policymakers that what we choose to eat has important consequences for climate change.

More explanation can be found at:
https://www.facebook.com/DavidAvocadoWolfe/videos/10153860126441512/

**SOIL PRODUCTIVITY**

We raised these issues in previous comments. (E.g., FOWS et al. March 2014 Citizen reVision pp. 37-38; April 2004 Citizen reVision pp. 21-22; AWR September 7, 2006 comments pp.10-11; FOWS September 29, 2016 comments pp. 2, 9.) And along with the points made on these issues in the other Objections we've incorporated, we make the following additional points.

Vegetative conditions are directly related to soil productivity, which has been damaged by past management activities on the Flathead National Forest. The Forest Plan and FEIS are not based upon the best available science regarding soil productivity.

The only quantitative soil standard adopted in the Forest Plan is FW-STD-SOIL-01:

> Vegetation management activities do not create detrimental soil conditions on more than 15 percent of an activity area. In activity areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current condition and proposed activity must not exceed 15 percent following project implementation and restoration. In areas where more than 15 percent detrimental soil conditions exist from prior activities, the effects from project implementation and restoration must address currently impaired soil functions to improve the long-term soil condition.

That standard is adopted directly from the "Forest Service Manual Section 2550 and the Region 1 Supplement 2500 - 99 - 1 (which) provide direction for maintaining soil quality." (Taylor Hellroaring EA, 1/2018.) That direction is also known as the Region 1 Soil Quality Standards (SQS).

The FEIS defines "detrimental soil disturbance" (essentially equivalent to "detrimental soil conditions"):

> Relates the intensity of soil disturbance to potential impairment of long term soil productivity. Soil disturbance thresholds whereby soil impairment could occur use

variables of compaction, rutting, displacement, severely burned soil, mass movement, and/or loss of organic matter (Forest Service Manual Supplement No. 2550-2014-1).

The Forest Plan omits Surface Erosion (found in Forest Service Manual Supplement No. 2550-2014-1) as a classification of detrimental soil disturbance, without providing scientific basis in the FEIS.

There is no Forest Plan requirement to quantify, minimize, or even consider the total amount of detrimentally disturbed soils on the Flathead NF or in a watershed.

The Forest Plan FW-STD-SOIL-01 adopts a proxy—detrimental soil disturbance—rather than more direct measures of management-induced losses or reductions of soil productivity. We are aware of no scientific information based upon Flathead NF data that correlates the proxy (areal extent of detrimental soil disturbance in activity areas) to metrics of long-term reductions in soil productivity in activity areas, which is necessary to validate the use of the proxy as a scientifically meaningful estimate of changes in soil productivity.

In practice on the Flathead NF, this proxy has resulted in observable or measurable soil damage to be completely discounted within an activity area because it falls below an arbitrary threshold—even though it may cumulatively affect the productivity of the soil.

Lacy, 2001 examines the importance of soils for ecosystem functioning and points out the failure of most regulatory mechanisms to adequately address the soils issue. From the Abstract:

> Soil is a critical component to nearly every ecosystem in the world, sustaining life in a variety of ways—from production of biomass to filtering, buffering and transformation of water and nutrients. While there are dozens of federal environmental laws protecting and addressing a wide range of natural resources and issues of environmental quality, there is a significant gap in the protection of the soil resource. Despite the critical importance of maintaining healthy and sustaining soils, conservation of the soil resource on public lands is generally relegated to a diminished land management priority. Countless activities, including livestock grazing, recreation, road building, logging, and mining, degrade soils on public lands. This article examines the roots of soil law in the United States and the handful of soil-related provisions buried in various public land and natural resource laws, finding that the lack of a public lands soil law leaves the soil resource under protected and exposed to significant harm. To remedy this regulatory gap, this article sketches the framework for a positive public lands soil protection law. This article concludes that because soils are critically important building blocks for nearly every ecosystem on earth, a holistic approach to natural resources protection requires that soils be protected to avoid undermining much of the legal protection afforded to other natural resources.

Lacy, 2001 goes on:

> Countless activities, including livestock grazing, recreation, road building, logging, mining, and irrigation degrade soils on public lands. Because there are no laws that directly address and protect soils on the public lands, consideration of soils in land use planning is usually only in the form of vaguely conceived or discretionary guidelines and monitoring

> requirements. This is a major gap in the effort to provide ecosystem-level protection for natural resources.
>
> The rise of an "ecosystem approach" in environmental and natural resources law is one of the most significant aspects of the continuing evolution of this area of law and policy. One writer has observed that there is a
>
>> fundamental change occurring in the field of environmental protection, from a narrow focus on individual sources of harm to a more holistic focus on entire ecosystems, including the multiple human sources of harm within ecosystems, and the complex social context of laws, political boundaries, and economic institutions in which those sources exist.
>
> As federal agencies focus increasingly on addressing environmental protection from a holistic perspective under the current regime of environmental laws, a significant gap remains in the federal statutory scheme: protection of soils as a discrete and important natural resource. **Because soils are essential building blocks at the core of nearly every ecosystem on earth, and because soils are critical to the health of so many other natural resources—including, at the broadest level, water, air, and vegetation—they should be protected at a level at least as significant as other natural resources.** Federal soil law (such as it is) is woefully inadequate as it currently stands. It is a missing link in the effort to protect the natural world at a meaningful and effective ecosystem level.
>
> … This analysis concludes that the lack of a public lands soil law leaves the soil resource under-protected and exposed to significant harm, and emasculates the environmental protections afforded to other natural resources.

FW-STD-SOIL-01 and the SQS are full of loopholes. Furthermore, they basically boil down to mitigation. There would be certain soil productivity losses with uncertain mitigation outcome, as explained below.

The Jam Cracker Environmental Assessment, Lolo National Forest, 2016 states:

> The Forest Service Soils Manual (FSM 2550; November 2010) and Region 1 Soil Quality Standards provide guidelines and methods to show compliance with the National Forest Management Act (NFMA). The objectives of the Region 1 Soil Quality Standards (R1 SQS) include managing National Forest System lands "without permanent impairment of land productivity and to maintain or improve soil quality", similar to the NFMA. Region 1 Soil Quality Standards are based on the use of six physical and one biological attribute to assess current soil quality and project effects. These attributes include compaction, rutting, displacement, severely-burned soils, surface erosion, soil mass movement, and organic matter.

Cumulative soil damage over geographical units such as a watershed, project area, and forestwide has implications for every other resource including water quality, the development of old-growth forests and even sustained yield of timber. The public deserves to know the scale of total area needing soil restoration in the Flathead National Forest.

In practice, the FS generally provides no idea of the degree of soil impacts in a project area—except for an estimate of detrimental soil conditions or detrimental soil disturbance (DSD)—but then only if a site happens to occur in a unit proposed for logging or burning under the project. Such a narrow view of the cumulative impacts on soils contradicts best available science and other FS policy.

The Soil and Water Conservation Practices Handbook (FSH 2509.22) states:

> Practice <u>11.01 – Determination of Cumulative Watershed Effects</u>
> OBJECTIVE: To determine the cumulative effects or impact on beneficial water uses by multiple land management activities. Past, present, or reasonably foreseeable future actions in a watershed are evaluated relative to natural or undisturbed conditions. Cumulative impacts are a change in beneficial water uses caused by the accumulation of individual impacts over time and space. Recovery does not occur before the next individual practice has begun.
>
> EXPLANATION: The Northern and Intermountain Regions will manage watersheds to avoid irreversible effects on the soil resource and to produce water of quality and quantity sufficient to maintain beneficial uses in compliance with State Water Quality Standards. Examples of potential cumulative effects are: 2) excess sediment production that may reduce fish habitat and other beneficial uses; 3) water temperature and nutrient increases that may affect beneficial uses; 4) compacted or disturbed soils that may cause site productivity loss and increased soil erosion; an 5) increased water yields and peak flows that may destabilize stream channel equilibrium.
>
> IMPLEMENTATION: As part of the NEPA process, the Forest Service will consider the potential cumulative effects of multiple land management activities in a watershed which may force the soil resource's capacity or the stream's physical or biological system beyond the ability to recover to near-natural conditions. A watershed cumulative effects feasibility analysis will be required of projects involving significant vegetation removal, prior to including them on implementation schedules, to ensure that the project, considered with other activities, will not increase sediment or water yields beyond or fishery habitat below acceptable limits. The Forest Plan will define these acceptable limits. The Forest Service will also coordinate and cooperate with States and private landowners in assessing cumulative effects in multiple ownership watersheds.

Booth, 1991 explains how soil quality conditions translate to watershed hydrology and thus, water quality and quantity:

> Drainage systems consist of all of the elements of the landscape through which or over which water travels. These elements include the soil and the vegetation that grows on it, the geologic materials underlying that soil, the stream channels that carry water on the surface, and the zones where water is held in the soil and moves beneath the surface. Also included are any constructed elements including pipes and culverts, cleared and compacted land surfaces, and pavement and other impervious surfaces that are not able to absorb water at all.

> …The collection, movement, and storage of water through drainage basins characterize the hydrology of a region. Related systems, particularly the ever-changing shape of stream channels and the viability of plants and animals that live in those channels, can be very sensitive to the hydrologic processes occurring over these basins. Typically, these systems have evolved over hundreds of thousands of years under the prevailing hydrologic conditions; in turn, their stability often depends on the continued stability of those hydrologic conditions.
>
> Alteration of a natural drainage basin, either by the impact of forestry, agriculture, or urbanization, can impose dramatic changes in the movement and storage of water. …Flooding, channel erosion, landsliding, and destruction of aquatic habitat are some of the unanticipated changes that …result from these alterations.
>
> …Human activities accompanying development can have irreversible effects on drainage-basin hydrology, particularly where subsurface flow once predominated. Vegetation is cleared and the soil is stripped and compacted. Roads are installed, collecting surface and shallow subsurface water in continuous channels. …These changes produce measurable effects in the hydrologic response of a drainage basin.

USDA Forest Service, 2008f recognizes:

> Many indirect effects are possible if soils are detrimentally-disturbed… Compaction can indirectly lead to decreased water infiltration rates, leading to increased overland flow and associated erosion and sediment delivery to stream. Increased overland flow also increases intensity of spring flooding, degrading stream morphological integrity and low summer flows.

USDA Forest Service, 2009c states:

> Compaction can decrease water infiltration rates, leading to increased overland flow and associated erosion and sediment delivery to streams. Compaction decreases gas exchange, which in turn degrades sub-surface biological activity and above-ground forest vitality. Rutting and displacement cause the same indirect effects as compaction and also channel water in an inappropriate fashion, increasing erosion potential.

Subwatersheds which have high levels of existing soil damage could indicate a potential for hydrologic and silviculture concerns. (USDA Forest Service, 2005b, p. 3.5-11, 12.) USDA Forest Service, 2007c acknowledges that soil conditions affect the overall hydrology of a watershed:

> Alteration of soil physical properties can result in loss of soil capacity to sustain native plant communities and reductions in storage and transmission of soil moisture that may affect water yield and stream sediment regimes. (P. 4-76, emphasis added.)

USDA Forest Service, 2009c states:

> Compaction can decrease water infiltration rates, leading to increased overland flow and associated erosion and sediment delivery to streams. Compaction decreases gas exchange, which in turn degrades sub-surface biological activity and above-ground forest vitality.

> Rutting and displacement cause the same indirect effects as compaction and also channel water in an inappropriate fashion, increasing erosion potential.

Kuennen et al. 2000 (a collection of Forest Service soil scientists) state:

> An emerging soils issue is the cumulative effects of past logging on soil quality. Pre-project monitoring of existing soil conditions in western Montana is revealing that, where ground-based skidding and/or dozer-piling have occurred on the logged units, soil compaction and displacement still are evident in the upper soil horizons several decades after logging. Transecting these units documents that the degree of compaction is high enough to be considered detrimental, i.e., the soils now have a greater than 15% increase in bulk density compared with undisturbed soils. Associated tests of infiltration of water into the soil confirm negative soil impacts; **the infiltration** rates on these compacted soils are several-fold slower than rates on undisturbed soil.
>
> …**The effects of extensive areas of compacted and/or displaced soil in watersheds along with impacts from roads, fire, and other activities are cumulative.** A rapid assessment technique to evaluate soil conditions related to past logging in a watershed is based on a step-wise process of aerial photo interpretation, field verification of subsamples, development of a predictive model of expected soil conditions by timber stand, application of this model to each timber stand through GIS, and finally a GIS **summarization of the predicted soil conditions in the watershed.** This information can then be combined with an assessment of road and bank erosion conditions in the watershed to give a holistic description of watershed conditions and to help understand cause/effect relationships. **The information can be related to Region 1 Soil Quality Standards to determine if, on a watershed basis, soil conditions depart from these standards.** Watersheds that do depart from Soil Quality Standards can be flagged for more accurate and intensive field study during landscape level and project level assessments. **This process is essentially the application of Soil Quality Standards at the watershed scale with the intent of maintaining healthy watershed conditions**. (Emphases added.)

Kootenai NF hydrologist Johnson, 1995 noted the hydrological implications of the cumulative soil damage caused by past management added to timber sale-induced damage from reading the scientific literature: "Studies by Dennis Harr have consistently pointed out the effects compacted surfaces (roads, skid trails, landings, and firelines) on peak flows." Elevated peak flows harm streams and rivers by increasing both bedload and suspended sediment are effects to be analyzed in a watershed analysis.

Harr, 1987 rejects absolute thresholds for making determinations of significant vs nonsignificant levels of soil compaction in watersheds, but nevertheless he does refer to his experience as noted above by Johnson, 1995. Harr, 1987 states:

> …a curvilinear relation between amount of compaction and increased flow is shown.
>
> Numerous plans, guidelines, and environmental impact statements have related the predicted amount of soil compaction to a defined threshold of compaction totalling 12 percent of watershed area. …The 12 percent figure is arbitrary. Flow changes at lesser amounts of compaction may also cause adverse impacts. …Without reference to the stream

> channels in question, we cannot arbitrarily say nothing will happen until the mythical 12 percent figure is surpassed.
>
> In some watersheds, compaction was determined from postlogging surveys, but in others, compaction was taken as the area in roads (including cut and fill surfaces), landings, and skid trails.

The FS has at times even quantified past DSD across watersheds of various sizes. USDA Forest Service 2005d states:

> **Cumulative effects may also occur at the landscape level, where large areas of compacted and displaced soil affect vegetation dynamics, runoff, and water yield regimes in a subwatershed.** About 4,849 acres are currently estimated to have sustained detrimental compaction or displacement in the American River watershed due to logging, mining, or road construction. … About 4,526 acres are currently estimated to have sustained detrimental compaction or displacement in the Crooked River watershed due to logging, mining, and road or trail construction.
>
> …An estimated 73 percent (208) of past activity areas on FS lands in American River (and an estimated 69 percent (166) of past activity areas on FS lands in Crooked River) today would show detrimental soil disturbance in excess of 20 percent. (Emphasis added.)

A recent IPNF forest plan monitoring report (USDA Forest Service 2013a) revealed the relatively high frequency of violating the 15% standard. Other units of the national forest system have monitored DSD with very mixed results (e.g., Reeves et al., 2011). The point is—as weak as the standards are—FS pledges to meet the standards must be taken with a grain of salt.

There is also an issue of reliability and validity of the FS's soil survey methods. USDA Forest Service, 2012a states:

> The U.S. Forest Service Soil Disturbance Field Guide (Page-Dumroese et al., 2009) was used to establish the sampling protocol.
>
> …Field soil survey methodology based on visual observations, such as the Region 1 Soil Monitoring Guide used here, can produce variable results among observers, and the confidence of results is dependent on the number of observations made in an area (Page-Dumroese et al., 2006). **The existing and estimated values for detrimental soil disturbance (DSD) are not absolute** and best used to describe the existing soil condition. The calculation of the percent of additional DSD from a given activity is an estimate since DSD is a combination of such factors as existing groundcover, soil texture, timing of operations, equipment used, skill of the equipment operator, the amount of wood to be removed, and sale administration.

(Emphasis added.) USDA Forest Service, 2012a admits that DSD estimates are "not absolute." In fact the DEIS states that the FS estimates DSD using "average" values from past monitoring—never considering the implication that DSD would be underestimated about half the time.

A set of cumulative soil impacts ignored by Forest Plan standards is associated with permanent, or "system" roads. Although every square foot of road is, of course compacted, this compaction is in no way limited by the application of Forest Plan standards. The same goes for existing or ongoing erosion—no amount of soil erosion on these road templates would violate the Forest Plan. Also, the detrimental soil condition "displacement" [organic matter layer(s) displaced due to management actions]—practically 100% on permanent/system roads—is not limited by Forest Plan soil standards.

Another cumulative impact the Forest Plan ignores is the existing or prior management-induced DSD on old log landings kept on the land for future use. They are typically flattened areas which had been compacted and/or had organic layers displaced to use as temporary log storage and log truck loading and often were not recontoured to original slope or decompacted following use. Unless they are being used by the current project (and thus within an activity area), they are not limited in extent by the Forest Plan soil standards. Much like system roads, there are no limits to total DSD from landings set by the Forest Plan soil standards, and there is no requirement that their extent in a project area be disclosed. Roads and log landings might be limited by other resource considerations such as road densities in sensitive wildlife habitat, but they are not limited by the Forest Plan soil standards.

Still more cumulative soil damages the Forest Plan soil standards ignore involve existing DSD on areas the FS maintains as part of the "suitable" or productive land base such as timber stands, grazing allotments and riparian zones that are <u>not within the boundaries of any current project activity areas</u>. The Forest Plan soil standards do not limit or require disclosure of the existing/prior DSD in such areas, possibly caused by past management activities such as log skidding, partially reclaimed log landings and temporary roads, firelines, burning of slash piles or other prescribed burns, compaction due to the hooves of livestock in springs, wetlands, or other riparian areas or simply in upland pasture areas. Furthermore, Forest Plan soil standards do not compel the FS to take actions that might restore the soil productivity in most such areas because their existing DSD does not matter for determining consistency with the Forest Plan soil standards —until the day arrives when a project is proposed and the damaged site in question is included within an "activity area" because it is proposed for a new round of logging and soil damage.

USDA Forest Service, 2016a explains another major cumulative effect ignored by the Forest Plan soil standards, which is the indirect effect of soil damage, or DSD, on <u>sustained yield</u>. It states that the FS "created the concept of 'Detrimental Soil Disturbance' (DSD) for National Forests in Region One as a measure to be used in assessing potential loss of soil productivity resulting from management activities." USDA Forest Service, 2016a further explains (emphases added):

> **Without maintaining land productivity, neither multiple use nor sustained (yield) can be supported by our National Forests**. Direct references to maintaining productivity are made in the Sustained Yield Act "…coordinated management of resources without impairment of the productivity of the land" and in the Forest and Rangeland Renewable Resources Act "…substantial and permanent impairment of productivity must be avoided".

> Soil quality is a more recent addition to Forest Service Standards. The Forest and Rangeland Renewable Resources Act (1974) appears to be the first legal reference made to protecting the "quality of the soil" in Forest Service directives. **Although the fundamental laws that directly govern policies of the U.S. Forest Service clearly indicate that land productivity must be preserved, increasingly references to land or soil productivity in Forest Service directives were being replaced by references to soil quality as though soil quality was a surrogate for maintaining land productivity. This was unfortunate, since although the two concepts are certainly related, they are not synonymous.**
>
> Our understanding of the relationship between soil productivity and soil quality has continued to evolve since 1974. Amendments to the Forest Service Manual, Chapter 2550 – Soil Management in 2009 and again to 2010 have helped provide some degree of clarity on this issue and acknowledged that **the relationship is not as simple as originally thought**. The 2009 (2500-2009-1) amendment to Chapter 2550 of the Forest Service Manual states in section 2550.43-5, directs the Washington Office Director of Watershed, Fish, Wildlife, Air and Rare plants to "Coordinate validation studies of soil quality criteria and indicators with Forest Service Research and Development staff to ensure soil quality measurements are appropriate to protect soil productivity" (USFS-FSM 2009). **Inadvertently this directive concedes that the relationship between soil productivity and soil quality is not completely understood.** In the end, the primary objective provided by National Laws and Directives relative to the management of Forest Service Lands continues to be to maintain and where possible potentially improve soil productivity. (Emphases added.)

USDA Forest Service, 2009c admits, in regards to project area sites where DSD soils were not to be restored by active management: "For the …severely disturbed sites… "no action" …would **create indirect negative impacts by missing an opportunity to actively restore damaged soils**. (Emphasis added.)

The FEIS does not disclose that the Forest Plan soil standards methodology for "activity areas" inherently encourages gerrymandering areas not previously logged into project "activity areas", which potentially artificially dilute the amount of effective DSD from previously logged units by creating a more favorable average.

The FEIS does not disclose that DSD percent limit is based upon the amount of damage that is operationally feasible, not scientific data that measures land and soil productivity losses caused by DSD. The Forest Plan soil standards were developed without independent scientific peer review.

DSD is merely a proxy for soil productivity. The FEIS fails to cite sufficient scientific support for validating the DSD methodology for use as a soil productivity proxy.

Discussing the SQS, USDA Forest Service, 2008a states:

> Powers (1990) cites that the rationale bulk density is largely based on collective judgment. The FS estimates that a true productivity decline would need to be as great as 15% to detect change using current monitoring methods. Thus the soil-quality standards are set to detect a decline in potential productivity of at least 15%. This does not mean that the FS

> tolerates productivity declines of up to 15%, **but merely that it recognizes problems with detection limits.** (Emphasis added.)

It is important to point out, however, that Powers refers to separate and distinct thresholds when he talks about 15% <u>increases in bulk density</u>, which is a threshold of when soil compaction is considered to be detectable, and 15% <u>areal limit for detrimental disturbance</u>, which is the soil quality standard threshold for how much of an activity area can be detrimentally disturbed (including compaction from temporary roads and heavy equipment, erosion resulting from increased runoff, puddling, displacement from skid trails, rutting, etc.). With that caveat, what Powers has to say in relation to the soil quality standard is quite revealing (as quoted in Nesser, 2002):

> (T)he 15% standard for increases in bulk density originated as the point at which we could reliably measure significant changes, considering natural variability in bulk density… (A)pplying the ***15% areal limit*** for detrimental damage is not correct... (T)hat was never the intent of the 15% limit… and ***NFMA does not say that we can create up*** **to 15%** ***detrimental conditions***, it says basically that we cannot create significant or permanent impairment, period... (Emphases added.)

USDA Forest Service 2008b stated, "The 15% change in aerial extent realizes that timber harvest and other uses of the land result in some impacts and impairment that are unavoidable. **This limit is based largely on what is physically possible**, while achieving other resource management objectives" (emphasis added). So the Forest Plan soil standards limits are based on feasibility of timber sale implementation rather than concerns over soil productivity; and additionally we have the bulk density increase limit is based upon the limitations of detection by FS bulk density measuring methods—again, <u>not concerns over soil productivity.</u>

The FS's soil proxy—its Forest Plan soil standards assumption that up to 15% of an activity area having long-term damage is consistent with NMFA and regulations—is arbitrary. The FS does not cite any scientific basis for adopting its numerical limits. Page-Dumroese et al. 2000 emphasize the importance of validating soil quality standards using the results of monitoring:

> Research information from short- or long-term research studies supporting the applicability of disturbance criteria is often lacking, or is available from a limited number of sites which have relative narrow climatic and soil ranges. …Application of selected USDA Forest Service standards indicate that **blanket threshold variables applied over disparate soils do not adequately account for nutrient distribution within the profile or forest floor depth. These types of guidelines should be continually refined to reflect pre-disturbance conditions and site-specific information.** (Emphasis added.)

Soil productivity can only be protected if it turns out that the soil standards work. To determine if they work, the FS would have to undertake objective, scientifically sound measurements of what the soil produces (grows) following management activities. But the FS has never done this on the Flathead NF.

There are more direct indices of losses in soil productivity due to management activities. A FS report by Grier et al., 1989 adopted as a measure of soil productivity: "the total amount of plant material produced by a forest per unit area per year." They cite a study finding "a 43-percent reduction in seedling height growth in the Pacific Northwest on primary skid trails relative to uncompacted areas" for example. And in another FS report, Adams and Froehlich (1981) state:

> Measurements of reduced tree and seedling growth on compacted soils show that significant impacts can and do occur. Seedling height growth has been most often studied, with reported growth reductions on compacted soils from throughout the U.S. ranging from about 5 to 50 per cent.

Detrimental soil compaction cannot be determined by mere visual observations. Kuennen, et al., 1979 discovered that although "the most significant increase in compaction occurred at a depth of 4 inches… some sites showed that maximum compaction occurred at a depth of 8 inches… Furthermore, ... subsurface compaction occurred in glacial deposits to a depth of at least 16 inches."

Cullen et al. (1991) concluded: (M)ost compaction occurs during the first and second passage of equipment." Page-Dumroese (1993), investigating logging impacts on volcanic ash-influenced soil in the IPNF, stated: "Moderate compaction was achieved by driving a Grappler log carrier over the plots twice." Page-Dumroese (1993) also cited other studies that indicated "Large increases in bulk density have been reported to a depth of about 5 cm with the first vehicle pass over the soil." Williamson and Neilsen (2000) assessed change in soil bulk density with number of passes and found 62% of the compaction to the surface 10cm came with the first pass of a logging machine. In fine textured soils, Brais and Camire (1997) demonstrated that the first pass creates 80 percent of the total disturbance to the site. Adams and Froehlich (1981) state, "(L)ittle research has yet been done to compare the compaction and related impacts caused by low-pressure and by conventional logging vehicles."

We note that it doesn't matter how sensitive the soils, how steep the land, how poor the site is for growing trees, the Forest Plan soil standard is the same arbitrary 15%. The FEIS itself includes discussion that reveals this one-size-fits-all standard is inadequate:

> Topsoil disturbance on drought-prone sites could proportionally affect the soil's ability to provide water to trees more than on wet sites where seasonal moisture stress is less.
>
> (C)oarse-textured soils appear resistant to compaction (Gomez, Powers, Singer, & Horwath, 2002) but are also nutrient poor and so particularly at risk to the nominally least risky treatments that remove forest floor (Deborah S. Page-Dumroese et al., 2010; D. S. Page-Dumroese & Jurgensen, 2006).

USDA Forest Service 2014a states:

> Management activities can result in both direct and indirect effects on soil resources. Direct and indirect effects may include alterations to physical, chemical, and/or biological properties. Physical properties of concern include structure, density, porosity, infiltration, permeability, water holding capacity, depth to water table, surface horizon thickness, and organic matter size, quantity, and distribution. Chemical properties include changes in nutrient cycling and availability. Biological concerns commonly include abundance, distribution, and productivity of the many plants, animals, microorganisms that live in and on the soil and organic detritus. (P. 3-279.)

The Forest Plan definition of DSD considers only alterations to physical properties, but not chemical or biological properties. The Forest Plan soil standards are not consistent with best available science.

USDA Forest Service, 2007 states:

> Sustained yield was defined in the …Forest Plan …as "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest System without permanent impairment of the productivity of the land." Sustained yield is based on the capacity of the lands ability to produce resources.

That statement is on point: Since the FS has no idea how much soil has been permanently impaired forestwide, "sustained yield" is an empty promise. There continues to be a lack of adequate regulatory mechanisms (Lacy, 2001) for protecting soil productivity on the Flathead NF.

The FEIS also fails to quantify or analyze cumulative forestwide deficits of coarse woody debris and fine organic matter, considering past and ongoing management activities. This is necessary to create scientifically sound direction in the Forest Plan.

The Forest Plan required mitigation or remediation of some soil damage. NEPA requires that the FS specify the effectiveness of its mitigations. (40 C.F.R. 1502.16.) The FEIS does not disclose the effectiveness of such mitigation. There is no <u>quantitative</u> monitoring data that demonstrates DSD remediation activities have taken an activity area with DSD amounts over the 15% limit to an amount that no longer violates the standard.

USDA Forest Service 2005d states:

> **Decompaction** can at least **partly restore** soil porosity and productivity. Soil displacement that mixes or removes the volcanic ash surface layer reduces soil moisture holding capacity, which may be **irreversible and irretrievable**. (Emphases added.)

Of decompaction as a mitigation, USDA Forest Service, 2015a admits:

> ***Anticipated Effectiveness:*** Low to high. Many soil characteristics and operating decisions affect the outcomes of this feature. Forest plan monitoring has shown a 30-60 percent reduction in compaction as measured by bulk density of the soil.

The FS reports, "It is acknowledged that the effectiveness of soil restoration treatments may be low, often less than 50 percent." (USDA Forest Service, 2005b at p.3.5-20.)

The FS often proposes winter logging as mitigation. Evidence that logging can affect vegetative production in the absence of significant ground disturbance was collected by Sexton (1994) and summarized by USDA Forest Service (2000a) in a study in central Oregon in postfire ponderosa pine stands, logged over snow. Sexton found that biomass of vegetation produced 1 and 2 years after postfire logging was 38 percent and 27 percent of that produced in postfire unlogged stands. He also found that postfire logging decreased canopy cover, increased exotic plant species, increased graminoid cover, and reduced overall plant species richness. Pine seedlings grew 17 percent taller on unlogged sites in this short-term study. Ground based winter logging may not be effective mitigation for soil impacts and may impede recovery of the burned area.

USDA Forest Service, 2005b states, “Monitoring of winter-logging soil effects conducted by the Forest Soil Scientist on the Bitterroot National Forest over the past 14 years has shown that 58% of the ground-based, winter-logged units failed to meet the SQS. Winter-logging resulted in an average of 16% detrimentally damaged soil.” (P. 3.5-21.)

FS Timber Sales Specialist Flatten, 2003 examines the practice of wintertime ground based logging and discusses what winter conditions provide the best protection for the soil resource. He points out the complexities and uncertainties of pulling off successful winter logging that effectively avoids of soil damage. He concludes:

> The conditions necessary to provide protection of the soil resource during winter logging can be both complex and dynamic. Guidelines that take a simplified approach, though well understood during project planning, will likely become problematic once operations begin. The result may be inadequate soil protection or unnecessary constraints on operations. Winter logging guidelines should be developed that incorporate the latest research on snowpack strength and frozen soil and provide measurable criteria for determining when appropriate conditions exist.

USDA Forest Service, 2007c also admits that soil displacement is essentially permanent anyway despite restoration:

> Surface soil loss from roads through displacement and mixing with infertile substrata also has long lasting consequences for soil productivity because of the superiority of the volcanic ash surface layer over subsoils and substrata. (, Page 4-76.)

Continual and repeated application of the Forest Plan soil standards will result in soils continuously maintained in a damaged condition.

The FEIS does not disclose the degree to which the productivity of the land and soil has been affected in the project area and forestwide due to noxious weed infestations, and how that situation is expected to change in the coming years and decades. Management activities exacerbate the spread of noxious weeds. The FEIS does not disclose the effectiveness of noxious weed treatment program mitigation.

USDA Forest Service, 2015a indicates:

> Infestations of weeds can have wide-ranging effects. They can impact soil properties such as erosion rate, soil chemistry, organic matter content, and water infiltration. Noxious weed invasions can alter native plant communities and nutrient cycles, reduce wildlife and livestock forage, modify fire regimes, alter the effects of flood events, and influence other disturbance processes (S-16). As a result, values such as soil productivity, wildlife habitat, watershed stability, and water quality often deteriorate.

## ADAPTIVE MANAGEMENT IN FOREST PLAN REVISION; ALSO MONITORING

We raised issues concerning insufficient or absent monitoring and adaptive management in comments. (E.g., incorporated SVC September 19, 2016 comments pp. 1; MEDC September 21, 2016 comments pp. 1-4, 6, 7; AWR September 7, 2006 comments pp. 4, 5-6, 9, 11, 13, 14; FOWS September 29, 2016 comments pp. 1, 8, 9, 18, 24, 28, 44-45; April 2004 Citizen reVision at pp. 22.) And along with discussions of monitoring and adaptive management in incorporated objections, we add the following.

AWR et al. September 7, 2006 comments stated:

> Regarding one of its original Forest Plans, the agency has stated, "The Forest Plan and the process used to develop it represents agreements on the management and uses of the … Forest among a wide variety of publics, agencies, Indian tribes, organizations, and individuals, it is a negotiated understanding with the public." What is at stake is nothing less than the integrity of the land resource management program, for if the Forest Service is able to leave behind a trail of broken promises and decimated habitat and forget its previous failures to maintain its "negotiated understanding with the public" by the simple expedience of adopting a new set of vague and non-binding "guidance" and objectives, then the entire forest planning process will have been rendered a sham that disenfranchises the public of its own irreplaceable resources, while paying lip service to far-sighted statutory requirements like safeguarding species biodiversity and soils and land productivity.

The National Forest Management *Act* states:

> "The Congress finds that …
> (2) the public interest is served by the Forest Service, Department of Agriculture, in cooperation with other agencies, assessing the Nation's renewable resources, and developing and preparing a national renewable resource and program, **which is periodically reviewed and updated**;
> …(5) be revised (A) from time to time when the secretary finds conditions in a unit have significantly changed, but at least every fifteen years, and (B) in accordance with the provisions of subsections (e) and (f) of this section and public involvement comparable to that required by subsection (d) of this section.
> …(d) The Secretary shall provide for public participation in the development, review, and revision of land management plans…

The FEIS fails to disclose that most monitoring and evaluation as required by the current (1986) Forest Plan has not been conducted. As a result, the Assessment and Forest Plan FEIS were not adequately informed. The failure to monitor leads to inadequate empirical basis for professional judgment or conclusions made in the FEIS and Assessment. This also frustrates a major purpose of forest plan revision, and is also not in compliance with Executive Order 11514, which provides that Agencies shall develop programs and measures to protect and enhance environmental quality <u>and shall assess progress in meeting the specific objectives </u>of such activities. When the FS simply scraps their strategies (e.g., Amendments 19 and 21, INFISH, the direction for grizzly bear conservation in the Lolo, Kootenai, and Helena-Lewis & Clark NF Plans to be dropped under the Grizzly Amendments, rejecting a list of Management Indicator

Species in favor of one Focal Species[11] and rejecting a list of Sensitive species in favor of an arbitrarily small list of Species of Conservation Concern[12])—all of which the FS previously stated was necessary to insure diversity of plants and animals—it is incumbent on the agency to explain why, and what they learned from implementing (or failing to implement) the previous strategy/forest plan. The FS has failed to do so.

Executive Order 11514 also provides that Agencies shall develop procedures to ensure the fullest practicable provision of timely public information and ***understanding*** **of Federal plans and programs** with environmental impact in order to obtain the views of interested parties. The FS has failed to do so.

The FEIS and Assessment also fails to provide an analysis of how well past FS management projects met the goals, objectives, desired conditions, etc. stated in the corresponding NEPA documents, and how well the projects conformed to forest plan standards and guidelines.

The 2012 Planning Rules also require an orderly revision of Forest Plans which is consistent with the results of monitoring that "is continuous and provides feedback for the planning cycle by testing relevant assumptions, tracking relevant conditions over time, and measuring management effectiveness." (36 CFR 219.5(a)(3).) The intent of NFMA is that forest plan revision is adaptive management to correct mistaken assumptions of the earlier plan.

Finally, as we discuss in other sections of this Objection, there is nothing the Forest Plan that compels monitoring which validate major plan assumptions. Such monitoring would seek to determine population trends of fish and wildlife species, and utilize monitoring criteria adopted after scientific peer review determines they are adequate as measurements of other metrics for ecological sustainability.

**REMEDY**

We request the FEIS Volumes, revised Flathead Forest Plan and Grizzly Amendments, and list of Species of Conservation Concern be remanded and withdrawn. We request all NCDE Forest Plans continue to implement Amendment 19 and/or its Forest-specific equivalents so the 19/19/68 objectives are met in all Grizzly Bear Management Subunits.

We request the FS prepare a Supplemental Draft EIS that addresses the analytical and scientific issues identified in this objection, and simultaneously undertake the Science Consistency Review process for the Supplemental Draft EIS and Assessment.

We request the Supplemental Draft EIS takes a hard look at the science of climate change.

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[11] The FS has not made a meaningful and functional distinction between Management Indicator Species and Focal Species.

[12] The FS has also not made a meaningful and functional distinction between Sensitive Species and Species of Conservation Concern.

## CONCLUSION

Objectors remain committed to participating in the development of ecologically sound management direction for these national forests.

Sincerely submitted,

**/s/**


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## References


Adams, P.W and H.A. Froehlich. 1981. Compaction of forest soils. Extension Publication PNW 217. 13 pp.

Allen, Craig D., David D. Breshears, Nate G. McDowell 2015. On underestimation of global vulnerability to tree mortality and forest die-off from hotter drought in the Anthropocene *ECOSPHERE* ESA Centennial Paper published 7 August 2015.

Andelman Sandy J., Steve Beissinger, Jean Fitts Cochrane, Leah Gerber, Paola Gomez-Priego, Craig Groves, Jon Haufler, Richard Holthausen, Danny Lee, Lynn Maguire, Barry Noon, Katherine Ralls, and Helen Regan; 2001. Scientific Standards For Conducting Viability Assessments Under The National Forest Management Act: Report And Recommendations Of The NCEAS Working Group. National Center for Ecological Analysis and Synthesis, November, 2001.

Angermeier, P. L., and J. R. Karr. 1994. Protecting biotic resources: Biological integrity versus biological diversity as policy directives. BioScience Vol. 44, No. 10, November 1994.

Aubry, K.B., C.M. Raley, S.W. Buskirk, W.J. Zielinski, M.K. Schwartz, R.T. Golightly, K.L. Purcell, Richard D. Weir, J. Scott Yaeger, 2013. Meta-Analyses of Habitat Selection by Fishers at Resting Sites in the Pacific Coastal Region. The Journal of Wildlife Management 77(5):965–974; 2013; DOI: 10.1002/jwmg.563

Aubry, Keith B. Kevin S. McKelvey, and Jeffrey P. Copeland, 2007. Distribution and Broadscale Habitat Relations of the Wolverine in the Contiguous United States. Journal of Wildlife Management 71(7):2147–2158; 2007

Baker, William L., Thomas T. Veblen and Rosemary L. Sherriff; 2006. Fire, fuels and restoration of ponderosa pine–Douglas fir forests in the Rocky Mountains, USA. Journal of Biogeography (J. Biogeogr.) (2006)

Bart RR, Tague CL, Moritz MA (2016). Effect of Tree-to-Shrub Type Conversion in Lower Montane Forests of the Sierra Nevada (USA) on Streamflow. PLoS ONE 11(8): e0161805. doi:10.1371/journal.pone.0161805

Bechtold, Timothy 1999. Listing the Bull Trout under the Endangered Species Act: The Passive-Aggressive Strategy of the United States Fish and Wildlife Service to Prevent Protecting Warranted Species.20 Pub. Land & Resources L. Rev. 99 (1999)

Beck, Jeffrey L., and Lowell H. Suring. 2011. Wildlife-Habitat Relationships Models: Description and Evaluation of Existing Frameworks. Chapter 10 in Millspaugh, Joshua & Frank R. Thompson (Editors), 2011**.** Models for Planning Wildlife Conservation in Large Landscapes. Academic Press.

Beiler K.J., Suzanne W. Simard, Sheri A. Maxwell & Annette M. Kretzer (2009). Architecture of the wood-wide web: Rhizopogon spp. genets link multiple Douglas-fir cohorts, *New Phytologist, 185* (2) 543-553. DOI: http://dx.doi.org/10.1111/j.1469-8137.2009.03069.x

Beschta, Robert L., Debra L. Donahue, Dominick A. DellaSala, Jonathan J. Rhodes, James R. Karr, Mary H. O'Brien, Thomas L. Fleischner, Cindy Deacon Williams. 2012. Adapting to Climate Change on Western Public Lands: Addressing the Ecological Effects of Domestic, Wild, and Feral Ungulates. Environmental Management, DOI 10.1007/s00267-012-9964-9 2012. http://www.springerlink.com/content/e239161819g0l117/fulltext.pdf

Booth, Derek B**.;** 1991. Urbanization and the Natural Drainage System—Impacts, Solutions, and Prognoses. *Northwest Environmental Journal*, v. 7, p. 93–118, 1991.

Brais, S. and C. Camire. 1997. Soil compaction induced by careful logging in the claybelt region of northwestern Quebec (Canada). Can. J. Soil Sci. 78:197-206.

Breshears, David D., Neil S. Cobb, Paul M. Rich, Kevin P. Price, Craig D. Allen, Randy G. Balice, William H. Rommei, Jude H. Kastens, M. Lisa Floyd, Jayne Belnap, Jesse J. Anderson, Orrin B. Myers, and Clifton W. Meyer; 2005. Regional vegetation die-off in response to global-change-type drought. Proceedings of the National Academy of Sciences of the United States of America, October 10, 2005.

Bull, E.L, Holthausen, R., and M.G. Henjum. 1990. Techniques for monitoring pileated woodpeckers. United States Department of Agriculture Forest Service General Technical Report PNW-GTR-269, Portland, Oregon.

Bull, Evelyn L. and Arlene K. Blumton, 1999. Effect of Fuels Reduction on American Martens and Their Prey. USDA Forest Service Department of Agriculture, Pacific Northwest Research Station, Research Note PNW-RN-539, March 1999.

Bull, Evelyn L. and Richard S. Holthausen, 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. Journal of Wildlife Management 57(2): 1993. Pp. 335-345.

Bull, Evelyn L. Richard S. Holthausen and Mark G. Henjum; 1992. Roost Trees Used by Pileated Woodpeckers in Northeastern Oregon. The Journal of Wildlife Management, Vol. 56, No. 4 (Oct., 1992), pp. 786-793.

Bull, Evelyn L., Catherine G. Parks, and Torolf R. Torgersen, 1997. Trees and Logs Important to Wildlife in the Interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-391. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55p.

Bull, E. L., N. Nielsen-Pincus, B.C. Wales, J.L. Hayes. 2007. The influence of disturbance events on pileated woodpeckers in Northeastern Oregon. Forest Ecology and Management 243:320-329.

Campbell, John L, Mark E Harmon, and Stephen R Mitchell, 2011. Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? *Front Ecol Environ* 2011; doi:10.1890/110057

Carnefix, Gary and Chris Frissell, 2009. Aquatic and Other Environmental Impacts of Roads: The Case for Road Density as Indicator of Human Disturbance and Road-Density Reduction as Restoration Target; A Concise Review. Pacific Rivers Council Science Publication 09-001. Pacific Rivers Council; PMB 219, 48901 Highway 93, Suite A, Polson, MT 59860)

Carroll, Carlos, Paul C. Paquet, and Reed F. Noss, 2001b. Carnivores as Focal Species for Conservation Planning in the Rocky Mountain Region. Ecological Applications, August, 2001, Vol. 11, No. 4 : 961-980.

Castello, J.D., D.J. Leopold, and P.J. Smallidge; 1995. Pathogens, patterns, and processes in forest ecosystems. Bioscience 45(1):16_24.

Cherry, M.B. 1997. The Black-Backed And Threetoed Woodpeckers: Life History, Habitat Use, And Monitoring Plan. Unpublished Report. On File With: U.S. Department Of Agriculture, Lewis And Clark National Forest, P.O. Box 869, Great Falls, Mt 59403. 19 P.

Christensen, Alan G.; L. Jack Lyon and James W. Unsworth, 1993. Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions. United States Department of Agriculture, Forest Service Intermountain Research Station, General Technical Report INT-303 November 1993.

Clough, Lorraine T. 2000. Nesting Habitat Selection and Productivity of Northern Goshawks in West-Central Montana. M.S. Thesis, University of Montana, 87 pp.

Cohen, Jack 1999a. Reducing the Wildland Fire Threat to Homes: Where and How Much? Pp. 189-195 *In* Proceedings of the symposium on fire economics, planning, and policy: bottom lines. April 5-9, 1999, San Diego, CA. USDA Forest Service Gen. Tech. Rep. PSW-GTR-173.

Cohen, Jack and Bret Butler, 2005. Wildlife Threat Analysis in the Boulder River Canyon: Revisited. Fire Sciences Laboratory, USDA Forest Service, Rocky Mountain Research Station, Missoula, Montana. July 26-27, 2005.

Cohen, Warren B., Zhiqiang Yang, Stephen V. Stehman, Todd A. Schroeder, David M. Bell, Jeffrey G. Masek, Chengquan Huang, Garrett W. Meigs. 2016. Forest disturbance across the conterminous United States from 1985–2012: The emerging dominance of forest decline. *Forest Ecology and Management.* 360 (2016) 242–252

Committee of Scientists, 1999. Sustaining the People's Lands. Recommendations for Stewardship of the National Forests and Grasslands into the Next Century. March 15, 1999

Copeland, Jeffrey P., James M. Peek, Craig R. Groves, Wayne E. Melquist, Kevin S. Mckelvey, Gregory W. Mcdaniel, Clinton D. Long, Charles E. Harris, 2007. Seasonal Habitat Associations of the Wolverine in Central Idaho. Journal of Wildlife Management 71(7):2201–2212; 2007.

Crocker-Bedford, D.C. 1990. Goshawk reproduction and forest management. Wildlife Society Bulletin; v. 18, no. 3, pp. 262-269.

Cullen, S.J., C. Montagne, and H Ferguson, 1991. Timber Harvest Trafficking and Soil Compaction in Western Montana. Soil Sci. Soc. Am. J., Vol. 55 (1416-1421), September-October 1991.

Darimont, Chris T., Paul C. Paquet, Adrian Treves, Kyle A. Artelle, and Guillaume Chapron; 2018. Political populations of large carnivores. Conservation Biology, Volume 32, No. 1. JAN 2018, DOI: 10.1111/cobi.13065

DellaSala, D.A., and M. Koopman. 2015. Thinning combined with biomass energy production may increase, rather than reduce, greenhouse gas emissions. Geos Institute, Ashland, OR.

DellaSala, Dominick A., Anne Martin, Randi Spivak, Todd Schulke, Bryan Bird, Marnie Criley, Chris van Daalen, Jake Kreilick, Rick Brown, and Greg Aplet, 2003. A Citizen's Call for Ecological Forest Restoration: Forest Restoration Principles and Criteria. *Ecological Restoration,* Vol. 21, No. 1, 2003 ISSN 1522-4740

Depro, Brooks M., Brian C. Murray, Ralph J. Alig, and Alyssa Shanks. 2008. Public land, timber harvests, and climate mitigation: quantifying carbon sequestration potential on U.S. Public timberlands. Forest Ecology and Management 255: 1122-1134.

Environmental Protection Agency, 1999. Considering Ecological Processes in Environmental Impact Assessments. U.S. Environmental Protection Agency, Office of Federal Activities. July 1999

Everett, Richard L., comp. 1994. Restoration of stressed sites, and processes. Gen. Tech. Rep. PNWGTR- 330. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 123 p. (Everett, Richard L., assessment team leader; Eastside forest ecosystem health assessment; volume IV.)

Fire Science Brief, 2009. Listening to the Message of the Black-backed Woodpecker, a Hot Fire Specialist. Fire Science Brief Issue 39 February 2009. www.firescience.gov/projects/briefs/04-2-1-106_FSBrief39.pdf

Flatten, Brad, 2003. Determining Appropriate Winter Logging Conditions for Protection of the Soil Resource. Okanogan & Wenatchee National Forests, December 2003 Draft.

Frissell, C.A. and D. Bayles, 1996. Ecosystem Management and the Conservation of Aquatic Biodiversity and Ecological Integrity. Water Resources Bulletin, Vol. 32, No. 2, pp. 229-240. April, 1996.

Funk, J., S. Saunders, T. Sanford, T. Easley, and A. Markham. 2014. Rocky Mountain forests at risk: Confronting climate-driven impacts from insects, wildfires, heat, and drought. Report from the Union of Concerned Scientists and the Rocky Mountain Climate Organization. Cambridge, MA: Union of Concerned Scientists.

Gautreaux, 1999. Vegetation Response Unit Characterizations and Target Landscape Prescriptions, Kootenai National Forest, 1999. United States Department Of Agriculture Forest Service, Northern Region, Kootenai National Forest.

Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. & Tempio, G. 2013. Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome.

Goggans, Rebecca, Rita. D. Dixon, and L. Claire S. Seminara, 1989. Habitat Use by Three-toed and Black-backed Woodpeckers, Deschutes National Forest, Oregon. Oregon Department of Fish and Wildlife Nongame Wildlife Program, USDA Deschutes National Forest, Technical Report #87-3-02.

Gorzelak MA, Asay AK, Pickles BJ, Simard SW. 2015. Inter-plant communication through mycorrhizal networks mediates complex adaptive behaviour in plant communities. AoB PLANTS 7: plv050; doi:10.1093/aobpla/plv050

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann, 1992. Old-growth forest types of the northern region. Northern Region, R-1 SES 4/92. Missoula, MT.

Grier, C. C., K. M. Lee, N. M. Nadkami, G. O. Klock, & P. J. Edgerton, 1989 Productivity of Forests of the United States and Its Relation to Soil and Site Factors and Management Practices: A Literature Review. USDA Forest Service General Technical Report PNW-GTR-222, March 1989.

Gucinski, Hermann; Furniss, Michael J.; Ziemer, Robert R.; Brookes, Martha H. 2001. Forest roads: a synthesis of scientific information. Gen. Tech. Rep. PNW-GTR- 509. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 103 p.

Guldin, James M., David Cawrse, Russell Graham, Miles Hemstrom, Linda Joyce, Steve Kessler, Ranotta McNair, George Peterson, Charles G. Shaw, Peter Stine, Mark Twery, Jeffrey Walte. 2003. The Science Consistency Review: A Tool to Evaluate the Use of Scientific Information in Land Management Decisionmaking. United States Department of Agriculture Forest Service FS-772, September 2003.

Guldin, James M., David Cawrse, Russell Graham, Miles Hemstrom, Linda Joyce, Steve Kessler, Ranotta McNair, George Peterson, Charles G. Shaw, Peter Stine, Mark Twery, Jeffrey Walter. 2003b. Science Consistency Reviews: A Primer for Application. United States Department of Agriculture Forest Service FS-771, September 2003.

Hanson, Chad 2010. The Myth of "Catastrophic" Wildfire: A New Ecological Paradigm of Forest Health. John Muir Project Technical Report 1 • Winter 2010 • www.johnmuirproject.org

Hargis Christina D., John A. Bissonette, and David L. Turner, 1999. The influence of forest fragmentation and landscape pattern on American martens. Journal of Applied Ecology, 1999, 36 Pp. 157-172.

Harmon, Mark E, William K. Ferrell, and Jerry F. Franklin. 1990. Effects on carbon storage of conversion of old-growth forest to young forests. Science 247: 4943: 699-702

Harmon, Mark E. & Barbara Marks, 2002. Effects of silvicultural practices on carbon stores in Douglas-fir - western hemlock forests in the Pacific Northwest, U.S.A.: results from a simulation model, 32 Canadian Journal of Forest Research 863, 871 Table 3 (2002).

Harmon, Mark E. 2001. Carbon Sequestration in Forests: Addressing the Scale Question, 99:4 Journal of Forestry 24, 24-25, 29 (2001) (citing C.F. Cooper, Carbon Storage in Managed Forests, 13:1 Canadian Journal of Forest Research 155-66 (1983); Harmon et al., infra n. 34, at 699-702; R.C. Dewar, Analytical model of carbon storage in trees, soils and wood products of managed forests, 8:3 Tree Physiology 239-58 (1991); and E.D. Schulze et al., Managing Forests after Kyoto, 289 Science 2058-59 (2000)).

Harmon, Mark E. 2009. Testimony Before the Subcommittee on National Parks, Forests, and Public Lands of the Committee of Natural Resources for an oversight hearing on "The Role of Federal Lands in Combating Climate Change", March 3, 2009. Mark E. Harmon, PhD, Richardson Endowed Chair and Professor in Forest Science, Department of Forest Ecosystems and Society, Oregon State University.

Harr, R. Dennis 1987. Myths and misconceptions about forest hydrologic systems and cumulative effects. Proceedings of the California Watershed Management Conference, November 18-20, 1986, West Sacramento, California. Wildland Resources Center, Division of Agriculture and Natural

Resources, University of California, 145 Mulford Hall, Berkeley, California 94720. Report No. 11, February, 1987.

Harmon, M. E. & Law, B. E. Concern about language in congressional bills 3. (2016). Available at: http://www.catf.us/resources/other/20160606-Scientists-Letter-to-Congress.pdf.

Harris, Larry D. 1984. The Fragmented Forest : Island Biogeography Theory and the Preservation of Biotic Diversity. Chicago Press, Chicago, Ill. 211pp.

Harrison S and Voller J. 1998. Connectivity. Voller J and Harrison S, eds. Conservation Biology Principles for Forested Landscapes. Ch3:76-97. Vancouver: UBC Press.

Harvey, A.E., J.M. Geist, G.I. McDonald, M.F. Jurgensen, P.H. Cochran, D. Zabowski, and R.T. Meurisse, 1994. Biotic and Abiotic Processes in Eastside Ecosystems: The Effects of Management on Soil Properties, Processes, and Productivity. GTR-323 93-204 (1994)

Hayes, Gerald E. and Jeffrey C. Lewis, 2006. Washington State Recovery Plan for the Fisher. Washington Department of Fish and Wildlife, Olympia. 62+ viii pp.

Hayes, John P., Alan T. Herlihy, Robert B. Jackson, Glenn P. Juday, William S. Keeton, Jessica E. Leahy, Barry R. Noon, 2011. Science Review of the United States Forest Service Draft Environmental Impact Statement for National Forest System Land Management. RESOLVE, 1255 23rd Street, NW, Suite 275, Washington, DC 20037 http://www.resolv.org. April 2011

Hayward, G. D., and R. E. Escano. 1989. Goshawk nest-site characteristics in western Montana and northern Idaho. Condor: v. 91, no. 2, pp. 476-479.

Hayward, Gregory D., 1994. Information Needs: Great Gray Owls. Chapter 17 *In:* Hayward, Gregory D., and Jon Verner, 1994. Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment. USDA Forest Service General Technical Report RM-253, pp. 207-211.

Hayward, Gregory D., and Jon Verner, 1994. Flammulated, Boreal, and Great Gray Owls in the United States: A Technical Conservation Assessment. USDA Forest Service General Technical Report RM-253

He, Yujie, Susan E. Trumbore, Margaret S. Torn, Jennifer W. Harden, Lydia J. S. Vaughn, Steven D. Allison, James T. Randerson 2016. Radiocarbon constraints imply reduced carbon uptake by soils during the 21st century. Science 23 Sep 2016: Vol. 353, Issue 6306, pp. 1419-1424 DOI: 10.1126/science.aad4273

Heinemeyer, KS and JL Jones. 1994. Fisher biology and management: a literature review and adaptive management strategy. USDA Forest *Service* Northern Region, Missoula, MT. 108 pp.

Hessburg Paul F. and James K. Agee; 2003. An environmental narrative of Inland Northwest United States forests, 1800–2000. Forest Ecology and Management 178 (2000) 23-59.

Hillis, Mike; Amy Jacobs, and Vita Wright, 2002. Black-Backed Woodpecker Assessment. U.S. Forest Service Region One.

Homann, Peter S., Mark Harmon, Suzanne Remillard, & Erica A.H. Smithwick, 2005. What the soil reveals: Potential total ecosystem C stores of the Pacific Northwest region, USA, 220 Forest Ecology and Management. 270, 281 (2005).

Huck, Schuyler W., 2000. Reading Statistics and Research (3rd Edition). New York: Longman, 2000.

Hutto, R.L. 1995. The composition of bird communities following stand-replacement fires in northern Rocky Mountain (U.S.A.) conifer forests. Conservation Biology 9:1041-1058.

Hutto, Richard L., 2006. Toward Meaningful Snag-Management Guidelines for Postfire Salvage Logging in North American Conifer Forests. Conservation Biology Volume 20, No. 4, 984–993, 2006.

Hutto, Richard L. 2008. The Ecological Importance of Severe Wildfires: Some Like it Hot. Ecological Applications, 18(8), 2008, pp. 1827–1834.

Johnson, Randy 2016. Looking to the Future and Learning from the Past in our National Forests. USDA Blog. http://blogs.usda.gov/2016/11/01/looking-to-the-future-and-learning-from-the-past-in-our-national-forests/

Johnson, Steve, 1995. Factors Supporting Road Removal and/or Obliteration, Memo from Kootenai Forest Hydrologist, February 6, 1995

Jones, Jeff, (undated) A Fisher Management Strategy for the Northern Rocky Mountains (draft). USFS Northern Region.

Jones, Jeffrey L., 1991. Habitat Use of Fisher in North-Central Idaho. A Thesis Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science with a Major in Wildlife Resources in the College of Graduate Studies. University of Idaho. 152 p.

Karr, J.R. 1991. Biological integrity: A long-neglected aspect of water resource management. Ecological Applications 1:66-84.

Kassar, Chris and Paul Spitler, 2008. Fuel to Burn: The Climate and Public Health Implications of Off-road Vehicle Pollution in California. A Center for Biological Diversity report, May 2008.

Kauffman, J. Boone, 2004. Death Rides the Forest: Perceptions of Fire Land Use, and Ecological Restoration of Western Forests. Conservation Biology, Vol. 18 No. 4, August 2004, Pp 878-882.

Keith, Heather; Brendan G. Mackey and David B. Lindenmayer. 2009. Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests PNAS July 14, 2009 vol. 106 no. 28 11635-11640

Kirilenko, Andrei P. and Roger A. Sedjo, 2007. Climate change impacts on forestry. *Proceedings of the National Academy of Sciences* © 2007 by The National Academy of Sciences of the USA.

Kootenai National Forest, 1991. Kootenai National Forest Policy Old-Growth Validation Process. FSM 1/91 KNF SUPP. 85.

Kormos, Patrick R., Charles H. Luce, Seth J. Wenger, and Wouter R. Berghuijs 2016. Trends and sensitivities of low streamflow extremes to discharge timing and magnitude in Pacific Northwest mountain streams. *Water Resources Research*. Published online 2 JUL 2016

Kosterman, Megan K., 2014. Correlates of Canada Lynx Reproductive Success in Northwestern Montana. Thesis presented in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Biology, The University of Montana, Missoula, December 2014. *Theses, Dissertations, Professional Papers.* Paper 4363.

Krebs John, Eric C. Lofroth, Ian Parfitt, 2007. Multiscale Habitat Use by Wolverines in British Columbia, Canada. Journal of Wildlife Management 71(7):2180–2192; 2007

Kuennen, L., G. Edson & T. Tolle, 1979. Soil Compaction Due To Timber Harvest Activities. Northern Region, May 1979

Kuennen, Lou; Henry Shovic, Bill Basko, Ken McBride, Jerry Niehoff, and John Nesser, 2000. Soil Quality Monitoring: A Review of Methods and Trends in the Northern Region. May 2000.

Kutsch, Werner L. Michael Bahn and Andreas Heinemeyer, Editors, 2010. Soil Carbon Dynamics: An Integrated Methodology. Cambridge University Press 978-0-521-86561-6 -

Lacy, Peter M., 2001. Our Sedimentation Boxes Runneth Over: Public Lands Soil Law As The Missing Link In Holistic Natural Resource Protection. Environmental Law; 31 Envtl. L. 433 (2001).

Larson, Michael A., Joshua J. Millspaugh, and Frank R. Thompson. 2011. A Review of Methods for Quantifying, Wildlife Habitat in Large Landscapes. Chapter 9 in Millspaugh, Joshua & Frank R. Thompson (Editors), 2011**.** Models for Planning Wildlife Conservation in Large Landscapes. Academic Press.

Law, B. & M.E. Harmon 2011. Forest sector carbon management, measurement and verification, and discussion of policy related to mitigation and adaptation of forests to climate change. Carbon Management 2011 2(1). http://terraweb.forestry.oregonstate.edu/pubs/lawharmon2011.pdf.

Law, Beverly E. 2014. Role of Forest Ecosystems in Climate Change Mitigation. Presentation by Beverly E. Law, Professor of Global Change Biology & Terrestrial Systems Science, Oregon State University. Feb. 2014. *terraweb.forestry.oregonstate.edu*

Lehmkuhl, John F., Leonard F. Ruggiero, and Patricia A. Hall; 1991. Landscape-level patterns of forest fragmentation and wildlife richness and abundance in the southern Washington Cascades. *IN:* Ruggiero, Leonard F., Keith B. Aubry, Andrew B. Carey, and Mark H. Huff, technical editors, 1991. Wildlife and vegetation of unmanaged Douglas-fir forests. USDA Forest Service PNW Gen. Tech. Report. 285 Olympia, WA 474 pp. plus appendix.

Lesica, Peter, 1996. Using Fire History Models to Estimate Proportions of Old Growth Forest In Northwest Montana, USA. <u>Biological Conservation</u> 77, p. 33-39.

Lofroth, E.C., 1997. Northern wolverine project: wolverine ecology in logged and unlogged plateau and foothill landscapes. Wildlife Branch, Victoria, British Columbia, May 7, 1997.

Lorenz, T.J.; Vierling, K.T.; Johnson, T.R.; Fischer, P.C. 2015. The role of wood hardness in limiting nest site selection in avian cavity excavators. Ecological Applications. 25: 1 016–1033. https://www.treesearch. fs.fed.us/pubs/49102

Mackey, Brendan, I. Colin Prentice, Will Steffen, Joanna I. House, David Lindenmayer, Heather Keith and Sandra Berry; 2013. Untangling the confusion around land carbon science and climate change mitigation policy. Nature Climate Change | Vol 3 | June 2013 |

Malmsheimer Robert W., Patrick Heffernan, Steve Brink, Douglas Crandall, Fred Deneke, Christopher Galik, Edmund Gee, John A. Helms, Nathan McClure, Michael Mortimer, Steve Ruddell, Matthew Smith, and John Stewart 2008. Forest Management Solutions for Mitigating Climate Change in the United States. *Journal of Forestry*. April/May 2008.

Marcot BG and Murphy DD. 1992. Population viability analysis and management. In Szaro, R., ed. Biodiversity in Managed Landscapes: Theory and Practice. Proceedings of: Conference on Biodiversity in Managed Landscapes: Theory and Practice, 13-17 July, 1992, Sacramento, CA.

Maxell, Bryce; Steve Corn; Paul Hendricks; Ted Koch; Charles Peterson; and Kirwin Werner; 1998. Unpublished letter to USFS Region 1 Species at Risk Task Group: Subject – Inclusion of the Boreal toad (*Bufo boreas boreas*) on the Sensitive SpeciesList for all Region 1 Forests. 8pp.

May, R., Landa, A., vanDijk, J., Linnell, J.D.C. and Andersen, R. 2006. Impact of infrastructure on habitat selection of wolverines *Gulo gulo*. Wildl.Biol.12:285-295. doi:10.2981/0909-6396 (2006) 12[285:IOIOHS] 2.0. CO;2.

McClelland, B. Riley, 1977. Relationships Between Hole-Nesting Birds, Forest Snags, And Decay In Western Larch-Douglas-Fir Forests Of The Northern Rocky Mountains. Presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy, University Of Montana, 1977.

McClelland B. Riley, Sidney S. Frissell, William C. Fischer, and Curtis H. Halvorson, 1979. Habitat Management For Hole-Nesting Birds In: Forests Of Western Larch And Douglas-fir. Journal of Forestry, August 1979 pp. 480-483

McClelland, B. Riley, 1985. Letter to Flathead National Forest Supervisor Edgar B. Brannon regarding old-growth management in draft forest plan. March 12, 1985.

McClelland BR and McClelland PT. 1999. Pileated woodpecker nest and roost trees in Montana: links with old-growth and forest "health." Wildlife Society Bulletin 1999, 27(3): 846-857.

McClelland, B. Riley (undated). Influences of Harvesting and Residue Management on Cavity-Nesting Birds.

Millar, C.I., and Wallace B Woolfenden, 1999. The role of climate change in interpreting historical variability. Ecological Applications 9(4): 1207-1216.

Mitchell, Stephen R., Mark E. Harmon, and Kari E. B. O'Connell. 2009. Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems. Ecological Applications 19:643–655. http://dx.doi.org/10.1890/08-0501.1

Montana Fish, Wildlife & Parks, 2005. Animal Field Guide: Boreal Toad. http://nhp.nris.state.mt.us/animalguide/speciesDetail.aspx?elcode=AAABB01030

Moomaw, Bill and Janna Smith, 2017. The Great American Stand: US Forests and the Climate Emergency. Why the United States needs an aggressive forest protection agenda focused in its own backyard. March 2017. Dogwood Alliance, PO Box 7645 Asheville, NC 28802. info@dogwoodalliance.org

Moriarty Katie M., Clinton W. Epps, and William J. Zielinski, 2016. Forest Thinning Changes Movement Patterns and Habitat Use by Pacific Marten. The Journal of Wildlife Management 80(4):621–633; 2016; DOI: 10.1002/jwmg.1060

Moser, Brian W. and Edward O. Garton 2009. Short-Term Effects of Timber Harvest and Weather on Northern Goshawk Reproduction in Northern Idaho. J. Raptor Res. 43(1):1–10

Mote et al. 2014. Ch. 21: Northwest. Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 487-513. doi:10.7930/J04Q7RWX. http://nca2014.globalchange.gov/highlights/regions/northwest

Nie, Martin and Emily Schembra, 2014. The Important Role of Standards in National Forest Planning, Law, and Management. Environmental Law Reporter, 44 ELR 10281-10298, April 2014.

Nesser, John A., 2002. Notes from the National Soil Program Managers meeting in Reno as related to soil quality issues. John A. Nesser, Regional Soil Scientist, USDA Forest Service, Northern Region. May 23, 2002.

Noon, B.R, D.D. Murphy, S.R. Beissinger, M.L. Shaffer and D. DellaSala. 2003. Conservation planning for US National Forests: Conducting comprehensive biodiversity assessments. Bioscience. December 2003.

Noss, Reed F. 2001. Biocentric Ecological Sustainability: A Citizen's Guide. Louisville, CO: Biodiversity Legal Foundation. 12pp. Noss, Reed F., and Allen Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Island Press.

Noss, Reed F., and Allen Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Island Press.

Olson, Lucretia E. Joel D. Sauder, Nathan M. Albrecht, Ray S. Vinkey, Samuel A. Cushman, Michael K. Schwartz; 2014. Modeling the effects of dispersal and patch size on predicted fisher (Pekania [Martes] pennanti) distribution in the U.S. Rocky Mountains. Biological Conservation 169 (2014) 89–98.

Pacific Northwest Research Station, 2004. Western Forests, Fire Risk, and Climate Change, Pacific Northwest Research Station, Issue 6 January 2004. http://www.fs.fed.us/pnw.

Page-Dumroese, D.; Jurgensen, M.; Elliot, W.; Rice, T.; Nesser, J.; Collins, T.; Meurisse, R., 2000. Soil quality standards and guidelines for forest sustainability in northwestern North America. Forest Ecology and Management 138 (2000) 445-462.

Page-Dumroese, Deborah, 1993. Susceptibility of Volcanic Ash-Influenced Soil in Northern Idaho to Mechanical Compaction. USDA Forest Service Intermountain Research Station, Research Note INT-409. February, 1993.

Pecl, G.T. et al., 2017. Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. Science 355, eaai9214 (2017) 31 March 2017.

Pederson, Gregory T., Lisa J. Graumlich, Daniel B. Fagre, Todd Kipfer, and Clint C. Muhlfeld 2009. A Century of Climate and Ecosystem Change in Western Montana: What do temperature trends portend? *Climatic Change* DOI 10.1007/s10584-009-9642-y 2009

Pfister, R.D., W.L. Baker, C.E. Fiedler, and J.W. Thomas. 2000. Contract Review of Old-Growth Management on School Trust Lands: Supplemental Biodiversity Guidance 8/02/00.

Pörtner, Hans O. and Anthony P. Farrell; 2008. Physiology and Climate Change. *Science.* 31 OCTOBER 2008

Probert, Cheryl 2017. Letter to Friends of the Clearwater regarding forest plan revision process and best available science. Nez Perce-Clearwater National Forest Supervisor Cheryl Probert, February 1, 2017.

Raley, C. M., E. C. Lofroth, R. L. Truex, J. S. Yaeger, and J. M. Higley. 2012. Habitat ecology of fishers in western North America: a new synthesis. Pages 231-254 in Aubry, K.B., W.J. Zielinski, M.G. Raphael, G. Proulx, and S.W. Buskirk, editors. Biology and conservation of martens, sables, and fishers: a new synthesis. Cornell University Press, Ithaca, NY, USA.

Reed, David H., , Julian J. O'Grady, Barry W. Brook, Jonathan D. Ballou, and Richard Frankham; 2003. Estimates of minimum viable population sizes for vertebrates and factors influencing those estimates. Biological Conservation 113 (2003) 23–34

Reeves, Derrick; Page-Dumroese, Deborah; Coleman, Mark. 2011. Detrimental soil disturbance associated with timber harvest systems on National Forests in the Northern Region. Res. Pap. RMRS-RP-89 Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p.

Reynolds, R. T., R. T. Graham, M. H. Reiser, R. L. Bassett, P. L. Kennedy, D. A. Boyce, Jr., G. Goodwin, R. Smith, and E. L. Fischer. 1992. Management recommendations for the Northern goshawk in the southwestern United States. Rocky Mountain Forest and range Experiment Station and Southwest Region Forest Service. US Dept. of Agriculture, Gen. Tech. Rpt. RM-217.

Ripple William J., Pete Smith, Helmut Haberl, Stephen A. Montzka, Clive McAlpine and Douglas H. Boucher, 2014. Ruminants, climate change and climate policy. Nature Climate Change, Vol. 4, January 2014.

Ruggiero LF, Hayward, G.D. and Squires, J.R., 1994a. Viability Analysis in Biological Evaluations: Concepts of Population Viability Analysis, Biological Population, and Ecological Scale. Conservation Biology, Vol. 8, No. 2, June 1994, pp. 364-372

Ruggiero, Leonard F., Keith B. Aubry, Steven W. Buskirk, L. Jack Lyon, and William J. Zielinski. 1994b. The Scientific Basis for Conserving Forest Carnivores in the Western United States: American Marten, Fisher, Lynx, and Wolverine. Pacific Southwest Research Station, USDA Forest Service. General Technical Report RM-254 September 1994.

Ruggiero, L.F., K.S. McKelvey, K.B. Aubry, J.P. Copeland, D.H. Pletscher, M.G. Hornocker. 2007. Wolverine Conservation and Management. Journal of Wildlife Management, 71(7):2145–2146.

Ruggiero, Leonard F.; 2007. Scientific Independence: A Key to Credibility. *From* ECO-Report 2007: Bitterroot Ecosystem Management Research Project, Rocky Mountain Research Station, 800 E. Beckwith St., Missoula, MT 59801.

Running, Steven W. 2006. Is Global Warming Causing More, Larger Wildfires? Science Express, 6 July 2006 (www.sciencexpress.org ).

Sallabanks, R.; Bruce G. Marcot, Robert A. Riggs, Carolyn A. Mehl, & Edward B. Arnett, 2001. Wildlife of Eastside (Interior) Forests and Woodlands. Chapter 8 in *Wildlife-Habitat Relationships in Oregon and Washington*, 2001 by David H. Johnson and Thomas A. O'Neil (Managing Editors); Oregon State University Press, Corvallis, OR.

Saunois M., R. B. Jackson, P. Bousquet, B. Poulter and J. G. Canadell; 2016a. The growing role of methane in anthropogenic climate change. EDITORIAL Environ. Res. Lett. v11 (2016) 120207.

Saunois, et al., 2016b. The global methane budget 2000–2012. Earth Syst. Sci. Data, 8, 697–751, 2016

Sauder Joel D. and Janet L. Rachlow, 2014. Both forest composition and configuration influence landscape-scale habitat selection by fishers (Pekania pennanti) in mixed coniferous forests of the Northern Rocky Mountains. Forest Ecology and Management 314 (2014) 75–84

Sauder, Joel D. 2014. Landscape Ecology of Fishers (*Pekania Pennanti*) in North-Central Idaho. Ph.D Dissertation, University of Idaho.

Schultz, C. 2010. Challenges in connecting cumulative effects analysis to effective wildlife conservation planning. BioScience 60:545–551.

Schultz, Courtney A.; Thomas D. Sisk, Barry R. Noon, Martin A. Nie, 2013. Wildlife Conservation Planning Under the United States Forest Service's 2012 Planning Rule. The Journal of Wildlife Management; 23 JAN 2013; DOI: 10.1002/jwmg.513

Schwartz, Michael K., Nicholas J. DeCesare, Benjamin S. Jimenez, Jeffrey P. Copeland, Wayne E. Melquist; 2013. Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management 305 (2013) 103–111

Servheen, G., S. Blair, D. Davis, M. Gratson, K. Leidenfrost, B. Stotts, J. White, and J. Bell. 1997. Interagency Guidelines for Evaluating and Managing Elk Habitats and Populations in Central Idaho. Wildlife Bulletin No. 11, Idaho Dept. of Fish and Game. 75p.

Sexton, Timothy O., 1998. Ecological Effects of Post-Wildfire Management Activities (Salvage-Logging and Grass-Seeding) on Vegetation Composition, Diversity, Biomass, and Growth and Survival of *Pinus ponderosa* and *Purshia tridentate.* Master's Thesis, Oregon State University, 1998.

Simard SW, Asay AK, Beiler KJ, Bingham MA, Deslippe JR, Xinhua H, Philip LJ, Song Y, Teste FP. 2015. Resource transfer between plants through ectomycorrhizal fungal networks. In: Horton TR, ed. Mycorrhizal networks. Berlin: Springer.

Simard SW, Martin K, Vyse A, Larson B. 2013. Meta-networks of fungi, fauna and flora as agents of complex adaptive systems. In: Puettmann K, Messier C, Coates K, eds. Managing forests as complex adaptive systems: building resilience to the challenge of global change. New York: Routledge, 133–164.

Simons, Rachel; 2008. Historic range of variability-based forest management and climate change: understanding causes of disturbances in a changing climate. Unpublished literature review.

Solomon, S.D. et al., 2007: Technical Summary, in Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 24, (Feb. 2, 2007).

Song Y.Y., Suzanne W. Simard, Allan Carroll, William W. Mohn & Ren Sen Zeng (2015). Defoliation of interior Douglas-fir elicits carbon transfer and stress signalling to ponderosa pine neighbors through ectomycorrhizal networks, *Scientific Reports, 5* 8495. DOI: http://dx.doi.org/10.1038/srep08495

Spiering, David J. and Richard L. Knight. 2005. Snag density and use by cavity-nesting birds in managed stands of the Black Hills National Forest. Forest Ecology and Management 214 (2005) 40–52.

Squires John R., Jeffrey P. Copeland, Todd J. Ulizio, Michael K. Schwartz, Leonard F. Ruggiero, 2007. Sources and Patterns of Wolverine Mortality in Western Montana. Journal of Wildlife Management 71(7):2213–2220; 2007.

Squires John R., 2009. Letter to Carly Walker of Missoula County Rural Initiatives. John R. Squires, Research Wildlife Biologist, USDA Forest Service Rocky Mountain Research Station, Forestry Sciences Laboratory, 800 E. Beckwith, Missoula, Montana 59801.

Squires John R., Nicholas J. Decesare, Jay A. Kolbe and Leonard F. Ruggiero 2010. Seasonal Resource Selection of Canada Lynx in Managed Forests of the Northern Rocky Mountains. The Journal of Wildlife Management Vol. 74, No. 8 (November 2010), pp. 1648-1660

Squires, J., L. Ruggiero, J. Kolbe, and N. DeCesare. 2006a. Lynx ecology in the Intermountain West: research program summary, summer 2006. USDA Forest Service, Rocky Mountain Research Station, Missoula, Montana.

Squires John R., Todd J. Ulizio, Leonard F. Ruggiero, Daniel H. Pletscher, 2006. The Association Between Landscape Features and Transportation Corridors on Movements and Habitat-Use Patterns of Wolverines. Final Report prepared for The State of Montana Department of Transportation in cooperation with The U.S. Department of Transportation Federal Highway Administration, June 2006

Squires, J., N. DeCesare, L. Olson, J. Kolbe, M. Hebblewhite, and S. Parks. 2013. Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. Biological Conservation 157:187-195.

Stephenson, N. L., A. J. Das, R. Condit, S. E. Russo, P. J. Baker, N. G. Beckman, D. A. Coomes, E. R. Lines, W. K. Morris, N. Ruger, E. Alvarez, C. Blundo, S. Bunyavejchewin, G. Chuyong, S. J. Davies, A. Duque, C. N. Ewango, O. Flores, J. F. Franklin, H. R. Grau, Z. Hao, M. E. Harmon, S. P. Hubbell, D. Kenfack, Y. Lin, J.-R. Makana, A. Malizia, L. R. Malizia, R. J. Pabst, N. Pongpattananurak, S.-H. Su, I-F. Sun, S. Tan, D. Thomas, P. J. van Mantgem, X. Wang, S. K.

Wiser & M. A. Zavala; 2014. Rate of tree carbon accumulation increases continuously with tree size. *Nature*. 2014.

Sullivan, Patrick J.; James M. Acheson; Paul L. Angermeier; Tony Faast; Jean Flemma; Cynthia M. Jones; E. Eric Knudsen; Thomas J. Minello; David H. Secor; Robert Wunderlich; Brooke A. Zanetell; 2006. Defining and Implementing Best Available Science for Fisheries and Environmental Policy, and Management. American Fisheries Society, Bethesda, Maryland; Estuarine Research Federation, Port Republic, Maryland. September 2006

Sun, Ge and James M. Vose. 2016. Forest Management Challenges for Sustaining Water Resources in the Anthropocene. *Forests* 2016, 7, 68; doi:10.3390/f7030068

Suzanne Simard "Trees Communicate" webpage. https://www.youtube.com/watch?v=-8SORM4dYG8&feature=youtu.be

Sylvester, James T., 2014. Montana Recreational Off-Highway Vehicles Fuel-Use and Spending Patterns 2013. Prepared for Montana State Parks by Bureau of Business and Economic Research, University of Montana. July 2014.

Traill, Lochran W., Barry W. Brook, Richard R. Frankham, Corey J.A. Bradshaw, 2010. Pragmatic population viability targets in a rapidly changing world. Biological Conservation 143 (2010) 28–34.

Trombulak SC and Frissell CA., 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14: 18-30.

Turner, David P., William K. Ferrell & Mark E. Harmon, 1997. Letter to the Editor, The Carbon Crop: Continued, 277 Sci. 1591, 1592 (Sept. 1997).

Turner, David P.; Greg J. Koerper; Mark E. Harmon; Jeffrey J. Lee; 1995. A Carbon Budget for the Forests of the Coterminous United States, 5:2 Ecological Applications 421 (1995).

USDA Forest Service, 1987a. Old Growth Habitat Characteristics and Management Guidelines. Kootenai National Forest, Forest Plan Appendix 17. USDA Forest Service Region One.

USDA Forest Service, 1987b. Appendix to "Old Growth Habitat Characteristics and Management Guidelines." Kootenai National Forest, Forest Plan Appendix 17. USDA Forest Service Region One.

USDA Forest Service, 1987c. Forest Plan Old-Growth Habitat Management Standards, Idaho Panhandle National Forests, USDA Forest Service Region One.

USDA Forest Service, 1987d. Old Growth Management, Idaho Panhandle National Forests, Forest Plan Appendix 27, USDA Forest Service Region One.

USDA Forest Service, 1990. Old-Growth Habitat and Associated Wildlife Species in the Northern Rocky Mountains. Warren, Nancy M. (ed.) USDA Northern Region.

USDA Forest Service, 1993. Wolverine habitat guidelines for the Malheur National Forest. Prepared by Richard Haines, Malheur National Forest; Reviewed by Robert Naney, USFS Region 6, June 1993.

USDA Forest Service, 1994b. Savant Sage Final Environmental Impact Statement, Idaho Panhandle National Forests.

USDA Forest Service, 2000a. Environmental Effects of Postfire Logging: Literature Review and Annotated Bibliography. Gen. Tech. Rep. PNW-GTR-486. Wenatchee, WA: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

USDA Forest Service, 2000b. Expert interview summary for the Black Hills National Forest Land and Resource Management Plan Amendment. USDA Forest Service, Black Hills National Forest, Hwy 385 North – R.R. 2, Box 200 Custer, South Dakota 57730 (605-673-9200). October, 2000.

USDA Forest Service, 2000c. Forest Plan Monitoring and Evaluation Report for 1998. Idaho Panhandle National Forests.

USDA Forest Service, 2003a. Bristow Area Restoration Project Environmental Assessment, Kootenai National Forest.

USDA Forest Service, 2004a. Logan Creek Ecosystem Restoration Project Final Environmental Impact Statement. Flathead National Forest.

USDA Forest Service, 2005b. Middle East Fork Hazardous Fuel Reduction Draft Environmental Impact Statement. Bitterroot National Forest.

USDA Forest Service, 2005d. American and Crooked River Project Final Environmental Impact Statement, Nez Perce National Forest.

USDA Forest Service, 2005e. Northern Goshawk Detection Survey – 2005. Northern Region, USDA Forest Service.

USDA Forest Service, 2007. Trego DN, Responses to Comments, Fortine Ranger District, Kootenai National Forest, February 2007.

USDA Forest Service, 2007a. Draft Environmental Impact Statement, Grizzly Vegetation and Transportation Management Project, Three Rivers Ranger District, Kootenai National Forest. June 2007

USDA Forest Service, 2007c. Myrtle Creek Healthy Forests Restoration Act Project Final Environmental Impact Statement. Soil Resources. March 2007. Bonners Ferry Ranger District, Idaho Panhandle National Forests

USDA Forest Service, 2008a. Young Dodge Draft Environmental Impact Statement, Rexford Ranger District, USDA Forest Service, Kootenai National Forest, February 2008

USDA Forest Service, 2008b. Young Dodge FEIS/ Responses to Comments-Soils. Rexford Ranger District, USDA Forest Service, Kootenai National Forest, April 2008

USDA Forest Service, 2008f. Gold Crown Fuels Reduction Project Soil Specialists' Report: Past Disturbance and Probable Impacts. Prepared by: Mark Vander Meer & Tricia Burgoyne, Soil Scientists, USDA Forest Service.

USDA Forest Service, 2009a. Lakeview-Reeder Fuels Reduction Project Draft Environmental Impact Statement, Priest Lake Ranger District, Idaho Panhandle National Forests.

USDA Forest Service, 2009c. Excerpt from Lakeview-Reeder Fuels Reduction Project Draft Environmental Impact Statement. Priest Lake Ranger District, Idaho Panhandle National Forests. January 2009.

USDA Forest Service, 2010t. Travel Analysis Report, Spring Gulch Travel Analysis, Cabinet Ranger District, Kootenai National Forest, 2010.

USDA Forest Service, 2011c. Griffin Creek Resource Management Project Environmental Assessment. Tally Lake Ranger District, Flathead National Forest, December 2011.

USDA Forest Service, 2012a. Doc Denny Vegetation Management Project Environmental Assessment, Salmon River Ranger District, Nez Perce National Forest, August 2012

USDA Forest Service, 2012d. Travel Management, Implementation of 36 CFR, Part 202, Subpart A (36 CFR 212.5(b)). Memorandum to Regional Foresters, Station Directors, Area Director, IITF Director, Deputy Chiefs and WO Directors. March 29, 2012

USDA Forest Service, 2013a. Idaho Panhandle National Forests Forest Plan Monitoring and Evaluation Reports 2010 and 2011. March 2013.

USDA Forest Service, 2013b. Travel Management Implementation. Memorandum to Regional Foresters, Station Directors, Area Director, IITF Director, Deputy Chiefs and WO Directors. December 17, 2013.

USDA Forest Service, 2013c. Wolverine Conferencing Guidance. Kristi Swisher, USDA Forest Service Northern Region, March 5, 2013.

USDA Forest Service, 2014a. Como Forest Health Project Draft Environmental Impact Statement, Darby Ranger District, Bitterroot National Forest, August 2014.

USDA Forest Service, 2015a. Deer Creek Soil Resource Report. Prepared by: Chandra Neils, Forest Soil Scientist for: Bonners Ferry Ranger District, Idaho Panhandle National Forests, August 2015.

USDA Forest Service, 2016a. Categorical Exclusion Worksheet: Resource Considerations-Soils. Smith Shields Forest Health Project, Yellowstone Ranger District, Custer Gallatin National Forest.

USDA Forest Service, 2017b. Draft Environmental Impact Statement. Pine Mountain Late-Successional Reserve Habitat Protection and Enhancement Project. Pacific Southwest Region

USDA-Objectivity of Regulatory Information. https://www.ocio.usda.gov/policy-directives-records-forms/guidelines-quality-information/regulatory

USDA-Objectivity of Scientific Research Information. https://www.ocio.usda.gov/policy-directives-records-forms/guidelines-quality-information/scientific-research

USDA-Objectivity of Statistical and Financial Information. https://www.ocio.usda.gov/policy-directives-records-forms/guidelines-quality-information/statistical-and-financial

Van der Werf, G. R.; D. C. Morton, R. S. DeFries, J. G. J. Olivier, P. S. Kasibhatla, R. B. Jackson, G. J. Collatz and J. T. Randerson; 2009. CO2 emissions from forest loss. Nature Geoscience vol. 2, November 2009.

Verbyla, D.L. & Litaitis, J.A. (1989) Resampling methods for evaluating classification accuracy of wildlife habitat models. Environmental Management 13: 783–7.

Vizcarra, Natasha 2017. Woodpecker Woes: The Right Tree Can Be Hard to Find. *Science Findings,* USDA Forest Service, Pacific Northwest Research Station, Issue 199, August 2017.

Vose, James M. David L. Peterson, and Toral Patel-Weynand (Eds.), 2012. Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector. United States Department of Agriculture, Forest Service Pacific Northwest Research Station General Technical Report PNW-GTR-870, December 2012.

Wales, Barbara C; Lowell H. Suring; Miles A. Hemstrom, 2007. Modeling potential outcomes of fire and fuel management scenarios on the structure of forested habitats in northeast Oregon, USA. Landscape and Urban Planning 80 (2007) 223-236

Wasserman, Tzeidle N.; Cushman, Samuel A.; Wallin, David O.; Hayden, Jim. 2012. Multi scale habitat relationships of Martes americana in northern Idaho, U.S.A. Res. Pap. RMRS-RP-94. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 21 p.

Weir, Richard D. and Fraser B. Corbould 2010. Factors Affecting Landscape Occupancy by Fishers in North-Central British Columbia. The Journal of Wildlife Management, Vol. 74, No. 3 (April 2010), pp. 405-410

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, T. W. Swetnam; 2006. Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity. Science Express, Research Article, July 6, 2006, www.sciencexpress.org.

Wilcove, David S., Charles H. McLellan, Andrew P. Dobson. 1986. Habitat fragmentation in the Temperate zone in Conservation Biology, The Science of Scarcity and Diversity, Michael Soule, ed. Sinauer Associates, Inc., Sunderland, Massachusetts.

Williams, A. Park, Craig D. Allen, Alison K. Macalady, Daniel Griffin, Connie A.Woodhouse, David M. Meko, Thomas W. Swetnam, Sara A. Rauscher, Richard Seager, Henri D. Grissino-Mayer, Jeffrey S. Dean, Edward R. Cook, Chandana Gangodagamage, Michael Cai and Nate G. McDowell; 2012. Temperature as a potent driver of regional forest drought stress and tree mortality. *Nature Climate Change,* PUBLISHED ONLINE: 30 SEPTEMBER 2012 | DOI: 10.1038/NCLIMATE1693

Williamson, J.R. and W.A. Neilsen. 2000. The influence of forest site and rate and extent of soil compaction and profile disturbance of skid trails during ground-based harvesting. Can. J. For. Res. 30:119

Wisdom, Michael J.; Richard S. Holthausen; Barbara C. Wales; Christina D. Hargis; Victoria A. Saab; Danny C. Lee; Wendel J. Hann; Terrell D. Rich; Mary M. Rowland; Wally J. Murphy; and Michelle R. Eames. 2000. Source Habitats for Terrestrial Vertebrates of Focus in the Interior Columbia Basin: Broad-Scale Trends and Management Implications. General Technical Report PNW-GTR-485 United States Department of Agriculture Forest Service Pacific Northwest Research Station United States Department of the Interior Bureau of Land Management General Technical Report PNW-GTR-485. May 2000

Witmer, Gary W.; Martin, Sandra K.; Sayler, Rodney D. 1998. Forest Carnivore Conservation and Management in the Interior Columbia Basin: Issues and Environmental Correlates. Gen. Tech. Rep. PNW-GTR-420. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 51 p. (Quigley, Thomas M., ed.; Interior Columbia Basin Ecosystem Management Project: scientific assessment).

Woodbridge, B. and C.D. Hargis, 2006. Northern goshawk inventory and monitoring technical guide. Gen. Tech. Rep. WO-71. Washington, DC: U.S. Department of Agriculture, Forest Service. 80 p.

Woodbury, Peter B., James E. Smith & Linda S. Heath, 2007. Carbon sequestration in the U.S. forest sector from 1990 to 2010, 241 Forest Ecology and Management 14, 24 (2007).

Wright, Vita, Sallie J. Hejl, and Richard L. Hutto, 1997. Conservation Implications of a Multi-scale Study of Flammulated Owl (Otus flammeolus) Habitat Use in the Northern Rocky Mountains, USA. From Duncan, J.R., Johnson, D.H., Nicholls, T.H. Eds. 1997. Biology and conservation of owls of the Northern Hemisphere: 2d International symposium; 1997 February 5-9; Winnipeg, Manitoba Gen. Tech. Rep. NC-190. St. Paul, MN: USDA Forest Service, North Central Research Station 635 p.

Yanishevsky, Rosalind M., 1994. Old-Growth Overview: Fragmented Management of Fragmented Habitat. Pp. 7-36 *in* Rocky Mountain Challenge: Fulfilling a New Mission in the U.S. Forest

Service. Association of Forest Service Employees For Environmental Ethics, P.O. Box 11615, Eugene, Oregon 97440, February, 1994.

Ziemer, Robert R. and Thomas E. Lisle, 1993. Evaluating Sediment Production by Activities Related to Forest Uses - A Pacific Northwest Perspective. U.S. Department of Agriculture, Forest Service Pacific Southwest Research Station, Arcata, California.