APPEAL TO THE REGIONAL FORESTER OF THE U. S. FOREST SERVICE
NORTHERN REGION

THE ECOLOGY CENTER, NATIVE FOREST NETWORK, ALLIANCE FOR THE WILD ROCKIES, AND NATIONAL FOREST PROTECTION ALLIANCE	)
APPELLANTS	)
v.	)
CATHY BARBOULETOS, FOREST SUPERVISOR FLATHEAD NATIONAL FOREST	)
RESPONSIBLE OFFICIAL	)

DATED THIS 28th DAY OF February, 2005

TO: Appeals Deciding Officer (RFO), USDA U.S. Forest Service Northern Region, P.O. Box 7669, Missoula, MT, 59807.

NOTICE OF APPEAL

DECISION APPEALED: On January 12, 2005 Flathead National Forest Supervisor Cathy Barbouletos signed a Record of Decision (ROD) for the West Side Reservoir Post-Fire Project, selecting a modified Alternative E from the Final Environmental Impact Statement (FEIS). The ROD authorizes logging of 38 million board feet of timber from approximately 3,169 acres, and 3.3 miles of new ("temporary") road construction in the Hungry Horse and Spotted Bear Ranger Districts of the Flathead National Forest (FNF).

Notice is hereby given pursuant to 36 C.F.R. 215 that the Ecology Center, Native Forest Network, Alliance for the Wild Rockies, and National Forest Protection Alliance appeal the ROD. The ROD is not 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, (APA) 5 U.S.C. Sec. 706, the Forest Plan for the Flathead National Forest, the Endangered Species Act, and the Forest Service Manual.

As a result of the ROD, individuals and members of the above-mentioned groups would be directly and significantly affected by the logging and associated activities. Appellants are conservation organizations working to ensure protection of biological diversity and ecosystem integrity in the Wild Rockies bioregion (including the FNF). The individuals and members use the project area for recreation and other forest related activities. The selected alternative would also further degrade the water quality, wildlife and fish habitat. These activities, if implemented, would adversely impact and irreparably harm the natural qualities of the West Side Reservoir

Project Area, the surrounding area, and would further degrade the watersheds and wildlife habitat.

STATEMENT OF REASONS

I. THE WEST SIDE RESERVOIR ROD REPRESENTS A FAILURE OF THE FOREST SERVICE TO MAINTAIN THE PUBLIC PROCESS UNDER NEPA AND NFMA.

The Forest Service (FS) failed to discuss most of the scientific issues our scoping and DEIS comments raised, and did not include in the project files much of the literature we volunteered to provide. The FS attempts to sidestep the scientific and social controversy represented by the proposed "salvage" activities. In fact, the FS's responses to public comments largely reflect a lack on the part of the FS to engage in any serious, meaningful, genuine dialog with the public. The lack of a meaningful review by the FS following the public comment process means that the job falls upon Appeal Reviewers, and likely, the judiciary. In both those scenarios, the NEPA/public process is broken. We therefore incorporate, by reference, appellants' previous comments on the West Side Reservoir project within this Statement of Reasons, for the Regional Forester and courts to review.

II. FEIS AND ROD RELY ON UNSCIENTIFIC TREE MORTALITY GUIDELINES

We commented extensively on the issue of the proposal to log "dying" trees or trees that the FS predicts would be dead in the future due to fire effects or due to indirect mortality from subsequent insect infestations. These inaccurate tree mortality guidelines represent not only an issue of lack of scientific integrity, the logging of live trees will reduce recruitment of old growth, and of future habitat components needed by old-growth species. Also, the FEIS's watershed analysis assumes that logging of dead trees has no hydrological effects. Our DEIS comments read:

> Mature conifers generally survive significantly greater crown scorch than the DEIS indicates. For example, Ryan and Reinhardt (1988) concluded that for Douglas fir, western red cedar, lodgepole pine and western larch, between 45% and two-thirds of the trees could be expected to survive 60% crown scorch if they had bark between two and three centimeters thick. (The authors stated that bark thickness over three centimeters is found in Douglas-fir and western larch, but is uncommon in western red cedar or lodgepole pine.) Even with more than 80% crown scorch, roughly one-third of such trees could be expected to survive. Id. Slightly higher mortality was found for western hemlock. Id. For Douglas-fir and western larch with bark between 4½ and five centimeters thick, more than half of the trees could be expected to survive even at 80% crown scorch. Id.
>
> Another study by the same authors concluded that Douglas fir 35 centimeters in diameter at breast height (about 14 inches dbh), have a 30% chance of survival with roughly 83% crown scorch, and have a 50% chance of survival with roughly 63% crown scorch. (Ryan et al., 1988.) The scale is linear, with increasing degrees of crown scorch necessary to predict the same probability of mortality as tree diameter

increases. Continuing along their linear scale, most Douglas fir 50 centimeters in diameter (about 20 inches dbh), would be expected to survive 80% crown scorch.

Yet another study by FS scientists developed a mortality model with general applicability for Western conifers. Their preliminary results indicated that in the absence of any significant cambial damage (cambium is the vascular system of the tree, and is located beneath the bark), a conifer with 90% crown scorch has about a 50% chance of surviving. (Peterson and Ryan, 1986.) Even with 50% cambial kill and 80% crown scorch, a Western conifer still has a better than 20% chance of survival, according to their model. Id.

One FS study recommends that in order to avoid marking errors (i.e., inappropriately marking trees “dead” that would otherwise survive), ponderosa pines should not be considered “dead” unless they have at least 90% crown scorch because significant numbers of ponderosas survive lesser crown scorch. (Saveland, and Neuenschwander, 1990) Indeed, it was recently noted by FS personnel that some mature ponderosa pines on the Sierra National Forest that experienced 100% crown scorch in a fire during the summer of 2001, were resprouting green buds (i.e., generating new foliage), by early 2002. (Peckinpah, 2000).

Scientists have repeatedly concluded that "a tree must be completely girdled to die from cambial damage alone." (Wyant, et al, 1986.) There is no reliable way to determine cambial damage in the field. Some scientific studies have taken core samples to labs to determine whether the cambium for various trees is dead. Even this method was deemed by FS researchers to be so "destructive" that they recommended not using cambial damage as a means to determine mortality, noting that it "may have little applicability in forest management." (Ryan et al., 1988, p. 195.) The FS’s typical process of using an axe to hack into the tree and visually determine whether the cambium is dead is totally unreliable and inadequate. In addition, scientists have commented that this method damages the portions of the cambium that weren't killed by the fire, significantly increasing the odds that the affected trees will die, and creating a self-fulfilling prophecy.

Finally, FS mortality guidelines are fatally flawed because they do not take into account the fact that mortality has been found to be far lower for late summer and early fall fires than for fires occurring in spring, when buds are developing. (See Ryan et al., 1988, pp. 192-193; see also Swezy & Agee, 1991).

The claim that specific beetle-infested trees can reliably be predicted to be imminently dead is likewise not reliable. What is the hurry? The IPNF’s Douglas-fir Beetle project comes to mind. The news coverage of the fact that far fewer trees died than the FS expected must was embarrassing to the IPNF. The FNF should ask the IPNF about the accuracy of the latter’s predictions.

…Likewise, the mortality figures given (3-32) are misleading. Since larger trees survive fires at much higher rates that smaller trees, an area that experiences even

> "80 percent" mortality might in fact have much of the basal area in live trees. This is how the DEIS misleads the public into believing that the old growth is "destroyed" when it is in many cases merely going through normal ecosystem processes and continuing as or towards old-growth conditions. In legal terms, this is "fraud." (See: http://www.wildrockies.org/teci/forestfraud/index.html and the web pages following.)

(See also McHugh and Kolb, 2003; and Fowler and Sieg, 2004.) A major problem is that the FS's mortality guidelines do not cite scientific studies showing reliability or validity of its prediction model. We cited scientific information that shows such predictions are unreliable. That the FS totally ignored this issue of scientific veracity of its modeling again reveals the unwillingness of the FS to engage in the public process.

Forest Service information has often revealed the inaccuracies of tree mortality predictions, and such predictions typically overestimate tree mortality (See Appeal Attachment 2).

Compounding the problem with the mortality guidelines is that the loggers will, in many units, be the ones deciding which trees will be cut anyway. The National Forest Management Act requires that all trees to be cut have to be marked by a Forest Service employee before sale, so this is illegal. The FNF is also allowing units to be cut from late fall until early spring, when Western Larch have no needles and thus could easily look dead when in fact they've survived the fire. This virtually guarantees that the impacts of the timber sales on present and future mixed conifer with larch component will continue to be negative, as discussed in the next section of this appeal.

III. SENSITIVE SPECIES, OLD-GROWTH SPECIES, AND FORMER MANAGEMENT INDICATOR SPECIES

Juday (1978) discusses in detail how the protection of old-growth forests greatly sustains the many uses of our national forests, as mandated by the Multiple Use-Sustained Yield Act and the National Forest Management Act. Based on Juday's discussion, one would think that the Forest Service would embrace old growth, perform complete inventories, and thus be able to accomplish much of its legal mandate of protecting water quality and overall diversity on our national forests. Instead, as the West Side Reservoir project reveals, the FS continues on a path of utilizing old-growth forests for mostly one objective—timber production.

Although the FEIS claims that old growth will not be logged in the West Side Reservoir project area, the data on comparison of the proposed cutting units to old-growth criteria is insufficient to support such a claim for all areas proposed for logging. The project would log forest that the FNF considered to be old growth before the 2003 fires (see: "Old Growth Info.doc" and the maps it refers to on CD-1, included with this appeal), and what is in dispute are these areas' continuing value for old-growth species. What is indisputable is that **components** of old growth species' **habitat** will be reduced, and that habitat for Threatened, Sensitive, and former MIS

species will be adversely impacted. The trend for these species is already downward, and projects such as this will only continue that trend.

The FEIS states that the only pre-fire old-growth areas to be logged are those that no longer qualify as old growth, but that not clear from the FEIS. This means that the FEIS is unable to disclose and analyze habitat amount and distribution information for old-growth wildlife species, a requirement under NFMA.

Our comments on the DEIS stated, "… the DEIS ignores the fact that some types of old growth are maintained by low intensity disturbances (Arno, Smith & Krebs 1997; Habeck 1990; Habeck 1988)." The FS's own studies disclose that mixed severity fires are also key to some old growth (Northern Region Overview). The DEIS, and the FEIS ignore the fact that development of mature forests to old growth is also being retarded by logging and fire suppression. The issue of old-growth mixed conifer—a type that contains a significant component of Western Larch—is being ignored on the FNF. The FS's Northern Region Overview (see Appeal Attachment 1) identifies Western Larch as a "forest type at risk" with "36% loss" within the Columbia River Basin. Causes listed are "fire exclusion and past harvest." Areas of the FNF had their value for wildlife enhanced by fire in 2003, but the FS wants to suppress this enhanced habitat by logging it, since fire suppression itself didn't accomplish the prevention of the development of this habitat!

And, the selected alternative would log in low severity and moderate severity fire areas (see: "Burn Severity & Units Info.doc" and the maps it refers to on CD-1, included with this appeal). Comparison of the ROD's Figure A-1 map of the Selected Alternative for the Beta Fire to the maps on CD-1 reveal that pre-fire old growth mapped by the Forest Service as medium vegetation burn severity are selected for logging. Two examples are units 16 and 16H.

Lindenmayer et al (2004) state "Salvage harvesting activities undermine many of the ecosystem benefits of major disturbances." They list four negative impacts associated with post fire logging that contribute to this:

- Removal of large quantities of biological legacies can have negative impacts on many taxa" by removing habitat.
- Post-fire logging "can impair ecosystem recovery…with major negative impacts on the regenerative potential of stands.
- [S]ome taxa may be maladapted to the interactive [epistatic] effects of two disturbance events in rapid succession.
- [G]ood planning should guide the timing and intensity of salvage harvesting" they say, but "[l]arge-scale harvesting is often begun soon after a wildfire, when resource managers make decisions rapidly, with long-lasting ecological consequences.

Wildlife biologist B.R. McClelland has for many years studied the relationship of cavity nesting birds, particularly the pileated woodpecker, to this very same larch-containing old-growth habitat. This is pointed out in the research we provided to the FNF in our draft EIS comments, most of it ignored and not included by the FNF in the project record. These include: McClelland and McClelland, 1999; McClelland et al. 1979; and McClelland, 1977.

If the FNF were to have studied the Northern Region Overview, connected the dots and disclosed the obvious conclusions in the FEIS, it would be clear from the FEIS that the proposed logging is severely detrimental to cavity nesting species, particularly the pileated woodpecker. This is probably one reason that the FNF was so eager to dump this species from its list of Management Indicator Species (MIS)—it's the very best indicator for the kind of forest the FNF has heavily logged, and continues to log with the West Side Reservoir project. From the Northern Region Overview, pp. 25-26, under Western Larch:

> Mixed severity fire intervals of 40-90 years followed by lethal fires on a 100-200 year + time frame are within the historical range of disturbance to which the seral species are adapted. In the absence of mixed severity fire or some stand thinning, on moist sites, larch is replaced by more shade tolerant species by 90-140 years. With thinning or mixed severity fire, larch can maintain site dominance for 200+ years.
>
> …(M)ixed severity fire often served to maintain or even increase the larch dominance in stands. Residual large tree cover (less than 20% canopy cover) after large stand replacing fire was common. This large tree residual structure (emergent structure) occurring singly or in small groups has declined in many areas. In addition, the areal extent of this cover type has decreased significantly. In many areas where a mix severity fire regime helped maintain a more diverse landscape structure with larger trees, the current landscapes are in a more homogenized landscape condition.
>
> …The loss of mixed-severity fire will result in much less recruitment of the type of mixed seral and climax species old growth type communities found in the past. There is also a risk of continued loss of the areal extent of the type due to the lack of mixed severity fire disturbance in early and mid-seral structural stages and a current lack of canopy openings large enough for successful larch regeneration in the mid and late successional communities.

Nothing in the FEIS discusses the relative value of burned, unlogged forest for old-growth recruitment compared to the obviously depleted value of logged forest, there is only vague implication that unlogged burned forest has more habitat components used by old growth species than would "salvage" logged areas.

The FS has still not committed to a program of monitoring species' populations to validate its assumptions, including the assumption that Amendment 21 is, in fact, insuring the viability of all old-growth dependent species. In the total absence of population monitoring information, the FS's decision to log <u>any</u> forest area that provides habitat for old-growth wildlife species is arbitrary and capricious. The logging would remove such habitat as well as adversely affect old-growth habitat components.

The FNF's Logan Creek Ecosystem Restoration Project Final EIS (USDA Forest Service, 2004a) at page 3-199 states:

> Across the Interior Columbia River Basin (Quigley, et al. 1996), old forests have declined by 27 to 60 percent over that past 100 years and large residual trees and

> snags have decreased by 20 percent. Fire exclusion and timber harvest have altered the structure and composition of forests throughout the Basin, resulting in a 60 percent increase in susceptibility to insects, disease, and stand-replacing fires. These changes have contributed to declining habitat conditions for numerous species of wildlife associated with old growth forests.

This FEIS does not sufficiently dealt with the issue of fragmentation, road effects, and past logging on old-growth species' habitat. It fails to disclose the degree to which edge effects on old growth species' habitat exist, and how much total edge effect would be increased, by the West Side Reservoir project. Cumulative effects on old-growth habitat and on old-growth associated species include increased fragmentation, reduced older forest patch sizes, increased high-contrast edge, reduced availability of interior habitat, and decreased forested connectivity. These effects would reduce the ability to provide for the habitat needs of old-growth associated species for decades to come following implementation of the West Side Reservoir project and other activities in the project area. The FEIS's analysis omits or ignores fragmentation effects from past or future road building and logging adjacent to old growth.

The continued fragmentation of the FNF 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. 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).

(Pp. 3-201.) Also,

> 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).

(Pp. 3-216.)

USDA Forest Service, 2004a further discusses the fragmentation effects on old-growth habitat, effects that would be exacerbated by the West Side Reservoir project and that were not adequately considered by the FEIS:

> 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.). Roads that are open to the public expose many important wildlife habitat features in old growth and other forested stands to loss 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."

(Pp. 3-196 and 3-197.)

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). The authors 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.)

L. Harris 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.

L. Harris 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.

L. Harris 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." Also:

> 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.

The FEIS falls far short of analyzing and disclosing these fragmentation effects on old-growth species' viability, caused by the current logged conditions and increased by the West Side Reservoir project.

Unfortunately, region-wide the pattern is the same. The FS has failed to meet Forest Plan old-growth standards, does not keep accurate old-growth inventories, and has not monitored population trends in response to management activities as required by Forest Plans and NFMA (Juel, 2003).

Mills (1994) criticizes a wildlife analysis performed by the Forest Service for a timber sale in the Kootenai National Forest. Mills points out that the FS's use of the term "viable" refers to <u>habitat characteristics</u>, not <u>population dynamics</u>. Mills goes on to explain the range of parameters that must be used to make a scientifically sound assessment of the viability of wildlife species. Population dynamics refers to persistence of a population over time—which is key to making predictions about population viability. Population dynamics include assessing population size, population growth rate, and linkages to other populations and must be included in a scientifically sound Population Viability Analysis (hereafter "PVA"). Ruggiero, et al. (1994) also point out that a sound PVA must utilize measures of population dynamics. Finally, the 1999 draft NFMA

planning regulations also recognize the importance of consideration of population dynamics for sustaining species.

The issue of providing for the larger landscape needs of far-ranging forest carnivores (including old-growth dependent species and the grizzly bear and gray wolf) reveals the need to utilize the principles of Conservation Biology on a landscape level. Core areas of relatively undisturbed habitats need to be maintained. Linkages with other core areas need to be established, providing sufficient habitat components so the linkages, or corridors, are functional for genetic interchange purposes. Both core areas and linkages should be the focus of the watershed rehabilitation and recovery (such as road removal). Buffer zones around core areas should also be recognized in their contribution to habitat needs for these wildlife species.

State-of-the-art conservation biology and the principles that underlie the agency's stated policy of "ecosystem management" dictate an increasing focus on the landscape-scale concept and design of large biological reserves accompanied by buffer zones and habitat connectors as the most effective (and perhaps only) way to preserve wildlife diversity and viability (Noss, 1993).

The FNF has failed to cite any evidence that its "managing for old growth habitat" (i.e., logging old growth) strategy will improve old growth species habitat over the short-term or long-term. In regards to the FNF's "managing for old growth habitat" theory:

> (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.**

(Pfister et al., 2000, pp. 11, 15 emphasis added). This is a clear indictment of the Amendment 21 methodology. Furthermore the FEIS fails to disclose how the areas logged will develop characteristics meeting old growth criteria at some specified time in the future, compared to a scenario under which the burned areas are not logged but retain all the current structure—structure such as large, dead trees and down logs that are necessary habitat components for old growth.

We incorporate, within this Statement of Reasons, the Ecology Center's (Ecology Center, 1998-1999), Friends of the Wild Swan's, Resources Limited's and Swan View Coalition's comments and appeals of the Flathead's Forest Plan Amendment 21. The FS's responses to those comments and appeals and the West Side Reservoir EIS, ROD (and responses to comments) do not adequately deal with the deficiencies of Forest Plan Amendment 21 pointed out by our previous and referenced documents. Rather than reiterate all of the same arguments put forth in the Amendment 21 appeals we incorporate by reference all the information previously provided to the Forest Service by the Ecology Center, Friends of the Wild Swan, Swan View Coalition, and Resources Limited.

Amendment 21 notes that old growth on the FNF been reduced to less than would have existed at historical times (15%). Optimal levels of old growth may have reached 60%. Amendment 21 (pages 53 and 84) suggests that a minimum of 20% old growth habitat may be required to ensure viability of associated wildlife. A scientifically sound assessment of direct, indirect and cumulative impacts of logging on the viability of old-growth associates has not been done. The drastic decline of mature and old-growth forests as compared to historical levels is also demonstrated with the more site-specific analysis provided in the West Side Reservoir FEIS.

The cumulative effects of the reduction of snag habitat within current old growth on snag-associated wildlife was never evaluated. Amendment 21 at page 54 notes that snags are an essential habitat component for two-thirds of the old-growth associated species, and that about 25% of all bird species nesting in the northern Rocky Mountains are cavity nesters. It notes at page 15 that "dead and defective trees are known to be one of the most important contributors to biological diversity within forest ecosystems."

By contrast, the proposed project would result in direct snag loss from logging operations. Given the importance of snag habitat to so many wildlife species, it is apparent that significant reductions in these wildlife species must have occurred on the FNF since historical times. Conifer snags have been cut near roads and larch snags located further from roads are still vulnerable to firewood cutters because of larch's high value as firewood.

Amendment 21 noted at page 54 that recent studies have shown that early snag models, such as the one used to develop the Forest Plan standards, used some assumptions and data that were incorrect, and that prescribed densities need to be revised upward. In this revision, they used the densities of snags found in unmanaged stands on the FNF, to which native cavity-nesting species presumably have adapted. Therefore snags left during the previous decades of management (before and after implementation of the FNF Plan in 1986) have been inadequate to ensure viability of associated wildlife.

Although the FS claims to have corrected the incorrect assumptions made regarding snag densities in the 1986 Forest Plan, it is unclear whether the necessary corrections have been implemented. The density of snags identified in a draft EIS for Amendment 21 was greatly reduced in that Final EIS, without any explanation. The draft of Amendment 21 concluded that in moist vegetation groups, 12 snags per acre were needed (8 over 12 inches and 4 over 20 inches dbh). The Amendment 21 FEIS reduced these to 8 snags (6 over 12 inches and 2 over 20 inches), or by 33%. This was an arbitrary reduction, as no discussion was ever provided to explain why the reduction was made.

In summary, there are many reasons why the existing snag levels on national forest lands are below levels the FS has identified as required for viability. No analysis of the current status of snag-dependent wildlife on the FNF, however, was provided in Amendment 21. And again, no analysis of the existing status of these species within the West Side Reservoir project or cumulative effects area was provided. This is a serious analysis flaw, because implementation of Amendment 21 will result in drastic reductions in prime snag habitat and closed-canopy old-growth forests.

It is likely that current conditions have strained the viability of many snag-dependent wildlife in many areas of the FNF due to poor management and heavy logging on both public and private lands. Many snag-associated species and populations may be heavily dependent upon what remains of quality habitat (old growth). Because the FS has failed in both the West Side Reservoir FEIS and Amendment 21 EIS to evaluate cumulative impacts on snag-dependent wildlife, the agency has failed to meet both the analysis and disclosure requirements of the NEPA and the viability requirements of the NFMA.

The FS failed to complete any analysis of the impacts of Amendment 21 on viability of old-growth wildlife species. Without such an analysis, the public could only guess as to the long-term impacts of implementation of Amendment 21 on wildlife. Although the FS recognizes that some threshold level of old-growth habitat loss may threaten forestwide viability of associated species, they proceed with this program without identifying when this threshold could be reached. The public is never informed of what this threshold level is, either. They in effect have no assurance that old-growth wildlife species will be preserved on the FNF.

SENSITIVE SPECIES

Populations of the species listed as Sensitive that occur on the FNF are already declining or at risk. The Forest Service Manual obligates Forest Supervisors to "[d]etermine distribution, status, and trend of … sensitive species and their habitats on Forest lands," see Forest Service Manual (FSM) 2670.45(4), and to document possible impacts to sensitive species of an activity in a "biological evaluation." FSM 2672.4, 2672.41, 2672.42. The FS itself has identified the obligation to determine the impact of logging on Sensitive Species - it uses BEs, has a Sensitive Species list, and has regulations specifically focusing on the special emphasis required for TES species (e.g. see FSM 2672.1) According to the FS Manual, Section 2670.22 on Sensitive Species, the FS must:

1. Develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions.
2. Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.
3. Develop and implement management objectives for populations and/or habitat of sensitive species.

The West Side Reservoir FEIS reveals no baseline or quantitative population data for the Sensitive species or their habitats. The agency has failed to obtain or maintain any past or current hard population or inventory or monitoring data for the Sensitive species at issue in the project area or for the FNF as a whole. Distribution, status and population trends have not been determined. FSM 2670.45. Viability cannot be assured without first establishing population objectives. FSM 2670.22(3) and 2672.1 and 32. These objectives have not been established. 36 CFR 219.12(d), 219.27(a)(5 & 6).

In response to USDA Regulation 9500-4 and NFMA's viability provisions, the Forest Service Manual outlines the need to design and implement conservation strategies for Sensitive and other species for which viability is a concern. The Forest Service Manual at FSM 2621.2 states:

> To preclude trends toward endangerment that would result in the need for Federal listing, units must develop conservation strategies for those sensitive species whose continued existence may be negatively affected by the forest plan or a proposed project.

Since the FNF does not meet species viability requirements, it is critical for the FNF to take steps to develop a multiple species conservation strategy. The problems with Amendment 21—its failure to be an effective conservation strategy—are pointed out above and in the administrative appeals of Amendment 21, incorporated by reference.

The limited analysis of the proposed logging on Sensitive species was too superficial and inadequate to support the West Side Reservoir FEIS's determinations of maintaining species viability. The FEIS does not contain enough data or analyses to support such conclusions. In the absence of specific population/inventory data and population trend analyses of Sensitive species, summary conclusions of maintaining species viability are not based on a hard look or all the relevant information and are necessarily unreasonable. Compliance with the biological and procedural requirements of Sensitive species is not ensured - see FSM 2670.46. Neither this ROD nor the Forest Plan are consistent with NFMA or NEPA.

A big problem with the West Side Reservoir FEIS's analyses is that discussions regarding the connection between the areas designated for old-growth management and habitat needs for Sensitive and other old-growth species such as the northern goshawk, fisher, black-backed woodpecker, and pine marten, i.e. how these areas contribute to population viability, is missing. Effects of cumulative habitat fragmentation from fire, roads, logging, private land developments, livestock grazing, motorized access, etc. is missing. The issue of fragmentation should have been more thoroughly considered with respect to interior forest species. It is documented that edge effects occur 10-30 meters into a forest tract (Wilcove, 1986). Other edge-adapted species may compete with and displace interior forest species if adequate amounts of forest interior habitat are not provided.

1. Fisher

The fisher is a Sensitive species. The West Side Reservoir FEIS contains no real analysis of fisher habitat. The current landscape is fragmented, with older forest and riparian blocks of habitat existing as small patches of habitat across the landscape. The amount of older forest in the West Side Reservoir project area is below or on the low end of normal historic range of variability. In other words, the FS is uncertain that adequate fisher habitat actually exists and provides no basis for claims that fisher viability is protected in this project area.

The West Side Reservoir FEIS failed to disclose and analyze the uncertain and precarious population status of fishers, as described in Witmer, et al., 1998:

> The status of the fisher in the Western United States is poorly known but generally perceived as precarious and declining. This is a serious issue alone, but it also is a component of the larger problem of the decline of biological diversity. Recovery of

> species of concern must necessarily focus on the population level, because this is the scale at which genetic variation occurs and because population[s] are the constituent elements of communities and ecosystems. Systematic habitat alteration and overexploitation have reduced the historical distribution of fishers in suitable habitat in the interior Columbia basin to isolated and fragmented populations. Current populations may be extremely vulnerable to local and regional extirpation because of their lack of connectivity and their small numbers (Id. at 14, internal citations omitted).

The project would adversely affect fishers and their habitat. Habitat elements for natal and maternal dens are found in large diameter logs or snags. These may be reduced in stands that have been intensively managed for timber. "Though the post-treatment stand condition would not be 'clear cuts', they would be fairly open and Jones (1991) did not expect to find substantial fisher hunting use of plantations by fishers until canopy approached 80% and 10-15 feet respectively (depending on snow depths)" (Flathead NF's Spotted Beetle EA, p. 3-62). Movement, denning, resting areas, genetic diversity, and other aspects of fisher life cycles and fisher survival would be impacted by the project; the FS does not fully consider these elements of the project or adequately mitigate their impacts.

Jones (undated) provides an example of a conservation strategies for the fisher, something the FNF has so far neglected for this species.

2. Black-Backed Woodpecker

The black-backed woodpecker is also a Sensitive species. Cherry (1997) states:

> The black-backed woodpecker appears to fill a niche that describes everything that foresters and fire fighters have attempted to eradicate. For about the last 50 years, disease and fire have been considered enemies of the 'healthy' forest and have been combated relatively successfully. We have recently (within the last 0 to 15 years) realized that disease and fire have their place on the landscape, but the landscape is badly out of balance with the fire suppression and insect and disease reduction activities (i.e. salvage logging) of the last 50 years. Therefore, the black-backed woodpecker is likely not to be abundant as it once was, and continued fire suppression and insect eradication is likely to cause further decline.

The West Side Reservoir FEIS fails to adequately consider the Region 1 black-backed woodpecker assessment (Hillis et al., 2003). Page 150 the DEIS stated, "These areas, especially in Glacier National Park, currently contain habitat to support high densities of black-backed woodpeckers." The other areas this statement refers to are the Moose and Red Bench fires. The Red Bench Fire was 16 years ago and is likely only providing habitat to a very few post fire or snag dependent species. The Moose Fire, along with most of the fires that have occurred in the North Fork Valley, has been logged as is now proposed in the West Side Reservoir Project and it is unclear from the analysis provided in the FEIS how useful these managed post-fire landscapes are to the black backed woodpecker or other post-fire dependent species.

Dolan (1998a,b) states in regards to impacts on the black-backed woodpecker due to fire suppression and post-fire logging states:

> It seems that we have a huge cumulative effects problem here, and that each salvage sale removes habitat that is already very limited. We are having trouble avoiding a "trend to federal listing" call for the BBWO in salvaging burns, unless comparable acres of fire-killed dead are being created through prescribed burns.

The comments by other biologists attached to Dolan, 1998a,b reveal that the FS has yet to design a consistent, workable, scientifically defensible strategy to ensure viable populations of the black-backed woodpeckers. The fire suppression and "salvage" logging policies of the FNF are the biggest threat to black-backed woodpecker population viability on the Forest, unfortunately in failing to create a conservation strategy the cumulative impacts of the FS's ongoing fire suppression and salvage polices remain unexamined. The FEIS represents a continuing policy of management for extinction.

The FEIS does not adequately consider management recommendations from other Region One black-backed woodpecker assessments such as O'Connor and Hillis (2000), such as:

> Conduct a Forest scale assessment of historic versus current amounts of source habitats for black-backed woodpeckers, including trends of subalpine, montane and lower montane old forests, managed and unmanaged young forest stages of lodgepole pine, areas of large scale insect infestations and burned forests. The assessment of burned forests should include estimates of amounts of post-fire habitat that currently exist compared to estimates of amounts that occurred historically and should consider historic fire regimes.
>
> … Leave some large patches of intact post-fire habitat, including entire fires. The size to leave is relative to the size of the fire, however we suggest that leaving a few larger patches or one very large patch is probably more valuable than scattered small patches, especially if managing for black-backed woodpeckers is an objective. Wisdom et al. (2000) suggest leaving patches at least 956 acres, based on home range sizes of black-backed woodpeckers in mature and old forests.

In their publication, "Trees and Logs Important to Wildlife in the Interior Columbia River Basin," Bull, et al. (1997) conclude:

> This document presents new information on the retention and selection of trees and logs most valuable to wildlife.
>
> …Current direction for providing wildlife habitat on public forest lands does not reflect this new information. Since the publication of Thomas and others (1979), new research suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting. Although we do not suggest specific numbers or snags to retain by forest type, tow recent studies indicate that viable woodpecker populations occurred in areas with about four snags per acre.
>
> We suggest that the next step in snag management should involve creating a model that incorporates the new information on woodpecker foraging substrates (live trees, snags, and logs), home range sizes, number and characteristics of roost trees,

> multiple occupancy of snags, and needs for other habitat structures. Once this information is incorporated, the model may suggest changes to guidelines that specify numbers of snags and other habitat features by forest type and geographic area. Additional information on fall rates of snags, foraging needs of black-backed and three-toed woodpeckers, relation of the density of woodpeckers to that of secondary cavity nesters, and relation of snag density to woodpecker density would greatly improve the model.

The FNF does not recognize this important research, and it implications for wildlife species such as black-backed and pileated woodpeckers. The West Side Reservoir FEIS makes promises that the Amendment 21 snag standards will be followed, yet never states how that will happen with a logging project that targets dead and dying trees for removal. The numerical, quantitative commitments to protecting snag habitat made in the FEIS do not adequately specify that, indeed, the largest snags will be prioritized for retention. By using trees as small as 18" dbh as representing the largest size class (FEIS at 3-269), for instance, the needs of the "former" MIS pileated woodpecker for nesting and roosting will be ignored. The FEIS also fails to cite the results of any monitoring that shows that snag standards have been met in similar projects.

In sum, the analysis for the black-backed woodpecker is clearly inadequate to maintain viable populations.

3. Northern Goshawk

The northern goshawk is also a Sensitive species. The West Side Reservoir FEIS states that there have been no goshawk surveys in this project area in recent years, but admits the area may provide some goshawk habitat.

Proposed logging, roadbuilding and other associated disturbance could affect goshawk nesting, post-fledging family habitat, alternative nesting, foraging, competitors, prey and potential habitat, including areas far from cutting units. Research in the Kaibab National Forest found that goshawk populations decreased dramatically after partial logging, even when large buffers around nests were provided (Crocker-Bedford, 1990).

Research suggests that it is essential to viability of goshawks that 20-50% of old growth within their nesting areas be maintained (Suring et al. 1993, Reynolds et al. 1992). USDA Forest Service, (2000b) recommends that forest opening greater than 50-60 acres be avoided in the vicinity of goshawks. At least five years of monitoring is necessary to allow for effective estimates of habitat quality (USDA Forest Service, 2000b). Research suggests that a localized distribution of 50% old growth should be maintained to allow for viability of goshawks (Suring et al. 1993).

The limited discussion in the West Side Reservoir FEIS provides limited scientific basis for habitat conditions believed necessary for goshawks. And the FEIS does not clearly disclose how goshawk habitat and goshawk viability would be affected by the project and cumulative effects.

The FEIS fails to include any scientifically developed conservation strategy for the goshawk such as Reynolds et al. 1992, Crocker-Bedford 1990, the Utah strategy (Graham et al., 1999), strategies for Alaska (Suring et al., 1993 and Iverson et al., 1996) and the Black Hills National

Forest (USDA Forest Service, 2000b). The Northern Region's guidance, USDA Forest Service (1990), could have gotten the FS moving in the right direction, however the agency ignores what that document recommends for a goshawk conservation strategy on the FNF.

And the FEIS provides no detailed analysis of cumulative effects to the goshawk, including impacts related to non-FS lands and other lands within goshawk range.

Goshawks are associated with habitat with large-diameter overstory trees, large standing dead or defective trees, downed logs, a deep duff layer, and formation of several canopy layers (USDA Forest Service, 1990).

4. Boreal Toad

The West Side Reservoir FEIS does not consider cumulative effects on upland habitat for boreal toads. This does not make sense, since such small populations that are likely to persist are especially susceptible to fragmentation and extirpation due to isolation of smaller populations. See Maxell, 2000. In fact, the FEIS has no real analysis of cumulative impacts on boreal toads at all.

In fact there seems to be more scientific information on boreal toads and wildland fire in the popular press than in this FEIS (see: Appeal Attachment 3, two newspaper articles).

MANAGEMENT INDICATOR SPECIES

The FNF Forest Plan originally designated the pileated woodpecker and pine marten as MIS for old growth, and as the comments on appeals of Amendment 21 discuss, illegally dropped them from the MIS list. As it stands, the Forest Plan is completely inadequate for maintaining viable populations of these species.

The FNF has also failed to perform monitoring of population trends, as NFMA (and also the Forest Plan before adoption of Amendment 21) requires. And as was noted in Amendment 21 at pg. 109, the FNF does not intend to monitor population trends of any species, including their "new" old growth MIS. Instead, viability of these species will be "inferred" from the monitoring of occupancy of old-growth habitats (#15 in Chapter V-Monitoring and Evaluation). The specifics of what such monitoring would require were never addressed within Amendment 21. In this respect, we are forced to wait and see how this monitoring would be implemented. It is clear that there is no commitment on the part of the FNF for monitoring population or habitat trends of old-growth wildlife, and therefore there exists a lack of feedback on the efficacy of the Forest Plan's strategies for maintaining viability on the FNF. Hence, the viability monitoring requirements as defined in the NFMA are not going to be met with Amendment 21 or the West Side Reservoir FEIS project.

The FEIS and ROD are not consistent with NFMA's provisions requiring adequate **amount** and adequate **distribution** of habitat to **insure** species' viability, for both MIS and Sensitive species.

1. Pileated Woodpecker

The Idaho Panhandle National Forests' Forest Plan provides an example of better management directives for the pileated woodpecker. Wildlife Standard #10f requires "One or more old-growth stands per old-growth unit should be 300 acres or larger. Preference should be given to a contiguous stand; however, the stand may be subdivided into stands of 100 acres or larger if stands are within one mile. The remaining old-growth management stands should be at least 25 acres in size. Preferred size is 80 plus acres." IPNF Forest Plan at II-29. This and other IPNF old growth Standards are based upon what the IPNF recognizes are pileated woodpecker habitat needs:

> To retain a viable population of pileated woodpeckers on the IPNF … our recommendations are:
>
> 1. Retain 10 percent old-growth throughout the Forests.
> 2. Distribute the old-growth so that old-growth compartments with 5 percent old-growth retain at least 5 percent old-growth. All old-growth stands 25 acres should be retained in old-growth compartments containing less than 5 percent old-growth.
> 3. In each 10,000 acre unit at least 300 acres should be managed specifically for pileated woodpeckers. To maximize benefits to other species as well as pileateds the 300 acres should be either contiguous or divided into subunits no smaller than 100 acres. The subunits should be within approximately two square miles.
> 4. The areas managed for pileated woodpeckers should be at least 200 yards wide.
> 5. Areas selected for old-growth management for pileated woodpeckers should also be close to water. Old-growth larch stands are highly recommended for pileated woodpecker management.

IPNF Forest Plan EIS Appendix 27 at p. II-40.

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

The West Side Reservoir FEIS also ignored many structural habitat components necessary for the pileated woodpecker. 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

This preferred diameter of nesting trees for the pileated woodpecker recognized therein is notable. 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 rather large diameter is not considered in the FEIS.

B.R. McClelland has extensively studied the pileated woodpecker habitat needs. To quote a March 12, 1985 letter from B.R. McClelland to FNF Supervisor Edgar B. Brannon:

> 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 minimum 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 old/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.

The West Side Reservoir FEIS ignores more specific habitat needs of this species in B.R. McClelland's comments on the FNF Forest Plan, in McClelland, 1977, and in McClelland et al., 1979. 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.
>
> A cluster analysis based on a nine-dimensional ordination of nest tree traits and habitat traits revealed close association between Yellow-bellied Sapsuckers, Mountain Chickadees, and Red-breasted Nuthatches. These three species plus the Pileated Woodpecker and Hairy Woodpecker are relatively grouped by coincident occurrence in old growth. Tree Swallows, Black-capped Chickadees, and Common Flickers are separated from the above five species by their preference for more open areas and their frequent use of small dbh nest trees.
>
> (Most) species found optimum nesting habitat in stands with a major component of old growth, particularly larch. Mean basal area for pileated woodpecker nest sites was 150 square feet per acre. (McClelland. B.R. and others, 1979)
>
> Many large snags are being cut for firewood. Forest managers should limit firewood cutting to snags less than 15 inches in d.b.h. and discourage use of larch, ponderosa

pine, and black cottonwood. Closure of logging roads may be necessary to save high-value snags. Logging slash can be made available for wood gatherers.

The FS has stated: "Well distributed habitat is the amount and location of required habitat which assure that individuals from demes, distributed throughout the population's existing range, can interact. Habitat should be located so that genetic exchange among all demes is possible." (Mealey, 1983.) This cited document also provides guidance as to how habitat for the pileated woodpecker must be distributed for populations to persist.

Since the FS has never analyzed the forestwide old growth situation in order to demonstrate it has the amount and distribution necessary to insure viability of old growth species' populations, the West Side Reservoir FEIS is based upon an inadequate cumulative impacts analysis for old-growth dependent wildlife species.

2. Pine Marten

Ruggerio, et al. (1998) and Bull and Blumton, 1999, indicate that vertical and horizontal diversity provided by snags and large down woody debris are important habitat characteristics for the pine marten. Their research shows that the logging proposed for the West Side Reservoir FEIS project reduce the availability of prey species for the marten. The FEIS's lack of analysis for impacts on marten viability is not scientifically defensible.

Old growth allows martens to avoid predators, provides resting and denning places in coarse woody debris and large diameter trees, and allows for access under the snow surface. USDA Forest Service (1990), a summary of old-growth habitat needs of martens, reviewed research suggesting that martens prefer forest stands with greater than 40% tree canopy closure and rarely venture more than 150 feet from forest cover, particularly in winter. It also cites research suggesting that at least 50% of female marten home range should be maintained in mature or old growth forest. Also, consideration of habitat connectivity is essential to ensuring marten viability: "To ensure that a viable population of marten is maintained across its range, suitable habitat for individual martens should be distributed geographically in a manner that allows interchange of individuals between habitat patches (Id.).

The FS has otherwise recognized the need for updated guidelines for the pine marten: "Apply snag and down woody material guidelines from the Upper Columbia River Basin Assessment to improve marten habitat" (USDA Forest Service 2000c, p. 39).

Unfortunately, the West Side Reservoir FEIS makes no determination regarding the significance of the pine marten habitat losses associated with the fire or past or proposed logging. This does not insure viability of the species, as NFMA requires.

IV. SOIL PRODUCTIVITY

If the FS genuinely were to respond to the water quality and fisheries concerns as Beschta et al., 1995 and Beschta et al., 2004 express, they would have included an alternative that would at least not log moderately nor severely burned sites due to impacts on water quality and fish

habitat from the 2003 fires alone. Such an alternative would respond to the major water quality issues, the existing cumulative effects from the fire and from past management activities. McBride (2001) puts it well: "…soils are the basic resource supporting terrestrial and to a significant degree, aquatic ecosystems; healthy ecosystems are not possible without healthy soils."

The proposal to log in areas of low soil productivity due to impacts of wildland fires and past logging activities flies in the face of NFMA's requirements to assure regeneration, sustained yield, and maintain soil productivity. Sec. 6. of the National Forest Management Act states:

> (g) As soon as practicable, but not later than two years after enactment of this subsection, the Secretary shall in accordance with the procedures set forth in section 553 of title 5, United States Code, promulgate regulations, under the principles of the Multiple-Use, Sustained-Yield Act of 1960, that set out the process for the development and revision of the land management plans, and the guidelines and standards prescribed by this subsection. The regulations shall include, but not be limited to-
>
> (3) specifying guidelines for land management plans developed to achieve the goals of the Program which-
>
> (E) insure that timber will be harvested from National Forest System lands only where-
>
> (i) soil, slope, or other watershed conditions will not be irreversibly damaged;

NFMA regulations at 36 C.F.R. § 219.27 (Management requirements) state:

> (a) *Resource protection.* All management prescriptions shall--
>
> (1) Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land;
>
> (b) *Vegetative manipulation.* Management prescriptions that involve vegetative manipulation of tree cover for any purpose shall--
>
> (5) Avoid permanent impairment of site productivity and ensure conservation of soil and water resources;

Forest Plan Standards state:

> 1) Ensure that all resource management activities will maintain soil productivity and minimize erosion…
>
> 2) Design or modify all management practices as necessary to protect land productivity.

Land productivity is not maintained by taking actions like those approved by the West Side Reservoir ROD that, essentially, permanently reduce the productivity of the soil. Furthermore, the FNF has never assessed "land productivity" losses due to the infestations of noxious weeds caused by soil disturbance associated with its land management practices. The principles of sustained yield of timber are also not served well when the FS does not know how losses in land productivity lead to reductions in timber yield over second and later rotations.

In order to comply with NFMA, its implementing regulations, and Forest Plan Standards, the Northern Region adopted Soil Quality Standards (FSM 2500-99-1). Therein the standards read:

> Policy. Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent. In areas where more than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality.

It is clear that the intent of the Soil Quality Standards is that the FS must, in each case, consider the cumulative effects of both past and proposed soil disturbances to assure the desired soil conditions are met. This includes impacts from activities that include logging, firewood gathering, livestock grazing, and motorized recreation impacts, for under Definitions the Standards state:

> Activity Area. A land area affected by a management activity to which soil quality standards are applied. Activity areas must be feasible to monitor and include harvest units within timber sale areas, prescribed burn areas, grazing areas or pastures within range allotments, riparian areas, recreation areas, and alpine areas. All temporary roads, skid trails, and landings are considered to be part of an activity area.

Further down at FSM 2554.1, the Soil Quality Standards state:

> 1. Detrimental Soil Disturbance. These disturbances includes the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. At least 85 percent of an activity area must have soil that is in satisfactory condition. Detrimental conditions include:
>
> Compaction. Detrimental compaction is a 15 percent increase in natural bulk density. The cumulative effects of multiple site entries on compaction should also be considered since compacted soils often recover slowly.
>
> Rutting. Wheel ruts at least 2 inches deep in wet soils are detrimental.
>
> Displacement. Detrimental displacement is the removal of 1 or more inches (depth) of any surface soil horizon, usually the A horizon, from a continuous area greater than 100 square feet.
>
> Severely-burned Soil. Physical and biological changes to soil resulting from high-intensity burns of long duration are detrimental. This standard is used when evaluating prescribed fire. Guidelines for assessing burn intensity are contained in the Burned-Area Emergency Rehabilitation Handbook (FSH 2509.13).
>
> Surface Erosion. Rills, gullies, pedestals, and soil deposition are all indicators of detrimental surface erosion. Minimum amounts of ground cover necessary to keep soil loss to within tolerable limits (generally less than 1 to 2 tons per acres per year) should be established locally depending on site characteristics.
>
> Soil Mass Movement. Any soil mass movement caused by management activities is detrimental.

3. Monitoring Methods. **Visual methods are generally used to make initial evaluations of the effects of management activities on soils.** The major objective of soil quality monitoring is to ensure that ecologically sustainable soil management practices are being applied. In most cases, qualitative estimates will be considered sufficient. The use of photo points provides good documentation and is recommended. Measurements and detailed sampling are used to calibrate visual methods and to conduct investigations where visual methods are inadequate or where benchmark or statistically valid sampling is required.

a. Areal Extent Sampling. **Estimates of the percent of an activity area affected by detrimental soil disturbance can be made visually or by transecting**. If statistically valid techniques are needed for benchmark sites, determine sample size and transect design using procedures described in Howes, Hazard, and Geist 1983.

b. Soil Sampling Techniques. Soil displacement, rutting, severely burned soil, erosion, mass movement, and above-ground organic matter can be observed and measured. (Emphasis added.)

It should be noted that the FS assumes that maintaining soil productivity is achieved simply by limiting detrimental disturbance to no more than 15% of an Activity Area (logging or "treatment" unit). Unfortunately, the scientific adequacy of the FS's methodology for maintaining soil productivity on the FNF has never been demonstrated. The FS's determination that it may permanently damage the soil on 15% of an activity area and still meet NMFA and planning regulations is arbitrary. The FEIS does not cite any scientific basis for adopting the 15% numerical limit.

Even considering their limitations, the Regional Soil Standards are clear—the FNF must measure the amount of detrimentally disturbed soils from past or ongoing logging, grazing, off-road vehicle use, etc. in logically bounded Activity Areas—especially if the soil in those disturbed sites would be further disturbed by proposed project activities.

Despite the Regional Soil Quality Standards requirement that temporary roads be included in calculations of percent detrimental soil disturbance for activity areas, the FEIS does not disclose the location or lengths of the proposed temporary roads to be constructed in the units. The FEIS is written as if unlimited skid trail and temporary road construction can be done in logged activity areas without considering the damaged areas as detrimental soil disturbance.

The FEIS does not disclose the locations and sizes of log proposed landings, which is important because of the extreme amount of soil and other disturbance that occurs on these sites—they will be essentially industrialized for the long-term, despite "mitigation." Also, these impacted areas must be part of the calculation of detrimental disturbance as per the Soil Quality Standards, which the FEIS neglects to do.

The FS, in its "Response to Motion for Preliminary Injunction" brief in the ongoing case CV-02-200-M-LBE states in regards to a scientific report, "Dr. Schloeder's purported 'statistical analysis' reports no confidence intervals, standard deviations or standard errors in association with its conclusions." The FS doesn't seem to want to hold itself to the same high standards it expects of those who disagree with FS analyses. Activity area detrimental soil disturbance percentages are not presented with "confidence intervals, standard deviations or standard errors

in association with its conclusions." This is likely because soil surveys of past logged areas in the project area were not performed with sound scientific methodology. Since the FEIS does not provide the public or decision maker with any kind of information on the accuracy of its estimates of detrimental soil disturbance, the FEIS's information is not scientifically valid or reliable and fails to meet NEPA requirements.

The FS is avoiding the entire issue of maintaining soil productivity. As indicated in the Forest Plan, FSM 2500-99-1 and FSH 2509.18, the FS assumes that maintaining soil productivity is achieved simply by limiting detrimental disturbance to no more than 15% of an activity area (cutting unit). Unfortunately, the scientific adequacy of the FS's methodology for maintaining soil productivity on has never been demonstrated. The FS's determination that it may permanently damage the soil on 15% of an activity area and still meet NMFA and planning regulations is arbitrary. Neither the FEIS, the Forest Plan, nor the FSM 2500-99-1 cite adequate scientific basis for adopting 15% as a numerical limit—it is simply arbitrary.

The FS has essentially admitted that it is in the dark as far as doing scientific research on soil productivity changes following management activities. In response to comments on the Black Ant Salvage DEIS, Lewis & Clark NF, the FS states:

> Soil Quality Standards "provide benchmark values that indicate when changes in soil properties and soil conditions would result in significant change or impairment of soil quality based on available research and Regional experience" (Forest Service Manual 2500, Region 1 Supplement 2500-99-1, Chapter 2550 – Soil Management, Section 2554.1).
>
> A formal research study, the "Long Term Soil Productivity Study," is currently being conducted by the Research Branch of U.S. Department of Agriculture, Forest Service to validate these soil quality standards.

(USDA Forest Service, 2002a.)

A problem with the soil quality standards (and the FEIS's interpretation of them) is that they do not set any rational limits for cumulative loss in soil productivity <u>outside the activity areas</u> of the proposed timber sale. It is thus the FS's position that areas that have experienced significant losses of soil productivity from livestock grazing, roads, landings, off-road vehicle can be unlimited in any project area or watershed regardless of what new is proposed.

It is clear that the intent of the Regional Soil Quality Standards is that the FS must, in each case, consider the cumulative effects of both past and proposed soil disturbances to assure that soil productivity will be maintained. This includes impacts from activities that include logging, livestock grazing, motorized vehicle use, etc.

Application of Regional Soil Quality Standards for soil productivity conservation requires direct, on-the-ground surveys in areas affected by previous management activities in order to provide numerical percentages of existing detrimentally disturbed activity areas. Without taking this step, decisions resulting in <u>any</u> soil impacts will be made lacking the cumulative effects analysis that NEPA and the Forest Plan requires.

Alexander and Poff, 1985 (cited in the FEIS) note that livestock grazing and other activities such as ORVs and motorcycles cause significant soil compaction.

The FEIS cites inadequate soil monitoring to justify its conclusions. Alexander and Poff (1985) reviewed literature and found that as much as 10% to 40% of a logged area can be disturbed by skyline logging. They state:

> There are many more data on ground disturbance in logging, but these are enough to indicate the wide diversity of results obtained with different equipment operators, and logging techniques in timber stands of different composition in different types of terrain with different soils. Added to all these variables are different methods of investigating and reporting disturbance.

Forest Plan monitoring requirement 52 requires the FS to "Monitor soil compaction and displacement resulting from Forest management activities."" (Forest Plan at V-14). The FS has consistently failed to monitor and report on this item adequately.

Adams and Froehlich (1981) provide reasons why impacts **beyond** the directly compacted 15% of an area must be considered in any reasonable definition of soil productivity:

> Since tree roots extend not only in depth but also in area, the potential for growth impact also becomes greater as compaction affects more of the rooting area. In a thinned stand, for example, you can expect the greatest growth impacts in residual trees that closely border major skid trails or that have been subject to traffic on more than one side of the stem."

In other words, when an Activity Area reaches 15% detrimentally impacted soils via compaction, tree growth **outside the skid trail,** or beyond the compacted area, is affected. This is ignored in the FEIS.

For a study done on the Kootenai and Flathead National Forests, soil scientists measured soil bulk densities, macropore porosities, and infiltration rates using paired observations of disturbed vs. undisturbed soils. They 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… (and) Furthermore, ... subsurface compaction occurred in glacial deposits to a depth of at least 16 inches." (Kuennen, Edson, and Tolle, 1979.) The FS does not have enough soil bulk density and other compaction monitoring data collected at the adequate soil depths and in enough sites on the FNF to be able to make accurate predictions about the effects of soil compaction in Project activity areas.

Following a study by Cullen et al., (1991) which was carried out on the Kootenai NF and the Flathead NF, the authors concluded: "This result lends support to the general observation that most compaction occurs during the first and second passage of equipment." And Page-Dumroese (1993), in a Forest Service research report investigating logging impacts on volcanic ash-influenced soil in the Idaho Panhandle NF, states, "Moderate compaction was achieved by driving a Grappler log carrier over the plots twice." She 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 to come 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, "Unfortunately, little research has yet been done to compare the compaction and related impacts caused by low-pressure and by conventional logging vehicles."

The Northern Region recognizes that soil quality standards must be validated. FSM 2500-99-1 requires that Forest Supervisors must:

- Assess … whether (soil quality standards) are effective in maintaining or improving soil quality;
- Evaluate the effectiveness of soil quality standards and recommend adjustments to the Regional Forester; and
- Consult with soil scientists to evaluate the need to adjust management practices or apply rehabilitation measures.

This all implies that monitoring must be undertaken. Furthermore, FSM 2500-99-1 recognizes that soil productivity is defined not merely in terms of the absence of meeting the 15% standard. "Soil Function" is defined thus:

> Primary soil functions are: (1) the sustenance of biological activity, diversity, and productivity, (2) soil hydrologic function, (3) filtering, buffering, immobilizing, and detoxifying organic and inorganic materials, and (4) storing and cycling nutrients and other materials.

And "Soil Quality" is defined as "The capacity of a specific soil to function within its surroundings, support plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation."

Neither soil function nor soil quality, as FSM 2500-99-1 defines it, have ever been monitored on the FNF following management activities. Unfortunately, the FS seems to have only interpreted monitoring requirements in terms of maintaining no more than 15% of activity areas in a detrimentally disturbed condition.

The Forest Management Handbook at FSH 2509.18 directs the FS to do validation monitoring to "Determine if coefficients, S&Gs, and requirements meet regulations, goals and policy" (2.1 – Exhibit 01). It asks what we are asking: "Are the threshold levels for soil compaction adequate for maintaining soil productivity? Is allowing 15% of an area to be impaired appropriate to meet planning goals?" The Ecology Center recently asked the Northern Region if they have ever performed this validation monitoring of its 15% Standard, in their February 26, 2002 Freedom of Information Act request to the Regional Forester, requesting:

> The Forest Management Handbook at FSH 2509.18 provides the Forest Service with examples of validation monitoring to "Determine if coefficients, S&Gs, and requirements meet regulations, goals and policy." It asks "Are the threshold levels for soil compaction adequate for maintaining soil productivity? Is allowing 15% of an area to be impaired appropriate to meet planning goals?" We request all

> documentation of validation monitoring by the Forest Service in the Northern Region that answers those two questions.

The Regional Office's reply letter stated that there is no documentation that responds to this request.

FSM 2500-99-1 superceded similar directives issued in 1994 (FSH 2509.18). Both versions of these Regional directives have required implementation and effectiveness monitoring. But as the Regional Office's reply to the Ecology Center FOIA indicates, the FEIS is unable to cite the results of any monitoring, required by the Standards, to provide a basis for assuming the Standards actually protect **soil productivity**.

Page-Dumroese et al. 2000 (an earlier version of which is cited in FSM 2500-99-1) 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. (Abstract.)

Soil productivity can only be assumed to 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 FNF.

Also, the mitigation measures, such as operating ground-based equipment when soil moisture is low is so vague as to protect nothing, Also, the FEIS fails to cite the results of monitoring that prove the mitigation measures are effective in protecting soil and maintaining soil productivity.

It is reasonable to expect that in order for the FS to assure that soil productivity is not or has not been significantly impaired, to assure that the forest is producing a sustained yield of timber, for one example, tree growth must not be significantly reduced by soil-disturbing management activities. Grier and others (1989), in a FS General Technical Report, adopted as a measure of soil productivity: "the total amount of plant material produced by a forest per unit area per year." (P. 1.) And 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.

The FEIS does not consider the location of fire suppression activities to fall under the definition of “activity area” as defined by the FSM R1 Supplement 2500-99-1.

The FEIS does not consider that areas where rill and/or gully erosion have occurred following the fires fall under the definition of “detrimentally displaced” (as per FSM R1 Supplement 2500-99-1).

The FEIS does not consider that the wildfires have caused areas to fall under the definition of “detrimentally burned” (as per FSM R1 Supplement 2500-99-1).

The FEIS does not consider that areas burned such that the areas having less available nitrogen, potassium, calcium, magnesium or other nutrients because of the effects of fire fall under the definition of “detrimentally burned” (as per FSM R1 Supplement 2500-99-1).

The FEIS does not consider that areas burned such that they would be void of soil fungi and bacteria fall under the definition of “detrimentally burned” (as per FSM R1 Supplement 2500-99-1).

The chemical and biological make-up of the specific soils in the project area, and their ability to withstand fire and detrimental disturbance that lowers soil productivity is not a subject adequately taken up by the FS. Harvey et al., 1994 state:

> 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.)

Another big problem is that the FEIS largely relies on the FS’s track record of relying upon Best Management Practices (BMPs) to base its claims that soil productivity will be maintained following logging practices. However, the BMP monitoring cited in the FEIS did not attempts to measure post-project soil productivity, since the audits are not scientifically designed to do so. Also, the BMP monitoring cited in the FEIS did not measure post-project detrimental disturbance percentages in any activity areas.

V. ROADLESS ANALYSIS IS INADEQUATE

This was another issue concerning which the FS chose to ignore the public process. Our comments on the DEIS stated:

> The DEIS discusses unroaded areas outside Inventoried Roadless, but it does not take the necessary step of clarifying roadless boundary issues. There isn't even a single map showing the unroaded areas it alleges to discuss. And the DEIS severely downplays impacts to Wilderness potential, dismissing impacts thus: "Salvage logging within the undeveloped areas may temporarily affect the impression of natural integrity, naturalness, and feeling of remoteness during the activities. …This effect will gradually decrease after completion of activities and become unrecognizable after trees become reestablished" (3-403). The DEIS even outrageously claims that logging activities will result in conditions being more natural: "The planting associated with the proposed action may even hasten the areas ability to appear natural and remote"!
>
> See Riggers, et al. 1998 for a good discussion on the comparison of stream and water quality conditions in roadless areas vs. roaded, developed areas. Barring the FNF's own similar analysis, please explain why the roaded streams on the FNF would show any less contrast with unroaded streams as for the Lolo NF.

The FEIS provided some additional analysis, but did not remedy the problems. There were no maps provided to the public at large that disclosed the locations of the unroaded areas the FEIS alleges to discuss. The FEIS fails to disclose the cumulative effects of project activities on the wilderness character of entire blocks of inventoried and uninventoried roadless areas. The FEIS failed to meet the requirements of the National Environmental Policy Act for analysis and disclosure of adverse environmental impacts on unroaded areas.

The FEIS does not include a logging alternative that would not affect all currently unroaded areas contiguous with inventoried roadless and Wilderness, despite the fact that their omission from inventoried roadless was arbitrary, and the science that indicates such areas are the highest ecological integrity across the Northern Rockies.

Since the FEIS failed, as required, to incorporate the Roads Analysis Process and disclose the locations of all motorized travelways in the project area, it is impossible for the decision maker and public to tell which of the areas to be logged fall within logically bound roadless areas (not just "inventoried" roadless areas).

Biologically, speaking, the arbitrary "inventoried" roadless areas boundaries are irrelevant. The FEIS failed to analyze significant resources the FS has repeatedly acknowledged are associated with unroaded areas. In addition it does not disclose the irreversible and irretrievable commitment of resources caused by logging activities in these areas, particularly unroaded areas contiguous to "inventoried" roadless areas.

Federal Register: October 19, 1999 (Volume 64, Number 201)]
[Notices]
[Page 56306-56307]

Notice of Intent to prepare an EIS

> "This proposed rulemaking responds to strong public sentiment for protecting roadless areas and the clean water, biological diversity, wildlife habitat, forest health, dispersed recreational opportunities and other public benefits they provide."
>
> "... establishing criteria and procedures to ensure that the social and ecological values, that make both inventoried roadless areas and other uninventoried roadless lands important, are considered and protected through the forest planning process"
>
> "It would also guide land managers in determining what activities are appropriate in uninventoried roadless areas that have important ecological and social values."
>
> "National procedures and criteria that address how land managers at the forest plan level should manage uninventoried roadless areas so as to protect their unroaded characteristics and benefits"

[Federal Register: May 10, 2000 (Volume 65, Number 91)]
[Proposed Rules]
[Page 30275-30288] Notice of Roadless Area Conservation Proposed Rule

> The intent of this rulemaking is to provide lasting protection in the context of multiple-use management for inventoried roadless areas and other unroaded areas within the National Forest System
>
> Soil, water, and air. These three key resources are the foundation upon which other resource values and outputs depend. Healthy watersheds provide clean water for domestic, agricultural, and industrial uses; help maintain abundant and healthy fish and wildlife populations; and are the basis for many forms of outdoor recreation.
>
> Healthy watersheds provide a steady flow of high quality water, maintain an adequate supply of water, and reduce flooding. Managing land uses to keep watersheds properly functioning and in natural balance is critical to maintaining watershed health and productivity.
>
> Roadless areas generally have attributes that promote watershed health, primarily because minimal ground-disturbing activities have occurred.
>
> Ground disturbing activities can accelerate erosion, increase sediment yields, and disrupt normal flow processes. Roadless areas maintain healthy and productive soils, which promote water entry into aquifers, minimize accelerated runoff, and provide for a diverse and abundant plant community important to both human and animal health. Roadless areas are less likely to suffer from human-caused landslides and other soil movement that fill streams with sediment and debris and disrupt normal stream processes. Roadless areas also have less dust and vehicle emissions, which reduce air quality, elevate human health risks, and diminish water quality.

Roadless areas help maintain the high quality visibility that forest users seek when visiting the national forests.

****

Unroaded areas are more likely than roaded areas to support greater ecosystem health, including the diversity of native and desired non-native plant and animal communities, due to the absence of disturbances caused by roads and accompanying activities. Healthy ecosystems can be characterized by the degree to which ecological factors and their interactions are reasonably complete and functioning for continued resilience, productivity, and renewal of the ecosystem. Native plant and animal communities tend to be more intact in these less disturbed areas. Roadless areas also conserve native biodiversity, by providing a buffer against the spread of invasive species.

Conserving biodiversity offers many benefits to society. The public has recognized the importance of protecting species and ecosystems for their utilitarian, subsistence, and intrinsic values. Important benefits provided by healthy ecosystems, with diverse organisms and intact natural processes, include: (1) conservation of air, water, and soil quality and (2) sustainable levels of goods and services, including viable and desired levels of both game and non-game species. In addition to these important reasons for maintaining healthy ecosystems with a full component of biodiversity, many species are valuable for medicinal and agricultural purposes.

Protecting and maintaining biodiversity also provides the opportunity for the appreciation and enjoyment of natural beauty and gives future generations the chance to experience wild places, with their unique living plant and animal communities.

***

The Forest Service manages environmental settings to provide, among other things, opportunities for recreational experiences. The Recreation Opportunity Spectrum (ROS Users Guide, FSM 2311 and FSH 2309.27) was developed to provide a framework for classifying and defining segments of outdoor recreational environments, potential activities, and experiential opportunities.

The Recreation Opportunity Spectrum's settings, activities, and opportunities represent a continuum that is divided into six classes: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban. Inventoried roadless and other unroaded areas are characterized mainly by the primitive, semi-primitive non-motorized, and semi-primitive motorized classes.

Primitive and semi-primitive non-motorized classes often have many wilderness attributes; however, unlike wilderness, the use of mountain bikes and other mechanized means of travel, such as those used by people with disabilities, can be

permitted. In addition, these classes have fewer restrictions on motorized tools, search and rescue operations, and aircraft use than in wilderness areas.
In semi-primitive motorized settings, there is little evidence of managerial control, yet these areas allow some motorized activities, such as: off-highway vehicle, over-snow vehicle, motorboat, and helicopter use; chainsaw and other motorized tool use; and appropriate motor vehicle use for other resource management activities. In addition, persons with disabilities have enhanced access capability in semi-primitive motorized class areas.

Inventoried roadless and other unroaded areas may provide outstanding opportunities for other dispersed recreational activities, such as hiking, fishing, camping, hunting, picnicking, wildlife viewing, cross-country skiing, and canoeing. All of these activities and those mentioned for the semi-primitive motorized class may occur in areas on the developed end of the spectrum, but the experience is different. Roaded natural, rural, and urban classes are characterized by increased interactions with other people, more sights and sounds of human development and activity, more management restrictions and controls, and more landscape modification resulting from resource management activities.

Inventoried roadless and other unroaded areas are the last remaining relatively undisturbed landscapes outside of wilderness and similarly designated areas. The demand for motorized and non-motorized recreation opportunities is increasing. As these lands continue to be developed, the supply of unroaded lands that are available for dispersed recreation is reduced.

***

The Forest Service believes that it is important to protect the roadless characteristics of unroaded areas within the context of its multiple-use mandate.

The Selected Alternative maps in the ROD reveal unroaded areas that would be logged along the edges of the obviously roaded areas. Contiguous unroaded lands can be critically important linkage between roadless and/or Wilderness areas, are often at lower elevations and therefore provide unique roadless values based on differences in vegetation and habitat, proximity to mainstem rivers and larger streams and accessibility to primitive and semi-primitive recreation to the public. The FEIS failed to recognize or analyze the role of these lands and to analyze them, despite the agencies continued recognition of their unique status and qualities. This is a failure to analyze a significant resource under Section 102(C) of the National Environmental Policy Act. As a result it also violates the public participation requirements of NFMA. In addition, logging in these lands is an irreversible commitment of resources, requiring full NEPA analysis of the values potentially affected by logging: soils, watershed and native fisheries, natural plant communities invasion, outdoor recreation, wildlife habitat, and wilderness value.

Contiguous unroaded lands (those contiguous with inventoried roadless areas) have been recognized for their unique ecological potential by the USFS. Recently, the current administration noted in its Interim Directive on the Roads Policy, issued December 14, 2001:

> Additionally, the revision of Forest Service Manual Chapter 7710 included interim requirements that, rather than addressing the transportation atlas, record, or analysis, imposed a significant restriction on road construction or reconstruction in inventoried roadless areas and contiguous unroaded areas until a forest-scale roads analysis was completed and incorporated into the Forest plan. (66 FR 65796.)

Thus, the first set of Forest Service Manual provisions accompanying the roads policy acknowledged the special importance of these lands for protection of roadless values. In addition, the agency continued to recognize their importance and link them to IRA's in terms of shared values:

> …. remains consistent with the agency's intent in adopting the final road management directive in January 2001. As explained in the January Federal Register notice, the agency retained the transition procedures of the proposed policy (renamed "interim requirements" in the final directive) to ensure that the "values associated with inventoried roadless and contiguous unroaded areas are fully considered within the context of forest planning" (66 FR 3226, Col. 3). (66 FR 65798)

Logging of the undeveloped tracts of land contiguous to inventoried roadless areas or Wilderness requires full analysis of the wilderness, recreational and other values of the areas. The FEIS fails to do this. Hence, the FS makes the untenable decision to defer the decision of what to do with these areas until after they have modified them. The impacts of this irreversible action occur now, not some unspecified time in the future, and must be completely reviewed before irreversible action is taken. Logging in these unroaded areas will change their nature and reduce and modify many of the watershed values they may now serve. The reliance on management unit designations in Forest Plans that have now expired under the 15-year term under NFMA (16 USC § 1604(f) (5) "Plans… shall (5) be revised … at least every fifteen years") is also misguided. Reliance on an outdated forest plan and then claiming that the decision can be deferred to a forest planning process to conclude at an uncertain time places these lands in limbo where the FS is free to alter their intrinsic value without analysis. The effects of logging cannot, as a practical matter, be reversed any time soon. Instead it will take decades for the areas to return to their prior values. In addition, the FEIS fails to adequately analyze and disclose adverse impacts that cannot be avoided by logging these areas. Plainly, the analysis given unroaded areas is not sufficient.

VI. INADEQUATE ASSESSMENT OF WATER QUALITY AND FISHERIES HABITAT.

As a legal matter, the FS's obligations under both the Clean Water Act (CWA) and NFMA are clear and beyond dispute. The agency must protect water quality and comply with state water quality standards on National Forest system lands. *Marble Mountain Audubon Soc. v. Rice*, 914 F.2d 179, 182 (9th Cir. 1990); *Oregon Natural Resources Council v. U.S. Forest Service*, 834 F.2d 842, 848 (9th Cir. 1987); *Northwest Indian Cemetery Protective Ass'n v. Peterson*, 794 F.2d 688, 697 (9th Cir. 1987); 33 U.S.C. 1323(a) ("Each department, agency, or instrumentality of the executive [branch] . . . shall be subject to, and comply with, all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and

abatement of water pollution"); NFMA at 16 U.S.C. 1604(g)(3)(E)(iii) (timber may be harvested only where "protection is provided for streams, streambanks shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment"); NFMA regulations at 36 C.F.R. 219.23(d) ("Forest Planning shall provide for -- Compliance with requirements of the Clean Water Act, the Safe Drinking Water Act, and all substantive and procedural requirements of Federal, State and local governmental bodies") and at 219.27(a)(4) ("All management prescriptions shall . . . Protect streams, streambanks, shorelines, lakes, wetlands and other bodies of water").

Elevated peakflows contribute to downstream flooding and increase the magnitude and extent of flood damage. Elevation of downstream flows also increases downstream channel erosion and sediment transport. Even relatively slight increases in downstream flooding greatly increase downstream erosion and sediment transport because they are exponentially related to streamflow (King, 1989).

Rain-on-snow events lead to further stream channel degradation, due to the large increases in runoff over a short time. Massive sediment delivery to the system occurs during high discharge events typically associated with rain-on-snow conditions.

The FEIS's watershed analysis relies, to a great degree, upon the WATSED model and on the ECA (Equivalent Clearcut Acres) modeling procedures. The WATSED model, used to estimate streamflow effects, consistently underestimates the effects of logging and roads on peakflows. The Iron Honey FEIS (Idaho Panhandle NF, 2001) concedes that the IPNF's own data indicate that WATSED consistently underestimates monthly peakflows by 3-17% (see Appeal Attachment 4). The FEIS fails to incorporate this FS information in its discussion of likely effects on flows within the project area and downstream. In fact, the model's consistent underestimation of monthly peakflows is never discussed in the context of the alternatives' effects on channel conditions and processes and aquatic habitat and fish populations.

The FEIS also wholly ignores and fails to disclose the FS's own research (King, 1989) on the accuracy of a peakflow model, similar to the ECA method, in estimating increases in peakflows from logging and roads in nearby northern Idaho. King (1989) examined the veracity of a model for changes in peakflow as a function of ECA. King found that the ECA model consistently underestimated measured increases in flow caused by roads and logging.

The WATSED model outputs are also inadequate to disclose the effects of the alternatives and cumulative effects on peakflows and resultant impacts on aquatic resources, because the model estimates changes in **average monthly** peakflow caused by logging and roads. The FEIS only discusses cumulative and alternative effects on these average monthly peakflows. The FEIS fails to disclose that King (1989) clearly noted that estimates of average monthly peakflows triggered by logging and roads are not adequate for estimating likely changes in channel conditions and sediment transport caused by logging and roads. King (1989) noted:

> …the largest 7 or 8 days of streamflow account for the majority of the bedload movement…Average monthly streamflows are usually not a good index of bedload transport, and 'changes in average annual monthly peakflows have no meaningful

> effect on sediment transport' (Megahan, 1979) and are thus poor indicators of changes in channel-forming flows.

In his research in northern Idaho, which is clearly relevant to the project area, King (1989) also stated:

> Thus, it is the relatively few **high flow days** that have the potential for shaping the channel. Increases in **short duration high flows** following harvesting and road building are more important in terms of potential channel erosion and bedload transport than increases in longer duration high flows such as the **maximum mean monthly streamflows**… (emphasis added).
>
> Therefore, increases in short-duration highflows are more important than longer duration highflows in shaping the channel, and any procedure to estimate streamflow responses and set limits on harvesting should focus on these shorter duration highflows.

Although the FEIS fails to disclose or discuss these important conclusions from the FS's own research, which are directly relevant to the West Side Reservoir project's likely impacts, King (1989) clearly indicates that the FEIS's estimates of effects on average monthly peakflows is inadequate for determining the effects of the alternatives and cumulative effects on peakflows and resultant impacts on channel erosion, bedload transport, sedimentation, bank erosion, fish habitat, fish survival, and downstream flooding impacts.

The FEIS's analysis of changes in monthly peakflow is not a surrogate for estimates of daily and instantaneous peakflows triggered by the alternatives and in combination with the cumulative effects of the existing road network and past logging. These peakflow attributes, which are ignored in the FEIS, are most important for determining the likely effects on channels and sediment transport triggered by logging and roads (King, 1989). Average peakflows are not of greatest concern. Sediment transport and channel change are greatly affected during extreme events.

WATSED and ECA estimates of peakflow changes do not address changes in daily and instantaneous peakflows from rain-on-snow events caused by logging and roads. Rain-on-snow events occur with some regularity within the Decision area. Rain-on-snow events during the winter and spring months have been found to be the dominant mechanism causing peak flows in the area (MacDonald and Hoffman, 1995).

WATSED's limitations are listed on page D-2 of the Iron Honey FEIS and read as follows:

> **Model Limitations:**
> WATSED estimates cumulative effects based on the average, measured response of the watersheds used to develop the model. Different watersheds respond differently to stress due to a vast number of climatic and environmental factors (Brooks and others 1991, Troendle and King 1985, Megahan 1983, Christner and Harr 1982). WATSED cannot account for the multitude of factors that cause variability among watersheds. Therefore, it uses simplified rules and assumptions set by the author (Patten 1989, Patten 2000, USFS (unpubl)). As a result, WATSED outputs should

not be interpreted as measured values from the watershed being analyzed. Natural variability, technical limitations, measurement error, and model limitations must be considered when interpreting hydrologic models (Harr 1986, Thomas and Megahan (1998)). For example,

- WATSED assumes that a road prism stays open and maintained to perpetuity. Many forest roads are little used and heavily re-vegetated. This model limitation would tend to result in overestimates of sediment yield.
- WATSED does not explicitly evaluate the risk of stream crossing failure, which is a major factor in sediment risk in the Coeur d'Alene River. This model limitation tends to result in underestimates of the bedload component of sediment yield. (An additional Risk Analysis procedure is used for evaluating stream crossings).
- Natural resilience to disturbance. Low-level changes in sediment yield and peak flow do not usually cause measurable changes in stream condition unless they are sustained for long periods of time (Patten 2000).

The FEIS vaguely states that WATSED does not estimate sediment and water discharge from rain-on-snow events and the effects of large destructive events. The FEIS fails, however, to disclose the model is also limited in evaluating in-channel and stream-bank erosion.

The Iron Honey FEIS (p. D-3) admits that because of model error, measurement error, and natural variability and resulting differences between WATSED estimates and actual values peak flows and sediment yield, WATSED results should be interpreted as relative indicators of watershed response rather than absolute predictors of flow; the WATSED model is useful for evaluating watershed condition and comparing management alternatives, but it does not provide accurate estimates of flow. Despite this admission, the WATSED estimates of changes in monthly average peakflow caused by the alternatives are not given as a possible range of real vales with their range of real environmental effects. The FEIS is devoid of a discussion of impacts of changes in peakflows on aquatic resources based on entirely reasonable assumptions that:

a) WATSED underestimates of effects on average monthly peakflows, and;
b) impacts on daily and instantaneous peakflows are likely to be greater than indicated by WATSED estimates.

Even very small changes in peakflow can have significant impacts on channel erosion and sediment transport, because they are exponentially affected by streamflow (King, 1989). For these reasons, even small and, possibly immeasurable increases in peakflows have significant impacts on channels, fish habitat, and sediment transport within the project area watersheds.

The FEIS fails to disclose that small headwater channels are especially vulnerable to increased erosion and sediment transport to downstream habitats caused by increased peakflows (King, 1989). Increased peakflows lead to head cutting channel erosion, expansion of cross-sectional channel area, channel widening, and elevated bank erosion. Increases in peakflow, alone, can increase erosion in smaller streams contributing to downstream sedimentation in pools and low gradient stream reaches. King (1989) warned that the increased peakflow documented in watersheds in northern Idaho could increase downstream sedimentation since sediment transport was highly

correlated to peak streamflow magnitude. Although channel adjustment processes are complicated, it is indisputable that increases in peakflow will result in enlarged channel area via increased channel erosion (Schumm, 1969; Richards, 1982). The FEIS fails to adequately disclose that these impacts can be extremely significant, even if they are immeasurable.

Since some watersheds likely exceed limits considered acceptable and present information is inadequate to conclude that project area streams meet all Riparian Management Objectives (RMOs), the ECA modeling procedure cannot be relied upon as the analysis does. This is reinforced in the three Kootenai NF memos included as Appeal Attachment 5.

It should be noted that the FEIS also fails to disclose the values of ECAs over time following past management actions, as modeled for past NEPA documents prepared to justify logging in these watersheds. Since the damage already exists, it is arbitrary and capricious to go forward with the Selected Alternative, reducing tree canopy and other vegetation cover over more acres, causing more damage to the watershed and aquatic habitat.

Another major problem with the ECA and WATSED is that they fail to take into account the extreme peak flow increases due to the high density of roads in the project area. As was pointed out in the Ecology Center's April 16, 1998 letter to Flathead National Forest Supervisor, incorporated as comments on the DEIS:

> Project analyses generally far underestimate the impacts of roads upon the affected watersheds. In a letter to the Kootenai National Forest, dated February 6, 1995, entitled: *Factors Supporting Road Removal and/or Obliteration*, KNF Hydrologist Steve Johnson, states, "Impacts from roads basically fall into three areas: introduced sediment into streams; snowmelt re-direction and concentration; and surface flow production."
>
> In this memo, Johnson discusses how "snowmelt re-direction and concentration and surface flow production" increase peak flow amounts <u>multiplicatively</u> by the presence of roads in a drainage. (He cites a Flathead National Forest study, by the way, to support this conclusion). Typical FNF project analyses fail to acknowledge the degree to which roads increase peak flows <u>above the amounts the WATSED model estimates</u>.
>
> Johnson adds, "For the roads we no longer actively use, our dwindling road maintenance budget will make it difficult to maintain the culvert crossings. When these fail during storm and runoff events, tremendous amounts of sediment can be delivered directly to the channel and from there down to lower streams with significant beneficial uses such as sensitive fish habitat." FNF timber sale project analyses always fail to disclose the significance of this foreseeable lack of maintenance, and the direct, indirect and cumulative effects poorly maintained roads have on water quality.

Johnson also pointed out in his memo that the old road design--the road design used on many roads in the project area—utilized ditches on the inside of the road which greatly increases drainage efficiency, causing peak flows to go far beyond any modeled predictions. So the very

existence of the current road network that is causing major water quality impacts. (*See* Johnson, 1995.)

Since modeled numbers and other statistics for peak flows are only estimates, the amount of error in such statistics should be disclosed in the FEIS to shed light on the real meaningfulness of differences in the various predicted ECA and WATSED figures used in analyses of the various alternatives. Indeed, the undated memo included with Appeal Attachment 5 admits that peak flow increases should be listed as a "range" of allowable increases. It is possible that differences may be mostly or entirely error. Whenever comparisons are made which rely on numerical value estimates, the amount of expected precision, or lack thereof, must be disclosed. This makes it possible for the decision maker and public to tell if the differences between alternatives in ECAs in specific watersheds are meaningful, or if the amount of inherent error or uncertainty in the models precludes such comparisons.

This is not to say that insignificant differences between alternatives in <u>modeled results</u> means that the alternatives have virtually the same impacts. It just means the model itself is not precise enough to detect differences in impacts between alternatives. The FEIS completely fails to disclose the amount of precision or error in the models.

The FEIS relies upon surveys of stream stability, etc. that were performed in September and October of 2003, the same year as the fires. Effects due to water yield increases and sediment impacts would likely no be apparent at that time, not even one spring runoff was reflected in the survey results.

The FS has failed to obtain or maintain any past or current hard population or inventory or monitoring data for the MIS and Sensitive fish species at issue in the project area or for the FNF as a whole. Distribution, status and population trends have not been determined. The FS hasn't even determined the minimum viable population as NFMA requires.

The FEIS fails to disclose the sediment yield due to simply increase use of the roads due to logging and administrative traffic. From an investigation of the Bitterroot Burned Area Recovery Project, hydrologist Rhodes (2002) notes, "On all haul roads evaluated, haul traffic has created a copious amounts of mobile, non-cohesive sediment on the road surfaces that will elevate erosion and consequent sedimentation, during rain and snowmelt events." USDA Forest Service, 2001a also presents an analysis of increased sedimentation because of log hauling.

Not all roads in the project area will be brought up to BMP standards. The FEIS fails to disclose the risk of resulting chronic watershed impacts of these continuing sub-standard roads and road/stream crossings. Even if all roads were to be brought up to BMP standards, it is clear that more maintenance will be needed in later years, without the FEIS identifying the needs nor the funding to achieve them.

Best Management Practices (BMPs) have failed to prevent degradation of water quality on the FNF. BMPs that have already failed cannot be relied upon to prevent further water quality degradation. Beschta et al. (2004) state:

> It is perhaps widely accepted that "best management practices" (BMPs) can reduce damage to aquatic environments from roads. Time trends in aquatic habitat indicators indicate, however, that BMPs fail to protect salmonid habitats from cumulative degradation by roads and logging (Espinosa et al. 1997.) Ziemer and Lisle (1993) note a lack of reliable data showing that BMPs are cumulatively effective in protecting aquatic resources from damage.

Fish habitat surveys cited in the FEIS were performed **before** the fires, and therefore before a major habitat-impacting event—the 2003 fire season including the fires and suppression activities. The FEIS fails to include reasonably up-to-date fish habitat surveys and fish population surveys, such that NFMA's viability provisions were met.

Furthermore, the FEIS fails to provide any data on most of the RMOs the Forest Plan alleges to manage for. Thus, the FEIS fails to demonstrate compliance with a major Forest Plan/INFISH standard, that being insurance that RMOs are not being retarded by the project activities.

INFISH buffers do not necessarily prevent further temperature increases in the streams. The programmatic bull trout Biological Assessment and Biological Opinion discusses how upland forest canopy removal causes higher water temperatures. Also, further aggradation of the stream channels due to increases water yield will lead to shallower, wider channels, which will naturally mean more of the water surface exposed to warm air in summer.

The FEIS does not adequately disclose the degree of mass failures in the watershed. Mass failures easily travel through INFISH buffer strips causing huge amounts of sediment increases into streams. Since INFISH and BMPs fail to prevent degradation of water quality and aquatic habitats, more logging and road building with implementation of INFISH and BMPs cannot be relied upon to prevent further water quality degradation.

The FS has also failed to monitor the long-term impacts on water quality and fish habitat from implementing the Forest Plan. As a result, the cumulative impacts of logging and road building are not sufficiently disclosed in the FEIS or anywhere else.
Furthermore, results of monitoring the impacts of a host of past projects in the Project Area watersheds were not adequately disclosed in the FEIS.

VII. OTHER MONITORING AND CUMULATIVE EFFECTS ANALYSIS FAILURES

The national forest and land of other ownerships in the West Side Reservoir project area has been heavily logged previously (see: "Logging Details Info.doc" and "Extent of Logging Info.doc" and the maps they refer to on CD-1 included with this appeal.). The NEPA documents for those FNF projects included monitoring requirements as part of each project. It is important that the results of past project-level and forest plan-level monitoring be incorporated into project-level analysis. The monitoring information following from those projects would naturally be of prime interest to the public and to the Interdisciplinary Team for the West Side Reservoir Project. All Interdisciplinary Team Members should be familiar with the results of all past monitoring pertinent to the project area, and any deficiencies of monitoring that have been

previously committed to. The FEIS didn't even have a list of those actions creating all the roads and logging all those acres, nor does the FEIS disclose the differential effects of those various projects on all resources of concern. Nor does the West Side Reservoir FEIS disclose the results of all monitoring done in the project area as committed to in the NEPA documents of those past projects. Finally, it fails to disclose if there was any proposed monitoring, specified in those past project NEPA documents which the FS has failed to perform or report on due to funding shortfalls or other problems.

In our comments on the DEIS, we stated:

> The cumulative effects analysis is largely a listing of projects, there is no meaningful analysis of how those activities, both inside and outside the project areas, have affected or will affect wildlife, fish, water quality or soils. In order for a cumulative effects analysis to be sufficient, the following must be included in the EIS:
>
> - A list of all past projects (completed or ongoing) implemented in the proposed project areas' watersheds.
> - The results of all monitoring done in the project areas as committed to in the NEPA documents of those past projects.
> - The results of all monitoring done in the proposed project areas as a part of the Forest Plan monitoring and evaluation effort.
> - A description of any monitoring, specified in those past project NEPA documents or the Forest Plan for proposed project areas, which has yet to be gathered and/or reported.
>
> It is important that the results of past project-level and forest plan-level monitoring be incorporated into project-level analysis. The project area was logged and roaded in previous projects. The NEPA documents for those projects included monitoring requirements as part of the project. The monitoring information following from those projects would naturally be of prime interest to the public and to the Interdisciplinary Team. The DEIS didn't even have a list of those actions creating the roads and logging units, nor disclose the differential effects of those different projects on all resources of concern. Finally, it fails to disclose if there was any proposed monitoring, specified in those past project NEPA documents or the Forest Plan for proposed project area, which the FS has failed to perform or report on due to funding shortfalls or other problems.

In past projects in the project area, thousands of acres have been logged to meet various project "Purpose and Need" statements. It is necessary to know if all aspects of those "Purpose and Need" statements have been met, and if not, why not. And the many assumptions and predictions of resource impacts, were they at all accurate? Do all native wildlife species still exist here as part of viable populations? Is the soil still productive enough to carry on sustained yield of timber? Did the mitigation measures for water quality prevent unwanted degradation? Did all the mitigation and restoration items identified in those NEPA documents get done, and were they effective? Was sediment yield reduced, or was that merely optimistic propaganda? These questions aren't mere idle speculation. But the lack of awareness of these facts and issues in the West Side Reservoir FEIS reveal a continuing bias in the agency towards one major preoccupation, that being timber production. We don't believe the agency really wants the public

(nor the ID Team members) to know the facts, because such facts would contradict the preconceived premises of this next industrial timber extraction project.

RELIEF REQUESTED

The analysis and decision-making process supporting the West Side Reservoir ROD's selection of Alternative E as modified is inadequate. Appellants have outlined, within this statement of reasons, why the ROD is arbitrary, capricious, and illegal. Appellants request that the FEIS and ROD be withdrawn or remanded for the reasons set forth in this Statement of Reasons, and if the FS wants to proceed with a logging project in this area, an Environmental Impact Statement be prepared that fully complies with all laws, regulations, and policies.

Submitted respectfully for the appellants:

Jeff Juel
The Ecology Center, Inc
314 North First Street West
Missoula, Montana 59802
406-459-5936

Michael Garrity
Alliance for the Wild Rockies
P.O. Box 505
Helena, Montana 59624
406-728-5733

Cameron Naficy
Native Forest Network
P.O. Box 8251
Missoula, MT 59807
406-542-7343

Jake Kreilick
National Forest Protection Alliance
P.O. Box 8264
Missoula, Montana 59807
406-829-6353

Literature cited in appeal and previous comments

(Most of these are included electronically on CD-2. Some others were supplied to the Appeal Deciding Officer as paper copies with appellants' appeal of the Robert-Wedge ROD, Flathead NF, on January 28, 2005, and we incorporate those by reference in this appeal.)

Aho, P. E., G. M. Filip and F. F. Lombard. 1987. Decay fungi and wounding in advance grand and white fir regeneration. Forest Science 33: 347-355.

Adams, P.W, and Froehlich, H.A. 1981. Compaction of Forest Soils, PNW-217, Pacific Northwest Extension Publication.

Alexander, E.B., and R. Poff. 1985. Soil disturbance and compaction in wildland management. USDA Forest Service, Pacific Southwest Region, Earth Resources Monogr. 8. 157 p.

Ament, Robert 1997. Fire Policy for the Northern Rocky Mountains (U.S.A.) American Wildlands, 40 E. Main, Suite 2, Bozeman, MT 59715. September 1, 1997

Arno, S.F., H.Y. Smith and M.A. Krebs 1997. Old growth Ponderosa Pine and Western Larch Stand Structures: Influences of pre-1900 Fires and Fire Exclusion. USDA Forest Service, Intermountain Research Station, INT-RP-495.

Bachman, D., G. Gadwa, and C. Groves. 1990. A winter survey for wolverines (Gulo gulo) on the Sawtooth and Challis National Forests, Idaho. Idaho Department of Fish and Game, July 1990.

Becker, Earl F. 1991. A Terrestrial Furbearer Estimator Based on Probability Sampling. Journal of Wildlife Management; v. 55, no. 4, pp. 730-737.

Beschta, Robert L., Christopher A. Frissell, Robert Gresswell, Richard Hauer, James R. Karr, G. Wayne Minshall, David A. Perry, and Jonathan J. Rhodes. 1995. Wildfire And Salvage Logging: Recommendations for Ecologically Sound Post-Fire Salvage Management and Other Post-Fire Treatments On Federal Lands in the West. Oregon State University, Corvallis, OR.

Beschta, Robert L., Jonathan J. Rhodes, J. Boone Kauffman, Robert E. Gresswell, G. Wayne Minshall, James R. Karr, David A. Perry, F. Richard Hauer and Christopher A. Frissell. 2004. Postfire Management on Forested Public Lands of the Western United States. Conservation Biology, Vol. 18, No. 4, August 2004, Pages 957-967.

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.

Bull, E., et al. 2001. Effects of Disturbance on Forest Carnivores of Conservation Concern in Eastern Oregon and Washington. Northwest Science. Vol 75, Special Issue, 2001.

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., 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.

Center for Biological Diversity, 2004. Petition To The Northern And Intermountain Regions Of The U.S. Forest Service To Amend National Forest Plans To Protect The Northern Goshawk. Center for Biological Diversity, Alliance for the Wild Rockies, Biodiversity Conservation Alliance, Friends of the Clearwater, Idaho Conservation League, Wyoming Wilderness Association.

Chavez, T. D., R. L. Edmonds and C. H. Driver. 1980. Young-growth western hemlock stand infection by Heterobasidion annosum 11 years after precommercial thinning. Canadian Journal of Forest Research 10: 389-394.

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.

Copeland, J. 1993. Assessment of Snow-tracking and Remote Camera Systems to Document Presence of Wolverines at Carrion Bait Stations. Idaho Department of Fish and Game, Boise, Idaho, April 1993.

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.

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

Dolan, P., 1998a, b. Email discussion with USFS Region One wildlife biologists regarding black-backed woodpecker and attached "Salvage of Burned Stands: Wildlife Considerations." On file at Lolo National Forest.

Edmonds, R. L., D. C. Shaw, T. Hsiang and C. H. Driver. 1989. Impact of precommercial thinning on development of Heterobasidion annosum in western hemlock. pp. 85-94 in Proceedings of the Symposium on Research and Management of Annosus Root Disease (Heterobasidion annosum) in Western North America. W. J. Otrosina and R. F. Scharpf, tech. coord. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

Ercelawn, A. 1999. End of the Road -- The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research. 130 pp. Natural Resources Defense Council. New York. Available online at: http://www.nrdc.org/land/forests/roads/eotrinx.asp

Ercelawn, A. 2000. Wildlife Species and Their Habitat: The Adverse Impacts of Logging -- A Supplement to End of the Road. 41 pp. Natural Resources Defense Council. New York. Available online at: http://www.nrdc.org/land/forests/eotrsupp.asp

Espinosa, F. A., Jr., J. Rhodes, and D. McCullough. 1997. The Failure of Existing Plans to Protect Salmon Habitat in the Clearwater National Forest in Idaho. Journal of Environmental Management 49, 205-230p.

Filip, G. M. 1979. Root disease in Douglas-fir plantations is associated with infected stumps. Plant Disease Reporter 63: 580-583

Foresman, Kerry R., and D. E. Pearson. 1998. Comparison of Proposed Survey Procedures for the Detection of Forest Carnivores. Journal of Wildlife Management; v. 62, no. 4, pp. 1217-1226.

Fowler, James F. and Carolyn Hull Sieg, 2004. Postfire Mortality of Ponderosa Pine and Douglas-fir: a Review of Methods to Predict Tree Death. Rocky Mountain Research Station RMRS-GTR-132, July 2004.

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

Goheen, D. J. and E. M. Hansen. 1993. Effects of pathogens and bark beetles on forests. pp. 175-196 in Beetle-Pathogen Interactions in Conifer Forests. T.D. Schowalter and G.M. Filip, eds. Academic Press. San Diego.

Goheen, D. J., F. W. Cobb Jr., D. L. Wood and D. L. Rowney. 1985. Visitation frequencies of some insect species on Ceratocystis wageneri infected and apparently healthy ponderosa pines. Canadian Entomologist 117: 1535-1543.

Goheen, E. M. and D. J. Goheen. 1989. Losses caused by annosus root disease in Pacific Northwest forests. pp. 66-69 in Proceedings of the Symposium on Research and Management of Annosus Root Disease (Heterobasidion annosum) in Western North America. W. J. Otrosina and R. F. Scharpf, tech. coord. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

Graham, Russell T.; Alan E. Harvey, Martin F. Jurgensen, Theresa B. Jain, Jonalea R. Tonn, and Deborah S. Page-Dumroese. 1994. Managing Coarse Woody Debris in Forests of the Rocky Mountains. Res. Pap. INT-RP-477. Ogden, UT: USDA-Forest Service, Intermountain Research Station. 13 pp.

Graham, Russell T.; Rodriguez, Ronald L.; Paulin, Kathleen M.; Player, Rodney L.; Heap, Arlene P.; Williams, Richard. 1999. The northern goshawk in Utah: habitat assessment and management recommendations. Gen. Tech. Rep. RMRS-GTR-22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 48 p.

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.

Habeck, J.R. 1990. Old-growth ponderosa pine-western larch forests in western Montana: ecology and management. Northwest Environmental Journal. 6: 271-292. 1990. University of Washington, Seattle, WA.

Habeck, James R. 1988. Old-growth Forests in the Northern Rocky Mountains. Natural Areas Journal. Vol. 8(3): 202-211. 1988.

Hansen, E. M. 1978. Incidence of Verticicladiella wagenerii and Phellinus weirii in Douglas-fir adjacent to and away from roads in western Oregon. Plant Disease Reporter 62: 179-181.

Hansen, E. M., D. J. Goheen, P. F. Hessburg, J. J. Witcosky and T. D. Schowalter. 1988. Biology and management of black-stain root disease in Douglas-fir. pp. 63-80 in Leptographium Root Diseases on Conifers. T.C. Harrington and F.W. Cobb, Jr. eds. APS Press. St. Paul, Minnesota.

Hanson, Chad (undated-a). Post-fire Survival of Mature Western Conifers. John Muir Project. mailto:chadhanson@nccn.net

Harris, Larry. The Fragmented Forest. Island Biogeography Theory and the Preservation of Biotic Diversity.

Harris, Richard B. 1999. Abundance and characteristics of snags in western Montana forests. Gen. Tech. Rep.. RMRS-GTR-31. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 19 pp.

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)

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., 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.

Hillis, Mike; Amy Jacobs, and Vita Wright, 2003. Black-Backed Woodpecker Assessment. U.S. Forest Service Region One.
http://www.fs.fed.us/r1/cohesive_strategy/integration/wildlife/R1_bbwo_assessment.htm

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

ICBEMP DSEIS Appx 12. Requirements For Snag And Downed Wood. Interior Columbia Basin Supplemental Draft Environmental Impact Statement, Vol. 2, Appendix 12. Interior Columbia Basin Ecosystem Management Project, United States Department of Agriculture Forest Service, United States Department of the Interior Bureau of Land Management. March 2000.

Ingalsbee, Timothy; 2004. Collateral Damage: The Environmental Effects of Firefighting. The 2002 Biscuit Fire Suppression Actions and Impacts. Western Fire Ecology Center and American Lands Alliance, May 2004. http://www.fire-ecology.org/research/biscuit_suppression.html

Iverson, George C., G.D. Hayward, K. Titus, E. DeGayner, R.E. Lowell, D.C. Crocker-Bedford, P.F. Schempf, and J. Lindell, 1996. Conservation Assessment for the Northern Goshawk in Southeast Alaska. USDA Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-387.

Johnsen, S., 1996. Identification of Potential Fisher Habitat on the Kootenai National Forest. July 11, 1996.

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

Jones, A.J., and Gordon E. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon . Water Resources Research, Vol. 32, No. 4, pages 95-974, April 1996.

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

Juday, Glenn Patrick, 1978. Old Growth Forests: A Necessary Element of Multiple Use And Sustained Yield National Forest Management. Environmental Law, Vol. 8, pp 497-522.

Juel, Jeff, 2003. Old Growth at a Crossroads: U.S. Forest Service Northern Region National Forests noncompliance with diversity provisions of their Forests Plans and the National Forest Management Act Regulations. The Ecology Center, Inc. 27p. August 2003.

King, J.G. 1989. Streamflow responses to road building and harvesting: a comparison with the equivalent clearcut area procedure. Res. Pap. INT-401. Ogden, UT: USDA-FS, Intermountain Research Station. 13 pp.

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

Lacy, Robert C., and Tim W. Clark. 1993. Simulation Modeling of American Marten (Martes Americana) Populations: Vulnerability to Extinction. Great Basin Naturalist; v. 53, no. 3, pp. 282-292.

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

Lindenmayer, David B., Clark, T.W., Lacy, R. C., and Thomas, V. C., 1993. Population Viability Analysis as a Tool in Wildlife Conservation Policy: With Reference to Australia. Environmental Management Vol. 17, No. 6, pp 745-758.

Lindenmayer D.B., D.R. Foster, J.F. Franklin, M.L. Hunter, R.F. Noss, F.A. Schmiegelow, and D. Perry, 2004. Salvage Harvesting Policies After Natural Disturbance. Science, Vol. 303, Feb. 27, 2004.

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.

MacDonald, L.H., and J.A. Hoffman, 1995. Causes of Peak Flows in Northwestern Montana and Northeastern Idaho. Water Resources Bulletin. 31(1): 79-95.

Marcot, Bruce G. & D. D. Murphy, 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 A. 2000 Management of Montana's Amphibians. Wildlife Biology Program, Univ. of Montana & USDA Forest Service, Northern Region. Report (Order Number 43-0343-0-0224).

McClelland B. Riley and McClelland Patricia T. 1999. Pileated woodpecker nest and roost trees in Montana: links with old growth and forest "health". Wildl. Soc Bull. 27(3):846-857

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, 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.

McDonald, G. I., N. E. Martin and A. E. Harvey. 1987. Armillaria in the Northern Rockies: Pathogenicity and Host Susceptibility on Pristine and Disturbed Sites. USDA Forest Service. Research Note INT-371. 5 p.

McHugh, Charles W. and Thomoas E. Kolb, 2003. Ponderosa Pine mortality following fire in northern Arizona. International Journal of Wildland Fire, 2003, 12, 7-22.

Mealey, Stephen P., 1983. Wildlife Resource Planning Assistance to the Payette and Boise National Forests. Land Management Planning Systems/WO, 3825 E. Mulberry, Ft. Collins, Colorado 80524. Memo 1920/2620 dated April 1, 1983. 10 pages.

Mills, L. Scott, 1994. Declaration in Support of Plaintiff's Motion for Summary Judgment and Permanent Injunction. Civil No. CV 94-108-M-CCL.

Morrison, D. and K. Mallett. 1996. Silvicultural management of armillaria root disease in western Canadian forests. Canadian Journal of Plant Pathology 18: 194-199.

Noss, Reed F.,1993. The Wildlands Project Land Conservation Strategy. Wild Earth Journal, Special Issue: 10-26

O'Connor, Tricia and Mike Hillis, 2000. Conservation of Post-fire Habitat, Black-Backed Woodpeckers and Other Bird Species on the Lolo National Forest (DRAFT). Lolo National Forest, November 2000

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.

Peckinpah, Ross, 2000. Personal communication with Chad Hanson, John Muir Project, 12/7/00).

Peterson, David L., Kevin C. Ryan, 1986. "Modeling Postfire Conifer Mortality for Long-range Planning," Environmental Management, Vol. 10, No. 6, p. 801-802, Fig. 5.

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.

Raphael, Martin G. 1994. Techniques for Monitoring Populations of Fishers and American Martens. Pages 224-240 in Martens, Sables, and Fisher. Biology and Conservation. Edited by S. W. Buskirk, A. S. Harestad, M. G. Rapheal, and R. A. Powell. Cornell University Press, Ithaca.

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.

Rhodes, Jon, 2002. Bitterroot National Forest Burned Area Recovery Project Post-fire salvage logging field review: 8/20-22/2002. Jon Rhodes, Hydrologist, Center for Biological Diversity.

Richards, K., 1982. Rivers: Form and Process in Alluvial Channels. Methuen & Co., New York.

Riggers, B., A. Rosquist, R. Kramer and M. Bills, 1998. An analysis of fish habitat and population conditions in developed and undeveloped watersheds on the Lolo National Forest. Forest Report. 64 pp.

Roth, L. F., L. Rolph and S. Cooley. 1980. Identifying infected ponderosa pine stumps to reduce costs of controlling Armillaria root rot. Journal of Forestry 78: 145-15

Ruggiero LF, Hayward, G.D. and Squires, J.R., 1994. 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., Dean E. Pearson, and Stephen E. Henry, 1998. Characteristics of American Marten Den Sites in Wyoming. Journal of Wildlife Management 62(2): 663-673, 1998.

Ruggiero, Leonard F.; Aubry, Keith B.; Buskirk, Steven W.; Koehler, Gary M.; Krebs, Charles J.; McKelvey, Kevin S.; Squires, John R. 1999. Ecology and Conservation of Lynx in the United States. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-30, 1999.

Ryan, K., Peterson, D., and Reinhardt, E., "Modeling Long-Term Fire-Caused Mortality of Douglas-Fir," Forest Science, Vol. 34, No. 1, p. 197, Fig. 1 (1988).

Ryan, Kevin C. and Reinhardt, Elizabeth D., 1988. "Predicting postfire mortality of seven western conifers," U.S. Forest Service, Intermountain Fire Sciences Laboratory, Intermountain Forest and Range Experiment Station, p. 1294, Fig. 2, published in Can. J. For. Res. Vol. 18 (1988).

Saveland, James M. and Leon Neuenschwander, 1990. "A Signal Detection Framework to Evaluate Models of Tree Mortality Following Fire Damage," Forest Science, Vol. 36, No. 1, pp. 73 – 75.

Schumm, S.A., 1969. River metamorphosis. J. Hydraul. Div., Amer. Soc. of Civil Engineers, 95: 255-273.

Smith, R. S., Jr. 1989. History of Heterobasidion annosum in Western United States. pp. 10-16 in Proceedings of the Symposium on Research and Management of Annosus Root Disease (Heterobasidion annosum) in Western North America. W. J. Otrosina and R. F. Scharpf, tech. coord. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

Suring L, Crocker-Bedford D, Flynn R, Hale C, Iverson G, Kirchhoff M, Schenck T, Shea L, and Titus K. 1993. A proposed strategy for maintaining well-distributed, viable populations of wildlife associated with old-growth forests in southeast Alaska. Report of an interagency committee. USDA Forest Service, Juneau, AK.

Swezy & Agee, 1991. "Prescribed-fire effects on fine-root and tree mortality in old-growth ponderosa pine," Can. Jour. of For. Res., Vol. 21, No. 5, (1991).

Trombulak SC and Frissell CA., 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14: 18-30.

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, 1990. Old-Growth Habitat and Associated Wildlife Species in the Northern Rocky Mountains. Warren, Nancy M. (ed.) USDA Northern Region.

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, 2000c. Forest Plan Monitoring and Evaluation Report for 1998. Idaho Panhandle National Forests.

USDA Forest Service, 2001a. Silverbird Post-Fire Harvest Environmental Analysis. Salmon-Cobalt Ranger District, Salmon-Challis National Forest, May 2001

USDA Forest Service, 2002a. Black Ant Final Environmental Impact Statement. Lewis & Clark National Forest.

USDA Forest Service, 2004a. Logan Creek Ecosystem Restoration Project Final Environmental Impact Statement. Flathead National Forest.

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.

USGS, Biological Resources Division. 1997. Report of a Workshop to Develop a North American Raptor Monitoring Strategy; August 1996. Raptor Research and Technical Assistance Center; Boise, Idaho.

Wargo, P. M. and C. G. Shaw, III. 1985. Armillaria root rot: the puzzle is being solved. Plant Disease 69: 826-832.

Watson, James W., D. W. Hays, and D. J. Hays. 1999. Efficacy of Northern Goshawk Broadcast Surveys in Washington State. Journal of Wildlife Management; v. 63, no. 1, pp. 98-106.

Weaver, J.L, B. Baxter, and G. Amato. 1997. Lynx Survey and Habitat Assessment. Kootenai National Forest, Montana. Year 1 Progress Report. Wildlife Conservation Society, 185th St.. and Southern Boulevard, Bronx, NY 10460.

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.

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

Witcosky, J. J., T. D. Schowalter and E. M. Hansen. 1986. Hylastes nigrinus (Coleoptera: Scolytidae), Pissodes fasciatus, and Steremnius carinatus (Coleoptera: Curculionidae) as vectors of black-stain root disease of Douglas-fir. Environmental Entomology 15: 1090-1095.

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).

Wyant, et al, 1986. "Fire Induced Tree Mortality in a Colorado Ponderosa Pine/Douglas-fir Stand," Forest Science, Vol. 32, No. 1, pp. 55-56 (1986).

Zielinski, William J., and Howard B. Stauffer. 1996. Monitoring Martes Populations In California: Survey Design and Power Analysis. Ecological Applications; v. 6, no. 4, pp. 1254-1267.

Zielinski, William J., and Thomas E. Kucera; tech. eds. 1995. American Marten, Fisher, Lynx, and Wolverine: Survey Methods for Their Detection. USDA, Forest Service, Pacific Southwest Research Station. General Technical Report; PSW-GTR-157.