

Swan View Coalition

Nature and Human Nature on the Same Path



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July 11, 2012

Chip Weber
Flathead Forest Supervisor
650 Wolfpack Way
Kalispell, MT 59901

Att: Shawn Boelman sboelman@fs.fed.us

Re: Comments on draft Travel Analysis Report, as PDF to cweber@fs.fed.us

Dear Mr. Weber and Mr. Boelman;

Please accept these comments on your draft FNF Travel Analysis Report (TAR) into the public record. These comments will focus on how the TAR's flawed economic analysis of road decommissioning and a few other factors unacceptably skew the recommendation to retain 3,465 miles of road and find only 55 miles of road "likely not needed for future use." We may submit further comments later.

Executive Summary

The TAR does not arrive at the promised "appropriately sized and environmentally sustainable road system that is responsive to ecological, economic, and social concerns." It instead proposes to place the vast majority of its roads into Maintenance Level 1 Basic Custodial Care while simultaneously admitting the Flathead currently receives less than half the budget need to maintain its roads, that the funding situation is getting worse, and that it will shift all the more roads into ML-1 while shifting limited funding toward higher level roads open to motorized travel. This means basic custodial care will largely not occur and is akin to simply abandoning these roads.

By falsely portraying ML-1 roads as safely "stored" for the long term, the TAR misleads the public into thinking these roads will not be causing environmental harm as uninspected culverts fail and send road fill dirt into streams. The TAR also inappropriately minimizes the important role of road decommissioning in saving the taxpayer money and in continuing the required implementation of Flathead Forest Plan Amendment 19 to better protect water quality, fish and wildlife.

Introduction

As early as 1974, the Flathead National Forest acknowledged "taxpayers couldn't afford road building costs necessary to cut old growth" as fast as it was logging it. The Flathead

proposed to slow down its logging and decrease the size of its Suitable Timber Base (STB) in order to better protect the taxpayers and watersheds it felt were being damaged. A number of sawmills, including F.H. Stoltze, sued to keep logging levels high and roads being built at taxpayer expense. (Flathead Forest Plan FIES Appendix G, attached).

In other words, even in its heyday, timber sales were not paying for the roads needed to haul even the biggest and most profitable logs out of the woods. Today these subsidies continue in spite of the continuing harm roads and logging do to water quality, fish and wildlife - and the timber industry continues its press to increase the STB along with the roads and taxpayer subsidies necessary to log it.

In 1998, Forest Service Chief Mike Dombeck announced the forthcoming ban on road building in roadless areas and the initiation of a new travel planning process finally being implemented in the TAR:

An estimated 373,000 of authorized roads and an additional estimated 60,000 miles of unplanned and unmanaged "ghost roads" traverse the National Forests - a road network far larger than the Interstate Highway System. The Forest Service estimates a \$10 billion backlog in needed road reconstruction and maintenance . . . We cannot afford to manage our existing road system . . ."

(Mike Dombeck, 1/22/98 Press Release, attached).

Deputy Chief Joel Holtrop, a former Flathead Forest Supervisor, on November 10, 2010, issued directives to complete the TAR process by 2015 and identify which roads would be kept and which would be decommissioned. He concluded "this process points to a smaller road system than our current one . . ." This conclusion would later be removed by Deputy Chief Leslie Weldon, a former Regional Forester for Region 1, following Holtrop's retirement.

The Flathead's draft TAR represents a wholesale retreat of the Forest Service from its earlier attempts to arrive at an environmentally and financially sustainable minimum road system. It continues the circular myth that timber sales are needed to fund the building and maintenance of the roads that are needed to conduct the timber sales - when the whole process instead requires massive taxpayer subsidies. The TAR proposes to continue fleecing the American taxpayer while allowing the environmental degradation to continue through a poorly maintained road system.

Economic Analysis

The Appendix D economic analysis on decommissioning roads is fatally flawed for two important reasons:

- 1) It compares the cost of decommissioning to the cost of ML-1 road maintenance, not to the true costs of properly "storing" a road, falsely concluding "You can store the road forever cheaper than decommissioning."

2) It presumes that the road will be rebuilt or reconditioned in the future, making decommissioning appear all the more costly and short-circuiting the whole purpose of the TAR in helping determine which roads should never be rebuilt for fiscal, environmental and other reasons of risk.

The economic analysis is at odds with similar analyses conducted on the Flathead National Forest and the Six Rivers National Forest. These find it is cheaper or more cost efficient to either decommission or prepare a road for Intermittent Stored Service (ISS), by removing stream-bearing culverts and stabilizing road drainage, than investing in BMPs and/or making upgrades necessary to storm proof the road.

The TAR's claim that ML-1 roads are stored in a manner that will effectively "maintain an appropriately sized and environmentally sustainable road system" is patently false. The Six Rivers' "Orleans Transportation and Road Restoration Project" EA, at 135, finds "While there is significant upfront investment associated with decommissioning a road, the long-term cost of maintaining the road are greater." The Six Rivers EA's economic analysis (included in this PDF) found that maintaining the roads for 15 years cost 2.5 times more than decommissioning them.

The Six Rivers' analysis finds:

There are also costs associated with storm proofing needed roads through upgrading culverts to meet 100 year flood and correcting diversion potential. Costs associated with correcting diversion potential is approximately \$2000 per stream crossing. This investment is not part of regular road maintenance but is an enormous preventative investment in reducing potential sedimentation risks associated with road-related storm or flood damage.

The TAR accounts for none of these costs in weighing decommissioning and instead implies that ML-1 roads are somehow already sufficiently storm proofed for storage, though most are simply gated or bermed shut with culverts left in place to eventually fail. The Flathead's "Chilly James Restoration Project," on the other hand, makes this important distinction regarding storage of roads needed in the future:

Rather than investing in BMPs now, it is more cost-efficient to remove any potential impact [the road] has to aquatic resources up front [and place it] in a condition that does not require maintenance. Stream culverts will be removed and water bars installed so the road has no potential to erode, gather water or affect stream channels.

(Chilly James proposal attached). This rationale for putting a road into ISS, where it is retained as part of the Forest System, is parallel to the Flathead Forest Plan Amendment 19 decision requiring that all stream-bearing culverts be removed from decommissioned roads, that a road must be decommissioned to remove it from calculations of total road density, and that decommissioning is the preferred method of closing roads in grizzly bear Security Core habitats (though decommissioned roads, unlike ISS, are removed from the Forest System).

Road Storage

In other words, a road is not sustainably “stored” until it is put in a condition needing no maintenance whatsoever to safeguard against environmental damage. On this point, the TAR would like to have it both ways.

The TAR claims that ML-1 roads are in storage, in a stable condition, and that there is no potential for resource damage when vehicular traffic is eliminated (App. D). This is simply not true, as described above, and it is expressly why Amendment 19 requires the removal of stream-bearing culverts from decommissioned roads to protect water quality and fisheries at the same time it protects bear habitat. As Fish and Wildlife Service has found:

Rehabilitation of road-miles cannot be accomplished alone by gating, berming, or otherwise blocking the entrance to a road permanently or temporarily, or seasonally closing roads, but will require obliteration, recontouring, and revegetating.

(U.S. Fish and Wildlife Service Regions 1 and 6. 1998a. See attached bibliography for full citation and more science we ask that you consider in finalizing the TAR). Moreover, FWS required in its August 1, 2001 Biological Opinion of the Effects to Bull Trout from Road Management Activities on National Forest System and Bureau of Land Management Lands in Western Montana that the agencies must “Annually check pipes and ditches to assure they remain free from blockage.”

The TAR, in Appendix D however, notes that ML-1 roads will, when fully funded, occur once every ten years. The TAR elsewhere makes it clear that ML-1 road maintenance is currently far from being funded, less funding is expected in the future, and less of that will go to ML-1 in order to maintain roads open to motor vehicles. Where is the commitment to annually inspect and perform needed ditch and culvert cleaning? There is none. Indeed, in a rather backhanded admission, Appendix D’s denouncement of decommissioning acknowledges that ML-1 and ML-2 roads are “receiving almost no maintenance.”

This lack of culvert inspection, maintenance and “hydrologic storage” was addressed specifically on the Flathead National Forest in the Big Creek watershed in 2002 by FWS. Leslie Kubin in a 9/6/02 email to her colleagues (included in this PDF) noted:

The Forest Plan states that maintenance on a level one road as “This level is basic custodial care as required to protect the road investment and to keep damage to adjacent land and resources to a minimum.” That provides no direction or commitment to maintain a road hydrologically . . . I was also informed [by the Flathead National Forest] that regardless of what we put in the [Biological Opinion] monitoring will not occur more frequently because they do not have money or people . . . I have witnessed plugged culverts on many of the roads . . . Plugged culverts are fairly frequent . . . From a fisheries perspective this is a huge concern because these will continue to plug and eventually causing all the road fill to flush into the stream and potentially take bull trout. There is literature to support that this is a problem.”

Indeed, FWS's resulting 11/14/02 Biological Opinion on the Effects of the Moose Post-Fire Project on Bull Trout in the Big Creek area cited scientific literature in concluding:

Whatever the design life, any crossing structure would have a 100% chance of failure over its installation life if it is not removed after the road is abandoned. Culvert plugging by stream bedload and woody debris was the most common cause . . .

In this regard, the agencies are not in disagreement. It is 4/16/99 Programmatic Biological Assessment for Road Maintenance; Bull Trout; Western Montana, the Forest Service and Bureau of Land Management found:

Lack of maintenance can result in elevated sediment delivery to streams as compared to existing baseline levels, primarily from high levels of sediment delivery due to culvert failures, ditch failures, and surface erosion.

The Flathead itself has found "One washout from failed culverts . . . can dump 100 times the amount of sediment created by road obliteration" and that it is cheaper to decommission a road than continue to maintain it. (11/20/98 Missoulian article attached).

In 1995, Montana Dept. of Fish, Wildlife and Parks reported to the Flathead National Forest that it had found 52 culverts partially plugged or undermined and 13 culverts that had failed in bull trout streams being surveyed in the South Fork Flathead. These, other similar findings, and a few photos of failed culverts can be found in our 2000 report "Counting Culverts: An Assessment of Integrated Road and Culvert Management on the Flathead National Forest." (Attached and available at <http://www.swanview.org/reports/Culvert-Report.pdf>).

While the TAR claims ML-1 roads are already "stored," it is very clear that they are not. Given the lack of funding to fulfill even the minimal ML-1 maintenance and the Flathead's intent to instead spend limited funds on roads open to public travel (TAR at 18) ML-1 could more honestly be described as road abandonment. The Flathead and its TAR cannot simply move more and more roads into ML-1 and claim with a straight face that these roads are stored and stable in hydrologic terms.

Conversely, and without adequate explanation, the TAR on page 23 finds that the 55 miles of road identified as "likely not needed for future use" would be slated for "remove, storage, or conversion" - as though "storage" is indeed something different and more intensive than ML-1 maintenance. The TAR fails utterly to maintain scientific and factual integrity in its references to road storage.

The Suitable Timber Base and Other Management Areas Serviced by Roads

Why is the TAR using an inflated and outdated Suitable Timber Base and other MAs to justify its retention of "needed" roads? Rather than using the 1986 Forest Plan's 670,000 STB, the TAR should be using the Flathead's draft 2006 Forest Plan and its 328,000 acre STB to better reflect evolved management of water quality, fish and wildlife. This

would head the Forest down the more appropriate path of a smaller road system and greatly reduce the number of single purpose, low benefit, ML-1 roads that once serviced the too-big STB.

Incomplete Budget Picture

The TAR fails to provide an adequate economic analysis from which to determine how many and which roads the Flathead can likely afford to retain and maintain over the long term. Appendix D makes it abundantly clear that 55% of the CMRD maintenance funding is being spent instead on timber sale support with very little of that returning as road maintenance funding.

Pages 17-18 provide lots of other numbers regarding other “road related” collections and funding, but it is not clear how much of this actually is available for road maintenance. Nor does the TAR make clear how much road maintenance gets accomplished via timber sales.

Absent a clearer picture of how roads are and are not being funded, a glance at Appendix D suggests that most of the recent shortfall in road maintenance funding could be made up simply by NOT skimming 55% of the CMRD road maintenance funding off the top for timber sale planning instead! The analysis seems to confirm the same thing the Flathead noted in 1974; that timber sales simply don’t pay for the needed road construction, reconstruction and maintenance. So it seems like a poor practice to keep diverting road maintenance money to the planning of timber sales.

Continued Implementation of Amendment 19

The TAR provides a map of grizzly bear management subunits that remain out of compliance with Amendment 19 standards after nearly 20 years of “implementation.” It fails to provide any estimate of how many more roads, let alone which roads, need to be closed and/or decommissioned to continue fully implementing Amendment 19 as required by its Biological Opinions and Incidental Take Statement. This information must be provided and, until it is provided, it is premature for the TAR to conclude that the bulk of the Forest’s road decommissioning has been completed.

Conclusion

The TAR is wholly inadequate in arriving at the intended minimum road system that is both environmentally and financially sustainable. It is instead a misleading attempt to put a smiley face on the Flathead’s essential abandonment of ML-1 roads rather than the prudent decommissioning or hydrologic storage of those roads. The Flathead is attempting to correct this problem in the same way that it created it. It is intentionally digging its hole all the deeper and creating the need for never ending taxpayer subsidies rather than one-time investments to truly decommission or store excess roads.

Thank you for this opportunity to comment and please keep us informed as this process moves forward.

Sincerely,

A handwritten signature in black ink that reads "Keith". The letters are cursive and slightly slanted to the right.

Keith J. Hammer
Chair

Attachments:

- 1) Flathead Forest Plan FEIS Appendix G: 1974 Timber Management Plan Deficiencies
- 2) 1/22/98 Press Release: Forest Service Protects Roadless Areas and Announces Development of New Transportation Policies
- 3) January 2007 Environmental Assessment: Orleans Transportation and Road Restoration Project. Appendix F: Economic Analysis. Orleans Ranger District, Six Rivers National Forest.
- 4) 2/14/14 Chilly James Restoration Project: Request for Public Input. Swan Lake Ranger District, Flathead National Forest.
- 5) 9/6/02 email message of Leslie Kubin, USFWS, regarding Moose Post-Fire Project
- 6) 11/20/98 Missoulian news article "Rallying Against Road Policy"
- 7) December 2000. Counting Culverts: An Assessment of Integrated Road and Culvert Management on the Flathead National Forest. Keith Hammer.
- 8) 3/6/14 Annotated Bibliography for Conserving Native Ecosystems; compiled by Swan View Coalition and Friends of the Wild Swan

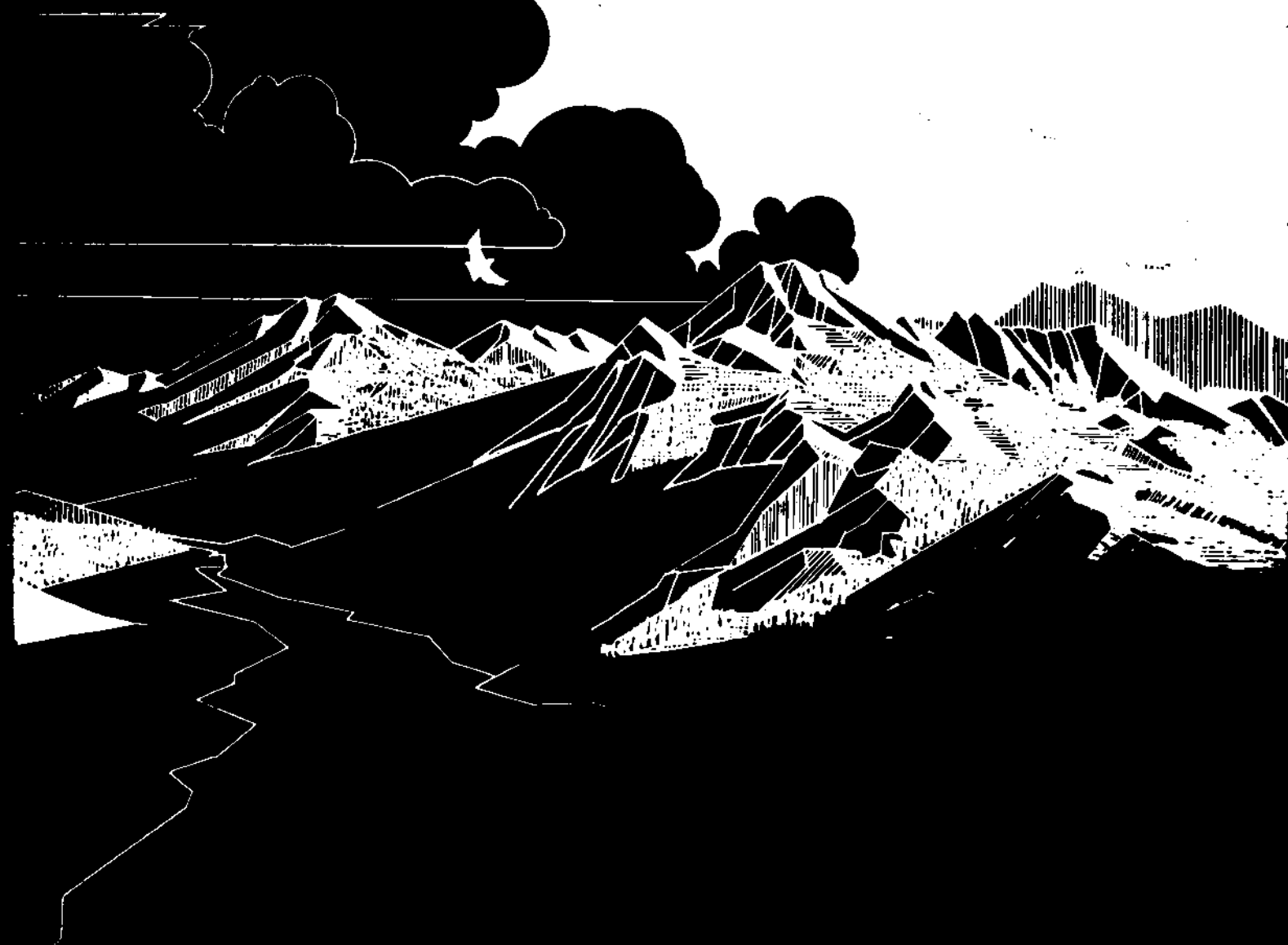


United States
Department of
Agriculture



Forest Service
Flathead
National Forest

Environmental Impact Statement Vol I



Fore

APPENDIX C

1974 TIMBER MANAGEMENT PLAN DEFICIENCIES AND PROCEDURES TO CORRECT THEM - FLATHEAD NATIONAL FOREST

A. BACKGROUND

In May 1974, the Flathead National Forest issued an Environmental Impact Statement for an interim revision of the Timber Management Plan.

In October 1976, American Timber Co., Stoltze Lumber Co., Louisiana Pacific Corp., Rudolph B. Hoecker, George Stearns, Harold McLaughlin, and Richard G. Stearns filed civil complaint vs. the Secretary of Agriculture, U.S.F.S. Chief, Northern Region Regional Forester, and Flathead National Forest Supervisor alleging the Draft and Final "interim" Timber Management Plan EIS failed to adequately assess social, economic, and natural environmental consequences of the proposed Forest Plan, did not analyze and consider reasonable alternatives to the Forest Plan, and did not comply with the NEPA (National Environmental Policy Act).

On July 16, 1979, U.S. District Judge Russell Smith in Civil Action CV-76-115-M found the 1974 EIS was not proposed under the "procedures required by law" and held the 1974 TM (Timber Management) Plan was invalid.

On August 15, 1979, the Forest Service proposed to treat the areas the Court found deficient under NEPA in a "Forest Plan," developed under the auspices of the National Forest Management Act.

B. AREAS OF DEFICIENCY

In Judge Smith's opinion the following deficiencies needed to be corrected.

1. THE CHANGE IN THE STRATIFICATION OF THE LAND BASE

Sixty to eighty percent of the reduction in potential yield from the 1969 TM Plan to the 1974 proposal was due to a change in commercial Forest base. An additional 194,568 acres were placed in the high noncommercial Forest zone. This classification was done by a team of foresters and others with no documentation in the 1974 EIS for the reasons for the reduction of 118,034 acres from the 1969 commercial Forest base.

2. LENGTH OF CONVERSION PERIOD FOR REMOVAL OF OLD-GROWTH SAWTIMBER

The justifications for lengthening the conversion period from 34 years in the 1969 TM Plan to 42 or 50 years in the 1974 EIS were aesthetics, road costs, and watershed. The 1974 EIS stated the decision to change the conversion period was that the 34-year period specified in the 1969 TM Plan would cause the Forest to have a significantly modified visual appearance and that taxpayers couldn't afford road building costs necessary to cut old growth in that time period. The 1974 EIS set the conversion period at 42 years with a temporary lengthening to 50 years

to allow for hydrologic stabilization with the understanding that adjustments would be made as more specific watershed information became available. The court found no analysis of tradeoffs, road construction costs, etc., in changing the conversion period to 42 years instead of 24 years. The temporary lengthening to 50 years was also faulted due to the blanket rather than separate watershed appraisal. In addition, conflicts of opinion among hydrologists were not dealt with.

3. MANAGED STANDS WOULD NOT YIELD AS MUCH AS HAD BEEN PROJECTED IN EARLIER PLANS

The 1974 EIS stated the basis for the yield projections was due to "improved information" but did not show what the information consisted of.

C. PROPOSED PROCEDURES TO DEAL WITH DEFICIENCIES

The following procedures have been used to address the deficiencies identified by the Court.

1. COMMERCIAL TIMBER LAND BASE

The major deficiency of the 1974 proposal was corrected through the Forest planning process by presenting and analyzing costs and benefits, and selecting from several land designation alternatives. The process for making the basic timber capability screen for the Forest Plan has been spelled out in a Flathead National Forest planning procedures document (219.12b dated 11/18/80). The process is analogous to the noncommercial Forest stratification for the 1974 TM Plan proposal. The criteria for classification of lands not suitable (noncommercial) of receiving consideration for timber management are plainly documented, and are measurable and mappable. The criteria are supported by scientific literature and experienced data.

2. LENGTH OF CONVERSION PERIOD

In previous timber management plans such as the 1969 and proposed 1974 revision, the major factors analyzed in determining alternative harvest levels were the length of conversion period for old growth and management intensities as reflected by yield projections. The Forest planning process deals not only with factors affecting growth, yield, and mortality. The major emphasis is on the economic consequences resulting from the interaction of management alternatives and biological growth and mortality. In Forest planning, the most cost effective combination of land designation, management intensities, and harvest schedule has been determined to achieve the objectives set for each alternative. Thus the rate of conversion of old growth is set for each stratification of the Forest necessary to achieve objectives and maximize economic benefits. Conversion of all old growth is no longer considered a given that is necessary or desirable to achieve in managing a Forest. Cutting of old growth or any other condition class has been scheduled with current

analysis methods only to the extent that it is necessary and/or economically desirable. Evaluation of alternative conversion periods on old growth is not necessary under the integrated planning methodology. The ecological and social costs and benefits associated with old-growth timber quantity over time has been considered in structuring and evaluating alternatives.

3. MANAGED STAND YIELDS

Procedures for projected yields are documented by Flathead National Forest FORPLAN Timber Yield Coefficients. The procedures are well documented, referenced, and summarized in the Forest Plan EIS thus correcting the 1974 deficiency.

NEWS RELEASE

USDA Forest Service
Washington, D.C.



Contact: Alan Polk 202/205-1134

<http://www.fs.fed.us>

Forest Service Protects Roadless Areas and Announces Development of New Transportation Policies

WASHINGTON (January 22, 1998, 2:00 p.m.) - The U.S. Department of Agriculture's Chief of the Forest Service, Mike Dombeck, today proposed a major overhaul of the forest road system including a proposal to halt all road construction in roadless areas on National Forests.

Dombeck said, "We intend to work with the American people, Congress, and the scientific community to develop a science-based forest transportation system that meets the needs of local people while minimizing, and reversing, environmental impacts such as erosion, landslides, and degradation of wildlife habitat and water quality."

The Forest Service road system is extensive. An estimated 373,000 miles of authorized roads and an additional estimated 60,000 miles of unplanned and unmanaged "ghost roads" traverse the National Forests - a road network far larger than the Interstate Highway System. The Forest Service estimates a \$10 billion backlog in needed road reconstruction and maintenance. Only about 40% of forest roads are maintained to the safety and environmental standards to which they were designed.

"Forest roads help fulfill many social, economic, and environmental objectives," said Dombeck. "However, of all the things that we do on National Forests, road building leaves the most lasting imprint on the landscape. Roads are a long-term financial commitment, once built they must be maintained year after year."

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The proposal to develop new forest transportation regulations will be announced in an Advanced Notice of Proposed Rulemaking (ANPR) published in the Federal Register. The ANPR invites public comment and involvement in helping to shape the scope and content of new forest road management policies and regulations. The public comment period will last for 60 days.

The agency identified three expected outcomes for the final road management policy. First, fewer forest roads will be built and those that are built will minimize environmental impacts. Second, roads that are no longer needed or that cause significant environmental damage will be removed. Third, roads that are most heavily used by the public will be made safer and promote more efficient use.

To ensure that forests and future management options are not compromised while the long-term road policy is under public review and development, the Forest Service issued a proposed interim regulation ("interim policy") to temporarily halt road construction in most areas of the National Forest System that are not presently roaded.

Dombeck noted, "We have ample new scientific evidence of the immense social and environmental values provided by roadless areas." As evidence, he pointed to new scientific information that proves over 60 percent of the healthiest aquatic habitats occur in roadless or very low road density areas on federal land in the Columbia River Basin, which includes all or parts of seven western states. Certain aspects of roads negatively affect 70 percent of key wildlife species in this area.

Presently, 33 million acres of the National Forest System are roadless but allow future roads. Of those 33 million acres, 9 million are defined as "suitable for timber harvest" and therefore more likely to be roaded.

Dombeck pointed out, "We cannot afford to manage our existing road system and are essentially proposing a 'time out' on road building in roadless areas until we can engage Congress and the American people in a constructive dialogue about where and when new roads should be built in National Forests."

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Page 3 of 4

The interim roadless proposal will be in the Federal Register and is open to public comment for 30 days. The proposal fully complies with all existing environmental laws. Once effective, the policy would remain in place for 18 months or until improved analytical tools are developed to make more informed decisions about building future roads in roadless areas, whichever is earlier.

The interim proposed policy would apply to about 130 National Forests that have:

- * Roadless areas inventoried and identified within their Land and Resource Management Plans ("forest plans");
- * Roadless areas over 1,000 acres that are adjacent to other roadless areas of 5,000 acres or larger, congressionally designated wilderness, or "wild river" corridors as classified under the Wild and Scenic Rivers Act; and
- * Roadless or very low road density areas designated for inclusion by Regional Foresters because of their unique ecological or social values such as those areas inventoried through the Southern Appalachian Ecosystem Assessment.

Forests that have had their plans recently revised and those that were recently amended by the President's Forest Plan for the Pacific Northwest would be exempted from the interim proposal. For revised forest plans that are still under public appeal, road construction in roadless areas will be addressed within the appeals period, as appropriate.

"These forests have recently completed an extensive, multi-year public planning process so it is important to people that we retain the integrity of the planning and appeals processes," Dombeck said. "We anticipate that the final long-term road policy will apply to all forests."

Dombeck added, "These proposals are sure to cause a great deal of debate, but prudence and sound stewardship require us to take a cautious approach to road construction and management. Our objective is to make scientifically based, publicly supported decisions that best meet the changing needs of the American people while protecting our rich forest legacy."

—More—

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Individuals or organizations seeking more information should contact Rhey Solomon, Ecosystem Management Coordination Staff, 202-205-0939, USDA Forest Service, 14th and Independence, Washington, DC, or email: roads/wo@fs.fed.us.

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Contact: Allen Telfer 202-205-1134

<http://www.fs.fed.us>

Forest Service Protects Roadless Areas and Announces Development of New Transportation Policies

WASHINGTON (January 22, 1998, 2:00 p.m.) - The U.S. Department of Agriculture's Chief of the Forest Service, Mike DeBock, today proposed a major overhaul of the forest road system including a proposed to halt all road construction in roadless areas on National Forests.

DeBock said, "We intend to work with the American people, Congress, and the scientific community to develop a comprehensive forest transportation system that meets the needs of local people while protecting the resources, environmental impacts such as erosion, landslides, and degradation of wildlife habitat and water quality."

The Forest Service road system is extensive. An estimated 372,000 miles of authorized roads and an additional estimated 60,000 miles of unplanned and unmanaged "ghost roads" crisscross the National Forests, a road network far larger than the Interstate Highway System. The Forest Service estimates a \$2.5 billion backlog in needed road reconstruction and maintenance. Only about 40% of forest roads are designed to the safety and environmental standards to which they were designed.

"Forest roads help fulfill many social, economic, and environmental objectives," said DeBock. "However, of all the things that we do on National Forests, road building leaves the most lasting impact on the landscape. Roads are a long-term financial commitment, once built they must be maintained year after year."

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United States
Department of
Agriculture

Forest
Service

January 2007



Environmental Assessment

Orleans Transportation and Road Restoration Project

Orleans Ranger District
Six Rivers National Forest
Humboldt, Siskiyou, and Del Norte Counties, California



***For Information Contact: Carolyn Cook
Team Leader
(Phone) 707-441-3551***

6.6 Appendix F. Economic analysis

Road maintenance funding for Forest Service roads has declined significantly over the past decade and the trend is projected to continue. Assessing the costs associated with maintaining roads as well as decommissioning roads is an important factor in designing a long-term (affordable, manageable, sustainable) transportation system.

Road Maintenance Costs:

Maintenance costs associated with National Forest system roads varying depending on their Objective Maintenance Level (OML e.g. OML 1 through 5) with Level 1 roads receiving the least maintenance funding due to infrequent need or use and Level 4 or 5 roads receiving the most maintenance funding associated with key arterial routes throughout the Forest. Due to declining budgets, there is a backlog of road maintenance on most roads (vegetation encroachment, falling debris, culvert and ditch cleaning etc) that is necessary for accesses and health and safety. Costs associated with this backlog vary by OML. In addition to the maintenance backlog, there are annual maintenance costs that vary by OML. Table 1 summarizes the typical costs per mile of road for both deferred road maintenance, annual maintenance, and capital investments needed for NFS roads. The 2006 costs per mile of road by OML level listed in Table 1 were used to estimate the cost of maintaining roads within the Orleans Ranger District over the next 15-year period. These future costs estimates are shown in Table 2. The costs of keeping and maintaining roads listed in Table 2 are an underestimate because storm damage is not included nor is inflation. Table 1 illustrates that by 2021 the cost of maintaining a given road is almost double due to inflation.

Table 1. Six Rivers National Forest Cost Per Mile Deferred and Annual Maintenance (Mtc)

Objective Maintenance Level	Miles	Work Type	2006 Cost/Mile	2021 Cost/Mile
1	135.410	Annual Mtc (once every 5 years)	\$459.85	\$828.16
		Deferred Mtc	\$3,784.77	\$6,816.13
2	247.190	Annual Mtc	\$1,064.98	\$1,917.96
		Deferred Mtc	\$40,047.00	\$72,122.05
3	97.703	Annual Mtc	\$1,029.30	\$1,853.70
		Capitol Improvements	\$1,056.77	\$1,903.17
		Deferred Mtc	\$17,319.00	\$31,190.40
4	17.579	Annual Mtc	\$705.45	\$1,270.47
		Capitol Improvements	\$248.92	\$448.29
		Deferred Mtc	\$47,740.04	\$85,976.71
5	29.650	Annual Mtc	\$506.43	\$912.05
		Capitol Improvements	\$105.25	\$189.55
		Deferred Mtc	\$17,210.59	\$30,995.16

- 1) Mtc level 1 costs for 2006 are an average of Klamath and Mendocino.
- 2) Miles do not include Ukonom.
- 3) Inflation rate between 2006 and 2021 is assumed to be 4% per year.

Table 2 shows the estimated costs of maintaining roads within the Orleans District by alternative. Over the next 15 years, Alternative 3 has the least cost, averaging approximately \$1,000,000 per year. Based on past maintenance funding, the Orleans District receives on average between \$10,000 to \$25,000 per year. These funds are clearly insufficient to maintain the existing road network. The bulk of the future road maintenance funding will have to originate from project work (future timber or fuels projects) or from grants. Traditionally, the bulk of the maintenance funding originated from Timber Sale receipts. With the decline in timber sales, the funding for maintaining roads has also significantly declined.

Table 2 - Cost (\$) of keeping roads by watershed and District over the next 15 years

Watershed	Alternative 1	Alternative 2	Alternative 3
Blue	\$1,478,221	\$608,820	\$429,157
Bluff	\$7,813,524	\$5,561,925	\$5,482,544
Camp	\$3,802,449	\$1,978,829	\$1,781,480
LMK	\$6,823,566	\$4,406,991	\$4,528,819
Red Cap	\$3,813,601	\$3,690,677	\$3,690,677
Total District	\$23,731,361	\$16,247,242	\$15,912,677

*costs include annual maintenance, deferred maintenance and capitol improvements over the next 15 years (assuming no inflation)

Road Decommissioning and Storm-proofing Costs:

The costs associated with road decommissioning vary considerably. Roads that have no culverts, ditches or stability concerns require no investment to decommission other than the installation of a dirt barricade. Roads having numerous culverts with large fills are significantly more costly. Road decommissioning costs are estimated based on the amount of stream crossing fill removed. Based on past road decommissioning records, approximately \$15 per cubic yard of fill is a good estimate of the investment need to decommission a road having culverts. Table 3 shows by watershed and alternative the estimated cost of decommissioning roads with culverts versus the cost of keeping and maintaining those roads over the next 15 years. While there is a significant upfront investment associated with decommissioning a road, the long-term costs of maintaining the road are greater. These costs apply only to roads with culverts because there are little to no costs associated with decommissioning low risk roads (e.g. no culverts).

Table 3. Cost comparison of proposed road decommissioning versus keeping and maintaining the roads over next 15 years

Watershed	Alternative 2		Alternative 3	
	Road Deco	Keep & Maintain	Road Deco	Keep & Maintain
Blue	\$33,135	\$32,696	\$33,135	\$32,696
Bluff	\$1,031,250	\$2,556,997	\$1,047,675	\$2,772,238
Camp	\$523,095	\$1,826,176	\$523,095	\$1,826,176
LMK	\$537,870	\$838,522	\$373,140	\$700,055
Red Cap	\$51,360	\$180,688	\$51,360	\$180,688
Total Cost	\$2,176,710	\$5,435,079	\$2,028,405	\$5,511,853

There are also costs associated with storm proofing needed roads through upgrading culverts to meet the 100 year flood and correcting diversion potential. Costs associated with correcting diversion potential is approximately \$2000 per stream crossing. This investment is not part of regular road maintenance but is an enormous preventative investment in reducing potential sedimentation risks associate with road-related storm or flood damage.

Funding for road decommissioning or road storm proofing is limited and mostly originates from outside grant sources. Funding for maintaining roads is also limited. Supplemental funding to maintain NFS roads through projects or grants is essential if the transportation network is to remain functional, accessible, and safe.



File Code: 1950

Date: February 14, 2014

REQUEST FOR PUBLIC INPUT

Chilly James Restoration Project

Dear Interested Party:

The Swan Lake Ranger District is proposing aquatic restoration activities in a project called the **Chilly James Restoration Project** (See Map 1). We are asking for comments on this proposal.

The Chilly James Restoration Project is based on a watershed assessment, field inventory, and collaborative input gathered from the public during the spring and summer of 2013. Input helped shape the purpose and need of the project.

The project is located within the Jim and Cold Creek watersheds of the Swan River valley, including smaller, unnamed watersheds between them. Jim and Cold Creek watersheds have been identified in various reports as potentially needing water quality and fish habitat restoration. The enclosed maps (Map 2 for north half and Map 3 for south half) identify the locations of the proposed restoration work.

Purpose and Need for Action

Restore Fish Habitat and Water Quality

- Reduce sedimentation from roads that are deposited in aquatic habitats.
- Reduce indirect effect of roads on stream channel morphology or wetlands.
- Improve aquatic habitat resiliency by minimizing risks associated with roads.

Maintain a Cost-efficient Road Network for Long term Resource Management

- Retain sufficient access for land management, wildfire suppression and recreation.

Reduce spread of Invasive Plants

- Control weeds on roads in a cost-efficient manner, primarily through utilizing herbicides sprayed from a truck or OHV.

Proposal

All proposed restoration activities are located on Forest Service system roads. No stream bank or stream bed work is proposed. This is based on the concept that it is better to address the root problem and allow the stream to naturally heal rather than artificially manipulating the stream channel. Furthermore, aquatic inventories did not locate any heavily degraded locations that needed immediate channel restoration.

Six different types of work are proposed on forest roads. These proposals were based on evaluation of the condition of the road, the type and level of resource impact it is having (if any), and the long-term need for the road. Please note there are no changes to travel restrictions for the public. All year-round or seasonally opened roads will remain available.

1. **Apply Best Management Practices (BMPs).** *28.9 miles.* These roads have been identified as having some negative impact to water quality and fish habitat but can be remedied with better maintenance or improved design. These roads are also valuable for immediate and long term resource management needs. Best Management Practices can include activities such as replacing & improving undersized culverts, armoring drainage features with riprap, installing drain dips, installing sediment basins, blading and reshaping roadway surfaces. These actions reduce erosion and discharge into streams. The exact work varies by each road. Applying BMPs does not change travel restrictions. Open roads remain open and closed roads remain closed. Weed treatment may occur based on funding and priorities.
2. **Place road in “Storage”.** *9.0 miles.* These roads have been identified as having some negative impact to water quality and fish habitat but they are not needed in the near term. Rather than investing in BMPs now, it is more cost-efficient to remove any potential impact it has to aquatic resources up front. If the road is drivable, it will be inventoried for weeds and herbicides may be applied for up to four years, as necessary. Following weed control activities, the roads will be placed in a condition that does not require maintenance. Stream culverts will be removed and water bars installed so the road has no potential to erode, gather water or affect stream channels. This will require heavy equipment which needs to clear vegetation on the road. Stored roads would be bermed and will likely slowly grow in with vegetation. Any further weed control would only be high-priority situations that can be handled with personnel walking to site (no vehicles). The roads would remain Forest Service system roads. Future land management needs (such as responding to wildfire or beetle outbreak) may utilize the roads again by clearing vegetation, re-installing culverts and reshaping the road surface.
3. **Passively decommission the road.** *13.6 miles.* These roads have no apparent resource impacts but they are simply no longer needed for resource management. Decommissioning the road reduces the road density, which is considered beneficial to fish and wildlife. A majority of these roads are short “spur” roads on lands previously owned by a private timber company. They have no stream crossings and many are already grown in. The roads will be closed with earthen berms if not already impassable. No weed control is anticipated except for high-priority infestations that can be treated with backpack sprayers. No ground work is needed; the only change is that they will be removed from the National Forest System Roads (NFSR) inventory.
4. **Actively decommission the road.** *5.0 miles.* These roads are no longer needed for resource management but they have slight to moderate negative impacts to water quality and fish habitat. First, if the road is drivable, it will be inventoried for weeds and herbicides may be applied for up to four years as needed. Then, all culverts and ditch relief pipes would be removed, and water bars installed as needed. Existing vegetation on the roads may need to be cleared to facilitate equipment access. After work is complete, available logs and slash would be left on the surface to add organic recovery, the area seeded with native mix, and the road entrance would be obliterated. The roads are then removed from the NFSR inventory. Decommission of a portion of NFSR 966 and 91279 are unique in that they require some road realignment (described below) in order to eliminate the need for these road segments.
5. **Re-contour and decommission the road.** *2.3 miles.* Three roads have been identified as no longer needed and also have substantial negative impact to water quality and fish habitat. The roads are impassable and no weed control would take place. The roads are located very close to streams or located on unstable soils, thus needing more work. Heavy equipment will reshape the cut and fill slopes of the road prism, thus returning the landscape contours to match what existed prior to road construction. All culverts and ditch relief pipes will be removed. Logs, slash, duff and native seed mix will be placed in

the road corridor. The roads would be removed from the NFSR inventory and no longer passable to vehicles and most foot traffic.

6. **Road realignment.** *0.2 miles.* Previously, much of the landscape in this area had ‘checkerboard’ ownership between the Forest Service and a private timber company. This resulted in an inefficient road network which tried to avoid crossing ownership lines. Since it is now entirely within National Forest system lands, there are two opportunities to reduce the total road mileage with better placed roads. Approximately 0.1 miles of construction at the end of NFSR 966 would connect the road with NFSR 10390, thus allowing the decommissioning of 0.5 miles of the loop road that is no longer needed. Likewise approximately 0.07 miles of construction is needed at the end of NFSR 91279 so it connects with NFSR 90464 at an angle that facilitates log trucks. This would then allow decommission of 0.86 miles of NFSR 90460, 91279 and 90464. Neither of these realignments would cross streams.

There are no proposals for work on the remaining Forest Service roads. These roads are considered necessary for short term or long term resource management. A recent inventory found little impact from the remaining road system due to location and/or adequacy of BMPs.

Some roads are located on lands previously owned by a private timber company. These roads are retained by an agreement with The Nature Conservancy until December 31, 2018. We may implement our restoration proposals, while coordinating with The Nature Conservancy, but we will not formally decommission roads until after the agreement expires.

Your comments, please!

This comment period provides those interested in or affected by this proposal an opportunity to make their concerns known prior to a decision being made by the Responsible Official. Only those who provide timely and substantive comments will be eligible to object to the decision pursuant to 36 CFR 281 Subparts A and B. Comments received in response to this solicitation, including names, addresses, email addresses, and phone numbers will be considered part of the public record, and will be available for public inspection.

Please review and provide us your comments on the Chilly James Restoration Project. Regardless of whether you were involved in the earlier collaborative meetings, this is a still good time to get involved. Your comments may help identify additional actions or alternatives. Please provide your comments by **March 21, 2014**. Comments are most useful when they are site-specific and include a clearly identifiable location. If you own private land in or adjacent to the project area, you will probably want to pay particular attention to activities proposed near your property.

We anticipate completing the draft Environmental Assessment (EA) in May 2014. At that time, we will send a copy of the draft EA and Decision Notice to those who commented or requested to be on our mailing list. We will also publish a notice of the release of these documents in the *Daily Inter Lake*, the newspaper of record and make the document available on the Flathead National Forest’s webpage. Those who provide comments for either this scoping letter or the draft EA have standing for the objection process.

If you need more information, please contact me or the Project Leaders, Beth Gardner (406-837-7508) and Mark Ruby (406-837-7531), at the Swan Lake Ranger District, 200 Ranger Station Road, Bigfork, MT 59911. E-mail comments may also be sent to comments-northern-flathead-swan-lake@fs.fed.us. Electronic comments should be submitted in MS Word, Word Perfect, or RTF format. Please make sure the subject line contains the name of the project for which you are submitting comments. For electronically mailed comments, the sender should normally receive an automated electronic acknowledgement from the agency as confirmation of receipt. If the

sender does not receive an automated acknowledgement of receipt of comments, it is the sender's responsibility to ensure timely receipt by other means.

If you do not have any comments but wish to remain on the mailing list for this project, please let us know either by filling in your name and address on this letter and returning it or e-mailing us at bpargman@fs.fed.us. If we do not hear from you, your name will be removed from the mailing list. Please feel free to share this letter with neighbors or other interested parties in the event we have missed someone.

Thank you for your interest in this project.

Sincerely,

A handwritten signature in blue ink, appearing to read "Richard H. KeHR, Jr.", with a stylized flourish at the end.

RICHARD H. KEHR, JR.
District Ranger

Enclosures (Chilly James Project Maps)

COMMENT SHEET
Chilly James Project

Your comments and recommendations will help us identify issues associated with the Chilly James Project and focus our efforts during the analysis process.

Please fill out and return this form by **March 21, 2014**. Additional comments may be made on a separate sheet of paper and included as well.

NAME: _____
ORGANIZATION / _____
ADDRESS: _____

COMMENTS & RECOMMENDATIONS:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Your Comments are Important!



Comments received on the Chilly James Project (including names, addresses, email addresses, and phone numbers of those commenting) will be considered part of the public record and will be available for public inspection. We can accept and consider comments submitted anonymously; however, people submitting anonymous comments will not be able to object to the subsequent decision (36 CFR 218). Any person may request that we withhold submitted comments from the public record (pursuant to 7 CFR 1.27(d)) by showing how the Freedom of Information Act permits such confidentiality. However, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets. We will inform the requestor of the agency's decision regarding the request for confidentiality. If the request is denied, we will return the submitted comments and notify the requester that the comments may be resubmitted, with or without name and address, with a specified time.

FOLD HERE AND MAIL BY March 21, 2014

FROM:

*Postage
Required*

District Ranger
Swan Lake Ranger District
200 Ranger Station Road
Bigfork, MT 59911



Leslie Kubin

09/06/02 10:25 AM

To: Tim Bodurtha/R6/FWS/DOI@FWS, Anne
Vandehey/R6/FWS/DOI@FWS, Jay Frederick/R6/FWS/DOI@FWS,
Katrina Dixon/R6/FWS/DOI@FWS, Paul Hanna/R6/FWS/DOI@FWS,
Dan Brewer/R6/FWS/DOI@FWS

cc:

Subject: last notes on Moose before I leave

Here are the concerns I still have at this time on the project. The primary concern is culverts left on decommissioned roads and bermed roads. Many of these culverts are being left in place for snowmobile access. Some of these culverts are being upsized at this time to meet INFISH standards under the BMP project. Specifically, the culvert on Kinnimiki creek and culverts on the Werner Peak road. The Forest has indicated that these roads will be level one maintenance and according to Earl Applecamp they will be maintained as needed. Or they may be decommissioned at a later date. An excavator will be needed to maintain these after a couple of years and even getting people into inspect these is very problematic according to Earl. He has been attempting to put together what he calls a hotshot crew to inspect these roads but the crew has not been formed as of yet. The Forest Plan states that maintenance on a level one road as "This level is basic custodial care as required to protect the road investment and to keep damage to adjacent land and resources to a minimum." That provides no direction or commitment to maintain a road hydrologically. The information provided to me from fisheries biologists and roads folks is that monitoring does not occur but every 3-10 years. Dean Suireck stated yesterday that it occurs every two years. I was later informed that this is not true, it just happened this year and two years ago. I was informed that this had more to do with the fire than anything. I was also informed that regardless of what we put in the BO monitoring will not occur more frequently because they do not have money or people. (The example was the Spotted Beetle BO, they will not monitor more than every three years) The concern is that monitoring will not occur. They have also told me that after a road grows in that they do not monitor because it is too hard to access the site. I have witnessed plugged culverts on many of the roads we are talking about in this project. Plugged culverts are fairly frequent on some of the roads in this project. From a fisheries perspective this is a huge concern because these will continue to plug and eventually fail causing all the road fill to flush into the stream and potentially take bull trout. There is literature to support that this is a problem. Influences of Forest and Rangeland Management by Meehan is one reference. Paul also has a BA from the Kooteni that supports removal of culverts due to risk of failure and impacts to fisheries. Ask Paul for this. Also paper by Keith Hammer. So there are other Forests out there that are not leaving culverts in place. I would just like to emphasize that this needs to be discussed in the BO in detail. From a fisheries perspective the best thing is no culverts be left on decom. or bermed roads, especially since monitoring is not a sure thing as stated above. If they are left in the potential impacts to bull trout needs to be assessed.

Earl did provide a new idea for culverts to be left in that is much better than what is out there now in that the fill would be removed so if the culvert plugs and blows fines will not be deposited downstream. But, as Dean stated it is not a free picnic because all of the fill gets pushed up and a bench is formed that at times is very large. This bench causes increased erosion and sediment delivery to the stream. This needs to be looked into more.

The BA presently does not contain enough information on bermed roads and culverts that will be left in place. If the new design Earl mentioned will be used we need to know where it will be used. I would recommend determining the number of culverts on bermed roads that are to be left; location in regards to bull trout spawning; associated fill with these culverts (shallow, moderate or deep as described in the BMP BA/BO); get a clear answer in writing from the Forest as to monitoring and maintenance of these structures; get the Forest to state specifically which roads will be bermed versus decommissioned (provided). The last item will be difficult as they have not selected an alternative. They just selected alternative 3 to do the BA on. At least determine under that alternative which roads will be bermed. Due to potential changes to this alternative there should be a term and condition that requires the Forest to provide an updated list of work on roads or change in status of roads at the beginning of the year. This should also include an assessment of and any change there may be to T&E species as a result of this change. If the change is considered substantial by FWS consultation should be reinitiated.

I would just like to make it clear that I think leaving these culverts in on decom. and bermed roads will negatively impact bull trout and will result in take sometime in the future. So are we providing the Forest with an incidental take statement for that future take (I would assume no)? I would also like to have considered a term and condition or conservation recommendation that requires the Forest to pull these culverts at some later date, prior to the risk of failure. I will think on this one some more and see if I can come up with more specific details before I leave at the end of the day.

The latest thing I heard from Betty Kuropat was that the Forest (Terry Schute) is not planning on addressing the culvert issues in the snowmobile access issue this winter. He is planning on continuing to do it project by project, site specific. Betty was concerned about this as are the fish biologists. From a fisheries perspective this is a huge nightmare and I am concerned about the precedence this Forest and this project will be setting for the Flathead and other Forests on the issue of culverts.

Other non-culvert issues or recommendations for terms and conditions. Have one Mcneil core sample site in Hallowat creek and possibly one in Big Creek above the present site the state has. Three of these could be monitored each year to assess changes in sediment deposition associated with roads, culvert work and decommissioning work. Data should be provided each year to FWS prior to work that year. If at any time the levels reach above 35% for fines <6.4mm (indicating that spawning is threatened) the Forest should contact FWS to reassess impacts from actions scheduled that year. It may require delaying of decommissioning work and culvert work until fine sediment levels drop. This will help to take the guess work out of what Mother Nature is doing and the effects of rain events or lack of rain in combination with sediment delivery associated with the road work.

One last thing not directly part of the Moose Fire project but part of the Big MT project. The culvert that was replaced in Kinimiki Creek (\$20,000 or more) we consulted on in the BMP project as road maintenance so the project went forward. What we (I) did not know was that was part of the Big MT project and the road will be decom. in 2005. The culvert was put in for snowmobiles, which has yet to be consulted on, not because the road will stay open.

Leslie Kubin

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Rallying against road policy

*Former
Forest
Service
workers
disagree
on the
impacts
of roads*

By MICHAEL JAMISON
of the Missoulian

11/26/98

KALISPELL - When Clarence Tabor hit a dead end with the Forest Service's road closure policy, he decided it was time to take to the streets in protest.

On Thursday, Tabor and other former Forest Service employees joined members of Montanans for Multiple Use and others in a show of force, demanding that the Flathead National Forest take another look at how and why it goes about ripping out roads.

Gathering at the Flathead County Fairgrounds, the group set up a Depression-era style bread line and soup kitchen, dramatizing what they feel is the Flathead's future if the Forest Service continues its present course. Decreased timber sales, Tabor said, will

suffocate the lumber industry. Prescribed fires, he said, will burn up marketable trees.

And most importantly, he said, the destruction of forest roads will endanger wildlife, threaten water quality and bar public access, driving the Flathead into economic depression.

"I'm not going to sit there and watch it happen," he said. "When they quit managing the land and don't do nothing and in the end have no game, well that's when I say something's wrong. That's when I stand up and protest."

The soup line, however, looked little like the lines of the 1930s. As nearly 100 people waited for a bowl of potato soup or elk stew, a few cell phones were heard ringing in the ranks. Patagonia fleece mingled with buffalo plaid wool as the line inched forward.

But times have changed and that, more than anything, was the impetus for Thursday's rally. Just like today's bread lines are unlike those of the Depression, today's forestry looks little like the woods work of 20 years ago.

Today's Forest Service keys on words such as "ecosystem," "restoration," and "rehabilitation," as yesterday's Forest Service keyed on road building and board feet.

And that change, Tabor said, is not all for the better. His lunch mates agreed, commenting on the changes with grim humor.

"Are you enjoying the spotted owl soup?" a woman asks.

"Well, I was hoping it was bull trout and grizzly bear stew," comes the answer. "I'm just here to find out what it is y'all are jawing about. You can't trust those federal boys."

See **RALLY**, Page B2

Rally

Continued

But many of those on hand were once those very same "federal boys."

Tabor, president of Montanans for Multiple Use, was for 13 years the road manager on the Glacier View Ranger District. He invited many of his old Forest Service co-workers to the bread line and rally, hoping they would hold some sway with their old boss.

However, not all former Forest Service employees with an interest in roads were on the invitation list.

"It's funny," said Keith Hammer. "I'm a former Forest Service employee, and I wasn't invited to speak."

Part of Hammer's job with the Forest Service was to patrol forest roads, watching for clogged culverts and washouts. Now, however, Hammer chairs the Swan View Coalition, an environmental group that has had much success in forcing road closures on behalf of grizzly bears.

In fact, a court battle waged by Swan View Coalition and others ultimately led to new rules on the Flathead National Forest requiring special protections for grizzly bear habitat. Among those protections was a call for the obliteration of about 650 miles of forest roads over 10 years. Four years have passed, and with only 80 miles ripped out so far, Hammer believes the Forest Service is "running at less than half throttle."

Allen Rowley and his co-workers at the Flathead National Forest office are caught, then, between former employees who want more roads open and former employees who want more roads closed. And with word from above that a moratorium against building roads in roadless areas is on the near horizon, Rowley and his counterparts on other forests are preparing for a war of words, with neither side satisfied the Forest Service is doing a good job.

The road war, he said, is just heating up, and the Flathead Forest will be one of the first and biggest battlefields. From here, it will spread across public lands throughout the West.

"We know some people don't like road management," Rowley said. "We've known that for years. But we must manage the forest for grizzly bears and bull trout and timber and people and game and a host of other critters. That's not an easy balance, but we're working from sound science. And to be honest, we're really just getting into this."

And despite Tabor's claims to the contrary, Rowley said, what's good for the bear is good for the

bull trout.

When a forest road is built, he said, it acts like a dam, cutting off the hundreds of rivulets that pour off a mountainside. To avoid a buildup of water behind the "dam," workers dig a ditch on the uphill side, funneling water to a number of culverts that cut beneath the road.

The problem, he said, is that without regular attention, the ditches grow up with brush. The culverts clog or collapse, and the backed up water eventually washes out entire sections of road. And when that happens, Rowley said, tremendous amounts of dirt pour into the streams below, choking fish spawning habitat.

Currently, Rowley said, 3,761 miles of road crisscross the 2.3 million-acre Flathead National Forest. But his budget for road maintenance, he added, is enough to cover less than 40 percent of those miles. One solution, he said, is to obliterate roads that are not being used, fixing the sediment problem before it becomes a problem.

The road closures also work to protect grizzlies, he said, by securing vital habitat away from trucks, dirt bikes and four-wheelers.

But the forest also has a responsibility to bull trout, Tabor said, and ripping out roads is bad for fish.

When a road is obliterated, Tabor said, culverts are removed and several large trenches are cut through the roadbed, allowing water to pass through unchecked. Those trenches are sediment flushes, he said, arguing that protecting grizzlies by cutting out roads is having an adverse impact on bull trout. Both species are listed under the Endangered Species Act.

Rowley admits some sediment is initially flushed down by the trenches - as much as three tons in the first one or two years, in some cases. But after the first couple of years, he said, the system stabilizes and sediment flows drop sharply.

One washout from failed culverts, he said, can dump 100 times the amount of sediment created by road obliteration.

Continuing studies of forest streams, he said, have shown no indication of sediment levels reaching dangerous levels.

Hammer insisted Rowley and others are correct when they say unmaintained roads are a bigger danger than obliterated ones.

"I have watched, in a matter of minutes, hundreds of yards of soil go flushing down into a creek because of clogged culverts,"

Hammer said. "For them to argue that we're endangering water quality by removing roads is an outright lie."

And culverts only last so long, he said. "It's not a matter of if a culvert is going to fail, it's a matter of when."

And with a fiscally conservative Congress, he said, it only makes sense to remove unused roads rather than pay to maintain them.

According to Rowley, it costs about \$5,000 per mile to obliterate a road. Given the back maintenance required on most roads, maintaining an open road can cost as much as \$6,000 per mile.

"I don't care what they say,"

Tabor said. "First they say it's for the bear, then they say it's for the fish, then they say it's because they don't have the money to keep the roads open. Just tell us the truth. The truth is they have an agenda to force people out of the woods."

And once groups like hunters are excluded from the woods, he said, the natural system fails. There will be no one, Tabor said, to shoot the bears and lions that he says are booming throughout the Flathead.

"Those bears eat fawns like popsicles," he said. "If we don't shoot (the bears), we won't have any game left."

Rowley, however, finds it hard to believe that obliterating 80 of 3,761 miles of road has seriously affected game herds one way or the other.

"Everybody seems to be taking a very short-term view here," he said. "In the long run, this policy will be good for wildlife. It will certainly be good for both grizzly bears and bull trout, and I think it will be good for the overall health of the forest, which has to be good for those who make a living in the forest. We're looking for winners in both columns."

As is Tabor. In fact, he asked those at the rally to keep their remarks directed at policy, not individuals. He is committed, he said, to working with the Forest Service to find a workable middle ground.

"That's what we're going to need," Rowley said, "people willing to work with us to offer new and better solutions. But they have to understand the mandates we're working under in today's Forest Service."

Mandates that will bring either the return of the bread line, or the return of the grizzly, depending on whom you ask.

December 2000

*prepared for
Friends of the Wild Swan*

*PO Box 5103
Swan Lake, MT 59911*

Counting Culverts:

An Assessment of Integrated Road and Culvert Management On the Flathead National Forest

*by
Keith J. Hammer*

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Kalispell, MT 59901
redraven@digisys.net*

Executive Summary

Flathead Forest Plan Amendment 19 is an integral part of the Flathead's program for reclaiming roads for the benefit of water quality, fish, and wildlife habitat security. Since 1995, it has benefited water quality and fish by requiring that stream-bearing culverts be removed during road reclamation necessary to achieve grizzly bear habitat security objectives. Watershed improvement funds financed 70% of the Flathead's road reclamation from 1995-1999, 80% of which occurred in grizzly bear habitat. Wildlife funds financed less than 1% of the road reclamation, while volunteer services provided the equivalent of 3% and new national road reclamation initiatives financed 26%.

An analysis of the Flathead's road reclamation program reveals the Flathead has failed to seize opportunities to promote its road reclamation program and prioritize funding for it. As national Forest Service initiatives have provided increased emphasis and funding for road reclamation, the Flathead has instead worked at cross-purposes to rescind Amendment 19's road reclamation and culvert removal requirements. As a result of inadequate priorities, funding, planning and implementation, the Flathead has failed to meet Amendment 19's mandatory 5-year objectives for road reclamation. This report looks at why this has occurred and suggests ways in which the situation can be corrected.

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Introduction

The reclamation of roads has been identified on many National Forests as a primary means to protect and restore water quality, fisheries and wildlife habitat security. On the Flathead National Forest, all stream-bearing culverts in roads to be reclaimed to provide security for grizzly bear must be removed to protect water quality and fish from the inevitable failure of the culverts. This

integrated program is found in large part in Amendment 19 to the Flathead Forest Plan. Information provided by the Flathead, however, shows that it has been unable to either adequately maintain its roads and culverts or provide for their timely removal. This report will look at why this is and suggest what can be done about it.

Inventories and Monitoring

While the Flathead reports publicly that it has 3,761 miles of roads, it reports to Fish and Wildlife Service that it has 5,025 miles of roads. [1] The Flathead has inventoried some 287 bridges, 55 culverts larger than 7' diameter, and some 5,500 smaller culverts. It has not tracked which of the smaller culverts either bear streams or drain water and sediment from road ditches (which collect and sometimes redirect sediment-laden water towards streams). Moreover, an undisclosed number of the smaller culverts remain uninventoried. [2] It appears that only about 5,555 large and small culverts out of an estimated 80,000 are accounted for in the Flathead's inventories. [3]



Keith Hammer photo

*Culverts stockpiled for 45 installations in 2.5 miles
of new road near Emery Creek,
Flathead National Forest.*

The Forest Service Manual requires a systematic monitoring of the Flathead's bridges in order to minimize bridge failures. However, the Flathead has no systematic monitoring program for inspection of its culverts. [4]

While it is not uncommon for culverts to fail and roads to wash out on the Flathead, it keeps no central inventory of such events. Such damages are generally only compiled in a central location following specific weather events, such as rain-on-snow, which cause enough immediate damage in a geographic area to perhaps qualify for emergency repair funds. For example, an April 4, 1990, Flathead report documents the damage caused largely by undersized culverts in the face of a November, 1989, rain-on-snow event that resulted in the need for \$391,000 in repairs to failed roads, culverts and bridges. [5]

Such rain-on-snow events are not uncommon, however, and blowouts of undersized culverts are a persistent problem often resulting from short-term cost-saving decisions at the time of their installation. The most recent such failure on the Flathead was during rain-on-snow in November, 1999, with a 54" diameter culvert washing out and sending 1,000 cubic yards of road downstream towards the bull trout spawning beds of Trail Creek. This culvert has since been replaced

with a 72" diameter culvert designed to withstand a 100-year rainfall event. [6]

Montana Department of Fish, Wildlife and Parks' sediment source surveys of South Fork Flathead River tributary streams supporting bull trout spawning and rearing indicate that nearly half of the surveyed road segments received a high priority ranking; meaning culverts were either partially plugged or had failed, or that the roads were

delivering sediment to live streams. These surveys found 52 culverts partially plugged or undermined and 13 culverts that had failed in these bull trout streams. [7] Such surveys, however, are not conducted on the Flathead in a routine manner, nor are they timely monitoring in terms of preventing culvert failures. Scattered records indicate that culverts that have failed may be left un-repaired for years, with additional road washing into the stream each year. [8]



Nokio Creek, Flathead National Forest

Fish and Wildlife Service photo

*Unable to fit through a 54" culvert,
Nokio Creek washes out Road #114
on November 13, 1999.*



Nokio Creek, Flathead National Forest

Forest Service photo

*The aftermath:
Over 1,000 cubic yards of road and
sediment were washed down
Nokio Creek.*

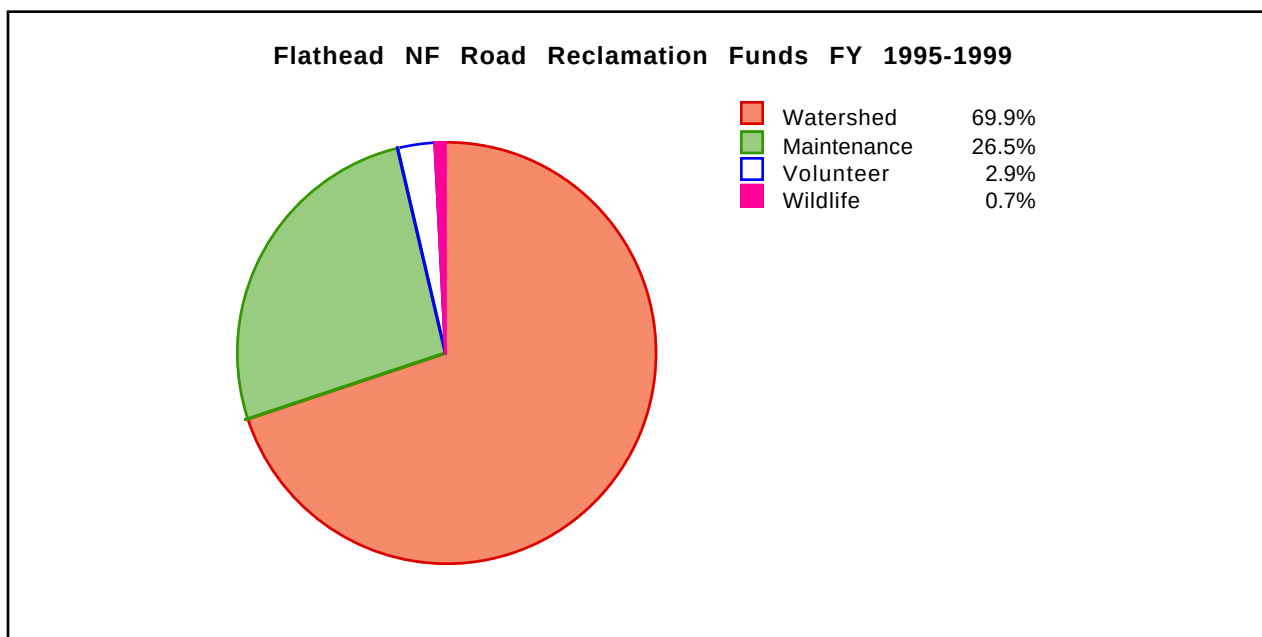
Funding

Nationally, the Forest Service has an \$8.4 billion backlog in maintaining its roads, bridges and culverts. Because it receives less than 20% of the funding necessary to maintain its 386,000 miles of inventoried roads, this backlog grows each year. An estimated 60,000 miles of additional, uninventoried roads exist nation-wide. [9] The Flathead National Forest reported in 1998 it has been able to properly maintain only 40% of its existing road system. [10]

According to federal agencies: "Lack of road maintenance can result in elevated sediment delivery to streams as compared to existing baseline levels, primarily from high levels of sediment delivery due to culvert failures, fill slope failures, ditch failures, and surface erosion." [11] Also, the Forest Service recognizes that road reclamation is cheaper in the long run than road maintenance. [12] As a result of these circumstances and an increasing awareness of the environmental costs of building and maintaining roads, the Forest Service has proposed to limit new road construction and reclaim some of its existing roads so it can better maintain the roads it keeps. [13]

With this shift in road management emphasis, road maintenance funds earmarked specifically for road reclamation (also known as obliteration or decommissioning) have been allocated to individual National Forests for the first time. On the Flathead National Forest, \$107,000 was allocated expressly for road reclamation work in Fiscal Year 1999 and \$78,511 was allocated in FY 2000. [14] These earmarked funds have proven inadequate on the Flathead, however, and their use is being hamstrung by a lack of companion funds for the planning of the road reclamation work. [15]

For FY 1995-1999, the specially earmarked road maintenance funds account for 26% of the total \$404,500 in road reclamation costs, with watershed improvement funds providing 70%, volunteer services providing the equivalent of 3%, and wildlife funds providing less than 1%. [16] This dearth of wildlife funding is notable, given these fiscal years represent the first five years of implementation of Flathead Forest Plan Amendment 19's road reclamation to meet grizzly bear security objectives.



Amendment 19

In addition to Forest Plan requirements to maintain and improve water quality and habitat for fisheries, the Flathead in 1995 adopted Amendment 19 to its Forest Plan in order to secure grizzly bear habitat via road closures and road reclamation. Amendment 19 was established as an integrated program that would also benefit water quality and fisheries by requiring that all stream-bearing culverts be removed from all reclaimed roads. [17] Amendment 19 further requires that measurable road density and grizzly bear security objectives be met on a 5- and 10-year implementation schedule clearly divorced from the Flathead's timber sale program. [18]

Prior to Amendment 19, the Flathead Forest Plan had no clear requirement for road reclamation to benefit grizzly bear or other wildlife and contained less restrictive standards for limiting open road densities with gates. It contained no limit on total road densities, nor any clear timetable by which open road density standards would be met. [19] The Flathead essentially proceeded to implement its open road density standard in areas where it was planning timber sales, thus allowing other areas of the Forest to retain persistently excessive open road densities. In response to several lawsuits filed by conservation groups and a resulting court order, the Flathead issued Amendment 19. It is in the "terms and conditions" of Fish and Wildlife Service's biological opinion on Amendment 19 that legally-binding time limits are set for the accomplishment of the amendment's road density and grizzly bear security objectives, without regard for the timber sale program. [20]

In the first five years of Amendment 19 implementation, the Flathead actively reclaimed 184 miles of road and declared another 89 miles as being reclaimed naturally. Of these 273 miles of road, 20% was reclaimed primarily for the benefit of water-

sheds and fish, in habitat deemed unoccupied by grizzly bear. [21] Conversely, prior to the receipt of road maintenance funds earmarked specifically for road reclamation in FY 1999, watershed improvement funds provided 95% of all road reclamation financing on the Flathead. [22]



Rock Creek, Flathead National Forest Keith Hammer photo

Properly removing a culvert before it fails returns the road to the contour of the land, rather than washing it downstream, and reestablishes a broad streambed that minimizes erosion.

While on the one hand taking credit for benefiting bull trout by removing culverts in roads reclaimed to benefit grizzly bear, the Flathead has on the other hand attempted to rescind its Forest Plan requirement that these culverts be removed at all. This was done in May 1999, when the Flathead Forest Supervisor issued Implementation Note #13, directing that "[d]rainage structures on streams may be left in place if [f]unding to fully reclaim the road is unavailable, and it is desirable to consider the road reclaimed for grizzly bear security." [23]

Similarly, the Interagency Grizzly Bear Committee is attempting to rewrite its road management guidelines to allow Forests like the Flathead to greatly reduce their road reclamation programs in favor of a return to the use of gates, which are of limited benefit to

wildlife and generally do nothing to benefit water quality and fish. [24] The IGBC proposal would reduce Amendment 19 road reclamation by some 80% and replace the essentially permanent grizzly bear security core areas secured by road reclamation with moveable “seasonally secure areas” temporarily protected by gates. [25] In other words, concerted attempts have been made to eviscerate Amendment 19’s road reclamation and culvert removal requirements.

Ironically, these efforts to abandon road reclamation come at a time when presidential initiatives have been launched to reduce the road system on the National Forests to a size that can be adequately maintained in order to restore ecosystem integrity. Although previously allowed to spend up to 5% of its road maintenance budget on road

reclamation, the Flathead allocated no maintenance dollars for reclamation prior to being awarded funds earmarked specifically for that purpose under the new national initiatives in fiscal year 1999. [26] As mentioned earlier, watershed improvement funds carried 95% of the Flathead’s road reclamation program prior to FY 1999.

While the Flathead has issued decisions to reclaim another 344 miles of road, the work has yet to be accomplished. [27] As a result of inadequate priorities, planning, funding and implementation, the Flathead has fallen far short of its mandatory Amendment 19 5-year implementation objectives and has asked Fish and Wildlife Service for more time to accomplish those objectives. [28]

The Problem

While numerous problems contribute to the Flathead’s failure to meet its road reclamation and culvert removal objectives, it is due in large part to the fact the Flathead has failed to seize opportunities to consolidate its road reclamation and culvert removal programs and has instead worked at cross-purposes to such an integrated program. As discussed previously, Amendment 19’s grizzly bear security program requires the removal of stream-bearing culverts from reclaimed roads. This not only benefits watersheds and fish, but allows the Flathead to utilize these funds in grizzly bear habitat when wildlife funds are scarce.

Similarly, in terms of benefits to multiple resources, the Flathead was legally required by Fish and Wildlife Service to develop and implement along with Amendment 19 “a public information program on the positive effects of road closures for fish and wildlife, water quality, and other Forest resources.” [29] In spite of written and binding assurances to FWS that it would develop a fact sheet describing the benefits of road closures and obliteration, the Flathead has never done so. [30] Rather than proactively demonstrating to the public the benefits of a road management program that is integrated to benefit multiple species and resources, the Flathead has instead placed

"The information indicates a stable [road reclamation] program, but at a rate which would have to increase to meet Forest Plan five and ten year objectives."

Flathead Forest Plan
Monitoring Report 1993-1997

itself in a defensive position and has worked alongside the Interagency Grizzly Bear Committee to eviscerate such a program.

In several major respects, the Flathead has simply failed to place highest priority on meeting the legally required 5- and 10-year road reclamation objectives of Amendment 19. In its 1995 requests for carry-over funds, the Flathead placed a higher priority on securing funding to grant Plum Creek Timber Company road access through grizzly bear habitat than on securing the funding necessary to implement the then-fledgling Amendment 19 road reclamation program. Plum Creek's access requests were prioritized as "critical," and the implementation of Amendment 19 as "not critical," to implementation of the Flathead Forest Plan. [31] Similarly, in its 1998 review of implementation of Amendment 19, the Flathead found the "information indicates a stable recent program, but at a rate which would have to increase to meet Forest Plan five and ten year objectives." Astoundingly, however, it recommended the Forest "continue on present course," rather than pick up the tempo. [32]

In the end, the Ranger District on the Flathead with the least grizzly bear habitat to manage, Tally Lake, is the only district to formulate a road reclamation work plan during the implementation of Amendment 19. [33] With limited exceptions, road reclamation work has been directed to areas where the expenditure of watershed improvement funds can be justified or where concerns for grizzly bear security can be addressed during the National Environmental Policy Act (NEPA) planning process for pending timber sales. Flathead officials point out that this latter phenomenon is due to the fact that, while they may receive funding for conducting road reclamation, it is most often not accompanied by funds to conduct the NEPA planning that must precede the reclamation work. [34]

Hence, these officials argue, they are predisposed to conserve their timber sale and/or NEPA planning money by planning road reclamation only in conjunction with and in areas where they are planning timber sales. This, of course, has inappropriately re-wed the road management and timber sales programs in a way that Amendment 19 intended to divorce them. As a result, road reclamation has often been planned and conducted at a pace and in areas where timber sales are desired, rather than in places where road reclamation is needed the most in terms of securing wildlife habitat, restoring watershed integrity, and meeting legally binding road reclamation objectives.



Road #2902, Flathead National Forest Forest Service photo

Culverts are removed to prevent the road from washing down the creek, as happened here.

Moreover, the implementation of road closures and reclamation have often relied upon timber sale generation of Knutson-Vandenberg funds, which are dependent upon the bid price of the sale but are not fully included in the calculation of the minimum acceptable bid. Thus, the K-V funds generated are often inadequate to accomplish the promised road closure and obliteration work.

Sadly, the incentives to wed road reclamation and watershed rehabilitation to timber sales is not limited to the Flathead. Across the western United States, hydrologists and

other specialists are watching funding for vegetative treatments and timber sales skyrocket as a means to theoretically reduce watershed damage due to wildfire. Meanwhile, programs to make these watersheds more resilient via proven road reclamation go begging and agency specialists are often assigned to mitigating the adverse effects of timber sales rather than being allowed to

focus on conducting proactive watershed restoration. It is of little comfort to find that the Forest Service's most recent Cohesive Strategy for watershed "restoration" uses fire-related vegetative conditions to prioritize which watersheds receive vegetative treatments first, rather than which watersheds contain the most roads in need of reclamation. [35]

The Solution

An integrated restoration program can no longer be defined as one in which vegetative treatments and logging take priority over road reclamation and other watershed restoration measures. This bias is persistent and clearly evident in the agency's myopic focus on attempting to return forests to pre-settlement vegetative conditions while completely ignoring the fact that pre-settlement conditions included no roads whatsoever. This bias flies in the face of an increasing body of scientific and agency literature finding that roads have the single most adverse and lasting impact on watersheds and ecosystem integrity. [36]

The tendency to link all other restoration activities on the National Forests to timber sales and vegetative treatments has become heavily institutionalized in both the Forest Service and the Congress. It equates quite literally to a failure to see the problems in the forests for the trees. This link must be broken if road reclamation programs which fully integrate protection for multiple spe-

cies and forest resources are to receive adequate independent funding and timely implementation.

In the case of the Flathead, Washington and Regional offices of the Forest Service have neither supplied, nor has the Flathead apparently requested of them, the funds necessary to fully implement its Amendment 19 integrated road reclamation program. As already noted, the special funds the Washington and Regional offices have supplied the Flathead to conduct road reclamation work have apparently not been accompanied by funds to firstly plan the road reclamation work. Rather than attempting to piggy-back its road reclamation program on increased funding for timber sales and vegetative "restoration" treatments, the Flathead needs to request and receive adequate funding for both the planning and the execution of an integrated road reclamation program that can be focused on watersheds and habitats most in need of road reclamation.

Shortcuts and End-Runs

The Flathead is only one of many National Forests to attempt short-cuts in its road reclamation programs. It is in good company in learning the hard way that these short-cuts are not ecologically acceptable. Following the Summer 2000 wildfires on the Bitterroot and Lolo National Forests, for example, agency experts are reexamining their former practice of assuming revegetated

roads to be reclaimed without firstly returning the road prism to the contours of the land. With the vegetation removed by fire, the means by which these long-forgotten roads continue to accumulate and re-channel water has been exemplified in the resulting magnification of soil erosion and mud flows.

The Flathead has also dropped from its road inventories and considered reclaimed scores of roads that have naturally revegetated in the absence of use. As noted earlier, 89 miles of inventoried road have been designated naturally reclaimed under Amendment 19.

Even on the roads actively reclaimed under Amendment 19, however, the Flathead has seldom, if ever, returned the entire road prism to the contour of the land. Generally, recontouring occurs only immediately adjacent to streams where Amendment 19 has required removal of the culverts. The majority of the remaining road prism, and increasingly the ditch-relief culverts, are left to continue accumulating and re-channelling water and sediment in the watershed, even though Amendment 19 requires that ditch-relief culverts be removed in “most cases.”[37] While this practice may stretch limited road reclamation dollars, it limits the overall effectiveness of such watershed restoration efforts both in the short term and in the face of inevitable long-term events such as wildfire.

As noted briefly earlier, the Flathead attempted to further stretch its road reclamation dollars and to fend off public criticism of road reclamation by attempting to ignore the Amendment 19 requirement that all stream-bearing culverts be removed during reclamation. Upon the advice of its own fisheries biologists and attorneys, however, the Flathead abandoned this end-run in the face of a threatened lawsuit. [38]

And, most recently, the Flathead and IGBC’s attempted end-run of Amendment 19 has been faulted by the scientists providing independent peer review of its proposal to replace essentially permanent grizzly bear security core areas secured by road reclamation with constantly moving “seasonally secure areas” temporarily protected by gates. The Peer Review found “the simplicity of A19 and its ability to permanently secure areas for grizzly bears makes it a powerful

tool in the conservation of the grizzly bear in the NCDE.” Conversely, the Peer Review found that the newly proposed approach relies too heavily on the use of gates and seasonally secure areas that change from season to season, concluding the “proposed approach’s added complexity unfortunately necessitated several additional assumptions, some of which are tenuous.” [39]

The Flathead and IGBC, however, have yet to abandon their attempt to eviscerate Amendment 19’s road reclamation requirements. [40] In summary, the primary means by which the agencies firstly developed and have since attempted to end-run Amendment 19’s road reclamation requirements, rather than fully implement them, are illustrated by the following chronology.

Chronology of Flathead Forest Plan Road Reclamation Requirements

1986 Flathead Forest Plan: No road reclamation requirements specific to grizzly bear security.

1995 Forest Plan Amendment 19: Requires that an estimated 650 miles of road be reclaimed in grizzly bear habitat, from which all stream-bearing culverts and most ditch-relief culverts must be removed.

1999 Implementation Note 13: “Drainage structures on streams may be left in place if [f]unding to fully reclaim the road is unavailable, and it is desirable to consider the road reclaimed for grizzly bear security.” (Approved 5/99 and rescinded 11/99).

1999 IGBC proposal: Would reduce the amount of road reclamation required by Amendment 19 some 80% by replacing essentially permanent grizzly bear security core areas secured by road reclamation with moveable “seasonally secure areas” temporarily protected by gates.

Conclusion

A number of employees on the Flathead have made honest attempts to meet and implement Amendment 19 and other Forest Plan requirements for the management and reclamation of roads and culverts. No one Flathead employee, however, has as his or her sole responsibility these tasks alone. Nor has the Flathead developed a clear work plan by which these responsibilities are shared in a manner that insures the timely implementation of Amendment 19 and other Forest Plan requirements.

Citizen groups have hired watershed restoration consultants to provide the Flathead with expertise on proper road reclamation and culvert removal. These groups have also offered to provide consultants and training to the Flathead on the revegetation of reclaimed sites, but the Flathead has declined the offer. [41] While some citizen groups and Flathead employees have attempted to insure that road reclamation is done properly and is presented in a proactive manner, leadership on the Flathead and in the IGBC has failed completely to produce even the most rudimentary fact sheet for public distribution, listing the numerous benefits of road reclamation.

This is all the more unacceptable given the Forest Service's acknowledgment that it has too many miles of roads to adequately maintain. Hence, the Forest Service acknowledges, it must reduce the size of its road system not only for environmental reasons, but because it is cheaper in the long run to reclaim a road than to maintain it. In other words, the money saved through road reclamation is needed to better maintain the roads retained as a part of the long-term transportation system.

Ultimately, it is a lack of support to planning and field personnel that has resulted in the Flathead's failure to meet its Amendment 19 and other road reclamation objectives. This lack of support is most obvious in the failure of the Flathead to prioritize and secure the funds necessary to develop an adequate work plan and to assign the necessary tasks and funding to planning and field personnel. This situation is bound to continue until the Flathead places a higher priority on the timely accomplishment of Amendment 19 and other Forest Plan road and culvert management objectives than on efforts to end-run them.



Flathead National Forest

Forest Service photo

Road #114 deposited downstream from the Nokio Creek culvert failure.

Notes

1. Flathead Forest Plan Monitoring and Evaluation Report 1993-1997, dated September 1998. Programmatic Biological Assessment for Road Maintenance: Bull Trout . . . Western Montana; Montana Level I Team of Forest Service and Bureau of Land Management; 4/16/99.
2. Flathead NF 11/24/99 and 10/26/00 responses to FOIA requests.*
3. Using the recent 2.5 miles of new road construction in the Flathead's Emery Creek as an example, there were 45 culverts installed, for an average of 18 culverts per mile (personal communication with Al Sorenson; Flathead NF; 11/21/00). Using the 3,761 and 5,025 miles of road reported to exist on the Flathead (see Note 1), an estimate of a total 67,698 to 90,450 culverts is derived.
4. Flathead NF 10/26/00 response to FOIA requests.*
5. Flathead NF Flood Damage report to the Regional Forester; 4/4/90.
6. Fisheries Biological Assessment for Nokio Creek Culvert Replacement. Pat Van Eimeren; Flathead NF; 6/20/00.
7. Montana Dept. of Fish, Wildlife and Parks survey report to Flathead NF; Tom Weaver; 12/18/95.
8. Swan Lake Ranger District photo report on failed culvert on Road 9569 in Kraft Creek; 10/18/99; included in Flathead NF 2/28/00 response to FOIA requests.*
9. Forest Service Roadless Area Conservation FEIS; Volume 1; 11/00. News Release; Washington Office Forest Service; 1/22/98.
10. Flathead NF press release; 11/16/98.
11. See Note 1, second reference.
12. Missoulian new article by Michael Jamison; 11/20/98. Allen Rowley, of the Flathead NF, is reported as stating that, while road reclamation may cost some \$5,000 per mile, maintaining an open road may cost \$6,000 per mile.
13. See Note 9. See also National Forest System Road Management Strategy Draft EA; Washington Office USFS; 2/16/00.
14. Obliteration Miles and Funds; Flathead NF; 9/26/00; included in Flathead NF 10/26/00 response to FOIA requests.* Transaction Register Budget Authority; Flathead NF; 5/19/00.
15. Personal communication with Debbie Manley and Terry Chute; Flathead NF; 10/11/00 and 11/9/00, respectively. Both claim that road maintenance funds specially earmarked for road reclamation can only be used for the actual reclamation, not for the NEPA planning of the reclamation.
16. See Note 14, first reference.
17. Flathead Forest Plan Amendment 19 Amended EA and Decision Notice; Flathead National Forest; 3/95.
18. Amended Biological Opinion on Flathead Forest Plan Amendment 19; Kemper McMaster, Fish and Wildlife Service; 2/17/95.
19. Land and Resource Management Plan and EIS for the Flathead NF; James Overbay; 1/22/86.

20. Friends of the Wild Swan was a co-plaintiff in all three lawsuits. In pertinent part, *Resources Limited v Robertson* alleged that the Flathead Forest Plan violated the Endangered Species Act by failing to insure it would not jeopardize the continued existence of the threatened grizzly bear, largely because its allowable timber sale quantity could not be implemented without violating the Plan's grizzly bear management standards. The Ninth Circuit Court of Appeals ruled in favor of the plaintiffs on 11/1/93, essentially ordering the Flathead to Amend its Forest Plan and re-consult with Fish and Wildlife Service to insure that it would not jeopardize grizzly bears.

Simultaneously, *Swan View Coalition v Turner* alleged that the excessive open road densities that were persisting on the Flathead were resulting in an illegal "taking" of threatened grizzly bear through the adverse modification of their feeding, breeding and sheltering habits. It further alleged that FWS's biological opinion approving the Flathead Forest Plan did not contain an adequate "incidental take statement" allowing for such a level of taking to occur legally. The District Court on 12/7/92 found the incidental take statement to indeed be inadequate and ordered the case to trial in order to determine if the taking could be traced to excessive open road densities.

Also simultaneously, *Swan View Coalition v US Forest Service* alleged that the Forest Service and FWS violated the ESA by failing to use the best available scientific data in planning and approving the Flathead's Lost Silver timber sale, which was to be located in Montana Department of Fish, Wildlife and Park's South Fork Grizzly Bear Study area. The South Fork Study investigated, in part, the effects of both open and closed roads on grizzly bear. It concluded that grizzly bears continue to avoid roads closed by gates and recommended that road reclamation would be required in order to provide adequate secure areas for grizzly bear.

By issuing Amendment 19 in 1995, the Flathead responded to the court's order in *Resources Limited* by reducing its allowable timber sale quantity from 100 million board feet per year to 54 and by issuing new grizzly bear management standards, particularly in regards to limiting both open and total road densities and providing adequate security core areas. These new standards were based on data collected by the South Fork Study. Through formal consultation, FWS issued a biological opinion which included an incidental take statement whose legally-binding terms and conditions required that the Flathead meet certain road density and security core objectives at the end of the fifth and tenth years of Amendment 19 implementation. It also required the Flathead to implement "a public information program on the positive effects of road closures for fish and wildlife, water quality, and other Forest resources," starting in the first year. These measures rendered the two *Swan View* lawsuits moot and they were dismissed.

21. Reclamation Projects spreadsheet; John Ganiere; Flathead NF; 6/12/00.

22. See Note 14, first reference.

23. Flathead NF's Top Ten Proposals for Road Projects Related to Bull Trout; Cathy Barbouletos; 1/11/99. Flathead LRMP Implementation Note #13; Cathy Barbouletos; 5/6/99.

24. Rationale and Choices Made in the Review and Development of an Access Direction Proposal for the NCDE Grizzly Bear Ecosystem; Ake, Carney, Dolan, Godtel, Gore, Harris, Mace, Madel, Servheen, Soukkala, Vandehey, Waller and Wittinger; NCDE Access Task Group of the Interagency Grizzly Bear Committee; 10/98 Draft.

25. Summary of Questions and Results for NCDE Access Management "Test Subunit Analysis"; NCDE Subcommittee of the Interagency Grizzly Bear Committee; 4/27/99. In a computer-modeled test of 9 grizzly bear management subunits, Amendment 19 would require the reclamation of 64 miles of road to meet total road density limits, while the new proposal would require only 12 miles of road reclamation.

26. See Note 14, first reference.

27. See Note 21.

28. Flathead NF letter to Fish and Wildlife Service; Cathy Barbouletos; 5/12/00; with Flathead NF 1999 LRMP Amendment 19 Monitoring Report enclosed.

29. See Note 18.
30. Flathead NF letter to Fish and Wildlife Service; Rodd Richardson; 11/27/96. Personal communication with Allen Rowley, Flathead NF; 11/29/00.
31. Carryover Request; Flathead NF; 11/17/95.
32. See Note 1, first reference.
33. Flathead NF 11/24/99 and 10/26/00 response to FOIA requests.* Tally Lake Ranger District is the only district on the Flathead which prepares work plans for the expenditure of watershed improvement funds.
34. See Note 15.
35. Protecting People and Sustaining Resources in Fire-Adapted Ecosystems, A Cohesive Strategy: The Forest Service Management Response to the General Accounting Office Report GAO/RCED-99-65; October 13, 2000. See Assumptions in Appendix D.
36. See Notes 9 and 13. See also generally the various scientific and NEPA documents prepared for the Interior Columbia River Basin Ecosystem Management Project. Swan View Coalition and Friends of the Wild Swan have also summarized these findings and compiled a lengthy bibliography in this regard in their 7/11/00 comments on the Roadless Area Conservation DEIS.
37. See Note 17.
38. Fisheries Biological Evaluation for Amendment 19; Donald Hair, Flathead NF Fisheries Biologist; 2/4/95. Directive rescinding Implementation Note #13; Cathy Barbouletos, Flathead Forest Supervisor; 11/19/99. Missoulian news article by Michael Jamison; 11/24/99. Presented with the requirements mandated by its fisheries biologist, the plain language of Amendment 19, and a 60-day notice of intent by Friends of the Wild Swan and Swan View Coalition to sue on behalf of threatened grizzly bear and bull trout, the Flathead withdrew its Implementation Note #13, stating it had talked it over with its attorneys and decided the conservation groups “were right.”
39. Peer Review of the Motorized Access Management Strategies for Grizzly Bear Habitat in the Northern Continental Divide Ecosystem; Dr. Bruce McLellan, Dr. M. A. Sanjayan and Dr. Nova Silvy; 9/19/00.
40. Personal communication with Cathy Barbouletos, Flathead NF, and Ann Vandehey, FWS; NCDE Inter-agency Grizzly Bear Committee subcommittee meeting; 11/29/00.
41. Friends of the Wild Swan, Swan View Coalition and Wildlands CPR paid for and hosted a 3-day workshop presented by Pacific Watershed Associates on the Flathead NF May 31-June 2, 1996. By letter of 7/20/98, Glacier View Acting District Ranger Debbie Manley refused Swan View Coalition’s offer to provide the services of Bitterroot Restoration in conducting a hands-on workshop in revegetating sites where culverts have been removed.

*The Freedom of Information Act (FOIA) requests referenced in these notes refer to those made of the Flathead NF in the matter of road and culvert management by Swan View Coalition and Friends of the Wild Swan on 8/10/99 and 6/13/00.

Annotated Bibliography For Conserving Native Ecosystems

**Swan View Coalition and Friends of the Wild Swan
March 6, 2014**

Scientific Findings on Roads and Roadless Lands

Virtually without exception, science is finding that ecological integrity remains highest in areas that remain unroaded and unmanaged and is lowest in areas that have been roaded and managed. As the density of roads increases, aquatic integrity and wildlife security decreases, while the risk of catastrophic wildfire and the occurrence of exotic weeds increases. The simplest and most cost-effective thing the Forest Service can do to maintain and restore aquatic and ecosystem integrity is to stop building roads and to obliterate in an environmentally sound manner as many roads as possible. This conclusion is supported by the following:

"Areas that are more highly roaded actually have a higher potential for catastrophic wildfires than inventoried roadless areas. Other national assessments have arrived at the same conclusions. [] The fire occurrence data revealed the following key points:

- Nationally, the average size of a large wildfire is greater on NFS lands outside of an inventoried roadless area;
- Nationally, the average size of a large wildland fire started by humans is greater on land outside of inventoried roadless areas;
- Regardless of the cause, a wildland fire ignition was nearly 2 times as likely to occur outside of an inventoried roadless area;
- A human ignited wildland fire is nearly 4 times as likely to occur outside of an inventoried roadless area." (Forest Service Roadless Area Conservation DEIS, page 3-157; hereafter USFS 2000).

"The U.S. Fish and Wildlife Service [] found that bull trout are exceptionally sensitive to the direct, indirect, and cumulative effects of roads. Dunham and Rieman [] demonstrated that disturbance from roads was associated with reduced bull trout occurrence. They concluded that conservation of bull trout should involve protection of larger, less fragmented, and less disturbed (lower road density) habitats to maintain important strongholds and sources for naturally recolonizing areas where populations have been lost." (USFS 2000, page 3-82, parenthesis in original).

"Hitt and Frissell [] showed that over 65% of waters that were rated as having high aquatic biological integrity were found within wilderness-containing subwatersheds. [] Trombulak and Frissell [] concluded that [] the presence of roads in an area is associated with negative effects for both terrestrial and aquatic ecosystems including changes in species composition and population size." (USFS 2000, pages 3-80-81).

"High integrity [forests] contain the greatest proportion of high forest, aquatic, and hydrologic integrity of all [] are dominated by wilderness and roadless areas [and] are the least altered by management. [] Low integrity [forests have] likely been altered by past management [] are extensively roaded and have little wilderness." (USFS 1996a, pages 108, 115 and 116).

"Much of this [overly dense forest] condition occurs in areas of high road density where the large, shade-intolerant, insect-, disease- and fire-resistant species have been harvested over the past 20 to 30 years. [] Fires in unroaded areas are not as severe as in the roaded areas because of less surface fuel, and after fires at least some of the large trees survive to produce seed that regenerates the area. Many of the fires in the unroaded areas produce a forest structure that is consistent with the fire regime, while the fires in the roaded areas commonly produce a forest structure that is not in sync with the fire regime. [] In general, the effects of wildfires in these areas are much lower and do not result in the chronic sediment delivery hazards exhibited in areas that have been roaded." (USFS 1997a, pages 281-282).

"Increasing road density is correlated with declining aquatic habitat conditions and aquatic integrity [] An intensive review of the literature concludes that increases in sedimentation [of streams] are unavoidable even using the most cautious roading methods." (USFS 1996b, page 105).

"This study suggests the general trend for the entire Columbia River basin is toward a loss in pool habitat on managed lands and stable or improving conditions on unmanaged lands." (McIntosh et al 1994).

"The data suggest that unmanaged systems may be more structurally intact (i.e., coarse woody debris, habitat diversity, riparian vegetation), allowing a positive interaction with the stream processes (i.e., peak flows, sediment routing) that shape and maintain high-quality fish habitat over time." (McIntosh et al 1994).

"Although precise, quantifiable relationships between long-term trends in fish abundance and land-use practices are difficult to obtain (Bisson et al. 1992), the body of literature concludes that land-use practices cause the simplification of fish habitat []." (McIntosh et al 1994).

"Land management activities that contributed to the forest health problem (i.e., selective harvest and fire suppression) have had an equal or greater effect on aquatic ecosystems. If we are to restore and maintain high quality fish habitat, then protecting and restoring aquatic and terrestrial ecosystems is essential." (McIntosh et al 1994).

"Native fishes are most typically extirpated from waters that have been heavily modified by human activity, where native fish assemblages have already been depleted, disrupted, or stressed []." (Moyle et al 1996).

"Restoration should be focused where minimal investment can maintain the greatest area of high-quality habitat and diverse aquatic biota. Few completely roadless, large watersheds remain in the Pacific Northwest, but those that continue relatively undisturbed are critical in sustaining sensitive native species and important ecosystem processes (Sedell, et. al 1990; Moyle and Sato 1991; Williams 1991; McIntosh et al. 1994; Frissell and Bayles 1996). With few exceptions, even the least disturbed basins have a road network and history of logging or other human disturbance that greatly magnifies the risk of deteriorating riverine habitats in the watershed." (Frissell undated).

"[A]llocate all unroaded areas greater than 1,000 acres as Strongholds for the production of clean water, aquatic and riparian-dependent species. Many unroaded areas are isolated, relatively small, and most are not protected from road construction and subsequent timber harvest, even in steep areas. Thus, immediate protection through allocation of the unroaded areas to the production of clean water, aquatic and riparian-dependent resources is necessary to prevent degradation of this high quality habitat and should not be postponed." (USFWS et al 1995).

"Because of fire suppression, timber harvest, roads, and white pine blister rust, the moist forest PVG has experienced great changes since settlement of the project area by Euroamericans. Vast amounts of old forest have converted to mid seral stages." (USFS/BLM 2000, page 4-58).

"Old forests have declined substantially in the dry forest PVG []. In general, forests showing the most change are those that have been roaded and harvested. Large trees, snags, and coarse woody debris are all below historical levels in these areas." (USFS/BLM 2000, page 4-65).

"High road densities and their locations within watersheds are typically correlated with areas of higher watershed sensitivity to erosion and sediment transport to streams. Road density also is correlated with the distribution and spread of exotic annual grasses, noxious weeds, and other exotic plants. Furthermore, high road densities are correlated with areas that have few large snags and few large trees that are resistant to both fire and infestation of insects and disease. Lastly, high road densities are correlated with areas that have relatively high risk of fire occurrence (from human caused fires), high hazard ground fuels, and high tree mortality." (USFS 1996b, page 85, parenthesis in original).

In simpler terms, the Forest Service has found that there is no way to build an environmentally benign road and that roads and logging have caused greater damage to forest ecosystems than has the suppression of wildfire alone. These findings indicate that roadless areas in general will take adequate care of themselves if left alone and unmanaged, and that concerted reductions in road densities in already roaded areas are absolutely necessary.

Indeed, other studies conducted by the Forest Service indicate that efforts to "manage" our way out of the problem are likely to make things worse. By "expanding our efforts in timber harvests to minimize the risks of large fire, we risk expanding what are well established negative effects on streams and native salmonids. [] The perpetuation or expansion of existing road networks and other activities might well erode the ability of [fish] populations to respond to the effects of large scale storms and other disturbances that we clearly cannot change." (Reiman et al 1997).

The following quotes demonstrate that trying to restore lower severity fire regimes and forests through logging and other management activities may make the situation worse, compared to allowing nature to reestablish its own equilibrium. These statements are found in "An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins, Volume 3 (ICBEMP):

"Since past timber harvest activities have contributed to degradation in aquatic ecosystems, emphasis on timber harvest and thinning to restore more natural forests and fire regimes represent risks of extending the problems of the past." (ICBEMP page 1340).

"Proposed efforts to reduce fuel loads and stand densities often involve mechanical treatment and the use of prescribed fire. Such activities are not without their own drawbacks -- long-term negative effects of timber harvest activities on aquatic ecosystems are well documented (see this chapter; Henjum and others 1994; Meehan 1991; Salo and Cundy 1987)." (ICBEMP page 1340).

"Species like bull trout that are associated with cold, high elevation forests have probably persisted in landscapes that were strongly influenced by low frequency, high severity fire regimes. In an evolutionary sense, many native fishes are likely well acquainted with large, stand-replacing fires." (ICBEMP page 1341).

"Attempts to minimize the risk of large fires by expanding timber harvest risks expanding the well-established negative effects on aquatic systems as well. The perpetuation or expansion of existing road networks and other activities might well erode the ability of populations to respond to the effects of fire and large storms and other disturbances that we cannot predict or control (National Research Council 1996). (ICBEMP page 1342).

"Watersheds that support healthy populations may be at greater risk through disruption of watershed processes and degradation of habitats caused by intensive management than through the effects of fire." (ICBEMP page 1342).

"Timber harvest, through its effects on forest structure, local microclimate, and fuels accumulation, has increased fire severity more than any other recent human activity. If not accompanied by adequate reduction of fuels, logging (including salvage of dead and dying trees) increases fire hazard by increasing surface dead fuels and changing the local microclimate. Fire intensity and expected fire spread rates thus increase locally and in areas adjacent to harvest". (USFS 1996c, pages 4-61-72).

"Logged areas generally showed a strong association with increased rate of spread and flame length, thereby suggesting that tree harvesting could affect the potential fire behavior within landscapes...As a by-product of clearcutting, thinning, and other tree-removal activities, activity fuels create both short- and long-term fire hazards to ecosystems. Even though these hazards diminish over time, their influence on fire behavior can linger for up to 30 years in dry forest ecosystems of eastern Oregon and Washington". (Huff et al 1995).

The answer, therefore, is not to try managing our way out of this situation with more roads and timber harvest/management. In summary:

- Roads have adverse effects on aquatic ecosystems. They facilitate timber sales which can reduce riparian cover, increase water temperatures, decrease recruitment of coarse woody debris, and disrupt the hydrologic regime of watersheds by changing the timing and quantity of runoff. Roads themselves disrupt hydrologic processes by intercepting and diverting flow and contributing fine sediment into the stream channels which clogs spawning gravels. High water temperatures and fine sediment degrade native fish spawning habitat.

According to the U.S. Forest Service 82% of all bull trout populations and stream segments range-wide are threatened by degraded habitat conditions. Roads and forest management are a major factor in the decline of native fish species on public lands in the Northern Rockies and Pacific Northwest.

- An open road density (ORD) of one mile per square mile of land reduces elk habitat effectiveness to only 60% of potential. When ORD increases to six miles per square mile, habitat effectiveness for elk decreases to less than 20%. (Lyon 1984).

- Black bears in southern Appalachia begin avoiding Forest Service roads when the density exceeds 0.8 miles per square mile. (Brody 1984). Grizzly bears use habitats less than expected when ORD exceeds one mile per square mile and total road density (TRD) exceeds two miles per square mile. (Mace and Manley 1993). Open roads contribute to grizzly bear mortality by poaching and, especially during the black bear hunting season, by mistaken killing. (Holland 1985).

- Roads have a similar, devastating effect on wolves. Studies show that wolves fail to survive in areas where ORD exceeds 0.93 miles per square mile. (Thiel 1985).

- Sediment from roads, both open and closed, damages the environment. In northwest Montana, for instance, 80-90% of the sediment produced by logging and road construction generally is attributable to the road (USFS 1985). The Flathead National Forest estimates that, on one of its most pervasive and sensitive land types, one mile of road produces 98 tons of sediment, 80% of which reaches the stream bed (USFS undated).

In addition, the Forest Service estimates that only a 10% increase in fine sediment deposition in spawning gravel decreases the spawning success of bull trout by 50%. (USFS 1986). A road cut across a hillside intercepts subsurface water flow and runs it down ditches and through culverts. There it is joined by sediment-laden runoff from

the roadbed and cut banks before running into a stream. Hence, subsurface water which would have once welled up from below a stream to clean bull trout spawning gravels now carries sediment from the road and land surface and deposits it onto the spawning gravels, where it smothers the eggs and fry.

"Rehabilitation of road-miles cannot be accomplished alone by gating, berming, or otherwise blocking the entrance to a road permanently or temporarily, or seasonally closing roads, but will require obliteration, recontouring, and revegetating." (U.S. Fish and Wildlife Service Regions 1 and 6. 1998a).

"Reduction of total miles of forest roads is an important component of watershed restoration. . . Many miles of roads must be 'put to bed', by pulling culverts, resloping road beds, pulling fill and replanting." (U.S. Fish and Wildlife Service. 1998b).

"Recontoured and abandoned sites displayed similar aboveground properties but exhibited notable differences in belowground properties, including soil hydraulic conductivity, organic matter, total carbon, and total nitrogen, among others. Our findings suggest that recontouring can dramatically accelerate recovery of above- and belowground properties so they resemble never-roaded reference conditions. In contrast, abandoning roads generates above- and belowground properties that follow a different path to recovery." (Lloyd et al 2013).

"Roots on A30 [abandoned] roads were constrained to the upper 15 cm (10 ± 0.45 cm). In contrast, never-roaded sites and recontoured roads had rooting depths that extended below the limits of soil pit excavations ($>60\text{--}75$ cm)." (Lloyd et al 2013).

"The simulated time to runoff generation after a 1-hour storm event was significantly different between treatments, with runoff occurring in the first 0.2 hours of the storm on A30 [abandoned] roads and never on R10 [recontoured] roads." (Lloyd et al 2013).

"In our study, the trajectory of plant succession on abandoned roads and recontoured roads followed similar trends to other research conducted on passively restored roads (Madej 2001; Foltz et al. 2009), although our data suggest that vegetation succession to shrubs and trees may be slower on abandoned roads as compared with recontoured roads. However, ecosystem recovery belowground differed markedly from that aboveground. The strong differences in belowground properties following road abandonment result in an effective decoupling of the recovery trajectories of above- and belowground ecohydrological properties (Figure 3). Together, these findings support the prediction that recontouring accelerates the rehabilitation of key ecohydrologic properties toward reference dynamics." (Lloyd 2013).

"After treatment, we conservatively estimate soil TC [carbon] storage increased sixfold, to 6.5×10^7 g C per road kilometer (to 25-cm depth). The same trends are seen for soil N [nitrogen]. Abandoned roads have approximately 6.96×10^5 g N per road kilometer, and this amount increases by an order of magnitude to 7.16×10^6 g N (to 25-cm depth). These major differences in soil C and N storage have potentially important implications for climate-change mitigation." (Lloyd et al 2013).

“Although more expensive as compared with road abandonment, recontouring may be the only way to restore both above- and belowground ecosystem processes, accelerating the recovery of these forest ecosystems by decades to millennia. . . Restoration techniques that fail to restore above- and belowground properties and processes may lead to an altered ecosystem with different functional processes and potential (Kardol and Wardle 2010).” (Lloyd et al 2013).

Comprehensive Management of Human Access

The following citations show that all human access to fish and wildlife habitat has negative impacts, including the existence of roads and trails regardless of use levels. The magnitude of impacts from human use generally occurs in descending order from motorized use of roads and trails to use by bicycles and finally foot or horse use. While many of these citations contend with research and opinions on Flathead Forest Plan Amendment 19, similar methods of quantifying the impacts of motorized and high levels of non-motorized use have been applied to other National Forests via guidance from the Interagency Grizzly Bear Committee.

“We have . . . created technologies that make virtually every place on this planet accessible to us. With our curiosity, money, leisure time, and motorized contraptions, we can invade any corner of the earth with impunity. . . That we can alter human behavior to protect wildland ecosystems and wild animals is reason for hope.” (Salwasser 1997).

“The simplicity of A19 [Flathead Forest Plan Amendment 19] and its ability to permanently secure areas for grizzly bears makes it a powerful tool in the conservation of the grizzly bear in the NCDE.” (McLellan et al 2000, page 11).

“Private roads were excluded from road density calculations and, if federal land was <75% of the sub-unit, ‘no net loss’ rather than the numerical guideline values was used. These, and other rules that relaxed road density guidelines were established in sub-units with private lands even when it was shown that a bear’s level of risk was 30.27 times as great in rural areas as in backcountry areas. It would appear that in sub-units with private holdings that stricter, not reduced, access controls would be necessary to offset higher levels of mortality.” (McLellan et al 2000, page 11).

“Based on the best information available, the current and planned distribution of roads and core area, large portions of roadless areas, and known grizzly bear distribution within the recovery zone portion of the [Flathead National] Forest reveal a pattern and trend in access management that is improving, is based on ecosystem-specific information, and will be conducive to supporting grizzly bears at numbers that promote recovery.” (USFWS 2005, page 132).

“The Service believes that grizzly bears in the NCDE would benefit from continued application of the [Flathead National] Forest’s access management strategy, as proposed. Efforts to reduce open road density, especially in seasonally important resource areas, and reducing roads to provide core habitat in subunits with high road

densities should be pursued and included in all project planning.” (USFWS 2005, page 139).

“As human population centers expand and increased dispersed human activity and development ensues, risks to grizzly bears may increase. Public lands will remain important to the recovery and sustainability of the NCDE grizzly bear population.” (USFWS 2005, page 140).

The northern Swan Range population of grizzly bear is likely decreasing at over 2% per year, enough to halve the population in about 30 years. (Mace and Waller 1997, errata to page 112).

“[The northern Swan Range] population was semi-isolated because of human development including hydroelectric development. . . until effective management programs are developed on private lands, federal lands should be considered invaluable source areas and managed to reduce man-caused mortality. This would be accomplished by establishing effective areas of high security that transcend seasonal habitats, and where access is regulated.” (Mace and Waller 1997, Chapter 9).

“Additional road restrictions and reductions required by A19 [Flathead Forest Plan Amendment 19] are important to reduce displacement (and indirect mortality) and ensure adequate habitat available for continued reproduction and population growth over the long term.” (USFWS 2005, page 145).

“It is the Service’s biological judgment that ‘harm’ of grizzly bears is likely to occur in the following conditions: 1. The precise open motorized access densities exceeds 1 mile per square mile in over 19 percent of a subunit. . . 2. The precise total motorized access density exceeds 2 miles per square mile in over 19 percent of a subunit. . . 3. Security core is less than 68% of a subunit.” (USFWS 2005, page 150).

“Security core area . . . is at least 0.3 miles from open roads and high-intensity, non-motorized trails. . . The number of restricted roads in security core should be minimized . . . and may not receive high levels of non-motorized use . . . defined as receiving 20 or greater parties per week . . . reclamation of roads [is] the preferred treatment. (USFS 1995).

“Habitat security conditions cannot be defined entirely by motorized access route density. . . heavily used non-motorized trails and areas of high levels of dispersed human use will also influence the effectiveness of area in regards to habitat security.” (IGBC 1998).

“[W]e determined that grizzly bears were significantly further than expected from [hiking only] trails, and from lakes with camp-sites during spring, summer, and autumn. . . Therefore, while in the JBHA [Jewel Basin Hiking Area], grizzly bears minimized their interaction with recreationists by spatially avoiding high use areas.” (Mace and Waller 1997, Chapter 7.2).

“Direction [is] for reclaiming/obliterating roads including removal of culverts which greatly reduces the risk of future sedimentation problems resulting from culvert failures

on reclaimed roads. . . the long term effect of implementing this direction should be beneficial to fish [due] to reduced sediment and routing of surface water once reclaimed and restricted roads have stabilized, and greatly reduced risk of future impacts from culverts left in place and inadequate treatment of closed or reclaimed roads.” (Hair 1995).

“The Forest Service estimates a \$10 billion backlog in needed road reconstruction and maintenance. . . Fewer roads will be built and those that are built will minimize environmental impacts. Roads that are no longer needed or that cause significant environmental damage will be removed. (Dombeck 1998).

“[T]his points to a smaller road system than our current one . . .” (Holtrop 2010).

The Flathead National Forest needs \$6.2 million each year to maintain its road system, but receives less than \$1 million. (USFS 2004).

“Roads that are not maintained can become an environmental liability on the watershed. . . It’s not a matter of if a culvert is going to fail, it’s a matter of when. . . It is cheaper to reclaim a road than to maintain it.” (Rowley 1998a and 1998b).

“Reduction of total miles of forest roads is an important component of watershed restoration [but] cannot be accomplished by gating, berming, or otherwise blocking the entrance to a road. . . Many miles of roads must be ‘put to bed’ by pulling culverts, resloping road beds, pulling fill and replanting.” (USFWS 1998a and 1998b).

“The management of roads is the most powerful tool available to balance the needs of bears and all other wildlife with the activities of humans. . . Roads closed to public use through the use of only signs or gates are often not effective. . . The optimum situation to maintain grizzly bear habitat effectiveness and minimize mortality risk is to obliterate the road.” (USFWS 1993).

“Roads are the single biggest problem on the landscape for elk. It’s well documented, and everything else pales in comparison. . . The more roads you have, the less elk you have.” (Stouder 2002).

“Elk travel time [displacement] was highest during ATV exposure, followed by exposure to mountain biking, hiking, and horseback riding. . . A comprehensive approach for managing human activities to meet elk objectives should include careful management of off-road recreational activities, particularly ATV riding and mountain biking, which caused the largest reductions in feeding time and increases in travel time.” (Naylor et al. 2009).

Old Growth Forests

Old-growth forest habitat is a diminishing resource on public lands due to many factors. Maintaining existing old-growth stands and providing for recruitment of future old growth is necessary to provide for the viability of old-growth associated wildlife

species. While not perfect, the Old-Growth Forest Types of the Northern Region (Green et al, 1992) is probably the best reference available for these forests and should be used as a guide to determine old-growth forest habitat.

We strongly caution though that the minimum characteristics in Green et al, are not the recommended standards, but merely the starting point by which to determine whether a stand is classified as old growth. It is NOT to be used to “manage” old growth down to these minimum characteristics. Also, it is important to note that old-growth attributes such as decadence, large trees, old trees, snags, canopy structure, coarse woody debris, etc. are critical components of old-growth forest habitat. Stands that may not have the minimum number of large trees but contain these other important attributes should be considered “recruitment” or future old-growth and allowed to progress towards meeting the Green et al definition.

Old-growth stands function best as habitat when they are connected to other stands. Connectivity can be achieved by corridors of actual old growth or by suitable closed-canopy or mature condition of the matrix between old-growth stands (Thomas, et al. 1990, Bennett, 1999). Stands designated as future old growth that are presently mature may be suitable (Pfister, et al 2000). Linkages, should whenever possible, contain a large fraction of interior forest (i.e., 100 meters from a high contrast edge, Bennett 1999).

Interior old growth habitat (>100 meters from edge of an opening or stand of lesser age or a road) is the most important component of old-growth habitat (Baker and Knight 2000). In general larger stands are more effective as habitat than smaller stands (Pfister 2000). Fragmentation of existing patches of old growth by roads, timber harvesting or other created openings will decrease effectiveness of the patch as habitat due to the reduction in amount of interior old-growth conditions (Baker and Knight 2000).

Stands that met the Green et al definition of old growth but are burned in a forest fire do not cease to provide a valuable function to wildlife and the forest ecosystem and should not be salvage logged. This burned old growth may function differently but it is still important habitat because burned snags stand much longer than beetle-killed trees, and the fact that it burned does not change its age and age is a primary factor in old growth habitat (Pers. comm. R. McClelland).

Management Recommendations to Protect Old Growth

To protect remaining old growth, provide for recruitment of future old growth, and link these currently small and isolated patches, we suggest the following management standards.

- Use the Old-Growth Forest Types of the Northern Region as a first step in identifying old growth stands.
- All existing old growth must be preserved. Historically old-growth habitat was 15% to 60% (source Amendment #21). Current old growth averages 11.6% across the Forest and ranges between 6.9% to 12.7% (source 1999 – 2007 Forest Plan Monitoring Report). Old-growth forest habitat must be increased to the historical range by allowing mature

stands to develop old growth characteristics (snags, down woody material, decadence and age). The Forest Service must calculate how much old growth there is on a watershed (i.e., approximately 10,000 acres) and forest-wide basis. Recruitment old growth must be identified on a watershed and forest-wide basis. Recruitment old growth is subject to the same protections as designated current old growth.

- Designate the existing old growth and future old growth, map it and connect these stands with linkages as described above.
- Place longer-rotation or less intensive uses adjacent to designated old growth, so that a lower-intensity managed zone serves as a buffer for the old-growth system (Noss and Cooperrider 1994). Avoid placing high intensity land uses (e.g. clearcuts, roads) next to designated old growth (Pfister 2000).
- Integrate future recruitment old growth into the network. Where otherwise equivalent replacement stands exist, choose those adjacent to designated old growth as future old growth.
- No logging should take place in old growth stands. Under limited and extraordinary circumstances some thinning of sapling and pole-sized timber less than 6 inches in diameter may be appropriate but only in ponderosa pine habitat type, without using heavy equipment, and when there are no adverse effects to old-growth dependent, management indicator, sensitive, threatened or endangered species.

Native Fish and Water Quality

The best available scientific information on bull trout supports the following specific, numeric and measurable standards for protection of the Primary Constituent Elements of bull trout habitat. Protecting these PCEs in all watersheds will provide benefits for westslope cutthroat trout and other native aquatic species.

Clean- The bull trout is virtually synonymous with water quality. Bull trout require very clean water and favor streams with upwelling groundwater for spawning (Fraley & Shepard 1989; Baxter & Hauer 2000). Of the many threatened and endangered fish species, bull trout are the most sensitive to changes in water quality, particularly from fine sediments generated by logging and grazing activities. Fine sediments can smother spawning beds and degrade other habitat components. A key determinant is the level of fine sediment ≤ 6.35 mm (Weaver & Fraley 1991) and protecting upwelling groundwater. Protection of critical habitat includes standards to maintain and improve water quality and control lethal sediments. For example, fine sediments < 6.4 mm in diameter must be limited to less than 20% in spawning habitat (Espinoza 1996) and standards must be developed to maintain groundwater.

Cold- Bull trout also require colder water than other native fish. Rieman & McIntyre (1993) reported that researchers recognize temperature more consistently than any other factor influencing bull trout distribution (see also, Pratt 1992). Habitat protection efforts must seek to maintain or reacquire natural cold water conditions. Specifically, stream

temperatures in current and historic spawning, rearing and migratory corridor habitats should not exceed 6-8 C for spawning, with the optimum for incubation from 2-4 C (McPhail & Murray 1979); 10-12 C for rearing habitat, with 7-8 C being optimal (Goetz 1989); migratory stream corridors should be 12 C or less.

Complex- Critical habitat for bull trout isn't just a set of places, but rather a complex arrangement of environmental conditions. Noting that "watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear," in its 1998 listing rule the Service listed the habitat components: "water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors." Implicit in this list of habitat requirements is the understanding that habitat critical to bull trout viability consists of a specific set of physical conditions in addition to particular places. For example, the Service explained that "[m]aintaining bull trout habitat requires stream channel and flow stability." And further explained that "[a]ll life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders and pools." Bull trout not only need clean, cold water, they need places to rest, hide, feed and travel.

Intact forests, which provide bank stability, shade and woody debris for formation and maintenance of pool habitat, are essential. Climate change will have implications for species such as bull trout because they require cold, clean water. Isaak et al (2010) state: "Riparian vegetation, for example, strongly affects near stream microclimates and minimizing near-stream disturbances associated with grazing, roadbuilding and timber harvest, or facilitating rapid vegetative recovery after these disturbances, could help buffer many streams from additional warming."

Climate change will also increase rain on snow events resulting in stream scour. Shelburg et al's (2010) study of bull trout redd scour emphasized the importance of habitat heterogeneity and refugia availability in sustaining salmonid populations at multiple spatial scales. Loss of complex fluvial spawning habitat such as large woody debris contributes to redd scour after rain on snow events. They conclude: "Processes that form complex habitat in association with LWD may partially mitigate against unfavorable discharge regimes, water and sediment yield alterations due to land-use, or future climate change."

Espinosa (1996) recommends that all streams should average $\geq 90\%$ bank stability and that cobble embeddedness in summer rearing habitat should be $< 30\%$ and $< 25\%$ in winter rearing habitats. Additional indices include channel morphology including large woody debris, pool frequency, volume and residual pool volumes.

The Flathead Lake Biological Station has been studying the aquatic environment in the Crown of the Continent ecosystem for decades. Hauer et al (2007) found that:

"Streams of watersheds with logging have increased nutrient loading, first as SRP and NO₃, which is rapidly taken up by stream periphyton. This leads to increased algal growth that is directly correlated with the quantity of logging within the watershed. The increased periphyton increases particulate organic matter in transport as the algal biomass is sloughed into the stream. We observed this as increased TP and TN in logged watershed streams. Other studies in the CCE

have shown that increased sediment loading and an incorporation of fines into spawning gravel, especially during the summer and fall base flow period, has a dramatic effect on the success of spawning by bull trout (*Salvelinus confluentus*). Experiments have shown that as the percentage of fines increases from 20% to 40% there is >80% decrease in successful fry emergence."

Hauer, et al. (1999) also found that bull trout streams in wilderness habitats had consistent ratios of large to small and attached to unattached large woody debris. However, bull trout streams in watersheds with logging activity had substantial variation in these ratios. They identified logging as creating the most substantive change in stream habitats.

"The implications of this study for forest managers are twofold: (i) with riparian logging comes increased unpredictability in the frequency of size, attachment, and stability of the LWD and (ii) maintaining the appropriate ratios of size frequency, orientation, and bank attachment, as well as rate of delivery, storage, and transport of LWD to streams, is essential to maintaining historic LWD characteristics and dynamics. Our data suggest that exclusion of logging from riparian zones may be necessary to maintain natural stream morphology and habitat features. Likewise, careful upland management is also necessary to prevent cumulative effects that result in altered water flow regimes and sediment delivery regimes. While not specifically evaluated in this study, in general, it appears that patterns of upland logging space and time may have cumulative effects that could additionally alter the balance of LWD delivery, storage, and transport in fluvial systems. These issues will be critical for forest managers attempting to prevent future detrimental environmental change or setting restoration goals for degraded bull trout spawning streams."

Wherever possible, critical habitat protection should extend to the entire hydrologic watershed. Frissell (1999) reported complex interactions between near-surface groundwater and surface waters in bull trout streams, suggesting a more comprehensive approach to watershed protection. Baxter and Hauer (2000) reported that geomorphology and hyporheic groundwater exchange have a strong influence on bull trout redd locations.

Connected- The sciences of conservation biology and conservation genetics show that bull trout have naturally occurred throughout the Northern Rockies and Pacific Northwest in a system of connected watersheds comprising migratory meta-populations of bull trout (Rieman & McIntyre 1993). Blockages to historic migration routes, both physical and thermal, must be addressed to provide access to spawning streams and protect the genetic integrity of the bull trout. Historically occupied, but currently unoccupied habitat must be protected and reoccupied to reconnect bull trout populations throughout their range.

In addition to these standards, roadless and low road density watersheds deserve special protection measures. Numerous scientific studies and reviews have consistently reported that bull trout strong populations, presence and biomass are inversely related to road densities (Huntington 1995; Quigley, et al. 1996; Rieman, et al. 1997). Bader (2000) found that 78% of bull trout "strong populations" were in roadless area with

most of the remainder directly downstream from roadless area. Quigley, et al. (1996) reported that roadless and wilderness areas can provide “strong anchors” for salmonid recovery. In recognition of this strong body of scientific evidence, the U.S. Fish & Wildlife Service (1998) recommended that remaining roadless areas within bull trout range be maintained in roadless condition.

Muhlfeld, et al. (2009) evaluated the association of local habitat features (width, gradient, and elevation), watershed characteristics (mean and maximum summer water temperatures, the number of road crossings, and road density), and biotic factors (the distance to the source of hybridization and trout density) with the spread of hybridization between native westslope cutthroat trout *Oncorhynchus clarkii lewisi* and introduced rainbow trout *O. mykiss* in the upper Flathead River system in Montana and British Columbia.

They found that hybridization was positively associated with mean summer water temperature and the number of upstream road crossings and negatively associated with the distance to the main source of hybridization. Their results suggest that hybridization is more likely to occur and spread in streams with warm water temperatures, increased land use disturbance, and proximity to the main source of hybridization.

Lynx

The Fish and Wildlife Service designated critical habitat for lynx that includes the Flathead National Forest. They determined the physical and biological features that are the primary constituent elements (PCEs) or, in other words, the elements of physical or biological features that, when laid out in the appropriate quantity and spatial arrangement to provide for a species’ life-history processes, are essential to the conservation of the species. They determined that the PCE specific to lynx in the contiguous United States is:

1) Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

(a) Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;

(b) Winter conditions that provide and maintain deep fluffy snow for extended periods of time;

(c) Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and

(d) Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to

travel through such habitat while accessing patches of boreal forest within a home range.

Lynx in the Rocky Mountains of Montana selected mature, multistoried forests composed of large-diameter trees with high horizontal cover¹ during winter. These forests were composed of mixed conifers that included lodgepole pine, Douglas-fir, and western larch, but predominately consisted of Englemann spruce and subalpine fir in the overstory and midstory. (Squires et al. 2010)

Squires et al. (2010) studied den selection in western Montana. They found that lynx denned in preexisting sheltered spaces created by downed logs (62%), root-wads from wind-thrown trees (19%), boulder fields (10%), slash piles (6%) and live trees (4%). Lynx overwhelmingly prefer preexisting sheltered spaces created by downed logs in mature forests.

Squires also found that lynx generally denned in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris. Eighty percent of dens were in mature forest stands and 13% in mid seral regenerating stands; young regenerating (5%) and thinned (either naturally sparse or mechanically thinned) stands with discontinuous canopies (2%) were seldom used.

Maintaining mature and mid-seral regenerating spruce-fir forests with high horizontal cover and abundant woody debris would be most valuable for denning when located in drainages or in concave, drainage-like basins. Management actions that alter spruce-fir forests to a condition that is sparsely stocked (e.g. mechanically thinned) and with low canopy closure (<50%) would create forest conditions that are poorly suitable for denning.

Squires et al. (2006) results also indicate that lynx preferentially forage in spruce-fir forests with high horizontal cover, abundant hares, deep snow, and large-diameter trees during winter. The high horizontal cover found in multistory forest stands is a major factor affecting winter hare densities. Lynx tend to avoid sparse, open forests and forest stands dominated by small-diameter trees during the winter.

They also sampled vegetative characteristics at kill sites and compared these to other locations along lynx travel routes. Lynx killed prey in areas of even higher horizontal cover than they generally encountered along their snow-tracks.

During winter, lynx preferentially foraged in mature, multilayer forests with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) in the overstory and midstory, but these forests also included lodgepole pine, Douglas-fir, and western larch. Forests used during winter were composed of larger diameter trees with higher horizontal cover, more abundant snowshoe hares (*Lepus americanus*), and deeper snow compared to random availability; multilayer, spruce-fir forests provided high horizontal cover with tree branching that touched the snow surface. During

¹ Horizontal cover is low hanging conifer boughs that touch the snow, small trees that are tall enough to protrude through the snow and herbaceous vegetation in the understory.

winter, lynx killed prey at sites with higher horizontal cover than that along foraging paths. Lynx were insensitive to snow depth or penetrability in determining where they killed prey.

During summer, lynx broadened their resource use to select younger forests with high horizontal cover, abundant total shrubs, abundant small-diameter trees, and dense saplings, especially spruce–fir saplings. Based on multivariate logistic-regression models, resource selection occurred primarily at a fine spatial scale as was consistent with a sight-hunting predator in dense forests. However, univariate comparisons of patch-level metrics indicated that lynx selected homogenous spruce–fir patches, and avoided recent clear-cuts or other open patches. Given that lynx in Montana exhibit seasonal differences in resource selection, we encourage managers to maintain habitat mosaics. Because winter habitat may be most limiting for lynx, these mosaics should include abundant multistory, mature spruce–fir forests with high horizontal cover that are spatially well-distributed.

Montana is near the southern extent of the lynx's current North American distribution. Here, boreal forests are fragmented into patches of suitable habitat at higher elevations, separated by valleys of open grasslands and dry forest types. Southern lynx populations tend to be small and relatively isolated. Therefore, movement and connectivity among groups is particularly important to maintain persistent populations and to recolonize unoccupied habitat.

Research by Dr. John Squires et al. (2012) modeled movements that indicated lynx selected home ranges at mid-elevations with low surface roughness, high canopy cover and little open grassland vegetation. They found that connectivity between lynx habitat in Canada and the conterminous U.S. is facilitated by only a few putative corridors that extend south from the international border.

They identified a primary lynx corridor from Canada that extends from the Whitefish Range, along the western front of the Swan Range ending near Seeley Lake. And a second corridor along the east side of Glacier National Park to the Bob Marshall Wilderness Complex.

Snowmobile trails may facilitate coyote movements into areas with deeper snow during the winter. (Gese et al. 2013) While direct impacts of snowmobiles on lynx were not documented, the potential impacts of a main competitor, the coyote, are worth mentioning. Due to their use of snowmobile trails, coyotes have the potential to access areas of habitat that might normally be too energetically difficult to access in deep snow. Lynx, with their superior body mass to footload, can access habitats containing deep snow that coyotes might typically avoid. In addition, expansion of current winter recreation use areas may create persistent travel corridors that could be utilized by coyotes. Since coyote use of snowmobile trails was related to how much was available, coyote movements could possibly be altered by limiting snow compaction. Researchers suggest the use of snowmobiles may result in consistent compacted trails within lynx conservation areas which may be detrimental to local lynx populations in the Intermountain West. (Id.)

Threats to lynx and their habitat

Excerpts from the 2013 Lynx Conservation Assessment and Strategy

Climate Change

Several possible effects of climate change on lynx can reasonably be anticipated. These include:

- 1) potential upward shifts in elevation or latitudinal distribution of lynx and their prey;
- 2) changes in the periodicity or loss of snowshoe hare cycles in the north;
- 3) reductions in the amount of lynx habitat and associated lynx population size due to changes in precipitation, particularly snow suitability and persistence, and changes in the frequency and pattern of disturbance events (e.g., fire, hurricanes, insect outbreaks);
- 4) changes in demographic rates, such as survival and reproduction; and
- 5) changes in predator-prey relationships. In addition, it is possible that interactions between these variables may intensify their effects.

Timber Harvest

Commercial timber management of conifer forests traditionally has been designed to: reduce tree density and promote tree growth (e.g., precommercial thinning), especially in young regenerating forests; improve growth and vigor of mature trees (e.g., commercial thinning, thinning from below); reduce the vulnerability of commercially-valuable trees to insects and disease (e.g., commercial thinning, group selection); and harvest forest products (e.g., regeneration harvest). Timber management practices may mimic natural disturbance processes but often are not an exact ecological substitute. Some practices, such as use of herbicides to suppress hardwood regeneration, do not have an historical analogue. Timber harvest may differ from natural disturbances by:

- Removing most standing biomass from the site, especially larger size classes of trees, and down logs, which alters microsite conditions and nutrient cycling;
- Creating smaller, more dispersed patches and concentrating harvest at lower elevations in mountainous regions and on more nutrient rich soils, resulting in habitat fragmentation;
- Causing soil disturbance and compaction by heavy equipment, which may result in increased water runoff and slower tree growth at the site; or
- Giving a competitive advantage to commercially-valuable tree species and reducing the structural complexity of the forest through the application of harvest, planting, thinning, and herbicide treatments.

Precommercial thinning has been shown to reduce hare numbers by as much as 2- and 3-fold due to reduced densities of sapling and shrub stems and decreased availability of

browse. Researchers believe that the practice of precommercial thinning could significantly reduce snowshoe hares across the range of lynx.

There are anecdotal examples of precommercially thinned stands that subsequently "filled in" with understory trees. Some have suggested this could be a technique to extend the time that understory trees and low limbs provide the dense horizontal cover that constitutes snowshoe hare habitat. At this time, no other data are available to quantify the re-establishment of snowshoe hare habitat and over what time period, or the response by snowshoe hares, as compared with sites that were not precommercially thinned, so this remains an unproven management technique.

Uneven-aged management (single tree and small group selection) practices can be employed in stands where there is a poorly developed understory, but have the potential to produce dense horizontal cover for snowshoe hares. Removal of select large trees can create openings in the canopy that mimic gap dynamics and help to maintain and encourage multi-story attributes within the stand.

If removal of large trees opens the canopy to the extent that the patch functions as an opening, this may discourage use by lynx. Removal of larger trees from mature multi-story forest stands to reduce competition and increase tree growth or resistance to forest insects may reduce the horizontal cover (e.g., boughs on snow), thus degrading the quality of winter habitat for lynx. Similarly, removing understory trees from mature multi-story forest stands reduces the dense horizontal cover selected by snowshoe hares, and thus reduces winter habitat for lynx.

Lynx habitats in higher-elevation spruce-fir forests have been less affected by past fire suppression and are mostly within the historical range of variability.

In much of the Rocky Mountains, the fire regime was more variable in lynx habitat, with both frequent (35–100 years) stand-replacing or mixed-severity fires, and infrequent (200+ years) stand-replacement fires (Hardy et al. 1998).

Fragmentation

Fragmentation of the naturally patchy pattern of lynx habitat in the contiguous United States can affect lynx by reducing their prey base and increasing the energetic costs of using habitat within their home ranges. Direct effects of fragmentation on lynx include creation of openings that potentially increase access by competing carnivores, increasing the edge between early-successional habitat and other habitats, and changes in the structural complexities and amounts of seral forests within the landscape. At some point, landscape-scale fragmentation can make patches of foraging habitat too small and too distant from each other to be effectively accessed by lynx as part of their home range. Maintaining preferred habitat patches for lynx and hares within a mosaic of young to old stands in patterns that are representative of natural ecological processes and disturbance regimes would be conducive to long-term conservation.

Recommendations

- Increase the amount of old growth and mature multi-story habitat on the Flathead. Historically old-growth habitat was 15% to 60% (source Amendment #21). Current old-

growth averages 11.6% across the Forest and ranges between 6.9% to 12.7% (source 1999 – 2007 Forest Plan Monitoring Report). Old-growth forest habitat must be increased to the historical range. Winter habitat may be most limiting for lynx, so maintaining and recruiting abundant multistory, mature forests with high horizontal cover is especially important.

- Reduce fragmentation of mature multi-story habitat. Forest patch size in late successional forest structure has been significantly reduced from historical levels. Horizontal cover is especially important for snowshoe hare habitat and winter lynx habitat.
- Pay special attention to maintaining or recruiting high horizontal cover and mature stands in the corridors identified by Dr. Squires that extend from Canada through the Whitefish Range, along the western front of the Swan Range ending near Seeley Lake. And the second corridor along the east side of Glacier National Park to the Bob Marshall Wilderness Complex.

Fisher

New research shows that the Rocky Mountain Fisher selects for large, old trees, snags and dense overhead cover more than had been previously thought. Research also shows that Fisher do not select and use riparian areas as much as biologists had hypothesized. Retention and recruitment of connected old-growth forest habitats is very important to maintain viability of fisher; relying on riparian buffer zones is not adequate.

From: Meta-analysis of habitat selection at resting sites by fishers in the pacific coastal states and provinces (Aubry et al. 2013)

Thus, throughout their Pacific coastal range, fishers exhibited clear and remarkably consistent selection for resting sites that had steeper slopes; cooler microclimates; denser overhead cover; greater volume of logs; greater basal area of large conifers, hardwoods, and snags; and larger diameter conifers and hardwoods than were generally available.

That is, fishers appear to be selective of relatively dense overhead cover and large forest structures at resting sites simply because they use relatively large trees, snags, and logs for resting, and the forest conditions around such structures differ from those that occur randomly in the forest.

Even with this sampling design, however, they were able to demonstrate selection of denser canopy cover and larger trees and snags at resting sites than were generally available, indicating that fishers are actively selecting specific environmental conditions around resting structures.

From Conservation of Fishers (*Martes pennanti*) in South-Central British Columbia, Western Washington, Western Oregon, and California–Volume III: Threat Assessment (Naney et al. 2012)

All known fisher reproductive dens are in cavities in live trees or snags. Reproductive dens are typically in the oldest and largest trees available. These den trees require extensive time periods to develop, because of size and time for ecological processes to occur that create cavities (Volume I, Chapters 7 and 8). Structural elements (e.g., large trees with cavities and platforms) are also used extensively by males and females for resting (Volume I, Chapter 7). There are no reported empirical thresholds at which reduction of structural elements may begin to negatively affect fishers.

Moderate to dense canopy closure provides key habitat features, and overstory trees provide one of the key components of this cover. They also contribute to the structural diversity of forested environments. Overstory trees also contribute to current and future structural elements and prey species abundance and diversity. One of the most consistent predictors of fishers appears to be expanses of forest with moderate to high canopy cover (Volume I, Chapter 7).

Evaluating the effects of fragmentation on any species is a function of several interacting factors: 1) the scale of fragmentation in relation to the scales at which an animal interacts with its environment, 2) the pattern and extent of fragmentation within a given scale, and 3) the degree of contrast between the focal habitat and the surrounding areas (Franklin et al. 2002b). Fishers have relatively large home ranges, use habitat at multiple spatial scales, and typically avoid areas with little or no contiguous cover (Volume I, Chapter 7). Fragmented landscapes may affect landscape permeability, either permanently through vegetation type conversion or temporarily until vegetation recovery occurs (Green et al. 2008). Anthropogenic (e.g., urban development) and natural features (e.g., large rivers; Wisely et al. 2004) can also act as filters to fisher movements. We concluded that fragmentation can affect fishers' use of the landscape because moderate to high amounts of contiguous cover are a consistent predictor of fisher occurrence at large spatial scales (Volume I, Chapter 7).

From Biology and conservation of martens, sables, and fishers: a new synthesis (Raley et al. 2012)

However, available evidence indicates that the incidence of heartwood decay and cavity development is more important to fishers for denning than is the tree species. Other characteristics, such as the size and height of the cavity opening and the interior dimensions of the cavity, may also influence females' choice of natal and pre-weaning den structures. The cavity must be large enough to accommodate an adult female and 1–4 growing kits, and have a relatively small opening (just large enough for a female to fit through) high off the ground (15–26 m on average; e.g., Aubry and Raley 2006; Weir and Corbould 2008; Thompson et al. 2010). These characteristics may be important for excluding potential predators and aggressive male fishers.

Presumably, the cavity must also have adequate thermal properties to protect kits from weather extremes. Compared with ambient temperatures, tree cavities provide stable microclimates with narrow temperature fluctuations (Sedgeley 2001; Weir and Corbould 2008; Coombs et al. 2010). Most (75%) of the dens used by reproductive female fishers were in live trees. Cavities in relatively large live trees appear to have more stable temperatures during the day, and stay warmer at night, than those in relatively small snags (Wiebe 2001; Coombs et al. 2010). Other factors, such as the

orientation of the cavity and exposure to sunlight (i.e., amount of canopy cover), may also influence the thermal properties of cavities, but quantitative evidence is lacking.

Fisher resting habitat in western North America is also strongly tied to forest structure. Fishers typically rest in large deformed or deteriorating live trees, snags, and logs, and forest conditions around the rest structures (i.e., the rest site) frequently include structural elements characteristic of late-seral forests.

Fishers rested primarily in deformed or deteriorating live trees (54–83% of all rest structures identified in individual studies), and secondarily in snags (6–26%) and logs (3–20%; e.g., Weir and Harestad 2003; Zielinski et al. 2004b; Aubry and Raley 2006; Purcell et al. 2009). The species of trees and logs used for resting appeared to be less important than the presence of cavities, platforms, and other microstructures. In live trees, fishers rested primarily in rust brooms in more northern study areas (Weir and Harestad 2003; Weir and Corbould 2008; Davis 2009) and mistletoe brooms or other platforms elsewhere (e.g., Self and Kerns 2001; Yaeger 2005; Aubry and Raley 2006). In contrast, fishers primarily used cavities when resting in snags (e.g., Self and Kerns 2001; Zielinski et al. 2004b; Purcell et al. 2009). Fishers used hollow portions of logs or subnivean spaces beneath logs more frequently in regions with cold winters (e.g., Weir and Harestad 2003; Aubry and Raley 2006; Davis 2009) than those with milder winters (e.g., Yaeger 2005; Purcell et al. 2009; Thompson et al. 2010). These results suggest that fishers use structures associated with subnivean spaces to minimize heat loss during cold weather (Weir et al. 2004; Weir and Corbould 2008).

When engaged in active behaviors (e.g., foraging, traveling), fishers in western North America were frequently associated with complex forest structure. In general, active fishers were associated with the presence, abundance, or a greater size of ³ 1 of the following characteristics: logs, snags, live hardwood trees, and shrubs (e.g., Carroll et al. 1999; Slauson and Zielinski 2003; Weir and Harestad 2003; Campbell 2004).

Fisher habitat in western North America is intricately linked to a complex web of ecological processes that include natural disturbances (e.g., wind, fire), tree pathogens, and other organisms (e.g., primary excavators) that create and influence the distribution and abundance of microstructures (e.g., cavities, mistletoe brooms) in live trees, snags, and logs. Because female fishers rely exclusively on tree cavities for reproduction, we conclude that heartwood decay by heart-rot fungi, the process by which most reproductive den cavities are created, is an essential component of fisher denning habitat in western North America. This ecological process is also important for creating the microstructures that fishers use for resting (cavities in live trees and snags, and hollows in logs).

In western North America, a moderate to dense forest canopy is one of the strongest and most consistent predictors of fisher distribution and habitat use or selection at all spatial scales. The association of fishers with high amounts of canopy cover is further demonstrated by their avoidance of open environments.

Similarly, fisher occurrence in the Rocky Mountain region was positively correlated with canopy cover up to an apparent threshold of 60% (Carroll et al. 2001).

Previously, it was thought that fishers in western North America may favor riparian forests (Buskirk and Powell 1994; Powell and Zielinski 1994); however, results from recent studies do not support this hypothesis. Although riparian forests were important to fishers in some locales (e.g., black cottonwood [*Populus balsamifera trichocarpa*] forests provided denning habitat in British Columbia; Weir and Corbould 2008), consistent use or selection for riparian forests has not been demonstrated.

From Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho (Schwartz et al. 2013)

Perhaps the most compelling result from this study was the consistent selection by female fishers for large trees at both stand and landscape scales

Thus, we recommend that silvicultural treatments of stands consider not only the retention of large trees, but consider the larger landscape when managing for fishers.

These results are similar to Jones and Garton (1994) who found fishers selecting mature and old growth forests during the summer in Idaho. Yet, during the winter, they found fishers using a wider array of habitats, although still selecting for the larger diameter trees compared to random (Jones and Garton, 1994). Zielinski et al. (2004) studied West Coast fisher habitat selection at resting locations in the Coastal Mountains and Sierra Nevada of California. They found that standing trees of California black oak and Douglas-fir of the largest diameter available were used in each area, respectively. In their Sierra study area their resource selection function showed that fishers selected sites nearby water, on steeper slopes, with larger maximum DBH trees at sites with more variable tree DBH than random. They interpreted these results to suggest that managers can maintain fisher resting habitat by retaining large trees and using forest management practices that aid in the recruitment of trees that achieve the largest sizes. They also recommend increasing structural diversity at these sites. We concur with these forest management recommendations in reference to NRM fishers as well.

Fishers likely avoid the ponderosa pine stands as they reflect the drier environments in the study area and generally have less understory cover to offer protection (Graham and Jain, 2005; Keeling et al., 2006). Avoidance of lodgepole pine is likely related to the relatively small diameter of even the oldest trees (i.e., mature sizes of lodgepoles in the Northern US Rocky Mountains is between 18 and 33 cm DBH; Burns and Honkala, 1990). This is consistent with evidence for fisher's selection for western red cedar stands, a species with large DBH and associated with wetter, more structure filled environments.

We recommend retention of large decadent trees and snags in areas with large trees to provide denning habitat for female fishers. While we identified univariate patterns of selection for variables that indicate structure, we also found avoidance of variables such as landscapes with a high proportion of grass, suggesting the corollary – avoidance of open areas - is also true. This is similar to results from Weir and Corbould (2010), where fishers avoided open areas, non-forested ecosystems, and areas with recent logging.

In this study, we found that females are indeed selecting habitat at two scales: a stand scale as indicated by stands that have large mean and maximum DBH trees (as well as a

large variation in tree size) and a landscape scale as indicated by the preference for landscapes with a high proportion of large trees. Thus, it appears that while fishers can be detected in riparian stringers that bisect open landscapes, this habitat may not be sufficient for persistence. The converse is also likely true. Landscapes that do not have variation in large trees, snags, and cavities, and drier landscapes (i.e., landscapes with ponderosa and lodgepole pine) are probably not sufficient for fisher persistence either. Forest activities that promote the growth of multi-stage stands with ample structure and variation in tree widths and ages will provide the best habitat for fishers. Retaining trees that have decadence, disease, or defects will help provide some of this habitat.

From Factors affecting landscape occupancy by fishers in north-central British Columbia (Weir and Corbould, 2010)

Fishers showed strong selection for where they established home ranges within the landscape, avoiding establishing home ranges in areas with high densities of open areas. Being that fishers establish home ranges only where there is a sufficient concentration of suitable habitat (Powell 1994), our observation that fishers excluded wetland ecosystems and recently logged stands from their home range may be linked to the low densities of resources found in these areas. Wetlands and recently logged areas typically have little overhead cover, which likely exposes fishers to greater risk from aerial predators (Powell and Zielinski 1994). Further more, escape cover, such as trees for climbing, is farther apart in these environments, making fishers further susceptible to terrestrial predators.

The relationship between the extent of open areas and probability of home range occupancy suggests that past and proposed forest harvesting can strongly affect the ability of the landscape to support fishers, especially in landscapes in which wetland ecosystems are common. Landscapes with previous widespread and intensive forest harvesting may lose their ability to support fishers until these harvested areas regenerate sufficiently. Depending on the residual density of fishers in the harvested landscape, fishers need to disperse from adjacent areas with less forest harvesting for these landscapes to support resident fishers again. Intensive forest harvesting in the future may exacerbate the already diminished ability of modified landscapes to support fishers, particularly in forests that are slated for salvage harvest of diseased or damaged trees.

Because salvage harvest of beetle-killed trees typically involves clear cut harvesting, whereby all tree species (including spruce and fir) and secondary structure within the harvest unit are felled or cleared, our results suggest that this expedited harvest will gravely affect the ability of these landscapes to be occupied by fishers.

Soils

Soils are the foundation of terrestrial life. Forest productivity is directly tied to soil conditions. Soil takes thousands of years to develop and is not 'renewable' on a human time scale. Soil is an ecosystem in itself that must be healthy in order to provide for healthy forests, grasslands, and aquatic systems. Actions impacting such complex

systems are prone to unintended consequences. Given the life-support role soils play, special care and prudence are essential.

The National Forest Management Act (NFMA) prohibits “irreversible damage” to soils as well as “substantial and permanent impairment of productivity of land”. Loss of soil (erosion) and displacement clearly cause “irreversible damage” and “permanent impairment of productivity of land”. Loss of coarse woody debris causes soil damage that can last a century or more. Soil compaction negatively impacts soil productivity, overland flow, erosion, stream sedimentation, and late season flows. Soil compaction from logging can persist 50 – 80 years. (ICBEMP, Assessment of Ecosystem Components, 1997)

Avoiding soil damage is the only option; full restoration of soil damage is not generally possible. Compacted soils are not completely mechanically restorable. Mechanized decompaction is only partially effective at decompacting and can compound problems by mixing rock and mineral soil with topsoil resulting in long term reduced productivity. Replacing eroded or displaced soil is problematic. Artificial coarse woody debris replacement is not practical over large areas such as burned clearcuts.

Timber harvest practices including road building, log skidding and slash disposal have caused most soil damage on forest lands.

Nutrient recycling is a critical function of soils that historically has been damaged by treatments that negatively affect the amounts, types, and distribution of organic matter retained on site. (Graham, R. T., 1990) Many years of piling and windrowing of slash using dozer blades has removed not only the litter plus duff layers but also the thin layer of organic rich mineral soil (A horizon) from large acreages of forested lands. (McBride, personal communication) Guidelines for retaining adequate coarse woody debris should be developed based on the site potential and be within the historic range of variability for the fire regime of the site. Coarse woody debris needs to be maintained at natural levels in the interface zone, with exception granted immediately around structures and residences. (Harvey, 1987).

Control of livestock concentration, especially in sensitive riparian areas is essential to maintaining soil porosity and bulk density. The moist soils in these areas become compacted by concentrations of cattle in only a few days. (Warren, S.D., 1986; BNF soil monitoring reports) Gentle upland ridge tops and swales are other “gathering places” for cattle that require special efforts to control their distribution to protect soils from detrimental compaction.

The process of nutrient cycling on the forest lands is primarily effected through fire; this recycling is key to forest and grassland ecosystem health. Therefore, the use of fire when treating vegetation should be in accordance with the natural fire regime for the site, and organic matter left on site should be within the natural historic range of variability for the site type. (Fischer, W. C., 1987)

Mycorrhizal fungi are an essential component of productive soil. (Amaranthus, M. P., 1996) Most regeneration failures may be due to problems with mycorrhizae. Monitoring

mycorrhizae needs to be part of soil condition assessments. Mycorrhizae are very temperature sensitive, so soil temperatures need to be monitored.

Monitoring of detrimental soil disturbances needs to include: compaction, displacement, rutting, severe burning, erosion, loss of surface organic matter (especially coarse woody debris), soil mass movement, soil temperature, and damage to micro-biological components of soil (especially mycorrhizal fungi).

Given that monitoring has demonstrated an extensive legacy of soil damage, it is time to include that information in watershed health assessments. There needs to be an inventory of where these highly damaged soils occur and the extent to which they are damaged. The Forest Plan needs to quantify the acreages by watershed and do cumulative effects analysis, including the road systems to understand the full impact management has had on watershed health.

Elk

Elk and other big game require secure habitat, low road densities, winter and summer thermal cover and special features such as wet sites, riparian habitat, licks, and movement corridors.

From Defining Elk Security: The Hillis Paradigm. 1991 Proceedings of a Symposium on Elk Vulnerability, Montana Chapter of the Wildlife Society (Hillis et al. 1991)

- Guidelines for elk security are a minimum of 250 acres for providing security under favorable conditions; under less favorable conditions the minimum must be >250 acres. Effective security areas may consist of several cover-types if the block is relatively unfragmented. Among security areas of the same size, one with the least amount of edge and the greatest width generally will be the most effective. Wallows, springs and saddles may require more cover than other habitats.
- Generally, security areas become more effective the farther they are from an open road. The minimum distance between a security area and an open road should be one half mile. The function of this $\geq$ one half mile "buffer" is to reduce and disperse hunting pressure and harvest that is concentrated along open roads. Failure to accomplish this function will reduce the effective size of the security area and may render it ineffective. When cover is poor and terrain is gentle, it may require > one half mile from open roads before security is effective.
- Roads may be closed to motorized travel to provide security and a buffer between security areas and open roads. However, the minimum distance between open roads and security areas increases as closed-road densities increase within both the security area and buffer.
- To be biologically meaningful, analysis unit boundaries should be defined by the elk herd home-range, and more specifically by the local herd home-range during hunting

season. Elk vulnerability increases when less than 30% of analysis unit is comprised of security area.

- These guidelines represent minimums and do not necessarily justify reducing security to meet these levels (i.e., if 50% of an analysis unit is security, do not assume that 20% of the unit is excess security).

Hillis, J. Michael, Michael J. Thompson, Jodie E. Canfield, L. Jack Lyn, C. Les Marcum, Patricia M. Dolan, David W. McCleerey; Defining Elk Security: The Hillis Paradigm. 1991 Proceedings of a Symposium on Elk Vulnerability, Montana Chapter of the Wildlife Society.

From Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions (Christensen et al. 1993)

- Considerations for Forest Plans Related to Habitat Effectiveness
 - Roads: density (miles / square mile), construction standards, seasons of use, method of closure. Roads are undoubtedly the most significant consideration on elk summer range. Any motorized vehicle use on roads will reduce habitat effectiveness (including administrative use).
 - Special features: wet sites, riparian habitat, licks, movement corridors. These sites are highly desirable for forage, water, temperature regulation, movement or a combination. Such sites should be recognized and protected; avoid damaging these features where elk are a benefiting resource.
 - Cover: extent, shape, size, connectiveness. Cover analysis includes maintenance of security, landscape management of coniferous cover and monitoring elk use. Cover unit size, patterns on a landscape basis, connectiveness with other cover, the amount of cover available to elk and know use patterns by elk should be considered in prescriptions.
 - Scale of analysis: site specific, herd unit, habitat analysis unit
 - Spatial relationships: intermingled ownerships, adjacent administrative units, district or forest "averaging"
 - Domestic livestock: forage and spatial competition.
- Levels of habitat effectiveness:
 - a. For areas intended to benefit elk summer range and retain high use, habitat effectiveness should be 70% or greater.
 - b. For areas where elk are one of the primary resource considerations habitat effectiveness should be 50% or greater.
 - c. Areas where habitat effectiveness is retained at lower than 50% must be recognized as making only minor contributions to elk management goals.
 - d. Reducing habitat effectiveness should never be considered as a means of controlling elk populations.
- Considerations for Forest Plans Related to Elk Vulnerability
 - Roads: season of use, density.
 - Security areas: distance from roads, size, cover characteristics, closures (area), topographic characteristics.
 - Cover management: description, connectiveness, scale, terrain relationships.

- Mortality models: demonstrated predictors of elk mortality based on habitat quality, hunter density, or other factors.

Wildfire And Salvage Logging

Salvage logging after wildfires has significant detrimental impacts to soils, wildlife habitat, birds, water quality and fish.

From Wildfire and salvage logging: Recommendations for ecologically-sound post-fire salvage management and other post-fire treatments on federal lands in the West (Beschta et al 1995):

POST-FIRE PRINCIPLES

We recommend that management of post-fire landscapes should be consistent with the following principles:

1) Allow natural recovery and recognize the temporal scales involved with ecosystem evolution.

Human intervention on the post-fire landscape may substantially or completely delay recovery, remove the elements of recovery, or accentuate the damage. In this light there is little reason to believe that post-fire salvage logging has any positive ecological benefits, particularly for aquatic ecosystems. There is considerable evidence that persistent, significant adverse environmental impacts are likely to result from salvage logging, based on many past cases of salvage projects, plus our growing knowledge of ecosystem functions and land-aquatic linkages. These impacts include soil compaction and erosion, loss of habitat for cavity nesting species, loss of structurally and functionally important large woody debris. Human intervention should not be permitted unless and until it is determined that natural recovery processes are not occurring.

2) No management activity should be undertaken which does not protect soil integrity.

Soil loss and soil compaction are associated with both substantial loss of site productivity and with off-site degradation. Decreased infiltration, increased overland flow, and excess sedimentation all directly contribute to the degradation of forest soils and the off-site degradation of aquatic systems and reduced survival of aquatic species, including salmonids. Reduction of soil loss is associated with maintaining the litter layer. Although post-burn soil conditions may vary depending upon fire severity, steepness of slopes, inherent erodibility, and others, soils are particularly vulnerable in a burned landscape. Soil and soil productivity are irreplaceable in human timescales; therefore, post-burn management activities that accelerate erosion or create soil compaction must be prohibited.

3) Preserve species' capability to naturally regenerate.

From an ecological perspective, there is frequently no need for artificial regeneration. Artificial reintroduction of species will circumvent natural successional changes, are often unsuccessful and will have unanticipated side effects even if successful. If native species are failing to reestablish naturally, that failure will frequently be associated with other reasons than the absence of seed sources or colonists. If warranted, artificial regeneration should use only species and seed sources native to the site, and should be done in such a way that recovery of native plants or animals is unhampered.

4) Do not impede the natural recovery of disturbed systems.

Delays in recovery may increase the likelihood of extirpation of stressed populations, or may alter the pathway of recovery altogether. As a practical example, areas that have experienced the effects of a severe burn and are likely to exhibit high erosion should not be subjected to additional management activities likely to contribute to yet more sedimentation. Efforts should focus on reducing erosion and sedimentation from existing human-caused disturbances, e.g., roads, grazing, salvage logging.

RECOMMENDATIONS ON POST-FIRE PRACTICES

1) Salvage logging should be prohibited in sensitive areas.

Logging of sensitive areas is often associated with accelerated erosion and soil compaction (Marston and Haire 1990), and inherently involves the removal of large wood which in itself has multiple roles in recovery. Salvage logging may decrease plant regeneration, by mechanical damage and change in micro-climate. Finally, logging is likely to have unanticipated consequences concerning micro-habitat for species that are associated with recovery, e.g., soil microbes. Salvage logging by any method must be prohibited on sensitive sites, including:

- in severely burned areas (areas with litter destruction),
- on erosive sites,
- on fragile soils,
- in roadless areas,
- in riparian areas,
- on steep slopes,
- any site where accelerated erosion is possible.

2) On portions of the post-fire landscape determined to be suitable for salvage logging, limitations aimed at maintaining species and natural recovery processes should apply.

Dead trees (particularly large dead trees) have multiple ecological roles in the recovering landscape including providing habitat for a variety of species, and functioning as an important element in biological and physical processes (Thomas 1979). In view of these roles, salvage logging must:

- leave at least 50% of standing dead trees in each diameter class;
- leave all trees greater than 20 inches dbh or older than 150 years;
- generally, leave all live trees.

Because of soil compaction and erosion concerns, conventional types of ground-based yarding systems (tractors and skidders) should be generally prohibited. . .

3) Building new roads in the burned landscape should be prohibited. . .

4) Structural post-fire restoration is generally to be discouraged.

Frequently, post-fire restoration efforts involve the installation of hard structures including sediment traps, fish habitat alterations, bank stabilization, hay bales, weirs, check dams, and gabions. Such hard structures are generally not modeled or sited on the basis of natural processes, and their ability to function predictably may be particularly low in dynamic post-fire landscapes. Hard structures have high rates of both failure and unanticipated side effects. Therefore, structures are generally an undesirable and unsuccessful method for controlling adverse environmental impacts. . .

5) Post-fire management requires reassessment of existing management.

For example, the condition of a transportation system (i.e., pre-existing roads and landings) should be reassessed after a fire. By increasing runoff, erosion, and sedimentation, fires may increase the risks posed by existing roads. Therefore, post-fire analysis is recommended to determine the need for undertaking road maintenance, improvement, or obliteration.

6) Continued research efforts are needed to help address ecological and operational issues.

There is a need to research certain questions in order to guide post-fire management decisions. For example, some argue that salvage logging is needed because of the perceived increased likelihood that an area may reburn. It is the fine fuels that carry fire, not the large dead woody material. We are aware of no evidence supporting the contention that leaving large dead woody material significantly increases the probability of reburn." (Beschta et al 1995)

From Forest Service report PNW-GTR-486 "Environmental Effects of Postfire Logging: Literature Review and Annotated Bibliography" (USFS 2000) which reviewed the literature on salvage logging after fire focusing on environmental effects of logging and removal of large woody structure. Following are some of the references used and conclusions drawn:

a) Working on the Entiat burn of 1970 (Wenatchee National Forest), Klock (1975) and Helvey and others (1985) compared five different log retrieval systems (after hand felling) with respect to soil disturbance and erosion: tractor skidding over bare ground (<30 percent slope), tractor skidding over snow (<40 percent), cable skidding over bare ground, skyline (Wyssen skycrane), and helicopter. Klock (1975) found that tractor

skidding over bare ground caused the greatest percentage of area of severe soil disturbance (36 percent), followed by cable skidding (32 percent), tractor skidding over snow (9.9 percent), skyline (2.8 percent), and helicopter (0.7 percent).

b) Evidence that logging can affect vegetative production in the absence of significant ground disturbance was collected by Sexton (1994) in a study in central Oregon in postfire ponderosa pine stands, logged over snow. Sexton found that biomass of vegetation produced 1 and 2 years after postfire logging was 38 percent and 27 percent of that produced in postfire unlogged stands. He also found that postfire logging decreased canopy cover, increased exotic plant species, increased graminoid cover, and reduced overall plant species richness. Pine seedlings grew 17 percent taller on unlogged sites in this short-term study.

c) Postfire logging normally removes a great percentage of large dead woody structure and thus has the potential for significantly changing postfire habitat for wildlife (Lindenmayer and Possingham 1995, 1996). These changes include “structural” effects, such as removal of existing and future snags and large woody material, and “functional” effects, such as reduction in insect populations that serve as food for various wildlife species (Blake 1982, Saab and Dudley 1998, Sallabanks and McIver 1998).

d) In four recent independent studies conducted in the intermountain West, postfire logging caused significant changes in abundance and nest density of cavity-nesting birds, although the effect differed somewhat by location (Caton 1996, Hejl and McFadzen 1998, Hitchcox 1996, Saab and Dudley 1998). Most cavity-nesters showed consistent patterns of decrease after logging, including the mountain bluebird and the black-backed, hairy, and three-toed woodpeckers; abundance of the Lewis’ woodpecker increased after logging.

e) No studies have specifically looked at how postfire logging alters the size distribution of fuel and the concomitant changes in future fire risk. Work examining fuels on harvested green tree stands suggests that postfire logging may increase short-term fuel loads and fire risk, owing to increased fine activity fuels, but reduce intermediate and long-term fire risk through removal of larger dead structure (Brown 1980).

f) Proper recovery and rehabilitation techniques by managers may be capable of mitigating soil loss and erosion problems associated with postfire logging (Simon and others 1994). For example, ground disturbance caused by postfire logging could disrupt water-repellent layers, increase infiltration, and thus decrease overland flow and sediment transport to streams, which could be a benefit during severe hydrological events. This hypothesis, however, has not been tested experimentally.

From Toward Meaningful Snag-Management Guidelines for Postfire Salvage Logging in North American Conifer Forests (Hutto 2006):

a) Birds in burned forests have very different snag-retention needs from those cavity nesting bird species that have served as the focus for the development of existing snag-management guidelines. Specifically, many postfire specialists use standing dead trees

not only for nesting purposes but for feeding purposes as well. Woodpeckers, in particular, specialize on wood-boring beetle larvae that are superabundant in fire-killed trees for several years following severe fire. Species such as the Black-backed Woodpecker (*Picoides arcticus*) are nearly restricted in their habitat distribution to severely burned forests. Moreover, existing postfire salvage-logging studies reveal that most postfire specialist species are completely absent from burned forests that have been (even partially) salvage logged. I call for the long-overdue development and use of more meaningful snag-retention guidelines for postfire specialists, and I note that the biology of the most fire-dependent bird species suggests that even a cursory attempt to meet their snag needs would preclude postfire salvage logging in those severely burned conifer forests wherein the maintenance of biological diversity is deemed important.

b) The ecological cost of salvage logging speaks for itself, and the message is powerful. I am hard pressed to find any other example in wildlife biology where the effect of a particular land-use activity is as close to 100% negative as the typical postfire salvage-logging operation tends to be.

c) Existing science-based data suggest that there is little or no biological or ecological justification for salvage logging. McIver and Starr (2000) note that because of this, the justification for salvage logging has begun to shift toward arguments related to rehabilitation or restoration, but those sorts of justifications also reflect a lack of appreciation that severe fires are themselves restorative events and that rehabilitation occurs naturally as part of plant succession (Lindenmayer et al. 2004). Interference with the natural process of plant succession by planting or spraying to speed the process of succession toward narrow timber-producing or old-growth goals, as some suggest (e.g., Sessions et al. 2004), is also incompatible with a holistic public-land-management goal of working within the constraints of a natural system. All things that characterize a severe disturbance event, including soil erosion and sometimes insufferably slow plant recovery, are precisely the things that constitute “rehabilitation” for those organisms that need those aspects of disturbance events at infrequent intervals to sustain their populations.

d) The profound failure of many decision makers to appreciate the ecological value of burned forests stems from their taking too narrow a view of what forests provide. The general belief that “dead and dying timber ought to be harvested and put to use” (Schwennesen 1992) prevailed prior to the infamous salvage rider of 1995 (U.S. Congress 1995), and it apparently still prevails today in many management circles. Land managers, politicians, and the public-at-large need to gain a better appreciation of the unique nature of burned forests as ecological communities, how sensitive the process of succession is to conditions immediately following the disturbance event (Platt & Connell 2003), and how important the legacy of standing deadwood is to the natural development of forests (Franklin et al. 2000). Nowhere are soils, special plants, or wildlife more sensitive to the proposition of tree harvesting than in a burned forest. And nowhere is the consideration of ecology more blatantly absent than in decisions to salvage log.

From Wildlife and Native Fish: Issues of Forest Health and Conservation of Sensitive Species (Rieman and Clayton 1997):

a) Although wildfires may create important changes in watershed processes often considered harmful for fish or fish habitats, the spatial and temporal nature of disturbance is important. Fire and the associated hydrologic effects can be characterized as “pulsed” disturbances (*sensu* Yount and Niemi 1990) as opposed to the more chronic or “press” effects linked to permanent road networks. Species such as bull trout and redband trout appear to have been well adapted to such pulsed disturbance. The population characteristics that provide for resilience in the face of such events, however, likely depend on large, well-connected, and spatially complex habitats that can be lost through chronic effects of other management. Critical elements to resilience and persistence of many populations for these and similar species will be maintaining and restoring complex habitats across a network of streams and watersheds. Intensive land management could make that a difficult job.

From Reducing Fire Risks to Save Fish – A Question of Identifying Risk. A position Paper by the Western Montana Level I Bull Trout Team (Riggers et al 2001):

a) Habitat conditions are another factor that has changed significantly. In general, fish habitat quality is much less diverse and complex than historic, and native fish populations are therefore less fit and less resilient to watershed disturbances. Roads, more than any other factor, are responsible for the majority of stream habitat degradation on National Forest Lands in this area (USDA 1997). Historically roads were not present in watersheds and did not affect hydrologic or erosional patterns. Now, however, extensive road networks in many of our watersheds contribute chronic sediment inputs to stream systems and these effects are exacerbated when fires remove the vegetation that filters road runoff.

b) ... the real risk to fisheries is not the direct effects of fire itself, but rather the existing condition of our watersheds, fish communities, and stream networks, and the impacts we impart as a result of fighting fires. There, attempting to reduce fire risk as a way to reduce risks to native fish populations is really subverting the issues. If we are sincere about wanting to reduce risks to fisheries associated with future fires, we ought to be removing barriers, reducing road densities, reducing exotic fish populations, and re-assessing how we fight fires. At the same time, we should recognize the vital role that fires play in stream systems and attempt to get to a point where we can let fire play a more natural role in these ecosystems.

c) Salvage of burned trees is often proposed to reduce future fuel loading. While salvage can be accomplished with minimal impacts in some areas, many burned areas are already extremely sensitive to ground disturbance due to the loss of vegetation. Further disturbance can result in increased erosion, compacted soils and a loss of nutrients from these areas (USDA 2000, Beschta et al. 1995).

d) ...we believe, in most cases, proposed projects that involve large-scale thinning, construction of large fuel breaks, or salvage logging as tools to reduce fuel loadings with the intent of reducing negative effects to watersheds and the aquatic ecosystem are

largely unsubstantiated. Post-fire activities such as these that increase the probability of chronic sediment inputs to aquatic systems pose far greater threats to both salmonid and amphibian populations and aquatic ecosystem integrity than do fires and other natural events that may be associated with undesired forest stand condition (Frissell and Bayles 1996).

From Factors Influencing Occupancy of Nest Cavities in Recently Burned Forests (Saab et al 2004).

a) Recently burned forests in western North America provide nesting habitat for many species of cavity-nesting birds. Year after fire had the greatest influence on occupancy of nest cavities for both groups, while site of the burn was secondarily important in predicting occupancy by strong excavators and less important for weak excavators. Predicted probability of cavity occupancy was highest during the early years (1–4) after fire, declined over time (5–7 years after fire), and varied by site, with a faster decline in the smaller burned site with a greater mosaic of unburned forest.

From Postfire Management on Forested Public Lands of the Western United States (Beschta et al 2004):

a) Scientific assessments of the current condition of forested systems in the western United States consistently yield the same broad conclusions: a century or more of road building, logging, grazing, mining, fire suppression, and water withdrawals, in conjunction with the loss of key species and the introduction of exotic species have degraded watersheds, modified streamflows and water quality, altered ecosystem processes and decreased biological diversity. Past and present actions limit the capacity for ecosystem recovery and reduce the range and abundance of many native species. Although postfire landscapes are often portrayed as “disasters” in human terms, from an ecological perspective they are the result of vital disturbance processes in forests.

b) Following a wildland fire, a common assumption is that immediate actions are needed to rehabilitate or restore the “fire-damaged” landscape. Yet abundant scientific evidence suggests that commonly applied postfire treatments may compound ecological stresses. Perhaps the most critical step in undertaking ecological restoration in the postfire environment is to forgo those activities and land uses that either cause additional damage or prevent reestablishment of native species, ecosystem processes, or plant succession.

c) To protect aquatic ecosystems in areas with moderate to high-severity burns, postfire management should not increase soil erosion or reduce soil productivity. Furthermore, onsite impacts to early successional native plant species during postfire logging, where such species are nitrogen fixers, can significantly affect a major pathway of nutrient replenishment in the postfire environment. Evidence continues to mount of a direct relationship between mechanical disturbance to the postfire environment and accelerated erosion. Soil compaction can persist for 50-80 years in many forest soils.

d) Postfire salvage logging has sometimes been justified on the assumption that >50% crown scorch results in tree mortality. However, trees within low and mid-elevation forests of the western United States possess a suite of adaptations that facilitate fire survival. Stephens and Finney (2000) found that the probability of conifer mortality is low when the percentage of the crown scorch was <60%. For trees greater than or equal to 50 cm dbh, they determined that the probability of mortality of ponderosa pine, incense cedar and white fir was <40% when crown scorch was as high as 80%. The multiple ecological roles of large trees and their high probability of survival supports the need to retain them in burned areas. Postfire salvage logging, based primarily on economic values, typically removes only the largest trees and...

e) Both ground-based yarding systems (tractors and skidders) and, to a lesser degree, cable systems can cause significant soil disturbance and compaction. Such practices should be prohibited in burned areas whenever they are likely to accelerate onsite erosion.

f) Accelerated surface erosion from roads is typically greatest within the first years following construction, although in most situations sediment production remains elevated over the life of a road. Thus, even “temporary” roads can have enduring effects on aquatic systems. Similarly, major reconstruction of unused roads can increase erosion for several years and potentially reverse reductions in sediment yields that occurred with disuse.

g) 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. Ziemer and Lisle (1993) note a lack of reliable data showing that BMPs are cumulatively effective in protecting aquatic resources from damage.

From other sources, as noted:

“[S]everely burned forest conditions have probably occurred naturally across a broad range of forest types for millennia. These findings highlight the fact that severe fire provides an important ecological backdrop for fire specialists like the Black-backed Woodpecker, and that the presence and importance of severe fire may be much broader than commonly appreciated.” (Hutto 2008).

“Whether forests that have been ‘restored’ through nontraditional harvest methods still retain the characteristics needed by Black-backed Woodpeckers after they burn severely under extreme weather conditions is currently unknown.

The second reason why we cannot assume that suitable postfire habitat will always be ample is that, even though severely burned forests will always be plentiful, postfire logging (a common postfire management practice) also reduces the suitability of burned forests to fire specialists like the Black-backed Woodpecker (Kotliar et al. 2002, Hutto 2006, Hutto and Gallo 2006, Koivula and Schmiegelow 2007, Saab et al. 2007).” (Hutto 2008).

“In contrast, the patterns of distribution and abundance for several other bird species (black-backed woodpecker [*Picoides arcticus*], buff-breasted flycatcher [*Empidonax fulvifrons*], Lewis’ woodpecker [*Melanerpes lewis*], northern hawk owl [*Surnia ulula*], and Kirtland’s warbler [*Dendroica kirtlandii*]) suggest that severe fire has been an important component of the fire regimes with which they evolved. Patterns of habitat use by the latter species indicate that severe fires are important components not only of higher-elevation and high-latitude conifer forest types, which are known to be dominated by such fires, but also of mid-elevation and even low-elevation conifer forest types that are not normally assumed to have had high-severity fire as an integral part of their natural fire regimes. . .

The ecology of selected species (in the present case, fire-dependent species) should be used to understand and embrace the natural processes that prehistorically produced conditions necessary for their maintenance, and not be used to devise artificial means to circumvent those natural processes.” (Hutto et al 2008).

“An appreciation of the biological uniqueness of severely burned forests is important because if we value and want to maintain the full variety of organisms with which we share this Earth, we must begin to recognize the healthy nature of severely burned forests. We must also begin to recognize that those are the very forests targeted for post-fire logging activity. Unfortunately, post-fire logging removes the very element — dense stands of dead trees — upon which many fire-dependent species depend for nest sites and food resources.

With respect to birds, the effects of post-fire salvage harvesting are uniformly negative. In fact, most timber-drilling and timber-gleaning bird species disappear altogether if a forest is salvage-logged. Therefore, such places are arguably the last places we should be going for our wood.” (Hutto 2013).

“Although the Black-backed Woodpecker is the most extreme species in terms of its restriction to, and evolutionary history with, burned forests, many additional bird species reach their greatest abundance in burned forests (15 of 87 species detected in burned forests, as I noted above). These include the Three-toed Woodpecker, Hairy Woodpecker, Olive-sided Flycatcher, Clark’s Nutcracker, Mountain Bluebird, American Robin, Townsend’s Solitaire, Cassin’s Finch, Dark-eyed Junco, Chipping Sparrow, and Red Crossbill.” (Hutto 2011).

“One of the most common management activities following forest fires is salvage logging (Figure 8). Perhaps we need to change our thinking when it comes to logging after forest fires. With respect to birds, no species that is relatively restricted to burned-forest conditions has ever been shown to benefit from salvage harvesting. In fact, most timber-drilling and timber-gleaning bird species disappear altogether if a forest is salvage-logged. Therefore, if we want our land-use decisions to be based, at least in part, on whether a proposed activity affects the ecological integrity of our forest systems, burned forests should be the LAST, rather than the first places we should be going for our wood.

For birds, standing dead trees are one of the most special biological attributes of burned forests. They house equally unique beetle larvae that become abundant because they feast on the wood beneath the bark of trees that have died and are, therefore, defenseless against attack. If we value and want to maintain the full variety of organisms with which we share this Earth, we must not only recognize that burned forests are quite “healthy,” but must also begin to recognize that post-fire logging removes the very element — standing dead trees — upon which each of those special bird species depend for nest sites and food resources. “(Hutto 2011).

“Patches of high-intensity fire (where most or all trees are killed) support the highest levels of native biodiversity of any forest type in western U.S. conifer forests, including many rare and imperiled species that live only in high-intensity patches. Even Spotted Owls depend upon significant patches of high-intensity fire in their territories in order to maintain habitat for their small mammal prey base. These areas are ecological treasures.” (Hanson 2010).

Beetle-Killed Trees

Beetle killed trees are a natural part of forest ecosystems and promote development of habitat attributes necessary for many other species.

“‘But beetle kill is very different. Change induced by beetles is less abrupt, and, unless beetle-killed trees are cut, they remain part of the overstory for years.’ Both of these traits have important implications for how a stand regenerates and how watersheds respond.” (USFS 2012, quoting Research Biogeochemist Chuck Rhoades).

“‘But the sick and dead trees are also losing needles that fall to the ground and help retain soil moisture. And, as trees decay, they release nutrients back into the system.’” (Id., quoting Research Biogeochemist Chuck Rhoades).

“‘[R]esearchers are already finding that beetles may impart a characteristic critically lacking in many pine forests today: structural complexity and species diversity.’” (Id.)

“‘As these infested trees die their diminutive competitors respond vibrantly. Healthy understory plants stand poised, like a carpet of dry sponges, ready to soak up the water, sun, and fertility liberated by the assault around them. Uptake by the surviving understory strongly dampens runoff and nutrient input into waterways downslope.’” (Id.)

“‘[T]otal understory plant cover declined in treated sites compared to those where no cutting took place. The difference was apparently driven by the negative responses of several key native species to mechanical harvest. ‘Species in the genus *Vaccinium* declined markedly in our clearcut sites,’ she said. ‘That genus includes shrubs related to blueberries that are important to some wildlife. They generally suffer in response to disturbance and copious direct sunlight.’” (Id., quoting researcher Paula Fornwalt).

Aside from promoting mixed age structure and helping to maintain native understory communities, retention of the dead [lodgepole] overstory favors a shift in tree species composition. . . 'Those include lodgepole pine, subalpine fir, and aspen, with subalpine fir as the most abundant species of new recruit. (Id., quoting researcher Paula Fornwalt).

Although an increase in subalpine fir may elevate fire risk in forests recovering from beetle infestation, untreated beetle-killed stands may be of great benefit to non-human forest inhabitants. The prevalence of fir following beetle outbreaks could be a boon for wildlife species that rely on the complex vertical structure that is generally lacking in lodgepole pine-dominated stands. The same low fir limbs that can carry fire into the canopy provide food, thermal cover, and protection from predators for a host of wildlife including snowshoe hare, favorite prey for the Canada lynx. Species of conservation concern ranging from Mexican spotted owls to the Canada lynx could respond positively to the structural complexity induced by mountain pine beetles. By driving these shifts at a huge spatial scale, beetles might even be viewed as a biological mechanism for creating the habitats that now limit some of the species we care most about. (Id.)

"[T]he most informative and striking lesson thus far may be the response that occurs in our absence. Apparently without posing serious threats to water quality or long-term ecosystem viability, mountain pine beetles may increase the structural complexity and species diversity of high elevation forests. These characteristics could have substantial benefits in the near term and, perhaps more importantly, they are the keys to improved resilience in our future forests." (Id.)

"A model of nitrate release from Colorado watersheds calibrated with field data indicates that stimulation of nitrate uptake by vegetation components unaffected by beetles accounts for significant nitrate retention in beetle-infested watersheds." (Rhoades et al 2013).

"The lack of a large streamwater nitrate response after extensive canopy mortality caused by bark beetles may be explained by some combination of two factors. Heterogeneous mortality (spatial and temporal) would be expected to reduce the amount of nitrate loss at any given time over the progression of infestation. In addition, compensatory responses by residual live vegetation are likely to respond to the increased resources available following overstory mortality. . . A second step in adaptation of the model is to assume that beetle-induced mortality, although killing much or most of the original canopy, does not disturb beetle-resistant overstory trees and the understory vegetation that would be lost or damaged during tree harvest." (Id.)

"While research is ongoing and important questions remain unresolved, to date most available evidence indicates that bark beetle outbreaks do not substantially increase the risk of active crown fire in lodgepole pine (*Pinus contorta*) and spruce (*Picea engelmannii*)- fir (*Abies* spp.) forests under most conditions. Instead, active crown fires in these forest types are primarily contingent on dry conditions rather than variations in stand structure, such as those brought about by outbreaks. Preemptive thinning may reduce susceptibility to small outbreaks but is unlikely to reduce susceptibility to large, landscape-scale epidemics. Once beetle populations reach widespread epidemic levels,

silvicultural strategies aimed at stopping them are not likely to reduce forest susceptibility to outbreaks. Furthermore, such silvicultural treatments could have substantial, unintended short- and long-term ecological costs associated with road access and an overall degradation of natural areas.” Black et al 2013.

Post-disturbance harvest is common practice on forest lands and is designed to remove trees or other biomass in order to produce timber or other resources. This type of resource extraction has the potential to inadvertently lead to heightened insect activity (Nebeker 1989; Hughes and Drever 2001; Romme et al. 2006). In particular, snags and fallen logs contribute to the protection of soils and water quality and provide habitat for numerous cavity and snag-dependent species (Romme et al. 2006), many of which prey on bark beetles and other economically destructive insects. Therefore, outbreaks could be prolonged because of a reduction in the beetle’s natural enemies (Nebeker 1989), including both insects and bird species that feed on mountain pine beetles (Koplin and Baldwin 1970; Shook and Baldwin 1970; Otvos 1979). Furthermore, post-disturbance harvest can damage soil and roots by compacting them (Lindenmayer et al. 2008) leading to greater water stress in trees, which may reduce conifer regeneration by increasing sapling mortality (Donato et al. 2006) and, in general, may cause more damage to forests than that caused by natural disturbance events (DellaSala et al. 2006). (Id.)

“Ton for ton, dead trees (‘snags’) are far more important ecologically than live trees, and there are too few large snags and logs to support native wildlife in most areas. Recent anecdotal reports of forest ‘destroyed’ by beetles are wildly misleading and inaccurate.” (Hanson 2010)

Helicopters

Helicopter logging can negatively affect grizzly bears and other wildlife.

“Activities Generally Resulting in a ‘Likely to Adversely Affect’ Determination: The available scientific literature suggests that high frequency helicopter use, particularly at low altitudes, in habitat occupied by grizzly bears can negatively affect the bears . . . These effects may include disturbance resulting in behavioral changes, such as fleeing from the disturbance; physiological changes, such as increased heart rate; displacement to lower quality habitat; and increased energetic demands.” (Summerfield et al 2006).

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