Citizen reVision
of the
Flathead Forest Plan

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Introduction

The Northern Rocky Mountains of the U.S. encompass one of America's last strongholds of native biodiversity. It contains virtually all the species present at the time of the Lewis & Clark Expedition over two hundred years ago, including grizzly bear, wolverine, lynx, and fisher. There are still free-roaming populations of bighorn sheep, elk, moose, wolves, mountain lions and many others. Native bull and westslope cutthroat trout still ply the waters as they migrate from crystal clear natal spawning streams to azure lakes and back. Bald eagles, golden eagles, hawks and falcons soar in the expansive skies overhead and nest in the forests and cliffs. Woodpeckers, goshawks, resident and migratory songbirds find shelter in both lush forests and those burned by wildfire.

The Flathead National Forest is the heart of this wild region. Congress has made great strides in protecting key portions of this Forest by designating some areas as Wilderness. However, approximately 479,000 acres of these unspoiled lands remain unprotected and are increasingly vulnerable to being lost forever through roadbuilding, logging, mining, wanton recreation and other developments which mar the beauty of the landscape and degrade wildlife habitat. The front country has been roaded, logged and scarred – it needs to be nurtured back to health.

The Citizen reVision is based upon sound scientific and economic principles and defines a sustainable future for the Flathead National Forest that emphasizes the outstanding wild, natural and recreational values while taking advantage of the opportunity to create new jobs through restoration work.

Core components of the Citizen reVision are:

- Protect all roadless areas so they maintain the characteristics necessary to be designated as wilderness by Congress in the future.

- Reduce the miles of roads to improve wildlife security and watershed integrity while also providing good paying jobs and reducing road maintenance costs to taxpayers.

- Protect old-growth forest habitat and allow mature forests to develop old growth characteristics such as large snags, down woody material and decadence that are vital to many wildlife and bird species.

- Provide wildlife linkage corridors so that animals can move unimpeded across the landscape. This includes connecting old-growth forest habitat.

- Maintain and/or restore the Five C's that characterize good bull trout and native fish habitat: clean, cold, complex, connected and comprehensive.

- Limit mechanized access to provide secure areas for grizzly bear, elk and other wildlife, while reducing erosion to streams, compaction of fragile soils, and the spreading of invasive weeds.

- Protect soils, the building blocks for healthy tree and vegetation growth that is vital for wildlife food and shelter.

- Protect and/or restore mature multi-story forests that provide essential habitat for lynx and their prey snowshoe hares, as well as other “untidy” forest features (snags, down logs, etc.) essential to the survival of wolverine, fisher, pine marten, other forest carnivores, and a host of bird species.

- Curtail clearcutting and other silvicultural prescriptions which leave large openings that create edge effects and fragment the landscape. These openings are avoided by numerous species.

- Allow fires to perform their ecosystem rejuvenating function -- do not damage this rejuvenation through “salvage” logging.

By leaving carbon-storing trees in the forest, reducing road miles and trimming back the use of motorized vehicles, the Citizen reVision reduces carbon emissions and promotes human health.

The Citizen reVision is organized with individual sections for each area of conservation concern. Each section contains a condensed summary of the best available science followed by Management Recommendations. A complete bibliography of scientific literature can be found at:
http://www.swanview.org/reports/Annotated_Bibliography.pdf

This information can be used by individuals, organizations and other agencies to provide science-based comments to the Flathead National Forest as it revises its Forest Plan. We are also submitting the Citizen reVision to the Flathead so it can be used to develop a conservation alternative in the Forest Plan Environmental Impact Statement.

We sincerely hope that you or your organization will endorse the Citizen reVision as a conservation guide for the future of the Flathead National Forest. Simply email us if you’d like to add your name to the list of Citizen reVision supporters.

To download a copy of the Citizen reVision go to:
http://www.swanview.org/reports/Citizen_reVision_Flathead_Forest_Plan.pdf

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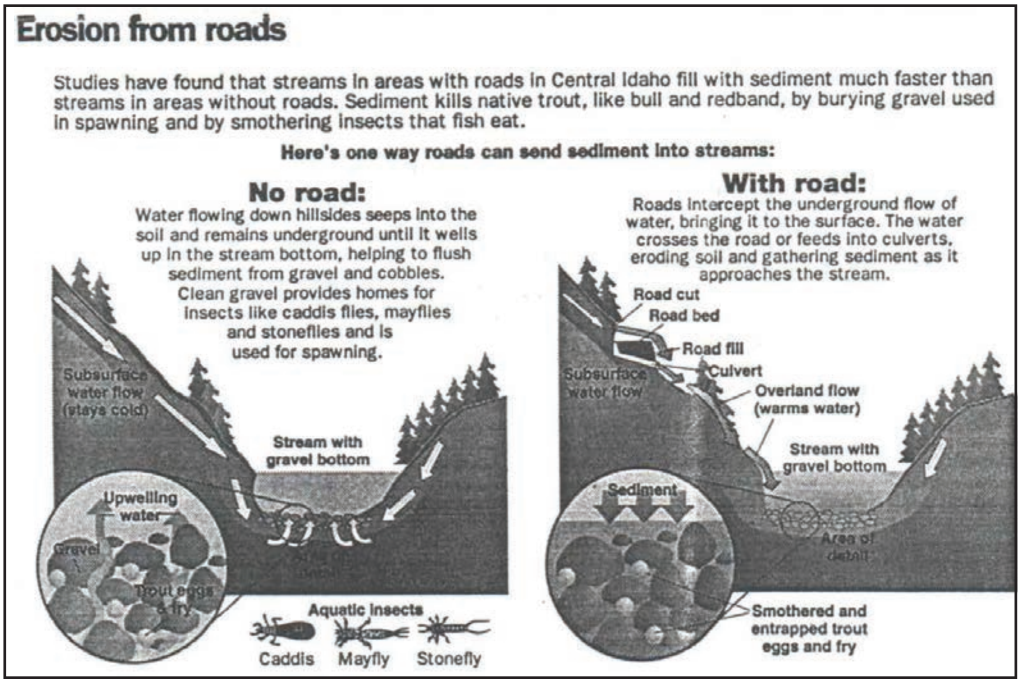
Roads and Roadless Lands

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.

"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).

"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



Erosion from roads

Studies have found that streams in areas with roads in Central Idaho fill with sediment much faster than streams in areas without roads. Sediment kills native trout, like bull and redband, by burying gravel used in spawning and by smothering insects that fish eat.

Here's one way roads can send sediment into streams:

No road:
Water flowing down hillsides seeps into the soil and remains underground until it wells up in the stream bottom, helping to flush sediment from gravel and cobbles. Clean gravel provides homes for insects like caddis flies, mayflies and stoneflies and is used for spawning.

With road:
Roads intercept the underground flow of water, bringing it to the surface. The water crosses the road or feeds into culverts, eroding soil and gathering sediment as it approaches the stream.

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, 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).

"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).

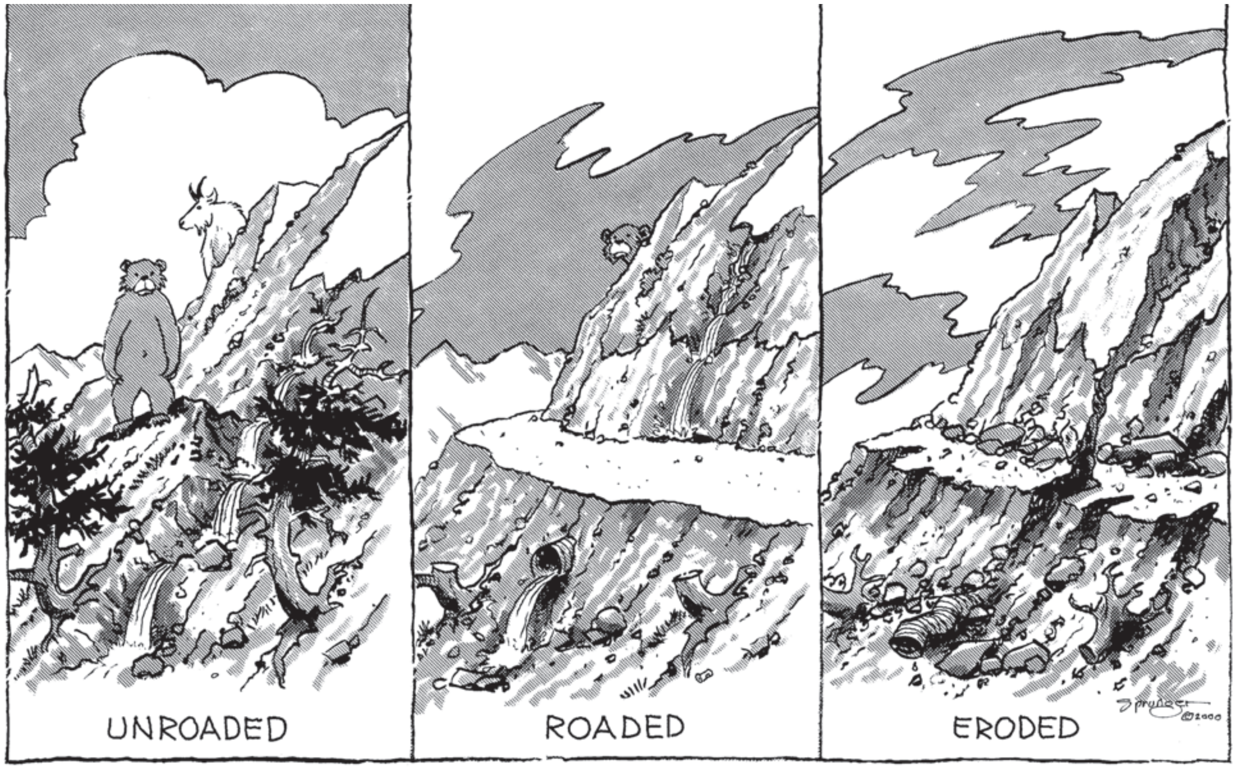
"This study suggests the general trend for the entire Columbia River basin is toward a loss in pool habitat on managed lands and stable or improving conditions on unmanaged lands." (McIntosh et al 1994).

"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).

"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. 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).

"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



WHY ROADLESS AREAS ?

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).

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 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 Forest Service 82% of bull trout populations and stream segments range-wide are threatened by degraded habitat conditions. Roads and forest management are major factors 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).

- 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." (USFWS Regions 1 and 6. 1998a).

Management Recommendations

- Protect all existing roadless areas and their wilderness characteristics so that they are eligible for Congressional Wilderness designation.

- Assess areas adjacent to roadless areas for opportunities to remove roads, recover aquatic and terrestrial ecological integrity and rewild these areas.

- Reduce the existing road system so that its full maintenance is affordable and ecological values are protected.

Wildlands Recovery Plan

Wildlands Recovery Plan Overview

Wildlands recovery on the Flathead National Forest (FNF) will be accomplished by decommissioning some of the roads that penetrate deeply into the Mission, Swan, Whitefish, and Flathead Ranges, as well as the Continental Divide, and by disallowing mechanized uses of trails in the Wildlands Recovery Areas.

This will help restore the connectivity of currently fragmented Grizzly Bear Security Core areas and provide similar habitat security for elk and other wildlife. It will also greatly reduce the potential for targeted roads to bleed sediment into streams, a number of which are key to native fish, including Critical Habitat for threatened bull trout.

The one-time investment in decommissioning roads will also save taxpayers money by eliminating the costly maintenance of those roads in perpetuity. (Rowley 1998). The Flathead receives only about one-sixth of the funds it needs to maintain its road system. (USFS 2004). The Flathead, like all other National Forests, is currently in the process of determining which roads it can afford to keep economically and environmentally, which "points to a smaller road system." (Holtrop 2010).

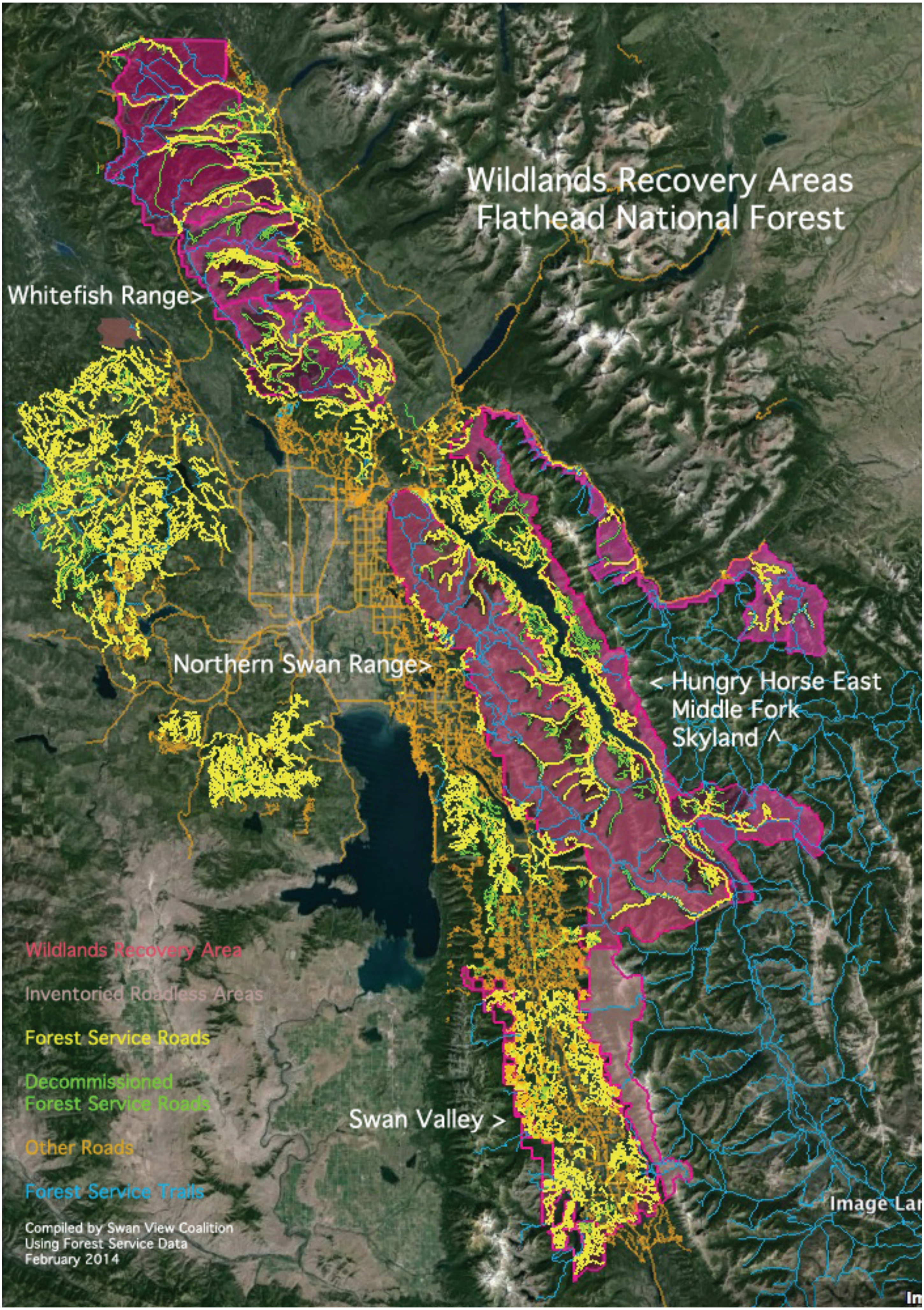
This Recovery Plan will retain road access to most popular trailheads, while converting some roads to trails below current trailheads. This will increase hiking and horseback opportunities while protecting core wildlife habitats from high levels of use.

This Recovery Plan will be submitted to the Flathead National Forest for consideration in revision of the Flathead Forest Plan. Those who endorse this Recovery Plan urge the Flathead to recommend all roadless lands be designated Wilderness, to remove all mechanized use from the Recovery Areas, and to recommend the remaining portions of the Recovery Areas be designated Wilderness as selected roads are decommissioned.

Wildlands Recovery Areas Map

The Wildlands Recovery Areas Map on the following page shows the four FNF Recovery Areas on a Google Earth base, along with FNF overlays of Inventoried Roadless Areas, Forest Service Roads, already Decommissioned Forest Service Roads, Other Roads (State, County, Private), and Forest Service Trails both motorized and non-motorized. This Forest-wide map is followed by a discussion of Grizzly Bear Security Core, maps showing where it is improved by Wildland Recovery, larger scale maps of each Recovery Area, and links to a "zoom-able" on-line Recovery Areas map.

The Security Core maps quickly show where motorized use has either been disallowed or continues, while a look at larger scales of Recovery Area maps provide more detail.



Compiled by Swan View Coalition
Using Forest Service Data
February 2014

Grizzly Bear Security Core Maps

The two Grizzly Bear Security Core Maps on the following pages shows how Security Core habitat is improved by Wildland Recovery. The first map shows how Security Core is currently fragmented by motorized use of roads and trails, as well as by high levels of non-motorized human use. Flathead Forest Plan Amendment 19 defines Security Core as areas at least 2500 acres in size and more than 0.3 miles from roads and trails open to motorized use or receiving 20 or greater parties of people per week not using motorized vehicles (such as hikers, mountain bike riders or horseback riders).

Roads must be legally and physically closed or decommissioned to remain in Security Core and cannot simply be gated. (USFS 1995).

The "Existing" Grizzly Bear Security Core Map is labeled to include three instructive examples of how Security Core is fragmented. From south to north on the map:

1. High levels of hiking, horseback riding, and river corridor use impact 0.6 mile wide corridors entering the Bob Marshall Wilderness on the South Fork and Gorge Creek trails, disqualifying them as Security Core. (Note that Security Core is mapped only a short distance into the Bob Marshall Wilderness because most impact assessments that use Security Core occur outside Wilderness areas. Security Core continues further into the Bob Marshall than the Forest Service map overlay shows).

2. A motorized "loop" portion of Alpine 7 Trail, from Thunderbolt Mountain to Sixmile Mountain is similarly "buffered" 0.3 miles on each side and disqualified as Security Core, along with the Wire and Sixmile trails descending toward Swan Lake. In contrast, the Bond Creek and Hall Lake trails that lie between them do not reduce Security Core as they descend toward Swan Lake because they are closed to motorized use.

3. Because Jewel Basin Hiking Area has easy, high-elevation road access via Camp Misery and is near human populations, it regularly receives high levels of hiking use during the summer. Hence, the most popular parts of Jewel Basin do not serve as Security Core habitat for grizzly bear and other wildlife.

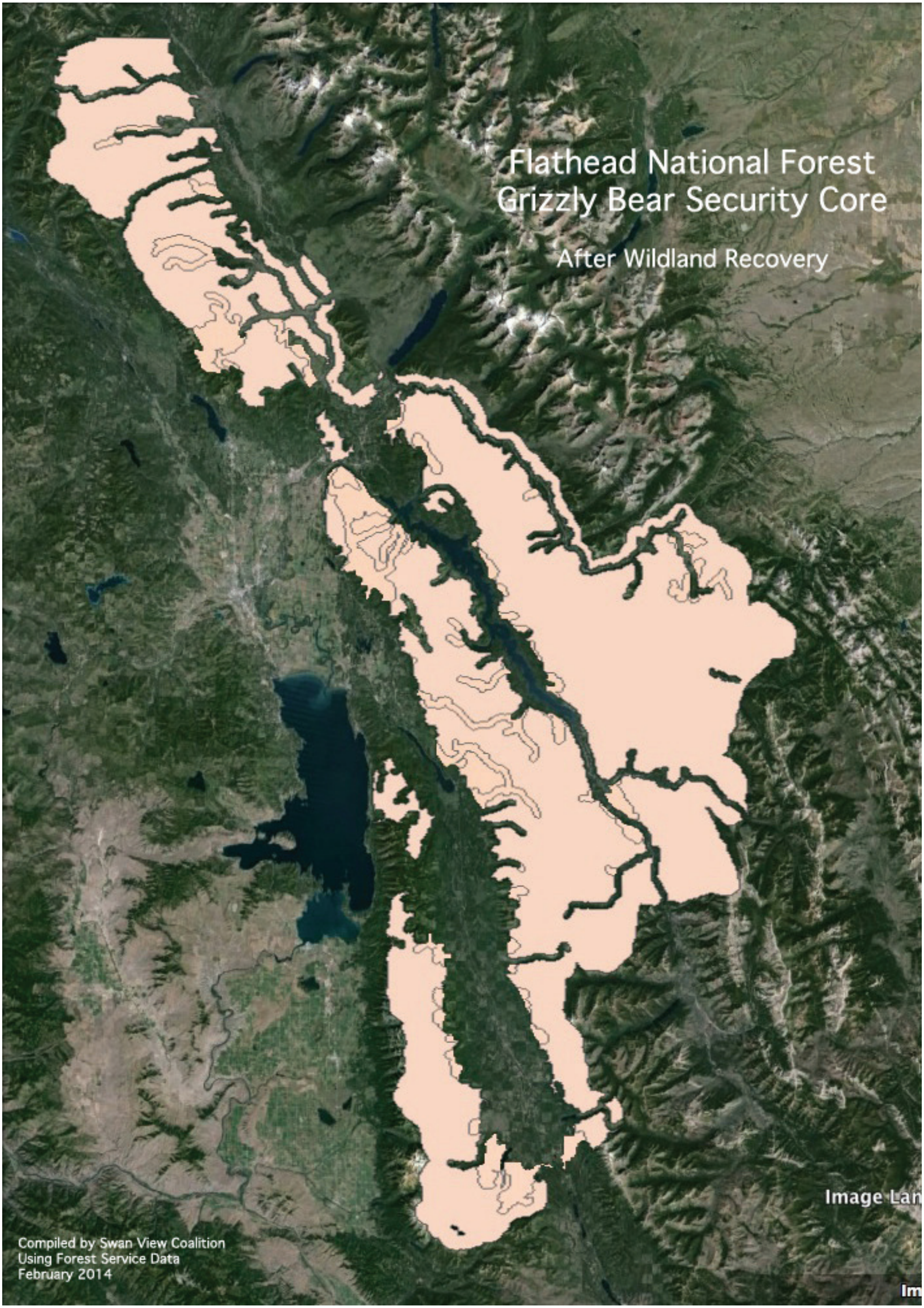
These examples help illustrate why this Recovery Plan will remove all mechanized uses within the Recovery Area and pull roads back from a number of high-elevation trailheads, primarily on the eastern slopes of the Swan Range for example. This in part because the South Fork Grizzly Bear Study found the northern Swan Range population of grizzly bear to be declining at over 2% per year, enough to halve the population in about 30 years, while being an important population "source" to offset the population "sink" of bears dying in the more densely developed Swan and Flathead valleys. (Mace and Waller 1997).

The goal is to restore Security Core habitats for wildlife and to restore opportunities for uncrowded, non-mechanized recreation. The "After Wildland Recovery " Grizzly Bear Security Core Map shows how this can be accomplished provided steps are taken to help insure decommissioned roads do not simply become high-use non-motorized trails - such as by disallowing mountain bikes.


Flathead National Forest
Grizzly Bear Security Core

Existing 2012

Compiled by Swan View Coalition
Using Forest Service Data
February 2014



Flathead National Forest
Grizzly Bear Security Core

After Wildland Recovery

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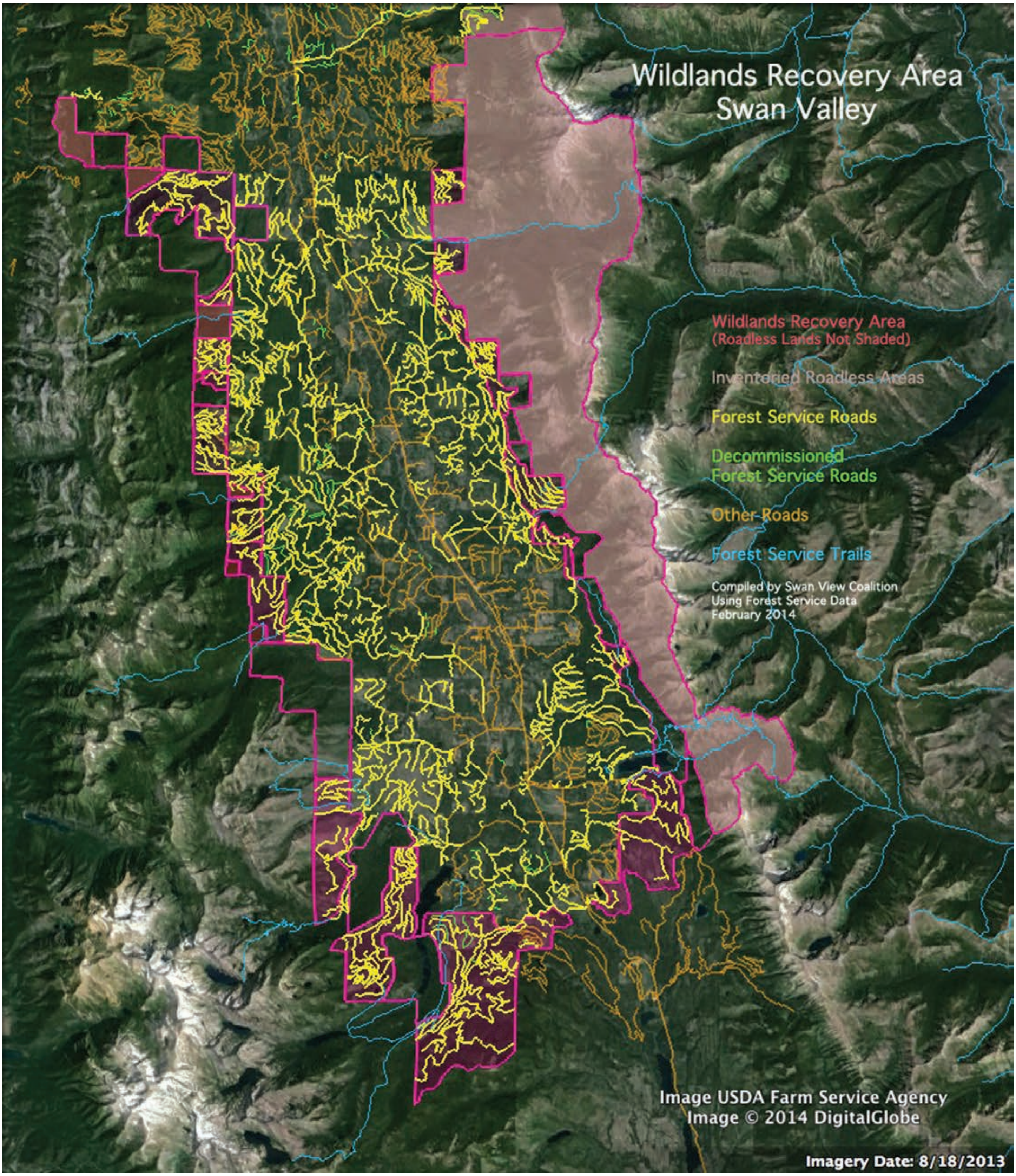

Compiled by Swan View Coalition
Using Forest Service Data
February 2014

Image USDA Farm Service Agency
Image © 2014 DigitalGlobe

Imagery Date: 8/18/2013


Wildlands Recovery Area
Northern Swan Range
Wildlands Recovery Area
Inventoried Roadless Areas
Forest Service Roads
Decommissioned Forest Service Roads
Other Roads
Forest Service Trails
Compiled by Swan View Coalition
Using Forest Service Data
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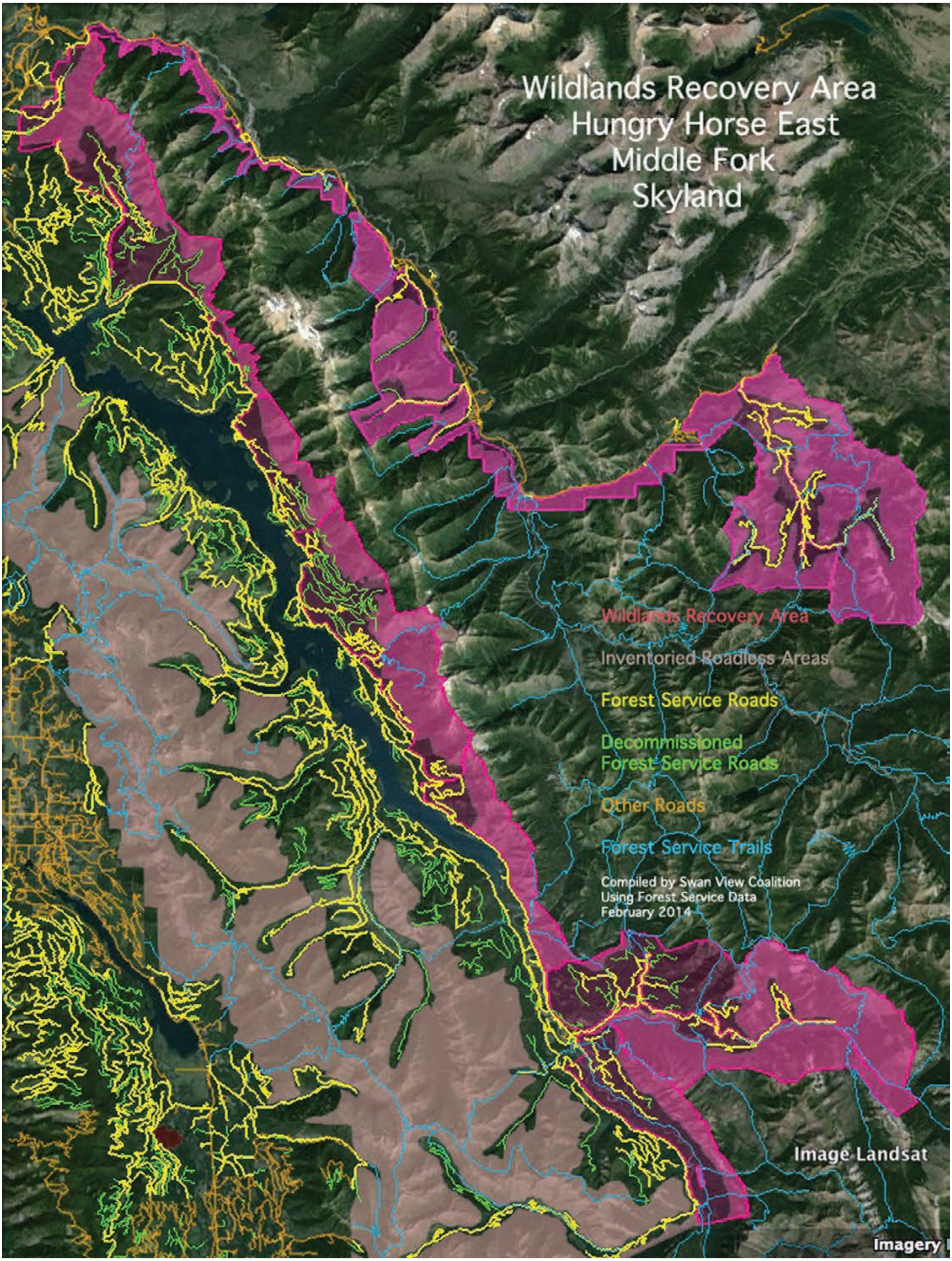
Wildlands Recovery Area
Hungry Horse East
Middle Fork
Skyland
Wildlands Recovery Area
Inventoried Roadless Areas
Forest Service Roads
Decommissioned Forest Service Roads
Other Roads
Forest Service Trails
Compiled by Swan View Coalition
Using Forest Service Data
February 2014
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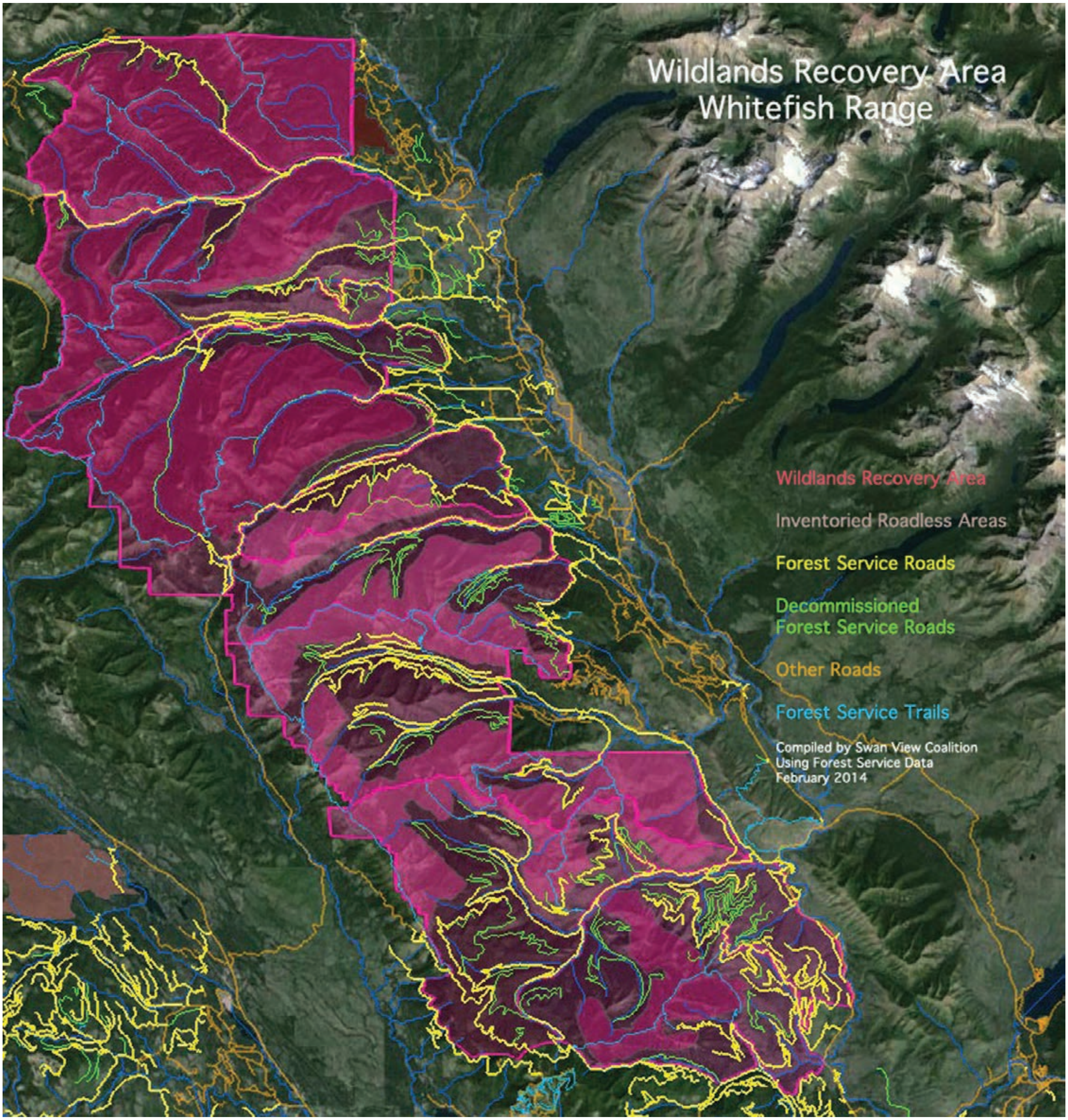
Wildlands Recovery Area
Whitefish Range
Wildlands Recovery Area
Inventoried Roadless Areas
Forest Service Roads
Decommissioned
Forest Service Roads
Other Roads
Forest Service Trails
Compiled by Swan View Coalition
Using Forest Service Data
February 2014

Interactive Versions of the Maps

The preceding maps show that roads and trails can exist in Security Core, provided they are legally and physically closed to motor vehicles. Flathead Forest Plan Amendment 19, however, prefers that the roads be fully decommissioned to simultaneously protect fish and water quality through the preemptive removal of all stream-crossing culverts and bridges before they fail. (USFS 1995). Fish and Wildlife Service concurs. (USFWS 1993, 1998a and 1998b).

The maps show quite a number of roads exist in Security Core that have not been decommissioned and that culverts and bridges remain at risk of plugging, collapsing and/or "blowing out" with dire consequences to fish and water quality. Viewing these map layers on Google Earth allows one to zoom in and see where culverts and bridges have or have not been removed - and clicking on individual Forest Service Roads displays pertinent road data including which roads are receiving what levels of maintenance when such funds are available.

Toggling various map layers on and off in Google Earth also allows one to discern greater detail and access more data than viewing the static maps we have included here.

To view Google Earth versions of these maps:

1. Install Google Earth on your computer if you haven't already. It's free at:
http://www.google.com/earth/download/ge/agree.html

2. Download the necessary Google Earth KML or KMZ map overlay files from the Flathead National Forest web site at:
http://www.fs.usda.gov/detailfull/flathead/landmanagement/planning/?cid=fsm9_042517&width=full

The files you'll need to download from the Flathead National Forest web site are: Inventoried Roadless Areas, National Forest System Roads, Other Roads, Historical (Decommissioned) Roads, Trail Routes, and Grizzly Bear Security Core Areas.

Click on the desired .kml or .kmz link in the right-hand column and it should automatically download to your computer. When you double-click on that file on your computer, it should automatically start up and display that map layer in Google Earth, while also placing that file/map layer in your Temporary Places folder. When you Quit Google Earth, select the option to save your Temporary Places if you don't want to have to rebuild all the map layers again.

3. Download our FNF Wildlands Recovery Areas KML map overlay file at:
http://www.swanview.org/home/articles/reports-documents/kml_files_for_use_with_google_earth/183
As above, double-click on our .kml file to load and display it in Google Earth.

4. For an example of the many factors considered in delineating the Wildland Recovery Areas, see pages 6-13 of our more detailed Wildlands Recovery Plan for the Northern Swan Range. It can be viewed or downloaded at:
http://www.swanview.org/reports/Wildlands_Recovery_Plan_N_Swan_Range.pdf

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.

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.

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

Joel Sartore/National Geographic Stock with Wade Fredenberg

Some wild creatures are important indicators about the condition of our environment.

The bull trout is one of those. They need the coldest, cleanest water of all salmonids making them excellent indicators of water quality.

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.

Wherever possible, 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 areas with most of the remainder directly downstream from roadless areas. 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.

Comprehensive protection and restoration of bull trout and native fish habitat must be done throughout the core watersheds that support native fish.

Management Recommendations for Water Quality and Fish Habitat

- Continue to implement the Riparian Management Recommendations, Standards and Guidelines, and Riparian Habitat Conservation Areas that are in the Inland Native Fish Strategy and the PACFISH/INFISH Biological Opinion with the following additions/changes:

- Fine sediments < 6.4 mm in diameter must be limited to less than 20% in spawning habitat (Espinosa 1996) and standards must be developed to maintain groundwater.

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

- 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.

- Establish a total and open road density standard that protects and restores native fish habitat by reducing sediment, restoring hydrologic upwelling, and eliminating barriers.

Habitat Fragmentation

Habitat fragmentation is generally defined as the process of subdividing a continuous habitat type into smaller patches, which results in the loss of original habitat, reduction in patch size, and increasing isolation of patches. (Heilman et al. 2002)

Habitat fragmentation is considered to be one of the single most important factors leading to loss of native species (especially in forested landscapes) and one of the primary causes of the present extinction crisis. Although it is true that natural disturbances such as fire and disease fragment native forests, human activities are by far the most extensive agents of forest fragmentation. For example, during a 20-year period in the Klamath–Siskiyou ecoregion, fire was responsible for 6% of forest loss, while clear-cut logging was responsible for 94%. (Id.)

Depending on the severity of the fragmentation process and sensitivity of the ecosystems affected, native plants, animals, and many natural ecosystem processes (e.g., nutrient cycling, pollination, predator–prey interactions, and natural disturbance regimes) are compromised or fundamentally altered. For many species, migration between suitable habitat patches becomes more difficult, leading to smaller population sizes, decreased gene flow, and possible local extinctions. (Id.)

As native forests become increasingly fragmented, ecosystem dynamics switch from being predominantly internally driven to being predominantly externally driven. Simultaneously, remnant patches become altered by changes within the patches themselves as the remnants become more and more isolated, thereby resulting in further ecological degradation across the landscape. Declines in forest species as a result of fragmentation have been documented for numerous taxa, including neotropical migrant songbirds, small mammals, and invertebrates. Forest fragmentation has also been associated with increased susceptibility to exotic invasion. (Id.)

Among the common changes in forests over the past two centuries are loss of old forests, simplification of forest structure, decreasing size of forest patches, increasing isolation of patches, disruption of natural fire regimes, and increased road building, all of which have had negative effects on native biodiversity. These trends can be reversed, or at least slowed, through better management. (Noss 1999)

Management Recommendations

• The revised Flathead Forest Plan should contain standards, guidelines and objectives that reduce fragmentation and edge effects and increase patch size and core areas.

• Past management through even-aged silvicultural prescriptions have contributed to the fragmentation of forest habitat to the detriment of many bird and wildlife species. Large and small openings should be allowed to be created through natural processes rather than clearcut logging.

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).

Old-growth forests are characterized by large, old trees and multiple canopy layers, as well as dead standing (snags) and fallen dead trees.

Some species of birds and mammals require the attributes of old-growth forests for their survival.

Pileated Woodpecker

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).

Arlene Montgomery

Woodpecker Tree

What good is a dead tree?

Long before a dead tree falls it becomes an important host for many creatures. More than 80 species of birds nest only in dead or dying trees.

In forests not influenced by human activities there are a diversity of tree species in a variety of age classes – saplings to mature trees as well as dead and dying trees.

This mosaic of trees along with the other vegetation creates a variety of habitats that are used by wildlife.

Management Recommendations

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.

Lynx

The Fish and Wildlife Service designated critical habitat for lynx that includes the Flathead National Forest. They determined the following physical and biological features are essential to the conservation of the species.

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.

US Fish and Wildlife Service

Canada Lynx

Lynx in the Rocky Mountains of Montana selected mature, multistoried forests composed of large-diameter trees with high horizontal cover[1] 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)

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. Management actions that alter spruce-fir forests to a condition that is sparsely stocked (e.g. mechanically thinned) and has low canopy closure (<50%) would create forest conditions that are poorly suitable for denning. (Squires et al. 2010)

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. (Squires et al. 2006)

During summer, lynx broadened their use to select younger forests with high horizontal cover, abundant total shrubs, abundant small-diameter trees, and dense saplings, especially spruce and fir saplings. Since lynx in Montana exhibit seasonal differences in resource selection, managers should 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 well-distributed across the landscape. (Id.)

Movement and connectivity is particularly important to maintain persistent populations and to recolonize unoccupied habitat. Lynx selected home ranges at mid-elevations with high canopy cover and little open grassland vegetation. A primary lynx corridor from Canada 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. (Squires et al. 2012)

Snowmobile trails may facilitate coyote movements into areas with deeper snow during the winter. (Gese et al. 2013) 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 that may be detrimental to local lynx populations in the Intermountain West. (Id.)

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[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.

Threats to lynx and their habitat (Excerpts from the 2013 LCAS)

1. Climate change.

2. Timber harvest - Commercial timber management of conifer forests traditionally has been designed to: reduce tree density and promote tree growth (e.g., precommercial thinning); 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.

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.

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.

3. Fragmentation - Fragmentation affects lynx by reducing their prey base and increasing the energetic costs of using habitat within their home ranges. Direct effects 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 on the landscape.

Management Recommendations

- Increase the amount of old growth and mature multi-story habitat on the Flathead. Historically old-growth habitat was 15% to 60% (Amendment #21). Current old growth averages 11.6% across the Forest and ranges between 6.9% to 12.7% (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.

Fishers appear to be selective of relatively dense overhead cover and large forest structures at resting sites 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. (Aubrey et al. 2013)

All known fisher reproductive dens are in cavities in live trees or snags. Reproductive dens are typically in the oldest and largest trees available. Large trees with cavities and platforms are also used extensively by males and females for resting. (Naney et al. 2012)

Washington Dept. of Fish and Wildlife

Fisher

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. (Id.)

Fishers have relatively large home ranges, use habitat at multiple spatial scales, and typically avoid areas with little or no contiguous cover. Fragmented landscapes may affect landscape permeability, either permanently through vegetation type conversion or temporarily until vegetation recovery occurs. 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. (Id.)

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. The cavity must also have adequate thermal properties to protect kits from weather extremes. (Raley et al. 2012)

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.

In live trees, fishers rested primarily in rust brooms in more northern study areas and mistletoe brooms or other platforms elsewhere. In contrast, fishers primarily used cavities when resting in snags. Fishers used hollow portions of logs or subnivean [under the snow] spaces beneath logs more frequently in regions with cold winters. These results suggest that fishers use structures associated with subnivean spaces to minimize heat loss during cold weather. (Id.)

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. (Id.)

Previously, it was thought that fishers in western North America may favor riparian forests; however, results from recent studies do not support this hypothesis. Although riparian forests were important to fishers in some locales, consistent use or selection for riparian forests has not been demonstrated. (Id.)

Female fishers consistently selected 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. (Schwartz et al. 2013)

Females are selecting habitat at two scales: a stand scale as indicated by stands that have large trees (as well as a large variation in tree size) and a landscape scale 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. (Id.)

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. Landscapes with previous widespread and intensive forest harvesting may lose their ability to support fishers until these harvested areas regenerate sufficiently. 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. (Weir and Corbould 2010)

Because salvage harvest of beetle-killed trees typically involves clearcut 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. (Id.)

Management Recommendations

- Follow the recommendations for old-growth forests and lynx.

- Do not rely solely on riparian areas for fisher viability. Mature and old growth forest attributes must be maintained and/or recruited to ensure large trees, snags, downed logs and decadence provide good fisher habitat.

Keith Hammer

Mature and old growth forests provide essential habitat for fisher and other animals, birds and insects.

Quiet recreation in forests is rejuvenating for people too.

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.

W.R. Montgomery

• 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 ≥ 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 more than 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).

(Excerpts from Hillis et al, 1991.)

• *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 known 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.

(Excerpts from Christensen et al 1993)

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.

Glacier National Park

Grizzly Bear

"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 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 el. 2009).

Management Recommendations

- Assess already roaded lands for appropriate uses by motorized vehicles and mountain bikes. Flathead National Forest currently has some 3,500 miles of road open to bicycling, with nearly 2,000 of those miles closed to motor vehicles but open to biking without the hassle of dust and traffic. Motor vehicles should be restricted to open roads only. In roaded lands only should single-track trails be assessed for the appropriateness of mountain bike use.

- Continue implementation of Flathead Forest Plan Amendment 19 to attain the 19/19/68 percentage standards for Open Motorized Route Density, Total Motorized Route Density and Grizzly Bear Security Core in each and every Grizzly Bear Management Subunit. This would include all of the Tally Lake Ranger District and the Island Unit of Swan Lake Ranger District, where Subunits need to be delineated.

- Follow up on the Flathead’s finding that decommissioning a road is cheaper than maintaining it for the long term. Arrive at a much smaller road system that can be fully maintained and meet all water quality Best Management Practices under existing and reasonably foreseeable budgets.

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.

Management Recommendations

- Monitor mycorrhizae needs as part of soil condition assessments. Monitor soil temperatures because Mycorrhizae are very temperature sensitive.

- Detrimental soil disturbance monitoring 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).

- Soil monitoring data should be included in watershed health assessments. There needs to be an inventory of where 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.

Keith Hammer

Nurse Log

Over long periods of time (centuries or millennia) soil formation occurs.

This fallen tree is used by other plants, animals, insects and many other forms of life.

Fungi, mosses, and lichens along with microbes aid in the decomposition of the log, recycling the nutrients in the tree and adding structure to the soil.

Wildfire And Salvage Logging

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

Post-Fire Principles (Beschta et al 1995)
We recommend that management of post-fire landscapes should be consistent with the following principles:

1) Allow natural recovery and recognize the time scales for ecosystem evolution.
2) No management activity should be undertaken which does not protect soil integrity.
3) Preserve species' capability to naturally regenerate.
4) Do not impede the natural recovery of disturbed systems.

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.

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.

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. 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, and how important the legacy of standing deadwood is to the natural development of forests. 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 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. Historically roads were not present in watersheds and did not affect hydrologic or erosional patterns. Now, 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 reassessing 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 results in increased erosion, compacted soils and a loss of nutrients from these areas.

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.

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 post-fire 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.

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. 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…

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.

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.

From other sources, as noted:

“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).

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. These areas are ecological treasures.” (Hanson 2010).

Management Recommendations

• Salvage logging should be prohibited in burned forests and sensitive areas including erosive sites, fragile soils, roadless areas, riparian areas, steep slopes, and any site where accelerated erosion is possible.

• Maintaining species viability and natural processes should be a priority.

• Building new roads in the burned landscape should be prohibited.

• All snags and downed woody material should be retained on the landscape.

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.)

"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. 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, 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, including both insects and bird species that feed on mountain pine beetles. Furthermore, post-disturbance harvest can damage soil and roots by compacting them leading to greater water stress in trees, which may reduce conifer regeneration by increasing sapling mortality and, in general, may cause more damage to forests than that caused by natural disturbance events. (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)

Management Recommendations

- Do not salvage or preemptively remove trees that may be susceptible to beetles.

- Allow insects to play their natural role in the ecosystem.

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).

Management Recommendations

- Recognize that logging with helicopters during the non-denning season is likely to adversely affect listed terrestrial species. Plan and consult with FWS accordingly.

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