WINTER RECREATION ON NATIONAL FOREST LANDS

A COMPREHENSIVE ANALYSIS OF MOTORIZED AND NON-MOTORIZED OPPORTUNITY AND ACCESS

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A Comprehensive Analysis of Motorized and Non-Motorized Opportunity and Access

June, 2015
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EXECUTIVE SUMMARY

The purpose of this report is to provide data on winter recreation use, opportunity and access on National Forest lands. The information presented here was collected from Forest Service offices across the country and is the most complete compilation of its kind. Presented on a forest-by-forest as well as Regional basis, the data is reported as use levels, miles of available motorized and non-motorized groomed trails, and acres open and closed to motorized use.

This is an update of a 2006 report titled Winter Recreation on Western National Forest Lands.[1] It is expanded to include 77 forests - 19 that the original report did not cover - and uses the most up to date information available from the Forest Service, acquired though Freedom of Information Act (FOIA) requests in 2014. The need for this report is similar to the first, as winter recreation use and conflict on public lands – and National Forest lands in particular – has only escalated in the decade since the original report was issued.

Participation in winter recreation is steadily growing at both ends of the spectrum. The most recent government survey, conducted in 2010, estimates that participation in cross-country skiing, snowshoeing, and snowmobiling in the United States have more than doubled since 1982-83. See Figure 1, pg. 3.

Opportunity and access are central issues to all user groups. Citing the motorized impacts of noise, exhaust, safety concerns and snowmobile tracks, skiers and snowshoers assert that opportunities for quiet, quality recreation have been lost on many forests. Snowmobilers counter that their access to forest lands is being limited.

Until the 1990s, there was little geographical overlap between motorized and non-motorized winter recreationists. Before that time, motorized use was generally limited to packed trails and roads as early snowmobiles would easily become bogged down in deep snow. Skiers and snowshoers wishing to avoid motorized impacts could go off-trail to areas unreachable by snowmobile. In the 1990s, however, the development of "powder sleds" designed for off-trail travel vastly increased the reach of snowmobiles allowing the newer, more powerful machines to dominate terrain previously accessible only by backcountry skis or snowshoes.

This report provides concrete data to Forest Service officials and public land users to help them better address the issue of equitable opportunity and access for quality winter recreation on National Forest lands. In 2014 Winter Wildlands Alliance submitted Freedom of Information Act (FOIA) requests to each National Forest receiving regular snowfall. See Table 1, pg. 11. The FOIA requests sought, from each individual National Forest, documentation of the following: number of acres open to snowmobiles; number of acres closed to snowmobiles, including Wilderness areas; miles of managed motorized snow trails, routes, or roads; miles of managed non-motorized snow trails, routes, or roads; GIS data related to winter recreation on National Forest lands.

In addition, using data from the National Visitor Use Monitoring Program (NVUM) conducted by the Forest Service, Winter Wildlands Alliance gathered annual visitor numbers for cross-country skiing, snowshoeing and snowmobiling for each forest. NVUM data shows that these forests receive 6.9 million cross-country skier and snowshoer visits annually and 4.0 million snowmobile visits annually. See Figure 2, pg. 3.

The FOIA responses show that, of the 176 million acres of National Forest land within the forests that receive regular snowfall, approximately 94 million acres, or 53%, is open to snowmobiles. See Figure 3, pg. 4.

Significantly, of the approximately 63.4 million acres officially designated as non-motorized, more than half lies within designated Wilderness areas. Motorized proponents often point out that non-motorized users have exclusive use of Wilderness areas. However, in winter, the distances from plowed parking areas and trailheads make the vast majority of designated Wilderness areas inaccessible to many skiers and snowshoers. Many acres of Wilderness that are included in this report do not support skiing or snowshoeing because of a lack of snow. Similarly, many of the acres that are technically open to snowmobiling do not have enough snow to support use. One much-needed element of further research is a better understanding of how designated Wilderness areas provide viable winter recreation opportunities by determining which Wilderness lands receive enough snowfall to support winter recreation and are sufficiently close to allow day-use access.

Despite the fact that the NVUM surveys show 58% more cross-country skier and snowshoer visits than snowmobile visits, more than one and a half times as many acres are open to motorized use than designated as non-motorized in winter. When difficult-to-access Wilderness areas are taken out of the equation the disparity becomes more severe, with three times as much designated motorized acreage as there is non-motorized, non-Wilderness acreage.

As for managed winter trails, the FOIA responses show an estimated 26,728 miles of managed snow trails in these National Forests. Just 5,746 miles, or 22%, are designated as non-motorized. See Figure 4, pg. 5.

The trails data provided in this report, while the best available at the moment, do not reflect the complete inventory of trails on National Forest lands. As it is, however, the data show that there are 4 times more winter trails open to snowmobiles than there are trails designated as non-motorized. There are several reasons why snowmobile trail miles vastly outnumber non-motorized trail miles. For one, snowmobiles cover much greater distances in a day than skiers or snowshoers do and therefore desire a more expansive trail system. However, this discrepancy in distance traveled is the very reason that there is a need for more non-motorized areas outside of Wilderness – areas near plowed parking areas should be prioritized for non-motorized use in order to remedy this inequity.

Local snowmobile clubs often pay to groom motorized trails, which are generally funded at least in part through snowmobile registrations. These trails are often also funded through

Recreational Trails Program (RTP) dollars, which are derived from the federal fuel tax. Anybody who buys gas for a vehicle pays into this fund. Both motorized and non-motorized users rely on Sno-Parks in states such as California, Idaho, Oregon, and Washington, which are funded through user fees. Nordic ski grooming operating costs are usually covered through a variety of means as well, such as use fees, although there is no mandatory state registration fee for skiing. Both motorized and non-motorized users share a variety of funding sources and funding is a challenge for all user groups.

The disparity between motorized and non-motorized opportunity and access is repeated on a forest-by-forest and Region-by-Region basis across the nation. As a result it is difficult for skiers and snowshoers to find a quality recreation experience, and with increasing use levels there is escalating conflict between motorized and non-motorized users on National Forest lands.

Multiple-use is defined as the "management of all the various renewable surface resources of the National Forests so that they are utilized in the combination that will best meet the needs of the American people."[2] This does not mean that all activities should or need to occur in all places. In fact the Multiple Use and Sustained Yield Act states that multiple use management specifically allows for land to be used for "less than all of the resources; and harmonious and coordinated management of the various resources".[3] Winter Wildlands Alliance and our constituents contend that in many cases the designation "multiple-use" is a misnomer and is de facto single use: motorized. In other words, while skiers and snowshoers have access to multiple-use areas, because of the motorized impacts listed above and elaborated in this report, the opportunity for a quality human-powered recreation experience is lost on many of the forest lands designated as multiple-use because those lands see high levels of snowmobile use often diminishing the skiing and snowshoeing experience.

Executive Order 11644, signed by President Nixon in 1972, requires the Forest Service "to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands." The order continues, stating that, "areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors."

In 2005, the Forest Service released new regulations to better manage and address the impacts associated with off-road vehicle use on National Forest lands and comply with Executive Order 11644. The 2005 Travel Management Rule marked a fundamental shift in how the Forest Service manages motorized recreation but it left management of over-snow vehicles (OSVs) as optional.[4] Following a challenge by Winter Wildlands Alliance, a Federal Court ruled that the OSV exemption in the 2005 Rule was unlawful and ordered the Forest Service to write a new rule to address this issue. The new Over-Snow Vehicle Rule was published in January 2015 and requires all National Forest Units that receive adequate snow to designate routes and areas where OSV use is allowed. Once these designations are published on an OSV Use Map, OSV use that is not in accordance with the map is prohibited. Some forests have already begun this process, and many more will do so in the coming years.

The data in this report provide a baseline understanding of winter travel management on National Forest lands at the start of this winter travel planning era. Through winter travel planning we hope that, in every applicable National Forest Unit, sizeable and accessible areas will be managed for non-motorized use to ensure a quality recreation experience for human-powered winter recreationists. All snow recreation should be managed to protect the safety and enjoyment of all users, natural resources and wildlife. Furthermore, Winter Wildlands Alliance believes that winter travel planning should prioritize protection of wintering wildlife and critical winter habitat over all recreation use, whether motorized or non-motorized.

HISTORICAL OVERVIEW

Skiing and snowshoeing have a long and rich tradition on Western forests. Early European trappers, hunters, explorers and surveyors adopted snowshoes from Native Americans as their primary mode of winter travel.[5] Scandinavian miners brought their skiing tradition with them to the Western mining camps of the mid-1800s and skiing quickly caught on both as recreation and for more utilitarian purposes such as mail delivery during long isolated winters.[6] Skiers and snowshoers have ventured into the backcountry ever since. The first ski race in the United States took place in 1860 in California.[7] The first backcountry ski huts were developed in Idaho and Colorado in the 1930s and 1940s. Archeological findings, including skis preserved in bogs and prehistoric rock art, date the use of skis and snowshoes to 5,000 years ago.[8]

As to historical snowmobile use, attempts to build over-the-snow machines date back to the 1920s.[9] In 1935 a utilitarian snowmobile that could carry twelve people was developed for emergency transport[10] and the timber industry also made use of an early snowmobile.[11] Not until the 1950s, however, with the invention of small gas engines, did snowmobiles come into use for recreational purposes. By the 1970s, a number of small manufacturers were building snowmobiles. Honda made a prototype machine in 1973 called the White Fox that had a 178 cc two-stroke engine and weighed 227 pounds. It could be carried in the back of a station wagon.[12] The specifications for the Sno-Jet (a company purchased by Kawasaki) made in 1976 show a 355-pound machine with a 338 cc engine.[13]

Until the 1990s, however, snowmobiles were generally restricted to packed trails and roads as the earlier machines would easily become bogged down in deep snow. In the mid-1990s, the development of the "powder sled" vastly changed the pattern of snowmobile use. As stated by the International Snowmobile Manufacturer's Association, "today's snowmobiles bear little resemblance to earlier models."[14] For example, the Snowmobile.com "Mountain Snowmobile of the Year" for 2015, the Ski-Doo 800 Summit with T3, weighs 467 pounds and has a 799.5cc engine that reaches up to 7,900 RPMs.[15]

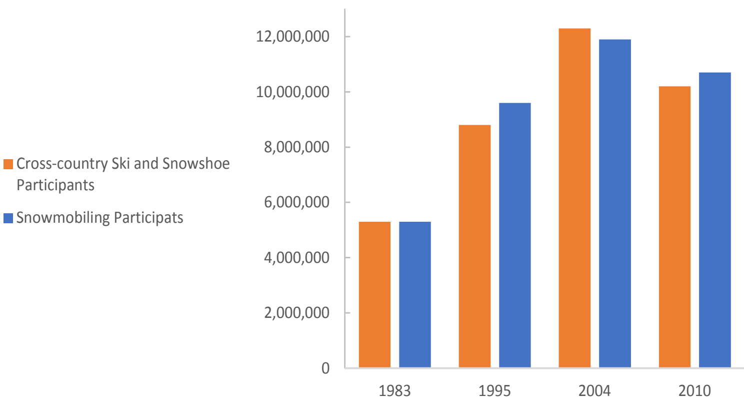
These advances in technology have expanded the terrain used by snowmobiles, leading to conflicts with skiers and snowshoers. The National Survey on Recreation and the Environment, a collaborative study co-sponsored by the Forest Service, concludes, "new technologies and better modes of accessing backcountry will continue to shift the nature of the demand for outdoor recreation."[16] The newest modes of backcountry winter travel include "snow bikes" – modified motorcycles with tracks instead of wheels – and "fat bikes" – bicycles with large, low-pressured tires designed for over-snow use – and have brought an even broader diversity of winter users into the backcountry.

INCREASING NUMBERS OF PARTICIPANTS

Participation in winter recreation is steadily growing. Government surveys put the number of snowmobile participants in the U.S. in 1982-83 at 5.3 million.[17] Prior to that time, snowmobiling was not even included in the surveys, the first of which was conducted in 1960.[18] The most recent survey, conducted in 2010, estimates that in the United States 10.7 million people snowmobile annually.[19] In 2014 there were 1,397,262 snowmobiles registered in the United States.[20]

Figure 1: National Participation in Cross-Country Skiing, Snowshoeing, and Snowmobiling

Source: U.S. Government, National Outdoor Recreation Survey
*The 1983 and 1995 surveys did not track snowshoeing



As to human powered winter sports, the same government surveys show that in 1960, 2.6 million people in the U.S. participated in snow skiing, including cross-country skiing.[21] By the winter of 1982-83 there were an estimated 5.3 million cross-country skiers (the survey did not track snowshoeing or telemark/alpine touring ski participation).[22] The most recent government surveys show that in the United States 10.2 million people cross-country ski or snowshoe annually.[23] See Figure 1. Forest Service surveys show that National Forests receive almost 7 million cross-country ski or snowshoe visits each year.[24] It is difficult to compare individuals and user days but these numbers both serve to indicate that Nordic skiing and snowshoeing are increasingly popular activities across the nation.

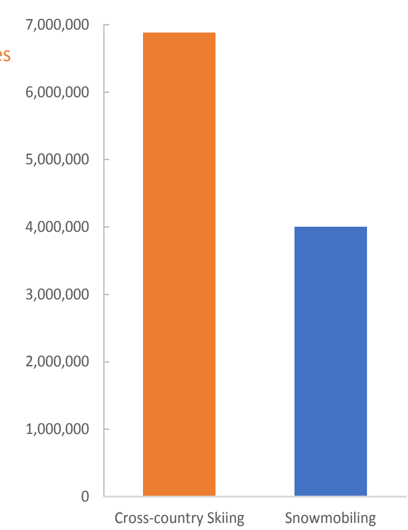
The Outdoor Foundation reports that 8.12 million people participated in cross-country skiing, snowshoeing, or telemark skiing in the 2012-2013 winter season.[26] By comparison, the Outdoor Industry Association reported that there were 2.98 million people who participated in snowmobiling during the 2012-2013 season. Participation in backcountry, or "undeveloped", skiing is projected to be one of the fastest growing forms of outdoor recreation through 2060 while participation motorized snowsports is projected to be among the slowest growing activities.[27] At the same time, hybrid skiing – using snowmobiles to access backcountry ski terrain – has grown in popularity although there are no hard numbers for how many people pursue this activity each year.

In recent years, the National Forest Service has conducted a National Visitor Use Monitoring Program (NVUM) to gain more detailed participation data for each forest. This program includes visitor use surveys that are designed to measure the reasons why people visit a particular forest and the amount of participation in each activity in that forest. The results of the surveys from the National Forests in this report show that these forests receive 6.9 million cross-country skier and snowshoer visits annually and 4.0 million snowmobile visits annually. Backcountry skiing is usually classified as cross-country skiing in NVUM surveys. See Table 1 for forests studied and Figure 2 for NVUM visitation estimates.

In their study of recreation trends, the Forest Service concludes, "there will likely be more conflicts among recreationists who will be competing at the same times for use of some of the same areas and sites for different forms of outdoor recreation."[28] These "continued increases in visits to most federal and state forests and parks will put added pressures on public managers to adopt new management policies and practices."[29]

Figure 2: National Forest Annual Visits per Activity in Snowbelt States

Source: U.S. Government, National Visitor Use Monitoring Data



COMPETING RECREATION USES ON A FINITE RESOURCE

The National Forests identified in Table 1 encompass a total of 176 million acres and include all of the forests that receive regular snowfall and manage for winter recreation.

This report focuses on the National Forest lands as these lands are generally at higher elevations and receive more reliable snow than most BLM and state-owned public lands. In addition, new Forest Service regulations that mandate winter travel planning provide context and an opportunity to revisit winter recreation management and address inequities on Forest Service lands.

These forests also represent escalating conflict zones, with cross-country skiers and snowshoers asserting that on many forests it is nearly impossible to find the quiet, peaceful recreation experience they seek, and snowmobilers countering that the forest lands are increasingly being closed off to them.

In an effort to shed more light on these competing assertions, in 2014, Winter Wildlands Alliance submitted Freedom of Information Act (FOIA) requests to each of these National Forests.[30] The FOIA requests sought, from each individual National Forest, documentation of the following:

1. Number of acres open to snowmobiles.
2. Number of acres designated as non-motorized in the winter, including Wilderness areas
3. Miles of trail or road managed for motorized over-snow use
4. Miles of trail or road managed for non-motorized winter recreation
5. Forest closure orders, travel management plan documents, or other decisions and supporting documents governing the use of over-snow vehicles
6. Surveys of public use, attitudes, preferences, or opinions concerning winter recreation
7. Reports detailing the economic impact of winter recreation
8. GIS data showing winter recreation management

The majority of forests[31] responded and the data were refined after many hours of follow up calls and submission of amended requests.

The responses received from the forests show that approximately 94 million acres, or 60%, of the forest land within the Snow Belt (forests that receive regular snowfall) are open to snowmobiles. See Figure 3.

It bears mention that, of the approximately 63 million acres officially designated as non-motorized, more than half of the acreage lies within remote Wilderness areas. In winter the distances from plowed parking areas and trailheads make the vast majority of designated Wilderness areas inaccessible to skiers and snowshoers. Interagency recreation planners in the state of Washington accurately noted in their state plan that "only the most hardy and determined mountaineers will undertake a winter visit to the tens of thousands of acres of rugged wilderness backcountry"[32] and that "simply getting into undeveloped areas of a National Forest in winter can be difficult, sometimes impossible."[33] This isn't to say that Wilderness areas do not provide backcountry skiing opportunities – indeed, Wilderness areas are an important part of the backcountry skiing experience – but these more remote destinations need to be supplemented by areas with easier access to provide a broader range of non-motorized opportunities.

Figure 3: National Forest Acres, by Region Open and Closed to Snowmobiles

As for trails, the FOIA responses show there are an estimated 26,728 miles of managed snow trails in these National Forests. Five percent of these trails are designated as non-motorized. See Figure 4.

NVUM surveys show that cross-country skier and snowshoer visits to National Forest lands are nearly double the number of snowmobile visits. In that light, the fact that there are more than one and a half times the number of forest acres designated motorized as non-motorized in winter is inequitable.

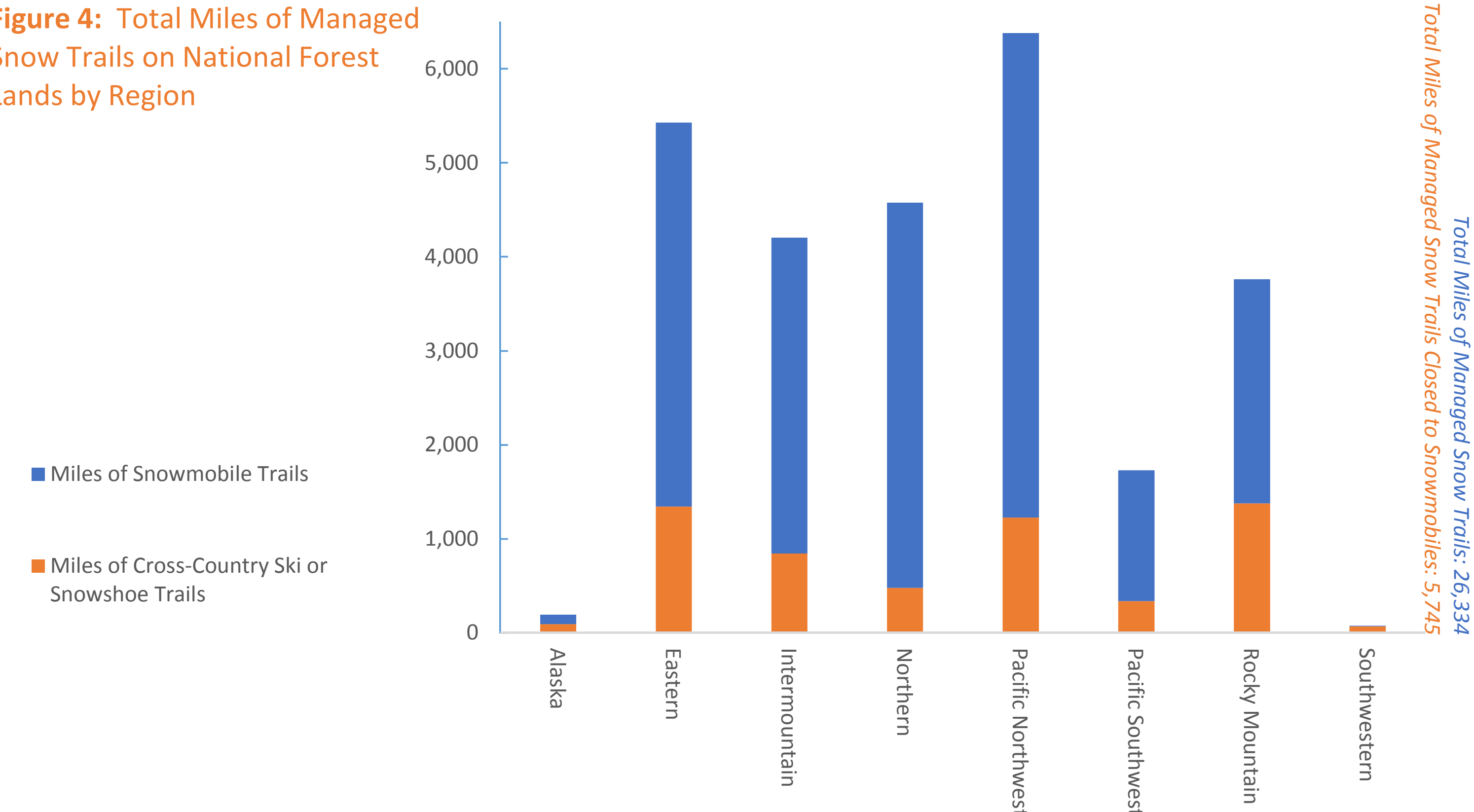
The consequence of this disparate situation is unequal opportunity for skiers, snowshoers and other quiet winter recreationists when compared to OSV users and escalating conflict between motorized and non-motorized uses on National Forest land.

Public land managers at the highest levels noted conflict between motorized and non-motorized use as early as the 1970s. In 1972 President Nixon signed Executive Order 11644 which requires the Forest Service "to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands." The order continues, stating that, "areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors."[34]

Winter recreation in its myriad forms is a popular use of National Forest lands. Locals and visitors alike spend a significant amount of time and money skiing, snowshoeing, and snowmobiling on our National Forests.[35] However, very few of the forests that receive enough snow to support winter recreation have done any form of comprehensive planning to determine how best to manage these uses. In the absence of deliberate planning, snowmobile use is primarily limited only by the constraints of terrain and technical capability. As snowmobiles have become more powerful and new over-snow vehicles, such as snowbikes, have appeared, the amount of terrain that is inaccessible to motor vehicles continues to shrink. While over-snow vehicles certainly have a place on our nation's forests, it has become more important than ever for Forest managers to institute restrictions on motorized over-snow use in order to protect sensitive winter ecosystems and non-motorized winter recreation opportunities.

Winter travel management planning is a huge opportunity to bring balance to our National Forests. By stepping back and reassessing where on the landscape motorized use is truly appropriate, the Forest Service and those who participate in the winter travel planning process will be able to take steps to reduce user conflicts and ensure that high quality winter recreation opportunities exist for all users. For example, while there are abundant opportunities for quiet and solitude deep in the backcountry, fewer opportunities exist for non-motorized winter recreation closer to home. Creation of sizable and accessible winter non-motorized areas on each National Forest, with enforceable common sense boundaries, will go a long way toward meeting the public's desire in this regard and reducing user conflict.

Figure 4: Total Miles of Managed Snow Trails on National Forest Lands by Region



This report explores the current on-the-ground management situation for winter recreation across all of the National Forests that have significant snow-based recreation opportunities and is presented to assist in the winter travel planning process. In many instances there was previously no cohesive record of how winter recreation was managed on a specific forest. However, with the implementation of the new Over-Snow Vehicle Travel Management Rule, it is important to understand the current state of winter recreation in order to properly plan for the future.

In reviewing the following data and the call for equitable access and opportunity, it is important to bear in mind the elements that constitute a quality recreation experience for skiers, snowboarders, snowshoers and other quiet winter recreationists. Human-powered recreationists venture into the winter backcountry in search of peace and solitude: to connect with nature. At the very core of this experience are the natural sounds, sights and beauty of pristine snowscapes.

IMPACTS OF SNOWMOBILE USE ON NON-MOTORIZED USERS

While it is possible for backcountry skiing and snowshoeing to occur alongside motorized recreation, OSV activity impacts human-powered winter recreation in a number of ways. These impacts often diminish the human-powered recreation experience and drive skiers and snowshoers away from trails or areas that are frequented by OSVs. These impacts fall into three categories: pollution, safety, and footprint.

OSV pollution comes in two forms – noise and exhaust. Noise has a significant impact on the cross-country skiing and snowshoeing experience[36] and in multiple-use backcountry areas, snowmobile noise can be difficult to escape. Snowmobile noise can travel up to 10 miles depending on speed, type of machine, and wind[37] – further than most non-motorized recreationists travel in a day. Likewise, snowmobile exhaust is another major detriment to a quality experience for skiers and snowshoers. Emissions from snowmobiles emit many carcinogens and can pose dangers to human health.[38] While most of the acute toxic effects of snowmobiles are limited to staging areas and parking lots, the smoke and fumes from snowmobiles on trails can dramatically reduce the quality of the experiences of non-motorized users along the trail as well. Newer, unmodified, machines emit less noise and exhaust pollution than older snowmobiles but they are still not entirely clean or quiet. In addition, many of the machines used on National Forest lands today are older 2-stroke sleds and/or have after-market modifications that increase noise and exhaust levels.

OSVs pose a safety concern for backcountry skiers and snowshoers just as wheeled motorized vehicles can be a safety issue for pedestrians. Avalanches aside, excessive speed, reckless driving, alcohol, and inexperience are the most commonly issued citations and causes of accidents involving snowmobiles.[39] Most winter backcountry trails have no posted speed limit[40] and the most powerful snowmobiles today have from 125- to 177-horsepower engines,[41] allowing them to travel at very high rates of speed. Snowmobiles weigh up to 600 pounds, and many can travel at speeds in excess of 90 miles per hour.[42] At such speeds, a snowmobile will travel almost 200 feet before being able to come to a stop.[43] The tremendous power and weight of snowmobiles are incompatible with skiers, snowshoers and other pedestrian users on winter trails and backcountry terrain.

Both skiers and snowmobilers travel into backcountry areas in search of untracked snow. However, the quality of cross-country and backcountry skiers' experience on National Forest lands across the nation is rapidly eroding due to the ever-increasing reach of snowmachines. Improvements in power, maneuverability and fuel tank capacities enable snowmobiles to climb the steepest mountain slopes to access places previously reachable only by skiers using climbing skins. Before these advances, most snowmobile riders stayed on groomed trails because the machines would become easily stuck in soft powder snow. One study reports that the average distance traveled by a snowmobiler in a day ranges between 127 and 367 miles.[44] By comparison, a skier or snowshoer will be hard pressed to cover more than five to 10 miles on ungroomed snow in a day. It can take less than an hour for a single snowmobile to completely track up a slope that multiple skiers could otherwise enjoy for days. Due to snowmobilers traveling freely on the vast majority of National Forest lands, pristine terrain for skiers and snowshoers is rapidly disappearing under the tracks of snowmobiles.

For more information on how over-snow vehicles impact non-motorized users and the environment, and management recommendations for how to minimize these impacts, please see the recently published Winter Wildlands Alliance paper "Best Management Practices for Forest Service Travel Planning."[45]

SUMMARY OF RESULTS

The 77 National Forests covered in this report include approximately:

- 176,008,137 acres of land (18,559,178 acres of land are unclassified, where designation status is uncertain)
- 94,025,989 acres of land open to snowmobiles
- 29,975,829 acres of non-wilderness land closed to snowmobiles
- 33,447,141 acres of designated Wilderness land, also closed to snowmobiles

See Figure 5.

These forests contain:

- 5,746 miles of cross-country ski and snowshoe trails
- 20,590 miles of snowmobile trails

See Figure 6.

The NVUM surveys show that in forests that manage for winter recreation, the number of cross-country skier and snowshoer annual visits far exceed the number of snowmobile annual visits. The NVUM surveys show that in these forests, there are an estimated:

- 6,878,106 cross-country ski and snowshoe visits annually
- 4,002,136 snowmobile visits annually

See Figure 7.

Figure 5: Total Acres of Snow Belt National Forest Lands Open and Closed to Snowmobiles

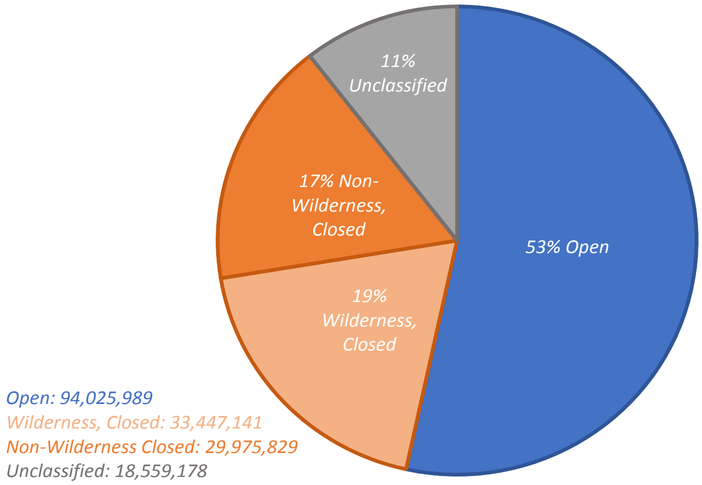


Figure 6: Total Miles of Managed National Forest Snow Trails Open and Closed to Snowmobiles

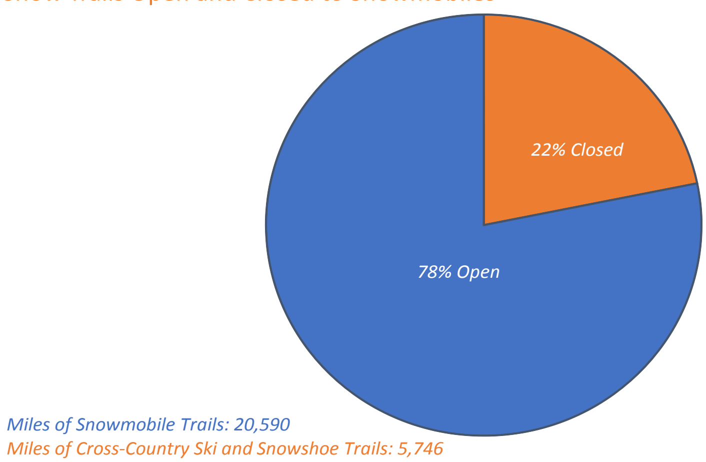
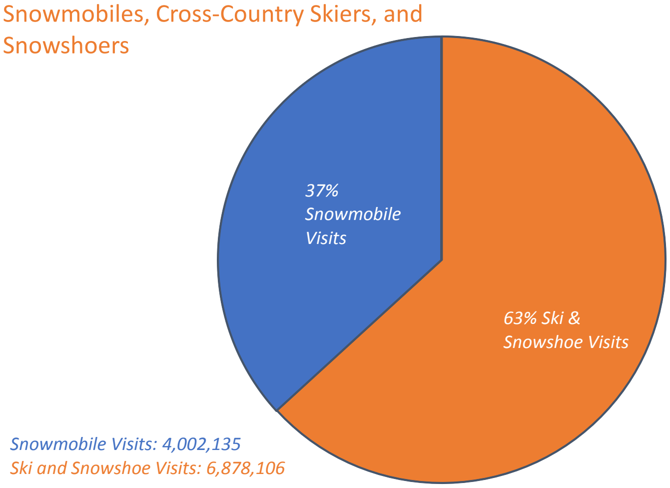


Figure 7: Annual Visits to Snow Belt Forests by Snowmobiles, Cross-Country Skiers, and Snowshoers



These numbers confirm that the vast majority of National Forest lands where winter recreation occurs are open to snowmobiles in one form or another. By comparison, only a fraction of those lands, and even fewer trails, are set aside for human-powered winter recreation.

At the same time, NVUM data show greater numbers of cross-country ski and snowshoe visits than snowmobile visits on these forests.

Nationwide, only 22% of the miles of managed winter trails are designated non-motorized, even though there are 1.7 times more cross-country ski and snowshoe visits than snowmobile visits to National Forest lands. Likewise, snowmobilers have access to 53% of the forest acreage, compared to human-powered recreationists, who, in order to enjoy a motor-free experience, are left with just 36% of the total acreage. Of this, more than half is Wilderness, which is largely inaccessible to skiers and snowshoers.

Similar disproportions exist in the individual forests in each Region. Although human-powered recreation visits outnumber snowmobile visits to National Forests across the country, less than half of the lands in National Forests that receive regular snowfall are designated as non-motorized.

CONCLUSION

This report shows that snow-based recreation opportunities for motorized uses on National Forest lands far exceed those for non-motorized use. 53% of the lands across the forests within the Snow Belt are open to motorized use in winter despite the fact that winter non-motorized use in these forests makes up almost two-thirds of the use (63%).

The imbalance in the acres and trail miles of forest open to snowmobiles versus those managed for winter non-motorized recreation has to be addressed. The adverse impacts that snowmobiles have on human-powered recreation, including noise, exhaust, safety concerns, and tracks create a disparate situation where the activities of one user group disproportionally affect the ability of another to use and enjoy public lands.

By implementing the Over-Snow Vehicle Rule, National Forests have the opportunity to bring management of forest lands back into balance. Through travel planning land managers have an obligation to “promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands” as directed by Executive Order 11644.

Forests that have proactively created winter travel plans set an example for possible ways to zone the backcountry and bring balance to the winter recreation landscape. For example, the White River National Forest completed a travel management plan in 2011 which addressed motorized recreation across all seasons. When drafting the plan forest managers took non-motorized recreation and other activities into account, creating a plan that reduces conflict, protects natural resources, and allows for the continuation of high-quality motorized recreation.

Winter travel planning presents an opportunity to think proactively about how to balance various types of winter recreation across a forest, especially with the ever-growing popularity of snowsports. Winter travel plans should provide space for non-motorized activities in both the frontcountry and backcountry, designate OSV use areas with enforceable boundaries, and take into account the current and projected demands of the local recreation community. The Winter Wildlands Alliance BMP document can help ensure winter travel plans satisfy the requirements of the OSV Rule and Executive Orders and provide equitable recreational opportunities.[46]

NOTES ON DATA AND SOURCES

The numbers in this report should be understood to be imperfect. Because very few National Forests have completed comprehensive winter travel planning many forests could not provide accurate data in all cases concerning the miles of trails managed for various forms of winter recreation or the total number of acres open to motorized winter recreation. This report reflects the best-available data as provided by the Forest Service. Trail mileage data were obtained from the Forest Service's national trails database, INFRA Trails, for FY 2014. This database is standardized and consistent across all forests and is the agency's official record for this type of information. However, INFRA Trail mileages are not accurate for all forests because the database is still in the process of being updated. In many cases the Forest Service provided acreage data in terms of total acres open and closed to OSVs. When the Forest Service did not provide an exact number of acres that are open or closed to OSVs on a particular forest we calculated these figures using GIS data when available. GIS analysis was done using a NAD 1983 Contiguous USA Albers projected coordinate system. When GIS data was not available this information was determined by sifting through Forest Plans, other planning documents, and special orders.

Several forests in Region 6 either did not respond to our FOIA request prior to publication or provided an incomplete response. For these – the Umpqua - Rouge River-Siskiyou, and Okanagan-Wenatchee – we have calculated approximate acres open and closed using the best information available.

The number of acres open and closed to OSVs as documented in this report does not necessarily reflect the number of acres that are actually suitable for winter recreation. This is true for both motorized and non-motorized winter recreation as we did not account for variability in terrain and snow accumulation. Some forests have snow depth requirements wherein there must be a set amount of snow before OSV use is allowed in a given area. We did not include this variable into our analysis.

FOIA REQUESTS

During 2014, Winter Wildlands Alliance submitted Freedom of Information Act (FOIA) requests to all of the forests listed in Table 2 and compiled the data presented in this report. These FOIA requests are available in Appendix 1 and 2 at the end of this report.

It is important to note the following with respect to the data:

1. Some minor discrepancies appear between the total of forest acres, open and closed acres, and Wilderness acres. This is because some forests administer lands technically within other forests and because forest land and boundaries are routinely modified.

2. Trail mileage data were obtained from the Forest Service INFRA Trails database, and while this data may not be completely accurate, it is the best available data that the Forest Service has.

3. All numbers are best estimates based on the information obtained.

4. The data, ratios and percentages presented in this report apply only to National Forest land. The number of trails or acreages of National Park Service lands, BLM lands, state lands, or other public lands are not included in this report.

5. A copy of the original FOIA request is attached as Appendix 1 to this Report. Appendix 2 is a second request that was submitted when it was believed that the data obtained was incomplete.

6. Where there was any doubt about the estimate of "acres closed to snowmobiles," if the exact figure was not provided in the FOIA response, the estimate is purposely generous to avoid any claim that the figure is underreported.

a. If the estimate was based upon the travel maps provided, areas on the travel maps shown as "closed to snowmobiles except on designated routes" were entirely included in "acres closed to snowmobiles." This means that even though the acreage is counted as closed to snowmobiles, that acreage may have a web of snowmobile trails through it. This procedure was justified on the basis these snowmobile routes would usually be counted in the "miles of snowmobile routes".

b. If the estimate was based upon a forest plan, the acreage was calculated based upon the total number of acres in all of the management areas that are closed to motorized vehicles. These areas are generally the Wilderness areas, research natural areas, and those areas classified as semi-primitive non-motorized. Several forests, however, allow snowmobiles in semi-primitive non-motorized areas while not stating so in the forest plan. Thus, it is believed that the estimates for "acres closed to snowmobiles" are generous, and that the acreage available for snowmobiles is even greater than shown.

NVUM DATA

Existing National Forest plans and other agency needs mandate visitor use monitoring. Therefore, the Forest Service instituted the National Visitor Use Monitoring program in 2000.[47] NVUM was developed to provide statistically reliable estimates of visitor use on National Forests throughout the United States.

Among other measures, NVUM reports visitation estimates using a standard definition for a "National Forest visit" in order to provide comparable estimates of visitor use. A "National Forest visit" is: "The entry of one person to a National Forest to participate in recreation activities for an unspecified period of time. A National Forest visit can be composed of multiple site visits."

In addition to estimating the numbers of visits, the NVUM program obtains descriptive information about National Forest visitors, including the activity in which the visitor participated. Included in the list of activities are snowmobiling and cross-country skiing/snowshoeing. Skate skiing and other forms of groomed Nordic skiing, ungroomed Nordic skiing, backcountry ski/snowboard touring, and snowshoeing are all considered "cross-country skiing" in the NVUM surveys. However, it is likely that some backcountry skiers report their activity as "downhill skiing" (which the Forest Service considers mainly to be resort-based skiing). Therefore, the visitation numbers for human-powered activities are likely higher than reported in the NVUM surveys.

It is important to keep in mind that NVUM estimates of visitor use are estimates and may not capture the true extent of a particular activity on a forest. NVUM survey sites are selected "using a stratified random sample of the times and locations where recreational visitors can be counted." However, the places that people choose to recreate, particularly for activities like skiing, snowshoeing, and snowmobiling are not distributed across Forest Service sites such that a random sampling is likely to capture them. Outdoor recreationists seek out particular experiences that can only be found in specific locations, and without weighting the site selection process to ensure that these favorite locations are included, the sample will result in an underrepresentation of these activities.

Additionally, data sampling at NVUM sites occurs on randomly selected days without adequately taking into account the variables that make any particular day optimal for a particular activity. NVUM sampling is unlikely to produce accurate data on winter recreational use because it fails to account for variables like whether there is enough snow for an activity to occur or differences in weather conditions that may encourage, or discourage, winter recreation on a particular day.

In reporting the amount of visitation to a forest for a particular activity, the NVUM surveys report visitation estimates only down to .01% of total forest visits. Thus, some forests show visitation rates of zero percent for the activities of snowmobiling or cross-country skiing/snowshoeing. This is usually the case in forests that do not have any groomed trails. For purposes of this report, it was assumed that a NVUM report of 0% visitation means less than .005% visitation and a NVUM report of .01% visitation means greater than or equal to .005 % visitation.

NVUM data are provided in terms of percent participation. In order to obtain numbers of actual visits we multiplied the percent participation for a given activity on a given forest by the visitation estimate for that forest. This approach was recommended by the Forest Service NVUM program.[48]

Forests that are jointly administered, like the Medicine Bow-Routt National Forest have NVUM data for each forest. Thus, to arrive at the users per mile and per acre for the jointly administered forest, the user numbers for each activity were calculated for each forest and then totaled and a new joint percent calculated for the combined forests.

SCORP DATA

The Land and Water Conservation Fund was created by Congress in 1964 to provide funds for, among other things, matching grants to states for outdoor recreation projects. Under the program, state recreation agencies are required to determine statewide outdoor recreation trends and demands. The data used in these reports comes from many sources including academic, NGO, and government surveys and GIS analysis. This data are then compiled into a Statewide Comprehensive Outdoor Recreation Plan, (SCORP), based on a planning horizon of 10 years.

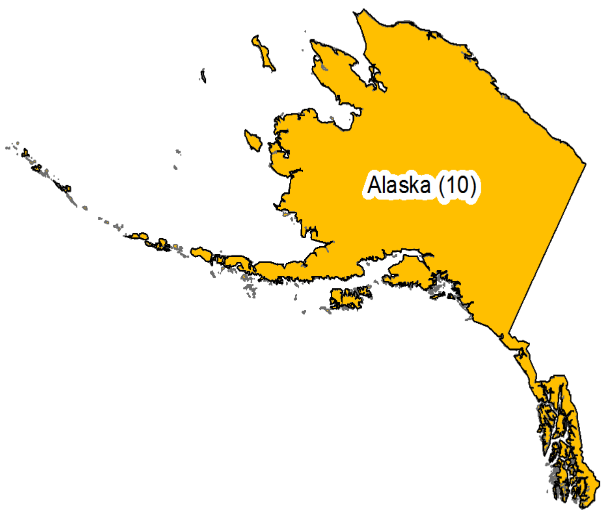
The format of the plans varies from state to state but most include data about the number of people participating in the state annually in snowmobiling, cross-country skiing and snowshoeing. SCORP reports are used in this study as a supplement to NVUM data to gain a better understanding of snowsports participation.

Erikson Creative Group

The Forest Service manages forests by Region with each Region encompassing several states or portions of states, as shown in Figure 8. While a National Forest may fall in more than one state, each Forest is located in a single Region. In general, states are fully within a single Region but some, such as Wyoming and Idaho, are split between multiple Regions.

Not all of the National Forests within every Region are included in this report. Certain National Forests have not been included, either because they do not receive regular or any snow, or there is little, if any, snowmobile or cross-country ski or snowshoe use in that forest. Only the forests that receive regular snow are included in this report.

Several National Forests prohibit snowmobile use unless there is minimum snow depth. For example, the Umpqua National Forest prohibits snowmobile use in areas with less than a foot of snow cover. Therefore, in these cases, it is difficult, if not impossible, to estimate acres open and closed to snowmobiles under those circumstances and this report makes no attempt to do so.



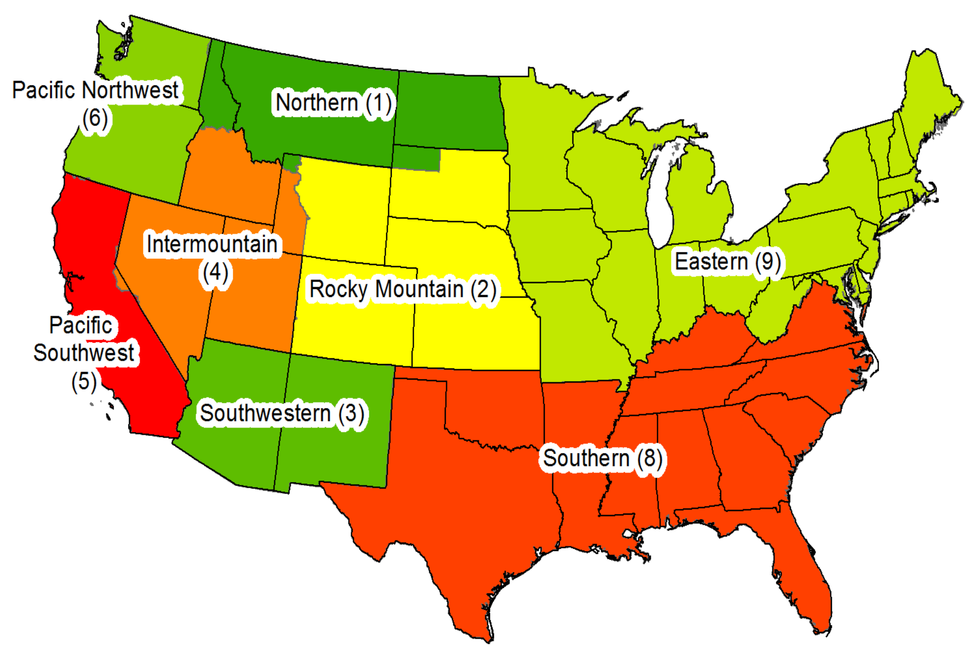


Figure 8: Forest Service Regions.
Source: USFS, ESRI.
Map created 2/2015 by Winter Wildlands Alliance.

TABLE 1: NATIONAL FORESTS STUDIED

Region 1 (Northern): Beaverhead-Deerlodge, Bitterroot, Custer-Gallatin, Flathead, Helena, Idaho-Panhandle, Kootenai, Lewis and Clark, Lolo

Region 2 (Rocky Mountain): Arapaho-Roosevelt, Bighorn, Black Hills, Grand Mesa-Uncompahgre-Gunnison, Medicine Bow-Routt, Pike-San Isabel, Rio Grande, San Juan, Shoshone, White River

Region 3 (Southwestern): Carson, Cibola, Coconino, Coronado, Kaibab, Lincoln, Santa Fe

Region 4 (Intermountain): Ashley, Boise, Bridger-Teton, Caribou-Targhee, Dixie, Fishlake, Humboldt-Toiyabe, Manti-LaSal, Payette, Salmon-Challis, Sawtooth, Uinta-Wasatch-Cache

Region 5 (Pacific Southwest): Eldorado, Inyo, Klamath, Lake Tahoe Basin, Lassen, Modoc, Plumas, Sequoia, Shasta-Trinity, Sierra, Stanislaus, Tahoe

Region 6 (Pacific Northwest): Colville, Deschutes, Fremont-Winema, Gifford Pinchot, Malheur, Mt. Baker-Snoqualmie, Mt. Hood, Ochoco, Okanogan-Wenatchee, Rogue River-Siskiyou, Umatilla, Umpqua, Wallowa Whitman, Willamette

Region 9 (Eastern): Allegheny, Chequamegon-Nicolet, Chippewa, Green Mountain and Finger Lakes, Hiawatha, Huron-Manistee, Monongahela, Ottawa, Superior, White Mountain

Region 10 (Alaska): Chugach, Tongass

The NVUM surveys for Region 1 forests show there are an estimated:

• 678,332 cross-country ski and snowshoe visits annually
• 506,524 snowmobile visits annually

See Figure A.

Region 1 National Forests contain:

• 24,148,297 acres of land
• 13,998,700 acres of land open to snowmobiles
• 4,999,097 acres of non-wilderness land closed to snowmobiles
• 4,987,877 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Region 1 National Forests contain:

• 475 miles of ski trails
• 4,100 miles of snowmobile trails

See Figure C.

Cross-country ski and snowshoe visits outnumber snowmobile visits on almost every National Forest in Region 1 yet there are almost 4 million more acres of land open to snowmobiles than there are designated as non-motorized and more than 10 times the number of miles of snowmobile trails versus ski trails in the Northern Region.

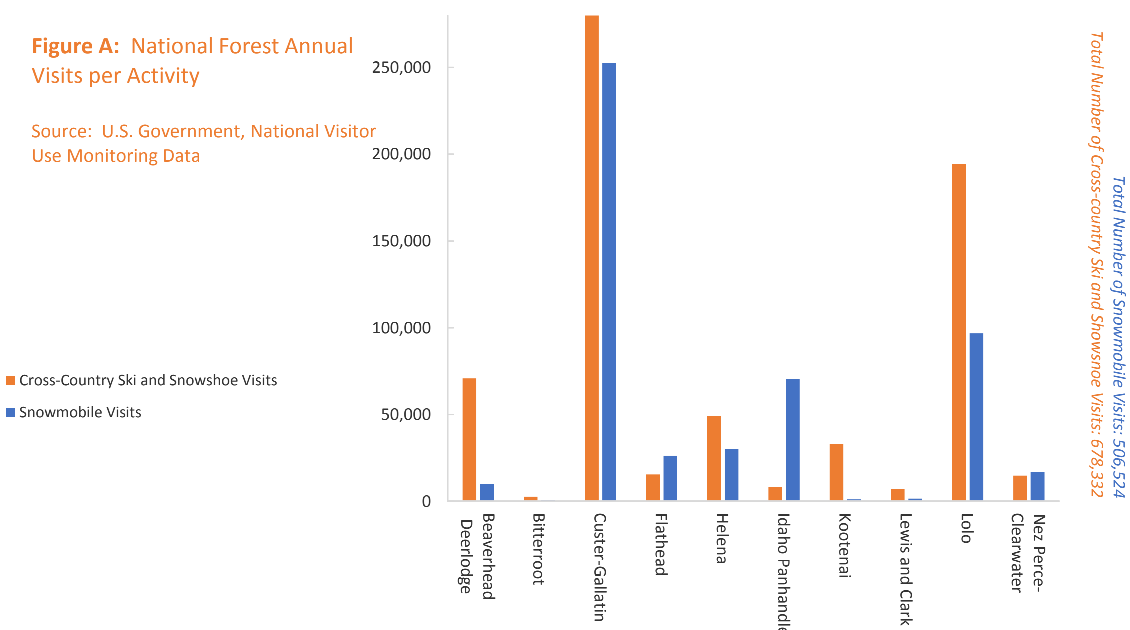
Across Region 1 there is an inequitable balance between the number of non-motorized winter recreationists visiting a forest and the number of acres on that forest that are managed for non-motorized use.

For example, on the Beaverhead-Deerlodge National Forest there are 7.2 times as many annual cross-country ski or snowshoe visits as there are snowmobile visits yet 1.3 times as many acres of the forest are open to over-snow vehicle use. Likewise, on the Kootenai National Forest cross-country ski and snowshoe visits outnumber snowmobile visits 30 to 1 yet there are 7 times as many acres on the forest that are managed for winter motorized use.

However, Region 1 is also unique in that it is home to several forests that have completed comprehensive winter travel management plans under the 2005 Travel Planning Rule. On these forests - the Gallatin, Lewis and Clark, and Helena - we see a much more equitable allocation of land for motorized and non-motorized winter use.[49]

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data



The Custer-Gallatin National Forest sees almost the same number of cross-country skier visits as snowmobile visits and has almost equal amounts of non-motorized and motorized lands. Thirty-five percent of this forest is Wilderness and an additional 19% is designated as non-motorized while 43% of the forest is open to OSVs.

There are almost 5 times as many cross-country ski and snowshoe visits to the Lewis and Clark National Forest as there are snowmobile visits and a large proportion of the non-wilderness lands on this forest are closed to OSVs. Under the Lewis and Clark winter travel plan OSV use is concentrated in the more developed parts of the forest. The result is a management plan that protects winter wildlands while also providing for high quality snowmobile opportunities.

National trends in snow sport activities are reflected across Region 1. More people participate in non-motorized snowsports than motorized, even though Montana and Idaho are among the top ten states for motorized recreation participation.[50] A University of Montana Institute for Tourism and Recreation Research survey of over 4,000 Montana households found that 21% of survey respondents used ski or snowshoe trails and 18% used snowmobile trails.[51] Likewise, 48% of survey respondents would like to see an increase in the amount of cross-country ski and snowshoe trails and 30% felt there should be more snowmobile trails.[52]

Figure B: National forest Acres Open and Closed to Snowmobiles

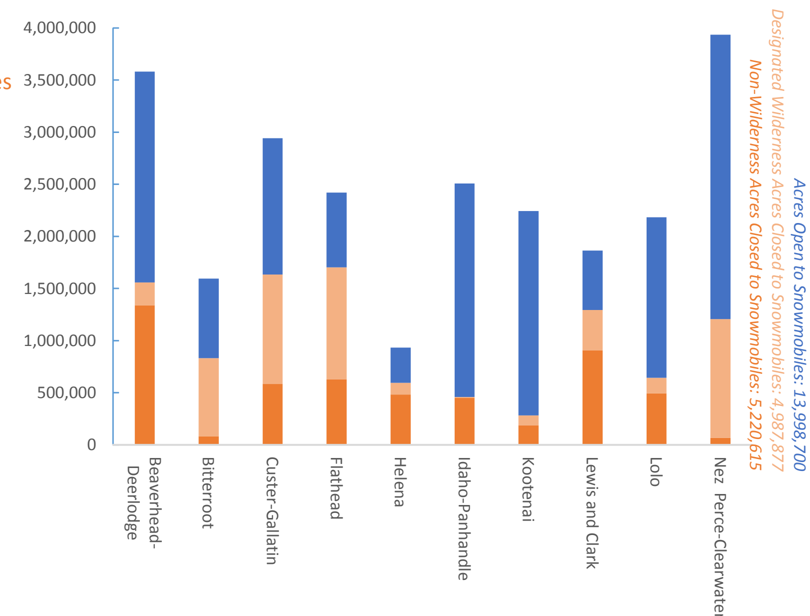
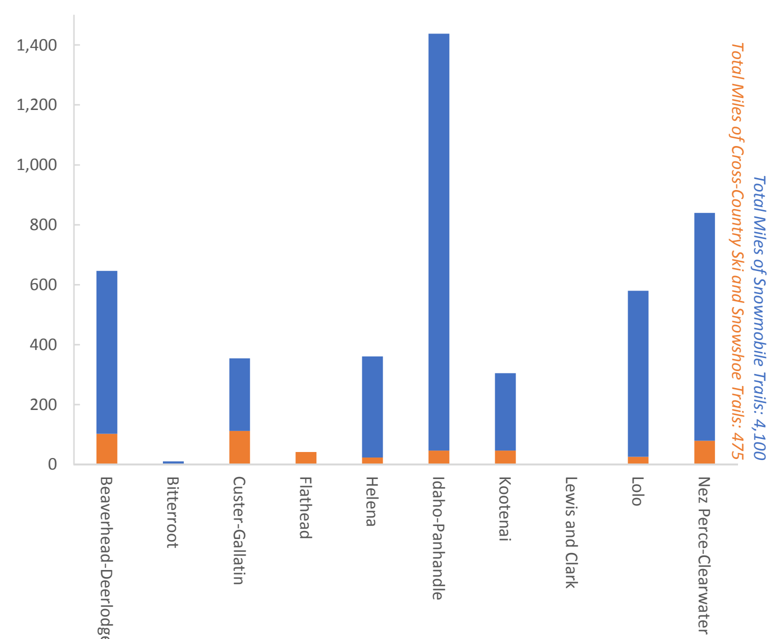


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 2 forests show there are an estimated:

- 2,198,604 cross-country ski and snowshoe visits annually
- 1,170,669 snowmobile visits annually

See Figure A.

Region 2 National Forests contain:

- 20,479,545 acres of land
- 11,799,009 acres of land open to snowmobiles
- 3,322,569 acres of non-wilderness land closed to snowmobiles
- 4,795,424 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Region 2 National Forests contain:

- 1,374 miles of ski trails
- 2,387 miles of snowmobile trails

See Figure C.

Wyoming forests in Region 2 receive more snowmobile visits than cross-country ski or snowshoe visits annually while all of the Colorado forests in Region 2 receive more non-motorized recreationists each winter. These numbers reflect general state-wide recreation trends. In 2013 17% of Coloradans participated in cross-country skiing or snowshoeing, 7.5% participated in backcountry skiing, and 5% participated in snowmobiling.[53] In contrast, snowmobiling is a much more popular activity in Wyoming, where 15% of households participated in snowmobile-based recreation during the winter of 2011-2012.[54]

Overall Region 2 sees almost twice as many cross-country ski and snowshoe visits as snowmobile visits annually yet there are one and a half times more acres of land available for motorized use than are designated for non-motorized activities across the Region. This is most striking on the Pike-San Isabel National Forest, where non-motorized winter visits outnumber snowmobile visits 70:1 yet there are almost three times the number of acres open to snowmobiles as there are designated for non-motorized use. Even more striking, when Wilderness acres are excluded the number of non-motorized acres on the Pike-San Isabel drops to only one tenth of the number of motorized acres.

Winter visitors to National Forest lands have different needs depending on their preferred type of recreation. A 2005 study of winter recreationists on the Medicine Bow-Routt National Forest

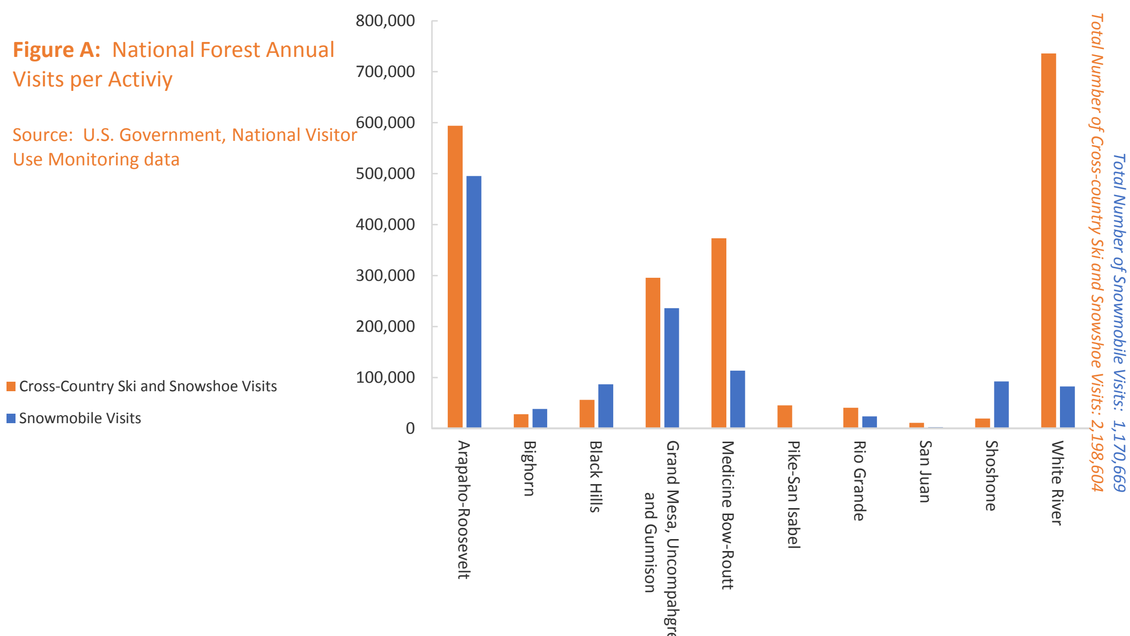


Figure A: National Forest Annual Visits per Activiy

Source: U.S. Government, National Visitor Use Monitoring data outlined the experiences and access sought by each user group.[55] Skiers and snowshoers desired areas that were free from the noise, smell, and sight of snowmobiles and untracked powder to ski downhill. In addition, hybrid skiers also sought out motorized access points to skiable terrain. Snowmobilers desired groomed and marked trails alongside open play areas and hills but also wanted more acres because they generally travel further than a skier in a day. On this forest there are approximately twice as many acres available for snowmobilers as compared to non-motorized acres where skiers can find the experiences they seek.

The White River National Forest is the only forest in Region 2 to undergo forest-wide winter travel planning prior to the OSV Rule. On this forest we see a much more equitable balance of opportunity. There are almost 9 times as many non-motorized winter visits to the forest and slightly more than twice as many non-motorized acres. If designated Wilderness is excluded then the number of motorized and non-motorized acres on the White River National Forest are approximately equal.

Figure B: National forest Acres Open and Closed to Snowmobiles

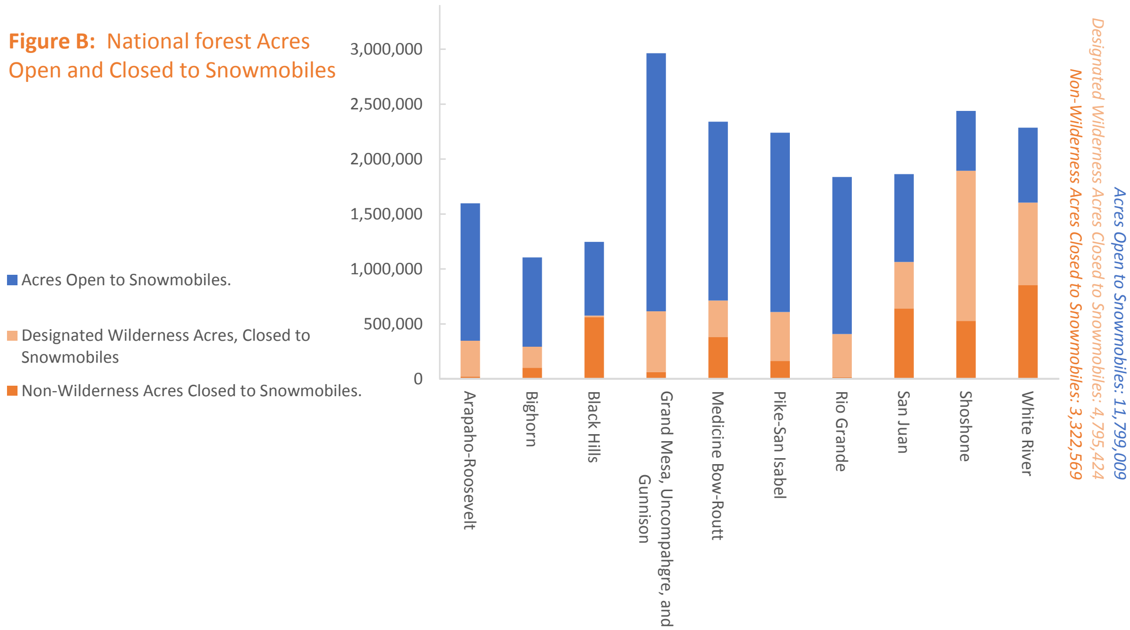
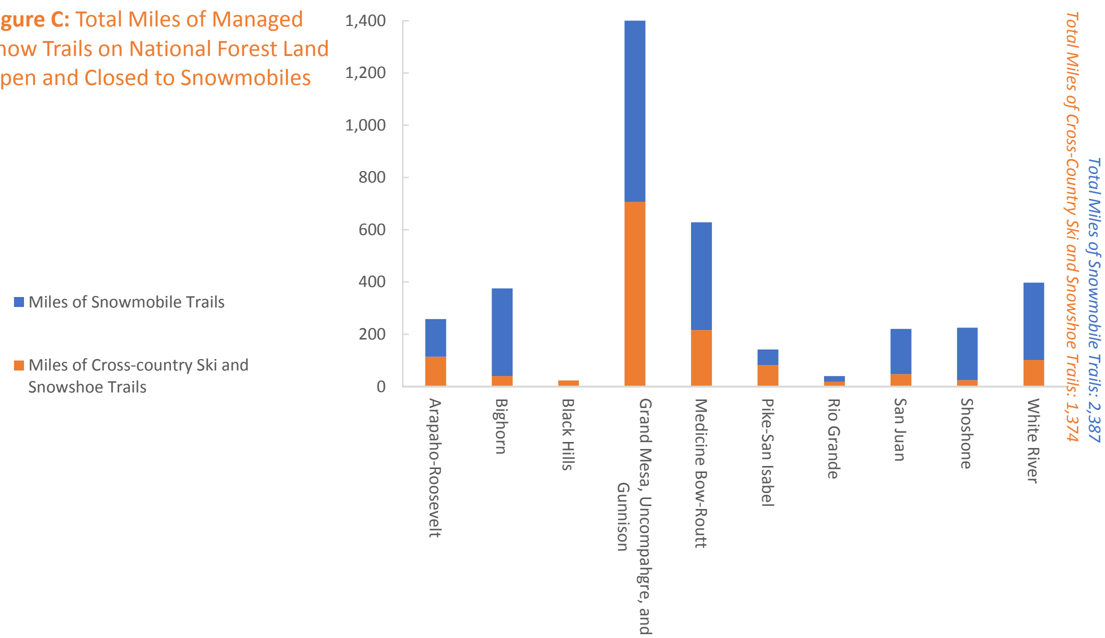


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 3 forests show there are an estimated:

- 251,712 cross-country ski and snowshoe visits annually
- 38,878 snowmobile visits annually

See Figure A.

Region 3 National Forests contain:

- 11,143,430 acres of land
- 8,411,389 acres of land open to snowmobiles
- 1,484,699 acres of non-wilderness land closed to snowmobiles
- 1,247,342 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Region 3 National Forests contain:

- 67 miles of ski trails
- 7 miles of snowmobile trails

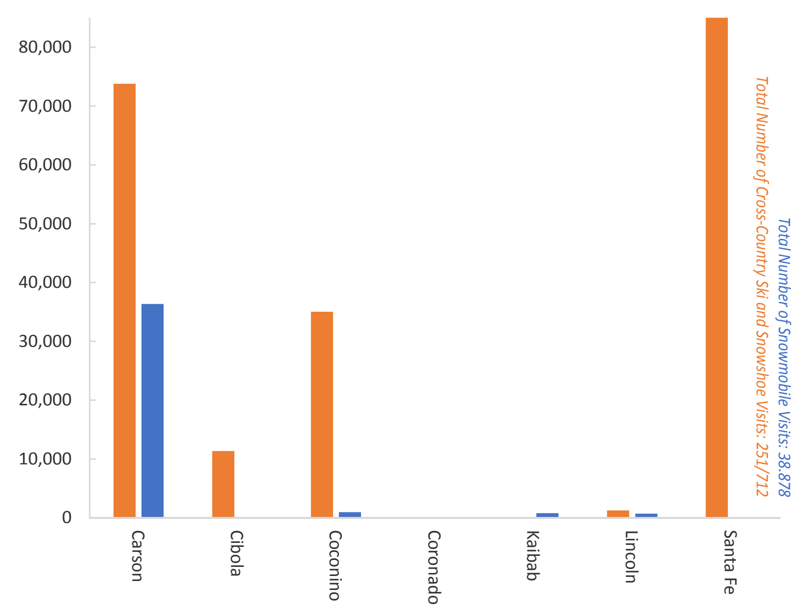
See Figure C.

Snow-based recreation is low for forests in Region 3, which is unsurprising given the climate in the desert Southwest. However, high elevation mountainous areas do provide winter recreation opportunities across Region 3. Approximately 7% of New Mexicans take part in non-motorized snow-sports[56] and 9% of Arizona residents reported moderate participation in cross-country skiing or snowshoeing in 2012.[57]

None of the forests in Region 3 that receive enough snow to support winter recreation currently have winter travel management plans and there are few trails or areas designated for backcountry snow-based recreation. Although the numbers in this report are somewhat misleading given that snow-based recreation is only feasible in limited areas on these forests, they provide a good example of why winter travel planning is needed. Winter travel plans can ensure that snowmobiling is allowed on those areas of the forest where it truly makes sense, as opposed to being allowed anywhere where there might be snow.

Figure A. National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data

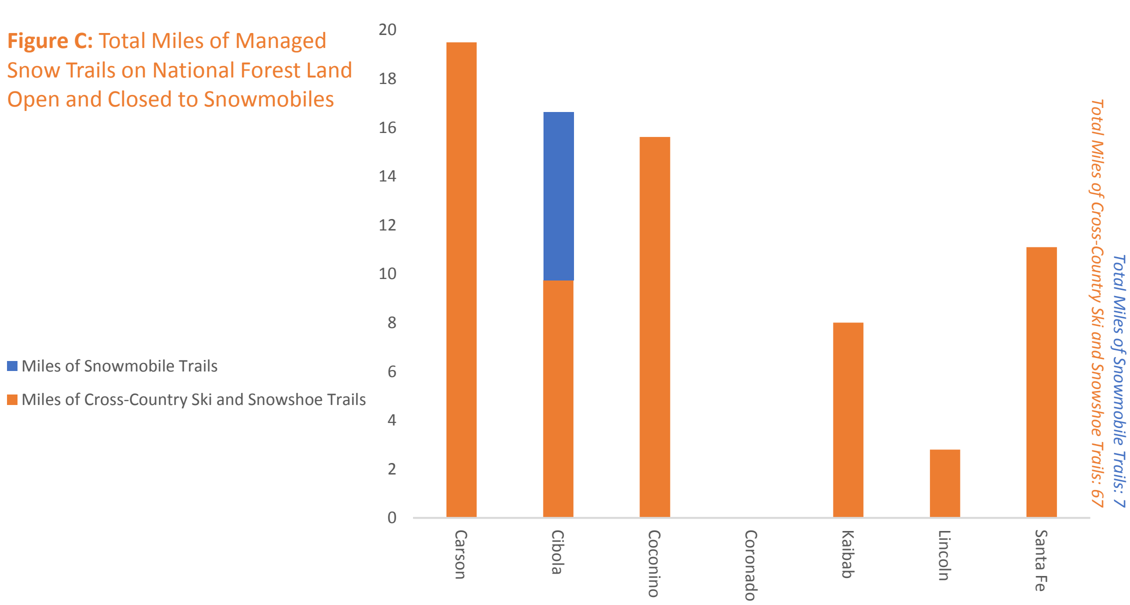


For example, the Kaibab National Forest receives approximately 791 snowmobile visits annually (and 38 cross-country ski or snowshoe visits) but there is virtually no guidance on how OSVs should be managed in any forest planning documents. By default snowmobiles are technically allowed everywhere on the forest except within designated Wilderness. While there are few places on the forest snowy enough to support winter recreation, there has been no analysis of how snowmobiles impact wildlife, natural resources, or other uses on the forest.

With the exception of the Kaibab, cross-country skiing and snowshoeing are far more prevalent across Region 3 forests than is snowmobiling. There are twice as many ski visits versus snowmobile visits on the Carson and Lincoln National Forests, 37 times more cross-country ski and snowshoe visits on the Coconino, and over 3,000 times more cross-country ski and snowshoe visits on the Santa Fe National Forest. No snowmobile visits were recorded during the NVUM surveys for the Coronado and Cibola National Forests and snowmobiles are not allowed off of designated routes on the Coronado.

Figure B: National Forest Acres Open and Closed to Snowmobiles

Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



INTERMOUNTAIN REGION

The NVUM surveys for Region 4 forests show there are an estimated:

• 893,975 cross-country ski and snowshoe visits annually
• 594,487 snowmobile visits annually

See Figure A.

Region 4 National Forests contain:

• 31,759,620 acres of land
• 22,469,720 acres of land open to snowmobiles
• 3,779,999 acres of non-wilderness land closed to snowmobiles
• 5,750,811 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Region 4 National Forests contain:

• 839 miles of ski trails
• 3,363 miles of snowmobile trails

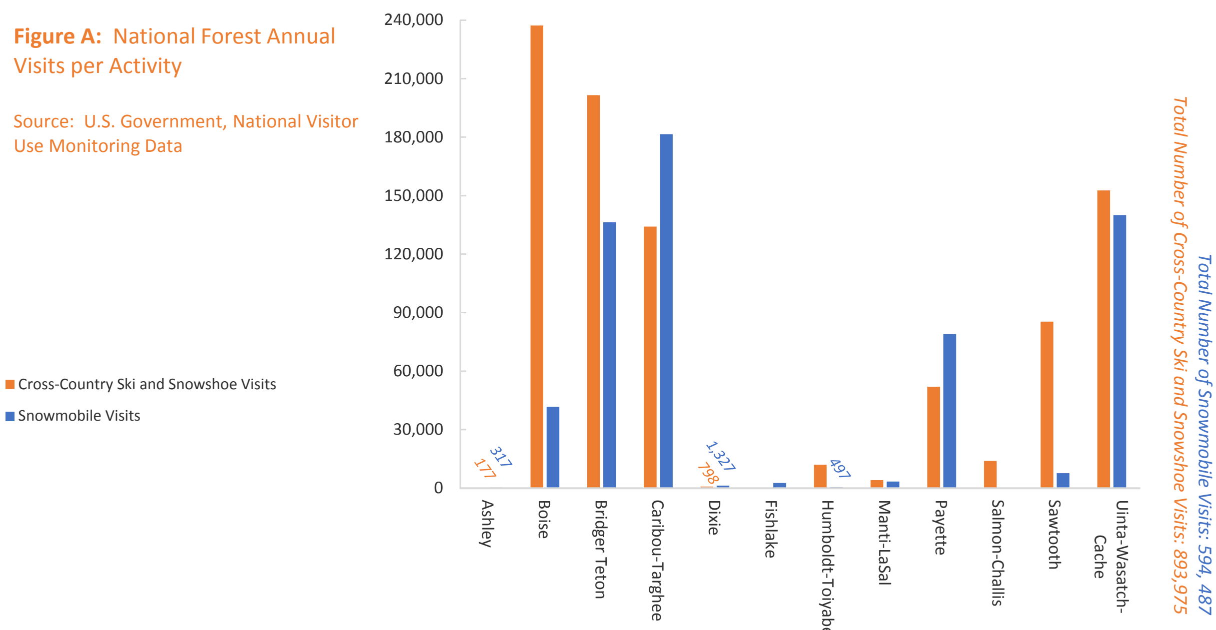
See Figure C.

Overall, National Forests in the Intermountain Region see approximately 1.5 times as many cross-country ski and snowshoe visits as snowmobile visits yet there are almost 2.5 times the number of acres available for over-snow vehicle travel than are closed to motorized use in the winter, over half of which is designated Wilderness. When Wilderness is excluded this difference jumps up to almost six times the number of motorized versus non-motorized acres across Region 4.

Non-motorized winter visits (cross-country skiing, backcountry skiing and snowshoeing) outnumber snowmobile visits on the majority of forests in Region 4. Snowmobile visits outnumber cross-country ski and snowshoe visits on the Ashley, Caribou-Targhee, Dixie, and Payette National Forests. With the exception of the Payette, there are far more acres available for motorized use than are designated non-motorized on these forests. When designated Wilderness is excluded motorized acres far outnumber non-motorized acres across these forests just as with every other forest in Region 4.

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data



Although there are almost six times more cross-country ski and snowshoe visits than snowmobile visits on the Boise National Forest, only one fifth of the forest is designated non-motorized. There are 11 times more cross-country ski and snowshoe visits than snowmobile visits to the Sawtooth National Forest but only a quarter of the forest is designated as non-motorized. Cross-country ski and snowshoe visits outnumber snowmobile visits on the Manti-La Sal as well, yet only one seventh of this forest is designated as non-motorized.

Most forests in Region 4 manage OSVs through a combination of special orders and Forest Plans. In some cases forests have developed winter travel management plans for certain areas of the forest where OSV recreation conflicts with other types of recreation or management objectives. For example, the Sawtooth National Forest developed a winter travel plan for the Wood River Valley in order to reduce conflict between motorized and non-motorized users. This travel plan is implemented through a special order. Similarly, the Bridger-Teton National Forest developed a winter travel management plan for the northern portion of the forest in order to reduce OSV impacts on wildlife. Both of these travel plans are over a decade old. Only one forest in Region 4 has a winter plan done under the Travel Management Rule and it does not cover the entire forest. The 2005 Caribou Travel Plan encompassed winter use but does not include the Targhee portion of the Caribou-Targhee National Forest.

Figure B: National Forest Acres Open and Closed to Snowmobiles

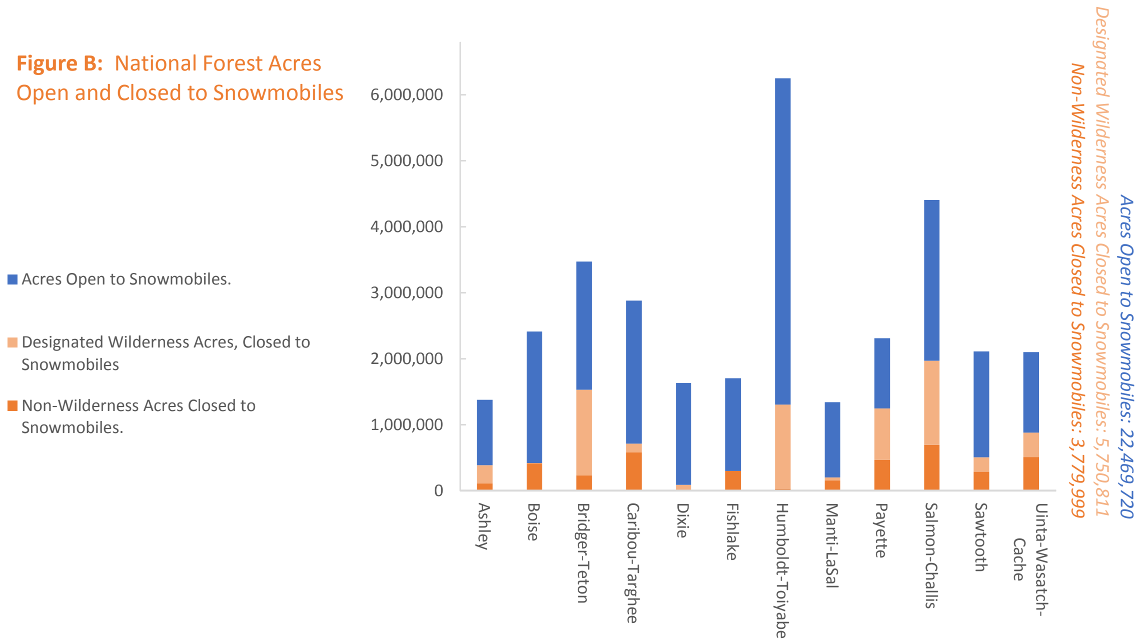
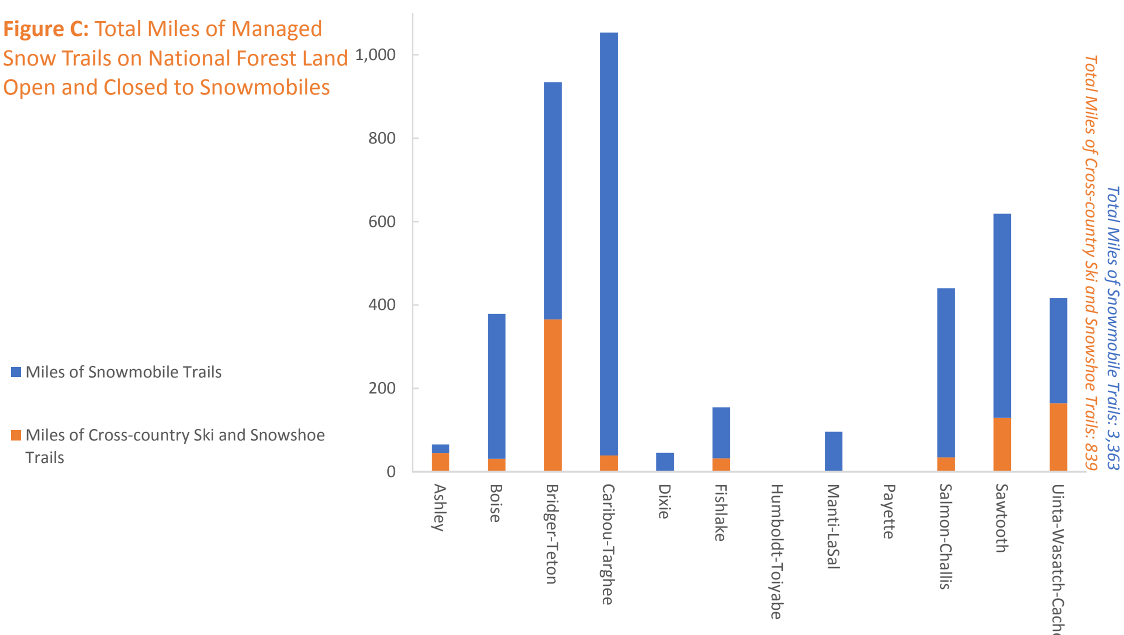


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 5 forests show there are an estimated:

- 1,170,761 cross-country ski and snowshoe visits annually
- 488,783 snowmobile visits annually

See Figure A.

Region 5 National Forests contain:

- 14,571,103 acres of land
- 10,519,174 acres of land open to snowmobiles
- 525,440 acres of non-wilderness land closed to snowmobiles
- 3,216,652 acres of designated Wilderness land, also closed to snowmobiles

See Figure B

Region 5 National Forests contain:

- 334 miles of ski trails
- 1,391 miles of snowmobile trails

See Figure C.

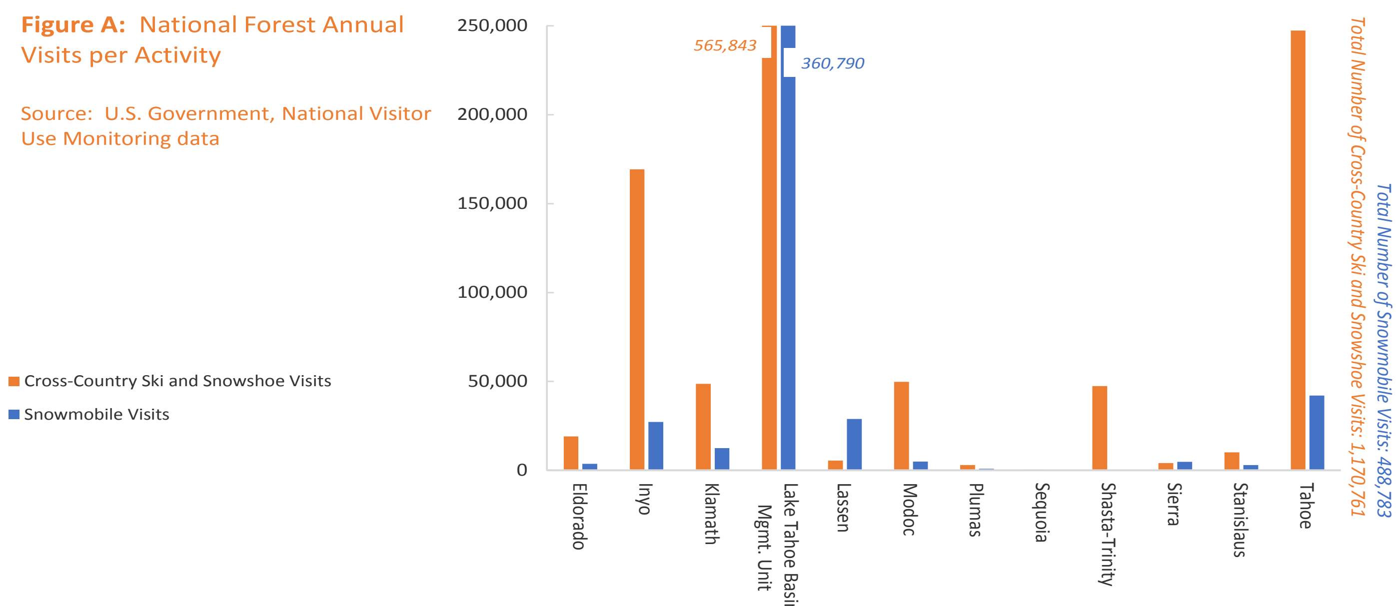
Forests in the Pacific Southwest Region receive approximately 1.2 million cross-country ski and snowshoe visits annually, 2.4 times the number of snowmobile visits. In contrast, there is almost three times the amount of land open to snowmobiles as there is designated for non-motorized use. On three forests – the Klamath, Modoc, and Shasta-Trinity – the only lands that are off-limits to snowmobiles are those within designated Wilderness.

The Klamath National Forest receives approximately 4 times more cross-country ski and snowshoe visits than snowmobile visits and the Modoc receives 10 times more cross-country ski and snowshoe visits. The Shasta-Trinity National Forest did not record any snowmobile visits during the most recent NVUM survey period but did record approximately 47,000 cross-country ski or snowshoe visits. These three forests coordinate snowmobile management through the TriForest Snowmobile Trail System but there is no such program for non-motorized winter recreationists. The TriForest Snowmobile Trails are open to skiers and snowshoers as well but, with the exception of 14 miles of ski trails on the Klamath, there are not any winter trails on these forests where non-motorized users can distance themselves from OSVs.

The Inyo National Forest receives approximately five times more cross-country ski and snowshoe visits than snowmobile visits. While the number of acres open to OSVs versus designated non-motorized are approximately equal, there are over six times more winter trails managed for motorized recreation. In 2005 the Mammoth Lakes Region of the Inyo surveyed visitors to better understand what is important to winter recreationists in the Mammoth area. The survey found that the most common activity pursued by winter recreationists was cross-country or backcountry skiing. Snowmobiling was the third most common activity. Of those surveyed, cross-country skiers were the most

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring data



dissatisfied, with over 20% reporting their experience was below their expectations.[58] In comparison, snowmobilers were the second most satisfied, with over 90% of participants stating that their expectations were met or exceeded.[59]

OSV activity on the Sierra National Forest is guided by the 1991 Land and Resource Management Plan and the 1977 Sierra OHV Plan. Under these documents, approximately 58% of the Sierra National Forest is open to snowmobiles. However, the Forest Service estimates that only 5% of the Sierra National Forest is actually available for OSV recreation in a given winter because there is generally no snow below 7,000 feet.

Five of the forests in Region 5 have taken the lead in implementing the OSV Rule. The Lassen, Tahoe, Eldorado, Stanislaus, and Plumas National Forests began winter travel management planning in early 2015. Each of these forests will go through a public process to identify routes and areas for OSV use. Once these routes and areas are identified and published on a map OSV activity outside of these designated locations will be prohibited. Snowmobilers, skiers, and others interested in how these forests are managed in winter have written comments, attended meetings, and otherwise been involved in the creation of these travel plans which are expected to be completed in 2017.

Figure B: National Forest Acres Open and Closed to Snowmobiles

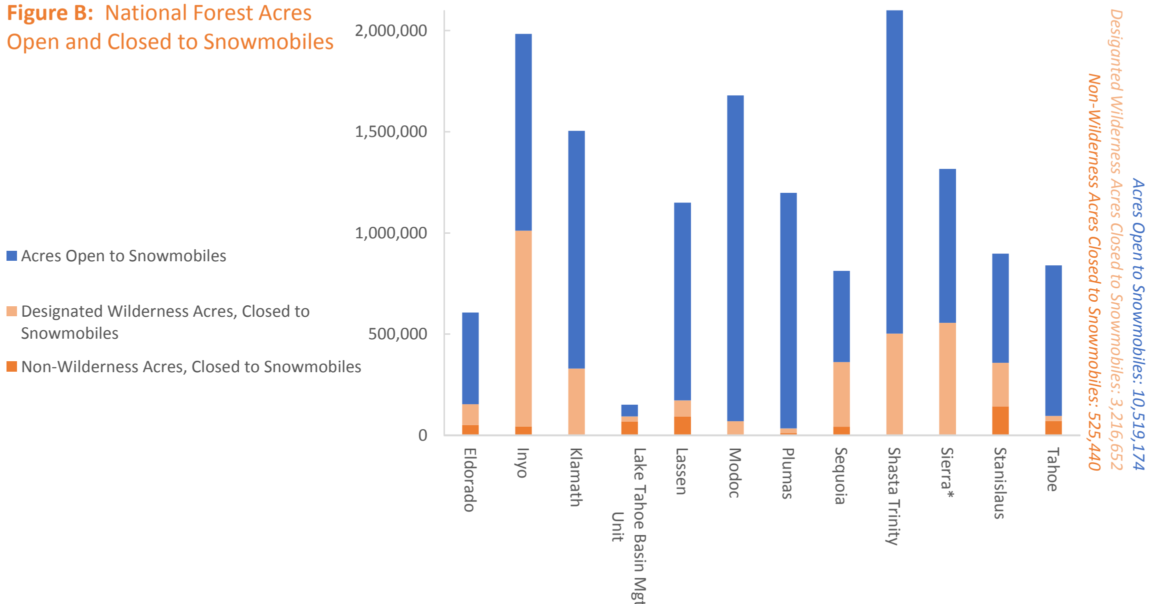
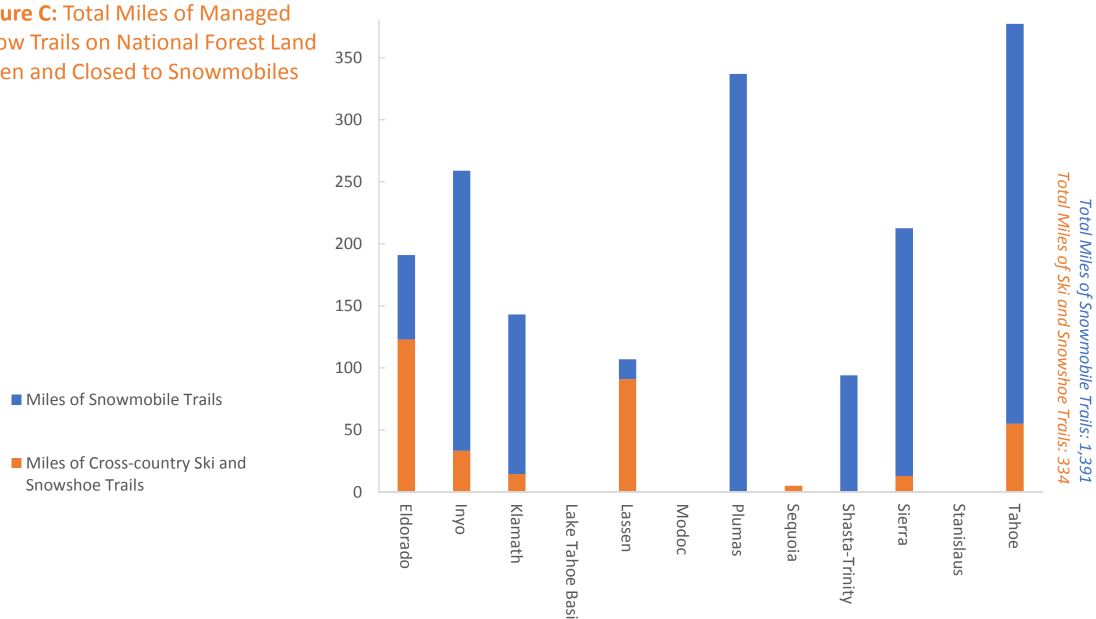


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 6 forests show there are an estimated:

- 830,639 cross-country ski and snowshoe visits annually
- 243,286 snowmobile visits annually

See Figure A.

Region 6 National Forests contain:

- 23,764,614 acres of land
- 14,354,742 acres of land open to snowmobiles
- 4,531,285 acres of non-wilderness land closed to snowmobiles
- 4,909,037 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Please note that acreage figures for Region 6 are approximate. Several forests in this Region were unable to provide concrete numbers to help answer the question of how many acres are open or closed to OSVs. As a result, this report relies on Forest Plan management areas and Recreation Opportunity Spectrum designations to arrive at a general idea of how many acres on a particular forest are open or closed to OSVs.

Region 6 National Forests contain:

- 1,223 miles of ski trails
- 5,157 miles of snowmobile trails

See Figure C.

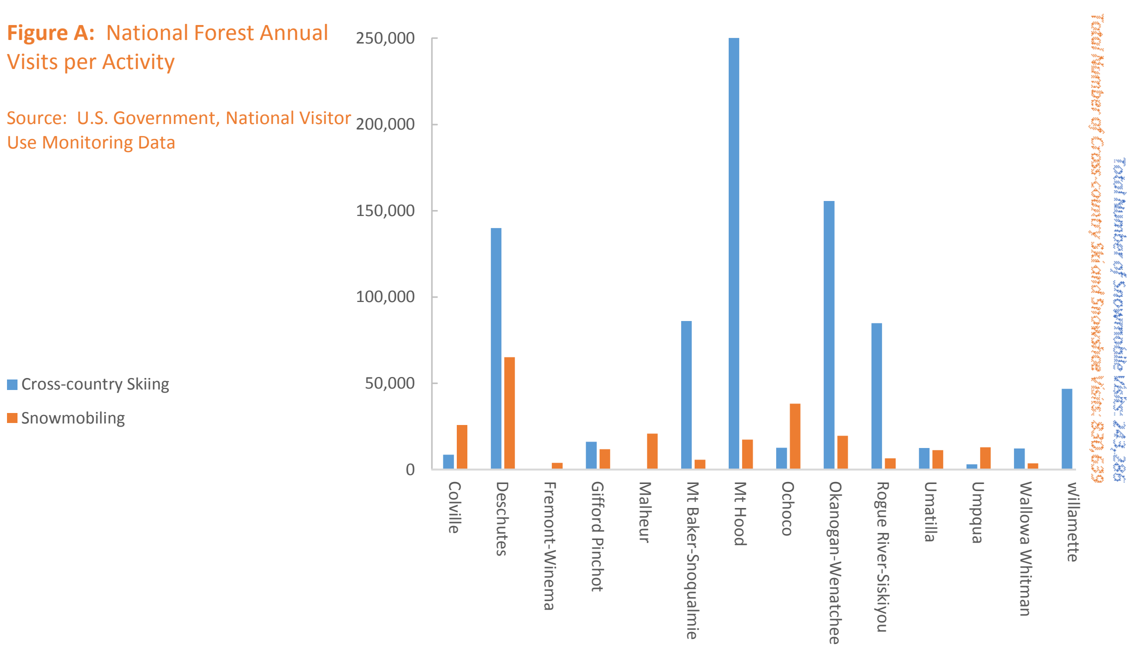
National Forests across the Pacific Northwest Region manage OSVs through motor vehicle designations made during forest planning and special orders that protect sensitive watersheds, wildlife habitat, or, occasionally, to reduce conflict between user groups. Overall, 60% of Region 6 is open to cross-country snowmobile travel and 76% of snow trail miles in Region 6 are open to motorized recreation.

On the Colville National Forest, where the 1988 Forest Plan is the only document dictating OSV management, 66% of the forest is open to cross-country snowmobile travel. On this forest snowmobile visits outnumber cross-country ski or snowshoe visits 3:1.

There are approximately twice as many cross-country ski and snowshoe visits annually to the Deschutes National Forest as there are snowmobile visits. Despite this, 74% of the forest is open to cross-country snowmobile travel and 80% of the trails are managed for motorized or shared use. In the early 2000's, the Deschutes National Forest underwent a winter recreation suitability analysis to assess how best to provide quality winter

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data

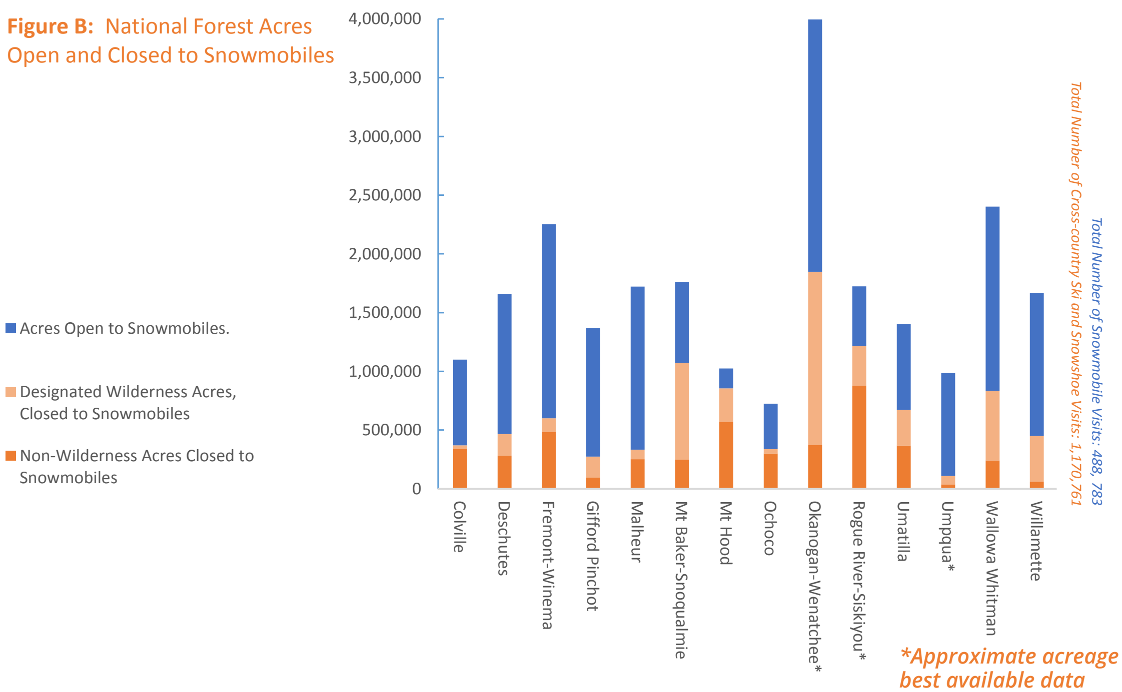


recreation opportunities and protect natural resources. This analysis pointed towards a need for backcountry zoning, increased educational efforts, and improvements to trail and parking facilities, among other recommendations. However, little has been done to date to implement the recommendations from this report.[60]

The Mount Hood National Forest is a major destination for winter recreationists and 94% of the 264,000 cross-country ski, snowshoe, and snowmobile visits to this forest are by human-powered recreationists. However, the forest does not have an official management plan for over-snow vehicle travel or winter recreation. The 1999 Travel and Access Management Guide is the closest thing to a management plan for motorized use on this forest. However, this document was intended for analysis purposes only and provides goals, objectives, strategies, processes, guidelines and general direction to manage forest routes. It is not a decision document and offers no site-specific recommendations.

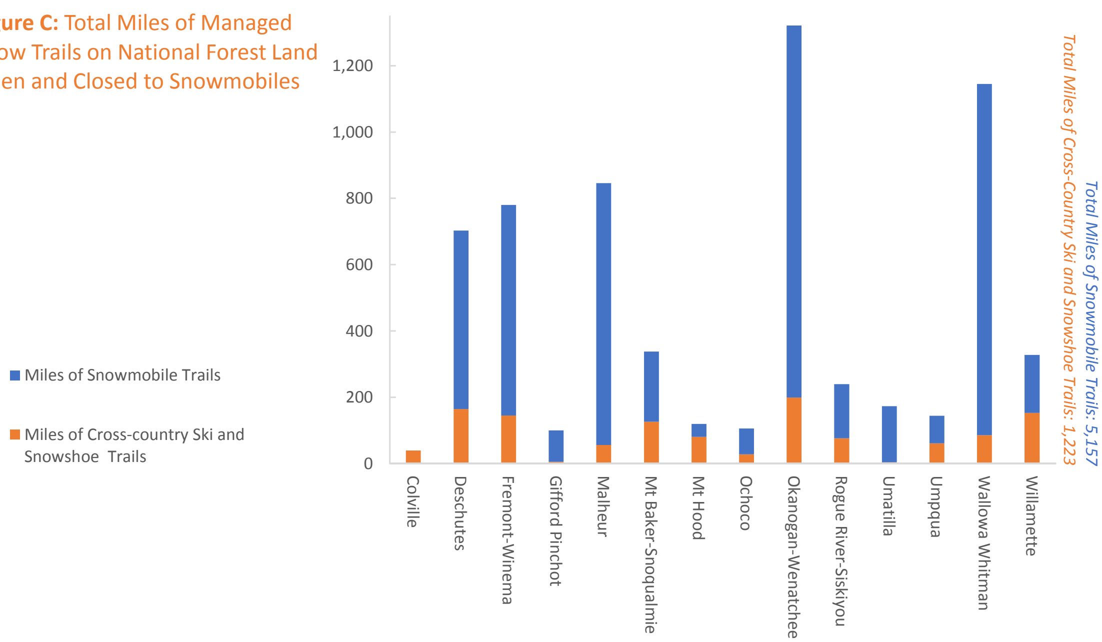
These three forests are examples of how OSVs are managed across Region 6. Of the Regions analyzed in this report Region 6 proved to be the most difficult insofar as calculating acres open and closed to snowmobiles. This was because, Region-wide, there are no recent management plans for winter motorized recreation or decision documents outlining where snowmobiles are and are not allowed to travel. Given that a significant percentage of Oregonians and Washingtonians participate in winter recreation[61] it is time for the National Forests in the Pacific Northwest to undergo comprehensive winter travel planning.

Figure B: National Forest Acres Open and Closed to Snowmobiles



**Approximate acreage calculated using best available data*

Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 9 forests show there are an estimated:

- 934,964 cross-country ski and snowshoe visits annually
- 969,098 snowmobile visits annually

See Figure A.

Region 9 National Forests contain:

- 9,904,649 of land
- 4,116,444 acres of land open to snowmobiles
- 4,170,030 acres of non-wilderness land closed to snowmobiles
- 1,615,577 acres of designated Wilderness land, also closed to snowmobiles

See Figure B.

Region 9 National Forests contain:

- 1,342 miles of ski trails
- 4,087 miles of snowmobile trails

See Figure C.

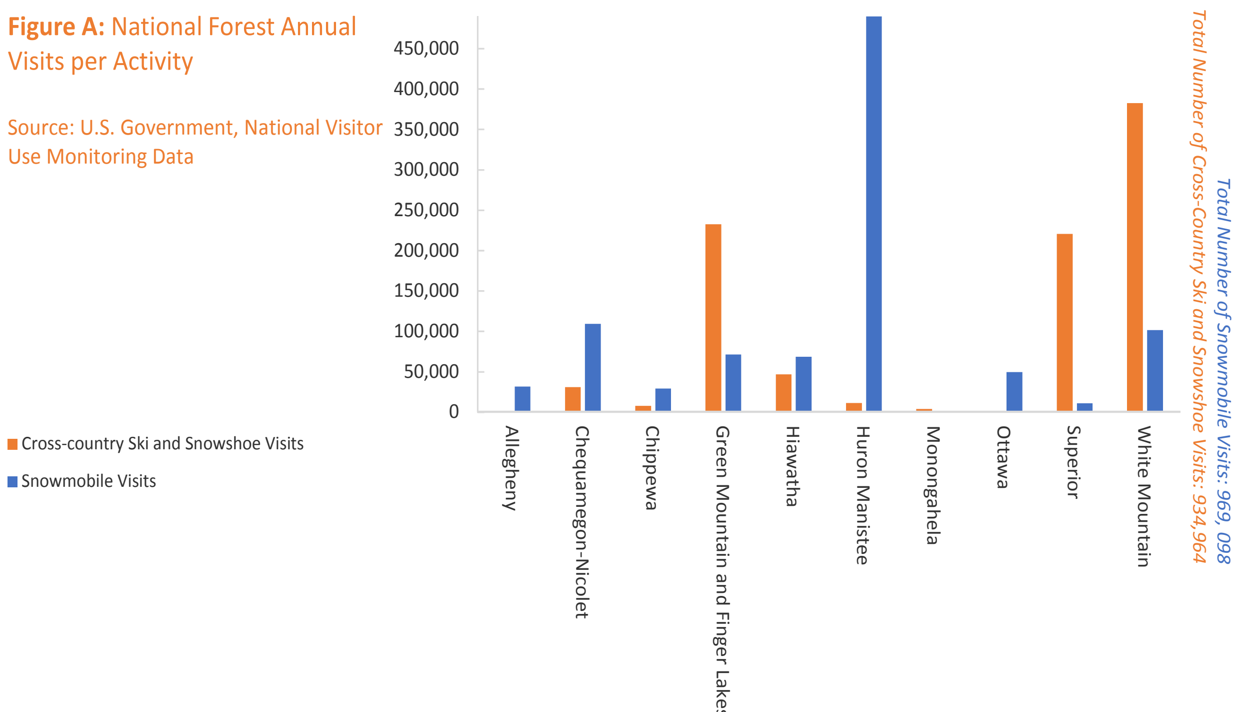
There are slightly more snowmobile visits to Region 9 overall than cross-country ski or snowshoe visits, making it the only Region in the country where NVUM surveys show more snowmobile visits to National Forests than cross-country ski or snowshoe visits. However, ski and snowshoe visits are more common on the Green Mountain and Finger Lakes, Monongahela, Superior, and White Mountain National Forests.

The Eastern Region is unique because most of the National Forests in this Region restrict snowmobiles to designated routes. Therefore, while at first glance it may appear that snowmobile travel is extremely limited in Region 9, it is important to consider how many miles of trails and roads are available for OSV use. 80%, or 4,087 miles, of the managed snow trails across all forests in the Eastern Region are open to snowmobiles.

Snowmobiles are restricted to designated routes on the Alleghany, Chequamegon-Nicolet, Chippewa, Green Mountain and Finger Lakes, Huron Manistee, Monongahela, Superior, and White Mountain National Forests. There are over 4,000 miles of designated snowmobile trails on Forest Service lands in the Eastern Region. In most cases National Forest snowmobile trails are connected to trail systems on state and private lands as well, further increasing opportunities for snowmobiling. For

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data



example, there are 62,000 miles of interconnected snowmobile trails stretching across the state of Michigan.[62] Well over half of the winter trail miles on every forest in Region 9 are open to or designated for snowmobile travel.

Cross-country snowmobile use is generally permitted on the Hiawatha and Ottawa National Forests. 94% of the Hiawatha is open to cross-country snowmobiling and 85% of winter trail miles are motorized. 40% of winter recreation visits (cross-country skiing, snowshoeing, or snowmobiling) to the Hiawatha National Forest are cross-country skiers or snowshoers yet there are very few areas on this forest where skiers and snowshoers can be guaranteed a non-motorized experience.

95% of winter recreation visits to the Superior National Forest are cross-country skiers or snowshoers yet there are 35 times more non-wilderness acres open to snowmobiles than there are designated as non-motorized on the Superior. The White Mountain National Forest sees almost 4 times as many ski and snowshoe visits as it does snowmobile visits yet 79% of the winter trail miles on this forest are motorized.

Figure B: National Forest Acres Open and Closed to Snowmobiles

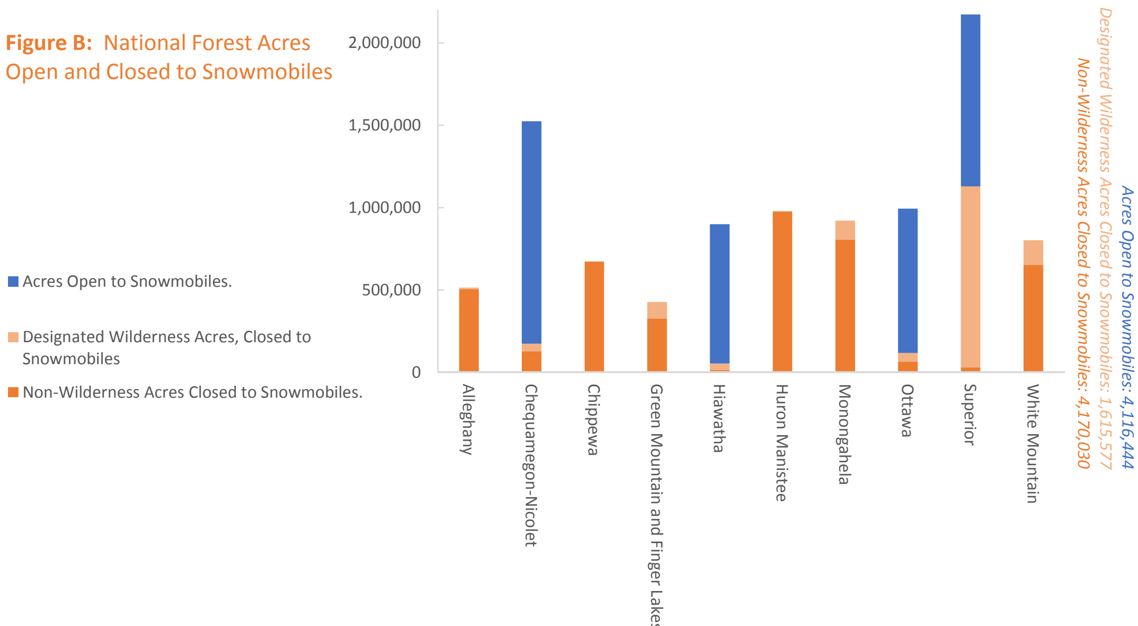
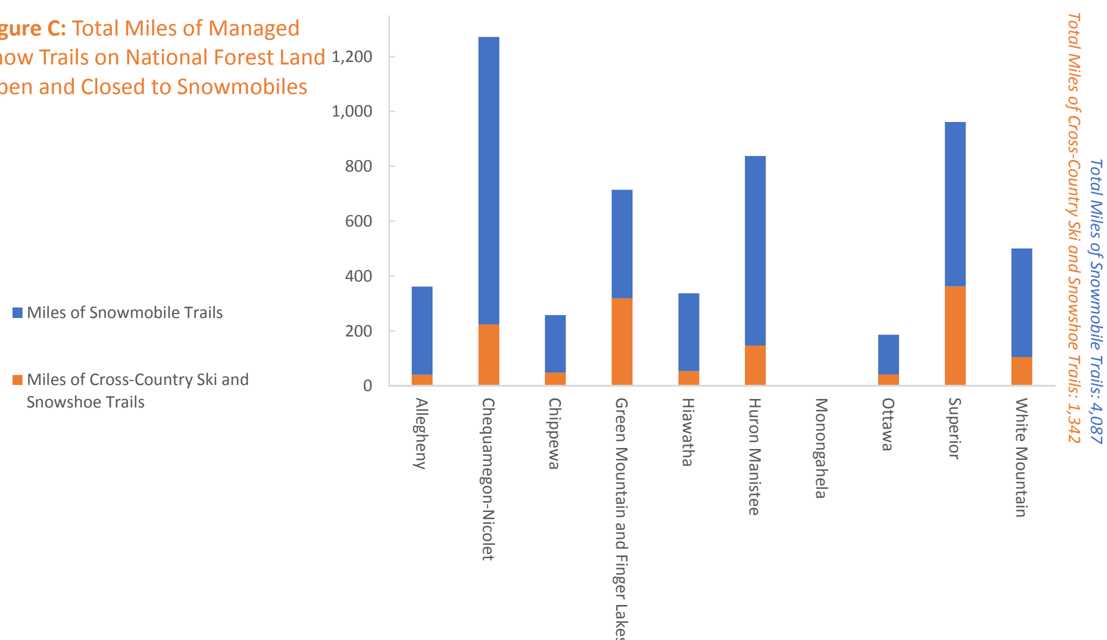


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



The NVUM surveys for Region 10 forests show there are an estimated:

- 33,261 cross-country ski and snowshoe visits annually
- 1,960 snowmobile visits annually

See Figure A.

Region 10 National Forests contain:

- 40,236,879 acres of land
- 8,574,599 acres of land open to recreational snowmobile use
- 6,954,788 acres of non-wilderness land closed to recreational snowmobile use
- 6,924,421 acres of designated Wilderness land, also closed to recreational snowmobile use

See Figure B.

Region 10 National Forests contain:

- 91 miles of ski trails
- 98 miles of snowmobile trails

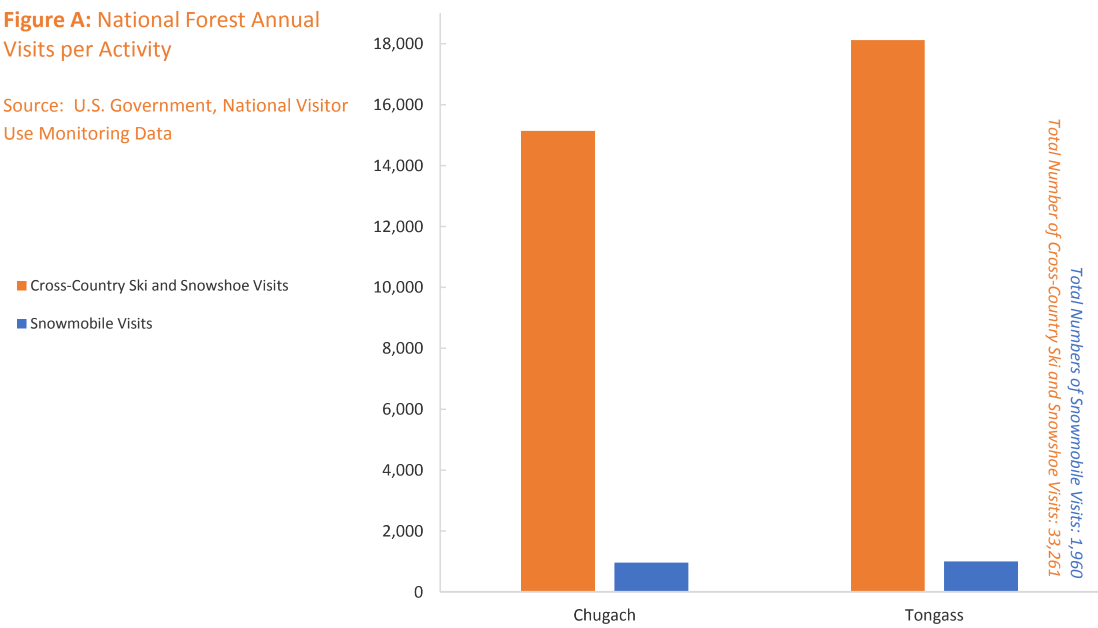
See Figure C.

Section 811 of the Alaska National Interest Lands Conservation Act (ANICLA) allows rural residents engaged in subsistence uses to use snowmobiles to access subsistence resources on public lands regardless of other laws. Likewise, section 1110 of ANICLA allows for the use of snowmobiles on conservation system units, National Recreation Areas, National Conservation Areas, and Wilderness Study Areas for traditional activities (where such activities are permitted) and for travel to and from villages and homesites. Section 1110 allows for snowmobile use across 5.8 million acres of conservation system units on the Tongass National Forest.

Notwithstanding the exceptions permitted because of ANICLA, this report focuses on where recreational snowmobile activity is and is not allowed in Region 10.

Figure A: National Forest Annual Visits per Activity

Source: U.S. Government, National Visitor Use Monitoring Data



The Chugach National Forest manages OSVs through its Forest Plan, amended to include the Kenai Winter Access Plan. The Kenai Winter Access Plan zones the Seward Ranger District into non-motorized and motorized areas. Because there are some areas on the Kenai that are highly valued by both skiers and snowmobilers 18% of the Kenai is managed under a Season A/ Season B scenario wherein certain areas are motorized one year and non-motorized the following. This type of zoning is not new to the Chugach National Forest. For many years the Forest Service has managed Turnagain Pass to reduce conflicts between skiers and snowmobilers. The pass is divided by the Seward Highway and lands south of the highway are designated for non-motorized use.[63] Overall, 72% of the Chugach is non-motorized in the winter.

On theTongass National Forest 23% of land is off-limits to recreational snowmobile use although much more of this forest is functionally off-limits to snowmobiles due to terrain, snowpack, and access. In areas of the forest that are near towns the Tongass has delineated OSV use areas. These areas are depicted on the forest Motor Vehicle Use Maps. The Forest Plan and additional forest orders are the guiding documents behind these designations.

Much of Alaska is too rugged or remote for snowmobile access, however, only 34% of the National Forest lands in Region 10 are officially closed to recreational snowmobile use. This includes designated Wilderness areas. Cross-country ski and snowshoe visits outnumber recreational snowmobile visits to the Chugach by a factor of almost 16 to 1. Likewise, cross-country ski and snowshoe visits to the Tongass outnumber recreational snowmobile visits 18 to 1.

Figure B: National Forest Acres Open and Closed to Snowmobiles

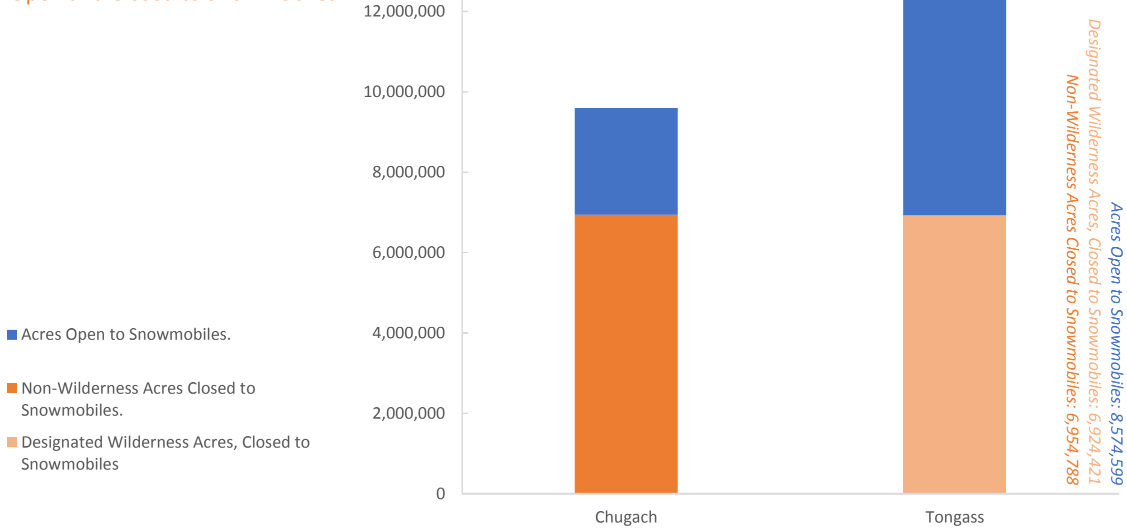
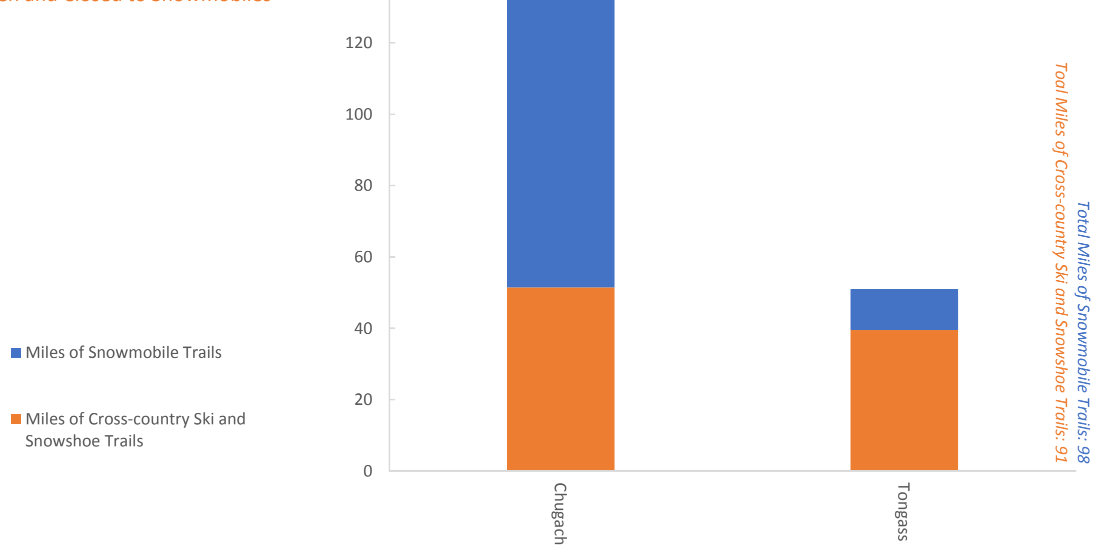


Figure C: Total Miles of Managed Snow Trails on National Forest Land Open and Closed to Snowmobiles



APPENDIX 1 - FIRST FOIA REQUEST

Winter Wildlands Alliance
PO Box 631 • Bozeman, MT 59771 • 208.336.4203
www.winterwildlands.org

(*Submitted via email*)
April 24, 2014

Region 1 FOIA Coordinator
*
Freedom of Information Act Request
Re: Winter Recreation Planning and Management

Dear *,

Pursuant to the Freedom of Information Act, 5 U.S.C. Part 552, and implementing regulations, 36 C.F.R. Part 200, Winter Wildlands Alliance, a 501(c)(3) national non-profit organization, is filing this request for information. We request the following items for all National Forests in Region 1, except the Dakota Prairie Grasslands:

1) Any and all records that summarize the length of all cross-country ski and snowshoe trails on the National Forests specified above
2) Any and all records that summarize the length of all snowmobile trails, including roads, on the National Forests specified above
3) Any and all records that summarize the length of all trails that are designated shared use for motorized and non-motorized winter recreational activities on the National Forests specified above
4) Any and all records that detail the total acreage in the National Forests specified above that is open to or available for snowmobile operation
5) Any and all records that detail the total acreage in the National Forests specified above that is closed to snowmobile operation
6) Any and all Forest Closure Orders, Travel Management Plan documentation, or other decisions and supporting documents governing the use of over-snow vehicles on the National Forests specified above
7) Any and all surveys of public use, attitudes, preferences or opinions that concern, in whole or in part, snowmobiling, cross-country skiing, backcountry skiing or snowshoeing, including summaries and drafts for the National Forests specified above. You do not need to include documentation related to National Visitor Use Monitoring surveys.
8) Any reports detailing the economic impact of winter recreation on National Forest system lands published since 2000 for the National Forests specified above
9) Electronic copies of any and all GIS files related to winter recreation trails and areas, including sno-parks, designated non-motorized areas outside Wilderness and the boundaries of any Special Use Permits if applicable (ski areas, cat ski, etc.) for the National Forests specified above

We respectfully request electronic copies of this information to the extent possible.

If you determine that any of the requested materials are exempt from disclosure, please separate the exempt portions from the non-exempt portions and provide us with copies of the non-exempt portions. For any exempt portions, please include a specific description of the record and the reasons, defined in the terms of the Freedom of Information Act, for which the record is deemed exempt from disclosure. Winter Wildlands Alliance (WWA) reserves the right to appeal a decision to withhold any records.

To our knowledge, the above-requested information is not available from any other federal, state, or other public agency required to provide the information. Furthermore, the release of the information will not provide WWA, its affiliates, and any other individual, group, or organization with any financial benefits.

Winter Wildlands Alliance is a national, non-profit, human-powered winter recreation and wildlands advocacy organization. Spanning the nation, WWA is affiliated with local, state, and national recreation and conservation organizations, including 34 grassroots groups in 10 states. WWA and its partners, who represent cross-country skiers and snowshoers, focus primarily on public land management and winter recreation opportunities.

Currently, WWA is working with grassroots groups in 12 states, including Alaska, California, Colorado, Idaho, Minnesota, Montana, Nevada, Oregon, Utah, Vermont, Washington and Wyoming. The information contained within this FOIA request will benefit these groups, their members, and other public partners by educating them about USFS management practices, specifically how the needs of recreational user groups are addressed through current trail designation and funding. In addition to these groups, WWA will make all requested information available to the general public, its members, and other recreation and conservation groups, who will all benefit as they pursue winter recreation opportunities on our national forests.

Winter Wildlands Alliance makes information concerning USFS management practices available to all interested parties through public meetings, electronic and printed action alerts, newsletters, press releases, magazine articles, phone calls, and other means. The requested information will also assist WWA in responding to opportunities for public comment on proposed actions concerning winter recreation planning on national forest lands, in addition to allowing WWA to assist others in the preparation of such comments. The requested information will better educate the public, allowing them to be more active participants in Forest Service forums on winter recreation planning and management. Many opportunities are presently available for such involvement, as many Forest Plans are or soon will be in the process of revision.

For reasons of public interest and education, WWA requests that you grant a waiver of fees pursuant to 5 U.S.C. Part 522 (a)(4)(A) and 43 C.F.R. Part and Section 2.21. We expect that such a waiver will be granted. However, if a waiver is not granted, please inform WWA immediately of the price of disclosing the above-described records if such fees exceed $15.00.

We respectfully request that you will respond to our FOIA request within 20 working days. Please feel free to call me at (208) 629-1986 or email me at heisen@winterwildlands.org if you have any questions. Thank you for your immediate attention to this matter.

Sincerely,

*

Recreation Planning Coordinator

Winter Wildlands Alliance
PO Box 631 • Bozeman, MT 59771 • 208.336.4203
www.winterwildlands.org

(*Submitted via email*)
December 1, 2014

National Program Manager, Trails & Congressionally Designated Areas
USDA Forest Service

Freedom of Information Act Request
Re: Winter Recreation Planning and Management

Dear *,

Pursuant to the Freedom of Information Act, 5 U.S.C. Part 552, and implementing regulations, 36 C.F.R. Part 200, Winter Wildlands Alliance, a 501(c)(3) national non-profit organization, is filing this request for information. We request the following items for all National Forests in Region 1, except the Dakota Prairie Grasslands; all National Forests in Region 2, except the Nebraska National Forest; the Carson, Cibola, Coconino, Coronado, Kaibab, Lincoln, and Santa Fe National Forests in Region 3; all National Forests in Region 4; the Eldorado, Inyo, Klamath, Lassen, Modoc, Plumas, Sequoia, Shasta-Trinity, Sierra, Stanislaus, and Tahoe National Forests as well as the Lake Tahoe Basin Management Area in Region 5; all National Forests in Region 6; the Alleghany, Hiawatha, Huron-Manistee, Ottawa, Chippewa, Superior, White Mountain, Green Mountain/Finger Lakes, Chequamegon-Nicolet, and Monongahela National Forests in Region 9; and all National Forests in Region 10:

1) Total existing NFST miles with Managed Use of cross-country ski and total existing NFST miles with Managed Use of snowshoe (as recorded in the current, FY14, INFRA database).

2) Total existing NFST miles with Managed Use of snowmobile (as recorded in the current, FY14, INFRA database).

In addition, we request the following items for the Alleghany National Forest:

1) Any and all records that detail the total acreage in the National Forests specified above that is open to or available for snowmobile operation. Specifically, we are requesting total NFS designated areas, in acres, open to motorized over-snow vehicle use such as cross country travel, play areas, etc. Do not include linear features such as trails, trail mileage or associated acres for National Forest System trails.

2) Any and all records that detail the total acreage in the National Forests specified above that is closed to snowmobile operation. Specifically, we are requesting total NFS designated areas, in acres, specifically closed to motorized over-snow vehicle use such as cross country travel, play areas, etc. Do not include linear features such as trails, trail mileage or associated acres for National Forest System trails. Include wilderness acres that are closed to over-snow vehicle use.

3) Any and all Forest Closure Orders, Travel Management Plan documentation, or other decisions and supporting documents governing the use of over-snow vehicles on the National Forests specified above. Specifically, we are requesting all Forest Closure Orders, Travel Management Plans or other means of closure and the supporting NEPA documents and/or Forest Plans for the closure. Specify the district, forest, and region. If documentation is within a Forest Plan, state the information is within a Forest Plan and supply the forest name, plan date, and a direct link. If supporting NEPA documents are available via the internet, provide the direct link to the document.

4) Any and all surveys of public use, attitudes, preferences or opinions that concern, in whole or in part, snowmobiling, cross-country skiing, backcountry skiing or snowshoeing, including summaries and drafts for the National Forests specified above. You do not need to include documentation related to National Visitor Use Monitoring surveys.

5) Any reports detailing the economic impact of winter recreation on National Forest system lands published since 2000 for the National Forests specified above

6) Electronic copies of any and all GIS files related to winter recreation trails and areas, including sno-parks, designated non-motorized areas outside Wilderness and the boundaries of any Special Use Permits if applicable (ski areas, cat ski, etc.) for the National Forests specified above

Finally, we request the following in regards to forests in Region 6:

1) Okanogan-Wenatchee

We request any and all GIS files that depict motorized vehicle restrictions and were used to create the 2005 Methow Valley and Tonasket Ranger District travel plan maps.

2) Willamette

We request electronic copies of any and all GIS files related to winter recreation trails and areas, including sno-parks, designated non-motorized areas outside Wilderness and the boundaries of any Special Use Permits if applicable (ski areas, cat ski, etc.).

We request the Motorized Access and Travel Management Plans prepared for each Ranger District as per the 1990 Forest Plan unless these documents have been superseded by other Forest Orders or other management guidelines pertaining to OSVs.

We request any and all Travel Management Area shapefiles that reflect Forest Plan Management Areas (or similar) for the Willamette National Forest.

We respectfully request electronic copies of this information to the extent possible.

If you determine that any of the requested materials are exempt from disclosure, please separate the exempt portions from the non-exempt portions and provide us with copies of the non-exempt portions. For any exempt portions, please include a specific description of the record and the reasons, defined in the terms of the Freedom of Information Act, for which the record is deemed exempt from disclosure. Winter Wildlands Alliance (WWA) reserves the right to appeal a decision to withhold any records.

To our knowledge, the above-requested information is not available from any other federal, state, or other public agency required to provide the information. Furthermore, the release of the information will not provide WWA, its affiliates, and any other individual, group, or organization with any financial benefits.

Winter Wildlands Alliance is a national, non-profit, human-powered winter recreation and wildlands advocacy organization. Spanning the nation, WWA is affiliated with local, state, and national recreation and conservation organizations, including 34 grassroots groups in 10 states. WWA and its partners, who represent cross-country skiers and snowshoers, focus primarily on public land management and winter recreation opportunities.

Currently, WWA is working with grassroots groups in 11 states, including Alaska, California, Colorado, Idaho, Minnesota, Montana, Nevada, New Mexico Oregon, Utah, Vermont, Washington and Wyoming. The information contained within this FOIA request will benefit these groups, their members, and other public partners by educating them about

USFS management practices, specifically how the needs of recreational user groups are addressed through current trail designation and funding. In addition to these groups, WWA will make all requested information available to the general public, its members, and other recreation and conservation groups, who will all benefit as they pursue winter recreation opportunities on our national forests.

Winter Wildlands Alliance makes information concerning USFS management practices available to all interested parties through public meetings, electronic and printed action alerts, newsletters, press releases, magazine articles, phone calls, and other means. The requested information will also assist WWA in responding to opportunities for public comment on proposed actions concerning winter recreation planning on national forest lands, in addition to allowing WWA to assist others in the preparation of such comments. The requested information will better educate the public, allowing them to be more active participants in Forest Service forums on winter recreation planning and management. Many opportunities are presently available for such involvement, as many Forest Plans are or soon will be in the process of revision.

For reasons of public interest and education, WWA requests that you grant a waiver of fees pursuant to 5 U.S.C. Part 522 (a)(4)(A) and 43 C.F.R. Part and Section 2.21. We expect that such a waiver will be granted. However, if a waiver is not granted, please inform WWA immediately of the price of disclosing the above-described records if such fees exceed $15.00.

We respectfully request that you will respond to our FOIA request within 20 working days. Please feel free to call me at (208) 629-1986 or email me at heisen@winterwildlands.org if you have any questions. Thank you for your immediate attention to this matter.

Sincerely,

*

Recreation Planning Coordinator

APPENDIX C. TABLE OF ALL FORESTS

Region	State	Forest	Annual Cross-country Ski and Snowshoe visits	Annual Snowmobile Visits
Northern (1)	Idaho	Idaho Panhandle	8,133	70,562
	Idaho	Nez Perce-Clearwater	14,802	17,045
	Montana	Beaverhead-Deerlodge	70,863	9,860
	Montana	Bitterroot	2,672	863
	Montana	Custer-Gallatin	282,961	252,496
	Montana	Flathead	15,524	26,275
	Montana	Helena	49,105	30,033
	Montana	Kootenai	32,882	1,079
	Montana	Lewis and Clark	7,079	1,479
	Montana	Lolo	194,310	96,832
(R1) Total			**678,332**	**506,524**
Rocky Mountain (2)	Colorado	Arapaho-Roosevelt	593,937	495,386
	Colorado	Grand Mesa, Uncompahgre, & Gunnison	295,730	236,025
	Colorado	Pike-San Isabel	45,445	646
	Colorado	Rio Grande	40,683	23,662
	Colorado	San Juan	10,778	2,624
	Colorado	White River	735,699	82,223
	Colorado & Wyoming	Medicine Bow-Routt	373,044	113,158
	South Dakota	Black Hills	56,101	86,712
	Wyoming	Bighorn	27,925	38,144
	Wyoming	Shoshone	19,260	92,088
(R2) Total			**2,198,604**	**1,170,669**
Southwestern (3)	Arizona	Cibola	11,367	0
	Arizona	Coconino	35,039	950
	Arizona	Coronado	0	0
	Arizona	Kaibab	38	791
	New Mexico	Carson	73,782	36,377
	New Mexico	Lincoln	1,257	718
	New Mexico	Santa Fe	130,229	42
(R3) Total			**251,712**	**38,878**
Intermountain (4)	Idaho	Boise	237,220	41,747
	Idaho	Caribou-Targhee	134,172	181,530
	Idaho	Payette	51,954	79,016
	Idaho	Salmon-Challis	13,918	0
	Idaho	Sawtooth	85,387	7,735
	Nevada	Humboldt-Toiyabe	12,034	467
	Utah	Ashley	177	317
	Utah	Dixie	799	1,328
	Utah	Fishlake	0	2,638
	Utah	Manti-LaSal	4,104	3,418
	Utah	Uinta-Wasatch-Cache	152,629	139,980
	Wyoming	Bridger-Teton	201,581	136,311
(R4) Total			**893,975**	**594,487**

Total Acres	Acres Open to Snowmobiles	Acres of Non-Wilderness, Closed to Snowmobiles	Acres of Designated Wilderness, Closed to Snowmobiles	Miles of Cross-Country Ski and Snowshoe Trails	Miles of Snowmobile Trails
2,498,020	2,047,586	440,568	9,866	47	1,392
3,935,460	2,729,835	66,382	1,139,243	79	761
3,392,010	2,023,011	1,115,517	221,518	102	544
1,594,580	543,840	300,397	750,343	0	10
3,039,170	1,308,346	583,476	1,051,301	111	243
2,411,910	717,901	627,739	1,075,558	41	0
980,757	338,130	483,357	112,023	23	338
2,243,330	1,961,260	188,304	93,766	46	259
1,869,610	570,200	906,696	386,197	0	0
2,183,450	1,540,803	494,585	148,062	25	554
24,148,297	**13,780,911**	**5,207,020**	**4,987,877**	**475**	**4,100**
1,596,970	1,251,297	19,252	326,421	114	144
2,965,960	2,349,684	60,934	553,680	706	744
163,039	1,631,237	163,039	445,339	82	59
1,837,770	1,429,477	14,784	392,407	18	22
1,864,290	798,599	640,170	424,281	47	173
2,287,150	682,429	853,315	750,947	101	296
2,892,400	1,627,216	380,959	331,247	216	412
1,250,960	672,399	560,889	13,548	24	0
1,105,090	812,113	100,935	191,911	40	336
2,439,340	544,558	528,291	1,365,643	25	200
18,402,969	**11,799,009**	**3,322,569**	**4,795,424**	**1,374**	**2,387**
1,879,340	1,719,621	21,586	138,133	10	7
1,852,300	1,649,664	45,982	156,654	16	0
1,718,950	0	1,380,466	338,484	0	0
1,561,270	1,446,379	0	114,891	8	0
1,490,110	1,344,953	15,753	129,404	20	0
1,095,470	991,153	20,912	83,405	3	0
1,545,990	1,259,619	0	286,371	11	0
11,143,430	**8,411,389**	**1,484,699**	**1,247,342**	**67**	**7**
2,203,710	1,996,133	416,719	249	31	348
2,898,500	2,167,359	579,096	134,566	39	1,015
2,309,420	1,063,092	465,122	781,206	0	0
4,353,900	2,437,931	693,941	1,273,428	34	405
2,110,410	1,604,899	287,810	217,701	129	490
6,251,680	4,948,373	30,000	1,273,307	0	0
1,378,350	994,196	110,000	274,154	45	21
1,631,930	1,544,929	1,378	85,623	0	45
1,704,880	1,407,178	297,702	0	32	122
1,340,370	1,139,568	154,445	46,357	0	96
2,155,920	1,223,142	511,040	367,069	164	252
3,420,550	1,942,920	232,747	1,297,151	365	569
31,759,620	**22,469,720**	**3,779,999**	**5,750,811**	**839**	**3,363**

APPENDIX C. TABLE OF ALL FORESTS, CONT.

Region	State	Forest	Annual Cross-country Ski and Snowshoe visits	Annual Snowmobile Visits
Pacific Southwest (5)	California	Eldorado	19,069	3,641
	California	Inyo	169,238	27,268
	California	Lake Tahoe Basin	565,843	360,790
	California	Lassen	5,506	28,938
	California	Modoc	49,830	4,994
	California	Plumas	3,026	905
	California	Sequoia	533	0
	California	Shasta Trinity	47,450	0
	California	Sierra *	4,141	4,750
	California	Stanislaus	10,139	2,928
	California	Tahoe	247,317	42,078
	Oregon	Klamath	48,670	12,491
(R5) Total			**1,170,761**	**488,783**
Pacific Northwest (6)	Oregon	Deschutes	139,953	65,180
	Oregon	Fremont-Winema	0	3,909
	Oregon	Gifford Pinchot	16,111	11,827
	Oregon	Malheur	0	20,906
	Oregon	Mt Hood	251,703	17,419
	Oregon	Ochoco	12,747	38,241
	Oregon	Rogue River-Siskiyou *	84,926	6,529
	Oregon	Umatilla	12,568	11,274
	Oregon	Umpqua *	3,039	12,997
	Oregon	Wallowa Whitman	12,298	3,726
	Oregon	Willamette	46,896	0
	Washington	Colville	8,619	25,870
	Washington	Mt Baker-Snoqualmie	86,100	5,768
	Washington	Okanogan-Wenatchee *	155,679	19,642
(R6) Total			**830,639**	**243,286**
Eastern (9)	Michigan	Hiawatha	46,393	68,171
	Michigan	Huron Manistee	10,855	499,329
	Michigan	Ottawa	1,041	49,355
	Michigan	Superior	220,542	10,524
	Minnesota	Chippewa	7,364	28,713
	New Hampshire	White Mountain	382,424	101,046
	Pennsylvania	Alleghany	0	31,123
	Vermont & New York	Green Mountain and Finger Lakes	232,194	71,019
	West Virginia	Monongahela	3,458	1,037
	Wisconsin	Chequamegon-Nicolet	30,693	108,779
(R9) Total			934,964	969,098
Alaska (10)	Alaska	Chugach	15,140	959
	Alaska	Tongass	18,121	1,000
(R10) Total			**33,261**	**1,960**
Overall			**6,878,106**	**4,002,135**

Total Acres	Acres Open to Snowmobiles	Acres of Non-Wilderness, Closed to Snowmobiles	Acres of Designated Wilderness, Closed to Snowmobiles	Miles of Cross-Country Ski and Snowshoe Trails	Miles of Snowmobile Trails
604,790	452,140	50,657	103,463	123	68
1,983,940	972,954	43,947	967,039	33	226
151,927	58,882	68,388	24,657	0	0
1,153,220	976,760	93,422	79,838	91	16
1,679,300	1,608,912	0	70,388	0	0
1,203,600	1,163,046	11,078	23,777	0	337
1,114,770	450,228	42,381	319,753	5	0
2,121,020	1,618,440	0	502,580	0	94
1,316,340	760,657	2,000	553,683	13	200
898,352	539,885	142,714	215,753	0	0
839,714	743,646	70,854	25,214	55	322
1,504,130	1,173,623	0	330,507	14	129
14,571,103	**10,519,174**	**525,440**	**3,216,652**	**334**	**1,391**
1,612,180	1,193,514	283,727	182,469	164	538
2,253,700	1,653,864	484,211	115,625	145	635
1,368,300	1,093,568	95,167	179,565	5	95
1,721,410	1,386,770	252,086	82,554	56	790
1,024,360	168,177	570,343	285,840	81	39
725,702	388,078	301,816	35,598	28	78
1,722,780	506,130	877,002	339,648	76	163
1,404,200	732,518	367,510	304,172	4	170
985,352	875,713	37,900	71,739	61	83
2,402,600	1,567,524	241,534	593,542	86	1,059
1,682,850	1,218,583	59,685	390,581	153	175
1,103,190	730,949	337,930	31,441	40	0
1,761,430	690,959	248,553	821,918	126	212
3,996,560	2,148,395	373,820	1,474,345	199	1,122
23,764,614	**14,354,742**	**4,531,285**	**4,909,037**	**1,223**	**5,157**
898,479	845,463	14,368	38,648	54	284
978,880	0	975,609	3,271	147	690
996,538	877,055	64,443	52,442	41	145
2,172,520	1,043,922	29,809	1,098,789	363	599
671,952	0	671,952	0	49	209
802,249	0	652,608	149,641	105	395
513,794	0	504,815	8,979	41	321
425,943	0	325,069	100,874	319	396
1,523,710	1,350,004	126,863	46,843	224	1,047
920,584	0	804,494	116,090	0	0
9,904,649	**4,116,444**	**4,170,030**	**1,615,577**	**1,342**	**4,087**
9,602,314	2,657,278	6,945,036	0	51	87
30,634,565	5,917,321	9,752	6,924,421	40	11
40,236,879	**8,574,599**	**6,954,788**	**6,924,421**	**91**	**98**
176,008,137	**97,025,989**	**29,975,829**	**33,447,141**	**5,746**	**20,590**

**Acreage figures are approximate based on best available data*

1. http://winterwildlands.org/wp-content/uploads/2014/04/Winter-Recreation-on-Western-National-Forests-WWA_2006.pdf
2. Multiple-Use and Sustained Yield Act of 1960, Public Law 86-517, 86th Congress (June 12, 1960), § 4(a)
3. Id.
4. An "Over-Snow Vehicle" is defined by the Forest Service as: "a motor vehicle that is designed for use over snow and that runs on a track and/or a ski or skis, while used over snow."
5. From: "A Brief History of Snowshoeing," at www.atlassnowshoe.com.
6. From: Lund, "A Short History of Alpine Skiing," at www.skinghistory.org/history
7. From: Dawson, "Chronology of North American Ski Mountaineering and Backcountry Skiing," WildSnow.com, at www.wildsnow.com/chronology/timeline_table.html
8. From: Lund and Masia, "A Short History of Skis," Journal of ISHA, The International Skiing history Association, Aug. 2005, at skiin ghistory.org/skishistory.html; See also: home.hia.no/~stephens/skihis.htm
9. From: Ingham, "As the Snow Flies, A History of Snowmobile Development in North America," at www.snowmobilehistory.com/index.html
10. From: International Snowmobile Manufacturers Association (ISMA), at www.snowmobile.org/facts_hist.asp
11. Id.; For photos of early machines see www.snowmobilehistory.com/page6.html.
12. See photo posted by the Snowmobile Canada website at www.snowmobile-canada.com/his3.htm
13. From: users.accesscomm.ca/rread/76spcs.JPG
14. From: The ISMA website at www.snowmobile.org/facts_hist.asp
15. From http://www.snowmobile.com/manufacturers/ski-doo/2015-snowmobiles-of-the-year-best-of-the-west-1866.html and the Ski-Doo website: http://www.ski-doo.com/Files/en-US/Models/2016/Specs/Ski-Doo_Summit_X3_specs.pdf#zoom=100
16. From: Cordell, et al., "Outdoor recreation participation trends", In: Cordell, et al., Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends, Champaign, IL., Sagamore Publishing, pp. 219-321, 1999, at www.srs.fs.usda.gov/pubs/ja/ja_cordell010.pdf
17. Id.
18. From: 1962 National Outdoor Recreation Survey at www.srs.fs.usda.gov/trends/Nsre/ORRRC/Ch3.pdf
19. Cordell, H.K. 2012. Outdoor Recreation Trends and Futures: A Technical Document Supporting the Forest Service 2010 RPA Assessment. General Technical Report SRS-150. U.S. Department of Agriculture Forest Service, Southern Research Station. Asheville, NC. 167p. http://www.treesearch.fs.fed.us/pubs/40453
20. From 2014 United States Snowmobile Registrations at http://www.snowmobile.org/stats_registrations_us.asp
21. See fn. 13.
22. See fn. 13.
23. From Cordell, H.K. 2012. Outdoor Recreation Trends and Futures: A Technical Document Supporting the Forest Service 2010 RPA Assessment. General Technical Report SRS-150. U.S. Department of Agriculture Forest Service, Southern Research Station. Asheville, NC. 167p. http://www.treesearch.fs.fed.us/pubs/40453.
24. The most recent National Visitor Use Monitoring data give an estimate of 6,878,106 cross-country ski or snowshoe visits annually and 4,002,135 annual snowmobile visits to all of the forests in this report
25. The Outdoor Foundation's 2014 Outdoor Recreation Participation Report.
26. Id.
27. From Cordell, H.K. 2012. Outdoor Recreation Trends and Futures: A Technical Document Supporting the Forest Service 2010 RPA Assessment. General Technical Report SRS-150. U.S. Department of Agriculture Forest Service, Southern Research Station. Asheville, NC. 167p.
28. See fn. 19, at p. 302.
29. Id.
30. Available in Appendix 1 and 2
31. Three forests in Region 6 – the Umpqua, Rogue River-Siskiyou, and Okanogan-Wenatchee failed to provide a full response to our FOIA request. Acreage calculations for these forests are approximate based on the information available.
32. From: Interagency Committee for Outdoor Recreation, An Assessment of Outdoor Recreation in Washington State, October, 2002, at page 43, at www.iac.wa.gov/Documents/IAC/Recreation_Trends/SCORP_Oct_2002.pdf
33. Id., at p. 48
34. Exec. Order No. 11644, 37 FR 2877, 1972 WL 19410 (Pres.)
35. For examples, see "Human Powered Snowsports Trends and Economic Impacts" at http://winterwildlands.org/wp-content/uploads/2014/09/Economic-Impact-of-Human-Powered-Snowsports.pdf, "Montana Recreational Snowmobiles Fuel-Use and Spending Patterns 2013" at http://www.snowmobileinfo.org/snowmobile-access-docs/Montana-Recreational-Snowmobiles-fuelUse-and-Spending-Patterns-2013.pdf, and the "2011-2012 Wyoming Comprehensive Snowmobile Recreation Report" at http://www.snowmobileinfo.org/snowmobile-access-docs/Wyoming-Comprehensive-Snowmobile-Recreation-Report_2012.pdf
36. "A telephone survey undertaken in 1998 for Teton County, Wyoming (Morey and Associates, Inc.) collected information on local resident winter participation and attitudes. The study found that 21% of households snowmobiled and 15% cross-country skied in Yellowstone in the winter of 1997-1998. In their usage of GTNP, 12% of residents snowmobiled, 46% cross-country or back-country skied, and 10% used snowshoes. A total of 52% of Yellowstone users and 56% of non-users felt snowmobiles negatively impact Yellowstone in the winter. Of these, 66% felt they are too noisy, 44% felt they affect air quality, 39% felt they disturb wild life, and 25% feel there are too many." From: Yellowstone SEIS, Chapter 3, Affected Environment, at www.nps.gov/grte/winter use/fseis/vol1/6-chap3.pdf
    Also: "In 1975, Glacier [National Park's] officials decided to ban snowmobiles from the park, primarily because they disrupted the solitude of the national park in winter: 'Over 90% of the comments opposed to snowmobile use related that concern to silence, tranquility, or in other words, aesthetics.'" Yochim, "The Development of Snowmobile Policy in Yellowstone National Park," Yellowstone Science, Spring, 1999, Vol. 7, No. 2.

See also Yochim, "Snow Machines in the Gardens, The History of Snowmobiles in Glacier and Yellowstone National Parks," Montana, The Magazine of Western History, August, 2003.

37. Hastings, A.L., G.G. Fleming, and C.S.Y. Lee. 2006. Modeling Sound Due to Over-Snow Vehicles in Yellowstone and Grand Teton National Parks. Report DOT-VNTSC-NPS-06- 06, Volpe Transportation Center, Cambridge, MA. http://www.nps.gov/yell/parkmgmt/upload/finalsound%20_modelingreport.pdf See also Burson, S. 2008. Natural Soundscape Monitoring in Yellow stone National Park December 2007– March 2008. National Park Service, Yellowstone Center for Resources, Mammoth, WY. 106p. http://www.nps.gov/yell/parkmgmt/upload/soundscape_monitoring-2007-2008.pdf
38. Eriksson, K., D. Tjarner, I. Marqvardsen, and B. Jarvholm. 2003. Exposure to Benzene, Toluene, Xylenes and Total Hydroc arbons among snowmobile drivers in Sweden. Chemosphere 50(10): 1343-7. See also Reimann, S., R. Kallenborn, and N. Schmidbauer. 2009. Severe aromatic hydrocarbon pollution in the arctic town of Longyearbyen (Svalbard) caused by snow mobile emissions. Environmental Science and Technology 43: 4791–4795.
39. See "Minnesota, 2013-2014 Fatal Snowmobile Accidents" at http://files.dnr.state.mn.us/enforcement/incident_reports/snowmobileaccidents14.pdf; "Wisconsin Snowmobile Safety and Enforcement Report", 2014 at http://dnr.wi.gov/files/pdf/pubs/le/LE0203_2014.pdf; http://www.auto-accident-resource.com/snowmobile-accidents.html; The Centers For Disease Con trol and Prevention, 1314 and 1315 JAMA, March 17, 2004—Vol 291, No. 11 (Reprinted); Fleming, "In Maine, speed thrills" Port land Press Herald, January 19, 2013 at http://www.pressherald.com/2013/01/19/in-maine-speed-thrills_2013-01-19/; Gustafs son and Eriksson. 2013. Off-road vehicle fatalities: A comparison of all-terrain vehicle and snowmobile accidents in Sweden. IATSS Research 35: 12-15.
40. Id., Fleming, supra; See also, http://www.snowmobilers.org/snowmobiling-laws-and-rules.aspx
41. See http://snowmobiles.axlegeeks.com/ for a complete list of current model year snowmobile specifications
42. From: National AG Safety Database, Snowmobiles and Youth Safety Packet, at http://nasdonline.org/document/994/2/d000977/snowmobiles-and-youth-safety-packet.html
43. Id. Other data suggest that it will take a snowmobiler operating at a speed of only 50 mph, at least 220 feet to come to a stop. See Gilmour and Bowe, "High Speeds at Night A Recipe for Disaster," The Forum, at www.in-forum.com/specials/snowmobiles/articles2.shtml
44. See Powers, supra, at fn. 44. See also www.seagrant.umn.edu/tourism/snow.html#6.
45. Winter Wildlands Alliance 2014. "Environmental Impacts from Snowmobile Use" available at http://winterwildlands.org/wp-content/uploads/2014/05/Environmental-Impacts-from-Snowmobile-Use.pdf and "Best Management Practices for Forest Ser vice Travel Planning" available at http://winterwildlands.org/wp-content/uploads/2015/02/BMP-Report.pdf
46. Id
47. The NVUM homepage is at www.fs.fed.us/recreation/programs/nvum/
48. Personal communication with Don English, Visitor Use Monitoring Program Manager, Feb. 13, 2015
49. In April 2015 the Bitterroot National Forest released a draft Record of Decision regarding a new travel plan. Because this plan was not finalized at the time of report publication the numbers from the new plan are not included in this report. However, the new plan outlines a much more equitable balance of land allocation for motorized and non-motorized users similar to other National Forest winter travel plans in Region 1.
50. From Montana Statewide Comprehensive Outdoor Recreation Plan, at Chapter 4, p. 33, at http://stateparks.mt.gov/about-us/scorp.html and Idaho Statewide Comprehensive Outdoor Recreation and Tourism Plan 2013-2017, Regional Participation Rates, p. 6 at http://parksandrecreation.idaho.gov/scortp
51. From Montana Statewide Comprehensive Outdoor Recreation Plan, Public Recreational Use Study: 2012, p. 30, at http://stateparks.mt.gov/about-us/scorp.html
52. Id.
53. Colorado Statewide Comprehensive Outdoor Recreation Plan, 2013 Public Survey Summary Report, p. 35, at http://cpw.state.co.us/aboutus/Pages/SCORP.aspx
54. 2011-2012 Wyoming Comprehensive Snowmobile Recreation Report, p. 3, at http://wyotrails.state.wy.us/pdf/2012Snowmobile Reportkeyfindingssummary.pdf
55. Environmental Assessment for the Medicine Bow-Routt National Forests and Thunder Basin National Grassland Winter Recre ation Management and Routt Forest Plan Amendment. May 2005.
56. http://www.outdoorfoundation.org/pdf/ResearchRecreationEconomyStateMexico.pdf
57. Arizona 2013 Statewide Comprehensive Outdoor Recreation Survey, p. 147, at http://azstateparks.com/publications/downloads/2013_SCORP_c.pdf
58. Mammoth Lakes Region of the Inyo National Forest Winter Recreation Needs Assessment Survey. Findings, Working Report. Feb 2005.
59. Id.
60. Deschutes National Forest Winter Recreation Suitability Analysis. August 2009.
61. SCORP – Ensuring Oregon's Outdoor Legacy, 2013-2017 Statewide Comprehensive Outdoor Recreation Plan, p. 51. And Out door Recreation in Washington – the 2013 Statewide Comprehensive Outdoor Recreation Plan, p.47.
62. Michigan Statewide Comprehensive Outdoor Recreation Plan, 2013-2017, at p. 4. Available at http://www.michigandnr.com/publications/pdfs/grants/scorp%20final%20report.pdf
63. Chugach National Forest, Kenai Winter Access Record of Decision. July 2007. Chugach National Forest Land and Resource Management Plan. May 2002.

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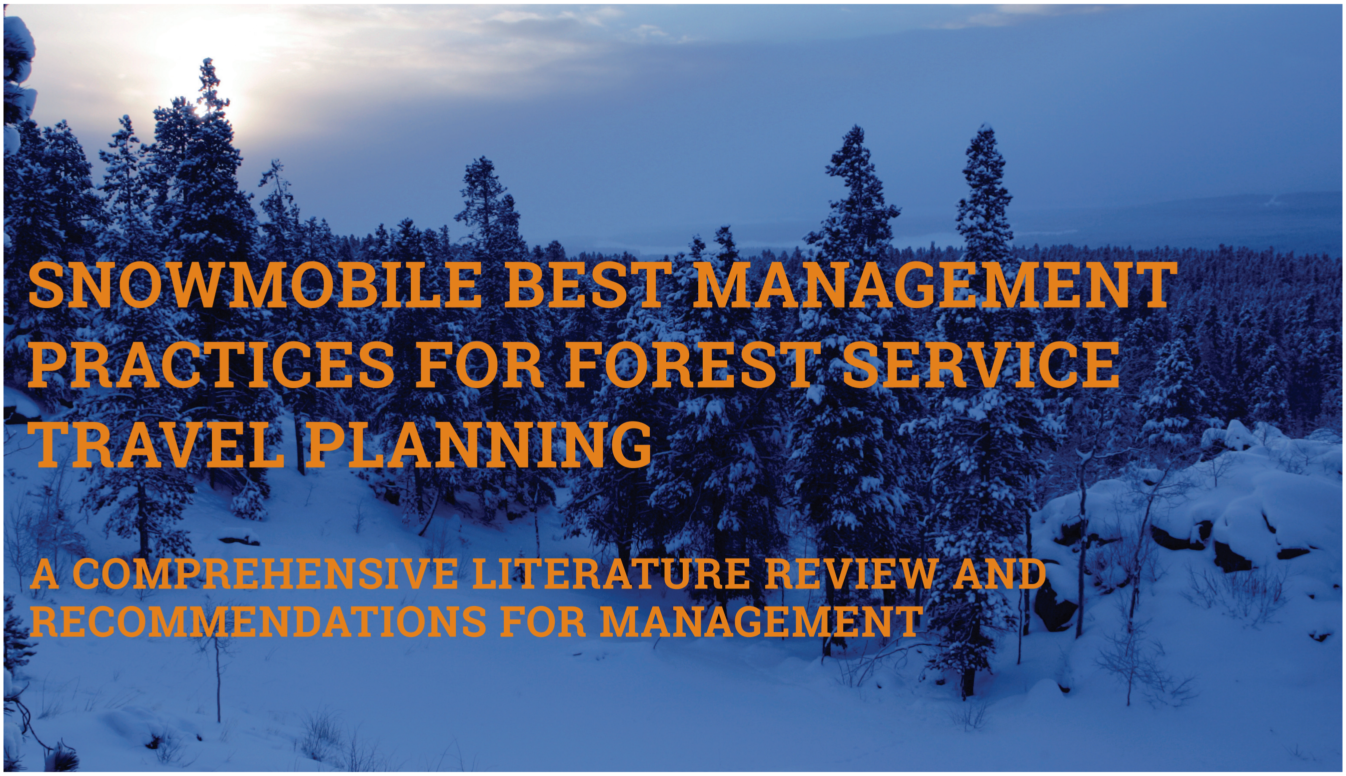

SNOWMOBILE BEST MANAGEMENT PRACTICES FOR FOREST SERVICE TRAVEL PLANNING

A COMPREHENSIVE LITERATURE REVIEW AND RECOMMENDATIONS FOR MANAGEMENT

DECEMBER 2014

WINTER WILDLANDS ALLIANCE

Winter Wildlands Alliance is a national nonprofit organization promoting and preserving winter wildlands and a quality human-powered snowsports experience on public lands.

Online: winterwildlands.org/what-we-do/policy-advocacy/

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INTRODUCTION

Winter backcountry recreation is a popular and steadily growing activity on Forest Service lands. Undeveloped skiing (including backcountry skiing, cross country skiing, and snowshoeing) is projected to be one of the five fastest growing activities on Forest Service lands in the next 50 years (Figure 1). In one scenario, the number of participants in undeveloped skiing is predicted to double - reaching 16 million participants by 2060 (Cordell 2012). Motorized snow activities are forecasted to grow as well, albeit at a slower rate. Overall, more than 20 million people participate in some form of backcountry winter recreation on National Forest lands each year (Cordell 2012).

Snowmobilers and skiers often seek out the same winter backcountry setting and look for similar experiences such as solitude, fun, and the enjoyment of the natural beauty of the mountains. But as motorized and non-motorized winter recreation grows on Forest Service lands, so does the potential for conflicts between the two user groups and impacts on natural resources. In terms of recreation opportunity, snowmobile use adversely impacts the recreation experience sought by many nonmotorized users, while the reverse is rarely true. Motorized recreation will displace nonmotorized users where use is heavy. This has occurred numerous places. Where displacement does not occur because of the high level of demand for a particular area or a lower density of snowmobile use, conflicts among users still arise, and can be substantial.

Additionally, advancements in technology and changes in use patterns among both user groups have increased the need for proactive management. While in the early years, snowmobiles were relatively slow and were limited to groomed trails, today's snowmobiles can go off-trail and up very steep slopes. "High marking" steep alpine bowls is now a popular riding technique, and modified motorcycles with a tread and ski allow riders to negotiate even heavily wooded areas. Backcountry skiers and snowboarders have also seen their sport evolve through technological changes in gear - making it easier for skiers and snowshoers to climb and descend mountains in the heart of the winter, and accelerating the trend of increased user participation and demand.

These advancements and changes in use patterns have led to increased use conflict and impacts to natural resources. Snowmobiles can create a number of impacts to wildlife which can result in fitness costs, fragmentation, and potential population declines (Gaines et al. 2003). Water quality, vegetation, and soils can also be greatly affected – especially in more sensitive alpine environments. Hundreds of research papers and monitoring reports have quantified these impacts and have been summarized in a number of recent literature reviews (e.g., Stokowski and LaPointe 2000, Gaines et al. 2003, Baker and Bithmann 2005, Davenport and Switalski 2006, Ouren et al. 2007, USDI NPS 2011, WWA 2014).

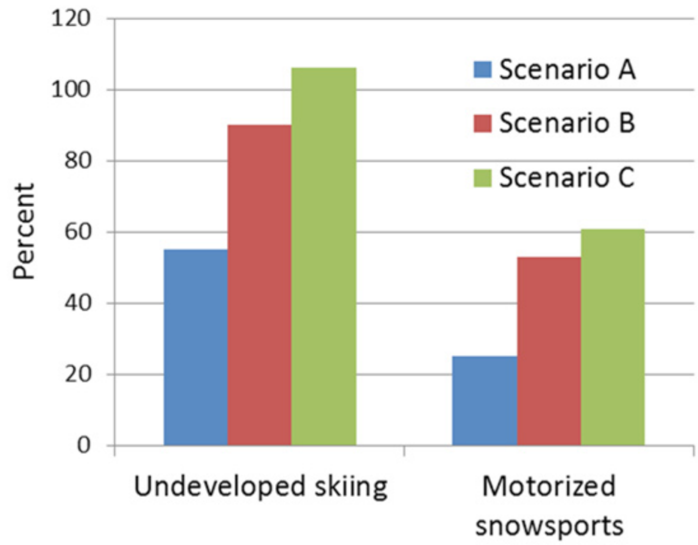

Figure 1: Percent growth in projected number of participants in undeveloped skiing and motorized snowsports on Forest Service lands in three model scenarios, 2008-2060 (adapted from Cordell 2012).

SNOWMOBILE MANAGEMENT

In recent years, the Forest Service has identified "unmanaged recreation" as one of the four threats to the health of National Forests (Bosworth 2003). On most forests, snowmobile recreation opportunities were never formally planned, but resulted from a default policy of allowing motorized use - including in many places where snowmobiling could not actually occur because of limitations in technology - in the absence of a specific reason to close or restrict it. As a result, more than 70 percent or 81 million acres in the western snowbelt forests are open to potential snowmobile use (Rivers and Menlove 2006, Figure 2). While skiers (including cross country, backcountry, and snowshoers) outnumber snowmobiles on National Forest System Lands (USDA FS 2014a), significantly more acreage and trail miles are available for winter motorized recreation than are designated for non-motorized recreation (Rivers and Menlove 2006, Figure 2). Of the thirty percent or 35 million acres closed to snowmobiles two-thirds are in Wilderness areas where all motorized use is legally prohibited, but where human-powered winter recreation opportunities are often difficult or impossible to access. Furthermore, many of the existing trailheads are weighted towards snowmobile recreation. The legacy of this unplanned "allocation" is widespread 'open' allocations for winter motorized use that is often not based on historical use patterns or any specific rationale, and displacement

[1] In this document, snowmobile and motorized use are used interchangeably, however, the Forest Service will also use over-snow vehicle (OSV). Skiing and non-motorized use are also used interchangeably and include backcountry skiing and snowboarding, as well as cross country skiing and snowshoeing. Snowmobile area and play area are also used interchangeably and are referring to an area on a forest which permits unrestricted snowmobile travel.

of non-motorized users has occurred as snowmobiles, aided by technology, expand their reach (e.g., Stokowski and LaPointe 2000, Manning and Valliere 2001, Adams and McCool 201). Revisiting the disparity of this allocation is critical to addressing recreational use conflict (Adams and McCool 2010).

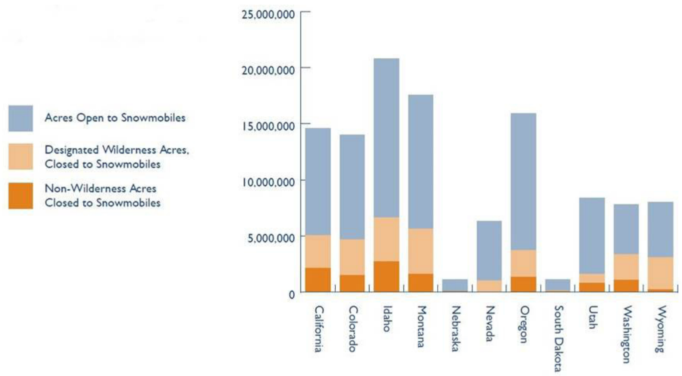

Figure 2: Acres open and closed to snowmobiles on National Forests in the western snowbelt region (reprinted from Rivers and Menlove 2006)

MAIN AUTHORITIES GOVERNING THE MANAGEMENT OF SNOWMOBILES IN THE NATIONAL FOREST SYSTEM

In the early 1970s, management of snowmobiles and other motorized uses on public lands was inconsistent. However, after a series of ecological research findings and an increasing need for conflict management, President Nixon signed Executive Order 11644 on February 8, 1972. This order charged federal land managers with developing and issuing regulations to manage off-road vehicles, including snowmobiles, specifically to minimize damage to natural resources and minimize conflicts between motorized and non-motorized communities. The Executive Order continues to be the legal authority guiding off-road vehicle designations on public lands.

Executive Order 11644:

> **Section 3. Zones of use. (a) Each respective agency head shall develop and issue regulations and administrative in structions, within six months of the date of this order, to provide for administrative designation ofthe specific areas and trails on public lands on which the use of off-road vehicles may be permitted, and areas in which the use of off-road vehicles may not be permitted, and set a date by which such designation of all public lands shall be completed. Those regulations shall direct that the designation of such areas and trails will be based upon the protection of the resources of the public lands, promotion of the safety of all users of those lands, and minimization of conflicts among the various uses of those lands. The regulations shall further require that the designation of such areas and trails shall be in accordance with the following—**
>
> **(1) Areas and trails shall be located to minimize damage to soil, watershed, vegetation, or other resources of the public lands.**
>
> **(2) Areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats.**
>
> **(3) Areas and trails shall be located to minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.**
>
> **(4) Areas and trails shall not be located in officially designated Wilderness Areas or Primitive Areas. Areas and trails shall be located in areas of the National Park system, Natural Areas, or National Wildlife Refuges and Game Ranges only if the respective agency head determines that off-road vehicle use in such locations will not adversely affect their natural, aesthetic, or scenic values.**

In 1977, President Carter signed Executive Order 11989, which amended and strengthened EO 11644 by giving federal public land managers the authority to close a motorized route or area if it "will cause or is causing considerable adverse effects" to natural resources:

Executive Order 11989:

> **Section 9. Special Protection of the Public Lands. (a) Notwithstanding the provisions of Section 3 of this Order, the respective agency head shall, whenever he**

determines that the use of off-road vehicles will cause or is causing considerable adverse effects on the soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands, immediately close such areas or trails to the type of off-road vehicle causing such effects, until such time as he determines that such adverse effects have been eliminated and that measures have been implemented to prevent future recurrence.

(b) Each respective agency head is authorized to adopt the policy that portions of the public lands within his jurisdiction shall be closed to use by off-road vehicles except those areas or trails which are suitable and specifically designated as open to such use pursuant to Section 3 of this Order.

Travel Management Rule (TMR)

Over the last few decades, impacts from unmanaged off-road vehicle use and the growth of non-motorized backcountry recreation on National Forest System lands has led to a renewed effort to comply with the Executive Order direction. In 2005, the Forest Service promulgated the Travel Management Rule (TMR) to govern the management of the summer and winter off-road vehicle systems.[2] Subpart B of the TMR requires the Forest Service to have a designated summertime off-road vehicle system, while subpart C allowed but did not require forests to designate a winter time off-road vehicle system.

In 2013, a Federal court found that subpart C failed to comply with the direction in the Executive Order to designate a system of trails and areas that minimize impacts to natural resources and conflicts. In response, the Forest Service issued a draft amendment to the TMR in 2014 to require the designation of roads, trails, and areas where over-snow vehicle (OSV) use is allowed, restricted, or prohibited. A final winter travel rule is expected during late 2014 or early 2015. In the coming years, Forests that receive enough snow to support winter recreation will be required to have a system of designated routes and areas for winter motorized use, providing opportunity for public involvement as they do so. This document is designed specifically to aid in the process of OSV route and area designation, management and monitoring on Forest Service lands.

Backcountry Skiing, Lolo National Forest, Adam Switalski. 2008.

[2] 79 Fed. Reg 34678, June 18, 2014.

BEST MANAGEMENT PRACTICES (BMPS) FOR LAND MANAGERS MINIMIZING IMPACTS FROM SNOWMOBILES

Best management practices provide science-based criteria and standards that land managers follow in making and implementing decisions that affect natural resources and human uses. BMPS are usually developed for a particular land use (e.g., road building and maintenance) and are based on the best available science, legal obligations and pragmatic experience (Switalski and Jones 2012).

While some BMPs currently exist for snowmobiles, they are presented in a piecemeal, resource-specific fashion, or only provide guidelines for trail building and maintenance. For example, the Forest Service has created BMPs for protecting water quality on their lands and gives some guidance on how to minimize impacts related to snowmobile route planning (USDA FS 2012). The Forest Service – as well as other land management agencies –also has guidance to pursue environmental collaboration and conflict resolution in addressing land management challenges generally (OMB CEQ 2012). The practice of collaboration and conflict resolution has been an increasing trend in recent years, and for environmental collaboration to be successful, several key aspects have been identified, including: balanced stakeholder representation, clear goals and objectives, information exchange, and shared decision-making (Schuett et al. 2001). As the Forest Service begins travel planning, it will be essential to have a comprehensive framework to help managers implement their mandate to minimize social and environmental impacts in designating winter motorized routes and areas.

In this document, we lay out the best available science for the impacts of snowmobiles on recreation use conflict and natural resources including water quality, soils, vegetation, and wildlife. Building off of the literature and existing recommendations from researchers and managers, we present a framework for minimization of snowmobile impacts. These Best Management Practices provide guidelines to help Forest Service managers designate appropriate routes and areas, and close inappropriate routes and areas. Additionally, they provide guidance on managing snowmobile use to be consistent with the Executive Orders minimization criteria and the Forest Service Travel Management Rule.

MONITORING, ENFORCEMENT, AND FUNDING

Key to any management action is monitoring the success or failure of a project and adapting the management strategy to reach the project objectives. Accordingly, the BMPs presented here rely heavily on monitoring. Enforcement of management actions is also essential for the success of any management plan (Adams and McCool 2010).

It is also essential that the Forest Service allocate adequate funding and resources to undertake travel planning efforts (Yankoviak 2005, Adams and McCool 2010). Education and outreach programs that reduce conflict between uses and to increase compliance have also been implemented (Lindberg et al. 2009, USDI NPS 2013); however there is limited data on the success of these programs and such efforts may need to supplemented with monitoring and enforcement of existing regulations.

Yellowstone National Park has developed an extensive adaptive management program following the implementation of their winter use plan (USDI NPS 2013). They have identified key resources affected by motorized recreation, indicators for measuring their effects, and the most appropriate monitoring methods (Table 1). Using this framework they are able to revisit management decisions so learn if they are effectively mitigating use conflicts and environmental concerns in the Park.

Table 1: Examples of adaptive management monitoring: affected resource, indicator, and monitoring method identification in Yellowstone National Park (reprinted from USDI NPS 2013)

Affected Resource	Indicator	Preliminary Monitoring Methods
Air Quality at the West Entrance and Old Faithful	Levels of: CO, PM10, and NO2	Fixed site monitoring for CO, PM10, and NO2
Soundscape directly adjacent to park roads	Audibility: decibel levels (dBA) in terms of magnitude and duration (constant sound level or Leq) sound is audible over an 8-hour period	Could include audibility logging, digital recordings, and sound pressure level measurement
Visitor Experience	Satisfaction	Visitor survey (pending OMB approval)
Wildlife on or near roads	Wildlife behavioral responses to OSV	Observational studies

CLIMATE CHANGE

Today's land managers have to plan in the context of a rapidly changing climate. This will include addressing rising temperatures, thinner snow packs, more intense storms, and more rain-on-snow events which can damage trail systems and add additional management challenges (IPCC 2013). A receding snowpack and earlier spring runoff will alter future winter backcountry recreation use patterns.

With fewer or smaller areas available, there will be a concentration of use which may lead to increased crowding, recreational conflict and resource damage. For example, it is becoming more commonplace for snowmobiles to travel on dry roadbeds or snow-free trails to access the receding snowline.

[3] *Winter Wildlands Alliance v. USFS, 2013 WL 1319598 (D.Idaho, March 29, 2013).*

This direct contact with the ground can cause soil compaction, erosion, and water quality issues and lead to a whole new set of management concerns. In another example, grizzly bears may leave their dens earlier as climate changes making previous seasonal management decisions obsolete. The trails themselves will need increased maintenance such as grading and clearing obstacles during snow-free months, upgrading culverts, building larger bridges, and moving routes from areas prone to flooding or rapid melting. To preserve quality recreation opportunities and minimize natural resource damage, land managers should consider the impacts of a changing climate when developing management direction.

WINTER RECREATIONAL USE CONFLICT RESEARCH

INTRODUCTION

As more people recreate in the backcountry, winter wildlands are becoming increasingly crowded and conflicts are on the rise. Backcountry skiers and other non-motorized users seek out solitude, quiet, and undisturbed natural areas. Desirable terrain, snow conditions and access are also key components of their recreational experience. Snowmobiles change the quality of this experience and create conflict with other winter recreationists (Adams and McCool 2012). Conflict among motorized and non-motorized use is typically "asymmetrical" where skiers experience conflict, while snowmobilers do not (Knopp and Tyger 1973, Jackson and Wong 1982, Gibbons and Ruddell 1995). Quiet non-motorized recreationists can have the quality of their experience dramatically altered by snowmobiles, while motorized users often don't even notice skiers using the same landscape.

In this section we present recent research on how snowmobile use and associated noise and fumes impact non-motorized use. Motorized use often creates a level of annoyance from non-motorized users that has been documented to lead to displacement (e.g., Stokowski and LaPointe 2000, Manning and Valliere 2001, Adams and McCool 2010). However, a well-planned and enforced system of routes and areas as well as improved management tools and technologies can help reduce or eliminate conflict.

SOUNDSCAPE

Protecting quiet soundscapes has become an increasingly important management issue in winter landscapes. Snowmobile noise is one of the biggest sources of use conflict, as an increasing number of winter recreationists seek out the peace and quiet found in the backcountry to escape the sounds of modern busy life (Abraham et al. 2010). Noise from motorized recreation is a particular problem in winter, when all use is restricted to a relatively small number of plowed trailheads and nonmotorized users cannot readily access Wilderness.

Natural soundscapes have been found to assist "in providing a deep connection to nature that is restorative and even spiritual for some visitors" (Freimund et al. 2009, pg. 4). When users have these expectations, the mechanical noise of snowmobiles can result in a substantial diminution in their recreation experience from the presence of snowmobile noise in otherwise quiet areas. This can negatively impact the experience of the recreationist, create conflict, and ultimately lead to displacement (Gibbons and Ruddell 1995, Manning and Valliere 2001, Vitterso et al. 2004, Adams and McCool 2010).

In "multiple-use" backcountry areas, snowmobile noise can be difficult to escape. While dependent on speed, type of machine, and direction of wind, snowmobile noise can travel up to 10 miles (Hastings et al. 2006, Burson 2008) – a distance farther than most non-motorized recreationists travel in a day. Additionally, considering that most forest roads are not plowed in the winter, the ability of skiers to avoid motorized noises is very restricted. Often trails and areas that are considered "frontcountry" and easily drivable in the summer are much more difficult to access in the winter. Accordingly, the user expectation in these areas is more aligned with a backcountry experience including a quiet soundscape. This disconnect between available recreation settings and desired user experience is something the Forest Service primarily addresses in planning through the Recreation Opportunity Spectrum (ROS). However, ROS is a classification tool that describes physical, social and managerial attributes – access, remoteness, size, user density, level of development – in summer, but not winter. Addressing these frontcountry multiple-use areas, which span a variety of ROS settings, is a particularly important source of conflict to address in travel planning.

Many people also travel in the winter backcountry to view wildlife. However, it has been well established that noise has a widespread and profound impact on wildlife (Barber et al. 2010, Farina 2014), which limits opportunities for watching and listening for birds and other wildlife. Most fundamentally, snowmobile noise creates a level of annoyance to many non-motorized users that either reduces the quality of their experience or can even cause displacement (e.g., Stokowski and LaPointe 2000, Manning and Valliere 2001, Adams and McCool 2010).

AIRSHED

Motorized and non-motorized winter backcountry recreationists are often confined to the same plowed parking areas to prepare for their trips. However in these "staging areas" snowmobile emissions can be concentrated and lead to an additional source of conflict and potential health concerns. While technological advances have produced cleaner four-stroke engines (and even zero emission electric snowmobile prototypes), the vast majority of snowmobiles still use highly polluting two-stroke engine technology. Lubricating oil is mixed with the fuel, and 20% to 30% of this mixture is emitted unburned into the air and snowpack (Kado et al. 2001). Also, the combustion process itself is relatively inefficient and results in high emissions of air pollutants (USDI NPS 2000). As a result, two-stroke snowmobiles emit very large amounts of smoke which includes carbon monoxide (CO), unburned hydrocarbons (HC) and other toxins (Zhou et al. 2010). Carbon monoxide is particularly harmful to the human body's ability to absorb oxygen (Janssen and Schettler 2003), and thus is particularly harmful to other users who wish to engage in aerobic exercise.

Concerns over human health related to snowmobile emissions have led to extensive recent research on snowmobile pollution in Yellowstone National Park (e.g., USDI NPS 2000, Bishop et al. 2001, Kado et al. 2001, Janssen and Schettler 2003, Bishop et al. 2006, Bishop et al. 2009, Ray 2010, Zhou 2010), and conclusions from these studies have led to a ban of older technology 2-stroke engines from the Park (USDI NPS 2013). Emissions from snowmobiles emit many carcinogens and can pose dangers to human health (Eriksson et al. 2003, Riemann et al. 2009). Several "known" or "probable" carcinogens are emitted including nitrogen oxides, carbon monoxide, ozone, aldehydes, butadiene, benzenes, and polycyclic aromatic hydrocarbons (PAH). Particulate matter, also found in snowmobile smoke, is detrimental in fine and coarse forms as it accumulates in the respiratory system and can lead to decreased lung function, respiratory disease and even death (Janssen and Schettler 2003). While most of the acute toxic effects of snowmobiles are limited to staging areas and parking lots, the smoke and fumes from snowmobiles on trails can dramatically reduce the quality of the experiences of non-motorized users along the trail as well.

VIEWSHED AND OTHER IMPACTS

In addition to the sounds and smells of snowmobiles, simply the presence of snowmobiles on the landscape can degrade the experience of many non-motorized users. In just a few hours, snowmobiles can access almost any basin in the west and disproportionately consume a limited resource, powder snow. Slopes displaying dozens of "high mark" tracks can take away the natural beauty of the landscape for some. The deep tracks of snowmobile can also create a hazard when skiing down a slope, or quickly "track out" a slope, rendering it un-skiable. Safety is also a concern as there is the possibility of collision with a snowmobile, or a risk of a snowmobile triggering an avalanche from above. Alternatively, a snowmobile can diminish the sense of risk or wildness because they effectively reduce the distance from safety (McCool and Adams 2012).

WINTER RECREATIONAL USE CONFLICT MANAGEMENT

The most effective way to manage recreational use conflict is a well-planned and enforced system of routes and areas that separate motorized and non-motorized uses as much as possible (e.g., Andereck et al. 2001, Lindberg et al. 2009, Adams and McCool 2010, USDI NPS 2013). Simply reducing snowmobile noise and smells may not be sufficient to reduce conflict or deter displacement, although limiting snowmobile use to best available technology (BAT) machines, as has been done at Yellowstone National Park, can substantially reduce use conflict. Closing or separating the non-compatible uses is the most effective way to reduce conflict. For example, an analysis of conflict reduction strategies in Sweden found that closing access to snowmobiles – a change from seeing hearing, and smelling snowmobiles, led to significant skier welfare gains (Lindberg et al. 2009).

Another strategy employed by the Forest Service is to separate motorized and non-motorized temporally, thereby granting all users some opportunity for use while minimizing conflict. On the Chugach National Forest, for example, one section of the forest is closed to motorized use on alternating years (USDA FS 2007b). On the Humboldt-Toiyabe NF, a high-elevation trailhead is shared use until lower elevation access receives enough snow for OSV use at which point it becomes non-motorized (USDA FS 2007a). In more popular areas, shorter alternating closure periods, such as biweekly, may be more appropriate.

Mitigating snowmobile noise can help address use conflicts as well. Snowmobile noise can travel long distances in the winter, and noise models have been used to identify areas of recreational use conflict, and plan for management actions. For example, noise modeling has been used extensively in Yellowstone National Park to estimate the area affected by noise under a range of management alternatives (Hastings et al. 2006, Hastings et al. 2010, USDI NPS 2013, Figure 3).

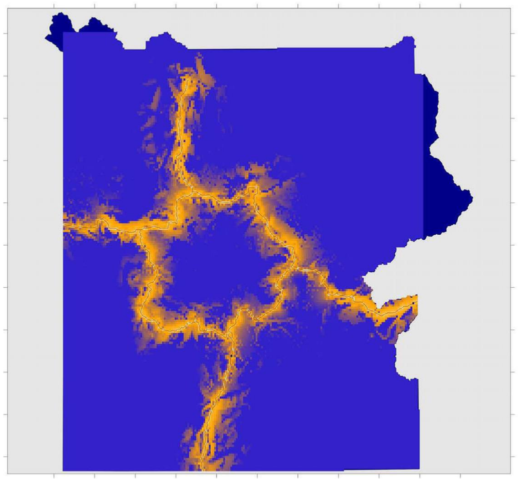

Figure 3: Example of noise simulation modeling used in Yellowstone National Park to identify where disturbance and conflict may be a management issue. Orange is the distance snowmobiles and snow coach noise travels beyond the groomed roads. Model inputs include temperature, relative humidity, snow cover, and natural ambient sound levels. The modeling also accounts for the acoustic effects of topography, vehicle speeds, and vehicle group size (USDI NPS 2013).

Several studies have recommended replacing two-stroke engines with four-stroke engines to significantly reduce emissions and noise (e.g., Miers et al. 2000, Kado et al. 2001, Eriksson et al. 2003). Four-stroke engines are significantly less polluting (Zhau et al. 2010, Figure 4), and have improved fuel efficiency, as well as a reduction in visible exhaust plumes, odor, and noise (Bishop et al. 2006). A study of using best available technology (BAT) machines in Yellowstone has resulted in a 60% reduction in Carbon Monoxide (CO) and a 96% reduction in Hydrocarbon (HC) emissions (Bishop et al. 2006).However, if motorized use of a route or area has been identified as having an unacceptable impact on other user groups, that route or area should be closed (Lindberg et al. 2009, McCool and Adams 2010, and NYSDEC 2011).

Furthermore, in some forests non-motorized opportunities are limited, so creating non-motorized areas may be needed. For example, a snowmobile plan for Adirondack Park (NY) calls for closing routes if the "...opportunities for quiet, non-motorized use of trails are rare or nonexistent;" (NYSDEC 2011, p.244). Finally, in some areas – regardless of conflict, snowmobiling should not be allowed. For example, Adams and McCool (2010) argue that roadless areas should be protected from motorized use because "roadless areas are exceptional for their wild and quiet recreational opportunities, their habitat for threatened and endangered species, and other values. Their character and values derive from their lack of accessibility by motor vehicles" (p. 109).

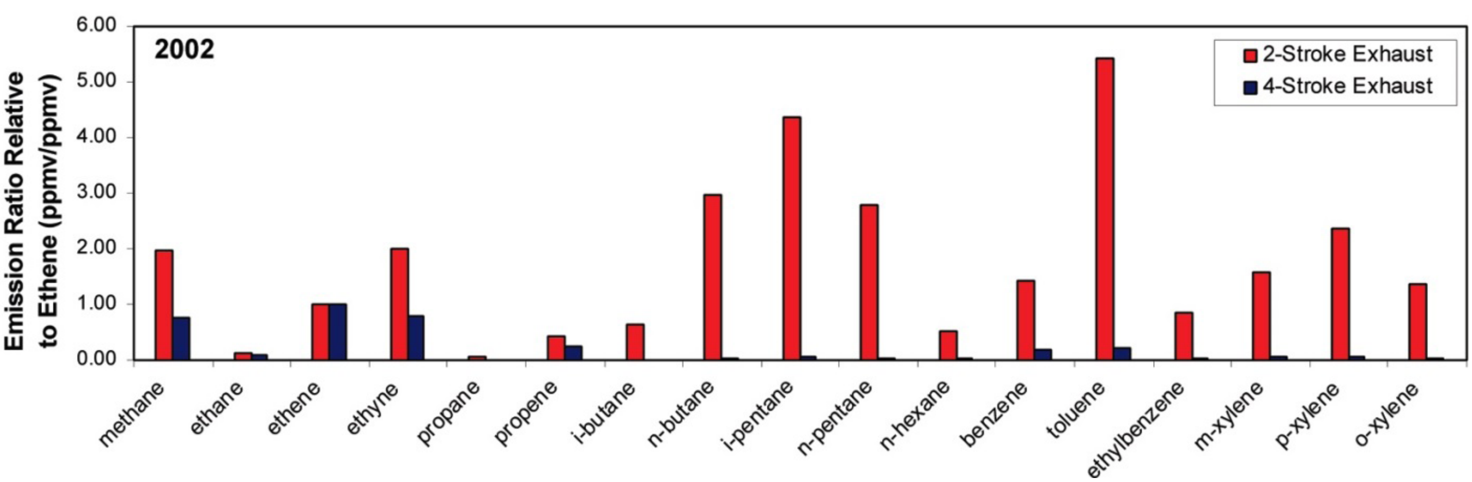

Figure 4: Average nonmethane hydrocarbons exhaust emission ratios relative to ethene (ppmv/ppmv) for two-stroke and four-stroke engines in 2002 (Reprinted with permission from (Zhou, Y., D. Shively, H. Mao, R.S. Russo, B. Pape, R.N. Mower, R. Talbot, and B.C. Sive. 2010. Air toxic emissions from snowmobiles in Yellowstone National Park. Environmental Science and Technology 44(1): 222-228. Copyright 2010 American Chemical Society)

BEST MANAGEMENT PRACTICES FOR WINTER RECREATIONAL USE CONFLICTS

DESIGNATING MOTORIZED USE

- When necessary elements for successful collaboration exist, establish a working group with motorized and non-motorized users, conservation interests, land managers, and other stakeholders to develop concepts for minimizing recreational conflict.

- Identify routes and areas where there is ongoing conflict among motorized and non-motorized winter recreational use using existing information, surveys, GIS modeling, and community outreach.

- Identify routes and areas of particularly high value or demand for motorized and non-motorized use.

- To the degree possible, allocate separate trails, trailheads, and areas.

- Ensure that non-motorized trails and areas are available:
  - o close to plowed access points, groomed trails, and other access portals.
  - o in contiguous non-motorized blocks.
  - o in areas where there are few non-motorized opportunities.
  - o in both frontcountry and backcountry settings.
  - o in areas with scenic beauty.
  - o in areas sheltered from noise emanating from motorized areas.
  - o across a variety of Recreational Opportunity Spectrum (ROS) categories.

- Ensure that a fair balance of unplowed roads are set aside for nonmotorized use.

- Locate motorized routes and areas:
  - o away from popular or historically used backcountry ski areas, or areas of growing use.
  - o outside proposed Wilderness Areas, Wilderness Study Areas, and Research Natural Areas.
  - o with easily enforceable boundaries using topographic or geographic features. (e.g., a ridge top or highway) - use boundary signage to provide additional clarity, or where unauthorized use is occurring.
  - o where they do not bisect non-motorized areas.

- Consider temporal restrictions in areas of high-use or high-value to both motorized and non-motorized use. This includes both early/late season restrictions, as well as alternating access.

- Where necessary to designate a motorized route through a nonmotorized area, locate and manage such route (such as speed and idling limits) to minimize disturbance to the nonmotorized area.

- In areas of shared use consider requiring Best Available Technology (BAT) to reduce conflict and impacts between uses.

MINIMIZING IMPACTS OF MOTORIZED USE

- Undertake proactive and systematic outreach programs in order to facilitate increased compliance of closures and reduce user conflicts.

- Provide free digital and paper maps that clearly show routes, areas, and watersheds open and closed to snowmobiles.

- Encourage or require the use of Best Available Technology (BAT) snowmobiles to reduce noise and local air quality impacts.

- Implement significant penalties and consequences for violating snowmobile regulations that will dissuade users from such violations.

- Monitor closed routes and areas to ensure that snowmobile intrusion is not occurring.

- Establish an adaptive management framework using monitoring to determine efficacy of current management.

- Revisit plan decisions as necessary to ensure use conflicts are being minimized and motorized impacts are below accepted thresholds. Close snowmobile routes and areas when motorized use is leading to trespass onto non-motorized trails or areas.

Backcountry skiing, Gallatin NF, Adam Switalski. 2009.

WILDLIFE RESEARCH

INTRODUCTION

While many animals are well adapted for survival in the winter, deep snow and cold temperatures can limit foraging opportunities and increase metabolic demands. Snowmobiles can add to animals' vulnerability during this critical time by eliciting physiological responses such as increased heart rate and elevated stress level; eliciting behavioral responses including displacement and avoidance; facilitating sources of competition; and/or increasing hunting, trapping, and poaching mortality (for a review see Gaines et al. 2003, Figure 5, Table 2). These impacts can result in fitness costs, fragmented wildlife populations, and potential population declines (Gaines et al. 2003).

In this section, we focus on three species that warrant special attention because their populations are in decline or vulnerable, and they have state and/or federal legal protections: grizzly bears (Ursus arctos), wolverine (Gulo gulo), and lynx (Lynx canadensis). The strongest protection is afforded by the Endangered Species Act which prevents any "take" of a listed species. The term "take" includes any "means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) As supported below, these three species are highly susceptible to snowmobile noise and disturbance and will need additional management actions to ensure winter recreation does not compromise their recovery. We also highlight research on the impact of snowmobiles on ungulates which are managed as game species and also need special management considerations.

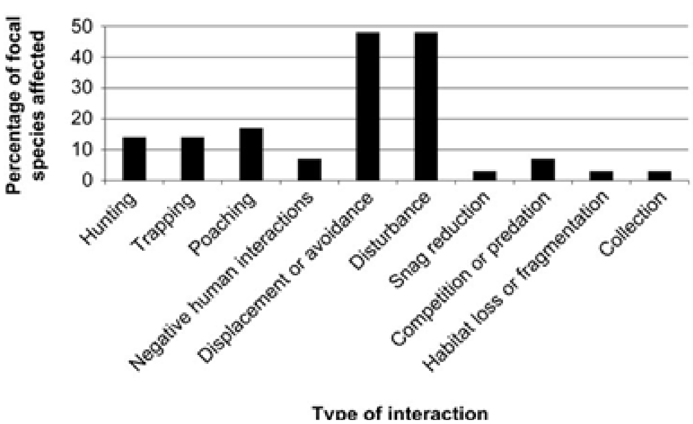

Figure 5. Interactions between the 29 focal wildlife species and snowmobile routes documented from a comprehensive literature review (reprinted from Gaines et al. 2003).

Table 2. Snowmobile route associated factors for wide-ranging carnivores and ungulate focal species (adapted from Gaines et al. 2003).

Focal species	Scientific name	Snowmobile route associated factors
Grizzly bear	*Ursus arctos*	Disturbance at a specific site
Wolverine	*Gulo gulo*	Trapping
		Disturbance at a specific site
Lynx	*Lynx canadensis*	Route for competitors or predators
		Trapping
		Disturbance at a specific site
Gray wolf	*Canis lupus*	Trapping
		Physiological response
American marten	*Martes americana*	Trapping
Fisher	*Martes pennanti*	Trapping
		Displacement or avoidance
Mule deer	*Odocoileus hemionus*	Displacement or avoidance
		Disturbance at a specific site
Elk	*Cervus canadensis*	Displacement or avoidance
		Disturbance at a specific site
		Physiological response
Bighorn sheep	*Ovis canadensis*	Displacement or avoidance
		Disturbance at a specific site
		Physiological response

GRIZZLY BEAR

Grizzly bears (Ursus arctos) are a Threatened Species under the U.S. Endangered Species Act and protected from harm across their range in the continental U.S. Their denning habitat often overlaps with winter recreation areas, and they are susceptible to disturbance - increasing energy expenditures and the potential of den abandonment (Linnell et al. 2000). Direct mortality is also possible if an avalanche is triggered on a slope where the bears are hibernating (Hilderbrand 2000).

Grizzly bears typically den in relatively high elevation areas with more stable snow conditions and steep slopes (Linnell et al. 2000). In general they avoid roads (Mace et al. 1996), and will typically select den sites one to two kilometers from human activity (Linnell et al. 2000). However, snowmobiles can easily access these remote sites, posing the potential for disturbance. No systematic data set exists on how denning bears react to snowmobile disturbance, but a comprehensive review on the topic found that human disturbance within one kilometer of a den site has a significant risk of abandonment, especially early in the denning season (Linnell et al. 2000).

GRIZZLY BEAR MANAGEMENT

Although grizzly bears can be susceptible to disturbance and the risk of den abandonment, careful management of winter recreation can help avoid this conflict. Linnell et al. (2000) recommended that "winter activities should be minimized in suitable or traditional denning areas; if winter activity is unavoidable, it should begin around the time bears naturally enter dens, so that they can choose to avoid disturbed areas; and winter activity should be confined to regular routes as much as possible" (Linnell et al. 2000, pgs. 409-410). Podrunzney et al. (2000) modeled the overlap of potential grizzly bear denning habitat and potential snowmobile use areas on the Gallatin National Forest, MT. This model was used in Forest Service travel planning and allowed managers to plan snowmobile routes and areas to avoid conflict with grizzly bears.

Similar modeling efforts have been conducted in Alaska incorporating both motorized and non-motorized recreation with bear denning habitat (see Goldstein et al. 2010).

As a federally protected Threatened Species, the U.S. Fish and Wildlife Service considers snowmobile disturbance as a potential "take" thus requiring management actions. In a recent Biological Opinion for snowmobiling on the Flathead National Forest (MT), the U.S. Fish and Wildlife Service required the Forest to "quantify and monitor snowmobile use… and ensure adequate protection to known and discovered grizzly bear den sites and post-emergent females with cubs" (USDI FWS 2008, p. 57). In 2014, the Flathead Nationa Forest closed the Skyland / Challenge snowmobile play area due to the emergence of a grizzly bear in the area.

Limiting open motorized route density is a key management action to increase grizzly bear habitat security. For example, USDA FS (2011) recommends limiting open motorized route density to lesthan 1 mile per square mile in much of the Cabinet-Yaak Recovery Area. State-level management plans also address management of snowmobiles in grizzly bear habitat. For example, The Montana Forested State Trust Lands Habitat Conservation Plan calls for minimizing road miles and restricting public access (including snowmobiles) on roads in important grizzly bear habitat areas and seasons (MT DNRC 2011).

WOLVERINE

Wolverine (Gulo gulo) are a rare, long-ranging carnivore that spends most of their lives in high elevation areas (Aubry et al. 2007). While they roam hundreds, sometimes thousands of miles seeking food and mates, in the heart of the winter females dig dens in the snowpack and give birth. Little has been known about this elusive carnivore until recently when it was petitioned for listing under the Endangered Species Act, resulting in a flurry of research studies. Wolverine are a Species of Special Concern in Montana, classified as a Sensitive Species by the Forest Service, and trapping has been banned across their range in the continental U.S.

In general, wolverine are sensitive to human disturbance. In studies in Canada, wolverine have been found to be much more common in protected areas than in multiple-use landscapes (Fisher et al. 2013, Whittington et al. 2014). Snowmobile use commonly overlaps with wolverine denning habitat, and their noise may cause female wolverines to abandon their denning sites, potentially reducing their reproductive success.

An ongoing five-year study is examining the impact of winter recreation on wolverine in multiple mountain ranges in Montana and Idaho (Heinemeyer and Squires 2013). Preliminary results suggest that in areas with winter backcountry use, denning female wolverine move more frequently, are moving at higher rates when in higher intensity recreation areas, and move more during the weekend when there is more use (Heinemeyer and Squires 2013). These impacts are creating a "significant additive energetic effects on wolverine during the critical winter and denning periods" (Heinemeyer and Squires 2013, p. 5).

While the majority of the study sites they have studied are snowmobile use areas, the ongoing study is adding more sites where non-motorized backcountry skiers recreate as well. However, researchers have already noted that limitations on the distance that skiers can travel often allows for core denning habitat to be available beyond the reach of backcountry skiers (Heinemeyer et al. 2014).

WOLVERINE MANAGEMENT

Wolverine have very large home ranges and need large blocks of interconnected habitat. Key management schemes for protecting wolverine include limiting disturbance and retaining and restoring habitat connectivity. Managers can reduce the potential conflict with snowmobiles and wolverine by identifying areas of overlap and managing accordingly. For example, The Wilderness Society developed the SPreAD-GIS model that can model snowmobile sound propagation overlap with wolverine denning habitat (Reed et al. 2009, Figure 6). Two other sound propagation models have also been used by Yellowstone National Park to model over-snow vehicle audibility including the Integrated Noise Model, and the Noise Simulation Model (USDI NPS 2013).

In the face of climate change, wolverines may lose much of their denning habitat as persistent snowfields disappear (Fisher et al. 2013), and connectivity among remaining habitat patches will become increasingly important (Schwartz et al. 2009). The 2014 Management Plan for the Conservation of Wolverines in Idaho calls for identifying wolverine linkage areas at local and regional scales and pro-actively conserving them (IDFG 2014).

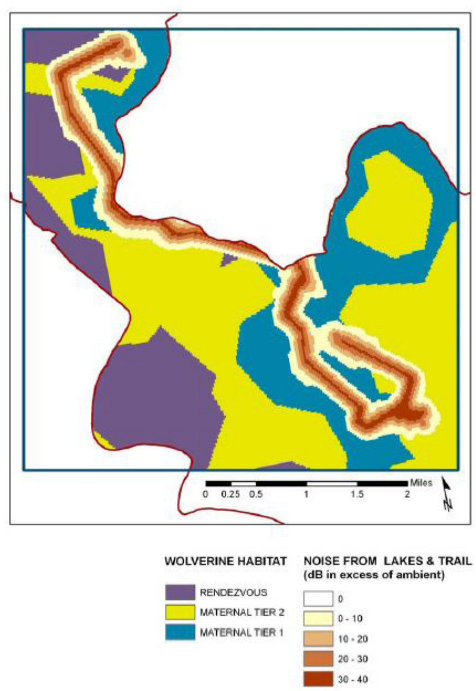

Figure 6: An example of using the SPreAD model to identify the overlap of snowmobile noise emissions and wolverine habitat types (Reed et al. 2009).

CANADA LYNX

Canada lynx (Lynx canadensis) is a Threatened Species under the U.S. Endangered Species Act. They are adapted to deep snow conditions, allowing them to thrive in habitats where potential competitors and predators like coyotes (Canis latrans) cannot easily survive. However, compacted snow trails and play areas help facilitate coyote movement into Canada lynx habitat. While one study in Montana found limited use of snowmobile trails by coyotes (Kolbe et al. 2007), studies in Utah and Wyoming documented coyotes using compacted trails extensively resulting in potential competition and displacement of Canada lynx (Bunnell et al. 2006, Gese et al. 2013, Dowd et al. 2014). The differences in results are probably due to different regional snow characteristics, predator communities, and snowmobile use (Bunnell et al. 2006). While both snowmobiles and skis create trails that coyotes could exploit, snowmobiles can travel an order of magnitude further in a day than non-motorized users.

CANADA LYNX MANAGEMENT

Both researchers and managers have recommended limiting snowmobile routes in lynx habitat. Following their research on coyotes use of snowmobile trails, Dowd et al. (2014) suggests "limiting the expanse of groomed trail system may minimize coyote encroachment into these deep snow environments" (p.39). The Canada Lynx Assessment and Conservation Strategy set planning standards on Forest Service lands that include, "on federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas by Lynx Analysis Unit… and map and monitor the location and intensity of snow compacting activities that coincide with lynx habitat, to facilitate future evaluation of effects on lynx as information becomes available" (USDA FS 2000, p.82).

UNGULATES

Ungulates are hoofed animals including deer (Odocoileus spp.), elk (Cervus canadensis), moose (Alces alces), mountain goat (Oreamnos americanus), and bighorn sheep (Ovis canadensis). All of these animals are highly prized game species. Bighorn sheep are classified as a Sensitive Species by the Forest Service, and two subspecies - Nelson's Peninsular and Sierra Nevada bighorn sheep - are listed as Endangered Species. It has been well established that undisturbed "winter range" is essential for ungulates survival (Canfield et al. 1999).

Studies have found that snowmobiles can exhibit both a physiological and behavioral response on a number of ungulate species (Gaines et al. 2003, Table 2). Recent studies in Yellowstone found elk had increased stress (Creel et al. 2002), and actively responded (Borkowski et al. 2006) when approached by snowmobiles. A recent study on moose in Scandinavia also found disturbance and displacement following snowmobile activity (Neumann et al. 2011). Bighorn sheep and mountain goats are particularly susceptible to the effects of disturbance because they are limited to relatively small areas of suitable habitat with very steep and rocky slopes Canfield et al. (1999)

UNGULATE MANAGEMENT

Limiting disturbance on ungulates, especially in winter range, is a key management strategy. For example, Canfield et al. (1999) in their review of the impact of recreation on Rocky Mountain ungulates suggest keeping motorized routes and trails away from wintering areas, and to create established designated travel routes to make human use as predictable as possible. Further, Harris et al. (2014) recently reviewed the impacts of winter recreation on northern ungulates and highlighted the importance of limiting the duration and spatial footprint of disturbance.

Yellowstone National Park has implemented a number of policies to reduce disturbance from snowmobiles. Some of these practices include: limiting the number of snowmobiles, requiring best available technology, setting speed limits of 35mph, and establishing open and closure dates (USDI NPS 2013). This has also been coupled with monitoring and complementary research projects which can measure the effectiveness of the management plan. For example, Borkowski et al. (2006) stated that snowmobile regulations in Yellowstone including levels and travel routes "were effective at reducing disturbances to bison and elk below a level that would cause measurable fitness effects" (p.1).

Illegal snowmobile highmarking on Aeneas Peak. This area is critical habitat for a number of important wildlife species, and is designated to provide a non-motorized experience. Flathead NF. Keith Hammer. 2014.

BEST MANAGEMENT PRACTICES FOR WILDLIFE

DESIGNATING MOTORIZED USE

- Identify routes and areas where there is the potential for snowmobile disturbance of key wildlife including grizzly bear, wolverine, lynx, and ungulate winter range using survey data or GIS modeling. Survey information should be catalogued and regularly updated in a GIS database.

- Locate motorized routes and areas:
    - o where disturbance is unlikely to significantly affect viability or recovery of listed or petitioned threatened or endangered species:
        - limit snowmobile routes and areas in grizzly bear suitable denning habitat, wolverine denning habitat, and Canada lynx Critical Habitat.
        - reduce snowmobile route density to below 1 mile/mile2 in occupied habitat.
    - o outside proposed Wilderness Areas, Wilderness Study Areas and Research Natural Areas.
    - o in discrete, specified areas bounded by natural features (topography and vegetative cover) to provide visual and acoustic barriers and to ensure that secure habitat is maintained for wildlife.
    - o outside critical ungulate wintering habitat.

- Set dates for snowmobile season opening and closure, and adjust based upon seasonal wildlife needs including:
    - o critical ungulate wintering habitat/winter concentration areas (e.g., December through March in Rockies).
    - o grizzly bear denning season (mid-November), and emergence time (mid-April).

- Limit or close routes and play areas with known bighorn sheep and mountain goat populations.

- Limit or close areas to off-road and oversnow vehicle use in areas where antler shed hunting is prevalent.

- Limit the number of routes and restrict off-trail use in key wildlife corridors.

- Maintain large un-fragmented, undisturbed, and connected blocks of forestland and alpine habitat where no snowmobile routes are designated.

MINIMIZING IMPACTS OF MOTORIZED USE

- Implement outreach programs to raise public awareness of winter wildlife habitat, wildlife behavior, and ways to minimize user impacts.

- Encourage or require the use of Best Available Technology (BAT) where necessary to limit disturbance on sensitive species.

- Close snowmobile routes and areas if a grizzly bear emerges from their den in the area.

- Monitor closed and areas to ensure they are effectively mitigating impacts to wildlife, and not being used illegally.

- Establish an adaptive management framework using monitoring to determine efficacy of current management. Revisit plan decisions as necessary to ensure wildlife impacts are being minimized and motorized impacts are below accepted thresholds.

WATER QUALITY, SOILS, AND VEGETATION RESEARCH

INTRODUCTION

Since the seminal research of Wallace Wanek and his colleagues in the 1970s, it has been well established that snowmobiles can negatively impact water quality, soils, and vegetation. However, while early researchers focused on localized impacts of snowmobiles on groomed trails, today's machines also travel off-trail and into many sensitive habitats such as alpine cirques, meadows, and wetlands. Water quality can also be affected when spring runoff releases pollutants stored in the snowpack. Furthermore, as snowmobiles become increasingly powerful, their increased torque and reach creates a potential for greater impact. For example, steep erosion-prone slopes are now commonly used for "high marking," increasing the risk of soil compaction and damage to slow-growing alpine vegetation.

WATER QUALITY

Protecting and enhancing water supply is a key mandate of the Forest Service, and a number of aquatic species and municipal watersheds depend on National Forests - especially in the West. For example, most National Forest acres west of the Cascade Mountains in Oregon and Washington are municipal watersheds (USDA FS 2000). During the winter, snowmobiles release toxins such as ammonium, nitrate, sulfate, benzene, and toluene which accumulate in the snowpack (Ingersol 1999), and increase acidity (Musselman and Kormacher 2007). In the spring runoff, accumulated pollutants are released as a pulse into the soil, groundwater, and surrounding waterbodies.

A recent study found snowmobiles are polluting a tributary of Lake Tahoe, CA. Examining 168 different semi-volatile organic compounds (SVOC), McDaniel (2013) found eight to 20 times greater loadings on snowmobile trails than background levels. He further reported that highly toxic and persistent polycyclic aromatic hydrocarbons (PAHs) had increased two to six times the background level in a nearby stream (McDaniel 2013). Impacts to water quality can be especially pronounced at trailheads and staging areas where snowmobiles congregate (USDA FS 2012). Lakes can also be vulnerable because snow melts directly into the waterbody without any vegetative buffer, and there is a risk of snowmobiles falling through thin ice and spilling toxins directly into the water (USDA FS 2012).

SOILS

Snowmobiles can directly impact soils in a number of ways including soil compaction, erosion, and contamination. When traveling in areas of low or no snow - such as such as wind-swept ridges, snow-free access points, or during periods of thin snowpack - snowmobiles can be particularly damaging.

They can also indirectly impact soils through snow compaction. Weighing several hundred pounds, snowmobiles easily compact the snow which can increase snowpack density, reduce soil temperatures, increase soil freezing, and result in a later melt-out (Gage and Cooper 2009). In areas of low or no snowpack, direct soil compaction can occur from snowmobiles leading to erosion (Gage and Cooper 2009). On steep slopes – especially south facing, or wind-swept slopes - vegetation and snow can be mechanically removed from snowmobile tracks resulting in exposed bare ground (Stagl 1999). Soil compaction impacts nearly all properties and functions of soil including increased bulk density and reduced pore space leading to reduced permeability of water and air (Batey 2009). This results in surface erosion especially on steep slopes (Batey 2009). Soil erosion when located near streams can also lead to localized stream sedimentation and increased turbidity. As climate change reduces the number of snow-free days, erosion from snowmobiles will be an increasing management concern.

Soils can also be contaminated when pollutants enter the soil from a melting snowpack. With inefficient engines, snowmobiles release much of their oil gas mixture into the snow unburned. Several pollutants have been recorded in the snowpack along snowmobile trails including ammonium, nitrate, sulfate, benzene, and toluene (Ingersol 1999). In the spring these pollutants are released into the soil creating local contamination and associated impacts.

VEGETATION

Snowmobiles impact vegetation either through directly crushing and breaking vegetation, or through a number of indirect mechanisms. When traveling off-trail, snowmobiles often run over trees and shrubs causing damage or death – often with minimal snowmobile traffic. Although these impacts may not be environmentally significant when they occur in robust forest environments, they can be very significant when they occur in sensitive forest habit, such as high mountain slopes or meadows.

A recent study on the Gallatin National Forest (MT) found 366 acres of trees damaged by snowmobiles on timber sale units - slowing forest regeneration (WWA 2009, Table 3). Trees such as white-bark pine (Pinus albicaulis), found only at high elevations and declining across its range, may be vulnerable to snowmobile damage. Trampling has also been found to result in a reduction in plant productivity, changes in the plant community, and a reduction in plant diversity (Stangl 1999).

As mentioned above, compaction of the snow reduces the insulating air spaces and conducts cold air to the ground (Gage and Cooper 2009).

These lower temperatures can reduce plant density and composition, reduce productivity and growth, delay seed germination and flowering, as well as affecting decomposition rates, hummus formation and microbial activity (Davenport and Switalski 2006). These impacts ultimately can change community structure and reduce the availability and duration of spring wildlife foods (Stagl 1999).

Table 3: Summary of snowmobile damaged trees on the Gallatin National Forest (MT) reported during regeneration transect surveys of previously logged timber stands (reprinted from WWA 2009).

Area name	Year logged	Year inven-toried	Acres	Average # damaged trees per acre	Total number of trees damaged
Little Teepee Creek Drainage	1969	1995	122	140	17,080
Horse Butte Road*	1992	1995	15	514*	7710*
Madison Arm	1991	1995	12	5	60
Unknown	1960s	1983	68	23	1564
Unknown*	1960s	1983	100	652*	65,200*
Cream Creek*	1986	1995	60	725*	43,500*
Total damaged trees:					**135,114**

****surveys note the presence of a snowmobile trail in this stand***

WATER QUALITY, SOILS, AND VEGETATION MANAGEMENT

The most common strategies for protecting water quality, soils, and vegetation from snowmobile impacts is to ensure that there is adequate snow cover and create a buffer around waterways. For example, the Forest Service has developed National Best Management Practices to protect water resources on Forest Service lands from snowmobile pollution (USDA FS 2012). This document recommends, "Allow over-snow vehicle use cross-country or on trails when snow depths are sufficient to protect the underlying vegetative cover and soil or trail surface; use and enforce closure orders to mitigate effects when adverse effects to soil, water quality, or riparian resources are occurring; use suitable measures to trap and treat pollutants from over-snow vehicle emissions in snowmelt runoff or locate the staging area at a sufficient distance from nearby waterbodies to provide adequate pollutant filtering" (USDA FS 2012, p. 96-97).

Snowmobile soil and vegetation damage, Helena NF, Adam Switlalski. 2009.

WATER QUALITY, SOILS, AND VEGETATION MANAGEMENT

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Individual Forests have also recommended restricting snowmobile use to protect water quality. The Uinta-Wasatch-Cache National Forest (UT) does not allow recreational snowmobiling in Salt Lake City's municipal watershed (USDA FS 2003). The Inyo, Sequoia, and Sierra National Forests are proposing a minimum of 18" of snowpack before allowing snowmobiling in their revised Forest Plan to protect forest resources (USDA FS 2014b). Restricting snowmobile use in sensitive habitats such as riparian areas and wetlands can be helpful in mitigating these impacts as well.

BEST MANAGEMENT PRACTICES FOR WATER QUALITY, SOILS, AND VEGETATION

DESIGNATING MOTORIZED USE

- Set dates for snowmobile season opening and closure, and adjust based upon adequate snow depth.
- Require a minimum snow depth of at least 12 inches, or sufficient depth to protect water quality, soils, and vegetation before allowing snowmobile trails to be groomed. Have a contingency plan and implement emergency closures if snowpack goes below this threshold.
- Require a minimum snow depth of at least 18 inches, or sufficient depth to protect water quality, soils, and vegetation before allowing snowmobiling off-trail. Have a contingency plan and implement emergency closures if snowpack goes below this threshold.
- Avoid locating snowmobile routes or areas in municipal watersheds.
- Restrict snowmobile use on wetlands, riparian areas, and sensitive meadows and buffer snowmobile trailheads and routes 150 feet from these areas.

MINIMIZING IMPACTS OF MOTORIZED USE

- Develop public information, educational programs, and signage about the impacts of snowmobiles on water quality, soils, and vegetation and how to minimize those impacts.
- Ensure adequate maintenance of bridges and culverts on routes to help prevent erosion during the spring run-off.
- If roads are only used for snowmobile use, scarify the roadbed to restore hydrology.
- Encourage or require the use of Best Available Technology (BAT) where necessary to minimize the impacts water quality, soils, and vegetation.
- Close routes and areas when excessive damage to soils and vegetation has occurred, and/or erosion has been documented.
- Monitor closed routes and areas to ensure the measures taken are effectively mitigating impacts to water quality, soils, and vegetation.
- Establish an adaptive management framework using monitoring to determine efficacy of current management. Revisit plan decisions as necessary to ensure impacts to water quality, soils, and vegetation are being minimized and motorized impacts are below accepted thresholds.

CONCLUSION

The growing number of winter backcountry users has increased recreational use conflicts and negative impacts on natural resources. As the Forest Service begins formally addressing winter recreation and determining where motorized use is allowed, restricted, and prohibited, it is essential that managers have the best available science to guide their decisions. In this document we presented the best available science on the impacts of snowmobiles. Based upon this research and the recommendations of researchers and managers, and professional experience, we have developed a list of best management practices. If these BMPs are followed, they will help mitigate recreational use conflicts and minimize impacts to natural resources. Once a system of routes and special use areas are established, enforcement and monitoring will be critical to the success of any management plan.

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Transportation Infrastructure and Access on National Forests and Grasslands
A Literature Review
May 2014

Introduction

The Forest Service transportation system is very large with 374,883 miles (603,316 km) of system roads and 143,346 miles (230,693 km) of system trails. The system extends broadly across every national forest and grasslands and through a variety of habitats, ecosystems and terrains. An impressive body of scientific literature exists addressing the various effects of roads on the physical, biological and cultural environment – so much so, in the last few decades a new field of "road ecology" has emerged. In recent years, the scientific literature has expanded to address the effects of roads on climate change adaptation and conversely the effects of climate change on roads, as well as the effects of restoring lands occupied by roads on the physical, biological and cultural environments.

The following literature review summarizes the most recent thinking related to the environmental impacts of forest roads and motorized routes and ways to address them. The literature review is divided into three sections that address the environmental effects of transportation infrastructure on forests, climate change and infrastructure, and creating sustainable forest transportation systems.

I. Impacts of Transportation Infrastructure and Access to the Ecological Integrity of Terrestrial and Aquatic Ecosystems and Watersheds

It is well understood that transportation infrastructure and access management impact aquatic and terrestrial environments at multiple scales, and, in general, the more roads and motorized routes the greater the impact. In fact, in the past 20 years or so, scientists having realized the magnitude and breadth of ecological issues related to roads; entire books have been written on the topic, e.g., Forman et al. (2003), and a new scientific field called "road ecology" has emerged. Road ecology research centers have been created including the Western

Transportation Institute at Montana State University and the Road Ecology Center at the University of California - Davis.[1]

Below, we provide a summary of the current understanding on the impacts of roads and access allowed by road networks to terrestrial and aquatic ecosystems, drawing heavily on Gucinski et al. (2000). Other notable recent peer-reviewed literature reviews on roads include Trombulak and Frissell (2000), Switalski et al. (2004), Coffin (2007), Fahrig and Rytwinski (2009), and Robinson et al. (2010). Recent reviews on the impact of motorized recreation include Joslin and Youmans (1999), Gaines et al. (2003), Davenport and Switalski (2006), Ouren et al. (2007), and Switalski and Jones (2012). These peer-reviewed summaries provide additional information to help managers develop more sustainable transportation systems

Impact on geomorphology and hydrology

The construction or presence of forest roads can dramatically change the hydrology and geomorphology of a forest system leading to reductions in the quantity and quality of aquatic habitat. While there are several mechanisms that cause these impacts (Wemple et al. 2001 , Figure 1), most fundamentally, compacted roadbeds reduce rainfall infiltration, intercepting and concentrating water, and providing a ready source of sediment for transport (Wemple et al. 1996, Wemple et al. 2001). In fact, roads contribute more sediment to streams than any other land management activity (Gucinski et al. 2000). Surface erosion rates from roads are typically at least an order of magnitude greater than rates from harvested areas, and three orders of magnitude greater than erosion rates from undisturbed forest soils (Endicott 2008).

[1] See http://www.westerntransportationinstitute.org/research/roadecology and http://roadecology.ucdavis.edu/

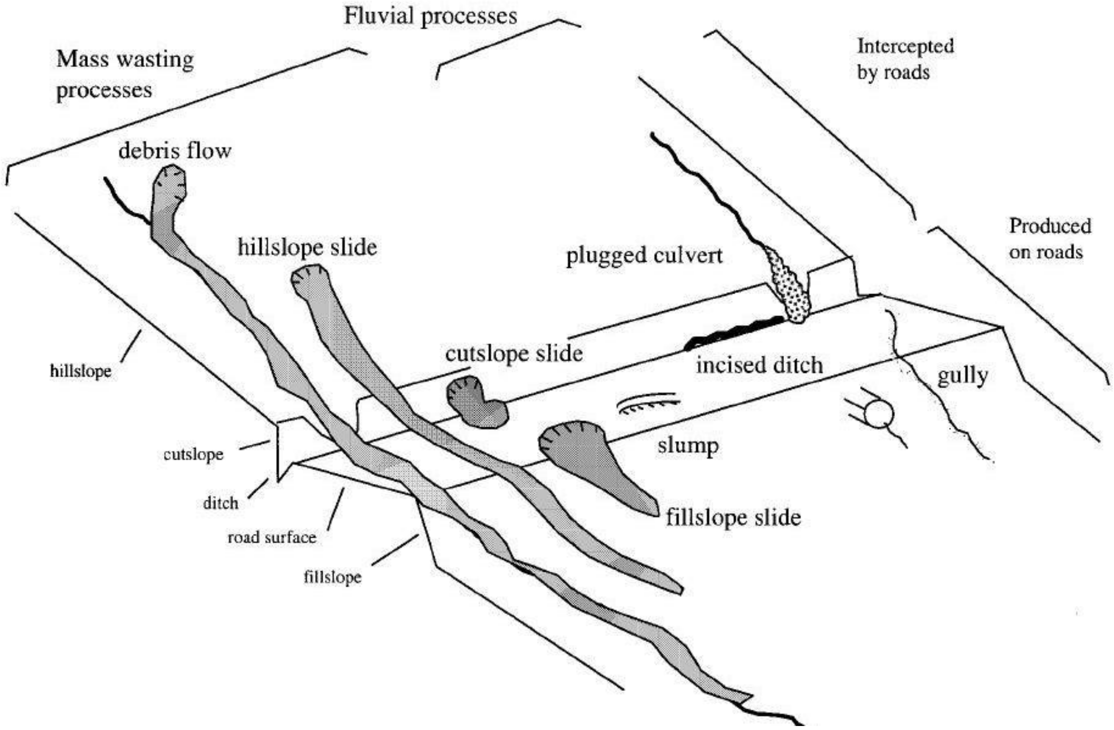

Figure 1: Typology of erosional and depositional features produced by mass-wasting and fluvial processes associate with forest roads (reprinted from Wemple et al. 2001)

Erosion of sediment from roads occurs both chronically and catastrophically. Every time it rains, sediment from the road surface and from cut- and fill-slopes is picked up by rainwater that flows into and on roads (fluvial erosion). The sediment that is entrained in surface flows are often concentrated into road ditches and culverts and directed into streams. The degree of fluvial erosion varies by geology and geography, and increases with increased motorized use (Robichaud et al. 2010). Closed roads produce less sediment, and Foltz et al. (2009) found a significant increase in erosion when closed roads were opened and driven upon.

Roads also precipitate catastrophic failures of road beds and fills (mass wasting) during large storm events leading to massive slugs of sediment moving into waterways (Endicott 2008; Gucinski et al. 2000). This typically occurs when culverts are undersized and cannot handle the volume of water, or they simply become plugged with debris. The saturated roadbed can fail entirely and result in a landslide, or the blocked stream crossing can erode the entire fill down to the original stream channel.

The erosion of road- and trail-related sediment and its subsequent movement into stream systems affects the geomorphology of the drainage system in a number of ways. The magnitude of their effects varies by climate, geology, road age, construction / maintenance practices and storm history. It directly alters channel morphology by embedding larger gravels as well as filling pools. It can also have the opposite effect of increasing peak discharges and scouring channels, which can lead to disconnection of the channel and floodplain, and lowered base flows (Furniss et al. 1991; Joslin and Youmans 1999). The width/depth ratio of the stream changes which then can trigger changes in water temperature, sinuosity and other geomorphic factors important for aquatic species survival (Joslin and Youmans 1999; Trombulak and Frissell 2000).

Roads also can modify flowpaths in the larger drainage network. Roads intercept subsurface flow as well as concentrate surface flow, which results in new flowpaths that otherwise would not exist, and the extension of the drainage network into previously unchannelized portions of the hillslope (Gucinski et al. 2000; Joslin and Youmans 1999). Severe aggradation of sediment at stream structures or confluences can force streams to actually go subsurface or make them too shallow for fish passage (Endicott 2008; Furniss et al. 1991).

Impacts on aquatic habitat and fish

Roads can have dramatic and lasting impacts on fish and aquatic habitat. Increased sedimentation in stream beds has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes, and reductions in macro-invertebrate populations that are a food source to many fish species (Rhodes et al. 1994, Joslin and Youmans 1999, Gucinski et al. 2000, Endicott 2008). On a landscape scale, these effects can add up to: changes in the frequency, timing and magnitude of disturbance to aquatic habitat and changes to aquatic habitat structures (e.g., pools, riffles, spawning gravels and in-channel debris), and conditions (food sources, refugi, and water temperature) (Gucinski et al. 2000).

Roads can also act as barriers to migration (Gucinski et al. 2000). Where roads cross streams, road engineers usually place culverts or bridges. Culverts in particular can and often interfere with sediment transport and channel processes such that the road/stream crossing becomes a barrier for fish and aquatic species movement up and down stream. For instance, a culvert may scour on the downstream side of the crossing, actually forming a waterfall up which fish cannot move. Undersized culverts and bridges can infringe upon the channel or floodplain and trap sediment causing the stream to become too shallow and/or warm such that fish will not migrate past the structure. This is problematic for many aquatic species but especially for anadromous species that must migrate upstream to spawn. Well-known native aquatic species affected by roads include salmon such as coho (*Oncorhynchus kisutch*), chinook (*O. tshawytscha*), and chum (*O. keta*); steelhead (*O. mykiss*); and a variety of trout species including bull trout (*Salvelinus confluentus*) and cutthroat trout (*O. clarki*), as well as other native fishes and amphibians (Endicott 2008).

Impacts on terrestrial habitat and wildlife

Roads and trails impact wildlife through a number of mechanisms including: direct mortality (poaching, hunting/trapping) changes in movement and habitat use patterns (disturbance/avoidance), as well as indirect impacts including alteration of the adjacent habitat and interference with predatory/prey relationships (Wisdom et al. 2000, Trombulak and Frissell 2000). Some of these impacts result from the road itself, and some result from the uses on and around the roads (access). Ultimately, roads have been found to reduce the abundance and distribution of several forest species (Fayrig and Ritwinski 2009, Benítez-López et al. 2010).

Table 1: Road- and recreation trail-associated factors for wide-ranging carnivores (Reprinted from Gaines et al. (2003)[2]

[2] For a list of citations see Gaines et al. (2003)

Focal species	Road-associated factors	Motorized trail-associated factors	Nonmotorized trail-associated factors
Grizzly bear	Poaching Collisions Negative human interactions Displacement or avoidance	Poaching Negative human interactions Displacement or avoidance	Poaching Negative human interactions Displacement or avoidance
Lynx	Down log reduction Trapping Collisions Disturbance at a specific site	Disturbance at a specific site Trapping	Disturbance at a specific site
Gray wolf	Trapping Poaching Collisions Negative human interactions Disturbance at a specific site Displacement or avoidance	Trapping Disturbance at a specific site	Trapping Disturbance at a specific site
Wolverine	Down log reduction Trapping Disturbance at a specific site Collisions	Trapping Disturbance at a specific site	Trapping Disturbance at a specific site

Direct mortality and disturbance from road and trail use impacts many different types of species. For example, wide-ranging carnivores can be significantly impacted by a number of factors including trapping, poaching, collisions, negative human interactions, disturbance and displacement (Gaines et al. 2003, Table 1). Hunted game species such as elk (*Cervus canadensis*), become more vulnerable from access allowed by roads and motorized trails resulting in a reduction in effective habitat among other impacts (Rowland et al. 2005, Switalski and Jones 2012). Slow-moving migratory animals such as amphibians, and reptiles who use roads to regulate temperature are also vulnerable (Gucinski et al. 2000, Brehme et al. 2013).

Habitat alteration is a significant consequence of roads as well. At the landscape scale, roads fragment habitat blocks into smaller patches that may not be able to support successfully interior forest species. Smaller habitat patches also results in diminished genetic variability, increased inbreeding, and at times local extinctions (Gucinski et al. 2000; Trombulak and Frissell 2000). Roads also change the composition and structure of ecosystems along buffer zones, called edge-affected zones. The width of edge-affected zones varies by what metric is being discussed; however, researchers have documented road-avoidance zones a kilometer or more away from a road (Table 2). In heavily roaded landscapes, edge-affected acres can be a significant fraction of total acres. For example, in a landscape area where the road density is 3 mi/mi^2 (not an uncommon road density in national forests) and where the edge-affected zone is estimated to be 500 ft from the center of the road to each side, the edge-affected zone is 56% of the total acreage.

Table 2: A summary of some documented road-avoidance zones for various species (adapted from Robinson et al. 2010).

Species	Avoidance zone m (ft)	Type of disturbance	Reference
Snakes	650 (2133)	Forestry roads	Bowles (1997)
Salamander	35 (115)	Narrow forestry road, light traffic	Semlitsch (2003)
Woodland birds	150 (492)	Unpaved roads	Ortega and Capen (2002)
Spotted owl	400 (1312)	Forestry roads, light traffic	Wasser et al. (1997)
Marten	<100 (<328)	Any forest opening	Hargis et al. (1999)
Elk	500–1000 (1640-3281)	Logging roads, light traffic	Edge and Marcum (1985)
	100–300 (328-984)	Mountain roads depending on traffic volume	Rost and Bailey (1979)
Grizzly bear	3000 (9840)	Fall	Mattson et al. (1996)
	500 (1640)	Spring and summer	
	883 (2897)	Heavily traveled trail	Kasworm and Manley (1990)
	274 (899)	Lightly traveled trail	
	1122 (3681)	Open road	Kasworm and Manley (1990)
	665 (2182)	Closed road	
Black bear	274 (899)	Spring, unpaved roads	Kasworm and Manley (1990)
	914 (2999)	Fall, unpaved roads	

Roads and trails also affect ecosystems and habitats because they are also a major vector of non-native plant and animal species. This can have significant ecological and economic impacts when the invading species are aggressive and can overwhelm or significantly alter native species and systems. In addition, roads can increase harassment, poaching and collisions with vehicles, all of which lead to stress or mortality (Wisdom et al. 2000).

Recent reviews have synthesized the impacts of roads on animal abundance and distribution. Fahrig and Rytwinski (2009) did a complete review of the empirical literature on effects of roads and traffic on animal abundance and distribution looking at 79 studies that addressed 131 species and 30 species groups. They found that the number of documented negative effects of roads on animal abundance outnumbered the number of positive effects by a factor of 5. Amphibians, reptiles, most birds tended to show negative effects. Small mammals generally showed either positive effects or no effect, mid-sized mammals showed either negative effects or no effect, and large mammals showed predominantly negative effects. Benítez-López et al. (2010) conducted a meta-analysis on the effects of roads and infrastructure proximity on mammal and bird populations. They found a significant pattern of avoidance and a reduction in bird and mammal populations in the vicinity of infrastructure.

Road density[3] thresholds for fish and wildlife

[3] We intend the term "road density" to refer to the density all roads within national forests, including system roads, closed roads, non-system roads administered by other jurisdictions (private, county, state), temporary roads and motorized trails. Please see Attachment 2 for the relevant existing scientific information supporting this approach.

It is well documented that beyond specific road density thresholds, certain species will be negatively affected, and some will be extirpated. Most studies that look into the relationship between road density and wildlife focus on the impacts to large endangered carnivores or hunted game species, although high road densities certainly affect other species – for instance, reptiles and amphibians. Gray wolves (*Canis lupus*) in the Great Lakes region and elk in Montana and Idaho have undergone the most long-term and in depth analysis. Forman and Hersperger (1996) found that in order to maintain a naturally functioning landscape with sustained populations of large mammals, road density must be below 0.6 km/km^2 (1.0 mi/mi^2). Several studies have since substantiated their claim (Robinson et al. 2010, Table 3).

A number of studies at broad scales have also shown that higher road densities generally lead to greater impacts to aquatic habitats and fish density (Table 3). Carnefix and Frissell (2009) provide a concise review of studies that correlate cold water fish abundance and road density, and from the cited evidence concluded that "1) no truly "safe" threshold road density exists, but rather negative impacts begin to accrue and be expressed with incursion of the very first road segment; and 2) highly significant impacts (e.g., threat of extirpation of sensitive species) are already apparent at road densities on the order of 0.6 km/km^2 (1.0 mi/mi^2) or less" (p. 1).

Table 3: A summary of some road-density thresholds and correlations for terrestrial and aquatic species and ecosystems (reprinted from Robinson et al. 2010).

Species (Location)	Road density (mean, guideline, threshold, correlation)	Reference
Wolf (Minnesota)	0.36 km/km2 (mean road density in primary range); 0.54 km/km^2 (mean road density in peripheral range)	Mech et al. (1988)
Wolf	>0.6 km/km^2 (absent at this density)	Jalkotzy et al. (1997)
Wolf (Northern Great Lakes region)	>0.45 km/km^2 (few packs exist above this threshold); >1.0 km/km^2 (no pack exist above this threshold)	Mladenoff et al. (1995)
Wolf (Wisconsin)	0.63 km/km^2 (increasing due to greater human tolerance	Wydeven et al. (2001)
Wolf, mountain lion (Minnesota, Wisconsin, Michigan)	0.6 km/km^2 (apparent threshold value for a naturally functioning landscape containing sustained populations)	Thiel (1985); van Dyke et al. (1986); Jensen et al. (1986); Mech et al. (1988); Mech (1989)
Elk (Idaho)	1.9 km/km^2 (density standard for habitat effectiveness)	Woodley 2000 cited in Beazley et al. 2004
Elk (Northern US)	1.24 km/km^2 (habitat effectiveness decline by at least 50%)	Lyon (1983)
Elk, bear, wolverine, lynx, and others	0.63 km/km^2 (reduced habitat security and increased mortality)	Wisdom et al. (2000)
Moose (Ontario)	0.2-0.4 km/km2 (threshold for pronounced response)	Beyer et al. (2013)
Grizzly bear (Montana)	>0.6 km/km^2	Mace et al. (1996); Mattson et al. (1996)
Black bear (North Carolina)	>1.25 km/km^2 (open roads); >0.5 km/km2 (logging roads); (interference with use of habitat)	Brody and Pelton (1989)
Black bear	0.25 km/km^2 (road density should not exceed)	Jalkotzy et al. (1997)
Bobcat (Wisconsin)	1.5 km/km^2 (density of all road types in home range)	Jalkotzy et al. (1997)

Large mammals	>0.6 km/km^2 (apparent threshold value for a naturally functioning landscape containing sustained populations)	Forman and Hersperger (1996)
Bull trout (Montana)	Inverse relationship of population and road density	Rieman et al. (1997); Baxter et al. (1999)
Fish populations (Medicine Bow National Forest)	(1) Positive correlation of numbers of culverts and stream crossings and amount of fine sediment in stream channels (2) Negative correlation of fish density and numbers of culverts	Eaglin and Hubert (1993) cited in Gucinski et al. (2001)
Macroinvertebrates	Species richness negatively correlated with an index of road density	McGurk and Fong (1995)
Non-anadromous salmonids (Upper Columbia River basin)	(1) Negative correlation likelihood of spawning and rearing and road density (2) Negative correlation of fish density and road density	Lee et al. (1997)

Where both stream and road densities are high, the incidence of connections between roads and streams can also be expected to be high, resulting in more common and pronounced effects of roads on streams (Gucinski et al. 2000). For example, a study on the Medicine Bow National Forest (WY) found as the number of culverts and stream crossings increased, so did the amount of sediment in stream channels (Eaglin and Hubert 1993). They also found a negative correlation with fish density and the number of culverts. Invertebrate communities can also be impacted. McGurk and Fong (1995) report a negative correlation between an index of road density with macroinvertebrate diversity.

The U.S. Fish and Wildlife Service's Final Rule listing bull trout as threatened (USDI Fish and Wildlife Service 1999) addressed road density, stating:

> "… assessment of the interior Columbia Basin ecosystem revealed that increasing road densities were associated with declines in four non-anadromous salmonid species (bull trout, Yellowstone cutthroat trout, westslope cutthroat trout, and redband trout) within the Columbia River Basin, likely through a variety of factors associated with roads (Quigley & Arbelbide 1997). Bull trout were less likely to use highly roaded basins for spawning and rearing, and if present, were likely to be at lower population levels (Quigley and Arbelbide 1997). Quigley et al. (1996) demonstrated that when average road densities were between 0.4 to 1.1 km/km^2 (0.7 and 1.7 mi/mi^2) on USFS lands, the proportion of subwatersheds supporting "strong" populations of key salmonids dropped substantially. Higher road densities were associated with further declines" (USDI Fish and Wildlife Service 1999, p. 58922).

Anderson et al. (2012) also showed that watershed conditions tend to be best in areas protected from road construction and development. Using the US Forest Service's Watershed Condition Framework assessment data, they showed that National Forest lands that are protected under the Wilderness Act, which provides the strongest safeguards, tend to have the healthiest watersheds. Watersheds in Inventoried Roadless Areas – which are protected from road building and logging by the Roadless Area Conservation Rule – tend to be less healthy than watersheds in designated Wilderness, but they are considerably healthier than watersheds in the managed landscape.

Impacts on other resources
Roads and motorized trails also play a role in affecting wildfire occurrence. Research shows that human-ignited wildfires, which account for more than 90% of fires on national lands, is almost five times more likely in areas with roads (USDA Forest Service 1996a; USDA Forest Service 1998). Furthermore, Baxter (2002) found that off-road vehicles (ORVs) can be a significant source of fire ignitions on forestlands. Roads can affect where and how forests burn and, by extension, the vegetative condition of the forest. See Attachment 1 for more information documenting the relationship between roads and wildfire occurrence.

Finally, access allowed by roads and trails can increase of ORV and motorized use in remote areas threatening archaeological and historic sites. Increased visitation has resulted in intentional and unintentional damage to many cultural sites (USDI Bureau of Land Management 2000, Schiffman 2005).

II. Climate Change and Transportation Infrastructure including the value of roadless areas for climate change adaptation

As climate change impacts grow more profound, forest managers must consider the impacts on the transportation system as well as from the transportation system. In terms of the former, changes in precipitation and hydrologic patterns will strain infrastructure at times to the breaking point resulting in damage to streams, fish habitat, and water quality as well as threats to public safety. In terms of the latter, the fragmenting effect of roads on habitat will impede the movement of species which is a fundamental element of adaptation. Through planning, forest managers can proactively address threats to infrastructure, and can actually enhance forest resilience by removing unneeded roads to create larger patches of connected habitat.

Impact of climate change and roads on transportation infrastructure
It is expected that climate change will be responsible for more extreme weather events, leading to increasing flood severity, more frequent landslides, changing hydrographs (peak, annual mean flows, etc.), and changes in erosion and sedimentation rates and delivery processes. Roads and trails in national forests, if designed by an engineering standard at all, were designed for storms and water flows typical of past decades, and hence may not be designed for the storms in future decades. Hence, climate driven changes may cause transportation infrastructure to malfunction or fail (ASHTO 2012, USDA Forest Service 2010). The likelihood is higher for facilities in high-risk settings—such as rain-on-snow zones, coastal areas, and landscapes with unstable geology (USDA Forest Service 2010).

Forests fragmented by roads will likely demonstrate less resistance and resilience to stressors, like those associated with climate change (Noss 2001). First, the more a forest is fragmented (and therefore the higher the edge/interior ratio), the more the forest loses its inertia characteristic, and becoming less resilient and resistant to climate change. Second, the more a forest is fragmented characterized by isolated patches, the more likely the fragmentation will interfere with the ability of species to track shifting climatic conditions over time and space. Noss (2001) predicts that weedy species with effective dispersal mechanisms might benefit from fragmentation at the expense of native species.

Modifying infrastructure to increase resilience

To prevent or reduce road failures, culvert blow-outs, and other associated hazards, forest managers will need to take a series of actions. These include replacing undersized culverts with larger ones, prioritizing maintenance and upgrades (e.g., installing drivable dips and more outflow structures), and obliterating roads that are no longer needed and pose erosion hazards (USDA Forest Service 2010, USDA Forest Service 2012a, USDA Forest Service 2011, Table 4).

Olympic National Forest has developed a number of documents oriented at oriented at protecting watershed health and species in the face of climate change, including a 2003 travel management strategy and a report entitled Adapting to Climate Change in Olympic National Park and National Forest. In the travel management strategy, Olympic National Forest recommended that 1/3rd of its road system be decommissioned and obliterated (USDA Forest Service 2011a). In addition, the plan called for addressing fish migration barriers in a prioritized and strategic way – most of these are associated with roads. The report calls for road decommissioning, relocation of roads away from streams, enlarging culverts as well as replacing culverts with fish-friendly crossings (USDA Forest Service 2011a, Table 4).

Table 4: Current and expected sensitivities of fish to climate change on the Olympic Peninsula, associated adaptation strategies and action for fisheries and fish habitat management and relevant to transportation management at Olympic National Forest and Olympic National Park (excerpt reprinted from USDA Forest Service 2011a).

Current and expected sensitivites	Adaptation strategies and actions
Changes in habitat quantity and quality	• Implement habitat restoration projects that focus on re-creating watershed processes and functions and that create diverse, resilient habitat.
Increase in culvert failures, fill-slope failures, stream adjacent road failures, and encroachment from stream-adjacent road segments	• Decommission unneeded roads. • Remove sidecast, improve drainage, and increase culvert sizing on remaining roads. • Relocate stream-adjacent roads.
Greater difficulty disconnecting roads from stream channels	• Design more resilient stream crossing structures.
Major changes in quantity and timing of streamflow in transitional watersheds	• Make road and culvert designs more conservative in transitional watersheds to accommodate expected changes.
Decrease in area of headwater streams	• Continue to correct culvert fish passage barriers. • Consider re-prioritizing culvert fish barrier correction projects.
Decrease in habitat quantity and connectivity for species that use headwater streams	• Restore habitat in degraded headwater streams that are expected to retain adequate summer streamflow (ONF).

In December 2012, the USDA Forest Service published a report entitled “Assessing the Vulnerability of Watersheds to Climate Change.” This document reinforces the concept expressed by Olympic National Forest that forest managers need to be proactive in reducing erosion potential from roads:

> "Road improvements were identified as a key action to improve condition and resilience of watersheds on all the pilot Forests. In addition to treatments that reduce erosion, road improvements can reduce the delivery of runoff from road segments to channels, prevent diversion of flow during large events, and restore aquatic habitat connectivity by providing for passage of aquatic organisms. As stated previously, watershed sensitivity is determined by both inherent and management-related factors. Managers have no control over the inherent factors, so to improve resilience, efforts must be directed at anthropogenic influences such as instream flows, roads, rangeland, and vegetation management….
>
> [Watershed Vulnerability Analysis] results can also help guide implementation of travel management planning by informing priority setting for decommissioning roads and road reconstruction/maintenance. As with the Ouachita NF example, disconnecting roads from the stream network is a key objective of such work. Similarly, WVA analysis could also help prioritize aquatic organism passage projects at road-stream crossings to allow migration by aquatic residents to suitable habitat as streamflow and temperatures change" (USDA Forest Service 2012a, p. 22-23).

Reducing fragmentation to enhance aquatic and terrestrial species adaptation
Decommissioning and upgrading roads and thus reducing the amount of fine sediment deposited on salmonid nests can increase the likelihood of egg survival and spawning success (McCaffery et al. 2007). In addition, this would reconnect stream channels and remove barriers such as culverts. Decommissioning roads in riparian areas may provide further benefits to salmon and other aquatic organisms by permitting reestablishment of streamside vegetation, which provides shade and maintains a cooler, more moderated microclimate over the stream (Battin et al. 2007).

One of the most well documented impacts of climate change on wildlife is a shift in the ranges of species (Parmesan 2006). As animals migrate, landscape connectivity will be increasingly important (Holman et al. 2005). Decommissioning roads in key wildlife corridors will improve connectivity and be an important mitigation measure to increase resiliency of wildlife to climate change. For wildlife, road decommissioning can reduce the many stressors associated with roads. Road decommissioning restores habitat by providing security and food such as grasses and fruiting shrubs for wildlife (Switalski and Nelson 2011).

Forests fragmented by roads and motorized trail networks will likely demonstrate less resistance and resilience to stressors, such as weeds. As a forest is fragmented and there is more edge habitat, Noss (2001) predicts that weedy species with effective dispersal mechanisms will increasingly benefit at the expense of native species. However, decommissioned roads when seeded with native species can reduce the spread of invasive species (Grant et al. 2011), and help restore fragmented forestlands. Off-road vehicles with large knobby tires and large undercarriages are also a key vector for weed spread (e.g., Rooney 2006). Strategically closing and decommissioning motorized routes, especially in roadless areas, will reduce the spread of weeds on forestlands (Gelbard and Harrison 2003).

Transportation infrastructure and carbon sequestration
The topic of the relationship of road restoration and carbon has only recently been explored. There is the potential for large amounts of carbon (C) to be sequestered by reclaiming roads. When roads are decompacted during reclamation, vegetation and soils can develop more

rapidly and sequester large amounts of carbon. A recent study estimated total soil C storage increased 6 fold to 6.5 x 107g C/km (to 25 cm depth) in the northwestern US compared to untreated abandoned roads (Lloyd et al. 2013). Another recent study concluded that reclaiming 425 km of logging roads over the last 30 years in Redwood National Park in Northern California resulted in net carbon savings of 49,000 Mg carbon to date (Madej et al. 2013, Table 5).

Kerekvliet et al. (2008) published a Wilderness Society briefing memo on the impact to carbon sequestration from road decommissioning. Using Forest Service estimates of the fraction of road miles that are unneeded, the authors calculated that restoring 126,000 miles of roads to a natural state would be equivalent to revegetating an area larger than Rhode Island. In addition, they calculate that the net economic benefit of road treatments are always positive and range from US$0.925-1.444 billion.

Table 5. Carbon budget implications in road decommissioning projects (reprinted from Madej et al. 2013).

Road Decommissioning Activities and Processes	Carbon Cost	Carbon Savings
Transportation of staff to restoration sites (fuel emissions)	X	
Use of heavy equipment in excavations (fuel emissions)	X	
Cutting trees along road alignment during hillslope recontouring	X	
Excavation of road fill from stream crossings		X
Removal of road fill from unstable locations		X
Reduces risk of mass movement		X
Post-restoration channel erosion at excavation sites	X	
Natural revegetation following road decompaction		X
Replanting trees		X
Soil development following decompaction		X

Benefits of roadless areas and roadless area networks to climate change adaptation
Undeveloped natural lands provide numerous ecological benefits. They contribute to biodiversity, enhance ecosystem representation, and facilitate connectivity (Loucks et al. 2003; Crist and Wilmer 2002, Wilcove 1990, The Wilderness Society 2004, Strittholt and Dellasala 2001, DeVelice and Martin 2001), and provide high quality or undisturbed water, soil and air (Anderson et al. 2012, Dellasalla et al. 2011). They also can serve as ecological baselines to help us better understand our impacts to other landscapes, and contribute to landscape resilience to climate change.

Forest Service roadless lands, in particular, are heralded for the conservation values they provide. These are described at length in the preamble of the Roadless Area Conservation Rule (RACR)[4] as well as in the Final Environmental Impact Statement (FEIS) for the RACR[5], and

[4] Federal Register .Vol. 66, No. 9. January 12, 2001. Pages 3245-3247.

include: high quality or undisturbed soil, water, and air; sources of public drinking water; diversity of plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non- motorized, and semi-primitive motorized classes of dispersed recreation; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; and other locally identified unique characteristics (e.g., include uncommon geological formations, unique wetland complexes, exceptional hunting and fishing opportunities).

The Forest Service, National Park Service, and US Fish and Wildlife Service recognize that protecting and connecting roadless or lightly roaded areas is an important action agencies can take to enhance climate change adaptation. For example, the Forest Service National Roadmap for Responding to Climate Change (USDA Forest Service 2011b) establishes that increasing connectivity and reducing fragmentation are short and long term actions the Forest Service should take to facilitate adaptation to climate change.[6] The National Park Service also identifies connectivity as a key factor for climate change adaptation along with establishing "blocks of natural landscape large enough to be resilient to large-scale disturbances and long-term changes" and other factors. The agency states that: "The success of adaptation strategies will be enhanced by taking a broad approach that identifies connections and barriers across the landscape. Networks of protected areas within a larger mixed landscape can provide the highest level of resilience to climate change."[7] Similarly, the National Fish, Wildlife and Plants Climate Adaptation Partnership's Adaptation Strategy (2012) calls for creating an ecologically-connected network of conservation areas.[8]

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[5] Final Environmental Impact Statement, Vol. 1, 3–3 to 3–7

[6] Forest Service, 2011. *National Roadmap for Responding to Climate Change*. US Department of Agriculture. FS-957b. Page 26.

[7] National Park Service. *Climate Change Response Program Brief.* http://www.nature.nps.gov/climatechange/adaptationplanning.cfm. Also see: National Park Service, 2010. *Climate Change Response Strategy*. http://www.nature.nps.gov/climatechange/docs/NPS_CCRS.pdf. Objective 6.3 is to "Collaborate to develop cross-jurisdictional conservation plans to protect and restore connectivity and other landscape-scale components of resilience."

[8] See http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Chapter-3.pdf. Pages 55- 59. The first goal and related strategies are:

> Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.
>
> > Strategy 1.1: identify areas for an ecologically-connected network of terrestrial, freshwater, coastal, and marine conservation areas that are likely to be resilient to climate change and to support a broad range of fish, wildlife, and plants under changed conditions.
> >
> > Strategy 1.2: Secure appropriate conservation status on areas identified in Strategy 1.1 to complete an ecologically-connected network of public and private conservation areas that will be resilient to climate change and support a broad range of species under changed conditions.
> >
> > Strategy 1.4: Conserve, restore, and as appropriate and practicable, establish new ecological connections among conservation areas to facilitate fish, wildlife, and plant migration, range shifts, and other transitions caused by climate change.

Crist and Wilmer (2002) looked at the ecological value of roadless lands in the Northern Rockies and found that protection of national forest roadless areas, when added to existing federal conservation lands in the study area, would 1) increase the representation of virtually all land cover types on conservation lands at both the regional and ecosystem scales, some by more than 100%; 2) help protect rare, species-rich, and often-declining vegetation communities; and 3) connect conservation units to create bigger and more cohesive habitat "patches."

Roadless lands also are responsible for higher quality water and watersheds. Anderson et al. (2012) assessed the relationship of watershed condition and land management status and found a strong spatial association between watershed health and protective designations. Dellasalla et al. (2011) found that undeveloped and roadless watersheds are important for supplying downstream users with high-quality drinking water, and developing these watersheds comes at significant costs associated with declining water quality and availability. The authors recommend a light-touch ecological footprint to sustain the many values that derive from roadless areas including healthy watersheds.

III. Sustainable Transportation Management in National Forests as Part of Ecological Restoration

At 375,000 miles strong, the Forest Service road system is one of the largest in the world – it is eight times the size of the National Highway System. It is also indisputably unsustainable – that is, roads are not designed, located, or maintained according to best management practices, and environmental impacts are not minimized. It is largely recognized that forest roads, especially unpaved ones, are a primary source of sediment pollution to surface waters (Endicott 2008, Gucinski et al. 2000), and that the system has about 1/3rd more miles than it needs (USDA Forest Service 2001). In addition, the majority of the roads were constructed decades ago when road design and management techniques did not meet current standards (Gucinski et al. 2000, Endicott 2008), making them more vulnerable to erosion and decay than if they had been designed today. Road densities in national forests often exceed accepted thresholds for wildlife.

Only a small portion of the road system is regularly used. All but 18% of the road system is inaccessible to passenger vehicles. Fifty-five percent of the roads are accessible only by high clearance vehicles and 27% are closed. The 18% that is accessible to cars is used for about 80% of the trips made within National Forests.[9] Most of the road maintenance funding is directed to the passenger car roads, while the remaining roads suffer from neglect. As a result, the Forest Service currently has a $3.7 billion road maintenance backlog that grows every year. In other words, only about 1/5th of the roads in the national forest system are used most of the time, and the fraction that is used often is the best designed and maintained because they are higher level access roads. The remaining roads sit generally unneeded and under-maintained – arguably a growing ecological and fiscal liability.

Current Forest Service management direction is to identify and implement a sustainable transportation system.[10] The challenge for forest managers is figuring out what is a sustainable road system and how to achieve it – a challenge that is exacerbated by climate change. It is

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[9] USDA Forest Service. Road Management Website Q&As. Available online at http://www.fs.fed.us/eng/road_mgt/qanda.shtml.

[10] See Forest Service directive memo dated March 29, 2012 entitled "Travel Management, Implementation of 36 CFR, Part 202, Subpart A (36 CFR 212.5(b))"

reasonable to define a sustainable transportation system as one where all the routes are constructed, located, and maintained with best management practices, and social and environmental impacts are minimized. This, of course, is easier said than done, since the reality is that even the best roads and trail networks can be problematic simply because they exist and usher in land uses that without the access would not occur (Trombulak and Frissell 2000, Carnefix and Frissell 2009, USDA Forest Service 1996b), and when they are not maintained to the designed level they result in environmental problems (Endicott 2008; Gucinski et al. 2000). Moreover, what was sustainable may no longer be sustainable under climate change since roads designed to meet older climate criteria may no longer hold up under new climate scenarios (USDA Forest Service 2010, USDA Forest Service 2011b, USDA Forest Service 2012a, AASHTO 2012).

Forest Service efforts to move toward a more sustainable transportation system
The Forest Service has made efforts to make its transportation system more sustainable, but still has considerable work to do. In 2001, the Forest Service tried to address the issue by promulgating the Roads Rule[11] with the purpose of working toward a sustainable road system (USDA 2001). The Rule directed every national forest to identify a minimum necessary road system and identify unneeded roads for decommissioning. To do this, the Forest Service developed the Roads Analysis Process (RAP), and published Gucinski et al. (2000) to provide the scientific foundation to complement the RAP. In describing the RAP, Gucinski et al. (2000) writes:

> "Roads Analysis is intended to be an integrated, ecological, social, and economic approach to transportation planning. It uses a multiscale approach to ensure that the identified issues are examined in context. Roads Analysis is to be based on science. Analysts are expected to locate, correctly interpret, and use relevant existing scientific literature in the analysis, disclose any assumptions made during the analysis, and reveal the limitations of the information on which the analysis is based. The analysis methods and the report are to be subjected to critical technical review" (p. 10).

Most national forests have completed RAPs, although most only looked at passenger vehicle roads which account for less than 20% of the system's miles. The Forest Service Washington Office in 2010 directed that forests complete a Travel Analysis Process (TAP) by the end of fiscal year 2015, which must address all roads and create a map and list of roads identifying which are likely needed and which are not. Completed TAPs will provide a blueprint for future road decommissioning and management, they will not constitute compliance with the Roads Rule, which clearly requires the identification of the minimum roads system and roads for decommissioning. Almost all forests have yet to comply with subpart A.

The Forest Service in 2005 then tried to address the off-road portion of this issue by promulgating subpart B of the Travel Managemenr Rule,[12] with the purpose of curbing the most serious impacts associated with off-road vehicle use. Without a doubt, securing summer-time travel management plans was an important step to curbing the worst damage. However, much work remains to be done to approach sustainability, especially since many national forests used the travel management planning process to simply freeze the footprint of motorized routes, and did not try to re-design the system to make it more ecologically or socially sustainable. Adams

[11] 36 CFR 215 subpart A
[12] 36 CFR 212 subpart B

and McCool (2009) considered this question of how to achieve sustainable motorized recreation and concluded that:

> As the agencies move to revise [off-road vehicle] allocations, they need to clearly define how they intend to locate routes so as to minimize impacts to natural resources and other recreationists in accordance with Executive Order 11644....[13]
>
> …As they proceed with designation, the FS and BLM need to acknowledge that current allocations are the product of agency failure to act, not design. Ideally, ORV routes would be allocated as if the map were currently empty of ORV routes. Reliance on the current baseline will encourage inefficient allocations that likely disproportionately impact natural resources and non-motorized recreationists. While acknowledging existing use, the agencies need to do their best to imagine the best possible arrangement of ORV routes, rather than simply tinkering around the edges of the current allocations.[14]

The Forest Service only now is contemplating addressing the winter portion of the issue, forced by a lawsuit challenging the Forest Service's inadequate management of snowmobiles. The agency is expected to issue a third rule in the fall of 2014 that will trigger winter travel management planning.

Strategies for identifying a minimum road system and prioritizing restoration

Transportation Management plays an integral role in the restoration of Forestlands. Reclaiming and obliterating roads is key to developing a sustainable transportation system. Numerous authors have suggested removing roads 1) to restore water quality and aquatic habitats Gucinski et al. 2000), and 2) to improve habitat security and restore terrestrial habitat (e.g., USDI USFWS 1993, Hebblewhite et al. 2009).

Creating a minimum road system through road removal will increase connectivity and decrease fragmentation across the entire forest system. However, at a landscape scale, certain roads and road segments pose greater risks to terrestrial and aquatic integrity than others. Hence, restoration strategies must focus on identifying and removing/mitigating the higher risk roads. Additionally, areas with the highest ecological values, such as being adjacent to a roadless area, may also be prioritized for restoration efforts. Several methods have been developed to help prioritize road reclamation efforts including GIS-based tools and best management practices (BMPs). It is our hope that even with limited resources, restoration efforts can be prioritized and a more sustainable transportation system created.

GIS-based tools

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[13] Recent court decisions have made it clear that the minimization requirements in the Executive Orders are not discretionary and that the Executive Orders are enforceable. See

- *Idaho Conservation League v. Guzman ,* 766 F. Supp. 2d 1056 (D. Idaho 2011) (Salmon-Challis National Forest TMP) .
- *The Wilderness Society v. U.S. Forest Service*, CV 08-363 (D. Idaho 2012) (Sawtooth-Minidoka district National Forest TMP).
- *Central Sierra Environmental Resource Center v. US Forest Service*, CV 10-2172 (E.D. CA 2012) (Stanislaus National Forest TMP).

[14] Page 105.

Girvetz and Shilling (2003) developed a novel and inexpensive way to analyze environmental impacts from road systems using the Ecosystem Management Decision Support program (EMDS). EMDS was originally developed by the United States Forest Service, as a GIS-based decision support tool to conduct ecological analysis and planning (Reynolds 1999). Working in conjunction with Tahoe National Forest managers, Girvetz and Shilling (2003) used spatial data on a number of aquatic and terrestrial variables and modeled the impact of the forest's road network. The network analysis showed that out of 8233 km of road analyzed, only 3483 km (42%) was needed to ensure current and future access to key points. They found that the modified network had improved patch characteristics, such as significantly fewer "cherry stem" roads intruding into patches, and larger roadlessness.

Shilling et al. (2012) later developed a recreational route optimization model using a similar methodology and with the goal of identifying a sustainable motorized transportation system for the Tahoe National Forest (Figure 2). Again using a variety of environmental factors, the model identified routes with high recreational benefits, lower conflict, lower maintenance and management requirements, and lower potential for environmental impact operating under the presumption that such routes would be more sustainable and preferable in the long term. The authors combined the impact and benefit analyses into a recreation system analysis "that was effectively a cost-benefit accounting, consistent with requirements of both the federal Travel Management Rule (TMR) and the National Environmental Policy Act" (p. 392**).**

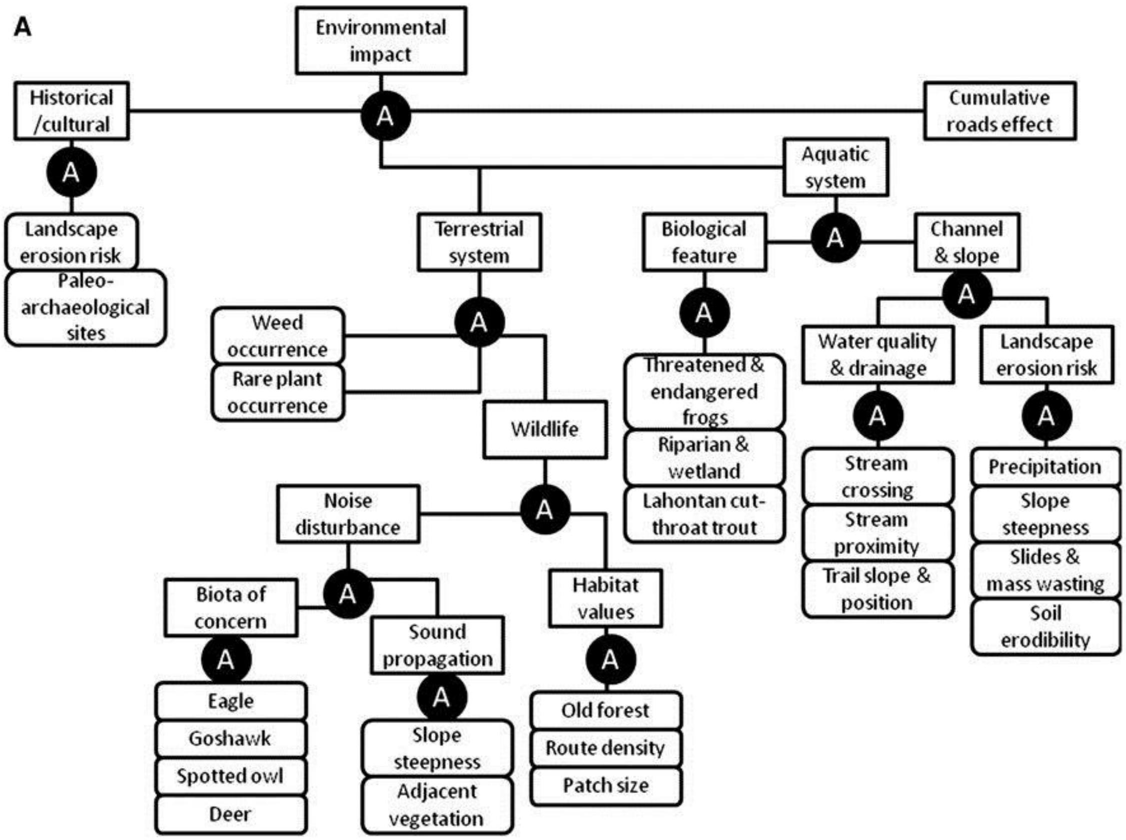

Figure 2: A knowledge base of contributions of various environmental conditions to the concept ''environmental impact'' [of motorized trails]. Rectangles indicate concepts, circles indicate Boolean logic operators, and rounded rectangles indicate sources of environmental data. (Reprinted from Shilling et al. 2012)

The Wilderness Society in 2012 also developed a GIS decision support tool called "RoadRight" that identifies high risk road segments to a variety of forest resources including water, wildlife, and roadlessness (The Wilderness Society 2012, The Wilderness Society 2013). The GIS system is designed to provide information that will help forest planners identify and minimize road related environmental risks. See the summary of and user guide for RoadRight that provides more information including where to access the open source software.[15]

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[15] The Wilderness Society, 2012. Rightsizing the National Forest Road System: A Decision Support Tool. Available at http://www.landscapecollaborative.org/download/attachments/12747016/Road+decommissioning+model+-overview+2012-02-29.pdf?version=1&modificationDate=1331595972330.

The Wilderness Society, 2013.
RoadRight: A Spatial Decision Support System to Prioritize Decommissioning and Repairing Roads in

Best management practices (BMPs)

BMPs have also been developed to help create more sustainable transportation systems and identify restoration opportunities. BMPs provide science-based criteria and standards that land managers follow in making and implementing decisions about human uses and projects that affect natural resources. Several states have developed BMPs for road construction, maintenance and decommissioning practices (e.g., Logan 2001, Merrill and Cassaday 2003, USDA Forest Service 2012b).

Recently, BMPs have been developed for addressing motorized recreation. Switalski and Jones (2012) published, "*Off-Road Vehicle Best Management Practices for Forestlands: A Review of Scientific Literature and Guidance for Managers*." This document reviews the current literature on the environmental and social impacts of off-road vehicles (ORVs), and establishes a set of Best Management Practices (BMPs) for the planning and management of ORV routes on forestlands. The BMPs were designed to be used by land managers on all forestlands, and is consistent with current forest management policy and regulations. They give guidance to transportation planners on where how to place ORV routes in areas where they will reduce use conflicts and cause as little harm to the environment as possible. These BMPs also help guide managers on how to best remove and restore routes that are redundant or where there is an unacceptable environmental or social cost.

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Attachments

Attachment 1: Wildfire and Roads Fact Sheet

Attachment 2: Using Road Density as a Metric for Ecological Health in National Forests: What Roads and Routes should be Included? Summary of Scientific Information

THE WILDERNESS SOCIETY

Roads and Fire: A Proven Relationship

Photo: Lou Anegli Digital

Roaded Forests Are at a Greater Risk of Experiencing Wildfires than Unroaded Forests

- A wildland fire ignition is almost twice as likely to occur in a roaded area than in a roadless area. (USDA 2000, Table 3-18)
- The location of large wildfires is often correlated with proximity to busy roads. (Sierra Nevada Ecosystem Project, 1996)
- High road density increases the probability of fire occurrence due to human-caused ignitions. (Hann, W.J., et al. 1997)
- Unroaded areas have lower potential for high-intensity fires than roaded areas because they are less prone to human-caused ignitions. (DellaSala, et al. 1995)
- The median size of large fires on national forests is greater outside of roadless areas. (USDA 2000, Table 3-22)
- A positive correlation exists between lightning fire frequency and road density due to increased availability of flammable fine fuels near roads. (Arienti, M. Cecilia, et al. 2009)
- Human caused wildfires are strongly associated with access to natural landscapes, with the proximity to urban areas and roads being the most important factor (Romero-Calcerrada, et al. 2008)

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Human Activity and Wildfire

- Sparks from cars, off-road vehicles, and neglected campfires caused nearly 50,000 wildfire ignitions in 2000. (USDA 2000, Fuel Management and Fire Suppression Specialist Report, Table 4.)
- More than 90% of fires on national lands are caused by humans (USDA 1996 and 1998)
- Human-ignited wildfire is almost 5 times more likely to occur in a roaded area than in a roadless area (USDA 2000, Table 3-19).

There are 375,000 miles of roads in our national forests.

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Roads and Fire: A Proven Relationship


Photo: USDA Forest Service, Coconino National Forest

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Attachment 2: Using Road Density as a Metric for Ecological Health in National Forests: What Roads and Routes should be Included?
Summary of Scientific Information
Last Updated, November 22, 2012

I. Density analysis should include closed roads, non-system roads administered by other jurisdictions (private, county, state), temporary roads and motorized trails.

Typically, the Forest Service has calculated road density by looking only at open system road density. From an ecological standpoint, this approach may be flawed since it leaves out of the density calculations a significant percent of the total motorized routes on the landscape. For instance, the motorized route system in the entire National Forest System measures well over 549,000 miles.[1] By our calculation, a density analysis limited to open system roads would consider less than 260,000 miles of road, which accounts for less than half of the entire motorized transportation system estimated to exist on our national forests.[2] These additional roads and motorized trails impact fish, wildlife, and water quality, just as open system roads do. In this section, we provide justification for why a road density analysis used for the purposes of assessing ecological health and the effects of proposed alternatives in a planning document should include closed system roads, non-system roads administered by other jurisdictions, temporary roads, and motorized trails.

Impacts of closed roads

It is crucial to distinguish the density of roads physically present on the landscape, whether closed to vehicle use or not, from "open-road density" (Pacific Rivers Council, 2010). An open-road density of 1.5 mi/mi² has been established as a standard in some national forests as protective of some terrestrial wildlife species. However, many areas with an open road density of 1.5 mi/mi² have a much higher inventoried or extant hydrologically effective road density, which may be several-fold as high with significant aquatic impacts. This higher density occurs because many road "closures" block vehicle access, but do nothing to mitigate the hydrologic alterations that the road causes. The problem is

[1] The National Forest System has about 372,000 miles of system roads. The forest service also has an estimated 47,000 miles of motorized trails. As of 1998, there were approximately 130,000 miles of non-system roads in our forests. Non-system roads include public roads such as state, county, and local jurisdiction and private roads. (USFS, 1998) The Forest Service does not track temporary roads but is reasonable to assume that there are likely several thousand miles located on National Forest System lands.

[2] About 30% of system roads, or 116,108 miles, are in Maintenance Level 1 status, meaning they are closed to all motorized use. (372,000 miles of NFS roads - 116,108 miles of ML 1 roads = 255,892). This number is likely conservative given that thousands of more miles of system roads are closed to public motorized use but categorized in other Maintenance Levels.

further compounded in many places by the existence of "ghost" roads that are not captured in agency inventories, but that are nevertheless physically present and causing hydrologic alteration (Pacific Watershed Associates, 2005).

Closing a road to public motorized use can mitigate the impacts on water, wildlife, and soils only if proper closure and storage technique is followed. Flow diversions, sediment runoff, and illegal incursions will continue unabated if necessary measures are not taken. The Forest Service's National Best Management Practices for non-point source pollution recommends the following management techniques for minimizing the aquatic impacts from closed system roads: eliminate flow diversion onto the road surface, reshape the channel and streambanks at the crossing-site to pass expected flows without scouring or ponding, maintain continuation of channel dimensions and longitudinal profile through the crossing site, and remove culverts, fill material, and other structures that present a risk of failure or diversion. Despite good intentions, it is unlikely given our current fiscal situation and past history that the Forest Service is able to apply best management practices to all stored roads,[3] and that these roads continue to have impacts. This reality argues for assuming that roads closed to the public continue to have some level of impact on water quality, and therefore, should be included in road density calculations.

As noted above, many species benefit when roads are closed to public use. However, the fact remains that closed system roads are often breached resulting in impacts to wildlife. Research shows that a significant portion of off-road vehicle (ORV) users violates rules even when they know what they are (Lewis, M.S., and R. Paige, 2006; Frueh, LM, 2001; Fischer, A.L., et. al, 2002; USFWS, 2007.). For instance, the Rio Grande National Forest's Roads Analysis Report notes that a common travel management violation occurs when people drive around road closures on Level 1 roads (USDA Forest Service, 1994). Similarly, in a recent legal decision from the Utah District Court , *Sierra Club v. USFS*, Case No. 1:09-cv-131 CW (D. Utah March 7, 2012), the court found that, as part of analyzing alternatives in a proposed travel management plan, the Forest Service failed to take a hard look at the impact of continued illegal use. In part, the court based its decision on the Forest Service's acknowledgement that illegal motorized use is a significant problem and that the mere presence of roads is likely to result in illegal use.

In addition to the disturbance to wildlife from ORVs, incursions and the accompanying human access can also result in illegal hunting and trapping of animals. The Tongass National Forest refers to this in its EIS to amend the Land and Resources Management Plan. Specifically, the Forest Service notes in the EIS that Alexander Archipelego wolf mortality due to legal and illegal hunting and trapping is related not only to roads open to motorized access, but to all roads, and that *total road densities* of 0.7-1.0 mi/mi² or less may be necessary (USDA Forest Service, 2008).

As described below, a number of scientific studies have found that ORV use on roads and trails can have serious impacts on water, soil and wildlife resources. It should be expected that ORV use will continue to

[3] The Forest Service generally reports that it can maintain 20-30% of its open road system to standard.

some degree to occur illegally on closed routes and that this use will affect forest resources. Given this, roads closed to the general public should be considered in the density analysis.

Impacts of non-system roads administered by other jurisdictions (private, county, state)

As of 1998, there were approximately 130,000 miles of non-system roads in national forests (USDA Forest Service, 1998). These roads contribute to the environmental impacts of the transportation system on forest resources, just as forest system roads do. Because the purpose of a road density analysis is to measure the impacts of roads at a landscape level, the Forest Service should include all roads, including non-system, when measuring impacts on water and wildlife. An all-inclusive analysis will provide a more accurate representation of the environmental impacts of the road network within the analysis area.

Impacts of temporary roads

Temporary roads are not considered system roads. Most often they are constructed in conjunction with timber sales. Temporary roads have the same types environmental impacts as system roads, although at times the impacts can be worse if the road persists on the landscape because they are not built to last.

It is important to note that although they are termed temporary roads, their impacts are not temporary. According to Forest Service Manual (FSM) 7703.1, the agency is required to "Reestablish vegetative cover on any unnecessary roadway or area disturbed by road construction on National Forest System lands within 10 years after the termination of the activity that required its use and construction." Regardless of the FSM 10-year rule, temporary roads can remain for much longer. For example, timber sales typically last 3-5 years or more. If a temporary road is built in the first year of a six year timber sale, its intended use does not end until the sale is complete. The timber contract often requires the purchaser to close and obliterate the road a few years after the Forest Service completes revegetation work. The temporary road, therefore, could remain open 8-9 years before the ten year clock starts ticking per the FSM. Therefore, temporary roads can legally remain on the ground for up to 20 years or more, yet they are constructed with less environmental safeguards than modern system roads.

Impacts of motorized trails

Scientific research and agency publications generally do not decipher between the impacts from motorized trails and roads, often collapsing the assessment of impacts from unmanaged ORV use with those of the designated system of roads and trails. The following section summarizes potential impacts resulting from roads and motorized trails and the ORV use that occurs on them.

Aquatic Resources

While driving on roads has long been identified as a major contributor to stream sedimentation (for review, see Gucinski, 2001), recent studies have identified ORV routes as a significant cause of stream sedimentation as well (Sack and da Luz, 2004; Chin et al.; 2004, Ayala et al.; 2005, Welsh et al;. 2006). It has been demonstrated that sediment loss increases with increased ORV traffic (Foltz, 2006). A study by

Sack and da Luz (2004) found that ORV use resulted in a loss of more than 200 pounds of soil off of every 100 feet of trail each year. Another study (Welsh et al., 2006) found that ORV trails produced five times more sediment than unpaved roads. Chin et al. (2004) found that watersheds with ORV use as opposed to those without exhibited higher percentages of channel sands and fines, lower depths, and lower volume – all characteristics of degraded stream habitat.

Soil Resources [4]

Ouren, et al. (2007), in an extensive literature review, suggests ORV use causes soil compaction and accelerated erosion rates, and may cause compaction with very few passes. Weighing several hundred pounds, ORVs can compress and compact soil (Nakata et al., 1976; Snyder et al., 1976; Vollmer et al., 1976; Wilshire and Nakata, 1976), reducing its ability to absorb and retain water (Dregne, 1983), and decreasing soil fertility by harming the microscopic organisms that would otherwise break down the soil and produce nutrients important for plant growth (Wilshire et al., 1977). An increase in compaction decreases soil permeability, resulting in increased flow of water across the ground and reduced absorption of water into the soil. This increase in surface flow concentrates water and increases erosion of soils (Wilshire, 1980; Webb, 1983; Misak et al., 2002).

Erosion of soil is accelerated in ORV-use areas directly by the vehicles, and indirectly by increased runoff of precipitation and the creation of conditions favorable to wind erosion (Wilshire, 1980). Knobby and cup-shaped protrusions from ORV tires that aid the vehicles in traversing steep slopes are responsible for major direct erosional losses of soil. As the tire protrusions dig into the soil, forces far exceeding the strength of the soil are exerted to allow the vehicles to climb slopes. The result is that the soil and small plants are thrown downslope in a "rooster tail" behind the vehicle. This is known as mechanical erosion, which on steep slopes (about 15° or more) with soft soils may erode as much as 40 tons/mi (Wilshire, 1992). The rates of erosion measured on ORV trails on moderate slopes exceed natural rates by factors of 10 to 20 (Iverson et al., 1981; Hinckley et al., 1983), whereas use on steep slopes has commonly removed the entire soil mantle exposing bedrock. Measured erosional losses in high use ORV areas range from 1.4-242 lbs/ft^2 (Wilshire et al., 1978) and 102-614 lbs/ft^2 (Webb et al., 1978). A more recent study by Sack and da Luz (2003) found that ORV use resulted in a loss of more than 200 lbs of soil off of every 100 feet of trail each year.

Furthermore, the destruction of cryptobiotic soils by ORVs can reduce nitrogen fixation by cyanobacteria, and set the nitrogen economy of nitrogen-limited arid ecosystems back decades. Even small reductions in crust can lead to diminished productivity and health of the associated plant community, with cascading effects on plant consumers (Davidson et al., 1996). In general, the deleterious effects of ORV use on cryptobiotic crusts is not easily repaired or regenerated. The recovery time for the lichen component of crusts has been estimated at about 45 years (Belnap, 1993). After this time the crusts may appear to have regenerated to the untrained eye. However, careful observation will reveal that the 45 year-old crusts will not have recovered their moss component, which will take an additional 200 years to fully come back (Belnap and Gillette, 1997).

[4] For a full review see Switalski, T. A. and A. Jones (2012).

Wildlife Resources [5]

Studies have shown a variety of possible wildlife disturbance vectors from ORVs. While these impacts are difficult to measure, repeated harassment of wildlife can result in increased energy expenditure and reduced reproduction. Noise and disturbance from ORVs can result in a range of impacts including increased stress (Nash et al., 1970; Millspaugh et al., 2001), loss of hearing (Brattstrom and Bondello, 1979), altered movement patterns (e.g., Wisdom et al. 2004; Preisler et al. 2006), avoidance of high-use areas or routes (Janis and Clark 2002; Wisdom 2007), and disrupted nesting activities (e.g., Strauss 1990).

Wisdom et al. (2004) found that elk moved when ORVs passed within 2,000 yards but tolerated hikers within 500 ft. Wisdom (2007) reported preliminary results suggesting that ORVs are causing a shift in the spatial distribution of elk that could increase energy expenditures and decrease foraging opportunities for the herd. Elk have been found to readily avoid and be displaced from roaded areas (Irwin and Peek, 1979; Hershey and Leege, 1982; Millspaugh, 1995). Additional concomitant effects can occur, such as major declines in survival of elk calves due to repeated displacement of elk during the calving season (Phillips, 1998). Alternatively, closing or decommissioning roads has been found to decrease elk disturbance (Millspaugh et al., 2000; Rowland et al., 2005).

Disruption of breeding and nesting birds is particularly well-documented. Several species are sensitive to human disturbance with the potential disruption of courtship activities, over-exposure of eggs or young birds to weather, and premature fledging of juveniles (Hamann et al., 1999). Repeated disturbance can eventually lead to nest abandonment. These short-term disturbances can lead to long-term bird community changes (Anderson et al., 1990). However when road densities decrease, there is an observable benefit. For example, on the Loa Ranger District of the Fishlake National Forest in southern Utah, successful goshawk nests occur in areas where the localized road density is at or below 2-3 mi/mi^2 (USDA, 2005).

Examples of Forest Service planning documents that use total motorized route density or a variant

Below, we offer examples of where total motorized route density or a variant has been used by the Forest Service in planning documents.

- The Mt. Taylor RD of the Cibola NF analyzed open and closed system roads and motorized trails together in a single motorized *route* density analysis. Cibola NF: Mt. Taylor RD Environmental Assessment for Travel Management Planning, Ch.3, p 55. http://prdp2fs.ess.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5282504.pdf.

- The Grizzly Bear Record of Decision (ROD) for the Forest Plan Amendments for Motorized Access

[5] For a full review see:Switalski, T. A. and A. Jones (2012).

Management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (Kootenai, Lolo, and Idaho Panhandle National Forests) assigned route densities for the designated recovery zones. One of the three densities was for Total Motorized Route Density (TMRD) which includes open roads, restricted roads, roads not meeting all reclaimed criteria, and open motorized trails. The agency's decision to use TMRD was based on the Endangered Species Act's requirement to use best available science, and monitoring showed that both open and closed roads and motorized trails were impacting grizzly. Grizzly Bear Plan Amendment ROD. Online at cache.ecosystem-management.org/48536_FSPLT1_009720.pdf.

- The Chequamegon-Nicolet National Forest set forest-wide goals in its forest plan for both open road density and total road density to improve water quality and wildlife habitat.

> *I decided to continue reducing the amount of total roads and the amount of open road to resolve conflict with quieter forms of recreation, impacts on streams, and effects on some wildlife species.* ROD, p 13.

Chequamegon-Nicolet National Forest Land and Resource Management Plan Record of Decision. Online at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5117609.pdf.

- The Tongass National Forest's EIS to amend the forest plan notes that Alexander Archipelago wolf mortality due to legal and illegal hunting and trapping is related not only to roads open to motorized access, but to all roads, and that *total road densities* of 0.7-1.0 mi/mi² or less may be necessary.

> *Another concern in some areas is the potentially unsustainable level of hunting and trapping of wolves, when both legal and illegal harvest is considered. The 1997 Forest Plan EIS acknowledged that open road access contributes to excessive mortality by facilitating access for hunters and trappers. Landscapes with open-road densities of 0.7 to 1.0 mile of road per square mile were identified as places where human-induced mortality may pose risks to wolf conservation. The amended Forest Plan requires participation in cooperative interagency monitoring and analysis to identify areas where wolf mortality is excessive, determine whether the mortality is unsustainable, and identify the probable causes of the excessive mortality.*
>
> *More recent information indicates that wolf mortality is related not only to roads open to motorized access, but to all roads, because hunters and trappers use all roads to access wolf habitat, by vehicle or on foot. Consequently, this decision amends the pertinent standard and guideline contained in Alternative 6 as displayed in the Final EIS in areas where road access and associated human caused mortality has been determined to be the significant contributing factor to unsustainable wolf mortality. The standard and guideline has been modified to ensure that a range of options to reduce mortality risk will be considered in these areas, and to specify that total road densities of 0.7 to 1.0 mile per square mile or less may be necessary.* ROD, p 24.

Tongass National Forest Amendment to the Land and Resource Management Plan Record of Decision and Final EIS. January 2008. http://tongass-fpadjust.net/Documents/Record_of_Decision.pdf

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How Off-Road Vehicles and Snowmobiles Are Threatening the Forest Service's Recommended Wilderness Areas

February 2011

In Need of Protection:

How Off-Road Vehicles and Snowmobiles Are Threatening the Forest Service's Recommended Wilderness Areas

Table of Contents

Executive Summary

Former Chief of the Forest Service, Dale Bosworth called "unmanaged recreation," including use of off-road vehicles and snowmobiles, one of the "top four threats" to our national forests. Motorized recreation is also the top threat to the Forest Service's recommended additions to the National Wilderness Preservation System. Increases in the volume of use, size of vehicles and advances in off-road vehicle and snowmobile technology are degrading the wilderness character of many Forest Service recommended wilderness areas.

The national forests in Idaho provide a unique opportunity to compare and contrast different management approaches to off-road vehicle and snowmobile use in Forest Service recommended wilderness areas. The national forests in the state are split between the Northern and Intermountain Regions of the agency. These regions manage the areas and uses differently.

Due to the degradation of wilderness character that has occurred as a result of motorized recreation, national forests in the Northern Region are prohibiting the use of motorized vehicles in recommended wilderness areas through travel management and land and resource management planning. Conversely, the national forests of the Intermountain Region continue to follow a loose national policy that permits existing uses of recommended wilderness areas to continue. Unfortunately, the national policy is leading to ecological damage, user conflicts, decreased opportunities for solitude and degradation of other wilderness values. Therefore, the Forest Service is not living up to its responsibility to ensure that the unique wilderness characteristics of these areas are maintained.

The time has come for a national policy that protects the unique character of the Forest Service's recommended additions to the National Wilderness Preservation System. The same uses of designated wilderness areas that are prohibited by the Wilderness Act should be banned from recommended wilderness areas. Such a policy is a commonsense means of protecting the wilderness character of Forest Service recommended wilderness areas until Congress considers statutory wilderness designation. At a minimum, a national policy for recommended wilderness areas should require the following:

- Adoption of a desired conditions statement in land and resource management plans that RWAs should be managed to reflect the definition of wilderness found in the Wilderness Act of 1964.
- Adoption of standards in land and resource management plans that require each national forest to prohibit uses of RWAs that are inconsistent with uses allowed per the Wilderness Act of 1964.
- Phase-out incompatible uses through land and resource management planning or travel management planning.
- Approval by the Chief of the Forest Service of any exceptions to this policy.

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Introduction

In 1964 Congress passed the Wilderness Act "[i]n order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States." The Act established the National Wilderness Preservation System (NWPS), including 16 "instant" wilderness areas. Additions to the NWPS are made by subsequent acts of Congress.

Section 3(b) of the Wilderness Act also set up a process whereby the Forest Service must make recommendations to Congress for additions to the NWPS. The Forest Service responded in the 1970s with the Roadless Area Review and Evaluation (RARE). However, litigation tied up RARE twice, so the agency elected to determine the wilderness suitability of individual roadless areas at the national forest level through the forest planning process.

Many national forests reviewed each roadless area for wilderness suitability and provided recommendations for additions to the NWPS in the first generation of forest plans. Subsequently, the Congressional delegations of all but two states with national forest system lands—Idaho and Montana—considered those recommendations and passed statewide wilderness bills in Congress. Idaho and Montana both attempted to produce and pass similar statewide legislation but fell short.

Since that time, both states have worked to resolve the wilderness debate through place-based legislation. The Selway-Bitterroot, Sawtooth, Hells Canyon, Gospel Hump and Frank Church – River of No Return Wilderness Areas were all designated by separate acts of Congress. The last are to be designated in Idaho was the Frank Church – River of No Return Wilderness in 1980.

With over 9 million acres of inventoried roadless areas in Idaho, many areas remain suitable for wilderness designation. Every forest plan in Idaho except the Nez Perce National Forest includes official Forest Service recommendations for additions to the NWPS (Table 1 and Figure 1).

Until Congress takes the opportunity to consider these recommendations, the Forest Service is obligated to protect the wilderness suitability of these areas. The Forest Service Manual states:

> Any inventoried roadless area recommended for wilderness or designated wilderness study is not available for any use or activity that may reduce the wilderness potential of the area. Activities currently permitted may continue pending designation, if the activities do not compromise the wilderness values of the area.[1]

Unfortunately some national forests have failed to curb the increasing use of off-road vehicles and snowmobiles in recommended wilderness areas (RWAs), which has resulted in the degradation of wilderness character and potential. Operating motorized vehicles, as a general rule, is a use that would be prohibited if an area were designated as wilderness. Therefore, permitting these uses to continue is, by definition, inconsistent with wilderness character. The use of larger off-road vehicles and snowmobiles, as well as technological advances, has decreased the naturalness of many RWAs, opportunities for primitive and unconfined types of recreation, and ecological, geological, or other features of scientific, educational, scenic, or historical value.[2] Specific examples are outlined in this report.

[1] FSM 1923.03
[2] See Section 2(c) of the Wilderness Act of 1964 for a definition of Wilderness.

Idaho provides a unique opportunity to compare the management of RWAs between two different regions of the Forest Service. The national forests in North Idaho are part of the Northern Region of the Forest Service, and those in South Idaho are part of the Intermountain Region. The former is phasing out off-road vehicle and snowmobile use in the RWAs because trends in use, size and vehicle technology are decreasing the wilderness potential of areas where motorized vehicles have been permitted to continue. Perhaps the *Clearwater National Forest Travel Management Plan, Draft Environmental Impact Statement* articulates these impacts best:

> As motorized technology continues to be developed levels of access into remote, back-country locations will rise and with this increased use will come additional noise and disturbance which adversely affects attributes of wilderness character. These technology improvements allow motorcycles, bicycles and over-snow vehicles to increasingly overcome the expectations of the 1987 Forest Plan that assumed the difficult and rugged terrain would prove to be self-limiting to motorized access. Activities, including motorized/mechanized (bicycle) trail or road use, or motorized over-snow vehicle use, that may potentially lead to the decline of an areas ability to provide the level of wilderness character that was present when it was recommended in 1987 does not support the protection of wilderness character. Proposing motorized/mechanized (bicycle) activities as part of travel planning decisions in recommended wilderness areas will not result in best meeting the desired future condition in these areas.[3]

Meanwhile, national forests in the Intermountain Region continue to permit off-road vehicle and snowmobile use in every recommended wilderness area in the region. As this report demonstrates, there are real on-the-ground consequences of these two different approaches that can no longer be ignored. A consistent national policy is needed to protect the wilderness characteristics of these areas from the increasing size, technological capability and use of off-road vehicles and snowmobiles.

[3] *Clearwater National Forest Travel Management Plan, Draft Environmental Impact Statement*, page 3-83.

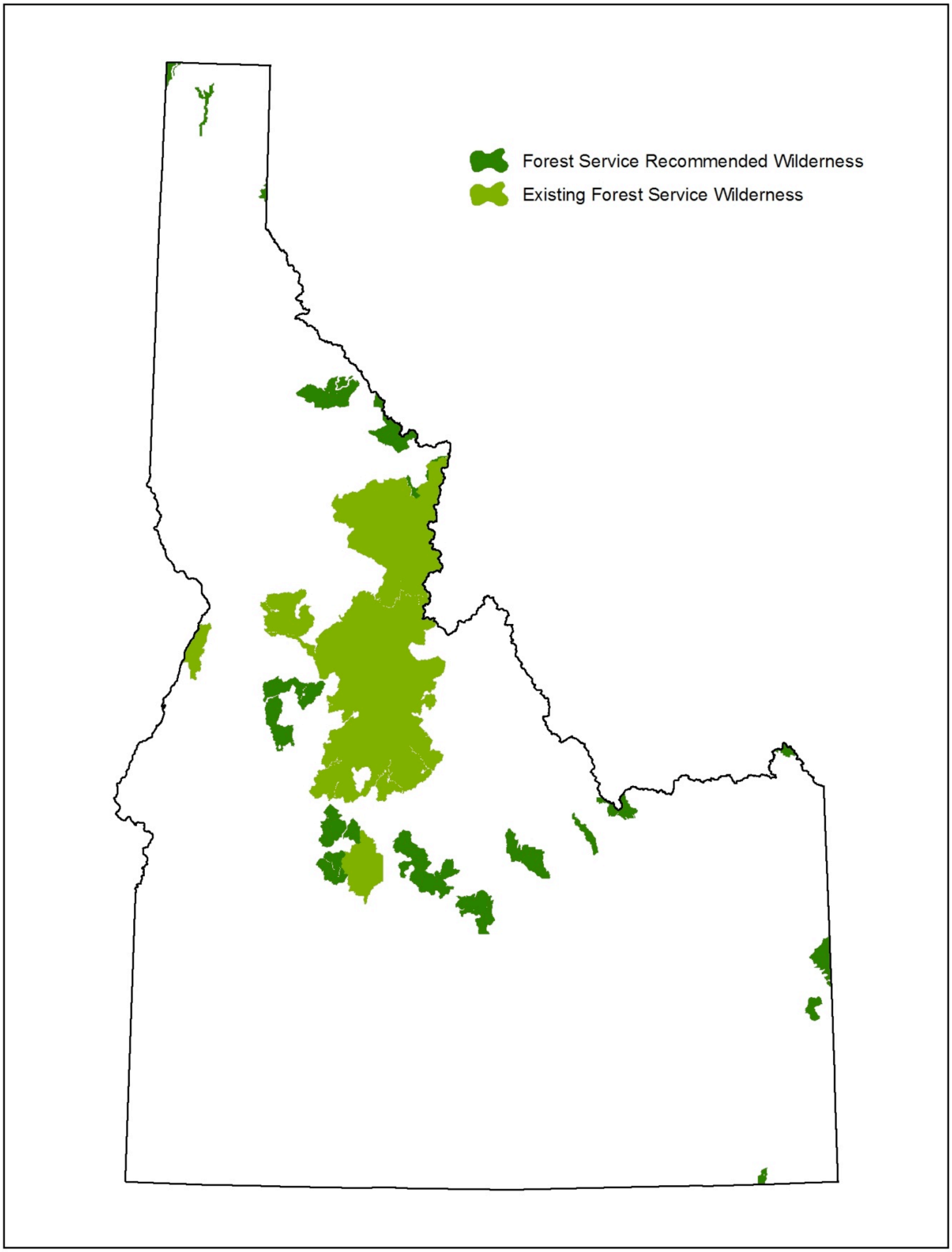

Figure 1. Forest Service recommended wilderness areas and designated Wilderness areas in Idaho.

Table 1. Forest Service recommended wilderness areas in Idaho by forest and region, including size and allowable off-road vehicle or snowmobile use within the area.[4]

Region	Forest	Area	Acres	Trails designated for off-road vehicle use (%)	Open yearlong or seasonally to snowmobiles (%)
Northern	Idaho Panhandle	Mallard-Larkins	78,500	0%	64%
		Salmo-Priest	17,600	0%	0%
		Scotchman Peaks	9,400	0%	100%
		Selkirk Crest	26,700	0%	10%
	Clearwater	Great Burn (Hoodoo)	113,000	1%, pending travel plan	0%, pending travel plan
		Mallard-Larkins	66,700	0%, pending travel plan	0%, pending travel plan
		Selway-Bitterroot Additions	18,500	0%	0%, pending travel plan
	Nez Perce	None	0	N/A	N/A
	Total		*330,400*		
Intermountain	Payette	Needles	91,900	30%	9%
		Secesh	115,400	37%	68%
	Boise	Hanson Lakes	13,600	0%	100%
		Needles	4,300	18%	100%
		Red Mountain	86,100	93%	100%
		Tenmile-Black Warrior	79,900	9%	100%
	Sawtooth	Boulder-White Clouds	184,400	30%	92%
		Hanson Lakes	18,500	39%	100%
		Pioneer Mountains	61,000	11%	80%
	Salmon-Challis	Borah Peak	119,000	41% of the routes are designated for motorized use[5]	0%
		Boulder-White Clouds	34,000	0%	0%
		Pioneer Mountains	48,000	10% of the routes are designated for motorized use[2]	0%
	Caribou-Targhee	Caribou City	29,201	0%	100%
		Diamond Peak	29,521	0%	79%
		Italian Peaks	49,406	72%	91%
		Lionhead	11,314	0%	100%
		Mt. Naomi	13,246	20%	100%
		Palisades	61,173	1%	94%
	Total		*1,049,614*		
Idaho Total			1,380,014		

[4] Figures for the acreage of each area were derived from the relevant forest management plans. Figures for motorized use were calculated with GIS software using spatial data provided by the Forest Service.
[5] The term "routes" is used because there are both roads (5.3 miles) and trails (7.2 miles) designated for motorized use in the Borah Peak RWA. There are 4.8 miles of designated roads in the Pioneer Mountains RWA.

Travel Management Planning

As described earlier, former Chief of the Forest Service, Dale Bosworth called "unmanaged recreation," including the use of off-road vehicles and snowmobiles, one of the top four threats to our national forests.[6] In 2005, the Forest Service promulgated the "Travel Management Rule" in response to the threat, prohibiting cross-country use of off-road vehicles. The rule also requires each national forest to designate specific roads, trails and areas for motor vehicle use.[7]

The travel management plans developed under these regulations must also be consistent with the land and resource management plans (LRMP) required by the National Forest Management Act (NFMA). Travel management decisions must reflect the desired conditions, goals, objectives, standards and management prescriptions contained in LRMPs, including those related to RWAs.

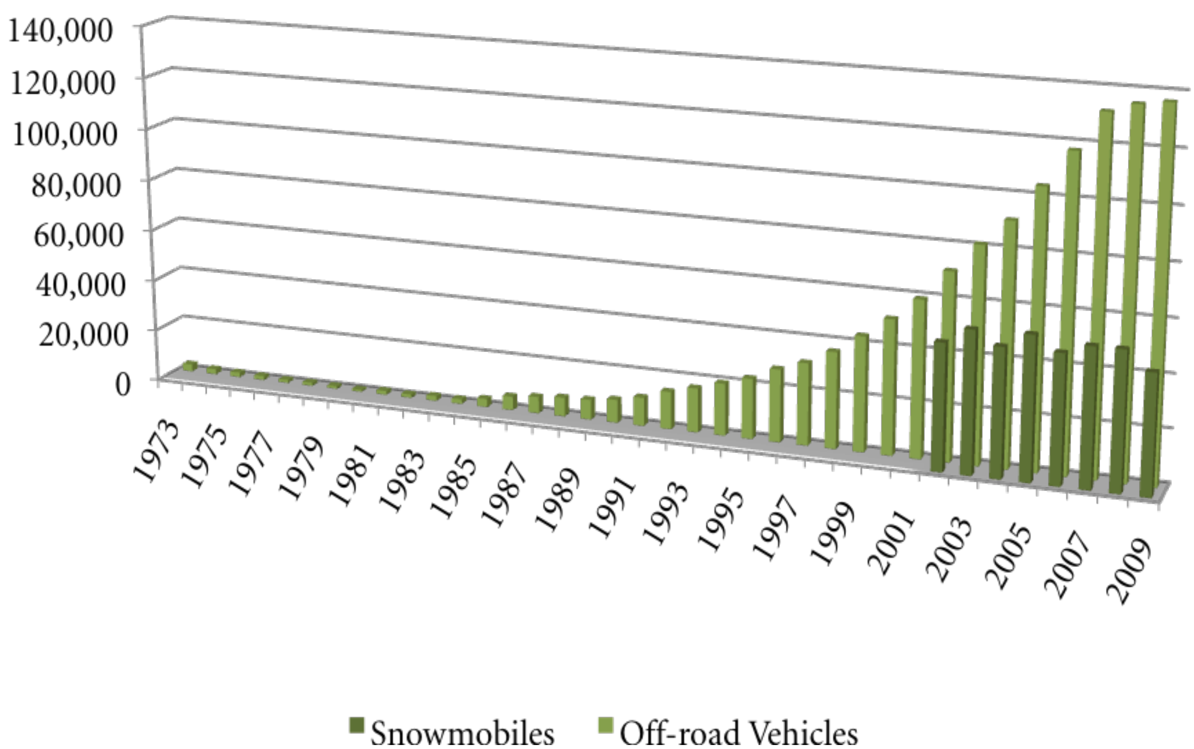

Figure 2. Registered off-road vehicles and snowmobiles in Idaho.[8]

Trends in off-road vehicle and snowmobile use in Idaho illustrate the magnitude of the threat that motorized recreation poses to our national forests and RWAs. The use of off-road vehicles has increased exponentially since the mid 1990s (Figure 2), due primarily to the rising popularity of all-terrain vehicles (ATVs).

[6] http://www.fs.fed.us/projects/four-threats/
[7] 70 Fed. Reg. 68264-68291.
[8] http://parksandrecreation.idaho.gov/datacenter/recreation_statistics.aspx

There are also larger off-road vehicles and snowmobiles on the market today than in the past. The 1980 Honda ATC 185 three-wheeler included a 180 cc engine and was used as a farm implement.[9] By 1988 Honda was manufacturing a 4x4 ATV with a 282 cc engine, called the Four Trax 300.[10] The Four Trax 300 was intended for recreational use not for farming and ranching. As the off-road vehicles became larger, more powerful and popular for recreational use, the Forest Service was pressured to change regulations governing the use of these vehicles on Forest Service lands. In 1991, the Forest Service quietly did away with the "40-inch rule," which previously prohibited the use of any vehicle greater than 40 inches in width on Forest Service trails. Forty inches happened to be the width of most dirt-bike handle bars. Most present-day travel plans and motor vehicle use maps accommodate modern ATVs by designating trails less than 50 inches in width.

1976 Kawasaki Sno-Jet

Advances in vehicle technology and capability have also increased the threat. In particular, significant technological advances in snowmobile capability have occurred. For example, in 1973 Honda made a prototype snowmobile called the White Fox that had a 178 cc two-stroke engine and weighed 227 pounds.[11] The Sno-Jet made in 1976 weighed 355 pounds and was powered by a 338 cc engine.[12]

In the mid-1990s, the introduction of "powder sleds" vastly changed the pattern of snowmobile use. Advancements in technology led to greater power/weight ratios. For example, the 2011 Arctic Cat Z1 Turbo LXR has a 1,056 cc engine,[13] a displacement more than three times the 1976 Sno-Jet.

These trends have challenged the Forest Service's ability to protect the wilderness characteristics of RWAs. Trails and areas once considered physically inaccessible to off-road vehicles and snowmobiles because of technological limitations are now readily accessible to modern day machines.

The wilderness characteristics of many RWAs in Idaho have been degraded by the advances in technology and use of off-road vehicles and snowmobiles. The natural integrity of RWAs has declined where trail tread widths have been widened by the larger classes of off-road vehicles now available on the market. Naturalness has also declined because of physical resource damage, including erosion, siltation, loss of vegetation and spread of noxious weeds. Use of snowmobiles has also decreased the naturalness of RWAs where trail grooming and high-marking occurs.

[9] http://www.atvriders.com/atvmodels/honda-history-1980-atc-185.html
[10] http://www.atvriders.com/atvmodels/honda-history-1988-fourtrax-300-atv.html
[11] See photo posted by the Snowmobile Canada website at http://www.snowmobile-canada.com/his3.htm
[12] http://www.snojet.com
[13] http://www.arcticcat.com/snow/Z1TURBOLXR.asp

Opportunities for solitude or primitive and unconfined recreation have declined where the use of off-road vehicles and snowmobiles has increased. Where terrain was previously considered to be a limiting factor for vehicular access, advances in vehicle technology have made access to previously inaccessible areas possible. The ability to use modern motorized vehicles in formerly inaccessible areas negates the need to use traditional, primitive and unconfined modes of travel to access remote areas in RWAs. Further, the noise from these machines transmits across the landscape and disrupts the natural acoustics thereby spoiling the solitude sought by many nonmotorized recreationists.

Last but not least, increased use of off-road vehicles and snowmobiles in RWAs has affected ecological, cultural and other values in RWAs. In some RWAs, wildlife are less secure where previously inaccessible areas provided undisturbed refugia or migration corridors for a host of wildlife species. Many of the habitats in RWAs are particularly important because of their rarity and sensitivity.

While degradation of wilderness character has occurred in many RWAs, it is not too late for the Forest Service to act and protect these unique places. Travel management and forest planning processes can restore wilderness character by limiting the uses of RWAs to those allowed by the Wilderness Act. However, a national policy is needed to provide consistency in management and implementation.

Northern Region

The Northern Region of the Forest Service includes three national forests in Idaho—the Idaho Panhandle, Clearwater, and Nez Perce National Forest. As the forests within the region revise their travel management plans and forest plans, uses of RWAs that are inconsistent with the Wilderness Act are being phased out to protect the unique character of these areas. This forward-thinking approach will ensure that, when Congress considers whether or not to designate these areas as wilderness, the Forest Service will have fulfilled its obligation to preserve the wilderness characteristics of these areas.

Idaho Panhandle National Forest

There are four RWAs on the Idaho Panhandle National Forests. The permissible uses of off-road vehicles and snowmobiles vary by area. The 1987 Forest Plan permitted off-road vehicle and snowmobile use in all four RWAs. However, various resource issues have led to off-road vehicle and snowmobile closures.

Snowmobile use in the Selkirk Crest and Salmo-Priest RWAs negatively impacts endangered woodland caribou survival during the critical winter months. Photo by Jerry Pavia.

The Salmo-Priest, Selkirk Crest and Scotchman Peaks RWAs were closed to off-road vehicle use to protect listed grizzly bear populations. Similarly, all of the Salmo-Priest RWA and the majority of the Selkirk Crest RWA were closed to snowmobile use to protect the last population of endangered woodland caribou in the coterminous United States. Despite these closures, seasonal monitoring by the agency and conservation groups reveals that snowmobilers continue to violate closures for both areas.

Designated snowmobile routes around the perimeter of the Selkirk Crest RWA facilitate illegal access into the caribou closure area and the RWA. Permitted snowmobile use within the "Trapper Burn" area between the Salmo-Priest RWA and the Selkirk Crest RWA has led to fragmentation of historic habitat in the Selkirk Crest RWA and habitat still used by caribou in the Salmo-Priest RWA. While snowmobile use is considered by the agency to be transitory in nature, wilderness characteristics are degraded on an ongoing basis by snowmobile use through increased noise, loss of opportunities for primitive and unconfined types of winter recreation, and impacts to ecological values including wildlife.

In 2006, the Forest Service nearly completed a revised forest plan for the Idaho Panhandle National Forest that would have prohibited off-road vehicles and snowmobiles in all four RWAs. However, nearly one-third of the Selkirk Crest RWA would have been dropped from the 1987 boundary to allow snowmobile use in the southern Selkirks. The Idaho Conservation League opposed this proposal because it would have sacrificed wilderness-quality landscapes in places like Fault Lake, Chimney Rock, Beehive Lakes, and Harrison Lake. These areas are also documented, historic caribou habitat. The revised plan was put on hold until recently because the Forest Service regulations used to draft the plan were enjoined in federal court. The plan revision is again underway using the 1982 planning regulations.

Snowmobiling is also permitted within the Scotchman Peaks RWA. However, actual snowmobile use is minimal. The 2006 revised plan would have slightly expanded the Scotchman Peaks RWA and prohibited both off-road vehicles and snowmobiles in the area. There is strong support in Bonner County for statutory wilderness designation of the Scotchman Peaks.

Snowmobile use at Kidd Lake in the Great Burn RWA is legal on the Clearwater National Forest, while just over the state line in Montana, it is illegal on the Lolo National Forest.

The last RWA on the Idaho Panhandle is the Mallard-Larkins, which straddles the shared boundary with the Clearwater National Forest. The St. Joe Ranger District recently completed a travel management plan that restricts the use of off-road vehicles in the Mallard-Larkins RWA to protect its wilderness character and opportunities for primitive and unconfined types of recreation commensurate with the Wilderness Act. The latest travel management plan for the St. Joe Ranger District does not prohibit snowmobile use in the area. However, the revised forest plan would have closed the area to snowmobiles. When the revised plan is completed, the prohibition of snowmobiles in the Mallard-Larkins RWA is expected to be carried forward.

Clearwater National Forest

There are three RWAs on the Clearwater National Forest identified by the 1987 Clearwater National Forest Plan. Off-road vehicles and snowmobiles are permitted in the Mallard-Larkins, Great Burn (Hoodoo) and proposed Selway-Bitterroot Wilderness additions. Conversely, the Forest Plan for the adjacent Lolo National Forest prohibits the use of snowmobiles and off-road vehicles within the portion of the Great Burn in Montana.

In 2007 the Clearwater National Forest began developing a new travel management plan for the forest. The draft plan released in 2009 proposed to prohibit the use of off-road vehicles and snowmobiles in all three RWAs with one exception—the existing ATV trail to Fish Lake (3 miles) in the Great Burn. The draft plan would close 38 miles of existing off-road vehicle trails within all three RWAs. Approximately 196,000 acres would be closed to snowmobiling. The preferred alternative would provide consistent management of the Great Burn and Mallard-Larkins RWAs across state and national forest boundaries. The Forest Service presented the following rationale in developing the preferred alternative:

The increase in vehicle capability, numbers, and local use, puts areas of recommended wilderness at far greater risk of degradation and loss of wilderness character than they were when the Forest

Plan was written. In addition, other areas recommended for wilderness have not received serious consideration for designation once motorized use has become established.

To date, the Clearwater National Forest Travel Management Plan, Draft Environmental Impact Statement is the best example of a plan that takes proactive steps to protect RWAs and their wilderness character. The plan correctly concludes that, due to the increasing size, capability and sheer numbers of off-road vehicles and snowmobiles, it is no longer possible for the agency to allow such uses in RWAs and protect their wilderness character at the same time.

Nez Perce National Forest

The 1987 Nez Perce National Forest Plan did not identify any RWAs on the forest. However, in 2006 the Clearwater and Nez Perce National Forests were in the midst of developing revised forest plans, which were not completed because of the injunction of the forest planning regulations in federal court. During the revision process, the Clearwater and Nez Perce National Forests reviewed every inventoried roadless area on the two forests for wilderness suitability. Each roadless area was given a "wilderness attributes rating" or WAR score. The East and West Meadow Creek Roadless Areas received WAR scores slightly higher and slightly lower, respectively, than the Great Burn RWA on the Clearwater National Forest.

For decades, the Idaho Conservation League has supported designating the Meadow Creek watershed as wilderness because of the area's intact fish and wildlife habitat, opportunities for primitive and unconfined modes of recreation, and its size (213,000 acres). During the planning process, the Idaho Conservation League worked to convince the Forest Service that Meadow Creek should be recommended to Congress for wilderness designation.

The expansion of ATV use into the Meadow Creek Roadless Area has degraded water quality, fish habitat and tribal cultural resources.

In 2007 the Nez Perce National Forest proceeded with a revision of the forest's travel management plan to comply with the 2005 travel management rule. Since Meadow Creek maintains high wilderness attribute ratings, the Idaho Conservation League and The Wilderness Society worked cooperatively to protect the Meadow Creek watershed from degradation by off-road vehicles.

A monitoring project conducted in 2008 uncovered severe off-road vehicle damage to sensitive meadows in the upper reach of Meadow Creek, clearly evidence of diminished naturalness and ecological value. In response, the Forest Service issued an emergency closure order to stop the damage and allow recovery of the meadows to begin. However, the emergency closure order will only remain in effect until the final travel management plan is completed.

Intermountain Region

The Intermountain Region of the Forest Service includes five national forests in Idaho—the Payette, Boise, Sawtooth, Salmon-Challis and Caribou-Targhee National Forests. The region follows a loose national policy concerning RWAs, that allows existing uses of RWAs to continue unless degradation of wilderness characteristics occurs.[14] All five national forests in the Intermountain Region allow off-road vehicle and snowmobile use in their RWAs. This policy is degrading the wilderness characteristics of many RWAs within the region, as described below.

Payette National Forest

Two RWAs identified in the 2003 Payette Forest Plan. Like almost all national forests in the Intermountain Region, some level of off-road vehicle and/or snowmobile use is permitted within the RWAs on the forest. Existing uses in the Secesh and Needles RWAs are permitted to continue unless they degrade wilderness character. Specifically, the "Southwest Idaho Ecogroup" forest plans for the Payette, Boise and Sawtooth National Forests provide that:[15]

> Mechanical transport in recommended wilderness areas where it currently exists may be allowed to continue unless: a) It degrades wilderness values,
> b) Resource damage occurs, or
> c) User conflicts result.

Motorcycle use on the Victor Creek Trail in the Secesh RWA is eroding trails.

In 2009 the Payette National Forest completed a travel management plan for off-road vehicle use. The travel management plan designated 61 miles (33%) of the 183 miles of trails in the Secesh and Needles RWAs as open to motorcycles, including the Victor Creek, Twentymile Creek, Secesh River, Buckhorn Creek and other trails. These motorized routes cut through the two RWAs from one side to the other, fragmenting wildlife habitat and nonmotorized zones in between the trail corridors. Consequently, opportunities for solitude in these RWAs have been diminished. Motorcycle use on popular trails like the Twentymile Creek Trail results in user conflicts where hikers and equestrians would otherwise find excellent opportunities for primitive and unconfined modes of recreation. Resource damage has also occurred due to motorized use on trails such as Victor Creek.

The Payette National Forest also recently completed a winter travel management plan. While the winter travel plan did not expand the physical acreage open to snowmobiles in the Secesh and Needles RWAs, more than two-thirds of the Secesh RWA remains open to snowmobile use. A smaller proportion of the Needles RWA is also open to snowmobiles. Places like Twentymile Creek, Duck Lake, and Buckhorn Summit have become increasingly popular with snowmobilers.

[14] See FSM 1923.03
[15] Payette Land and Resource Management Plan. 2003. Pages III-73 and III-74.

Advances in snowmobile technology and capability have led to snowmobile access in terrain that was formerly inaccessible. Snowmobiles high mark slopes and track up otherwise untouched snow deep in the backcountry, leaving their mark in an otherwise pristine landscape. Noise caused by snowmobiles can be heard far across the landscape and is disruptive to other users, diminishing naturalness, solitude, and opportunities for primitive and unconfined recreational experiences.

Boise National Forest

The Boise National Forest recently completed travel management plans on a district-by-district basis. The scope of the district travel plans was limited to the portions of each district where cross-country use of off-road vehicles had not been previously restricted. Since cross-country off-road vehicle use was already restricted in the RWAs on the forest, there were no changes made to existing route designations in RWAs.

This was an unfortunate omission by the Boise National Forest, which boasts more motorized trails (by percentage) than any other national forest in Idaho. With the proximity of this forest to the rapidly growing Treasure Valley, recreational uses of the Boise National Forest are closely following growth trends in the valley. On summer weekends, people from Boise, Nampa, Caldwell and other suburbs flock to the Boise National Forest to camp and partake in other recreational activities, including off-road vehicle use. The Red Mountain, Hanson Lakes and Tenmile-Black Warrior RWAs are all within a three-hour drive of nearly one-half million people.

ATV use on the Black Warrior Trail diverted the creek from its native stream channel in the Tenmile-Black Warrior RWA.

The Red Mountain RWA is particularly at risk, where more than 92% of the trail miles are open to motorcycle use. Opportunities for primitive and unconfined types of recreation are difficult to find without leaving the trail and venturing into terrain that would be difficult to access on foot. Recreational vehicle and off-road vehicle use is supported at Forest Service facilities on the perimeter of the Red Mountain RWA at Bull Trout Lake and Bear Valley where many Treasure Valley residents camp during summer weekends.

Although the Tenmile-Black Warrior RWA is perhaps a bit more difficult to access, off-road vehicle use also threatens the wilderness character of this RWA, which would make a logical addition to the Sawtooth Wilderness. The Blue Jay and Tenmile Ridge Trails on the edge of the RWA are increasingly popular with motorcycle enthusiasts, which has decreased opportunities for solitude, quiet, and primitive and unconfined types of recreation.

Resource damage has also occurred in the Tenmile-Black Warrior RWA, particularly in Black Warrior Creek where illegal ATV use caused significant resource damage that resulted in an emergency resource closure order. While Table 1 and Appendix A indicate that less than 9% of the trails in the Tenmile-Black Warrior RWA are open to off-road vehicles, the true figure remains uncertain. Many trails open to off-road vehicles follow the boundaries of the RWA and could be counted "in or out." Such trails are excluded from Table 1 and Appendix A.

In the Hanson Lakes RWA, significant resource damage has occurred on the Bench Creek and Swamp Creek Trails from illegal four-wheeler use. The increased trail tread width, erosion and siltation has reduced the naturalness and ecological integrity of the area. Motorized use has also decreased opportunities for solitude and primitive and unconfined types of recreation in the Hanson Lakes RWA due to intrusion by noise and dissruption of the primitive and remote characteristics of the RWA.

Snowmobile use is also an issue in all four RWAs on the Boise National Forest. Not a single acre of these four areas is closed to snowmobile use. It's not clear that a winter travel plan has ever been developed for the Boise National Forest despite the popularity with winter motorized and nonmotorized recreationists. The open nature of the timber stands and above-tree-line terrain in all four RWAs make for easy snowmobile access. Issues with wolverine denning habitat and mountain goats exist, but they have not been addressed through winter travel management planning.

Sawtooth National Forest

The Sawtooth National Forest is home to some of the most popular RWAs in Idaho. The Boulder-White Clouds RWA has a long and colorful history that includes the ascendency of Cecil Andrus in Idaho politics. Although the threat to this great area in the 1960s was a proposed open-pit mine, the modern threat is off-road vehicles. Existing off-road vehicle use is permitted to continue in the Boulder-White Clouds RWA under the Sawtooth Forest Plan. Nearly one-third of the trails in the Boulder-White Clouds RWA are open to motorcycles, and more than 90% of the RWA is open to snowmobiles. Resource damage has occurred on the Little Boulder Creek and Warm Spring Trails as a result of motorized use, lessening the natural character in these trail corridors. Motorcycles also regularly use nonmotorized trails in Upper Warm Springs, Castle Divide, Born Lakes and Garland Lakes. Motorized use has lessened opportunities for solitude and primitive and unconfined types of recreation since the area was first recommended for wilderness in 1972.

Motorcycle use is causing resource damage to the Little Boulder Creek Trail in the Boulder-White Clouds RWA.

There are no designated off-road trails in the portion of the Pioneer Mountains RWA managed by the Sawtooth National Forest. However, nearly 80% of the Pioneer Mountains RWA is open yearlong or seasonally to snowmobiles. Significant snowmobile recreation occurs in the Upper Little Wood drainage and is permitted seasonally in Hyndman Basin. While snowmobile use is considered by the agency to be transitory in nature, impacts to wolverine are likely resulting in this high mountain environment where this species has been confirmed. Advances in snowmobile technology have also facilitated access to formerly inaccessible terrain in the Pioneers. Consequently, opportunities for solitude and primitive and unconfined types of recreation have been diminished, including backcountry skiing and snowshoeing. Conflicts between snowmobilers and skiers and snowshoers have occurred. The Pioneers Mountains RWA is closed to snowmobiles on the Salmon-Challis National Forest side.

Nearly 40% of the trails in the portion of the Hanson Lakes RWA managed by the Sawtooth National Forest are designated for off-road vehicle use. Resource damage has been caused by off-road vehicle use on the Swamp Creek and Trap Creek Trails, including illegal four-wheeler use. Increases in trail tread width, erosion and siltation has occurred in both portions of the RWA managed by the Boise and Sawtooth National Forests. One-hundred percent (18,500 acres) of the portion of the Hanson Lakes RWA managed by the Sawtooth National Forest is open to snowmobile use.

In 2008 the Sawtooth National Forest completed a travel management plan that included only the portions of the forest open to cross-country use of off-roads at the time. Unfortunately, the scope of this plan did not include any of the three RWAs on the forest, despite increasing problems with resource damage, user conflicts, and illegal use of nonmotorized trails.

Salmon-Challis National Forest

Snowmobile use is prohibited in all three RWAs on the Salmon-Challis National Forest, including the Borah Peak, Boulder-White Clouds and Pioneer Mountains RWAs. The 1987 Forest Plan also prohibited off-road vehicle use in all three RWAs at the time. Unfortunately, the Forest Plan was amended in 1993 to allow nine different exceptions for off-road vehicle use on specific routes in all three RWAs. This amendment was followed by exponential growth in off-road vehicle use, putting the wilderness character of all three RWAs at risk.

Illegal ATV use is causing resource damage to the Swauger Lakes Trail in the Borah Peak RWA.

In 2009 the Salmon-Challis National Forest revised the forest-wide travel management plan, primarily to end cross-country off-road use on the forest. At the request of the Idaho Conservation League and The Wilderness Society, the Forest Service considered and analyzed an alternative that would have prohibited off-road vehicle use in all three RWAs to enhance and protect the wilderness characteristics of all three areas, reduce user conflicts, address resource impacts and increase opportunities for solitude and primitive and unconfined types of recreation consistent with the Wilderness Act.

The selected alternative closed the Herd Peak-Toolbox Trail to off-road vehicles in the portion of the Boulder-White Clouds RWA managed by the Salmon-Challis to address problems with cross-country off-road vehicle use and enforcement. Unfortunately, the existing designated routes in the Borah Peak and Pioneer Mountains RWAs were carried forward despite documented evidence shared with the Forest Service that resource impacts and degradation of wilderness character was occurring as a result of off-road vehicle use.

For example, motorized use of the Swauger Lakes Trail in the Borah Peak RWA has resulted in documented resource damage to the trail tread, sensitive meadows and wildlife habitat. The Idaho Conservation League and The Wilderness Society also documented illegal four-wheeler use along the entire length of the trail. Forest Service records that are part of the travel management plan revision also indicate that ATV users illegally graded portions of the trail with machinery to a wider tread width. All of these activities have lessened the natural character of the area and opportunities for primitive and unconfined types of recreation.

In the Pioneer Mountains RWA, an old mining road in Wildhorse Canyon is open to use by all vehicles. While the rough conditions of the road formerly limited use by motorized vehicles to some degree, the increasing use of four-wheelers has made motorized access easier in Wildhorse Canyon. Increased motorized access in Wildhorse Canyon has also increased dispersed camping and noise levels. Consequently, opportunities for solitude and primitive and unconfined types of recreation have declined.

The 2009 travel plan did not take into account increasing trends in the size, use and capabilities of off-road vehicles since the 1993 travel management plan was adopted. The 2009 plan did not analyze these trends in the context of the existing designated routes in all three RWAs and how those trends would affect the wilderness character of each area.

Caribou-Targhee National Forest

There are six RWAs on the Caribou-Targhee National Forest. Management of off-road vehicle and snowmobile use varies in each area. For Example, the 2003 Forest Plan for the Caribou National Forest identified two RWAs, including Mt. Naomi and Caribou City. The plan prohibits the use of off-road vehicles in both areas during the "snow-free" season but permits cross-country snowmobile use during the winter months. These travel management designations remained unchanged in the 2005 Caribou National Forest Travel Plan.

The 1997 Forest Plan for the Targhee National Forest identified four RWAs, including the Diamond Peak, Italian Peak, Lionhead and Palisades RWAs. Between 80 and 100% of each of these RWAs is open to snowmobile use (Table 1). Consequently, opportunities for solitude and primitive and unconfined types of recreation are limited, and impacts to wintering wildlife are on-going.

Snowmobiling in the Palisades RWA is degrading wilderness character, including ecological integrity and solitude. Photo by Thomas Turiano.

Off-road vehicle use also varies between each RWA. There are no designated off-road vehicle trails in the Diamond Peak or Lionhead RWAs. However, 72% (31 miles) of the trails in the Italian Peaks RWA are open to off-road vehicle use, offering few opportunities for primitive and unconfined types of recreation. The inconsistency in the management of each RWA has also led to public confusion about how the Forest Service regulates uses of RWAs. User conflicts also occur between backcountry skiers and snowmobilers.

Conclusions

As this report demonstrates, the Northern and Intermountain Regions of the Forest Service have sharply contrasting management approaches for recommended wilderness. Since 2003, the national forests of the Northern Region have been phasing out uses of RWAs that are impairing or have the potential to impair wilderness values as defined by the Wilderness Act of 1964. Draft plans on the Idaho Panhandle and Clearwater National Forests propose phase-outs of off-road vehicles and snowmobiles in RWAs.

In contrast, every national forest within the Intermountain Region allows some level of off-road vehicle and/or snowmobile use in one or more of their RWAs. For example, approximately 92% of the Boulder-White Clouds RWA managed by the Sawtooth National Forest is open to snowmobiles. Similarly, approximately 33% of the trails in the Secesh and Needles RWAs on the Payette National Forest are designated for off-road vehicle use.

These contrasting management strategies result in public confusion, inconsistent administration and user conflicts. As on-the-ground evidence indicates, allowing off-road vehicles has degraded wilderness character within the RWAs of the Intermountain Region. Deep ruts, stream bank erosion, impacts to wildlife habitats, illegal use of hiking trails by off-road vehicles, decreased opportunities for primitive and unconfined types of recreation, diminished solitude and user-conflicts are increasingly widespread throughout the RWAs in the Intermountain Region.

A national policy is needed for consistent management of Forest Service RWAs throughout the country. This policy should reflect the original intent of Congress in passing the Wilderness Act—to recommend additions to the National Wilderness Preservation System and to protect the wilderness character of such lands until Congress considers the agency's recommended additions to the NWPS. If the Forest Service finds particular lands suitable for wilderness designation, then the agency should support its own recommendations by allowing only the uses that are consistent with wilderness designation. At a minimum, a national policy that protects the wilderness character of RWAs should require the following:

- Adoption of a desired conditions statement in land and resource management plans that RWAs should be managed to reflect the definition of wilderness found in the Wilderness Act of 1964.

- Adoption of standards in land and resource management plans that require each national forest to prohibit uses of RWAs that are inconsistent with uses allowed per the Wilderness Act of 1964.

- Phase-out incompatible uses through land and resource management planning or travel management planning.

- Approval by the Chief of the Forest Service of any exceptions to this policy.

Appendix A Data regarding motorized recreation in each RWA

Area	Forest	Motorized Trails (mi)	Non-motorized Trails (mi)	% Motorized Trails	Acreage	Acres Open to Snowmobiles Yearlong	Acres Open to Snowmobiles Seasonally	% Open to Snowmobiles	Notes
Hanson Lakes	Boise	0	0	0.0%	13,600	13,600	0	100.0%	
Needles	Boise	0.9	4	18.4%	4,300	4,300	0	100.0%	
Red Mountain	Boise	47	3.8	92.5%	86,100	86,100	0	100.0%	
Tenmile - Black Warrior	Boise	3	31.7	8.6%	79,900	79,900	0	100.0%	
Caribou City	Caribou-Targhee	0	32	0.0%	29,201	29,201	0	100.0%	
Diamond Peak	Caribou-Targhee	0	14	0.0%	29,521	23,407	0	79.3%	Approximately 9,797 acres are also open to snowmobiles on designated routes only. These areas are not counted toward the total acres open to snowmobiles.
Italian Peak	Caribou-Targhee	31	11.8	72.4%	49,406	44,981	0	91.0%	Approximately 6,182 acres are also open to snowmobiles on designated routes only. These areas are not counted toward the total acres open to snowmobiles.
Lionhead	Caribou-Targhee	0	12.8	0.0%	11,314	11,314	0	100.0%	
Mt. Naomi	Caribou-Targhee	3.2	13	19.8%	13,246	13,246	0	100.0%	
Palisades	Caribou-Targhee	1.1	104.9	1.0%	61,173	57,660	0	94.3%	Approximately 7,836 acres are also open to snowmobiles on designated routes only. These areas are not counted toward the total acres open to snowmobiles.
Great Burn	Clearwater	1.2	117.7	1.0%	113,000	0	0	0.0%	
Mallard - Larkins	Clearwater	0	48.7	0.0%	66700	0	0	0.0%	

Area	Forest	Motorized Trails (mi)	Non-motorized Trails (mi)	% Motorized Trails	Acreage	Acres Open to Snowmobiles Yearlong	Acres Open to Snowmobiles Seasonally	% Open to Snowmobiles	Notes
Selway - Bitterroot Additions	Clearwater	0	23.1	0.0%	18,500	0	0	0.0%	
Mallard - Larkins	Idaho Panhandle	0	106.8	0.0%	78,500	49,963	0	63.6%	
Salmo - Priest	Idaho Panhandle	0	12.1	0.0%	17,600	0	0	0.0%	
Scotchman Peaks	Idaho Panhandle	0	8.4	0.0%	9,400	9,400	0	100.0%	
Selkirk Crest - Long Canyon	Idaho Panhandle	0	27.9	0.0%	26,700	2,666	0	10.0%	
Needles	Payette	25.1	60	29.5%	91,900	8,177	0	8.9%	
Secesh	Payette	36.2	62.1	36.8%	115,400	78,583	0	68.1%	
Borah Peak	Salmon-Challis	12.5	24.5	33.8%	119,000	0	0	0.0%	In addition to 7.2 miles of motorized trails in the Borah Peak RWA, there are also 5.3 miles of roads.
Pioneer Mountains	Salmon-Challis	4.8	42.5	10.1%	48,000	0	0	0.0%	While there are no motorized trails in the Pioneer Mountains RWA, there are 4.8 miles of designated roads.
Boulder-White Clouds	Salmon-Challis	0	12.8	0.0%	34,000	0	0	0.0%	
Hanson Lakes	Sawtooth	9.3	14.7	38.8%	18,500	18,500	0	100.0%	
Pioneer Mountains	Sawtooth	6.7	52.9	11.2%	61,000	44,780	3,945	79.9%	
Boulder-White Clouds	Sawtooth	50.7	115.9	30.4%	184,400	157,103	12,730	92.1%	