



Snowmobile Best Management Practices for Forest Service Travel Planning: A Comprehensive Literature Review and Recommendations for Management – *Introduction to Snowmobile Management and Policy*

Adam Switalski

Adam Switalski

Ecologist / Principal, InRoads Consulting, LLC
1301 Scott St., Suite C
Missoula, MT 59802
Phone: 406-396-1941
Email: inroadsnw@gmail.com
www.inroadsnw.com

ABSTRACT: Wintertime backcountry recreation, including snowmobiles, is a large and rapidly growing use on National Forest System lands. As the number of participants increase, so does the potential for conflict between motorized and non-motorized uses, as well as impacts to natural resources such as wildlife, water quality, soils, and vegetation. The USDA Forest Service has started travel analysis across forests in the snow-belt region, which will determine where motorized use is allowed, restricted and prohibited for decades to come. For planning to be effective, managers and conservationists must have access to the most recent data on the impacts of snowmobiles and need to be aware of successful management strategies for mitigating those impacts. The next four articles review the environmental and social impacts of winter motorized recreation and present a set of best management practices (BMPs). Article 1 provides context and describes the current state of management and policy governing snowmobiles. Article 2 reviews water quality, soils, and vegetation research and presents BMPs to reduce the impacts to these resources. Article 3 reviews research on the impact of snowmobiles on wildlife and presents BMPs to address those impacts. Article 4 reviews the growing conflict between non-motorized users and snowmobile users and presents BMPs to mitigate this conflict. Applying these BMPs will lead to a more socially and environmentally sustainable system of motorized and non-motorized routes and areas on National Forest lands.

Keywords: *Travel planning, snowmobiles, best management practices, BMPs, winter recreational use conflict, wildlife, water quality, soils, vegetation, USDA Forest Service*

INTRODUCTION

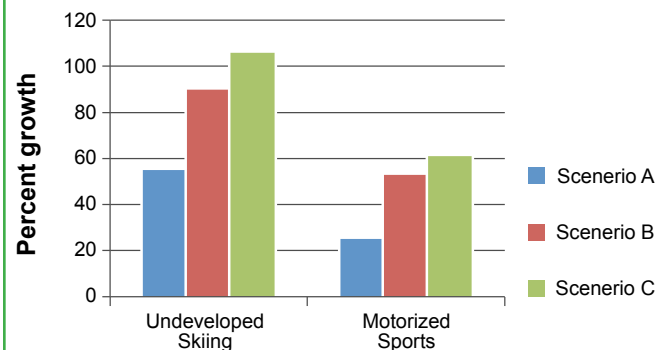
Winter backcountry recreation is a popular and steadily growing activity on USDA Forest Service (Forest Service) lands. Undeveloped skiing (including backcountry skiing, cross country skiing, and snowshoeing) is projected to be one of the top five fastest growing activities on Forest Service lands within 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, including snowmobiling, 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, looking for similar experiences such as solitude, fun, and the enjoyment of the natural beauty of the mountains. 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 non-motorized users, while the reverse is rarely true. Motorized recreation will displace non-motorized users where use is heavy. This has occurred in numerous places. Where actual displacement does not occur, conflicts among users still arise from snowmobile use; the associated noise and fumes often creates annoyance for non-motorized users – especially if they are seeking quite solitude.

Additionally, advancements in technology and changes in use patterns of both user groups have increased the need for proactive management. In the early years, snowmobiles were relatively slow and 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 also have seen their sports evolve through technological changes in gear, making it easier for skiers and snowshoers to climb and descend mountains in the deepest of winter, thus accelerating the trend of increased user participation and demand.

These advancements and changes in use patterns have led to increased user conflicts and negative impacts on natural resources. Snowmobiles can impact wildlife, resulting in declines in animal health, 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 identified “unmanaged recreation” as one of the four threats to the health of National Forests (Bosworth 2003). On most forests, snowmobile activity was never formally planned or expected, but resulted from a default policy of allowing motorized use. This stance arose primarily due to the absence of a compelling reason to close or restrict motorized access, as it was already deemed self-limiting due to extreme terrain challenges and limitations of current technologies of the time. 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 (Rivers and Menlove 2006, Figure 2). Of the 30 percent or 35 million acres closed to snowmobiles, two-thirds are in designated Wilderness Areas where all motorized use is legally prohibited, but where human-powered winter recreation opportunities are often difficult or impossible to access. Furthermore, numerous existing trailheads are weighted towards snowmobile recreation. The legacy of this *unplanned* “allocation” is widespread *open* allocation for winter motorized use that is often not based on historical use patterns or any specific rationale. Furthermore, significant displacement of non-motorized users has occurred as snowmobiles expand their reach, aided by ever-increasing technological advancements (e.g., Stokowski and LaPointe 2000, Manning and Valliere 2001, Adams and McCool 2010). Addressing this allocation disparity is critical to addressing recreational use conflict (Adams and McCool 2010).

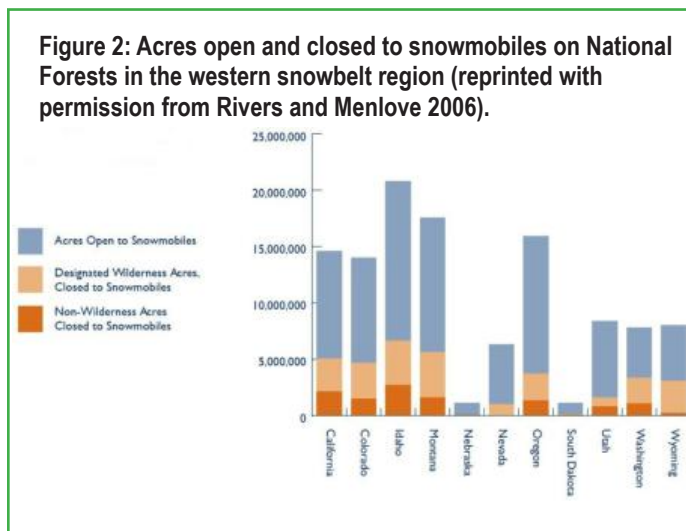
resources and *minimize* conflicts between motorized and non-motorized communities. The Executive Order continues to be the primary legal authority guiding off-road vehicle designations on public lands.

Executive Order 11644

Section 3. Zones of Use. (a) Each respective agency head shall develop and issue regulations and administrative instructions, within six months of the date of this order, to provide for administrative designation of the 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



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 a rising 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

federal public land managers the authority to close a motorized route or area if current access “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 resulting from unmanaged off-road vehicle use and the growth of non-motorized backcountry recreation on National Forest System lands have 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 summer and winter off-road vehicle systems. Subpart B of the TMR requires the Forest Service to have a designated summertime off-road vehicle system, while subpart C allows *but does not require* the Forest Service to designate a wintertime 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 in 2014 issued a draft amendment to the TMR requiring

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 in the near future. In the coming years, areas 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 input as they do so. The BMPs presented in the next three articles are designed specifically to aid in the process of OSV route and area designation, and to improve management and monitoring on Forest Service lands.

Best management practices (BMPs) for 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 snowmobile use, 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 its 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. 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, a comprehensive framework is essential to help managers implement the mandate to minimize social and environmental impacts in designating winter motorized routes and areas.

The next three articles present the best available science for studying 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, a framework is outlined for the minimization of snowmobile impacts. These best management practices (BMPs) provide guidelines to help Forest Service managers designate appropriate routes and areas as *open*, and to close inappropriate routes and areas. Additionally, these practices 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

Implementing the BMPs presented here will help create a more sustainable and manageable system of routes and areas that will limit impacts to natural resources and use conflicts. Key to any management action is monitoring the success or failure of a project or program and adapting the management strategy to reach the goal or objectives. Accordingly, the BMPs rely heavily on monitoring to ensure they are indeed reducing negative social and environmental impacts. Once management actions are implemented, enforcement is essential for the success of any management plan (Adams and McCool 2010). It is also very important that the Forest Service allocates 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 increase compliance have also been implemented (Lindberg et al. 2009, USDI NPS 2013). However, data is limited on the success of these programs, and such efforts may need to be supplemented with monitoring and enforcement of existing regulations.

Yellowstone National Park has developed an extensive adaptive management program following the implementation of its winter use plan (USDI NPS 2013). Land managers 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 to determine 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 includes addressing rising temperatures, thinner snow packs, more intense storms, increased number of freeze/thaw cycles, and more rain-on-snow events which can damage trail systems and add additional management challenges (IPCC 2013). These changes in snow conditions as well as a receding snowpack and earlier spring run-off will alter future winter backcountry recreation use patterns.

With fewer or smaller areas available (and possibly a shortened timeframe with good snow conditions), use will be concentrated, 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. 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. The quality of snow, the number of days with good snow conditions, and quality of recreation experience may also be altered in some regions as there are more freeze-thaw cycles. To preserve quality recreation opportunities and minimize natural resource damage, land managers should consider the impacts of a changing climate when developing management direction.

CONCLUSION

The growing number of winter backcountry users has increased recreational use conflicts and negative impacts on natural resources. Climate change may also restrict where winter recreation takes place, further concentrating use and associated impacts. As the Forest Service begins formally addressing winter recreation through OSV travel planning and determines where motorized use is allowed, restricted, and prohibited, it is essential that land managers have the best available science to guide their important decisions. Furthermore, several management strategies have already been found to successfully mitigate these impacts.

This series of articles presents the best available science on the impacts of snowmobiles. Based upon this research and the recommendations of researchers and managers, and professional experience, a list of best management practices has been developed. If these BMPs are followed, they will help mitigate recreational use conflicts and minimize impacts to natural resources. Once a system of routes is established and special use areas are designated, effective enforcement and monitoring will be critical to the long-term success of any management plan.

ACKNOWLEDGEMENTS

This article was improved upon by thoughtful reviews from John Adams, Hilary Eisen, Allison Jones, Cailin O'Brien-Feeney, Chris Gaughan, Mark Menlove, Sarah Peters, Robert Rowan, Vera Smith, and two anonymous reviewers.

LITERATURE CITED

- Adams, J.C., and S.F. McCool. 2010. Finite Recreation Opportunities: The Forest Service, the Bureau of Land Management, and Off-Road Vehicle Management. *Natural Resources Journal* 49:45-116.
- Baker, E., and E. Bithmann. 2005. Snowmobiling in the Adirondack Park: Environmental and Social Impacts. St. Lawrence University, Canton, NY. http://it.stlawu.edu/~bart/Barthelmess/CB2005_final_papers/pdfs/snowmobiles.pdf
- Bosworth, D. 2003. Four Threats to the Health of the Nation's Forests and Grasslands. USDA Forest Service, Washington, D.C. <http://www.fs.fed.us/projects/four-threats>
- Cordell, H.K. 2012. Outdoor recreation trends and futures: a technical document supporting the Forest Service 2010 RPA assessment. General Technical Report SRS-150. USDA Forest Service, Southern Research Station. Asheville, NC. <http://www.treearch.fs.fed.us/pubs/40453>
- Davenport, J., and T.A. Switalski. 2006. Environmental Impacts of Transport Related to Tourism and Leisure Activities. In: J. Davenport and J. Davenport (eds.) *The Ecology of Transportation: Managing Mobility for the Environment*. Kluwer Academic Publishers. Dordrecht, Netherlands. P. 333-360.
- Gaines, W.L., P.H. Singleton, and R.C. Ross. 2003. Assessing the cumulative effects of linear recreation routes on wildlife habitats on the Okanogan and Wenatchee National Forests. Gen. Tech. Rep. PNW-GTR-586. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. <http://www.fs.fed.us/pnw/pubs/gtr586.pdf>
- IPCC. 2013. Climate Change 2013: *The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels,

Y. Xia, V. Bex and P.M. Midgley (eds.]. Cambridge University Press, Cambridge, United Kingdom and New York.

Lindberg, K., P. Fredman, and T. Heldt. 2009. Facilitating Integrated Recreation Management: Assessing Conflict Reduction Benefits in a Common Metric. *Forest Science* 55(3):201-209.

Manning, R.E., and W.A. Valliere. 2001. Coping in Outdoor Recreation: Causes and Consequences of Crowding and Conflict Among Community Residents. *Journal of Leisure Research* 33(4):410-426.

Office of Management and Budget, Council on Environmental Quality (OMB CEQ). 2012. Memorandum on Environmental Collaboration and Conflict Resolution. Washington, D.C. 9p. <http://georgewbush-whitehouse.archives.gov/ceq/joint-statement.html>

Ouren, D.S., C. Haas, C.P. Melcher, S.C. Stewart, P.D. Ponds, N.R. Sexton, L. Burris, T. Fancher, and Z.H. Bowen. 2007. Environmental effects of off-highway vehicles on Bureau of Land Management Lands: a literature synthesis, annotated bibliographies, extensive bibliographies, and internet resources: U.S. Geological Survey, Open-File Report 2007-1353. <http://www.fort.usgs.gov/products/publications/22021/22021.pdf>

Rivers, K.E., and M. Menlove. 2006. Winter recreation on western national forest lands: a comprehensive analysis of motorized and non-motorized opportunity and access. Published by Winter Wildlands Alliance, Boise, ID. http://winterwildlands.org/wp-content/uploads/2014/04/Winter-Recreation-on-Western-National-Forests-WWA_2006.pdf

Schuett, M.A., S.W. Selin, and D.S. Carr. 2001. Making It Work: Keys to Successful Collaboration in Natural Resource Management. *Environmental Management* 27(4):587–593.

Stokowski, P.A., and C.B. LaPointe. 2000. Environmental and social effects of ATVs and ORVs: an annotated bibliography and research assessment. School of Natural Resources, University of Vermont.

Switalski, T.A., and A. Jones. 2012. Off-Road Vehicle Best Management Practices for Forestlands: A Review of Scientific Literature and Guidance for Managers. *Journal of Conservation Planning* 8:12-24.

USDA Forest Service (FS). 2012. National best management practices for water quality management on national forest system lands - Volume 1: national core BMP technical guide FS-990a. Washington, D.C. http://www.fs.fed.us/biology/resources/pubs/watershed/FS_National_Core_BMPs_April2012.pdf

USDI National Park Service (NPS). 2011. Scientific assessment of Yellowstone National Park winter use March 2011. Yellowstone National Park, Mammoth, WY. http://www.nps.gov/yell/parkmgmt/upload/yell_sci_assessment_deis_release_2011.pdf

USDI National Park Service (NPS). 2013. Yellowstone National Park winter use plan / supplemental environmental impact statement February 2013. Yellowstone National Park, Mammoth, WY. <http://parkplanning.nps.gov/document.cfm?parkID=111&projectID=40806&documentID=51874>

Winter Wildlands Alliance (WWA). 2014. Environmental impacts from snowmobile use. Published by Winter Wildlands Alliance, Boise, ID. <http://winterwildlands.org/wp-content/uploads/2014/05/Environmental-Impacts-from-Snowmobile-Use.pdf>

Yankoviak, B.M. 2005. Off-road vehicle policy on USDA national forests: evaluating user conflicts and travel management. MS Thesis: University of Montana, Missoula, MT.