Title

Monitoring the recovery of decommissioned roads with citizen scientists in the Clearwater National Forest, Idaho

Authors

Court, Katherine
Switalski, T. Adam
Broberg, Len
et al.

Publication Date

2005-08-29

Monitoring the Recovery of Decommissioned Roads With Citizen Scientists in the Clearwater National Forest, Idaho

Katherine Court (Phone: 406-542-8510, E-mail: kcourt@gmail.com), Environmental Studies Program, Jeannette Rankin Hall, University of Montana, Missoula, MT 59812
T. Adam Switalski (Phone: 406-543-9551, E-mail:adam@wildlandscpr.org), Wildlands CPR, P.O. Box 7516, Missoula, MT 59807
Len Broberg (Phone: 406-243-5209, E-mail: len.broberg@umontana.edu), Environmental Studies Program, Jeannette Rankin Hall, University of Montana, Missoula, MT 59812-4320
Rebecca Lloyd (Phone: 208-942-3113, E-mail: rebeccal@nezperce.org), The Nez Perce Tribe, P.O. Box 365, Lapwai, ID 83540

Abstract: Road decommissioning is an increasingly important tool for restoring watersheds on national forest lands. Wildland roads can result in a number of negative impacts leading to decreased terrestrial and aquatic habitat quality. It is believed, therefore, that road decommissioning can have significant positive effects on a watershed—cleaner water, improved fisheries, and restored habitat for terrestrial animals.

However, very little research has been conducted to quantify these benefits. In 1998, the Clearwater National Forest (CNF) and Nez Perce Tribe (NPT) began an intensive road decommissioning program after extensive flooding caused hundreds of landslides in 1995-1996. Since the program's inception, more than 500 miles of roads have been decommissioned. Neither the CNF nor the NPT can sustain the budget and personnel necessary to monitor how effectively these projects are restoring fish and wildlife habitat.

Data collected through a citizen monitoring program will fill this need. Citizen science is a popular and powerful way to monitor the long-term trends and conditions of natural systems while also encouraging a stewardship ethic for the resources being monitored. The information gathered by "citizen scientists" can help land managers make more informed decisions about how best to care for public and private land. We have created the first citizen monitoring program that focuses on the ecological recovery of decommissioned roads. We developed monitoring protocols for citizen scientists, recruited and trained volunteers, and led monitoring trips in the field every weekend during the summer and fall of 2005, engaging, thus far, some 20 volunteers.

As this project is still in progress, all conclusions and findings reported are preliminary. We can, however, make general observations on the efficacy and accuracy of employing citizen scientists to measure ecosystem recovery as a result of road decommissioning. In addition, a second year of funding has been obtained for this project. We anticipate that next year's program will be a success in forwarding our objectives for this project.

Background

The importance of wildland road removal

The effect that roads can have on ecosystems has become an extremely popular area of scientific comment, theory, and research. The presence of roads is associated with the presence of non-native weeds, invasions of non-native animals that are attracted to edge habitat, and other alterations in the structure and function of communities of animals and plants (Trombulak and Frissell 2000). Restoration of watersheds through road removal is an increasingly important tool for land managers, including the U.S. Forest Service. However, very little research has been conducted to quantify the perceived benefits of such restoration. The Forest Service's long-term transportation policy calls for removing up to 25 percent of its existing road system during the next 20-40 years. Wildland roads are a target for restoration because, while they can provide economic and social benefits, they can also degrade the quality of both aquatic (water) and terrestrial (land) habitats (Trombulak and Frissell 2000).

Aquatic Impacts

Removing roads from national forest lands can have a number of beneficial effects. Major beneficial effects include increased infiltration of surface water and reduced surface erosion, which can, in turn, lead to reduced landslide risk and decreased sediment delivery to streams and lakes (Switalski et al. 2004). Road removal and the accompanying decrease in sedimentation can be an important step in protecting aquatic species which need streams nearly free of suspended sediments (for example, most species of salmon and trout). Sediments can harm salmon and trout fisheries through direct mortality, by hindering the development of eggs and larvae, disrupting natural movements and migration, and disrupting fish feeding behavior as a result of reduced visibility (Newcombe and MacDonald 1991).

Terrestrial Impacts

Many species of terrestrial wildlife are influenced by roads as well. Wisdom et al. (2000) reviewed the impacts of forest and range roads on animals and reported that roads and road-associated factors had a negative effect on over 70 percent of the species reviewed. Roads directly or indirectly lead to habitat loss and fragmentation, poaching, overtrapping, snag reduction, down log reduction, negative edge effects, movement barriers, displacement or avoidance, harassment or disturbance at specific use sites, and chronic negative interactions with humans. Additionally, more intact forests (habitat which has not been fragmented by roads) have been shown to provide better habitat for various species of wildlife. We predict that removing wildland roads and restoring habitat to a more intact system will benefit wildlife.

The Clearwater National Forest road removal program

Ecological Conditions in the Clearwater
Idaho's Clearwater National Forest covers nearly two million acres of land in the north-central portion of the state, from the Bitterroot Mountains in the east to the Palouse Prairie in the west. It is the ancestral home of the Nimi'ipuu, or Nez Perce Tribe and forms a nearly contiguous block with the Selway-Bitterroot Wilderness Complex to the south—wild country where old growth cedars, larch, and pine still stand, and where clear, cold water is birthed—much of which flows, eventually, into the Lochsa Wild and Scenic River to the north.

A noted premier whitewater recreation site, the Lochsa River is also home to several protected species of fish, including spring Chinook salmon and steelhead and bull trout—fisheries which supported the Nez Perce when the rivers west of here still ran free, and the draw of which continues to support communities economically who have grown to focus on tourism as a main source of revenue. Additionally, hunting outfitters and guides profit from leading paying visitors to the full complement of native terrestrial wildlife (with the exception of the grizzly bear) which still thrives in the CNF.

On the north side of the Lochsa, however, things are not quite so unspoiled. A legacy of logging over several decades has left the Forest heavily roaded and greatly reduced the quality of much of the habitat on the forest, with more than 4,500 total miles of roads in the forest, some areas have road densities as high as 30 miles of road per square mile. That's higher than in metropolitan areas like New York City. In an area already heavily landslide prone, roads, especially in densities such as these, increase the risk of landslides by interrupting natural water flow patterns and threatening water quality and fish habitat with high influxes of sediment.

The Road Removal Program
In the winter of 1995-96, extensive flooding caused hundreds of landslides, nearly half of which were directly traced to old, abandoned, and overgrown logging roads which had previously been considered stable (McClellan et al. 1997). Similar flooding events had occurred approximately once every 10-15 years, with the number of landslides increasing as the road mileage increased. In 1998, with an influx of cash from emergency federal funding, the CNF partnered with the NPT to begin an ambitious road-decommissioning program in an attempt to restore watershed health and protect the valuable fisheries that still exist in the area (Wildlands CPR 2003). Since the program's inception, more than 500 miles of roads have been decommissioned, hundreds of stream channels have been restored, and planning is underway to restore many more watersheds by decommissioning hundreds more miles of roads. The Clearwater National Forest road-removal program is now one of the largest road-restoration programs in the country.

The goal of ongoing road decommissioning on the CNF is "to reduce watershed impacts by reclaiming roads that are no longer a necessary part of the Forest's transportation system" (USDA FS 2003). The primary objectives are to reduce erosion from road surfaces, reduce the risk of mass failures, restore drainage patterns, stream channels, and site productivity and to protect and restore fish habitat. These habitat improvements should benefit many fish and other aquatic species. Decommissioned roads would presumably create habitat for a variety of terrestrial animals as well. Some wildlife biologists argue that road decommissioning will reduce grizzly bear mortality risk (USFWS 1993) and increase elk-habitat security. Unfortunately, as with many projects that are ambitious but strapped for funding, in-depth monitoring of watershed restoration across the Forest has been somewhat less than adequate, because resources to monitor the effectiveness of this restoration activity are slim. Adding to the complexity of the problem, it will very likely take several years to detect significant changes in watershed health once monitoring has begun and after decommissioning has occurred.

Citizen science is a powerful tool to monitor restoration
The primary goal of ecological restoration (like road decommissioning) is to return ecosystem structure, functions, and processes to natural conditions (Block et al. 2001). It is often assumed that if restoration is "successful," ecological conditions will be favorable for the native plant and animal species. Although this assumption is rarely tested, it should be, and citizen monitoring can play a key role in that testing. Often, project monitoring is not completed by federal, state, or private land managers because of lack of funding. But without that monitoring, the effectiveness of particular restoration techniques is unknown. Without monitoring, restoration techniques cannot improve.

Citizen Scientists Fill in the Gaps
Citizen science is a powerful way to monitor the long-term trends and conditions of natural systems while also encouraging a stewardship ethic for the resources being monitored. This method is popular across the United States. According to the U.S. Environmental Protection Agency, in 1998 there were more than 772 citizen monitoring projects across the country (US EPA 1998). Participants in these monitoring projects can become intimately acquainted with the systems they are monitoring and often develop into exceptional advocates for their protection and conservation as a result of that relationship.

One of the most important roles of citizen scientists is to help fill in the blanks that cannot be covered by government or private personnel because of funding constraints. Therefore, these citizen scientists can provide a more complete picture to public-lands managers and decision-makers. Limited resources mean limited time and personnel to carry out essential monitoring projects. The information gathered by citizen scientists through monitoring can provide vital help to land mangers as they make more informed decisions about how best to care for public and private land.

The Clearwater National Forest as a Citizen Science Testing-Ground
The Clearwater National Forest is ideal for developing and implementing a citizen monitoring protocol for several reasons. First, the Forest Service and Nez Perce Tribe have worked in close partnership on this project since 1998, creating a strong cooperative bond that extends beyond the reach of these two entities and into the surrounding communities. Second, the CNF and NPT have developed active education programs to promote road decommissioning in their communities, which has enabled them to significantly reduce the controversy that often accompanies such work. Because several local communities are already relatively supportive, there are local citizens interested in engaging in this volunteer project. Third, the CNF, as the leader in road removal on Forest Service lands, has several hundred miles of roads identified as candidates for decommissioning as funding becomes available. Fourth, the scale of road decommissioning on the Clearwater National Forest affects entire watersheds; consequently, monitoring stream response in these watersheds may yield meaningful data. The Forest Service does not have the budget or personnel to expand their monitoring of stream-habitat conditions and conduct population assessments of fisheries and wildlife. Citizen science has the potential to be an effective, low-cost solution, while also increasing local involvement and support for watershed restoration.

Benefits of Citizen Science on the Clearwater National Forest
Participation in this citizen-science program will result in a number of long-term benefits to local communities. Most importantly, informed local communities will better understand why road decommissioning is a critical component of watershed restoration. Additionally, by investing community time and energy in monitoring, citizen science promotes community stewardship and cooperation. With a greater understanding of watershed restoration, this community will be more supportive of the benefits of watershed protection and sustainable management practices.

In addition to benefiting local communities, this project could act as a model for other programs across the U.S. Extensive road decommissioning efforts are occurring across the western coastal states (Washington State, Oregon, and California). Although some monitoring is occurring in these locations as well, there is no universal protocol to allow comparison and meta-analysis. By implementing a protocol and promoting citizen science programs in other areas of the country, we will increase the amount of data available to analyze the benefits and impacts of road decommissioning—a topic that remains almost completely unstudied.

Objectives
Seeing this need and perceiving a possible solution, the CNF and NPT teamed up with Wildlands CPR and the University of Montana's Environmental Studies program to create a citizen monitoring program which would fulfill several objectives simultaneously. Our specific objectives for this project were twofold: 1) to assist Forest Service and tribal personnel in obtaining vital monitoring data regarding their road decommissioning program in several areas of the forest, and 2) to engage and educate members of the public about the existence of road-decommissioning projects and their benefits and impacts. Each of these objectives was achieved by fulfilling various goals set out at the beginning of the project in a detailed planning process undertaken as a part of the original grant-application procedure.

Methodology

The project was divided into two main components with separate and clearly definable purposes. The first component was to develop monitoring protocols specifically geared toward monitoring decommissioned roads with citizen scientists and plan for their implementation. The second component was to recruit citizen scientists from local communities within and nearby the Clearwater National Forest to carry out the implementation of the aforementioned protocols.

Developing monitoring protocols and ensuring their usefulness
Initially, during the summer and fall of 2004, we assessed existing monitoring protocols and programs and adapted them to create our own unique citizen monitoring program, focused on road decommissioning. The protocols outline aquatic and terrestrial sampling methods (see list 1), including pebble counts, erosion pins, vegetation surveys, measurement of water temperature, collection of macroinvertebrates, and the use of photo points. Wildlife-sampling methods, including remote-sensor cameras and tracking stations designed specifically for use on decommissioned roads, were incorporated into these protocols (see Townsend and Switalski 2004). Simultaneously, we developed a quality-assurance plan to ensure that the data collected would be accurate and useful. We also field tested several of the monitoring protocols during the fall with students from the University of Montana's (UM) Wilderness and Civilization class.

Recruiting Citizen Scientists
The following winter we developed an outreach plan to guide outreach activities in various target communities and groups. This plan helped us identify local citizen leaders and organizations interested in long-term, consistent volunteer opportunities. During the spring of 2005, we actively recruited volunteers via schools, county groups, local businesses, and environmental and conservation organizations from small communities in Idaho such as Kamiah, Kooskia, and Orofino, as well as from larger communities such as Moscow, Lewiston, and Missoula (Montana). Individual recruitment presentations were made at local chapters of Trout Unlimited, as well as at several university and high school classrooms. That spring, we also prepared for the field season by developing an informational data entry and analysis website (online at www.clearwaterroads.com) and citizen comment surveys with the help of the University of Montana's Wilderness Institute. The website allows volunteers to remotely upload data collected in the field to a central database, as well as perform some basic analyses.

Preparing for Citizen Scientists in the Field

Before we brought volunteers into the field, we identified seven monitoring segments on the CNF and set up monitoring equipment in preparation for data collection. Our broad goal was to compare the results of decommissioning across drainage types for a watershed-level assessment. Our sampling design, therefore, included monitoring segments that exist in unroaded (or nearly so) drainages, drainages that have overgrown (un-decommissioned) roads slated, and drainages where a great deal of restoration through decommissioning and culvert removal has occurred. We also monitored an area that will remain roaded. Comparisons between data collected at the watershed level can increase the scale of the overall picture gained from monitoring. We attempted to choose sites in drainages which were as similar to one another as possible, with similar topography and soils composition, and which drained to a similarly-sized creek. Included in our monitoring sites are a roadless area, a decommissioned area, a site slated to be decommissioned, and an area which will remain roaded. Once the monitoring sites, protocol, and data-entry website were all in place, citizen monitoring began.

List 1. Monitoring methods used by citizen scientists:

- Pebble counts
- Macroinvertebrate surveys and temperature measurements
- Vegetation transects
- Erosion pins
- Photo points
- Wildlife surveys (cameras, track stations)

We trained citizen scientists to collect various ecological data using the protocols specifically developed for their use on decommissioned roads. Citizen scientist teams of 2-10 participants were created from communities throughout the Clearwater region, with a goal of creating long-term, self-sustaining volunteer partnerships at these and other study sites.

Results

Our monitoring season began in late June and will continue through mid-October. Through our wildlife-monitoring methods, we have already recorded use of decommissioned roads by black bear, cougar, gray wolf, coyote, fisher, white-tailed and mule deer, elk, moose, squirrels, chipmunks, and voles. We have set up erosion pins and conducted five vegetation surveys. Three pebble counts have been completed in target streams and three macroinvertebrate surveys are planned for the fall. The season will continue through mid-October, when we anticipate snow will prevent access to our study sites, and will begin again after the snow melts in May or June. More than 30 volunteers will participate in this inaugural field season, including members of eight separate environmental organizations, students from four high schools and two universities, and residents of six different communities within two states. The rural nature of the area has been one of the primary challenges to developing a larger citizen science program.

Discussion and Conclusion

Lessons learned

In terms of practical lessons we have learned, there are several things that have been achieved. We have learned that we can capture photos and tracks of wildlife on decommissioned roads using our modified tracking methods. Additionally, we have found that our protocol for collection of data by citizen scientists works. We discovered some technical limitations of the projects, such as the fact that cameras don't work in very cold temperatures. Weather also can limit our access to sites and snow has prevented us from beginning our sampling.

We have also found that it is essential to build a strong foundation for a citizen monitoring program. Ensuring that quality data can be collected over time is a must. Once we developed a protocol, created our online database with the capacity for analysis, we could begin field sampling. The next step was to get the volunteers on the ground and begin collecting high-quality data following the detailed guidelines laid out in our protocols. In our first year of field work with citizen scientists, there have been few observable problems with employing citizen volunteers. Many of the complications of using citizens for field work may have been offset by our development of protocols specifically tailored to use by citizen scientists, thus preventing initial confusion and difficulties in following guidelines.

In terms of getting the word out, we have found that advertising the project opportunities has created a local "buzz" that will continue and we hope help build community support of restoration on the CNF. Above all, the partnerships which were created during the project have been essential to its being carried out successfully—without these partnerships, citizens could never have become engaged.

List 2. Partnerships created during this project are essential to its success, now and in the future. Wildlands CPR has worked closely with the following:

- The Nez Perce Tribe, Clearwater National Forest, and University of Montana helped review the protocol, assisted in deciding priorities for monitoring on the forest, and provided logistical support.
- Conservation & Education groups helped find citizen leaders and recruit volunteers: the Palouse-Clearwater Environmental Institute, the Three Rivers and West Slope Chapters Trout Unlimited, the Native Forest Network, Friends of the Clearwater, the Watershed Education Network, and the Flagship Program.
- Schools helped generate volunteers: Willard Alternative High School, Hellgate High School, Kamiah High School, Clearwater Valley High School, Orofino High School, Lapwai High School, the University of Montana, and the University of Idaho.

Future research needs

Future research should examine the accuracy of data collected by citizen scientists. Also, more work is needed to determine how to make a citizen science program self-sustaining and how to promote citizen involvement in road decommissioning in other regions.

Final thoughts

The potential for good things to come from this project is massive. We anticipate many beneficial effects. As with all projects begun from the ground up, things are bound to move slowly at first, especially in rural areas where communities are often resistant to change and to anything that might be perceived as coming from the outside. However, excellent groundwork has been laid for what will very likely be a successful program as work progresses over the next few years. It is our hope that, if we can prove that this type of monitoring is valuable, other forests with similar road-decommissioning programs will also see the potential and begin to employ citizen scientists. In time, citizen scientists may help national forests all over the country complete essential research on road decommissioning, which will in turn allow forests to make more informed decisions about where restoration should occur and how to accomplish it.

Acknowledgments: We would like to thank the National Forest Foundation for providing the funding that made this project possible and all the wonderful citizen scientists who gave their time.

Biographical Sketch: Katherine Court is a graduate student in the Environmental Studies Program at the University of Montana. She obtained a B.A. in environmental studies from Eckerd College in 2002. Adam Switalski is the science coordinator for Wildlands CPR. Len Broberg is the director of the Environmental Studies Program at the University of Montana. Rebecca Lloyd is a hydrologist with the Nez Perce Tribe of Idaho.

References

Block, W., A. Franklin, J. Ward, J.L. Ganey, and G. White. 2001. Design and implementation of monitoring studies to evaluate the success of ecological restoration on wildlife. *Restoration Ecology* 9: 293-303.

McClelland, D.E., R.B. Foltz, C.M. Falter, W.D. Wilson, T. Cundy, R.L. Schuster, J. Saurbier, C. Rabe, and R. Heinemann. 1997. Relative effects on a low-volume road system of landslides resulting from episodic storms in northern Idaho. Transportation Research Record 2(1652): 235-243. http://forest.moscowfsl.wsu.edu/4702/reports/slides%5Ftrb1652.pdf

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosystems. *North American Journal of Fisheries Management* 11: 72-82.

Switalski, T.A., J.A. Bissonette, T.H. DeLuca, C.H. Luce, and M.A. Madej. 2004. Benefits and impacts of road removal. *Frontiers in Ecology and the Environment* 2(1): 21-28.

Townsend, S. and T.A. Switalski. 2004. *Guidelines for wildlife monitoring following road decommissioning*. Wildlands CPR, Missoula, Montana.

Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology* 14: 18-30.

USDA Forest Service. 2003. *Road decommissioning monitoring report 2002*. U.S. Department of Agriculture, Forest Service, Clearwater National Forest, Orofino, Idaho.

US Environmental Protection Agency. 1998. *National directory of volunteer environmental monitoring programs*. U.S. Environmental Protection Agency, Washington, D.C. http://www.epa.gov/OWOW/monitoring/dir.html

Wildlands CPR. 2003. Investing in communities, investing in the land: Summary report. Adapted from *Reinvestment in jobs, communities and forests: The benefits and costs of a national program from road removal on U.S. Forest Service lands, a preliminary analysis*. The Center for Environmental Economic Development. Arcata, California. Wildlands CPR, Missoula, Montana.

Wisdom, M.J., R.S. Holthausen, B.C. Wales, C.D. Hargis, V.A. Saab, D.C. Lee, W.J. Hann, T.D. Rich, M.M. Rowland, W.J. Murphy, and M.R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. Volume 1, Overview. Gen. Tech. Rep. PNW-GTR-485. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. http://www.fs.fed.us/pnw/pubs/gtr485/gtr485v1.pdf