

WATERSHED, RIPARIAN, & AQUATICS

Monitoring Question

To what extent is Superior National Forest (SNF) management affecting water quality, quantity, flow timing and the physical features of aquatic, riparian, or wetland ecosystems?

Monitoring Conducted

Effects of Management Actions on Watershed Conditions¹

Objective. O-WS-1. *Improve and protect watershed conditions to provide water quality and quantity and the soil productivity necessary to support ecological functions and intended beneficial water uses AND 36 CFR 219.12 (k) [2]. Documentation of the measured prescriptions and effects, including significant changes in productivity of the land.*

Stream Monitoring Reaches

In 2006, stream monitoring reaches were established at 18 sites on 20 streams and rivers including Bill Creek, Camp 97 Creek, Denley Creek, Harris Creek, Hill Creek, Little Isabella River, Lost Jack Creek, Mitawan Creek, Nira Creek, Norway Creek, Snake Creek, Spawn Creek, Sphagnun Creek, Spring Creek, Stony River, Trappers Creek, and tributaries to Pickett, Mudro, and Grassy Lakes (e.g. Photo 1). As in 2005, sites in 2006 were established in an effort to continue long-term monitoring of stream habitat, fish populations, water quality, and stream channel conditions. They were selected based upon proposed vegetation management and/or transportation activities, existing Regional Forester Sensitive Species (RFSS) populations, stream channel and/or riparian conditions, and habitat restoration project sites. It is anticipated that monitoring will occur at established sites every 3-5 years depending upon proposed National Forest management, RFSS information needs, and/or environmental conditions.



Photo 1. Established long-term stream monitoring reach on the Gunflint Ranger District



Photo 2. Existing culvert identified as a fish passage barrier during road/stream crossing surveys

¹ The following Stream Monitoring Reaches, Stream Crossing Monitoring & Restoration, and Large Woody Debris discussions also apply to Aquatic RFSS and MIH resources. (See Terrestrial and Aquatic Wildlife Sections).

Stream Crossing Surveys and Restoration Projects

In 2006, road/stream crossing surveys were completed at 139 locations within the Twins, Cascade, Clara, and Glacier Mid-Level Project Areas (e.g. Photo 2). Survey information will be used to monitor the effects of road construction activities and to prioritize future stream crossing restoration projects that promote high quality native aquatic species habitat and enhanced stream channel and riparian functions. In the past, many road stream crossings were designed without recognizing the importance of these attributes.

In 2006, the SNF Fisheries and Aquatic Program, in conjunction with Forest Engineering Staff and external partners, restored 10 road/stream crossing sites on Harris Creek, the Kadunce River, Nester Creek, Laird Creek, two tributaries to Pine Lake, and two tributaries to the Sturgeon River. These projects were specifically designed to improve aquatic organism passage and to restore stream and riparian habitat conditions upstream and downstream from the project sites. Other benefits included removal of potential sediment sources, improved stream flow and sediment transport, and floodplain function. Future monitoring efforts are planned to occur every 3-5 years to evaluate the success of these restoration projects.



Photo 3. Inga Creek stream crossing restoration project completed in 2004.



Photo 4. Twenty-Proof Creek stream crossing restoration project completed in 2005

The effectiveness of road/stream crossing restoration projects implemented in 2004 and 2005 was also monitored in 2006. Monitoring and evaluation was conducted at 7 sites on 6 streams including Inga, Snake, and Twenty Proof Creeks, tributaries to Jack Pine Creek, the East Branch of the Sturgeon River, the Dark River, and the Dunka River (e.g. Photos 3 and 4). Pre and post project data collected included substrate conditions, floodplain characteristics, water levels, and stream crossing structure dimensions. Photo points and site sketches were also created for comparison with future site conditions. Future survey protocols will be developed to quantify, monitor, and document biological conditions at crossing sites. Long-term monitoring is planned to occur every 3-5 years.

Dark River Large Wood Debris Project

In 2006, stream channel conditions, large woody debris structures, and fish populations were monitored within the one-mile Dark River Large Woody Debris Project Area. Survey information was collected from established stream cross sections at 14 sites (e.g. Photo 5). Habitat structure measurements, site sketches, and photo documentation were completed at all 28 structure sites. Fish populations were surveyed with backpack electro fishing gear in both project area and control reference reaches. This monitoring information indicated that there was little change in



Photo 5. Dark River Large Woody Debris Project Site #13

the large woody debris structures that were placed in the Dark River in 2005. As expected, increased stream bed scouring and gravel deposition were documented at several large woody debris structure sites. Fish population surveys indicated that brook trout abundance within the project area had increased from 2005 but was still lower than in the control reach.

Lake Water Chemistry

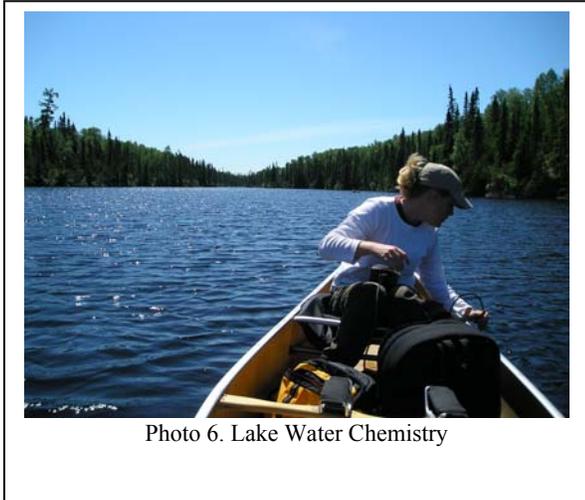


Photo 6. Lake Water Chemistry

The chemistry of two groups of lakes was monitored during the 2006 field season (e.g. Photo 6). Ten lakes associated with the Joint Fire Science Program funded project to study the effect of burning on lake chemistry and mercury in fish were sampled for about two dozen chemical parameters, several physical parameters and for mercury in fish (perch). This study began in 2004 and is anticipated to continue for at least two more summers. The prescribed burns associated with this study have not been lit yet so a report has not yet been written.

A second group of seven lakes was sampled in 2006 with the goal of documenting any long term changes in lake chemistry. Most of these lakes were sampled for over ten years in the past by the Minnesota Pollution Control Agency (MPCA), so they have an existing rich

historic data set. The analysis costs were provided for by the Forest Service Northern Research Station and MPCA.

Mercury in Fish

The SNF continued its 30+ year partnership with Minnesota DNR in providing funds for analysis of game fish from SNF lakes for mercury and other contaminants. The data from this work is included in the Minnesota Department of Health's fish advisory database where it is accessible by the public.

Mercury in Loons

As a top predator that specializes in fish consumption, loons are thought to be particularly at risk from high levels of mercury in fish. In the summer of 2005, the SNF funded a study where loons were captured and feather and blood samples were taken for mercury analysis (e.g. Photo 7). The report for this work has been delayed, but when issued will also include a spatial and temporal analysis of mercury in loon, game fish and young of the year fish of northeastern Minnesota in one dataset.

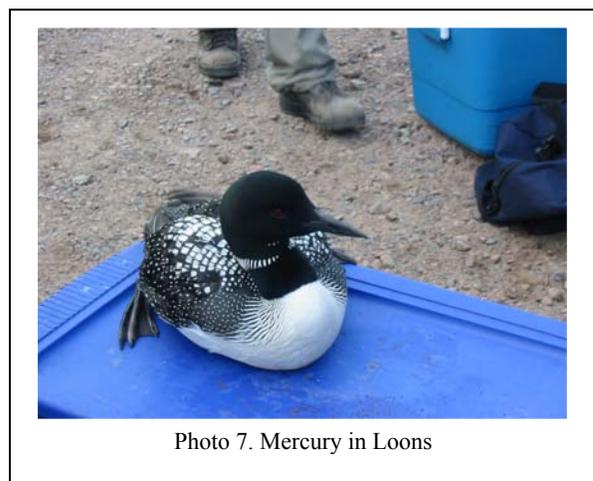


Photo 7. Mercury in Loons

Monitoring Question

To what extent are Forest Plan Standards & Guidelines being met, specifically standard S-WS-4 and guideline G-FW-1?

Monitoring Conducted

Compliance with Forest Plan Standards and Guidelines

36 CFS 219.12 (k) [2]. *Documentation of the measured prescriptions and effects, including significant changes in productivity of the land and **Objective O-WS-2(c)** Characterize the ecological composition, structure and function and patterns of individual lakes, streams, wetlandsand the watershed and landscapes in which they are nested.*

There are numerous standards and guidelines pertinent to watershed and riparian resources. Standard S-WS-4 (Forest Plan p. 2-13) and guideline G-FW-1 (Forest Plan p. 2-7) were identified as the most important to document during 2006. The following five applicable monitoring activities were selected as the best parameters to measure prescriptions and effects.

- * Degree to which Standards and Guidelines representative of Water Quality Best Management Practices (BMPs) are being applied to SNF projects
- * Lakes- Water quality parameters
- * Streams – Stream channel, habitat, substrate conditions, and fisheries information collected at established stream monitoring sites on the SNF.
- * Road/Stream Crossing Restoration Projects – Projects are monitored to evaluate the success of road/stream crossing improvements in delivering benefits to aquatic organism passage, stream flow, sediment transport, and floodplain function.
- * Dark River Large Woody Debris Project - Monitoring occurs to document large woody debris structure function and integrity, changes in stream channel and habitat conditions, and fish population diversity and abundance.

Evaluation and Conclusions

Stream Monitoring Reaches

Identification and establishment of stream channel monitoring reaches on the Superior National Forest has been very successful. The SNF Fisheries and Aquatics Program has established 47 monitoring reaches on 33 streams and rivers on the SNF since 2005. Monitoring reaches were established downstream of proposed timber harvest units to evaluate potential effects of vegetative management activities to in-stream aquatic habitat conditions and fish populations. Future monitoring efforts may include water chemistry (pH, alkalinity, total suspended solids), invertebrate sampling, and sieve substrate analyses. It is too early to conclude whether vegetative management activities are affecting aquatic habitat conditions. Monitoring data collected in 2007 and beyond should provide sufficient information to evaluate potential effects to watershed, stream channel, and aquatic wildlife, including RFSS.

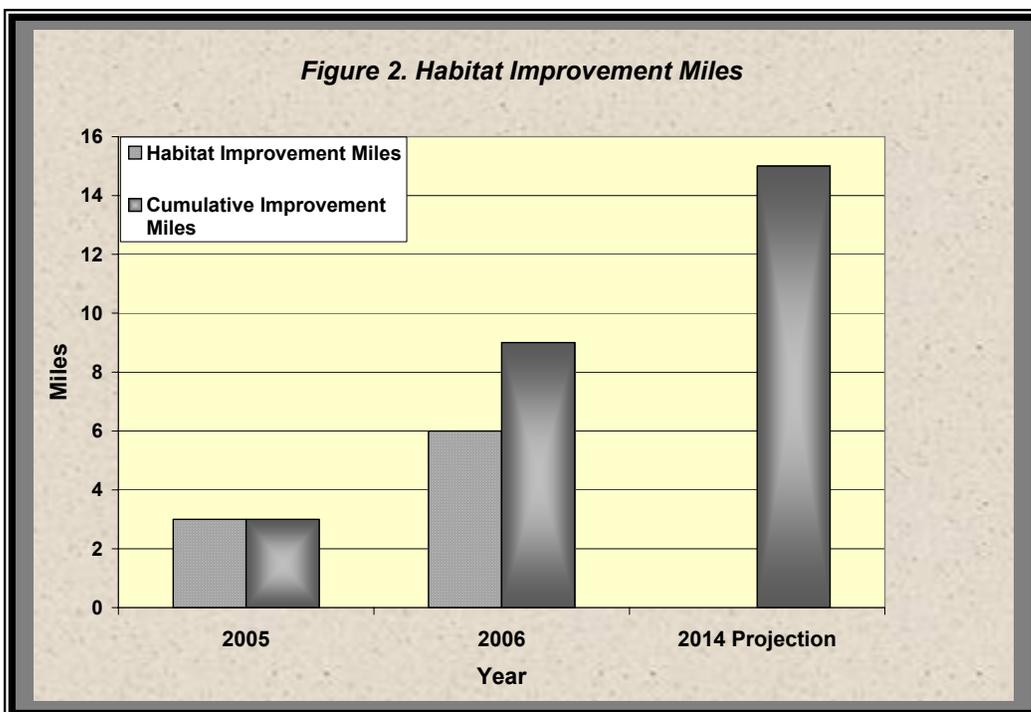
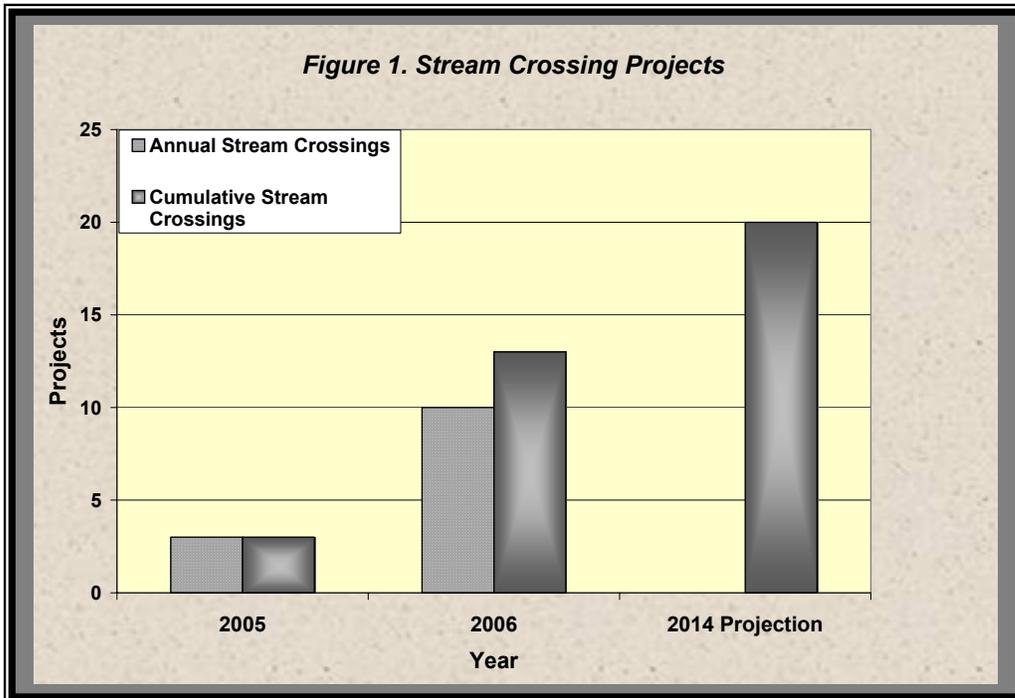
Stream Crossing Surveys, Restoration Projects, and Monitoring

Ten road/stream crossing improvement projects were completed in 2006. The 2006 projects, when combined with the three projects completed in 2005, brings the total number of road/stream projects completed to date to thirteen. This exceeds Forest Plan direction to annually complete 1-2 road/stream crossing projects and will most likely exceed decade 1 projections of 10-20 projects (see Figure 1).

In addition, six miles of stream habitat was improved in 2006. During 2005, three miles of habitat improvement were completed resulting in a total of nine miles since the Revised Forest Plan was approved in 2004. If this

trend continues, the SNF will achieve its projected Decade 1 habitat improvement objective of 5-30 miles prior to 2014 (see Figure 2).

The strategies used to inventory, complete, and monitor road/stream crossing restoration projects has been extremely successful. Beginning in 2002, SNF fisheries and engineering staff have cooperated to identify, plan, design, and complete multiple projects throughout the SNF. Many of these projects have been specifically designed to improve aquatic organism passage while promoting stream flow, sediment transport, and floodplain function. In 2006, the SNF began utilizing a standardized protocol to evaluate and monitor completed road stream crossing restoration projects. Monitoring surveys conducted at seven road stream crossing sites indicated that all the road/stream crossing structures were functioning as planned and designed.



Water Chemistry

In 2006, the SNF monitored the chemistry of over a dozen lakes to assess changes that could affect the aquatic ecosystem. Trends in lake water chemistry data often take many years to reveal themselves. This data is scheduled to be analyzed in late 2007. Analysis of fish mercury data by MPCA from lakes that have been repeatedly sampled over multiple years revealed that fish mercury content in SNF lakes decreased in approximately half of the lakes, increased in about ¼ of the lakes, and remained relatively constant in about ¼ of the lakes. These ratios are approximately the same as the trends observed in the overall statewide dataset.

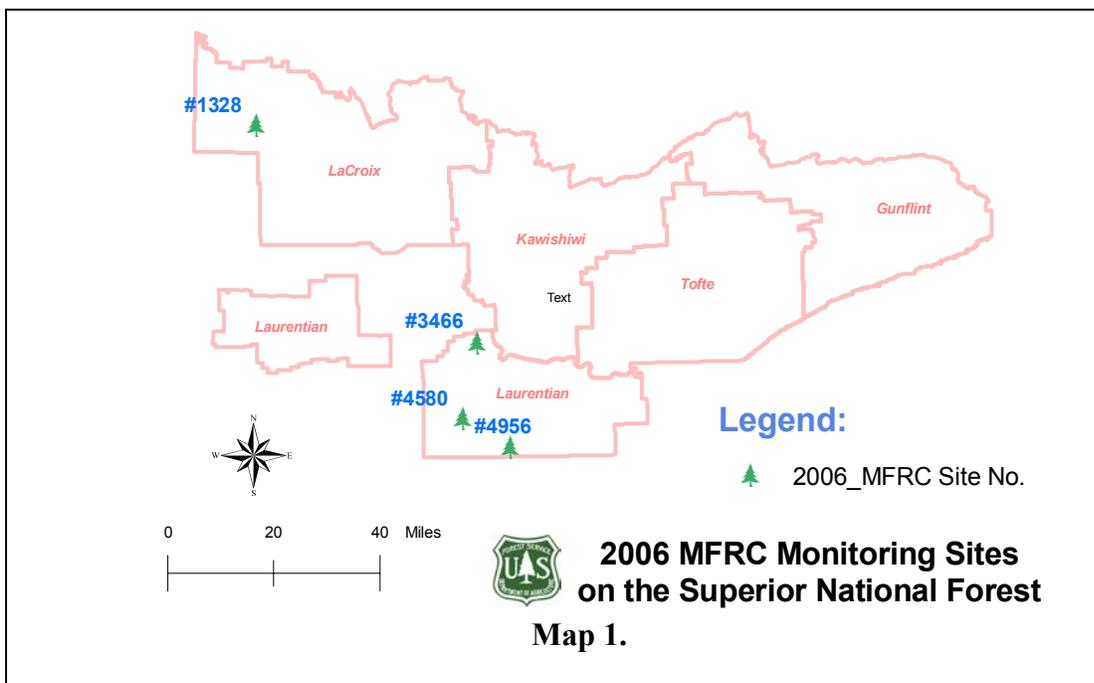
Loons were captured, measured, and blood samples taken to be tested for mercury and other toxics. A report on the work is scheduled to be issued in 2007 describing any adverse affects the loons may be experiencing due to the contamination of their diet. The report will also examine spatial trends in mercury contamination across the forest.

Effects of Management Actions on Watershed Quality

Results of auditing of Fiscal Year 2006 timber sales demonstrate good use of appropriate BMPs identified by the Minnesota Forest Research Council (MFRC). During 2006, four sites were monitored by the MFRC. Highlights of FY 06 findings are:

- ❖ Water quality evaluations were performed for projects near or including a total of 22 wetlands / water bodies.
- ❖ Rutting was either not evident in or impacted less than 2-5% of wetland areas for all of the sites monitored
- ❖ No bare soil, erosion, or rutting was observed in any of the filter strips that were monitored
- ❖ The main skid trails were all more than 50% vegetated
- ❖ Erosion was only reaching one (a non-open water system) of 22 wetlands monitored in 2006
- ❖ There was observed unauthorized ATV use on 3 of the 4 sites (see Map 1; sites 1328, 4580, and 4946)
- ❖ There was no evidence of equipment fueling and maintenance or spills at any of the sites
- ❖ Between 2 to 5 logs per acre of coarse woody debris was left on all of the sites
- ❖ Slash was present in non-open water wetlands at two of the four sites

These findings indicate a continuation of high level of compliance as documented in audit results from previous years.



Standards and Guidelines

Approximately 18 applicable Standards and Guidelines (S&G's) were monitored during 2006. Ten of the S&G's were successfully implemented while 11 S&G's need more focused monitoring. In particular, water quality BMPs were found to be successfully implemented based on current and past audits by MFRC and observations of SNF timber sale administrators. Early indications based on project planning and design features suggest that timber harvest within near bank riparian zones was completed with good compliance with relevant S&Gs. S&G's needing more focused monitoring include timber and fuel management near wetlands.

Necessary Follow-up and Management Recommendations

After reviewing monitoring findings, the Forest Interdisciplinary Team identified six follow-up actions to carry forward and two management recommendations for Program Managers for their review and action. These actions are as follows:

Follow-Up Actions

- * Long-term monitoring at established monitoring reach sites should occur at least once every 3-5 years.
- * Continue establishing stream monitoring sites. Include water chemistry data collection, invertebrates, and sieve analysis. Formally establish lake and wetland monitoring sites as well as monitoring protocols.
- * Road/stream crossing and stream habitat restoration projects should be monitored at least once every 3-5 years. Continue to conduct post-project monitoring to evaluate the effectiveness of each project. Protocols initiated in 2005 will be further refined and adopted in 2007 and beyond.
- * Annually, continue to add to the mercury-in-fish and precipitation chemistry databases to detect and assess trends. Continue to monitor at intervals of no more than five years to detect trends in mercury levels in loons. The next sample collection for loons should be in the year 2010 or sooner.
- * Initiate a monitoring program to evaluate road/stream/wetland crossing improvement projects in 2007 and beyond. This monitoring program would utilize the Coarse Level Culvert Survey Protocol and established stream cross sections and longitudinal profiles. A formal monitoring protocol should be developed. Expand the systematic process used to assess road and trail crossings to address wetland crossings. Include "stream" crossings in the identification of priority locations for crossing improvement projects.
- * There is a need for more focused monitoring of timber and fuel management near wetlands, especially deposition of slash near wetlands.

Management Recommendations

- * Update the upland young/upland open analysis for the entire SNF every three years. Existing information is 10-12 years old and should be revised to assist with required NEPA watershed, fish and aquatic analyses. The analysis will be updated in 2007 and beyond as new information becomes available. SNF Hydrology, Fisheries and GIS staff should cooperate to accomplish this task.
- * Continue to consider that vegetation management NEPA decisions include proactive riparian management, particularly in the near-bank zones.

A complete display of Specific Follow-up and Management Recommendations are shown in Appendices A and B.

Collaborative Opportunities To Improve Efficiency And Quality Of Program

Partnerships

During 2006, the SNF coordinated with federal, state, local and Tribal governments as well as non-governmental organizations to inventory and monitor a variety of indicators for watershed condition, including management indicator species, Regional Forester Sensitive Species, non-native invasive species, riparian habitat conditions, and water quality, with an emphasis on mercury in fish. Partners included U.S. EPA, Minnesota Department of Natural Resources (MN DNR), Fond Du Lac Band of Chippewa, Minnesota Forest Resource Council, the Nature Conservancy, Quetico Provincial Park, and Voyageurs National Park among others. Efforts will be made to coordinate future monitoring activities, share monitoring data, and potentially collaborate to fund future monitoring efforts.

Research

Two research projects related to watershed condition occurred during 2006. These included a project by the Forest Service Northern Research Station to assess fire effects on mercury recycling in watersheds and a project conducted by the Minnesota Pollution Control Agency to evaluate precipitation chemistry and trends in lake & stream chemistry as part of the National Lakes Assessment Project.

Summary Points

- * Stream monitoring reaches were established at 18 sites on 20 streams and rivers.
- * Road/stream crossing surveys were completed at 139 locations.
- * 10 road/stream crossing sites were restored.
- * Within the Dark River, Large Woody Debris structures increased stream bed scouring and gravel deposition. Fish population surveys indicated that brook trout abundance within the project area had increased from 2005.
- * The chemistry of two groups of lakes was monitored. In the 1st group, baseline fire effects on lake chemistry and mercury in fish were sampled as part of a study that began in 2004. A 2nd group of lakes was sampled to document long term changes in lake chemistry.
- * The SNF assisted researchers from the MN DNR and other organizations in sampling game fish and loons for mercury contamination.
- * Results of MFRC implementation auditing of Fiscal Year 2006 timber sales demonstrate good use of appropriate BMPs. In particular, water quality BMPs were found to be successfully implemented.
- * Update the upland young/upland open analysis for the entire SNF every three years.
- * Continue to encourage that vegetation management NEPA decisions include proactive riparian management, particularly in the near-bank zones.