

Monitoring Conducted

Effects of Management Actions on Watershed Quality

Stream Monitoring Reaches

In 2007, stream monitoring reach surveys occurred at 7 established monitoring sites within the Virginia and Devil Trout Project Areas and at 1 new site within the Mid-Temperance Project Area. Monitoring surveys occurred in Slow (two sites), West Knuckey, Leander, Murray, and McNiven Creeks in the Virginia Project Area, Elbow Creek in the Devil Trout Project Area, and Pancake Creek in the Mid-Temperance Project Area. As in previous years, stream monitoring sites were established and revisited in an effort to continue long-term monitoring of stream habitat, fish populations, and stream channel conditions. They were selected based upon proposed vegetation management and/or transportation activities, existing 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, Regional Forester Sensitive Species, and environmental monitoring needs.

Monitoring of stream bed material at established cross-sections in fine-bed and coarse-bed streams continued in 2007. There were no significant changes in the estimated bed material characteristics. The methodology used was an aerial estimate using a pebble count. This method can under-represent the fine component of the sediment strata. Hence, the method of sample collection and analysis may be modified in 2008 to provide improved information on stream bed material and distribution.

Stream Crossing Surveys, Restoration Projects, and Monitoring

In 2007, coarse level road/stream crossing surveys at 106 locations in the Border and Lima-Green Mid-Level Areas were completed. San Dimas surveys were also completed at 34 prioritized stream crossing sites to assist with planning and designing future stream crossing improvement projects. These surveys included a more detailed collection of information at the crossings, including stream profile and channel width data. During both surveys it was estimated that 32 miles of stream habitat was surveyed. Survey information will be used to plan, design, and implement stream crossing restoration projects. San Dimas Survey data will also be entered into the National Resource Information System (NRIS) Water Module in the near future.

Watershed, Riparian, & Aquatics Summary Points

- * Physical habitat conditions and fish populations at established stream monitoring sites have changed very little since 2005.
- * The SNF is exceeding Forest Plan direction to complete 1-2 road/stream crossing projects annually. Since 2005, the Forest has successfully designed and completed seventeen projects which have improved aquatic systems. It is likely that this positive trend will continue and exceed decade 1 projections of 10-20 projects.
- * When combined with projects completed in 2005 and 2006, the SNF has improved 13.5 miles of stream habitat. If this trend continues, the Forest will achieve its projected Decade 1 habitat improvement objective of 5-30 miles prior to 2014.
- * Monitoring results from the Dark River Large Woody Debris Project indicated that there was little change in the large woody debris structures between 2005 and 2007. Fish population surveys indicated that brook trout abundance within the project area continued to increase since 2005.
- * Results of Minnesota Forest Resource Council implementation auditing of FY 06 timber sales demonstrate good use of water quality Best Management Practices.



Photo 1. Stream monitoring reach on Slow Creek in the Virginia Project Area.

In 2007, the SNF completed stream crossing improvement projects at four locations including Arrowhead Creek (FR380), Tributary to Fawn Creek (FR608BA), Sphagnum Creek (FR1472), and Sylvania Lake (FR379). These projects were designed to improve aquatic organism passage, stream flow, riparian function, and watershed conditions. Benefits to Regional Forester Sensitive Species included improved fish passage and connectivity for freshwater mussel host fish species and northern brook lamprey. These projects also addressed Forest-wide and District road maintenance, engineering, and watershed priorities. At the tributary to the Fawn Creek site, material deposited from historic roadway crossing failures and the existing road prism was removed from the stream channel and floodplain. The channel was reconstructed and the riparian area was revegetated in the Summer of 2007.

The SNF and The Nature Conservancy (TNC) also continued monitoring the success of a stream crossing improvement project on Laird Creek in the Sand Lakes Seven Beavers Area in 2007. This project was originally identified during a watershed analysis conducted by TNC and the SNF. The stream crossing was considered a barrier to fish passage and improperly sized to accommodate stream flows. Established monitoring stations, including multiple stream cross sections and a longitudinal profile were surveyed in 2006 and 2007 to evaluate stream channel conditions following the completed project.



Photo2. Arrowhead Creek Stream Crossing Improvement Project.



Photo 3. Laird Creek stream crossing in 2005.



Photo 4. Improvement to the Laird Creek stream crossing (Photo D. Peterson, TNC)

Lake Water Chemistry

The chemistry of three groups of lakes was monitored during the 2007 field season. Ten lakes associated with the Joint Fire Science Program funded project to investigate the effect of burning on lake chemistry and mercury in fish were sampled for about two dozen chemical parameters, physical parameters, and fish (perch) for mercury. This study began in 2004 and is hoped to continue for at least two more summers. The 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 for the SNF by the Minnesota Pollution Control Agency (MPCA) in 2007 with the goal of documenting any long term changes in lake chemistry. Most of these lakes have data that go back to the 1980s, so they provide a rich historic data set. The analysis costs were donated by the Northern Research Station and MPCA.



Photo 5. Lake Water Chemistry

The third sampling project completed in 2007 was the National Lake Assessment Project led by the U.S. Environmental Protection Agency (EPA) and MPCA. This project is a nationwide survey of the condition of the nation's lakes. The survey is designed to estimate the percentage of lakes that are in good, fair, or poor condition, serve as a scientific report card, and evaluate the effectiveness of protection and restoration efforts on America's lakes. It will examine ecological, water quality, and recreational indicators, and assess how widespread key stressors (such as nitrogen, phosphorus, and acidification) are across the country. The survey included 9 lakes on the SNF. The SNF partnered with the MPCA to help complete the sampling and assessment for the all of the SNF lakes. A report from EPA on the assessment is due

in 2009, although data collected from Minnesota is already becoming available on MPCA's website (<http://www.pca.state.mn.us/water/nlap.html>). EPA plans to repeat the assessment in five years.

In 2007, an intensive lake assessment report was completed by the MPCA for five lakes on the SNF (<http://www.pca.state.mn.us/publications/reports/wq-lar3-13.pdf>). It was based on sampling done in 2006 and a review of historical data. The report concluded that the five lakes had excellent water quality as compared to other lakes in northeastern Minnesota.

Mercury in Fish

The SNF continued its 30+ year partnership with Minnesota DNR in providing funds for analysis of game fish from Forest lakes for mercury and other contaminants. The data from this work is included in the 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. To investigate this issue, in the summer of 2005 the SNF funded a study where loons were captured and feather and blood samples were taken for mercury analysis.

A report was issued in early 2008 that also included a spatial and temporal analysis of all mercury in biota data for northeastern Minnesota incorporating game fish, young-of-the-year fish, and loon data into one dataset.

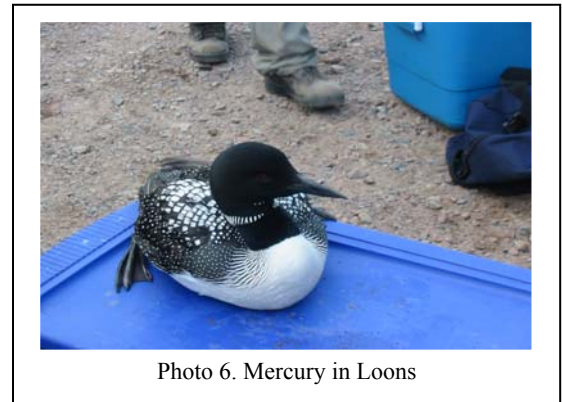


Photo 6. Mercury in Loons

Evaluation and Conclusions

Stream Monitoring Reaches

Since 2005, the SNF has established 48 monitoring reaches on 34 streams and rivers across the Forest. Monitoring reaches have been selected based upon proposed forest management in an effort to evaluate the effectiveness of best management practices and potential impacts to aquatic habitat and wildlife. A review of recent timber sales in the Virginia and Devil Trout Project Areas indicated that no harvest activities had occurred near any of the established monitoring sites.

It will be important to evaluate existing stream monitoring protocols and to develop or adopt new procedures for monitoring water chemistry (pH, alkalinity, and total suspended solids), invertebrate populations, and stream habitat conditions in the future. The SNF should also coordinate with other agencies to identify priority locations for establishing new stream monitoring reaches and to collect monitoring information in the future.

Stream Crossing Surveys, Restoration Projects, and Monitoring

The SNF is exceeding Forest Plan direction to complete 1-2 road/stream crossing projects annually. Since 2005, the Forest has successfully designed and completed seventeen projects which have improved aquatic organism passage, stream flow, sediment transport, and floodplain function. It is likely that this positive trend will continue and exceed decade 1 projections of 10-20 projects (see Figure 1).

In addition, 4.5 miles of stream habitat was improved in 2007. When combined with projects completed in 2005 and 2006, the SNF has improved 13.5 miles of stream habitat since the Revised Forest Plan was approved in 2004.

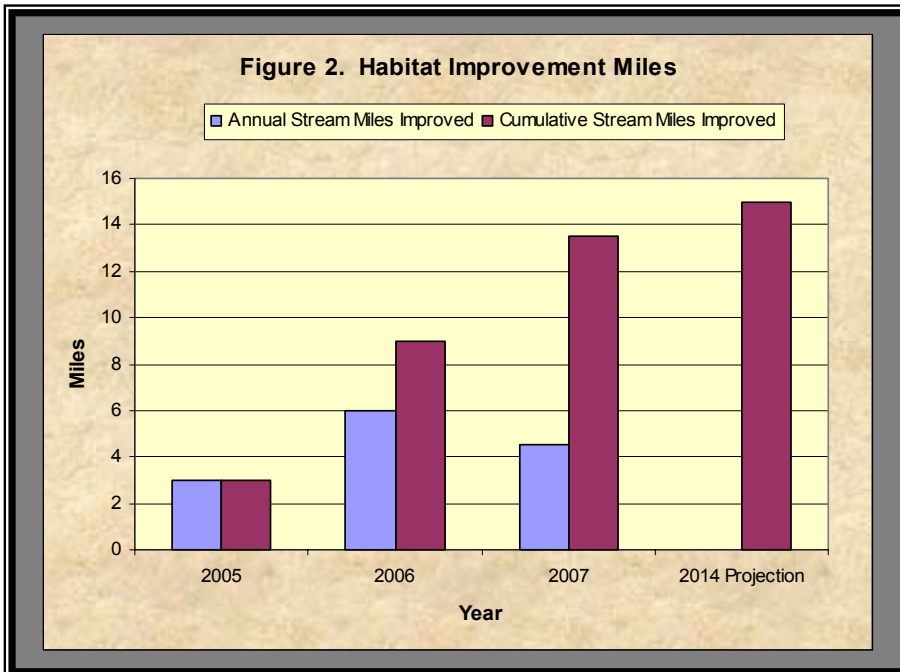
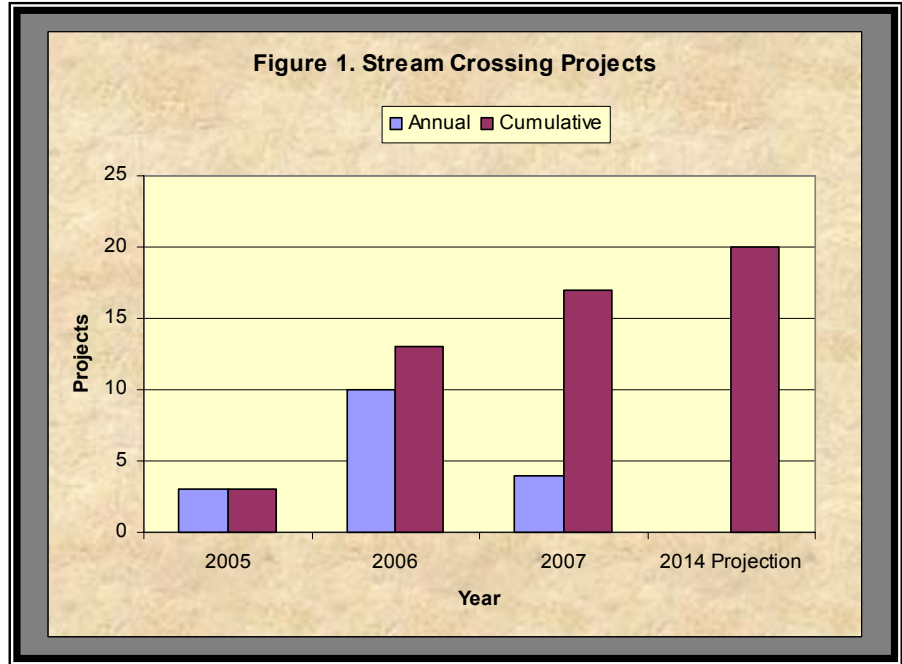
If this trend continues, the Forest will achieve its projected Decade 1 habitat improvement objective of 5-30 miles prior to 2014 (see Figure 2).

Results from the cooperative SNF/TNC monitoring project in the Sand Lake Seven Beavers Area indicated that the stream channel had responded positively by readjusting and further establishing connectivity between upstream and downstream reaches. Fish passage for RFSS mussel host fish species had remained adequate over the two-year period (see Photos 5 and 6).

Monitoring results from the Dark River Large Woody Debris project indicated little change in the large woody debris structures and stream cross-sections between July 2005 and July 2007 with the exception of some anticipated scouring behind logs and sorting of gravels. Fish population surveys indicated that brook trout

abundance within the project area continued to increase from 2005 to 2006 and 2007, although abundance was still considered low relative to other areas of the river.

Monitoring strategies to inventory, complete, road/stream crossing and habitat projects have been extremely successful. Beginning in 2002, Forest and District fisheries and engineering staff have cooperated to identify, plan, design, and complete multiple projects throughout the Forest. Many of these projects have been specifically designed to improve aquatic organism passage while promoting stream flow, sediment transport, and floodplain function.



Water Chemistry

In 2007, the chemistry of 26 lakes on the SNF was monitored to assess changes that could affect the aquatic ecosystem. Most of this work was completed through partnerships. Trends in lake water chemistry data often take many years to reveal themselves. This data will be analyzed over different time periods as discussed above.

Mercury in Biota

Mercury contamination of fish is chronic and causes consumption advisories on lakes across the SNF. Atmospheric deposition is the source of the mercury. The MPCA is developing a plan (<http://www.pca.state.mn.us/water/tmdl/tmdl-mercuryplan.html>) to reduce mercury emissions in Minnesota that, with reductions from sources outside the state, would reduce the levels of mercury in fish so that they could be safely consumed by everyone. There is recent anecdotal evidence from other agencies in the area that mercury levels in biota may be on the rise again after a period of decline.

Loons were captured, measured, and blood samples taken to be tested for mercury and other toxics. A report on the work found spatial trends that were similar to those seen in fish and that at most 10% of the loons in one part of the Forest had mercury above adverse effect levels. The report showed that mercury tends to be the highest in the northern and western parts of the SNF although there is considerable variability. This spatial pattern reflects that seen in the game fish dataset. For the most part, loons on the SNF were found to be carrying body burdens of mercury that are thought not to be above adverse effect levels. For this analysis, the SNF was split into 13 geoprovinces and the highest percentage of loons over the adverse effect level in any geoprovince was 10%. Loons from the SNF had mercury levels that were in the middle of those measured across North America.

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The SNF has coordinated with the Minnesota Forest Research Council (MFRC) to evaluate the use and effectiveness of best management practices on timber sales. In 2007, the MFRC was concentrating on writing a 5-year report that summarized previous monitoring efforts. Hence, they did not perform any monitoring of sites within the SNF in 2007. The SNF will be performing some monitoring of sites in 2008 and it is anticipated the MFRC will resume their monitoring efforts as well.

Management Considerations

After reviewing monitoring findings, the Forest interdisciplinary team recommended two management considerations to carry forward during FY 2008 as follows:

- * Continue to encourage that vegetation management NEPA decisions include proactive riparian management, particularly in the near-bank zones.
- * Working with regulators and industry, advocate for reduction in emissions of mercury and other pollutants that impair lake ecosystems.