

Soil

This section addresses monitoring the effects of Forest Plan implementation to soils on the Superior National Forest. Soil protection and soil restoration are the two categories considered in Forest Plan implementation.

Soil Protection

Soil protection monitoring evaluates the application of [Forest Plan direction](#) standards and guidelines for the soil resource during management activities. The monitoring specifically assesses compliance with guidelines G-WS-8, G-WS-9 and G-WS-11. These guidelines serve as direction in Forest Plan implementation to achieve objectives listed in O-WS-1, O-WS-9 and O-WS-10. Guidelines G-WS-8, G-WS-9 and G-WS-11 exceed the requirements of guidelines listed for soils in *Sustaining Minnesota Forest Resources: Voluntary Site-Level Management Guidelines* (Minnesota Forest Resource Council 2005). Consequentially, this fulfills the guidance provided in G-FW-1 and S-WS-4. G-WS-9 also meets the requirement established in FSH 2509.18, *Soil Management, Chapter 2, Soil Quality Monitoring* (USDA Forest Service 2005). This handbook supplement provides direction to protect soil productivity by ensuring that no more than 15 percent of a treatment area is in a detrimentally compacted, eroded, rutted, displaced or severely burned condition as a result of management activity.

Monitoring Question

Soil protection monitoring addresses the monitoring question listed for the soil resource from [Forest Plan Chapter 4](#):

Are the effects of Forest management, including prescriptions, resulting in significant changes to productivity of the land?

The question is driven by 36 CFR 219.12 (k) [2], Documentation of the measured prescriptions and effects, including significant changes in productivity of the land; D-WS-3, D-WS-12, O-WS-9, O-WS-10.

This monitoring question was developed to determine if soil guidelines are followed during implementation of projects and to assess how effective those guidelines are in protecting the soil resource.

There are two units of measure for soil protection. The first is percentage of treatment area in a detrimentally compacted, eroded, rutted, displaced or severely burned condition (G-WS-9). Forest floor (organic matter and organic soil horizons) lost as a result of management activity (G-WS-11) is the second. These units of measure are effective and appropriate because they relate directly to Forest Plan guidelines that are intended to protect the soil resource. This information measure determines whether or not the guidelines are being

followed and their effectiveness. Monitoring results can also determine how well G-WS-8 had been followed during management activity to determine if ecological landtypes (ELTs) are taken into account.

In addition to units of measure, units of comparison are identified as a component of soil monitoring. Pre-treatment condition is the unit of comparison for soil protection. Monitoring is conducted before management activities, such as harvest or prescribed burning, to establish baseline data and make comparisons with post-treatment conditions. Any pre-existing conditions are also noted during this phase of monitoring.

Monitoring Method(s)

Soil monitoring is performed for areas having vegetation management completed under direction of the Forest Plan and approved in NEPA documents which provide design features for project implementation. Pre-treatment monitoring is performed on units to establish baseline data and make comparisons determining the areal extent and severity of impacts to the soil resource. Monitoring performed through 2009 followed protocol established by Superior National Forest soil program staff.

Monitoring data was collected from May to August 2009. Some data was collected from recent timber sales associated with the Dunka and Whyte Environmental Assessments and the Echo Trail Environmental Impact Statement. These projects covered the Kawishiwi, Laurentian, and LaCroix Districts, respectively. All monitoring data collected for the 2009 field season came from sites scheduled to be treated by timber harvest or timber harvest in combination with additional biomass harvest. Pre-treatment data was collected on approximately 1100 acres in eight sale areas.

Post-treatment monitoring data was not collected during the 2009 field season because none of the areas with pre-treatment monitoring data were harvested. This was a result of poor market conditions for forest products.

In addition, informal monitoring will occur throughout implementation of the projects. Timber management assistants and timber sale administrators ensure project-specific design criteria are included in timber sale contracts and are followed by the timber sale purchaser.

Results

Because no post-treatment monitoring data was collected for the 2009 season there are no results to report. Results and conclusions included in the 2008 monitoring report are still considered valid.

Implications

The results of past monitoring indicate that Forest Plan guidelines are providing adequate protection to the soil resource. This meets Forest Plan objectives. Additional pre-treatment monitoring and the subsequent post-treatment monitoring will provide data useful in determining if that conclusion is still appropriate.

Recommendations

Recommendations for the soil program driven by the results of soil protection monitoring should include continued monitoring of management practices, additional monitoring for emerging issues (biomass, climate change, fuels reduction, etc.), and participation in a long-term soil productivity study.

1. Continued monitoring would be useful to collect additional observations and information on the impacts of management activities. Monitoring across various ELTs and within the various landtype associations (LTA) would give a better understanding of how management activity affects various ecological units. The information would be useful in determining adequacy of soil protection provided by Forest Plan guidelines to ensure soils maintain ecosystem function, thus contributing to healthy watersheds and forest ecosystems. Continued monitoring is desirable because relatively little post-treatment monitoring data has been collected. Also, some ELTs and LTAs have not been monitored.
2. Additional monitoring for emerging issues would be beneficial in determining if resource issues not considered in Forest Plan revision and/or if deviations from guidelines are having a noticeable impact to the soil resource. Biomass from forested lands is gaining interest, as sources of renewable energy have become more desirable. Previously un-utilized portions of trees, such as limbs and tops, are now being considered as a source of energy (fuel) for various applications; such as ethanol production, biomass burners, and pellet production. Current guidelines provide general direction but have not been tailored to address biomass harvest beyond traditional timber harvest. Monitoring would determine whether or not the additional biomass harvest is having a tangible effect to the soil resource.
3. Occasionally, deviations from Forest Plan guidelines are viewed as necessary management practices to achieve other resource goals and objectives that may be desirable. Two objectives that have resulted in management activities, that have departed from soil protection guidelines, are fuel reduction and site preparation. Both fuel reduction and site preparation activities have been used to reduce the amount of slash left after timber harvest but for different reasons. Fuel reduction activities have removed additional slash to decrease fuel loads. Site preparation activities have removed some slash to create a more favorable seed bed for specific tree species. Typically, these deviations are considered to have minor impacts to site productivity and be short-term in duration (Grigal 2004). Monitoring these activities would be useful in determining if the deviations are within acceptable limits or if the practices need to be discontinued to provide adequate protection to the soil resource.
4. A long-term soil productivity study would provide research tailored specifically to the Superior and its ecological units. The study would result in research that would be useful in project planning, assessment of current guidelines, and in considering potential changes for Forest Plan revision.

Soil Restoration

Soil restoration monitoring evaluates the implementation of [Forest Plan direction](#) as it relates to moving the resource towards meeting the objectives of O-WS-1 and O-WS-9. Watershed improvement projects enhance the soil's ecological function in the watershed and forest environment. The types of projects include, but are not limited to; erosion controlling along a shoreline, planting long-lived tree species on nutrient sensitive soils, replacing culverts replacement, and decommissioning roads.

The plan objectives are met while following the direction from guideline G-WS-8. This includes guidance on management options to achieve these goals. For example, G-WS-8 designates the ecological units that would benefit most from the addition of long-lived tree species.

Monitoring Question

Soil protection monitoring is done to address the monitoring question listed for the soil resource from Chapter 4 of the Plan:

Are the effects of Forest management, including prescriptions, resulting in significant changes to productivity of the land?

The question is driven by 36 CFR 219.12 (k) [2]. Documentation of the measured prescriptions and effects, including significant changes in productivity of the land.

Monitoring Method(s)

Soil restoration monitoring is qualitative and examines watershed improvement projects to determine if the treatments are effective. This is a value judgment based on professional knowledge and experience. This could also be used to compare the effectiveness of various methods used in completing similar projects. Monitoring also determines if any additional work is necessary to maintain or further enhance resource conditions.

Results

Watershed improvement projects have been effective in enhancing the ecological function of soil. Shoreline erosion control projects have reduced erosion while improving habitat or providing recreational access (Figures 3-1 and 3-2). Plantings have added long-lived species to riparian areas and nutrient sensitive soils. Trail improvements and relocations have greatly improved watershed conditions by decreasing erosion or by moving recreational use to an appropriate location where it would not impair ecological function as a result of damage such as erosion, rutting, or compaction (Figure 3-3).

Figure 3-1. Camp 4 Lake Access (left) hillside used to launch canoes and small boats eroded from visitor use (before) and (right) steps being installed to mitigate impacts from visitor use (during).

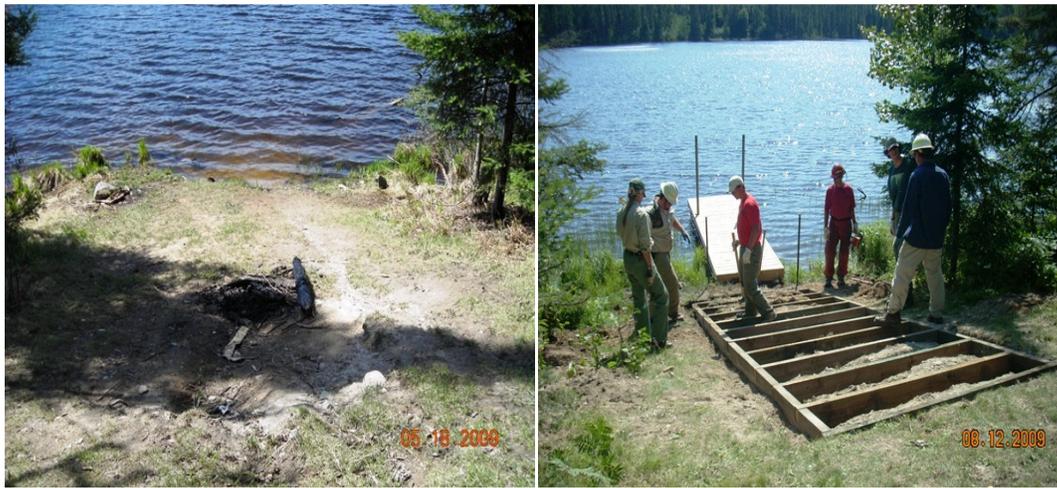


Figure 3-2. Camp 4 Lake (left) visitor created walking trail used to access area for angling along the shoreline (before) and (right) the trail constructed to mitigate impacts of foot travel to the area along the shoreline utilized for angling (after).



Figure 3-3. Triangle Lake Campsite erosion along a pathway to access the campsite from lake (before) and (after) steps installed by F.S. and M.C.C. crew to mitigate visitor use.



Implications

Observations made monitoring watershed improvement projects indicate the projects are meeting Forest Plan objectives listed above. This would suggest continuing with these types of projects in the future would be beneficial for the Forest.

Recommendations

1. Watershed improvement projects can benefit multiple resource areas, such as aquatics, wildlife, and recreation. Considering the success of completed projects, additional watershed improvement projects should be completed where the opportunities are identified.
2. Monitoring of the effectiveness of these projects is simple and requires a minor investment of personnel time. Continued monitoring of these projects will provide additional information on the success of various projects. Additional monitoring will also determine if follow-up work is needed to ensure the treatments remain effective.

References

- Minnesota Forest Resource Council. 2005. *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Loggers and Resource Managers*. Minnesota Forest Resources Council, St. Paul, MN.
- Grigal, D.F. 2004. An update of Forest soils. A Technical Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota.
- USDA Forest Service. 2005. Forest Service Handbook 2509.18, Soil Management, Chapter 2, Soil Quality Monitoring.
- USDA Forest Service. 2009. Superior National Forest Soil Monitoring Protocol 2009. Superior National Forest. Duluth, MN.