

3.11 SOILS

3.11.1 Summary

Implementation of Alternative 1 (no-action) would result in no vegetation management activities and therefore would not result in impacts to the soil. Alternatives 2, 3 and 4 would result in vegetation management activities that could lead to impacts to the soil; however, these impacts would be minimal.

3.11.2 Introduction

This section addresses concerns that proposed management activities may impact soil quality and productivity through erosion, compaction, displacement, and nutrient drain. An analysis for these impacts was also performed in Chapter 3.6 of the Final Environmental Impact Statement: Forest Plan Revision; Chippewa and Superior National Forests: Volume I (2004). Best Management Practices (BMPs) referenced in this document and used by other landowners and agencies are outlined in Sustaining Minnesota Forest Resources: Voluntary Site-level Forest Management Guidelines (2005). BMPs are mitigations used to minimize impacts to the environment that can occur during management activities.

3.11.3 Analysis Methods

Indicator 1: Acres proposed for mechanical treatment and prescribed fire, and associated temporary roads, skid trails, and landings

This indicator highlights the differences between alternatives related to the influence mechanical treatment has on erosion, compaction, displacement and nutrient drain.

Indicator 2: Miles of roads being added to the system

This indicator examines the difference in the amount of roads that would be used for vegetation management, and the potential impacts from erosion, compaction and displacement.

3.11.4 Analysis Area

The analysis area used to examine the direct, indirect and cumulative effects of each alternative is the ecological landtype(ELT). Ecological landtypes are mapped soil units whose natural boundaries best define site-specific soil resource information for the Superior National Forest. Potential effects to the soil resource are logically confined to the soil directly beneath where the activity takes place. An example would be a piece of heavy equipment causing soil compaction that reduces pore space for air, water and roots within a section of a treatment area does not impact pore space on adjacent areas.

The time period used for analyzing the direct, indirect and cumulative effects of the proposed activities is fifteen years. This time frame was selected because the effects of the management actions would diminish over time and would not be measurable fifteen years after the management activity has occurred.

3.11.5 Affected Environment

The classification system used for the Glacier Environmental Analysis is discussed in the *National Hierarchical Framework of Ecological Units in Ecosystem Management* by Cleland and others (1997). This system classifies and maps ecological units based on associations of climate, topography,

soils, water, and potential natural communities. An overview of the Ecological Classification System for ecological units is useful to understand the soils information presented in this document, including design criteria.

Within this hierarchical system, mapping units range from provinces that are thousands of square miles in size, to landtype associations (LTAs) that are broad geographic areas, to ecological landtypes (ELTs) which are more site-specific. The province is the largest unit representing the climate zones of North America. The Superior National Forest falls into the Laurentian Mixed Forest Province with short, warm summers and long, cold winters. Within the province there are increasingly smaller ecological units called sections, subsections, landtype associations, and ecological landtypes.

The Glacier Project Area is in the Northern Superior Uplands section (212L), and includes the Border Lakes and Laurentian Highlands subsections (USDA Forest Service, 1998).

More detailed information concerning Project Area LTAs and ELTs can be found in the project record.

3.11.6 Environmental Consequences

3.11.6.1 Direct and Indirect Effects

Alternative 1 (No-action)

Alternative 1 (No Action) would result in no future vegetation management activities and no impacts from these treatments.

None of the existing unclassified roads within the project area would be converted to system roads or would be decommissioned. As a result, these roads would remain open for motor vehicle traffic in their current condition. Existing resource damage, such as erosion and rutting, would remain. Additional damage from continued use would also occur. This damage would potentially result in sediment delivery to adjacent waterways and wetlands. Overall soil quality would decline in the impacted area resulting in a diminished capacity to support vegetation and function for watershed health. Areas of road that would not be decommissioned under the No Action Alternative would remain unproductive.

Direct and Indirect Effects Common to All Action Alternatives (Alternatives 2, 3 and 4)

Indicator 1

Alternatives 2, 3 and 4 would result in future vegetation management activities. By following Operational Standards and Guidelines described in Appendix E, these treatments would result in minimal impacts to the soil.

To determine overall impacts to soil quality, the amount and area impacted and the degree of impact was analyzed. Table 3.11-1 shows the acres of harvest, acres of prescribed fire, and the acres of mechanical and prescribed fire site preparation that would occur on harvested sites.

Treatment Type	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Harvest ¹	0	8,074	5,655	9,290
Prescribed Fire	0	1,253	1,253	1,253
Site Preparation ²	0	463	268	463

¹Acres shown are stand acres. Actual treated acres would be less than the acres shown to account for legacy patches, reserve islands, and other resource mitigations.

²Acres of site preparation could include mechanical treatments and/or prescribed fire treatments for the purpose of site preparation.

Much of the impact to the soil within harvest areas, including mechanical site preparation, is associated with landings and primary skid trails. Landing and primary skid trail impacts to soil include soil compaction and, as a result of compaction, reduced water infiltration and an increased potential for erosion. Soil compaction resulting from vehicle and skidder traffic usually results in reduced vegetation growth and regeneration. Units scheduled for summer harvest would have the greatest potential for compaction. Frost action and floral and faunal activity tend to reduce compaction within three to eight years after activity. The projected amount of area impacted by landings and skid trails are shown in Table 3.11-2.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Landings	0	81	57	93
Skid Trails	0	242	170	279

¹Landings calculation assumed 1% of harvested area would be utilized (See Forest Plan)

²Skid trail calculations assume 3% of harvested area would be utilized. Figures obtained by averaging actual monitoring data on the Superior National Forest.

Impacts of temporary road construction include compaction and displacement of soil and potential sediment delivery to nearby wetlands and waterways. The impacts would be minimized by using existing corridors where possible. Impacts would also be greatly reduced through the use of BMPs along with Forest Plan standards and guidelines(S-TS-3, G-TS-13). Most of these impacts would be short-term (less than fifteen years). Once treatment activities were completed the road would be rehabilitated and revegetated.

The potential impact from prescribed fire is a loss of site productivity as a result of nutrient loss. Nutrient loss could occur as a result of volatilization and/or a loss of organic matter on nutrient sensitive ELTs. This impact would be minimized by following Forest Plan guideline G-WS-10. Following this guideline would take into account the amount of fuel; ignition timing and patterns; and factors that would influence fuel conditions such as vegetation type, number of days since precipitation, weather conditions, and fuel moisture.

Indicator 2

Currently some compaction and displacement are occurring on unclassified roads resulting in the potential for sediment delivery to nearby wetlands and waterways. In compliance with the Forest Plan standards and guidelines(S-TS-1, G-TS-4), unclassified roads converted to system roads would be brought to a standard that would minimize these impacts. The amount of road that would be added to the system through the implementation of each alternative is shown in Table 3.11-3.

	Alt. 1		Alt. 2		Alt. 3		Alt. 4	
	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres
Roads added to the system	0	0	1.0	2.4	1.0	2.4	1.0	2.4

¹Acreeage calculated using a 20 foot road width

Conclusion – Direct and Indirect Effects

The No Action Alternative would result in no impacts from vegetation management activities. This alternative would also result in future resource damage from continued use of unclassified roads which would not be brought up to standard.

The vegetation management activities proposed in the action alternatives would result in minimal impacts to the soil resource. The actions taken to convert unclassified roads to system roads would minimize impacts caused by current use. Some areas of nutrient sensitive soils will be converted to long-lived tree species. Converting these areas to long-lived species means management activity will occur less frequently and there will be less nutrient removal on these sites over time as a result.

3.11.6.2 Cumulative Effects

Past and present Forest Service management activities (other than proposed in the Glacier Project) would continue. No discernable impacts to long-term soil productivity have been identified as a result of past management activities within the Glacier Project Area. Management activities on non-federal lands would have minimal impacts to the soil through the implementation of BMPs. Minimal cumulative effects are anticipated through the use of Forest Plan standards and guidelines and the use of BMPs. Reasonably foreseeable future actions that would occur on land impacted by proposed management activities would have minimal impacts to the soil resource. This would result in no cumulative effects.