

Soils and Landforms

ABSTRACT

The soils and geology on the Bighorn Forest are complex and subject to degradation from ground-disturbing activities. Federal law requires the Forest Service to protect the long-term site productivity of NFS lands and ensure that irreversible damage will not occur. Region 2 has developed *soil quality standards* to ensure this protection. The Bighorn National Forest is committed to maintain long-term soil productivity, and will meet this responsibility by thoroughly evaluating potential impact of management activities on the soil and geologic resource. Mitigating measures will be implemented as needed, to keep the impact of management activities within the Regional Soil Protection Standards.

INTRODUCTION

Soils and geology are an integral component of ecological groupings. The influence vegetation, watershed condition, mineralogy, and land uses. Soils and geology have been used to determine the suitability of forestlands for timber sales and the effects that land management projects may have on watersheds.

Because of the wide range of geologic and soil features that occur on the Bighorn National Forest, only broad generalizations can be made in this section to provide a basic understanding of the Forest's geology and soils. A soil survey conducted by John Nesser (1982) of the landforms, soils, and geology of the Bighorn National Forest was used in this report to describe the basic landform features on the forest. Soils are divided into major groupings based on vegetation cover types, elevation, parent materials, or dominant physiographic breaks. Detailed soil maps are available on the forest and are used for project level analysis.

LEGAL AND ADMINISTRATIVE FRAMEWORK

- The Forest and Rangeland Renewable Resources Planning Act (1974) requires an assessment of the present and potential productivity of the land. Regulations are to specify guidelines for land management plans developed to achieve the goals of the program that "...insure that timber will be harvested from NFS land only where...soil, slope, or other watershed conditions will not be irreversibly damaged."
- The National Forest Management Act (1976) amended RPA by adding sections that stressed the maintenance of productivity and need to protect and improve the soil and water resources, and avoidance of permanent impairment of the productive capability of the land.

AFFECTED ENVIRONMENT

For the purposes of this document, the Bighorn National Forest has been divided into six physiographic units, which are areas that contain similar soils, relief and drainage (Nesser 1982). Each unit is a unique natural landscape. Typically, within each physiographic unit, there are one or more major soils and some minor soils or miscellaneous areas. Each physiographic unit is named for the major soils or miscellaneous areas that occur there. The descriptions for each unit can be used to compare the suitability of large areas for general land uses. Because of its scale, geographic units are not suitable for use as a site level analysis tool. The soils in any one unit may vary from place to place in respect so slope, depth, drainage, and other characteristics that can affect management.

Rubble Land - Rock Outcrop - Cirque Land

These are miscellaneous areas on moderately sloping to nearly vertical mountainsides near or above treeline.

- Geology** Most of this land unit is in the uplifted granitic core of the Bighorn Mountains. Elevations range from 9,000 feet to over 13,000 feet. Rubble lands consist of very angular cobbles, stones, and boulders on unglaciated slopes and summits above timberline. There is very little or no vegetation except for mosses and lichens. The rock outcrop is on glacial trough valley slopes and is generally smooth because of glacial scouring. The cirque lands consist of a glacial cirque headwall with associated talus and a cirque basin that commonly contains a small, round lake or tarn. Little or no vegetation grows in these areas except for a small amount of alpine vegetation on soils of minor extent.
- Soils** This unit makes up about 12 percent of the Forest. Of minor extent in this unit are Agneston, Mirror, and Teewinot soils. They are on the more protected mountainsides and in depressional areas.
- Interpretation** This unit is primarily used for recreation, wildlife habitat, and watershed health. It is important hydrologically as a collection and storage area for accumulated snow and trough valley and cirque basins provide a summer habitat for elk. Steepness and rockiness are the main limitations for most uses.

Frisco – Troutville - Fourmile

These are deep, well-drained soils that formed in glacial till and alluvium derived from granite on moraines and abandoned terraces.

- Geology** This unit is located in the central and southern parts of the survey area. It is in the glacial valleys adjacent to or partly within the uplifted granitic core of the Bighorn Mountains and extends from there down the valley. The Frisco and Troutville soils support lodgepole pine vegetation, and the Fourmile soils support big sagebrush and Idaho fescue vegetation. Elevations range from 6,500 to 9,000 feet, and average annual precipitation ranges from 15 to 30 inches.
- Soils** This unit makes up about 9 percent of the Forest. The Frisco soils are deep and well drained. They formed in glacial till in sloping areas on forested moraines. The surface layer is loam. The subsurface layers are cobbly and very cobbly sandy loam. The subsoil is very stony sandy clay loam. The substratum is extremely stony sandy loam. The Troutville soils are deep and well drained. They formed in glacial till in the steeper areas on moraines. The surface layer is very stony sandy loam. The subsoil is extremely stony sandy loam and lamellae of sandy clay loam. The Fourmile soils are deep and well drained. They formed in glacial till or alluvium on terraces and moraines. The surface layer is loam. The subsurface layer is gravelly loam. The subsoil is very cobbly sandy clay loam overlying an extremely cobbly loamy coarse sand substratum.

Interpretation The Frisco Troutville soils are used mainly for timber production. The main limitations are slope and the large volume of coarse fragments. The Fourmile soils are used mainly for livestock grazing. All the soils provide wildlife habitat for deer and elk.

Owen Creek – Tongue River - Gateway

This unit contains soils that are deep; well drained and formed in material derived from interbedded shale, sandstone, and limestone; on mountainsides and landslide deposits.

Geology This unit is in the northern half of the survey area. The Owen Creek soils support big sagebrush and Idaho fescue, the Tongue River soils are forested with lodgepole pine, and the Gateway soils are forested with Engelmann spruce. Elevations range from 5,600 to 9,500 feet and the average annual precipitation ranges from 15 to 35 inches.

Soils This unit makes up about 10 percent of the forest. The Owen Creek soils are moderately deep and well drained. They formed in colluviums derived from interbedded shale and sandstone on mountainsides and landslide deposits. The surface later is clay loam. The subsoil is clay. The Tongue River soils are moderately deep and well drained. They formed in residuum derived from soft interbedded sandstone and shale on mountainsides. The Gateway soils are moderately deep and well drained. They formed in residuum derived from interbedded shale and limestone on mountainsides.

Interpretation This unit is used for livestock grazing, timber production, wildlife habitat, and recreation. The main limitations are the hazards of landslides, erosion, and slope steepness.

Cloud Peak – Starley – Rock Outcrop

This unit contains soils that are moderately deep to shallow. They are well drained and were derived from limestone on mountainsides and ridges.

Geology This unit occurs throughout the survey areas, but it is most extensive in the northern part of the forest. The Cloud Peak soils support forests of Engelmann spruce, subalpine fir, and Douglas fir. The Starley soils support Idaho fescue and sedges. Elevation ranges from 4,600 to 10,500 feet. The average precipitation ranges from 12 to 38 inches.

Soils This unit makes up about 29 percent of the forest. The Cloud Peak soils are moderately deep and well drained. They formed in residuum or colluviums derived from limestone on mountainsides. The Starley soils are shallow and well drained. They formed in residuum and colluviums derived from limestone on mountainsides and ridges. Rock outcrop consists of limestone cliffs and escarpments.

Interpretation This unit is used for livestock grazing, timber production, recreation, and wildlife habitat. The main limitation is the large volume of coarse fragments.

Rock Outcrop – Mirror - Teewinot

This unit consists of rock outcrop and moderately deep to shallow, well-drained soils that formed in material derived from granite on mountainsides and ridges near timberline.

- Geology** This unit is adjacent to the uplifted granitic core of the Bighorn Mountains, in the central and southern parts of the forest. Both the Mirror and Teewinot soils support alpine vegetation consisting of sedges, aven, and Idaho fescue. Elevation is 9,200 to 11,000 feet, and the average annual precipitation ranges from 28 to 35 inches.
- Soils** This unit makes up about 6 percent of the forest. Rock outcrop commonly is the more strongly windswept area on convex mountain ridges and peaks. It is mostly granite, but schist, gneiss, and quartz-diorite are also present. The Mirror soils are moderately deep and well drained. They formed in colluviums or residuum derived from granite on mountainsides and in saddles between areas of Rock outcrops. The Teewinot soils are shallow and well drained. They formed in residuum derived from granite on mountainsides and ridges.
- Interpretation** This unit is used for livestock grazing, recreation, and wildlife habitat. The main limitations are areas of rock outcrop and slope steepness.

Agneston – Granile – Rock Outcrop

These soils are moderately deep to deep, well drained soils that formed in material derived from granite, and Rock outcrop on mountain sides.

- Geology** This map unit occurs throughout the forest but is most extensive in the central and southern portions. The dominant vegetation is lodgepole pine and grouse whortleberry. Elevations range from 6,500 to 9,500 feet, and the average annual precipitation ranges from 15 to 35 inches.
- Soils** This unit makes up about 34 percent of the forest. The Agneston soils are moderately deep and well drained. They formed in residuum derived from granite and are in gently sloping to steep areas on mountainsides. The Granite soils are deep and well drained. They formed in residuum derived from granite and are in gently sloping areas on mountainsides. Rock outcrops consist of rounded exposures of granite.
- Interpretation** This unit used for timber production, livestock grazing, wildlife habitat, and recreation. The main limitations are slope, areas of rock outcrop, and the large volume of coarse garments in the soils.