

CROW INDIAN TRIBE



Resources Report

S O I L S

SOILS

The Crow Reservation is dominated by gently sloping to very steep, shallow to very deep, well drained, sandy, loamy and clayey textured soils. These soils were formed in semi-consolidated sedimentary beds, baked sandstone and shale, colluvium and alluvium on sedimentary plains, hills, mountains, and valleys (Crow Tribe et al. 1997).

The Soils Appendix to the Statewide Draft Oil and Gas EIS lists the predominant soils associations in the region. The soil types in the area considered to contain the economical coal deposits for, (i.e., the southeastern part of the reservation including the Wolf Mountains area) was identified as: Wayden-Regent-Doney, Doney-Shaak-Wayden, and Bitton-Shambo-Doney.

Three of the above series correspond to those shown in a comprehensive soil survey published in 1979 (U.S.D.A. Soil Conservation Service et al. 1979). According to the soil survey publication's General Soil Map, in general, soil types in the above-described part of the Crow Reservation are classified as "soils on dissected shale hills." The three primary soil associations in that area are:

- Doney-Reeder-Wayden - This soil association occurs south of U.S. Highway 212 (US-212). These well-drained soils on sedimentary uplands are loams, silty clay loams, and clay loams. Soils are moderately deep and shallow (BIA 1983; Soil Conservation Service et al. 1979).
- Wayden-Regent-Shale outcrop association - This soil association occurs south of the forks of Rosebud Creek. These well-drained soils on sedimentary uplands have silty clay loam textures. Areas of barren shale outcrop make up about 15% of this association (BIA 1983; Soil Conservation Service et al. 1979).
- Ringling-Searing-Arnegard association - This soil association occurs north of the forks of Rosebud Creek. These well-drained soils and Shale outcrop on fans, foot slopes, and sedimentary uplands have a dark surface layer. Textures are loams and clay loams and in shallower areas are channery loams. Soils are shallow and moderately deep over shale (BIA 1983; Soil Conservation Service et al. 1979).

More detail is presented in the soil maps prepared from aerial photographs that are presented in the back of the 1979 Soil Survey publication (U.S.D.A. Soil Conservation Service et al. 1979).

Most of the soils in Big Horn County on dissected shale hills are used for range, but some are used for dry-farmed crops. The native vegetation is mainly mid and short grasses. The main concerns of management for these soil types are maintenance or improvement of rangeland vegetation, control of erosion, and to an extent, localized protection from flooding of dry-farmed crops.

The average number of frost-free days on lands with these soil types is listed as 90-125 days. The average annual precipitation over these soil types in the county as a whole is listed as 11 to 17 inches (U.S.D.A. Soil Conservation Service et al. 1979). However, another source presenting information more specific to the southeastern part of the reservation states that the Wolf Mountains are mostly in the 20 to 24 inch precipitation zone (BIA 1983).

The individual soil series that predominate in the southeastern part of the Crow Reservation, according to the 1979 Soils Survey publication, are described in more detail below (U.S.D.A. Soil Conservation Service et al. 1979).

- Doney soils are sloping and rolling to very steep. They are well-drained soils on dissected hills, ridges, and knolls in the sedimentary uplands. They formed in place in material weathered from mixed loam shale, siltstone, and sandstone. The surface layer typically is grayish-brown loam about 6 inches thick. It is underlain by light yellowish-brown and pale yellow loam that is about 30% shale fragments that can be easily crushed in the hand. Shale and sandstone are at a depth of about 24 inches. Permeability is moderate and available water capacity is low.
- Reeder soils are gently undulating to hilly. They are well-drained soils on hills and ridges. They formed in place in material weathered from mixed shale and sandstone. The surface layer typically is dark grayish-brown and brown loam about 4 inches thick. The subsoil is dark grayish-brown and brown loam and clay loam about 17 inches thick. It is underlain by pale-brown clay loam and loam. Sandy shale and sandstone are at a depth of about 30 inches.
- Wayden soils are strongly sloping to very steep and rolling to hilly. They are excessively drained soils on hills and ridges in dissected sedimentary uplands. They formed in material weathered from clay and shale. The surface layer typically is grayish-brown silty clay loam about 5 inches thick. The substratum is light brownish-gray silty clay loam that is about 35% weathered shale chips. Shale is at a depth of about 19 inches. Permeability is slow, and available water capacity is very low or low.
- Regent soils are gently undulating to hilly and steep. They are well-drained soils on hills and ridges in the sedimentary uplands. These soils formed in place in material weathered from clay shale. The surface layer typically is grayish-brown silty clay and pale-olive silty clay loam about 3 inches thick. The subsoil is grayish-brown and pale-olive silty clay loam about 13 inches thick. It is underlain by light-gray silty clay loam. Platy shale is at a depth of about 26 inches. Permeability is slow and the available water capacity is low or moderate.
- Ringling soils on sedimentary uplands, are rolling to very steep. They are well-drained soils in the sedimentary uplands. These soils formed in place in material weathered from hard, red, baked shale or porcelanite rock. The surface layer typically is reddish-brown channery loam. It is underlain by reddish-brown very channery loam. Shale is at a depth of about 13 inches. Permeability is rapid, and available water capacity is very low. Permeability is moderate and available water capacity is low.
- Searing soils on sedimentary uplands, are undulating to hilly and steep. They are well-drained soils on sedimentary uplands. These soils formed in place in material weathered from burned shale and porcelanite rock. The surface layer typically is dark reddish-gray loam about 6 inches thick. The subsoil is reddish-brown loam and clay loam about 18 inches thick. It is underlain by red channery loam. Shale and sandstone are at a depth of about 30 inches. Permeability is moderate and available water capacity is low or moderate.
- Arnegard soils on fans and foot slopes are gently sloping to steep and hilly. These are well-drained soils on fans and footslopes. These soils formed in alluvium derived

from mixed rocks in small stream valleys. The surface layer typically is very dark grayish-brown and very dark gray loam about 14 inches thick. The subsoil is dark gray clay loam about 17 inches thick. It is underlain by dark-brown clay loam and loam that extends to a depth of 61 inches or more. Permeability is moderate, and available water capacity is high.

- Shale outcrop is on deeply dissected parts of shale uplands. A single shale escarpment or headwall, or a combination of buttes, hills, and ridges (with 80% or more outcrops of soft shale) comprise these areas. Slopes range from 15 to 100%. Runoff is very rapid and erosion hazard is high. The runoff carries large amounts of sediment.

Available water capacity is the soil's ability to hold water. Soils with low available water capacity, especially soils on slopes, are subject to water erosion if not suitably protected by vegetation (BLM 1983). Permeability is a measure of vertical water movement when the soil is saturated.

Using a simpler soil classification system and applying it to the reservation forestland, it can be said that three soil orders potentially underlie most of the forests on the reservation: mollisols, and alfisols (Montana Fish Wildlife and Parks 2002):

- Mollisols are formed under open forests and woodlands, other under grass. They are fertile, dark soils rich in humus. Those found on foothills and mountains have the thickest and darkest surface horizons. All occur in areas with moderate to low precipitation and cool to cold temperatures.
- Alfisols, found primarily in forested intermountain valleys, mountains, and foothills, formed under coniferous or mixed forests with low to high precipitation and cool to cold climates. They are comparatively fertile soils and slightly to moderately acid with a clay-rich-B-horizon.

Water erosion hazards may be severe on slopes greater than 15%, depending on the characteristics of the surface soil material. Areas of steep slopes occur dominantly in the southeastern part of the Crow Reservation in the Wolf Mountains (BIA 1983). To reduce runoff and soil loss from these soils, a minimum amount of vegetative cover is needed. Accelerated erosion, usually occurs through overgrazing, off-road vehicle use, or cultivation (BLM 1984). On the other hand, wind erosion is slight on soil with rock fragments on the surface, as in some Ringling soils (BIA 1983).

Soils with a low permeability (i.e., poor drainage) are more likely to be affected by increasing sodicity when irrigated with water containing a relatively high level of sodium. The Soils Technical Document warns that fine textured, slow infiltration, poorly drained soils (including "silts, clays, silt loams, silty clay loams, clay loams, sandy clays") should not have high SAR/sodic water applied (ALL Consulting 2001). The Soils Survey describes most of the soil types in the southeastern part of the reservation as being well-drained, although they are made up of loams and silty clay loams (U.S.D.A. Soil Conservation Service et al. 1979). However, to prevent unacceptable impacts, site-specific studies should be performed prior to releasing the produced water from CBM onto the soil.