CHARACTERIZATION OF SOILS IN YELLOWSTONE NATIONAL PARK

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Objectives

The soil characterization study was initiated in 1980 to identify and describe the major soil areas of Yellowstone National Park. Recent investigations have provided detailed geologic (U.S.G.S., 1972; U.S.G.S., 1972) and vegetation data (Despain, 1980); however, specific soils data and soil interpretations for resource management have been lacking. This study provides for detailed analyses of the major soils with specific emphasis on geologic and vegetative relationships.

The objectives of this study are:

1. Describe and classify the soils in the major geological and vegetative regions, according to Soil Taxonomy (Soil Survey Staff, 1975);
2. Sample and analyze the dominant soils in major geological and vegetative regions;
3. Prepare soil interpretations and analysis report, including a soils legend for the Park; and
4. Development and application of a soils data base to be utilized in conjunction with the digitized geologic and vegetative maps for the Park.

Methods

Because there is little existing soil information for the Park, the geologic and vegetation data was used to identify the major soil areas. The recent geological map (U.S.G.S., 1972) and the detailed surficial geological mapping provide an excellent base to evaluate soil parent materials and geomorphology. This soils investigation was performed in accordance with National Cooperative Soil Survey Standards and each soil has been classified according to Soil Taxonomy (Soil Survey Staff, 1975).

Sample plots were located in representative habitat/geological areas. Plot locations were determined by evaluating the Geological Map of Yellowstone National Park, the Surficial Geological Map of Yellowstone National Park (U.S.G.S., 1972), the Vegetative Habitat Type Map for Yellowstone National

Park (Despain, 1980) and by field inspection of the desired area. The field inspection included describing soil morphological features and identifying the vegetative habitat. Aerial photographs were used to evaluate the extent of the soil area.

The soils were sampled and described for each sample plot according to U.S.D.A. Soil Conservation Service standard procedures (Soil Survey Staff, 1951). Each soil horizon was sampled, except where the horizon was too thin, or coarse fragments prevented adequate exposure of the horizon. The volume of coarse fragments was also estimated in the fields. Vegetative habitat type and soil parent material were also determined for each plot.

The soil samples were sent to the Michigan Technological University Soil Research Laboratory for complete chemical and physical analyses according to U.S.D.A.-Soil Conservation Service procedures (Soil Survey Staff, 1972). Data analysis includes summaries of the soils and their properties. All laboratory results are also stored in a soils data base for subsequent analyses.

Discussion

Sixty-seven pedons have been described and sampled to characterize the soils of the major geologic and vegetative regions of the Park. The sampled soils are representative of soils derived from rhyolite, andesite and hydrothermal alterations. Within the major parent materials, twenty-two vegetative types and seventeen surficial geology units are represented. Laboratory analyses have been completed for each sampled soil. Computerized data summaries and profile descriptions are available for each of these soils.

Analyses and interpretation of the data has been initiated but is not complete. Table 1 presents a cross tabulation of the soil taxa and vegetative units by parent material. The rhyolitic soils are characterized by coarse textured solums ranging in thickness from 0.5 to 1.0 meters. These soils are moderately acid and typically have an intermediate base saturations. The subalpine fir/grouse whortleberry-grouse whortleberry phase habitat type (2HH) is most common on these soils. In contrast, the andesitic soils have significantly higher amounts of clay sized particles and exchangeable bases. The andesitic soils are dark colored, having thick surface horizon. The solum thickness ranges from 0.3-1.2 meters. The forested sites on these soils are typically the Douglas-fir/snowberry (5NO), the Subalpine-fir/globe hickleberry-globe huckleberry phase (2EE) or the Subalpine fir/meadow rue (2FO) habitat types.

Data sets containing geological, vegetation and soil morphology information are also being assembled to facilitate the data interpretations. This data set will also be used in conjunction with the digitized map data base, which is being developed for the Park. Complete specifications for interfacing the soils data has not been finalized, since the system will not be available until spring, 1983. However, it is anticipated that an interactive system will be developed.

Table 1. Cross Tabulation of Soil Taxa and Habitat Units by Geological Unit.

Geological Unit	Common Soil Taxa (Sub Group)	Common Vegetative Units (Habitat Type)
Rholite Plateau Flows	Dystric Cryochrepts	2LL, 2L3, 3HO
	Typic Cryochrepts	
Rhyolitic Welded Ash Flows	Dystric Cryochrepts	2LL, 2GO
Rhyolitic Detritus	Typic Cryohemists	FD
	Typic Cryaquents	DW
	Aquic Cryorthents	KF
	Typic Cryochrepts	TFG
	Typic Cryorthents	2LL, 4PO
Andesitic Till and Colluvium	Mollic Cryoboralfs	5NO, 2FO
	Pachic Cryoborolls	TFG, FN
	Typic Cryoboralfs	2EE
	Typic Cryumbrepts	2EE
Andesitic Detritus	Terric Cryohemists	FD
	Typic Cryorthents	TFG
	Typic Cryoborolls	TFG
Hydrothermally Altered Soils	Typica Cryorthents	2LL

Literature Cited

Despain, D. G. 1980. Vegetative Habitat Types of Yellowstone National Park (Draft). National Park Service, U. S. Department of Interior, Yellowstone National Park. Map including legend.

Soil Survey Staff. 1951. Soil Survey Manual. U.S.D.A. Handbook No. 18, U. S. Government Printing Office, Washington, D.C.

_____. 1972. Soil Survey Laboratory Methods and Procedures for Collecting soil Samples. U.S.D.A. Soil Conservation Service. Soil Survey Investigations Report No. 1. Washington, D.C.

_____. 1975. Soil Taxonomy. U.S.D.A. Soil Conservation Service, Agriculture Handbook No. 436. Washington, D.C.

U.S. Geological Survey. 1972. Geologic Map of Yellowstone National Park. U.S. Geological Survey, U.S. Department of the Interior, Washington, D.C.

_____. 1972. Surficial Geologic Map of Yellowstone National Park, U.S. Geological Survey, U.S. Department of the Interior, Washington, D.C.