

CHARACTERIZATION OF SOILS IN YELLOWSTONE NATIONAL PARK

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Objectives

Yellowstone National Park is predominantly underlain by two volcanic rock types, the Tertiary andesitic rocks and the Quaternary rhyolitic rocks. Data concerning the nature and properties of the soils derived from these rocks is limited. This study provides a detailed soil characterization analysis of benchmark soils and associated interpretations for use by both research and operations personnel. Data from this study will also further the knowledge of soils in mountain environments.

Recent habitat mapping in the Park identified 38 habitat types. The habitat types were associated with the type of bedrock and soil conditions. However, an understanding of this relationship is precluded by the lack of basic soil information. Results of this study will be referenced to both the habitat and geological maps of the Park, thereby providing a comprehensive natural resource base for the Park.

The objectives of this study are:

1. Describe and classify the soils in each habitat type and geological region according to Soil Taxonomy (Soil Survey Staff, 1975).
2. Sample the model soils in each habitat type and geological region for detailed soil characterization analysis (Soil Survey Staff, 1972).
3. Prepare a comprehensive soil interpretations and analysis report.
4. Develop guidelines for a soils legend based on the field and laboratory investigations. The guidelines will provide the basis for a soils map legend of the Park.

Methods

The field design for this project entails the use of the Park habitat map, surficial and geological maps, and aerial photo interpretations. The field crew evaluates the homogeneity of the habitat-geological area and then makes several soil borings in the unit. A detailed

profile description and samples are obtained from a representative pedon. Subsequent satellite samples and descriptions are obtained from within either the same unit or a similar unit. The complete soil characterization sampling and analysis are performed according to U.S.D.A. Soil Conservation Service standard procedures (Soil Survey Staff, 1972). The soil analysis is performed at the Michigan Technological University Soil Survey Laboratory.

Data analysis includes summaries of the soils and their properties and classification according to Soil Taxonomy. Soil interpretations are prepared according to S.C.S. guidelines. All laboratory results are stored in an ancillary system to the National Pedon Data Subsystem, which is used for data retrieval and analysis.

Results and Discussion

Because only the field work has been completed and the laboratory analysis is in process, this discussion will be limited to an evaluation of the field investigations. During the initial field season, August to September, 1980, the major rhyolitic soils were investigated. Several andesitic and limestone soils were also sampled. A total of 38 pedons were sampled representing 17 habitat types. Vegetation types corresponded well to the soil conditions and geological units.

The rhyolitic till soils are tentatively classified as Typic Xerochrepts. They are characterized as mildly acid, medium textured, light colored and shallow. The solum-thickness ranges from 40-120 cm. The texture of these soils averages a loamy sand to sandy loam, with the fines dominated by fine sand and silt. Particle size determination analysis will be required for exact textures and to evaluate the possibility of an argillic horizon in several of the pedons. Inherent soil fertility is believed to be low; however, conclusions must await laboratory analysis. This soil type is dominated by the subalpine fir/grouse whortleberry habitat types with seral stages of lodgepole pine.

Classification of the soils based on field descriptions has proved difficult. Diagnostic properties critical to proper classification must be determined in the laboratory. Several diagnostic criteria necessary are particle size, base saturation, temperature soil moisture regimes, carbon content, and cation exchange capacity. Once these properties are determined for the benchmark soils, field classification of other similar soils will be accurate.

The field investigations have proven the close relationship between soils and habitat-geologic units. The soils tend to be relatively uniform within a particular landform. Factors such as drainage and topography will introduce some variation in the specific soil properties. However, it is felt that a comprehensive soil legend can be obtained through this investigation. Evaluation of the surficial geology and bedrock geology maps provides an accurate assessment of the soil parent material.

Summary

A detailed soil characterization study of the major soils in Yellowstone National Park has been initiated. The study provides a comprehensive data base for the soils and associated interpretations. The soil interpretations detail the data with respect to recreation management, wildlife management, and ecological relationships, and also provide basic soils data for use in other research projects.

Preliminary field investigations have shown that the use of the Park habitat map and geologic maps provides a suitable method for identifying the benchmark soils of the Park. However, proper soil classification is dependent on laboratory analysis of particle size, base saturation, cation exchange capacity and carbon content. A preliminary soils legend of the Park will be developed on the basis of results of this study. Final analysis of the soils data and interpretations will be available in the spring of 1981.

Literature Cited

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