Proceedings of the Iowa Academy of Science

Volume 76 | Annual Issue Article 21

1969

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Abstract. The soil surveys in Iowa are being made by the Soil Conservation Service in cooperation with Iowa Agricultural and Home Economics Experiment Station, Iowa Agricultural Extension Service, and State Soil Conservation Committee. Soil Survey field work is now completed in 26 counties, and is in progress in 18 additional counties.

In soil survey operations, soils are first classified into the National Soil Classification System. Soils are then identified in the field and delineated on 4"-to-the-mile aerial photographs. After field work is completed, a soil survey report, including maps, is published.

Soil survey reports include interpretations which organize and present knowledge about characteristics, qualities and behavior of each kind of soil as it occurs in the county. Such information will be helpful to planners concerned with proper management of soils for agricultural crops, woodland pasture, engineering measures, recreation and wildlife.

To the person who is primarily concerned with the use and management of soils for agriculture, soil may be defined as the natural medium for plant growth. An almost entirely different meaning of the word "soil" has been used by other people who are concerned with the use and management of soils for non-agriculture purposes. To these people soil has been defined as a layer of regolith or unconsolidated material which mantles the earth's surface.

Soil as used in this text is the collection of natural bodies on the earth's surface, containing living matter and supporting or capable of supporting plants. Soil as defined here includes all horizons which differ from the underlying rock material as a result of interactions between climate, living organisms, parent materials, and relief.

Only within the last century has it been recognized that a soil is a collection of natural bodies paralleling those of flora, fauna, and rock formations. Before this fact was recognized, construction of a system of soil classification applicable to wide areas was not possible.

The smallest volume that can be called a soil is three dimensional and one to ten square meters in lateral extent. It might be considered comparable to the unit cell of a crystal.

How A Soil Survey is Prepared

The earliest attempt to classify soils systematically seems to have occurred in China some 40 centuries ago (2357-2261 B.C.). The soils of the Kingdom at that time were reportedly graded into

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nine classes, apparently on the basis of their known productivity. The best grade was the yellow, soft soils of Yung Chow, whereas the next best was the red, rich clayey soils of the Su Chow.

During the late 1800's, practical objectives also prompted the first efforts to classify and map soils in the United States. As had been the case earlier in China, the first soil surveys in this country were made for the purpose of increasing production of certain crops such as tobacco.

Additional interest and demand for soil information at the turn of the twentieth century resulted in the gathering of more precise and quantitative information regarding the soils throughout the United States.

Soil survey work within the Department of Agriculture was first organized in the Division of Soils. In 1901 this work was reorganized under the Bureau of Soils.

By U. S. Secretary of Agriculture's Memorandum 1020, dated June 23, 1942, soils inspection and correlation work was transferred to the Agricultural Research Administration Bureau of Plant Industry, Soils and Agriculture Engineering. On October 14, 1952, Secretary of Agriculture issued Memorandum 1318, placing responsibility for all soil survey activities of the Department of Agriculture in the Soil Conservation Service. The soil survey work and staff of the Agricultural Research Administration and the conservation surveys of the Soil Conservation Service were thus consolidated, effective November 15, 1952, within the Soil Conservation Service. This work included mapping, classification, correlation, interpretation, direct laboratory services, map compilation, and publications.

Following the issuance of the Secretary's Memorandum 1318, a memorandum of understanding between the Iowa Agricultural Experiment Station and the Soil Conservation Service was developed. This memorandum spelled out the cooperative endeavors of the Iowa Agricultural Experiment Station and the Soil Conservation Service in planning, scheduling, and preparation of soil surveys in counties throughout Iowa. This memorandum remained in effect until 1967 when a new memorandum of understanding was developed. During 1967, a memorandum of understanding relative to the making and using of soil surveys in Iowa was developed between the Iowa Agricultural and Home Economics Experiment Station, Cooperative Extension Service; the State Soil Conservation Committee of Iowa, and the Soil Conservation Service of the United States Department of Agriculture.

The general purpose of this Memorandum is to: 1) continue the cooperative effort of coordinating the collection, compilation, interpretation, publication, dissemination, and use of soil surveys in Iowa, 2) insure that all phases of the soil survey program are given adequate attention, and 3) achieve maximum utilization of

resources of the four parties working toward a common goal.

Soil Surveys Prepared during the Early Part of This Century

During the early years of soil survey work, field men covered large areas of land during each season. The first soil survey of Tama County, published in 1904, required about 100 man-days to complete and cost in the neighborhood of $1,000. Field men covered about 3,000 to 4,000 acres per day.

The early soil maps show simple, generalized soil patterns in large individual areas. For example, the soil survey of Tama County shows only five kinds of soils throughout the entire county. These patterns reflect what was known about the classification of soils and their management requirements during the first decade of the American soil survey. Early instructions to field parties state that areas of distinct soils should be separated on the field sheets whenever they were ¼ mile or more in diameter. As time passed, the size of the smallest area to be shown on the map was gradually reduced from 40 to 10 acres, 10 acres being the smallest that could conveniently be shown on a published map with a scale of 1 inch equals 1 mile (1:63,360). From a study of the maps and texts of the earlier soil surveys, it is clear that soil scientists were thinking in terms of broad areas with respect to soils and land use.

Present Soil Surveys

The examination of the land is far more detailed and thorough at present than it was in the soil surveys of the first decade.

In the soil survey of Tama County, Iowa, in 1904, field men covered five square miles (3,200 acres) a day. Field work in the same county 30 years later was at an average of one square mile (640 acres) per man-day. At present, a field soil scientist can cover 300-600 acres a day, depending on the complexity of the soil pattern and the relationships between soils in the area.

The acres mapped in a day would be even less were it not for aerial photographs now available for use as base maps. With the use of 4″-to-the-mile scale aerial photography, soil boundaries can be placed more accurately with reference to local features, such as streams, houses, and roads.

With the kinds of information now required concerning soils in Iowa, our present soil survey program consists of the following major activities:

1. Determining the physical and chemical characteristics of each kind of soil.

2. Classifying each kind of soil in the nation-wide system of the Soil Classification.

3. Delineating each kind of soil on 4″-to-the-mile aerial photographs.

4. Interpreting each kind of soil according to its kind and degree of limitations under alternative systems of management.

5. Publishing soil survey reports of each county which include soil survey maps, descriptions of soils, and basic soil interpretations.

Following is a brief discussion of each of the above activities:

Determining Physical and Chemical Characteristics of Each Kind of Soil. During the process of making a soil survey of a county, soil scientists first determine the characteristics of soils in the survey area. They determine, through field examination, such characteristics as color, texture, structure, consistance, natural drainage, degree of acidity or alkalinity, and thickness of horizons of each taxonomic unit. They record other information regarding each kind of soil such as slope, stoniness, and evidence of flood hazard. In addition to their field observations, soil scientists supplement field data with laboratory information involving such characteristics as permeability, organic matter content, nutrient status, kinds and amounts of clay, etc.

Classifying Each Kind of Soil in the Nation-wide System of the Soil Classification System. There are six categories in the present soil classification system. They are: Order, Sub-order, Great Groups, Sub-groups, Families, and Series. In Iowa there are approximately 275 recognized soil series which are grouped into five orders.

Preparation of Soil Survey Maps in the Field Delineating Each Kind of Soil. After soils of a certain county are characterized and classified, soil survey mapping is undertaken. Soil survey maps are prepared in the field by soil scientists who identify and delineate areas of each kind of soil on 4″-to-the-mile aerial photographs.

Interpreting Each Kind of Soil According to Kind and Degree of Limitations Under Alternative Systems of Management. After soil survey maps of a certain area are prepared, each kind of soil is interpreted as to its kind and degree of limitation for various uses. Information about how soils respond to different kinds of management and treatment is gathered from many sources. Farmers' experience and field trials provide much information regarding agricultural uses of soils. More precise information is gained by Experiment Stations and other laboratory and field experiments where tests are made under controlled conditions.

Thus, the information provided by the soil survey forms the foundation for a series of decisions that a landowner can make. The farmer can make decisions regarding the specific crops to be grown under alternative combinations of practices which are needed.

Land appraisers and tax assessors have found soil surveys useful in establishing true and common standards of land values. County and community planning officials are finding soil surveys helpful in planning areas for residential, industrial, and recreational developments. Foresters and woodland conservationists are learning a great deal about the relationships between different kinds of soils and their management requirements for woodland production. Engineers use soil survey information as a guide in selecting sites for engineering structures and in determining the measures that are needed in their construction. Wildlife conservationists can use soil survey information and interpretations in developing wildlife management plans.

In summary, soil surveys are not only helpful in the planning and management of areas for agriculture and woodland production but are also useful in directing non-agricultural expansion into those areas which are less suited to agricultural use.

Publication of Soil Survey Reports. After soils of a county have been characterized, classified, and mapped, the soil survey report, including soil survey maps, is published.

To date, published soil survey reports are available in 14 counties of Iowa. It is expected that soil survey reports will be completed and published at the rate of three to four per year in the future.

Soil survey reports are now available for Monona, Shelby, Adams, Taylor, Polk, Lucas, Jefferson, Van Buren, Iowa, Tama, Allamakee, Bremer, Humboldt, and Winneshiek counties.

Soil survey field work has been completed and published reports will be made available during the next few years for Woodbury, Crawford, Clay, Webster, Appanoose, Fremont, Howard, Keokuk, Cass, Madison, Guthrie, and Wayne counties.

Soil survey field work is now under way in Lyon, Worth, Mitchell, Plymouth, Buena Vista, Sac, Palo Alto, Grundy, Black Hawk, Harrison, Warren, Jasper, Fayette, Linn, Union, Page, Lee, and Mahaska counties.

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