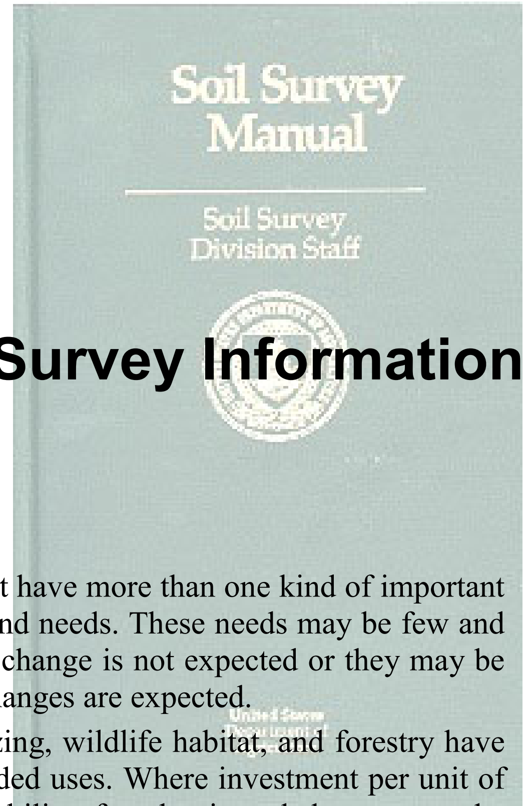
CHAPTER

7 Disseminating Soil Survey Information



Uses of Soil Surveys

Soil surveys most commonly are made for areas that have more than one kind of important land use and for users who have varied interests and needs. These needs may be few and noncomplex in areas of extensive land use where change is not expected or they may be many and complex in areas of intensive land use where changes are expected.

Predictions for uses of soils other than farming, grazing, wildlife habitat, and forestry have tended to concentrate on limitations of soils for the intended uses. Where investment per unit of area is high, modifying the soil to improve its suitability for the intended use may be economically feasible. Soil scientists work with engineers and others to develop ways of improving soils for specific uses. Such predictions are increasingly important in areas where the demand on soil resources is high.

The information assembled in a soil survey may be used to predict or estimate the potentials and limitations of soils for many specific uses. The information must be interpreted in forms that can be used by professional planners and others. A soil survey represents only part of the information that is used to make workable plans, but it is an important part.

The predictions of soil surveys serve as a basis for judgment about land use and management for both small tracts and regions of several million acres. The predictions must be evaluated along with economic, social, and environmental considerations before recommendations for land use and management become valid.

Soil surveys are used to appraise potentials and limitations of soils in local areas having a common administrative structure. Planning at this level is sometimes called *community planning*. It applies to community units—villages, towns, townships, counties, parishes, and to trade areas that include more than one local political unit.

Soil surveys also may be used to evaluate soil resources in multicounty or multi-State areas that have problems that cannot be resolved by local political units. *Regional planning* deals with land use in broad perspective and appraises large areas. Regional planning is done in less detail than community planning. Soil surveys and their interpretations for regional planning are correspondingly less detailed and less specific. Soil maps and their interpretations for regional planning must provide graphic presentations of the predominant kinds of soil of similarly large areas.

Soil surveys provide basic information about soil resources needed for planning development of new lands or conversion of land to new uses. Failures of trial-and-error land settlements influenced the start of the soil survey in the United States. The use of soil surveys avoids the waste caused by ignorance of soil limitations when major changes of land use are contemplated or when new lands are to be brought into use.

Soil survey information is important in planning specific land use and the practices needed to obtain desired results. For example, if recreational use is being considered, a soil survey can indicate the limitations and potential of the soil for recreation. The soil survey can help a landscape architect properly design the area. A contractor can use the soil survey in planning, grading, and implementing an erosion control program during construction. A horticulturist can use it in selecting suitable vegetation.

Soil surveys provide a basis for decisions about the kind and intensity of land management needed, including those operations that must be combined for satisfactory soil performance. For instance, soil survey information is useful in planning, designing, and implementing an irrigation system for a farm. The kind of soil and its associated characteristics help in determining the length of run, water application rate, soil amendment needs, leaching requirements, general drainage requirements, and field practices for maintaining optimum soil conditions for plant growth.

Soil surveys are also useful in helping to locate possible sources of sand, gravel, or topsoil. They are an important component of technology transfer from agricultural research fields and plots to other areas with similar soils. Knowledge about the use and management of soils has been spread by applying experience from one location to other areas with the same or similar soils and related conditions.

The hazards of nutritional deficiencies for plants, and even for animals, can be predicted from soil maps if the relationships of deficiencies to soils have been established. In recent years, important relationships have been worked out between many soils and their deficiencies of such elements as copper, boron, manganese, molybdenum, iron, cobalt, chromium, selenium, and zinc. The relationships between soils and deficiencies of phosphorus, potassium, nitrogen, magnesium, and sulfur are widely known. Relationships of soils to some toxic chemical elements have also been established. By no means have all of the important soils been characterized, especially for the trace elements. More research is needed.

Land appraisal.—Soil is one of the many attributes of land that contribute to its value. The relative importance of soil varies widely among the many uses of land. Where the soil is a factor of production, as in farming, ranching, or forestry, its capacity to produce and its requirements for production are elements of land value.

Soil surveys provide information in terms of soil qualities that bear directly on land value for many different purposes. These interpretations are used most often, however, in assessing farmland for taxation and equalization, in appraising land for loans, and in guiding land buyers.

The soil is only one of the elements that must be considered for appraisal of land value within the local, economic, and institutional environment of an area. Many of the other elements that determine value of real estate can change with time. The recorded kinds of soil in a soil survey, however, remains valid over time and can easily be reinterpreted as economic or institutional conditions change.

Other uses.—In addition to the above mentioned widely recognized uses, soil surveys serve other purposes.

Soil surveys commonly provide essential data and information for the compilation of general soil maps. Many soil surveys are done for purposes that require relatively intense field investigation and map scales of about 1:12,000 to 1:24,000. A smaller scale soil map, however, with more broadly defined units may be better for developing land-use plans for large areas. This map can be made by grouping units of the large-scale soil maps and generalizing the map detail. The resulting map units are more useful for the intended use. The selected scale of the general soil map is usually the same as that of the land-use planning map.

Soil surveys also provide information for compiling soil maps for areas that are largely unsurveyed. These maps are made by predicting the kinds of soil in an area from existing information, largely or entirely without the benefit of preexisting soil survey maps or field investigations. Scattered soil surveys in these areas provide some soil information that can be projected to unsurveyed areas by photo interpretation or by predicting the occurrence of kinds of soil from related climatic, topographic, geologic, or vegetative features.

Soil surveys have served as a basis for educational programs to inform people of the important place soil resources have in maintaining a quality environment.

Small-scale soil maps provide a basis for comparison of broadly defined capabilities and limitations that relate to the soil on regional, national, and even worldwide scales. International cooperation among soil scientists has accomplished much in relating the different soil classification systems of various countries to one another using small scale maps. This permits extending the findings of research on soils of one country to similar kinds of soil elsewhere. *Soil Taxonomy* (1975) *and the Soil Survey Manual* (1951) have guided soil scientists worldwide for many years. Many have contributed ideas and data to form the basis of the soil survey system. As a result, the uses of soil survey data have been extended far beyond the boundaries of the countries where data were originally obtained.

The results of soil surveys are published to provide the public with the soil information it needs to make sound decisions about land use and management and to provide a permanent record of what has been learned about soils. The soil survey is the key element in planning both agricultural and nonagricultural uses. Much of the information is spread by soil scientists, conservationists, and other agricultural workers in day-to-day contracts. This chapter discusses other methods used to disseminate soil survey information.

Making Information Available

In the United States the information assembled in a soil survey is public property. Computer data banks of basic soil survey data are also public property and are available to workers in soil research and land use management.

Technical information about soils for both nontechnical and technical users appears in special reports and professional publications and in bulletins and circulars issued by agricultural experiment stations or other government agencies. Popular media also release timely information.

The first obligation of a soil survey party is to complete the fieldwork and assemble the information for the final publication of a survey. The soil survey work plan, however, should provide reasonable extra time to allow the survey party to satisfy any obligations it may have to collect specific information for particular groups or individuals.

The *National Soil Handbook*, particularly the section on the descriptive legend, is the primary reference material used while a survey is in progress. The descriptive legend identifies the symbols that appear on the soil maps and describes the map units they represent. The legend provides the means by which the survey leader maintains accuracy and uniformity in mapping and is a primary source of information for public use before the survey is published. The completed field sheets and the descriptive legend together provide a ready reference about the kinds of soil and their basic properties where mapping has been done. As the survey progresses, various kinds of interpretations are made for the soils of the area. The interpretations, along with the descriptive legend, gradually become a preliminary draft of the published soil survey. While the survey is in progress, technicians apply soil survey information from the Handbook and make the information available to the general public. The staffs of all of the cooperating agencies should have access to the descriptive legend and other references.

The survey party commonly receives requests to prepare interpretative maps and text for special purposes while a survey is in progress. For example, a town planning board may ask that its township be completed and a special interpretative report be made for the board's use. Such a report is time consuming and costly; therefore, appropriate allowances of time and arrangements for financing this service should be listed in the soil survey work plan.

Even though the published soil survey is the principal medium for disseminating soils information, it cannot include detailed interpretations for all of the various uses of soils. Special interpretations often are needed after a soil survey has been published. The published soil survey becomes the repository for the basic data on which the various agencies depend.

The data collected for a soil survey are published in a variety of forms under the authorship of an individual or a group. The information is of special interest to the scientific community and appears in general articles, bulletins, and releases. The data collected for soil surveys and special investigations are readily available to all scientists.

A soil survey commonly draws on the data and experience of experts in other disciplines, including direct collaboration of scientists in other fields. Any release of information should acknowledge the source of supporting data and assistance and cite published material from which interpretations have been drawn. The contributions of individuals who have collaborated must be acknowledged.

Soil Survey Publications

Soil survey reports are the primary means for disseminating the information gathered by the National Cooperative Soil Survey in the United States. These publications commonly cover a county or a particular part of a State. They may cover two or more counties or only part of one or more. The area covered by a survey is determined by many factors, including complexity of soils, topography, and the needs of users.

Besides the formal soil survey report, special summaries of soils information for the survey area may be required. Information may be needed before the formal report is finished, or new information may be needed after the report has been released. Special reports are often useful to present information on specific topics.

Many people and agencies contribute to the making and publishing of soil survey reports. Local, State, and Federal cooperators may provide funds and personnel for the survey. The central responsibility for coordinating the individual soil surveys, as well as the national soil survey program in the United States, rests with the Soil Conservation Service.

Soil survey publications are distributed widely, although most of the copies of a survey are distributed in the area covered by that survey. Publications are distributed by the cooperating agencies and the local conservation district. Publications are also available from Members of Congress. The Extension Service conducts educational programs about the use of soil surveys.

Published soil surveys are available in libraries of most universities and colleges in the United States and in libraries of many towns and cities. In addition, they are distributed to agricultural colleges, ministries of agriculture, and libraries in many other countries.

Followup.—Feedback from soil survey users in both the private and the public sectors helps to evaluate soil survey information and to decide whether additional kinds of information are needed and whether the content and format of soil survey publications should be changed. Feedback from users may reveal new ways to disseminate soil survey information and suggest adjustments in the objectives and design of soil surveys.

The Texas staff of the Soil Conservation Service sends out a questionnaire for each soil survey report about a year after it has been published and distributed. The questionnaire, sent to a cross section of potential users, is designed to determine who uses the soil survey information and how it is being used. It also is designed to obtain suggestions from users on how to make the information more helpful. It asks about the kinds and amount of media coverage, meetings, and other activities used to promote the new publication.

Soil Survey Reports

The soil survey report provides a permanent record of what was learned about the soils of a survey area. In addition to a map showing the distribution of the different kinds of soils in the area, the publication describes the soils and summarizes research that has been done on the effects of soil on plants and engineering practices.

The text provides descriptions, laboratory data, and other information about the properties of the soils. From these basic data, interpretations are made about potentials, suitabilities, and limitations of the soils for crops, pasture, forest, wildlife habitat, recreation, engineering, and any other uses known to be important at the time of the survey. The interpretations and predictions are based on an up-to-date understanding of soils. Discussions of land use and management are written to bring out specific relationships to individual soils or groups of soils shown on the map.

The properties, responses to management, and suitabilities and limitations of each kind of soil are given to enable the public to make full use of the soil map, whether for producing crops or for locating building sites or sources of construction material. Predictions are made of the behavior of each kind of soil under specified uses and management systems. Predicted yields under defined systems of management and use are also provided. The use of a soil classification system permits eventual development of many useful interpretations beyond those required for the immediate objectives of the survey.

A published soil survey contains instructions for its use, information about how the survey was made, an account of the general nature of the area, a description of the general soil map, a classification of the soils, a discussion of soil formation, references, and a glossary.

The form and content of the publication depends on the nature of the area surveyed, local conditions and needs, and the kinds of uses anticipated. The contents are arranged so that the user can find information as conveniently and rapidly as possible. Data and interpretations are assembled in tables to bring out relationships and contrasts among soils.

Interim and Supplemental Reports

Occasionally, soil survey information is requested before a survey can be published. In such cases, an *interim report* may be issued. An interim report is not needed if only a few people request the soil survey information.

An interim report may cover townships, metropolitan areas, shoreline areas, strips along highways, or large parts of a survey area. A limited number of copies of the report are printed. The groups and agencies that require the report commonly contribute toward the cost of preparing it and participate in its distribution. The report generally contains reproductions of soil survey field sheets, descriptions of the map units, and interpretations for the important uses. Those who use the information in an interim report must be cautioned that the information is tentative and may be revised.

Updating or expanding interpretations, making additional interpretations, or mapping parts of the survey area in greater detail may be desired after a survey has been published. Revised information is commonly needed where land use is changing significantly, such as areas of rapidly expanding population. The new information can be disseminated in *supplemental reports*. If a part of the survey area is mapped in greater detail, reproductions of the new field sheets and descriptions and interpretations of the new map units are included.

The Soil Survey of Durham County, North Carolina, was published in 1976 (USDA, SCS, 1976). Within a few years, it became apparent that those working with the design, installation, and maintenance of sewage disposal systems needed more information on rating soils for absorption of sewage effluent. The supplement, issued in 1981, contains graphic models that compare soil criteria for conventional systems with those for two other systems. It also contains profile sketches of soils that depict the major features that adversely affect the use of the soils for absorption of sewage effluent.

Another example of expanding existing interpretations is the supplement to the published Soil Survey of Comanche County, Oklahoma (USDA, SCS, 1982). Although the original soil survey interpreted the soils for agricultural and nonagricultural uses, more detailed information was needed. The supplement provides soil potential ratings that reflect not only the performance or productivity of the soils and the limitations of the soils for selected uses but also takes into account the corrective measures needed to overcome the limitations and the cost of the corrective measures.

The supplement to the published Soil Survey of the San Diego Area, California (Bowman, 1973), shows some innovative ways of presenting updated and more detailed soil interpretations for a survey area that has experienced a tremendous population increase and extensive urban growth (San Diego County, CA Planning Dept., 1975). The supplement includes text and tables of soil interpretations that can be applied to farming, ranching, land management, construction, and to urban and recreational uses.

Special Reports

Special interpretative reports can be prepared on the suitability and limitations of the soils for a single use. Other special reports integrate soils data from sources other than SCS survey teams.

The "Red Tart Cherry Site Inventory" for Leelanau County, Michigan, is an example of a report interpreting the soils for a specific use (USDA, SCS, 1973). Soils were evaluated on a "fruit site rating sheet" based on soil, physiographic, and climatic factors for growing red tart cherries. The soils information came from the Soil Survey of Leelanau County. Boundaries of the red tart cherry sites are outlined on a set of inventory map sheets. The sites are color-coded to indicate the difficulty of overcoming the limitations to production.

"Soil Potential Ratings for Septic Tank Absorption Fields, Northeastern Illinois" provides home buyers, planners, installers of septic systems, and sanitary engineers a guide that indicates the relative potential of every soil as septic tank absorption fields in the area of the six counties (USDA, SCS, nd). It aids in site selection, community planning, and subdivision design where septic tank absorption fields are considered.

The special report "Alaska Agricultural Potential" is based on a cooperative study by more than a dozen State and Federal agencies (ARDC, 1977). It was developed as a basic reference in response to rapidly accelerating interest in and need for information on Alaska's land and natural resources. It has text, tables, and interpretative maps.

"America's Soil and Water: Condition and Trends" is an example of a special report that used text, charts, graphs, and national interpretative maps to present a brief account of our basic resources (USDA, SCS, 1980).

A special report for Pennsylvania, "Chester County Natural Environment and Planning," analyzes the natural environment in terms of landforms, soils, geology, woodland, and climate (PA Planning Comm., 1963). The section on soils includes text, a general soil map, and a series of colored interpretative maps.

The pocket-size book "Soil Resource Inventory, San Mateo Mountains, Magdalena Ranger District, Cibola National Forest" interprets the soils for multiple-use planning and management (USDA, FS, 1975). It includes a landscape photograph and a description of each map unit, tables that interpret the map units for a number of uses, and a soil map at the scale of 1 inch to the mile.

"Soil Resource Inventory for the Umatilla National Forest" provides land managers with the necessary soil interpretations for extensive management and resource planning (USDA, FS, n.d.). This report gives the description of and the interpretations for any map unit adjacent to any map sheet.

"Natural Soil Groups of Maryland" is part of the technical series of the Maryland Department of State Planning, which deals with the development of a generalized land-use plan for the State (MD Dept. State Plan, 1973). This publication is designed as an interpretative guide to the detailed soil survey maps. Map units, listed by counties, are assigned to natural soil groups (groups of soils that have similar major properties and features). A large table shows color-coded ratings of natural soil groups for selected uses. Natural soil group maps, which are not included with this publication, are generalized from the detailed soil maps. A separate map is made for each county.

General Soil Maps

General soil maps provide an overview of the location and extent of the dominant soils in a large area. General soil maps are useful in showing the soils in community areas, counties, States, and other large areas. They are most useful in general planning and in locating areas that have the soil properties needed for a specific land use, such as a site for an industrial plant. The general soil map can help in narrowing the field of search, but it is not precise enough to fix an exact location for the plant.

General soil maps commonly are derived from detailed soil maps by combining their delineations from units that are more extensive but less homogeneous (generalized soil maps). Where detailed information about soils is lacking, general soil maps can be compiled from knowledge about features related to soils—geology, climate, vegetation, topography—and principles of soil genesis.

The amount of information that can be given about the units on a general soil map—and, therefore, the interpretations that are feasible—depends on the degree of generalization of the map units. The degree of generalization is determined by the scale of the map. A general soil map at a scale of 1:100,000 can show associations of soil series, so the features of those series can be used in developing interpretations. By contrast, a general soil map at a scale of 1:1,000,000 can show only associations of subgroups, and only phase criteria that are characteristics of subgroups can be conveyed to the user. From the latter map, the feasible interpretations are much fewer and less specific than those developed from a large scale map. For a discussion of schematic soil maps, see chapter 2.

The text that accompanies the general soil map includes identification of the components of map units and a description of their physical setting. The most useful texts also include percentages of the components, characterizations of the soils, and interpretations that give the limitations and suitabilities of the soils for various agricultural and nonagricultural uses.

Generalized Soil Maps of Survey Areas

Generalized soil maps published as part of detailed soil surveys in the United States usually have a mapping scale between 1:63,360 and 1:316,800 with even inch and mile increments, such as 1 inch equals 3 miles or 1:190,080. The scale is determined by the expected requirements of the user, by the size of the survey area, and by restrictions imposed by compilation and printing. The map units commonly are associations of soil series.

Legends vary considerably among maps of survey areas; they may give the underlying material, landforms, soil texture, depth to bedrock, and drainage. Detailed descriptions of the map units, soil profile descriptions, and evaluations of limitations and suitabilities for agricultural and nonagricultural uses are given in the accompanying report.

Generalized soil maps are used to make planning policy decisions for large areas—for community planning, for identifying management problems common to extensive areas, and for general educational purposes where a broad overview of the soil is needed. These maps are not suitable for farm and ranch planning or for site evaluation.

General Soil Maps of States

State maps are similar in many parts to the generalized soil maps in published soil surveys; other parts may be similar to schematic soil maps. Many State general soil maps have been published at scales of 1:1,000,000 to 1:1,500,000; they range from 1:300,000 to 1:3,000,000. Map units generally are associations of soil series, although associations of higher taxa have been used on some maps.

The legends are similar to those of the generalized soil maps of survey areas. Explanatory text for most State maps is brief. For some the text is limited to what can be printed in the margin of the map or on the back of the map sheet. On the other hand, some maps are accompanied by a booklet that includes both basic information and interpretations. "Soils of Tennessee" contains descriptive text interpretations for the State general soil map, which is folded in a pocket at the back of the pamphlet (Springer and Elder, 1980).

These general soil maps provide an overview of the distribution of the more extensive soils of the State. They are useful in planning broad land use for multiple-county and statewide areas and aid in the identification of broad areas that have features suitable or unsuitable for a variety of purposes. They are also useful in the transfer of technology between areas of similar soil environments. They can be used to identify areas for which more detailed information should be collected, and they aid the study of soils and their environment.

Regional and National Soil Maps

Maps of the soil pattern of large areas in terms of a relatively few kinds of soils are compiled by generalizing more detailed soil maps and information about them; they are also compiled in part on the basis of inferred properties determined by interpreting information about geology, climate, vegetation, and topography. The scale is commonly smaller than 1:1,000,000.

Units on regional and national maps are usually associations of great groups or suborders. Accompanying descriptive material is usually brief, as in the *National Atlas of the United States of America* (DOI, USGS, 1970). Some regional maps have accompanying booklets.

General soil maps at the small scales of regional and national soil maps are used for studying very broadly defined capabilities and limitations that affect regional and national issues. They are useful in relating areas of similar soils for transferring technology and exchanging research results. Interpretations for broad land uses and estimates of limitations and suitabilities can be made to the degree permitted by the scale of the map and the heterogeneity of the map units.

The map "Soils of the Southern States and Puerto Rico" is based on soil surveys and research by State and Federal agencies (Buol, 1973). The map is organized at two levels of generalization—soil orders and associations of great groups. The text discusses each soil order of the region, including its geography, landscape, relief, vegetation, land-use considerations, and soil mineralogy, as well as the distinguishing features of the major soils in the order. This publication facilitates the interchange and application of research findings across State borders and provides general information on the region.

Technical Reports

Some technical soil survey information is used mainly by workers in soil science and in related fields. This information is recorded in technical papers, theses, and dissertations, many of which are published in technical report series and summarized in professional journals.

Soil survey investigative reports.—The Soil Survey Investigation Reports, published by the U.S. Department of Agriculture, Soil Conservation Service, makes technical information available from cooperative laboratory and field investigations of soils of the 50 States, Puerto Rico, and the Virgin Islands. Some volumes contain physical, chemical, and mineralogical data from soil laboratories and descriptions of the profiles that were sampled. Others report studies of the genesis of significant soils in a particular area.

Before Soil Survey Investigative Reports were started, laboratory data were distributed in unpublished form to those immediately concerned with specific problems. Some data appeared in technical journals, regional or national technical bulletins, or published soil surveys; however, much of the data was not readily available.

Some experiment stations issue summaries of available data on soils within their States. These summaries are issued periodically as data accumulate and are available to those who need it.

Technical monographs.—Monographs summarize the existing data and provide additional data for as nearly complete an understanding of the genesis, morphology, and classification of the subject soils as possible. A technical monograph generally deals with the dominant soils of a comparatively large area, such as a major land resource area. In such areas, the dominant soils are broadly similar in genesis and morphology.

Technical monographs differ somewhat in form and content from one area to another. Generally, a monograph contains an introduction that gives pertinent geographic information, a small-scale soil map with explanation, general and detailed description of the soils, laboratory data for soil characterization, and a thorough discussion of the classification of the soils. "The Desert Project Soil Monograph" is an example (Gile and Grossman, 1979).

Reports on benchmark soils.—A benchmark soil is one that, because of its great extent or its key position in the soil classification system, is important in determining properties and interpretations of the soils in a large area. The information obtained about benchmark soils can be extended to closely related soils. These reports are usually cooperative efforts among State agencies and the Soil Conservation Service. Many of the reports are published by the experiment stations.

Reports on benchmark soils generally contain a summary of location and extent of the soils and a summary of suitabilities of the soils for use. The body of the report contains laboratory data, detailed descriptions of selected profiles, crop-yield data and predictions for defined management systems, a discussion of the use of the soil for engineering and a table of engineering properties, and a fairly detailed discussion of management of the soils for the various uses to which they are suited. There is also a review of the problems related to management and an outline of methods for solving such problems. For an example, see "The Charlton Soils" (Hill and Shearin, 1969).

Scientific papers.—Papers and reports on special studies about soils record the procedures used and the results obtained. For the most part, these papers are presented and distributed at professional meetings. Many of the papers are published in professional journals and similar publications. These papers not only keep soil scientists up-to-date on soils information, but they are also helpful to scientists in other disciplines. Some papers integrate soil data with data of other disciplines and are published in the journals of those fields.

Other publications.—Soils information appears in publications other than soil survey reports. For example, the Soil Conservation Service has published reports for resource conservation and development projects, river basin studies, flood hazard analyses, and small watershed projects. These reports, as a rule, contain considerable information about the soils of the area covered in the project.

A special technical publication, "Soil Classification in the United States," records and partly explains the changing concepts that have guided soil classification through its various stages of development in the United States (Cline, 1979). It assembles the various attempts at classification of soils, emphasizing those developed after the system was presented in the 1938 Yearbook of Agriculture.

Popular Media

Government agencies issue publications to inform the general public about common soil problems and to explain how the soil survey can help people to avoid or solve such problems. Some publications discuss soil problems broadly and are aimed at people who are not familiar with the information available in soil surveys. Other publications are directed toward certain groups, such as farmers, or homeowners. These publications explain specific soil-related problems and tell how to avoid or solve them.

Indiana's pamphlet "Adaptability of Various Tillage-Planting Systems to Indiana Soils" is intended to help managers determine which tillage system and what combination of equipment are best for their particular soils, climate conditions, and farming operations (Galloway et al., 1977). Arable soils are assigned to tillage-management groups, and these groups are rated for nine tillage-planting systems, including no-till.

"Yield Estimates for the Major Crops Grown on the Soils of West Tennessee" estimates yields for the major crops of the area under currently recommended technology and production practices (Buntley and Bell, 1976). It also discusses the soil factors that affect crop yields.

"Soil Productivity in Illinois" shows the average yields of various grain, forage, and tree crops obtainable under basic and high-level management (Univ. Illinois, Coll. Agric. Coop. Ext. Serv., 1978). It consists of text, graphs, and tables. Productivity indices are given for the soils, and a simplified method of adjusting both yields and productivity indices for slope and erosion phases is provided for the two levels of management.

Photographs and captions in the bulletin "Using Soils as Ecological Resources" explain how some soil properties affect the usefulness of particular soils (Olson, 1971). This bulletin also illustrates some of the ways that soils information can be applied to land-use problems. The bulletin is an adaptation of a slide presentation developed for New York.

The bulletin "Soils of the Southeast Missouri Lowlands" shows some innovative ways of arranging soils by pH value and texture of the surface layer and then putting together data on soil properties significant to agronomy (Univ. Missouri, 1978). This publication has a general soil map, block diagrams with brief soil descriptions, text, and tables.

"Water for Nevada" describes the use of a reconnaissance soil survey of a large desert basin to determine enough facts about the common soils to evaluate their potential for irrigated agriculture, for engineering works, and for the application of certain range improvement practices on a planning basis (Univ. Nevada Agric. Exp. Sta., 1971). A detailed study of such a large and unknown area would have been prohibitively expensive and slow.

Displays are a useful way to pass along information about soils. Displays can be set up at State or local fairs or in offices, libraries, or store windows. These displays are particularly effective in showing relationships between soils and natural vegetation or between soils and land-use management. Displays are also effective in illustrating soil features, such as depth to layers that restrict plant roots and characteristics of specific layers. The display should contain no more information than can be absorbed in a few minutes. Displays at fairs should have a soil scientist or conservationist present to answer questions. Place mats in restaurants also are effective in disseminating soil survey information because they reach a cross section of the population.

Local newspapers generally follow a soil survey as the work progresses and report the release of the published soil survey. Some newspapers also print articles about the application of information in soil surveys to local use and management problems. Some newspapers will carry a feature story about a different soil each day or each week. Such articles are written by local soil scientists to appeal to the general reader. Periodicals of wider circulation occasionally contain articles dealing with widespread soil problems and tell how soil survey information can be applied in solving these problems. Television and radio can tell a large audience about experiences with soil-related problems.

Automated Soil Data Bases

Soil survey information lends itself well to automation. Most information about a single soil phase is applicable to the phase wherever it is mapped. The computer allows soil data and soil interpretations to be entered edited, stored, manipulated, and retrieved in various formats quickly and accurately. Soils information can be given to the public more quickly than ever before.

Soil Interpretations

Soil interpretation records in the United States are stored in a national computer data base. This data base produces:

- interpretations of phases of soil series, including estimates of selected soil properties; limitations for various uses; capability classifications; yields of crops and pasture; and interpretations for woodland, windbreaks, wildlife habitat, and range;
- interpretative tables in various formats, including most of the tables used in published soil surveys and technical guides[1]; and numerous other tables of soil properties for evaluating soils for irrigation, drainage, and other purposes.

The name and acreage of every soil survey map are stored by survey. The major land resource area and interpretation number for each unit are also stored. This permits the retrieval of lists for many different kinds of users. For example, the map units may be sorted and printed out by major land-resource area, by a specific feature (such as being well drained), or by a specific soil interpretation (such as having only slight limitations for the disposal of septic effluent).

Physical, chemical, and mineralogical laboratory test data are stored for reference and support in soil correlation, classification, and interpretation. Descriptions of the analyzed profiles also are stored. These data contribute significantly to the understanding of soil genesis, soil-landscape relationships, and soil behavior.

Also included in the national computer data base is the classification of all soil series and official series descriptions, which helps in maintaining the consistency and integrity of the classification system. The information in this file can be manipulated to obtain such groupings as all soil series in a particular category of classification.

Computer Storage of Soil Maps

More soil survey maps are being stored in a computer. Soil boundaries are input by digitizing and are referenced to a State plane coordinate system. Soil areas (cells) are identified by name. The computer allows the soil information to be edited, revised, manipulated, and retrieved in various scales quickly and accurately. Computer stored soil information can be a part of a Geographic Information System (GIS) or can be used to provide output in the form of graphic thematic maps and statistical data. A GIS is a very effective means of using soil information. The system integrates soil data and other resource relational data bases for the needs of a specific user.

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[1] These tables provide estimates of soil properties, suitability, and limitations of soils for selected uses and predictions of yields of selected crops and pasture plants.

Three kinds of thematic maps have been prepared through computers:

- county interpretative maps, such as the "Soil Blowing Hazard" map for McClean County, North Dakota, and the "Source of Sand" map for Brevard County, Florida;
- watershed area interpretative maps, such as "Hydrologic Soil Groups" for Chickies Creek Watershed Area, Lancaster County, Pennsylvania, and the "Cropland by Capabilities" map for the Loosahatchie and Wolf Rivers Watershed in Tennessee and Mississippi; and
- special area maps, such as the city of Garrison, McClean County, North Dakota.

Other subjects that have been selected for computer-generated maps include important farmland, land capability classes, slope, potential for dwellings with basements, potential for disposal of septic effluent, crop production, and soil erodibility.

A pilot project in North Carolina (Computerized Soils and Interpretive Maps, n.d.) tested the feasibility of automating the manual steps of soil map drafting. Several interpretative maps were made of a 7.5-minute quad soil survey map from the published soil survey of Jones County, North Carolina.

"Using Soil Surveys Through Interpretive Maps" illustrates how computers can be used to store information, assemble the data for interpretations and predictions, and provide maps at the size and scale requested (USDA, SCS, n.d.).