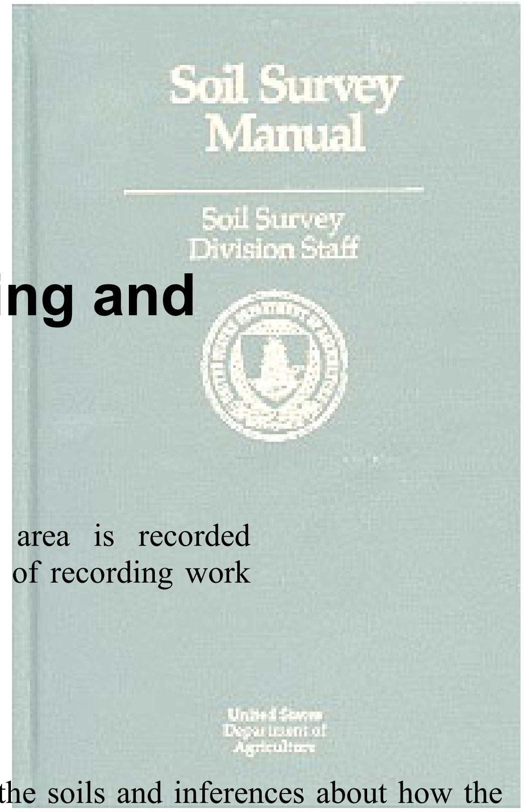
CHAPTER 5

Information Recording and Management



Information gathered during a soil survey of an area is recorded partly on maps and partly as notes. The two methods of recording work together to ensure a quality survey.

Field Notes

Field notes include both information on the behavior of the soils and inferences about how the soils formed. Field notes make up the basic information used in developing the descriptive legend, soil interpretations, and the manuscript of individual soil surveys. The notes are used for preparing standard definitions and descriptions of soil series and for correlating soils in the national program. Field notes are as important as the field sheets on which accomplishments are recorded.

The best notes are those written while observations are fresh. For example, the description of a soil profile is recorded as it is examined. Information from a conversation with a farmer is best recorded during the conversation or immediately thereafter. Unless notes are recorded promptly, information may be lost. All field notes should be clearly identified. The survey area, date, location, and author are necessary on loose-leaf sheets and tape recordings. The date and location are needed for each entry in a notebook. Each note should be related to an identified soil. The source of information that is obtained other than from direct observations should also be identified.

Field notes must be understandable to all survey personnel. Shorthand notes need to be transcribed to be useful to others. Only common words and expressions, as found in a standard dictionary, should be used.

The most important notes record the commonplace—extensive kinds of soils and their properties, the common crops, the success of septic systems, and so on. The tendency to record other than the commonplace should be avoided, because subsequent efforts to prepare a descriptive legend or make interpretations from such notes will be unsuccessful. Field notes should indicate how closely they represent the commonplace. Survey personnel must first learn to see and record the commonplace, then add departures from the usual.

Field notes record observations and complete descriptions of pedons at specially selected sites. Notes that are made during mapping are usually not full descriptions. They may record only color, texture, and thickness of major horizons as seen in auger cores (fig. 5-1). The information is used to supplement detailed examinations. Notes of this kind are especially important for soils that are not well known and for soils of potential, but questionable, map units.

Field notes include information about the relationship of map units to one another, to landforms, and to other natural features. The setting of a soil—its position in the landscape—is important. Landscape features strongly influence the distribution of soils. From the landscape, the properties and extent of the soil and the location of soil boundaries can be deduced. The kind of landform or the part of it that a particular soil occupies and how the soil fits into the landscape should be described. Soil patterns and shapes of soil delineations are important in relation to large-scale soil management. Landscape identification is discussed in chapters 2 and 3 of this manual.

The kinds and amounts of inclusions in map units, as well as their positions in the landscape, are noted and recorded during fieldwork. The inclusions are either identified by name, or their contrasting properties are described. Although the kinds and amounts of inclusions vary from delineation to delineation, an experienced surveyor has little difficulty in maintaining an acceptable level of interpretative purity within a mapping unit. This is due to the fact that most contrasting inclusions (dissimilar soils and miscellaneous areas) occupy specific, easily recognized positions in the landscape. If a precise estimate of the taxonomic purity of a given delineation is needed, special sampling techniques—line-transects or point-intercept methods—are required (ch. 2).

Notes should be made on soil erosion in particular map units. This could include such items as descriptions of eroded areas, degrees of erosion within and between phases, differences in variability among soils and landscape positions, extent of redeposition in map units, and effect of erosion on crop yields and management of the soil (ch. 3).

Soil behavior concerns the performance of a soil as it relates to agricultural productivity, its susceptibility to erosion, and its performance as a foundation for houses or as a waste-disposal site. Notes on soil behavior, unlike those on nature and properties, are obtained largely from the observations of others. In addition, field scientists record direct observations and make inferences which should be labeled as such.

Notes on behavior focus on the current and foreseeable uses of the important soils in an area. Where range is the primary use of a survey area, information on range production may be needed for all of the soils of the area. Notes on the performance of soils under irrigation, however, would probably be needed as well where the soils are irrigated. Information on probable forest growth might be pertinent to the purposes of the survey even though it comes from the experience of only a few individuals or a few kinds of soils. An area of rapidly expanding population needs data on the engineering performance of soils—how well the different kinds of soils would support houses, what kinds of subgrades are required for streets and roads, and whether onsite waste disposal systems would function satisfactorily.

Valuable information about soils can be obtained from observations made in the field while surveying. Soil scientists can see poor crop growth on a wet soil or on an eroded area. They note the failure of a road subgrade or of an onsite waste-disposal system in specific kinds of soil. On the other hand, data on yields and management practices for specific crops usually come from farm records or experimental fields. Similarly, information on forest growth is usually derived from observations made by others, but can be supplemented by information recorded by the soil scientist. Most information on the engineering performance of a soil comes from people who work with structures and soil as a construction material. During field work, a special effort should be made to obtain this kind of information from knowledgeable people.

The source of information about soil behavior is evaluated and recorded in the field notes. Inferences are to be clearly distinguished from observations of soil morphology, vegetation, landform, and the like. Most notes about how soils formed, for example, are inferences. The condition of growing crops is observable, but statements about soil productivity based on such observations are inferences. That soil material is nearly uniform silt loam and lacks coarse fragments is directly observed; the conclusion that the soil formed from loess is an inference.

Theories that have been formed on the basis of inference should not unduly influence the choice of observation sites or the properties to be observed.

Form and Storage of Notes

Each field party should devise a simple, easy system for taking and filing field notes. No single way of taking field notes is prescribed, because no standard system necessarily works well in all parts of the country.

Most field notes are handwritten, in longhand or shorthand, and are immediately available for reference. Such notes can be typed later, although typing is seldom necessary if the notes are neat and well-organized.

Portable tape recorders and small computers can be used for taking field notes. Note taking will need to be well organized for this method. The risk of oversight is larger with tape recordings than with handwritten notes because less time is available for reflection when recording the spoken word than when writing notes. Tapes should be played back after notes are recorded. Recorded notes are usually retrieved and typed later for filing.

Photographs are a quick and accurate way to store information. They could be used more often in soil surveys than they have been in the past.

The sizes and formats of the notebooks that are used in soil surveys depend on working conditions and personal preferences. Large notebooks with pages of about 21 x 27 cm provide ample space for writing and sketching. Smaller notebooks, 8 to 13 cm in width and 13 to 20 cm in length, have advantages for a person on foot because they can be carried in a pocket. Loose-leaf notebooks, springback binders, and clipboards are widely used. These permit easy sorting and arrangement, if notes for only one site or observation are made on a sheet. Completed sheets can be filed at field headquarters every day. For the study of large areas and for reconnaissance trips, small bound notebooks are less bulky and less apt to be misplaced than are the individual sheets. Computers also can be used to store information.

The filing system set up at field headquarters to preserve the information should be as simple as possible and yet allow recovery of the information when it is needed. All withdrawals from the files should be recorded.

In early stages of a survey, a standard filing cabinet with a folder for each map unit is sufficient. Alternatively, descriptions and notes can be kept in binders arranged by map units and taxonomic units. Map unit descriptions and notes are usually filed under series name plus modifiers. A separate folder is provided for notes that apply to the series as a whole. The mechanics are not important as long as notes and descriptions are accessible.

As a survey continues, additional folders are usually needed for soil interpretations, for the various kinds of general information about the area, for photographs, and for miscellaneous notes. Separate folders generally are kept for the specific sections in the soil survey manuscript—geology, vegetation, land use, crop yields, soil suitability, soil potential ratings, and others. As the survey progresses, having the information and notes on each topic in one place becomes increasingly useful, and the notes are transferred to individual files.

Cross-referencing helps in finding notes that include information on more than one subject. For example, a given note may contain both information on the nature of a map unit and on the yields of one or more crops. That note can be placed in the folder for the map unit and a reference to the map unit placed in the file on crop yields.

Much of the information in field notes is summarized in the descriptive legend. Field notes on soil behavior are repeated or summarized in sections of the soil handbook. Although the information in the soil handbook and descriptive legend is readily accessible, not all of the field notes are included. Consequently, the original notes are kept on file.

Field notes and information in the soil handbook and descriptive legend are very useful after publication for evaluation of the soil survey. Adequate notes help soil correlation and interpretation specialists to update an old survey and eliminate the need to completely remap the survey area. This information can be copied and stored in the computer, on microfilm, or on microfiche. Computer disks and microfiche copies are inexpensive and may be very useful to technical staffs. The original paper can then be discarded.

Soil Profile Descriptions

Soil profile descriptions are basic data in all soil surveys. They provide a major part of the information required for correlation and classification of the soils of an area. They are essential for interpreting soils and for coordinating interpretations across State and regional boundaries. The soil descriptions and the soil map are the parts of a published survey having the longest useful life.

Field descriptions of soil profiles range from partial descriptions of material removed by a spade or by an auger to complete descriptions of pedons seen in three dimensions from intersecting pits as horizontal layers are removed sequentially from the surface downward. Most field descriptions of soil profiles are the former, so care in making them is essential.

Field descriptions should include:

- Observed external attributes of the polypedon, such as landform and characteristics of slope;
- Inferred attributes of the polypedon, such as origin of soil parent material and the annual sequence of soil-water states;
- Observed internal properties of the pedon, such as horizon thickness, color, texture, structure, and consistence;
- Inferred genetic attributes of the pedon, such as horizon designations and parent material;
- Inferred soil drainage class;
- The classification of the pedon in the lowest feasible category;
- The location of the site relative to geographic markers and in terms of landscape position;
- The plant cover or use of the site;
- The date, time of day, and weather conditions; and
- The name of the describer.

The degree of detail that is recorded depends on whether the description is intended to provide a complete standard for comparing the other pedons placed in the same taxonomic class or simply to determine the variation of a selected property within a taxon.

The attributes of pedons and polypedons, procedures for describing their internal properties, and standard terminology are described in chapter 3. When standard terms are not adequate to characterize all properties and attributes of a soil, common descriptive words are used to elaborate.

Standard Forms for Soil Profile Descriptions

Standard forms are useful for recording the observations and data required in a soil survey. They permit recording of information in a small space. Examples of standard forms used for soil profile descriptions, along with some additional information, are illustrated in figures 5-2 and 5-3. These figures are merely examples, because no standard form covers all situations. Furthermore, forms require modification as more is learned about soils and how to evaluate data.

Standard pages or forms can be prepared in different sizes to fit various notebooks. Forms printed on blue rather than white paper produce less glare when used outdoors.

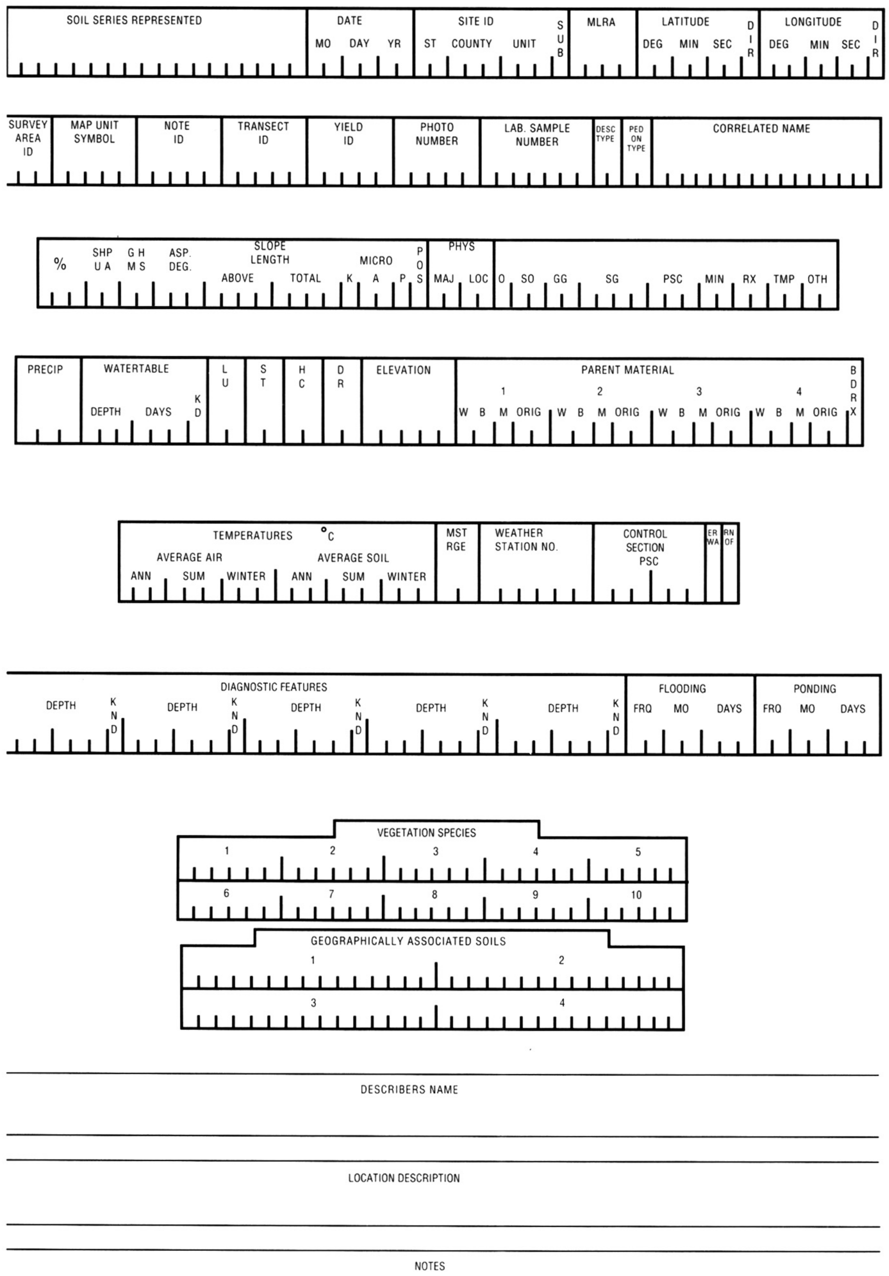
Handheld computers can be programmed, following a standard format, to permit entering soils information while in the field. The information can be downloaded later to a computer in the office. The office computer can be used for storage of information, sorting, and printing out the description.

A standard form serves as a checklist of characteristics that should be recorded. A checklist is especially valuable for beginners because it reminds them to look for at least the listed properties, but observations should not stop with the listed properties. There is a strong tendency to record the information required by the form and then stop. Thus, a form designed to set a minimum on the amount of information recorded also tends to set a maximum. Good soil profile descriptions, however, require information beyond that needed to complete the form.

Standard forms are most useful for recording the day-to-day observations made during mapping. Many such notes are not full descriptions of pedons. These short notes can usually be made on a standard form more easily than they can be written in longhand. Abbreviated notes are also useful in recording many observations during field reviews and when transecting. For these and similar purposes, the forms make note-taking easier and lessen the risk of recording an inadequate description. Complete descriptions of pedons, such as those made when soils are sampled for special studies or those of the typical pedons of soil series, can be written in longhand as block descriptions on a standard form which becomes a checklist.

Notations on forms.—The small spaces on standard forms require that abbreviations or symbols be used for much of the information. Words can be used to identify and describe the polypedon; symbols are needed for internal properties. Many different standard notations have been used. The symbols and codes used by each soil scientist should be documented either (1) by defining the individual's own notations or (2) by referencing a standard document, such as chapter 3 of this manual or the pedon coding system used by the National Cooperative Soil Survey. Individual documentation should become a permanent record of a survey area so that the information can be correctly interpreted by others.

FIGURE 5-2



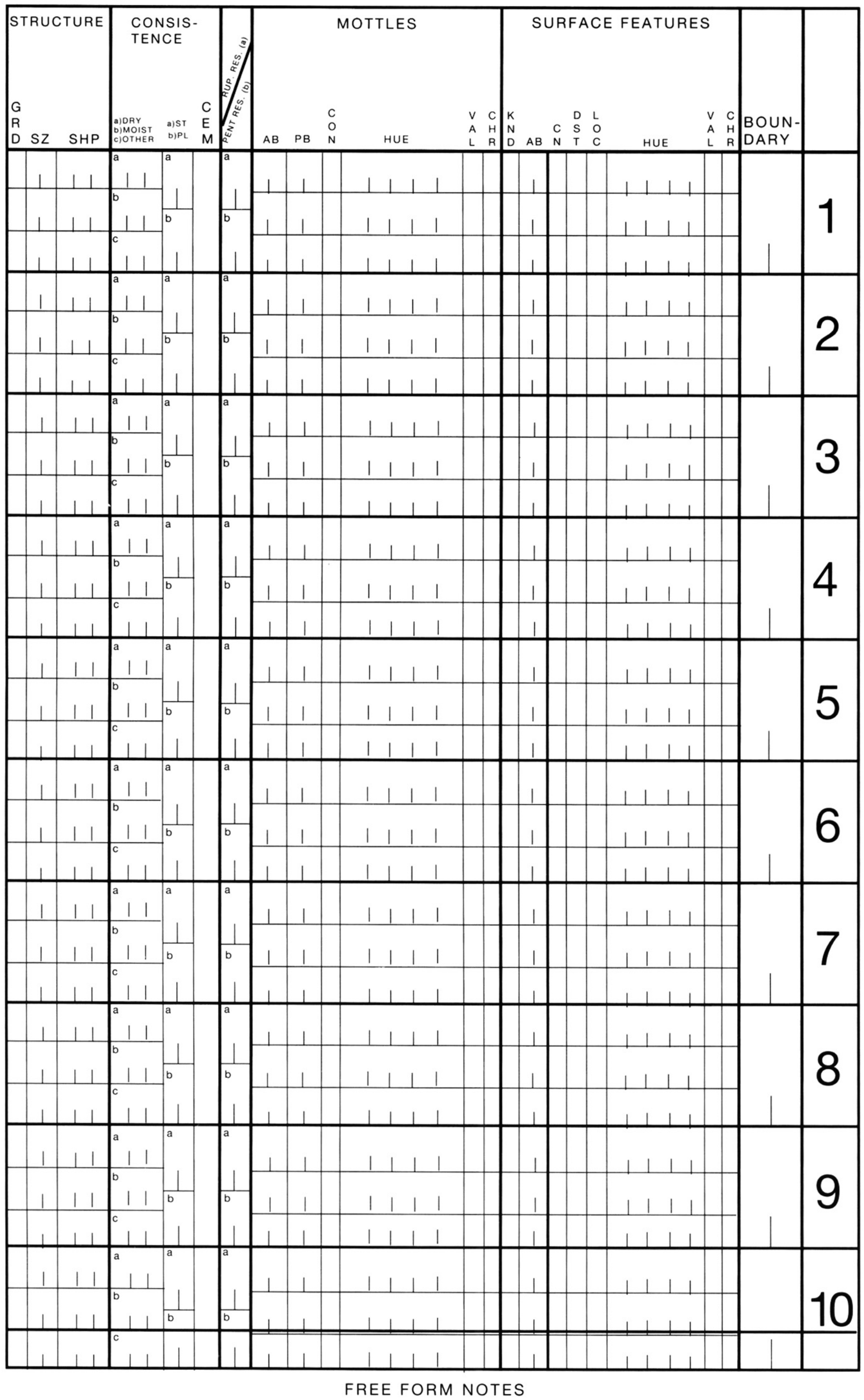
Soil description form.

FIGURE 5-2 (continued)

	DEPTH UPPER / LOWER	HORIZON DESIGNATION DISC / MASTER LETTER / SUFFIX	VOL % LAT / TOT	THICKNESS AVE(a) / MAX(b) / MIN(c)		DRY COLOR LOC	DRY COLOR %	DRY COLOR HUE	DRY COLOR VAL	DRY COLOR CHR	MOIST COLOR LOC	MOIST COLOR %	MOIST COLOR HUE	MOIST COLOR VAL	MOIST COLOR CHR	TEXTURE CLASS	TEXTURE MOD
1					a												
					b												
					c												
2					a												
					b												
					c												
3					a												
					b												
					c												
4					a												
					b												
					c												
5					a												
					b												
					c												
6					a												
					b												
					c												
7					a												
					b												
					c												
8					a												
					b												
					c												
9					a												
					b												
					c												
10					a												
					b												
					c												

Soil description form (continued).

FIGURE 5-2 (continued)



Soil description form (continued).

FIGURE 5-2 (continued)

EFFER-VES-CENCE			FIELD MEASURED PROPERTIES		FIELD MEASURED PROPERTIES		WETNESS	HYDO CONDO	ROOTS			PORES				CONCENTRATIONS				ROCK FRAGMENTS				ROCK FRAGMENTS			
CL	AG	EX	KND	AMOUNT	KND	AMOUNT			QT	SZ	LOC	SHP	QT	SZ	CN	KND	QT	SHP	SZ	KND	%	RND	SZ	KND	%	RND	SZ

FREE FORM NOTES

Soil description form (continued).

FIGURE 5-3

Soil type		File No.
Area	Date	Stop No.
Classification		
Location		
N. veg. (or crop)		Climate
Parent Material		
Physiography		
Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope	Moisture	
Aspect	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *
Permeability		
Additional Notes		

* Control section average

Horizon	Depth	Color		Texture	Structure	Consistence			Reac-tion	Bound-ary				
		Dry	Moist			Dry	Moist	Wet						

Soil description form.

The most serious error in using standard symbols is using a symbol when it is not fully appropriate. Additional notes are needed to supplement symbols that do not convey the facts completely and accurately. Another error is the introduction of individual variations in use of the standard symbols. This complicates use of descriptions by others and can defeat the purpose of standard terminology. Standard notations are used exactly as defined.

Field descriptions in which abbreviations and symbols are used can be converted to narrative form at field headquarters. If recording and transcribing facilities are available, the narrative can be dictated from the field notes and typed in block form. After narrative descriptions have been transcribed by a typist or keyed into a computer and printed, the soil scientist should check the accuracy of the descriptions.

Block Descriptions of Pedons

Comparisons among soils and within a pedon are most easily made from columnar descriptions that use standard symbols and abbreviations. The descriptions usually give dominant color, texture, mottling, structure, consistence, roots, pores, additional features, reaction, and horizon boundary. Conventions for describing each of these are given in chapter 3.

Columns of symbols and abbreviations are used mainly by soil scientist or researchers, but they can be understood by others who are familiar with narrative descriptions of typical pedons, pedons sampled for special studies, and pedons that help in defining taxa. Abbreviations and symbols used in descriptions will need to be converted to words. A standard format for narrative soil descriptions is the "block description" (see typical pedon of Sharpsburg series in Appendix II).

Maps and References

The selection of a mapping base for a soil survey is discussed in chapter 4. Some reference maps that also are useful in conducting a soil survey are mentioned. Much geographic information pertinent to soil survey work is available on maps published by various public and private organizations. Maps dealing with climate have been prepared in the past by the Weather Bureau and, more recently, by its successor in the National Oceanic and Atmospheric Administration. Maps showing surface geology and bedrock geology are prepared by U.S. Geological Survey, State geological surveys, and various other State agencies, including some universities. Topographic maps are available for most areas; some have overprints showing patterns of vegetation. For some areas, maps showing vegetation, land use, and long-range zoning or land-use planning are available.

Many reference maps are large and should be filed without folding. A plan file or map file large enough to accommodate them can be purchased or improvised. A simple file made from hardboard or plywood is adequate. The file should have a systematic index so that maps can be found readily.

The soil survey field sheets can normally be stored in a letter file. Atlas-size sheets need legal-size or larger files. Individual aerial photographs can be filed by flights which can be separated by file indexes. The index map to field sheets is a part of this file. Some care is required in filing and handling completed field sheets to avoid cracking the photographic emulsion or abrading the inked boundaries and symbols. The file and the completed field sheets should be protected from fire, loss, and theft. Field sheets can be photographed as soon as they are completed. The prints or negatives should be stored where a fire cannot destroy both the reproduction and the originals.

During a soil survey, a substantial number of references are accumulated. One of the first activities of the survey party is assembling a list of available reference material about the survey area and its soils. This list is updated during the survey. Some of the documents are kept in the soil survey office; others are available only in libraries. Documents that are generated during a survey also become references. By the time of final preparation of the manuscript for publication, a substantial amount of reference material will have been accumulated and should be readily accessible.

Literature databases, covering virtually every field of science and technology, are available through the National Agriculture Library and commercial information systems. Bibliographies can be prepared from the databases for specific research problems, or general bibliographies can be prepared for several subjects in a selected geographic area. A data base is searched through an interactive computer terminal connected by telephone to the information system computer. Using selected search terms and codes, the operator examines the entire data base, selects data sets and narrows them from general to specific. The retrieved citations can be printed on-line, which is faster for short lists, or off-line, which is more economical for long lists.

Photographs

Photographs can illustrate important things about a soil in soil survey reports, scientific journals, textbooks, and periodicals. Color transparencies are ideal for slide presentations and color publications. Good photographs provide records and reference sources of basic soils information. It is necessary to plan early in the soil survey to begin taking photographs.

Photographs that include a scale are useful in estimating volume, area, or size distribution. The comparison of coarse fragments in a soil against photographs of known quantities of coarse fragments improves the reliability of estimates. Similar photographic standards can be used to estimate volume or size of nodules and concretions, mottles, roots, pores, and rock fragments. In like manner, photographic standards can be used in estimating area or the special arrangement of surface features and land use.

Equipment for field use.—Cameras suitable for soil survey documentation include the 35-mm single-lens reflex, the 2 1/4 twin-lens reflex, and the 4x5 "press" camera. Self-developing cameras have proved very useful for recording and documenting information for immediate and future reference.

A tripod is necessary, especially at shutter speeds below 1/50 second. Use of a tripod reduces camera movement and enables the photographer to concentrate on composition and focus. A flash is necessary in some poorly lighted situations or to eliminate shadows.

Certain other items of field equipment are necessary for good pictures of soil profiles. A scale to indicate depth or thickness is important. A scale that does not contrast greatly with the soil, such as an unvarnished and unpainted wood rule or a brown or khaki cloth tape, 5 cm by 1.5 m, can be used effectively. Large black or yellow figures at 50-cm intervals, large ticks at 10-cm intervals, and small ticks at 5-cm intervals complete the scale.

A small spatula, kitchen fork, or narrow-bladed knife is useful for dressing the soil profile. Paint brushes of various widths and a tire pump aid in cleaning dust from peds. A sprayer can be used to moisten the profile when necessary.

Photographing soil profiles.—Careful planning is essential for obtaining high-quality photographs of soil profiles. A representative site is selected on a road cut or borrow-pit face or in an area where a pit can be dug large enough for adequate lighting of all horizons and for the camera to be 1 1/2 to 2 1/2 m from the profile. The pit or cut face should be oriented so that when the picture is taken the maximum amount of light will strike the prepared face at the proper angle.

The profile will need to be properly prepared to bring out significant contrast in structure and color between the soil horizons. Beginning at the top, fragments of the soil can be broken off with a spatula, kitchen fork, or small knife to eliminate digging marks. Dust and small fragments can be brushed or blown away. Moistening the whole profile or part of it with a hand sprayer is helpful in obtaining uniform moisture content and contrast.

Every profile should be photographed three or four times with different aperture settings, angles of light, or exposure times. Notes should be made immediately after each photograph is taken to record location and date, complete description of the subject, time of day, amount and angle of light, camera setting, method of preparing the profile, and other facts that will not show in the photograph. Besides adding to the way the photograph can be used, good notes provide information for improving technique. If possible take a landscape photograph to accompany the soil profile photograph.

Photographing landscapes.—Landscape photographs illustrate important relationships between soils and geomorphology, vegetation, and management. They should be clear, be in sharp focus, and have good contrast. Needless to say, photographs that are representative of the area being mapped are the most useful.

The most important thing in landscape photography is lighting. The best pictures are made at a time of day and during the time of year when the sun lights the scene from the side. The shadows created by this lighting separate parts of the landscape and give the picture depth. Photographs taken at midday or with direct front lighting lack tonal gradation and, therefore, appear flat. Photographs taken on overcast days are unsatisfactory for the same reason. A small enough aperture should be used to gain maximum depth of focus.

A good photograph has one primary point of interest. Objects that clutter the photograph—utility poles, poorly maintained roads and fences, signs, vehicles, and personal items placed to show scale—detract from the main point. The point of interest should not be in the center of the photograph. The "rule of thirds" for composition is used by looking at the scene through the viewfinder and visualizing the image area divided into thirds both horizontally and vertically. The center of interest is placed at one of the four points where these lines intersect. The image should contain no more than one-third sky, and the camera must be kept level with the horizon.

Photographs should be taken from a variety of angles—from a kneeling position, on a ladder, on top of a car or low building.

Close-up photography.—Many soil features such as peds, pores, roots, rock fragments, krotovinas, mottles, concretions, and organisms can be photographed at close range.

The minimum focusing distance for most cameras used in the field is such that small features can be photographed. Short distances require a much smaller aperture setting and, consequently, a slower shutter speed to ensure adequate depth of focus.

Macrolenses are available for 35-mm cameras. These lenses permit focusing as close as about 4 inches. They usually have a focal length of 50 to 55 mm and can be used for general photography as well. Close-up attachments for conventional lenses are available.

As with landscape photography, the lighting angle is important in close work. Direct front lighting tends to blend texture, separation, and contrast in the photograph.

Photographing clay films and other minute soil features requires special equipment and techniques of photomicrography that are outside the range of this manual.

Filing and care of negatives and prints.—A file system similar to that used for field notes is helpful. Most photographs taken in support of a soil survey can be related to a taxonomic unit or map unit and filed by series. A subject card file with cross-references permits the greatest use of photographs with the least effort. Photographic files should be organized in the same way as files of notes. Negatives can be filed with each print in individual envelopes for protection. Card files of an appropriate size with dividers are satisfactory for storage.

Color 35-mm transparencies can be filed in clear vinyl pages, 22 cm by 28 cm, with pockets for individual slides. These pages are kept in 3-ring binders appropriately divided. Pages can be held to a light source for a quick search of the file. All photographs and negatives should be kept in a cool area that is isolated from chemicals and cleaning materials.

Automated Data Processing (ADP)

A large amount of many kinds of data are collected on a soil survey. How to handle accumulated data to make full use of them always is a problem. A powerful tool for dealing with this problem is ADP using computers and word processing, data base, and spread sheet programs. ADP makes possible timely summaries, comparisons, and analyses that otherwise would be impractical or impossible. It enables frequent and inexpensive updating of long lists, such as lists of soil series for States, regions, or the entire Nation, in any order or sequence. Such summaries can provide information to guide important policy decisions. ADP can quickly perform routine, time-consuming computations. It allows for easy editing of descriptive materials, manuscripts, and so forth.

ADP is now widely used in soil survey and its use is expected to increase greatly. Soil scientists need to know the fundamentals of ADP just as they need to know the fundamentals of chemistry, botany, geology, mathematics, economics, and other subjects that support the work of soil survey. Literature on the fundamentals of ADP is readily available. Automated data processing can be used for many soil survey tasks, but this is not to say that it should be used for all of them. Before any decision is made to use ADP, an objective study—systems analysis—is needed to determine what combination of equipment, personnel, and other factors will be the most useful and economical. Any new system to be used must take into account the compatibility with systems used by cooperating agencies to handle soil survey data and related physical and environmental data. Many combinations of computers, storage media, input-output devices, and communications facilities are possible.

Even after an ADP system has been designed and implemented, study continues. ADP technology is changing rapidly, and new equipment and new procedures are appearing constantly. As experience is gained, an existing system may need to be improved or replaced.

Automated data processing can manipulate data in many ways. Because most of the data are likely to be needed in different combinations, the basic use is likely to be data storage and retrieval. Such a use requires that precisely and consistently defined records be entered into some medium readable by computers and arranged in cataloged files. These files of soil records are a soil survey data bank. Data banks can be kept at more than one location, depending on needs and facilities. Also, soils data can be entered into banks at more than one location. A uniform coding system is essential so that the data in the banks will have a consistent format. A uniform coding system permits direct transfer and sharing of data and the computer programs used to manipulate the data.

After the soils information has been systematically entered into the data bank and the necessary equipment and operating instructions have been organized, the data are available for many kinds or operations. Computer programs (software) must be developed if they do not already exist. Software development is usually the most expensive and time-consuming aspect of data processing. A good data management system can reduce the amount of software needed. Some examples of the important applications for soil survey are:

1. Questions can be answered: What soils have certain sets of properties? What soils are mapped in specified localities? What soils will produce corn yields of more than 100 bushels per acre under a particular management system?
2. Statistical studies, particularly multiple correlations, can be made for many purposes. These include: testing the numerical limits of values in Soil Taxonomy, determining what soil properties observable in the field correlate well with laboratory results, and determining what observable soil properties reliably indicate soil behavior.
3. Summaries can be prepared by ADP—summaries of interpretations by soil families, or phase of soil families, subgroups, and so on; summaries of the acreage of kinds of soil in States, drainage basins, or other geographic areas; and summaries of the number and area of soils having selected features, such as a fragipan.
4. Tabular material can be arranged and printed out for soil survey manuscripts and other reports. Text that is repeated in published surveys of a given State or region can be stored in finished form.
5. Lists, such as the classification of soil series, can be stored and easily updated.
6. Interpretative maps can be printed on demand. This is likely to become an increasingly valuable application for soil management and land-use planning.

Additional examples could be cited. As experience with ADP is gained, many additional applications will become apparent. Users of ADP outputs must be aware of the importance of reliable and accurate original information. High-quality data must be entered in the first place; ADP cannot improve the quality of the data.