Appraisal of soil survey reports for extension clientele[1]

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ABSTRACT

Soil survey reports record soil facts of an area and inform readers of the facts. This paper is an analysis of modern soil survey reports as a communication channel for transmitting soil facts to extension audiences.

Modern soil survey reports are more technical than earlier reports and are aimed at audiences with varied interests and needs for soil facts. A comparison of soil reports published in 1913 and 1972 for the same county illustrate the differences between present and early models of soil survey reports. A modern soil report for an urban county (Lake County, Illinois) was essentially the same in format, content, and audience orientation to a modern one from a rural area (Edwards and Richland Counties, Illinois). Technical language and complex tables pose translation problems for nonsoil scientist audiences.

Soil survey reports can be improved so soil survey facts are effectively communicated to decision makers and other report users. Audience identification and preparation of reports for specific rather than general audiences are important first steps. Use of less technical language and clear definitions of necessary technical terms will help remove language barriers. Changes in format may be necessary to effectively reach target audiences. A suggested format is presented.

Soil survey extension programs provide a means of improving communication of soil survey facts. Extension specialists can plan and implement educational activities to enhance communication efforts.

Research is needed to determine the effectiveness of various communication methods with different audiences. Soil survey methods to provide soil facts quicker and at a lower cost are needed.

Additional index words: Communication of soil survey facts, Detailed soil reports, Interim soil reports, General soil survey reports, Extension soil survey program.

SOIL SURVEYS are conducted to obtain facts about the soils of an area. Soil characteristics are studied, defined, and used as a basis for placing soils into taxonomic units and soil maps are prepared to show the spatial distribution of different soil units. The soil map and other soil facts obtained in field and laboratory studies are assembled, analyzed, and interpreted with results published in soil survey reports (28, 52). The reports contain soil facts to guide soil use decisions. People who use soil survey reports are potential target audiences for extension program efforts.

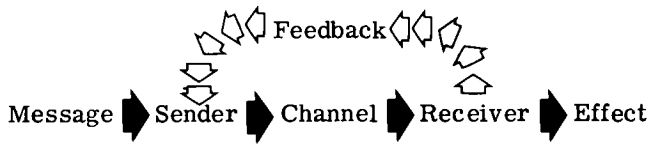

Fig. 1—Elements of the communication process (43, 45).

The purposes of this paper are (a) to analyze soil survey reports as a means for communicating soil survey facts to extension audiences and (b) to provide a focal point for discussion of reports and other methods of communicating soil survey facts. Hopefully, the analysis and resulting discussion will lead to improvements in the communication of soil survey facts to extension clientele.

Communication is the process by which messages are sent from a source to a receiver. A communication channel, such as a soil survey report, is a means for transmitting the message. The purpose of communication from the source viewpoint is to change the behavior of the receiver (43, 45). The receiver may send a return message, or feedback, regarding the effectiveness of the communication process. Figure 1 illustrates the elements of the process.

The effectiveness of communication is a function of source, message, channel, and the interactions of these factors with the audience or receiver (43). The source of soil survey reports is the agency (or agencies) responsible for the survey; the channel is the soil survey report, the message is the contents of the report; and the audience is the intended user of the soil survey report. In this paper, message and audience characteristics are emphasized while source and channel are fixed.

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Table 1—Comparison of 1913 and 1972 soil survey reports for LaSalle County, Illinois (1, 21)

Soil survey report characteristic	1913 report	1972 report
Dimensions	17.1 cm X 25.4 cm	21.6 cm X 27.9 cm
Pages of text	45	140
Number of tables	9	7
Number of figures	5	21
Type of soil map	Multicolor lithograph	Controlled photo mosaic
Position of map sheets	Center of report	End of report
Number of map sheets	3	96
Map scale	1:126,720 (0.8 cm/km)	1:20,000 (5.2 cm/km)
Soil mapping units	Soil types	Phases of soil types
Number of soil mapping units	27	239
Soil associations	5	13
Kind of soil descriptions	Popular	Popular and technical
Laboratory and field experiment data	a. total chemical analysis b. crop yields and value from field experiments	Chemical and particle size analysis
Type of interpretations	Soil fertility management	a. agricultural land use b. crop yields by soil map units c. woodland use d. wildlife land use e. engineering properties f. nonagricultural land use

Three questions guided the analysis. First, what are soil survey reports? Soil survey reports are analyzed on the basis of purpose, format, and type of report. Second, who are the users of soil survey reports? Audience characteristics such as level of knowledge and motivation for wanting soil facts are discussed in relation to knowledge flow systems. Third, how can the communication of soil survey facts be improved? Modifications in format and language are discussed. Soil survey extension activities are related to the communication of soil facts. Research needs to improve communication of soil facts are suggested.

WHAT ARE SOIL SURVEY REPORTS?

A soil survey report serves two functions. First, a report records soil facts for future reference. The printed report becomes a part of the literature related to soil surveys and has a permanence that is missing in spoken communication. Second, a report informs audiences of the facts obtained in the survey and the significance of these facts (42, p. 161-165).

The soil survey report includes a soil map and legend, soil descriptions, interpretations, and general information about the survey area. The form and detail of the soil map and text has changed and varies with the type of report. Soil survey reports for the same geographic area, but published in different time periods, illustrate the changes that have taken place in the evolution of the modern soil survey report.

Two soil surveys have been conducted in LaSalle County, Illinois. The report for the first survey was published in 1913 (21) and that for the second in 1972 (1). Table 1 compares the format and content of these soil survey reports. The 1913 report is typical of early published soil survey reports in mapping detail and soil descriptions. The emphasis of the report was on soil fertility experiments on the soils of LaSalle County. The 1972 report, an example of a modern soil survey report, emphasized technical soil descriptions and soil interpretations to guide soil use decisions. Most modern soil survey reports have format and contents similar to the 1972 report.

Detailed Soil Survey Report

A standard format is used for detailed soil survey reports published by the Soil Conservation Service, U. S. Department of Agriculture. The page size for the report text is 22.86 cm by 27.84 cm. Soil map sheets and soil legend, attached inside the back cover, are larger and folded to fit the text page dimensions. Tables 2 and 3 show the amount of space devoted to different topics in two recent Illinois soil survey reports is essentially the same although the Edwards-Richland report is for a rural area (20) and the Lake County report is for an urban area (37). These reports are typical of standard detailed soil reports. The individual sections of the standard report are discussed in the following paragraphs.

Table 2—Comparison of contents of soil survey reports for Edwards-Richland Counties and Lake County, Illinois (20, 37)

Topic	Space devoted to topic: Edwards-Richland Counties (rural area)		Lake County (urban area)	
	pages	%	pages	%
General nature of area	3.4	4.05	3.4	4.15
How this survey was made	0.9	1.07	0.8	0.98
General soil map	4.2	5.00	5.8	7.07
Descriptions of the soils	29.5	35.12	28.9	35.24
Use and management of the soil	41.0	48.81	37.5	45.73
Formation and classification of soils	2.5	2.98	3.0	3.66
Laboratory data references	0.1	0.12	0.0	0.00
Literature cited	0.5	0.60	0.4	0.49
Glossary	1.9	2.26	2.2	2.68
Total	84.0	100.00	82.0	100.00

Table 3—Comparison of amount of space devoted to soil descriptions and use and management sections of soil survey reports for Edwards-Richland Counties and Lake County, Illinois (20, 37)

Section of soil survey report	Edwards-Richland Counties (rural area)		Lake County (urban area)	
	column cm	%	column cm	%
Soil descriptions				
Series, popular	241.3	20.72	243.84	20.70
Series, technical	573.4	49.24	494.03	41.94
Soil mapping unit	349.9	30.04	440.06	37.36
Total	1164.6	100.00	1177.93	100.00
Use and management				
Capability grouping	286.38	15.38	193.04	11.23
Estimated yields	83.18	4.47	106.17	6.17
Woodland	167.64	9.00	6.04	0.52
Wildlife	154.30	8.28	109.73	6.38
Recreational use	118.11	6.34	103.63	6.02
Engineering use	1052.83	56.53	1003.30	58.35
Tree plantings	--	-	51.30	2.98
Shrub and vine plantings	-	--	143.51	8.35
Total	1862.44	100.00	1716.72	100.00

The Text Section

A. How to use this soil survey. This section is on the inside front cover. It describes what the report contains, how to locate soils on the map, and how to find and use the information in the report. The position of this section may cause many readers to consider it as a preface which they ignore.

B. Table of contents.

C. General nature of the county. This section presents the geographical setting of the area and accounts for about 4% of the total space in the report.

D. How this survey was made. This section reviews the process of making a soil survey. The concept of a soil profile is briefly considered and the criteria that are used to define soil series, soil phases, and soil mapping units are discussed. The scope of soil survey activities is mentioned. About 1% of the report is devoted to this section.

E. General soil map. A description of the soil associations of the survey area are given with brief descriptions of the dominant soil series included. The general soil map is usually attached in the back of the report. The section would be more appropriately called "General Soil Areas". In the reports analyzed in Table 2, 5 to 7% of the report discussed the general soil areas.

F. Descriptions of the soils. Technical and popular soil descriptions are given, including popular descriptions of soil series and soil mapping units and technical soil series descriptions. Table 3 gives the amount of space used for each description. In the two reports analyzed in Table 3, technical descriptions account for 40 to 50% of the space devoted to soil descriptions. The print of the technical descriptions is smaller than the rest of the text so the number of words used for technical descriptions is greater than the number used for popular descriptions. The space devoted to technical descriptions (for soil taxonomists) is evidence of the soil classification emphasis in modern soil survey reports.

G. Use and management of the soils. Nearly 50% of the space in the reports is devoted to the potential and limitations of soils for various uses (Table 2). More than 55% of the space for soil use and management is devoted to the subsection on engineering use with much of the information presented in long tables (Table 3).

H. Formation and classification of the soils. This section gives a brief discussion of the formation and classification of the soils of the area. Discussion of these topics occupied 2.5 to 3.0% of the space in the two soil report examples (Table 2).

I. Laboratory data references. Some reports give the sources of laboratory data while others present results of laboratory analysis. Results relative to chemical and physical properties of soil profiles are often included in the formation and classification section.

J. Literature cited. A list of publications cited in the text is given. Most of the citations are oriented toward the professional soil scientist and may not be available in public libraries.

K. A short glossary of technical terms is included but references to the glossary are not gener-

ally made in the text or in the section on "how to use this soil survey."

The Soil Map Section

A. Guide to Mapping Units. The guide to mapping units is attached immediately after the last numbered page of the text to provide an index to the descriptions and interpretations of mapping units.

B. General Soil Map. The general soil map referred to in the report is attached following the guide to mapping units. The map scale of the colored general soil map is on the order of 1: 126,720, the scale of the 1913 LaSalle County Illinois Map (21). In the soil survey of Carroll and Haralson Counties, Georgia, the soil map (1: 63,360) is inserted in an envelope attached to the inside rear cover of the report (9).

C. Index to Map Sheets. Indexes to map sheets follow the general soil map. Indexes are designed to aid the reader in locating a particular tract of land.

D. Soil Legend and Conventional Signs. A list of soil mapping unit symbols and conventional mapping unit signs follows the index to map sheets.

E. Soil Map Sheets. Soil map sheets with a map scale of 1:20,000 or 1:15,340 are attached following the soil legend and conventional sign sheet. The area covered by the maps on the foldout sheets include 15.54 km^2 (6 square miles). Maps are printed on both sides of the sheet. The photo mosaic background provides cultural detail that is lacking on colored soil maps.

The modern detailed soil survey report contains soil facts that are either technical or popular in nature. The process of conducting and publishing a modern soil survey report is a lengthy one. The time lag from completion of field work to publication date was 5 to 8 years for a group of 10 soil survey reports selected at random from recently published reports. In these reports, major field work required from 2 to 12 years. The reports based crop yields and interpretations on conditions that existed 3 to 7 years before publication (9, 11, 16, 18, 19, 25, 26, 30, 31, 38).

The time lag is especially critical in areas that have been surveyed with local financial assistance. The lag may also mean prepublication obsolescence of the report.

Soil survey facts are used before the soil survey report is published. Tax assessors may use soil maps prepared from field sheets and soil productivity data to provide more equitable tax assessment (33). County planners, health department officials, extension agents, and others use copies of field sheets to obtain soil facts (6, 29, 39, 44, 50, 55).

Interim Soil Reports

Interim soil survey reports are a means for providing soil facts in printed form several years in advance of the final report. They are prepared during or soon after the completion of a standard soil survey and designed to meet a particular expressed need such as urban planning or watershed development. Several examples are cited in following paragraphs.

An interim report in Ela Township, Lake County, Illinois (5) provided soil facts for planning land use 9 years before the Lake County soil survey report (37) was published. The general format of the report was similar to the detailed soil survey reports, however, emphasis was placed on popular rather than technical soil descriptions and interpretations. The section on how the survey was made provided a more definitive exposition of what soil profiles are than the most detailed reports. Interpretations were given for agricultural and nonagricultural uses of land. Six printed map sheets, of similar quality to the final report, provided detailed soil maps with a scale of 1:15,840 on a photo mosaic background.

Interim soil survey reports were prepared for the Rend Lake (27) and Kinkaid Lake (36) watersheds in southern Illinois. The reports included detailed soil maps (1:15,840 scale), soil descriptions, and interpretations for agricultural and nonagricultural uses.

The soil maps in the reports were prepared by a photographic reproduction process similar to the one currently used to reproduce soil map sheets for the Champaign-Urbana, Illinois area. The cost is about one-third that of maps produced by scribing (J. B. Fehrenbacher, personal communication).

Odell, Fehrenbacher, and Klingebiel (32) described personalized soil management guides for individual farms in Illinois. The guides consisted of manila folders that contained (a) a soil association map of the county, (b) a description of each soil association area, (c) an aerial photograph of the

farm, and (d) soil description and management guide sheets for each soil type on the farm. The guides were available 4 to 9 years before the final report.

Similar soil sheets are now available for major soil series in Illinois and other states. These sheets plus low cost reproductions of soil maps are a means of providing soil facts soon after completion of the soil survey field work.

Interim reports may provide soil facts on mapping units that do not appear in the final report since they may have been published prior to final correlation. With the publication of the final report, two versions of soil facts are in circulation. A problem of which version to accept arises.

Missing map symbols, mismatched borders, and other errors may be more prevalent in interim reports, but the added checking before publication of the final report helps eliminate such errors.

Publication of interim soil survey reports as well as final soil survey reports results in duplication. Scarce financial resources are used to duplicate soil survey facts in one survey area rather than providing them for two or more areas. While interim reports having the form of a book of maps and a book of information and interpretations are now produced rather generally in soil survey programs, financing of these is often supported by local funding which may be private as well as public.

Faster map reproduction techniques and report publication methods should be used to speed the release of soil survey reports. A goal of 12 to 18 months from field work completion to report publication should be attainable.

General Soil Survey Reports

A general soil survey report includes a general soil map in which the mapping units are soil associations. Each mapping unit is a geographic association of soils that are defined in terms of soil types or phases (4, 48, 52).

A general soil survey report serves two functions. First, it provides a broad picture of the soils of an area and introduces the user to the soils or even the subject of soils. A simplified rather than detailed view is essential at this stage of the learning process. Second, the report provides soil facts useful in developing broad land use plans (4, 10, 12, 24, 48, 53).

The report also provides soil facts useful in revising old county soil survey reports. Translation aids such as block diagrams, soil series conversions, current crop yields, and other interpretations add years to the useful life of otherwise obsolete soil surveys. General soil reports for Illinois (15), Iowa (35), Minnesota (2), Missouri (46), Nebraska (14), and South Dakota (54), are examples of publications that provide soil facts on a statewide basis.

In addition to the two broad functions, general soil reports for counties provide soil facts (a) prior to the publication of a detailed soil report, (b) for revising old surveys, and (c) for areas that have not had the benefit of a standard soil survey. As with general soil reports for states, those for counties may aid the reader in understanding the formation and characteristics of the soils of a county. The reports are also useful in the development of county or regional land use plans (4). Foldout and booklet formats have been used for general soils reports for counties.

The foldout format generally included a brief description of the soil mapping units, interpretive tables, and general soil map. The report is folded similar to a road map with the smallest folds serving as pages. The report for Cuyahoga County, Ohio is an example (49).

The booklet format provides more space for text, tables, figures, etc. than the foldout format. The general soil map may be a page in the booklet (51) or on a larger sheet that tips out or is placed in an envelope in the report (23, 34).

Up to this point, the message element of the communication process has been considered. In the next section, audience or receiver characteristics are discussed.

WHO ARE POTENTIAL USERS OF SOIL SURVEY REPORTS?

Communication is a knowledge transfer process involving a resource (sender), a message, and the receiver or user of knowledge. The receiver or user is the audience toward which the message is aimed.

Audience identification in the soil survey report is on a use basis. On the inside front cover of current USDA soil survey reports, the writer specifies the use that he anticipates will be made of the soil facts. User groups are listed as (a) farmers, ranchers, and their advisers; (b) foresters; (c) game managers and sportsmen; (d) community planners,

county boards, and other governmental representatives; and (e) soil scientists, teachers, and students.

The groups differ from each other in their purpose for using soil survey reports and in their prior knowledge of soil science. The language of soil science is easily understood by some groups but difficult for other groups to translate.

User's Viewpoint of the Purpose of Soil Survey Reports

As stated earlier, the writer of a soil survey report writes to record soil facts and to inform the user of the soil facts. The user of the report is likely to need soil facts organized to help solve specific problems.

Soil scientists, including students and teachers, use soil survey facts for the purpose of increasing understanding of the soils of the area (13). The added knowledge may be obtained with little thought for its application in solving real world problems. This group may have little or no involvement with soil use decisions in the survey area. Individuals in the group are likely to view soil science from the same perspective as the author of the report. They can communicate in the language of soil science with few translation problems. Soil scientists and students may represent the largest group of soil survey report users. However, expenditures for soil surveys are usually controlled by organizations that anticipate direct benefit from their investment (8).

The users of soil survey reports who expect direct benefit are individuals or organizations that are involved in the process of making soil use decisions. The soil use may be for crop production, forestry, septic tank filter fields, recreation, etc. In any case, the user is likely to be a decision maker or an adviser of decision makers.

The decision maker has goals that he hopes to obtain from soil resources. For example, an agricultural producer may have a three-fold goal of efficient crop production while providing for conservation of soil and water resources without causing off-site environmental difficulties.

The decision maker may view problems as barriers that prevent goal attainment. He may use the principles of decision making to define problems, to generate and test alternative solutions, and to develop and implement a plan aimed to goal attainment. He will periodically review the plan and reevaluate his goals and the progress toward their attainment (47).

Decision makers may not speak or understand the language of soil science. Although some have strong backgrounds in soil science, most have had limited exposure. Translation difficulties result in incomplete use of soil surveys in guiding soil use decisions.

Decision makers view soil use problems as part of the total resource use situation rather than in the discipline oriented view of a soil scientist (7). Soil facts are only one of several sets of resource data that are used in the development of land use plans (10, 47).

The soil science discipline has made important contributions in providing soil facts to guide soil decisions and even greater contributions can and should be made. Soil scientists have the responsibility to present soil use alternatives and the potential effect of each alternative. The alternatives and their effects must be communicated to soil survey users in language that the user can comprehend (3). Improvements in soil survey communications are necessary if soil facts are to be effectively communicated.

HOW CAN COMMUNICATION OF SOIL FACTS BE IMPROVED?

Communication of soil facts can be improved through improvements in soil survey reports, through soil survey extension activities, and through research. Each of these topics is discussed in this section.

Improving Communication Through Soil Survey Reports

Soil survey reports can be improved so soil survey facts are more effectively communicated to potential users. Audience identification, language, and format are areas where improvements can be made.

Audience identification involves looking at soil survey facts and their use from the user's viewpoint. What is the user's purpose in using soil survey facts? Is he using the report to gain a better understanding of the soils of the area? Is he motivated by a desire to obtain soil facts to guide soil use decisions?

What experience and knowledge does he have? Is he a professional soil scientist, a resource manager, or an interested citizen? Consideration of such questions will help characterize target audiences.

The language of soil survey reports can aid effective communication. Soil science terminology is shorthand to the soil scientist but it may be "Greek" to a person with little or no background in soil science. Nontechnical terms should be used whenever possible if soil survey reports are to be effective communication channels for nonsoil science audiences.

Soil survey reports are technical publications and it is neither desirable nor possible to express all soil survey facts in nontechnical language. Technical terms should be defined in the text when first used or in a glossary (22, Chapter 4). The glossary in current soil survey reports is hidden away in the back of the report. In "Soils of Missouri," Scrivner, Baker, and Miller (46) insert a glossary of terms near the front of the report to alert the reader to technical terms.

Graphic elements such as illustrations, graphs, and tables can be used to supplement the text. Visual aids should be as simple as possible to be effective communication aids.

Tables in soil survey reports are often extremely complex, for example the table of engineering interpretations. The reader needs a full measure of desire and patience to translate the soil facts in a 13 column, 10- to 15-page table. At best, complex tables should be divided into a series of simple tables. At the least, the reader should be introduced to the mechanics of using the complex tables to obtain soil facts.

Detailed soil maps are complex and difficult for many readers to interpret. Additional translation aids are needed to help the user understand the soil map. Block diagrams can be used to give a three dimensional landscape interpretation of the soil map. Interpretive maps also help the report user translate soil survey facts (56, 57).

The preface (inside front cover) of current soil survey reports suggests that the user prepare colored interpretive maps. Green, yellow, and red colors are suggested to indicate slight, moderate, and severe limitations for different soil uses. The reader is more likely to follow the suggestion if specific examples are included in the body of the report. The colored interpretive maps aid most readers in translating soil survey facts into understandable language (39, 40, 41), however, colored interpretive maps may be considered oversimplification by professional soil scientists.

A suggested format for soil survey reports is given below. Various sections of the report are identified by a particular paper color.

Suggested Format for Soil Survey Reports
(A First Approximation)

- Preface (inside front cover)
  - Acknowledgments
  - Locations and general nature of survey area
- Table of Contents
- Introduction (white paper)
  - What is a soil survey
  - Purpose of soil survey report
  - Who can benefit from soil survey report
  - Overview of paper
    - White: general material
    - Green: woodland use
    - Blue: nonagricultural uses
    - Yellow: agricultural use
    - Orange: wildlife use
    - Pink: technical materials
- Understanding the soils of the survey area (white paper)
  - Glossary of soil terms used
  - Concept of a soil as a three dimensional unit
    - Soil profile
    - Landscape unit
  - How soils differ
  - Why soils differ (soil forming processes)
  - Soil associations of the survey area
  - Climate in relation to soil use in the area
- Understanding the soil map (white section)
  - How to locate a tract of land
  - Characteristics of the soils
    - Popular descriptions (text and tabular material)
    - Soil patterns and their meaning (typical maps)
  - Relation of soil map to soil use (overview)
- Agricultural use and management (yellow section)
  - Potential and limitations
    - Soil productivity
    - Soil management groups
  - Soil management for (as appropriate):
    - Field crops
    - Pasture and range
    - Horticultural and fruit crops
  - Engineering practices (related to agricultural use)
- Woodland Use (green section)
  - Potential and limitations for (as appropriate):
    - Forest products
    - Recreation
    - Watershed management
- Wildlife Habitat (orange section)
  - Potential and limitations (as appropriate)

Nonagricultural Uses (blue section)
- Home sites
- On site waste disposal
- Recreation
- Transportation, etc.

Summary (white section)

Appendix (pink section)
- Technical soil descriptions
- Soil classification (7th Approximation)
- Laboratory data
  - Profile characteristics
  - Engineering properties

Map Section (Attached or separate envelope)

Improving Communication Through Soil Survey Extension Activities

Extension specialists in soil survey have a unique opportunity to improve communication of soil survey facts to target audiences. The specialists are charged with the specific responsibility of interpreting and extending the results of research in soil survey to the appropriate clientele.

Extension programs are based on the premise that target audiences with specific requirements for soil facts can be identified. The problems of extension clientele provide the focal point for extension activities. Problem definition, generation of solutions, testing of solutions, and communication of the results to target audiences are involved in the development and implementation of extension programs.

Soil survey extension specialists assist with the identification of target audiences. Interpersonal communication with individuals provides opportunities to evaluate needs and suggested communication channels that are complementary to the soil survey report. The specialist should devote considerable energy to the reduction of translation barriers that impede the communication of soil survey facts. Many extension specialists are on split extension-research appointments.

Improving Communication Through Research

Research to help remove barriers to effective communication of soil survey facts could well command the attention of extension specialists on split extension-research appointments. Studies are needed to test various communication methods and their effectiveness with different audiences. The relation of communication of soil survey facts to the knowledge dissemination and utilization system is an appropriate area of study. Interdisciplinary activities involving soil scientists and scientists in the emerging science of knowledge utilization should prove to be productive. The work of Havelock and associates (17) should receive the attention of soil scientists who are interested in improving communication effectiveness.

Soil survey includes activities that have a relatively high cost. The benefit/cost ratio is favorable for expansion of soil survey activities. However, this does not forego the necessity for developing soil survey methods that will provide the same soil survey facts with a smaller investment.

The time lag between completion of field work and publication is another critical area that has an impact on the communication of soil survey facts. The development and testing of more rapid publication techniques will help to reduce the time lag.

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