A NEW SOIL SURVEY REPORT FORMAT FOR SASKATCHEWAN

D.F. Acton, A.B. Woloschuk and C.R. Hilliard
Saskatchewan Institute of Pedology
Saskatoon, Saskatchewan

INTRODUCTION

Semi-detailed soil surveys that have been ongoing in Saskatchewan for several decades have been published on areas encompassing 1° latitude and 2° longitude, corresponding to the 1:250,000 National Topographic Series of maps. These NTS reports contain a soil map at a scale of 1:125,000, printed in two parts. The report describes the soils of the area and makes reference to agricultural use as part of this description.

Recently, in Saskatchewan, reports have been introduced in an atlas-type format in an attempt to increase utilization of land resource information by a variety of potential users. It is the purpose of this presentation to review the development of the earlier publications and indicate some of their limitations. Justification for revising the format will be presented, followed by an outline of the new report series and a review of some initial attempts to evaluate these new reports.

DEVELOPMENT OF THE NTS SERIES OF REPORTS

It was realized by those responsible for preparing the broad reconnaissance surveys, which culminated with the publication of Soil Survey Report No. 12 in 1944, that more detailed surveys would be required to meet the needs of the agricultural industry in Saskatchewan. In 1958, these surveys were initiated. They were to focus on mapping the soils, utilizing a natural system of classification rather than a practical one. The task of interpreting these surveys was to follow as our

knowledge of the relationship of soil individuals to some particular problem or set of problems increased (Hutcheon 1962).

Every thematic map requires a base of some kind or another and a soil map is no different. Vastly improved base maps were emerging at this time for the national series of topographic maps; so it was a natural progression for the soil survey to utilize this base. Initially, it was perceived that the scale would be the same: at 1:250,000, but upon seeing the soil map for the first area, Regina, it was decided to double the scale to 1:125,000. This is how we came to map on an NTS basis.

This mapping utilized the emerging Canadian System of Soil Classification, not only to classify soils of the area but to name them. Names of taxa were applied to the association name which was retained from earlier surveys, to provide a name for soil series. For example, the hard columnar member of the Weyburn Association became the Orthic Dark Brown Weyburn series and the bluff podzol in the Oxbow or Whitewood Association became the Low Humic Eluviated Gleysol series of these associations.

Early NTS reports struggled with methods of recognizing variations in extent of series within an association and how to represent areas where series from different associations were present. The soil map unit that was devised recognized the former. Any combination of map units could be chosen to recognize the latter. The former (e.g. 02) were defined on the legend and described in the report but the latter (e.g. Ox7-B6) were defined and described separately on the legend and in the report.

In an attempt to meet the "natural" classification objective alluded to above, considerably more information on soil landscapes was provided.

This included the material, pattern and slope class as part of the symbol on the map.

The basic philosophy in mapping was to create map units that would fully describe the natural soil landscape. This philosophy was facilitated, in part, by an open style map legend whereby various elements of the map symbol were placed in different parts of the map legend. For example:

$$\frac{07:1 - B6:1\text{-}sicl}{Ga3:St1\text{-}2}$$

Each of the soil map units (07 and B6) are presented separately in the legend and described separately in the report. The soil textures, materials, pattern, slope and stone classes are all presented separately. The user must move from place to place on the legend and in the report to try and appreciate the soil landscape presented. As alluded to above, however, this system did provide the capability of presenting a tremendous amount of information on the soils and landscape features of that area. Four series are represented in the above example but it was possible to include 6 or 7. This is in contrast to many soil surveys which restrict themselves to presenting 3 series.

The report that accompanied the maps focused on describing the soil map units. It contained general statements on agricultural suitability of these units. There were introductory sections describing the natural features of the area and explaining soil genesis and classification concepts. A section on soils and agricultural (or forestry) use was usually presented, often oriented to soil limitations or to suitability for grain crop or forest.

REASONS FOR A NEW REPORT SERIES

The development of a new series of reports for Saskatchewan was internally inspired and conceived. It was agreed among most soil surveyors that our information was not reaching the potential we perceived it to have. We attributed this failure to lack of interpretation of data, problems with readability and, hence, comprehension, and slow turnaround of information from the time of mapping to printing, to name a few.

It is generally accepted that most potential users of soil survey information do not really want a soil survey but rather some kind of interpretation thereof. Land assessors want soil productivity, foresters want texture and drainage, others want irrigation suitability, erosion susceptibility, etc. Where the demand for these interpretations was sufficiently strong, the survey responded with productivity ratings, (Moss, 1968), or irrigation evaluation in various small projects and the South Saskatchewan River Irrigation Project. The survey also tried in various ways to educate students, farmers, land appraisers and others in the use and interpretation of soil maps but there was no comprehensive presentation of a given set of interpretive material.

The utilization of taxa in the System of Soil Classification for Canada as a means of naming soil series required the reader to have a working knowledge of this system to appreciate the properties of the soils. This was a very high expectation. Presentation of texture, landform and stone symbols as part of the map symbol added to the complexity of these symbols.

The large size of the survey area (4 M acres) meant there was a considerable length of time between the initiation of mapping and publishing of material for that area. It usually took 4 or 5 years to map the

area, 2 years to compile all of the data and another 2 years to have it published.

Initially, at least, the soil survey reports were written for the agrologist or forester. Over time, some data was presented to facilitate engineering interpretations. There was reference to wind and water erodibility but no clear-cut rating system. Salinity was recognized, like all other soils, when the extent was perceived to exceed 15%. Soil capability for agriculture was presented descriptively, but maps were presented at different scales in separate publications.

A revised format was developed and introduced with the publication of the Wolseley Rural Municipality in 1984. This new format is referred to as the R.M. series of soil reports.

DESCRIPTION OF R.M. FORMAT

There are two basic components of the revised format. The first is a preliminary publication, which is available within a year from the initiation of mapping. A second is a multi-colored resource atlas which takes 2-3 years longer to produce. The preliminary publication contains an uncolored soil map with a unique number for each delineated area on the map. The soil map symbol includes soil map units, slope class and surface form. Legends and some descriptive materials are presented for each of these soil landscape components. An appendix to this report contains a listing of the above soil landscape features along with surface texture, irrigation suitability, agricultural capability, stones, wetlands and drainage, sand and gravel, soil acidity, wind and water erosion and acreage for each delineated area on the map. A section of the report briefly explains each of these classification systems and, in turn, defines all of the units for that R.M.

In effect, the preliminary report contains nearly all of the information that will be presented in the published report, however, the style of presentation requires a high level of expertise on the part of the user.

The published report can be likened to an atlas in that all maps are presented as pages in the report. The report is 30 x 45 cm, bound with Cerlox. It can be considered to contain three parts: Introduction, Description of Soils and Interpretations. For the most part, each theme in the report will be presented on two opposite-facing pages, one a map at a scale of 1:100,000 and the second an explanation of the map information. Each of these themes will be briefly outlined below and, where necessary, reasons for inclusion will be presented:

1. **Introduction** - Presents the extent and location of the municipality, the physiographic features and the glacial history of the area. Small-scale maps help depict these components.
2. **Geology and Groundwater Resources** - This section describes the glacial stratigraphy, utilizing a series of cross-sections and a small-scale planimetric map depicting the distribution of aquifers and direction of groundwater flow. This information is basic to understanding the distribution of saline soils and their management.
3. **Landforms** - A map and description of the surface deposits, surface forms and slope classes for the area. Presenting this information on a separate map reduces the complexity of symbols on the soil map.
4. **Introduction to Soils** - Basic concepts of the soil profile, soil forming factors, kinds and distribution of soil profiles (including

a series of theoretical sketches) and the soil map are presented to enable the reader to appreciate the description of soils of the area.

5. **Soil Map** - Contains only the soil map unit and slope class. Landforms, surface textures and slopes are presented elsewhere. The soil map unit is presented in a closed system so that each symbol is defined in one place on the legend and in the ensuing description of soils, e.g.:

   CdOx2 - Mainly orthic Cudworth soils, with orthic and calcareous Oxbow soils on upper slopes and knolls, calcareous Cudworth soils on mid- and lower slopes, and poorly drained soils in depressions.

   An important deviation from the NTS reports was the "softening" of the terminology used for soil names. For example, shallow soils on knolls are called calcareous soils or eroded soils instead of Rego, Calcareous or Orthic Regosols, as in early publications and wet soils of sloughs are called poorly drained rather than Gleysolic soils.

6. **Description of Soils** - Each of the map units from the soil map are described in terms of the overall properties of the soil association or complex as well as a schematic outline of the properties of each of the component series. The specific soil map units are described, often supplemented with a sketch, and finally, some inferences are drawn to relate soil properties to crop production and land use.

7. **Soil Capability for Agriculture** - A map and description of soil capability for agriculture. This presentation utilizes the same

land classification system as was used in the CLI series of maps and in the R.M. brochures but represents revised interpretation based on more detailed soil information.

8. **Soil Productivity** - This section relates soil texture (including a soil textural map) to available soil moisture. Potential yields may be estimated from spring moisture and precipitation probability. Soil fertility, particularly soil organic matter, nitrogen and phosphorus, is also discussed along with the need for soil testing.

9. **Soil Salinity** - The map classifies soil salinity in terms of its extent and degree, relating this to its effect on productivity of the delineated area. Position of salinity in the landscape is also indicated to provide some indication of cause. Some general information is provided on the nature, development and management of saline soils as well as a specific description of the occurrence, possible origin and suggestions for management for that R.M.

10. **Surface Drainage and Wetlands** - The map provides an overview of surface drainage characteristics by classifying the R.M. into areas of regional runoff, local runoff and accumulation, major accumulation and wetlands.

11. **Initial Irrigation Potential** - This map provides an initial evaluation of the irrigation potential insofar as soil characteristics are concerned. The evaluation does not consider availability or quality of water, distribution, economics or management.

12. **Susceptibility to Wind Erosion** - This map classifies soils as to their susceptibility to wind erosion while under fallow.

13. **Susceptibility to Water Erosion** - This map classifies soils as to their susceptibility to water erosion.

14. **Soil pH** - This map indicates pH range and distribution of soils within a delineated area on the map.

15. **Stones** - A map depicting stone classes is presented partly to reduce the complexity of the symbols on the soil map and partly to meet the needs of those particularly interested in stoniness.

16. **Sands and Gravels** - This map classifies the soils in terms of potential for containing sources of sands or gravels for road or building construction. This has been augmented, recently, with information on site location and characteristics of gravels at known point sources.

It should be appreciated that all of these derived (landforms, texture, etc.) and interpretive maps (salinity, irrigation, etc.) were developed electronically from the soil map and an extended legend. As such, delineations for any areas on a derived or interpretive map were obtained from the soil map. It is then possible to readily relate all interpretive maps back to the initial soil description.

It should also be noted that many of the maps contain contour lines to enable the user to relate the soil or some interpretive map (i.e., salinity) to topography.

Finally, although much has been said about the difference in format and even in mapping system between the NTS and R.M. reports, it is not difficult to adjust from one to the other. Some will miss the presentation of surface texture on the soil map in the R.M. format. Others may find it difficult to equate 07-B4 with OxBL2 and still others may be inconvenienced by a slightly larger (1:100,000) scale of the R.M. maps

than the 1:125,000 scale of the NTS map but these inconveniences appear justifiable in view of the benefits.

COVERAGE BY NTS AND R.M. REPORTS

The accompanying map (Fig. 1) shows actual and planned coverage by the NTS and R.M. reports. Nearly one-half of the agricultural area of the province lying south of Tp 48 (the area covered by Soil Survey Report No. 12) has been covered by the NTS series of reports. A major block in eastern Saskatchewan has been mapped, preliminary and published reports prepared. Three R.M.'s have been published and distributed and two more are at press. Publication costs have necessitated publishing groups rather than individual R.M.'s. Several of these groups or block reports are planned for printing in the coming year.

EVALUATION OF THE R.M. FORMAT

The R.M. format of publishing soil survey information is considerably more expensive than the NTS format. Printing the report, cartography and printing of maps for the NTS series cost approximately $0.04/ha ($0.015/ac.) as compared to $0.17/ha ($0.07/ac.) for the R.M. reports. Although the cartography and printing costs are less than 10% of the total cost of the soil survey, it is important to establish whether the added costs are justified.

One group of users the planners of the R.M. report format hoped to make a bigger impact on were the farmers. The first step was to invite all farmers in a municipality to a meeting to make them aware of the publication. Three of these have been held to date (attendance in brackets): Wolseley (45), Indian Head (50) and Glenavon (30). Subjectively measured, the response was good at the meetings.

PROGRESS OF R.M. AND N.T.S. SOIL SURVEY PUBLICATIONS IN SASKATCHEWAN

LEGEND

R.M. Publications:

|1| Printed.

|2| At press; preliminary publications available.

|3| Printing scheduled in 1988; preliminary publications available.

|4| Mapped in 1986; preliminary copies available in 1987.

|5| Mapping planned for 1987-88; preliminary copies available 1988-89.

N.T.S. Publications:

|6| Printed.

|7| At press.

Other Publications:

|8| Soil Survey Report No. 12 - Broad Reconnaissance.

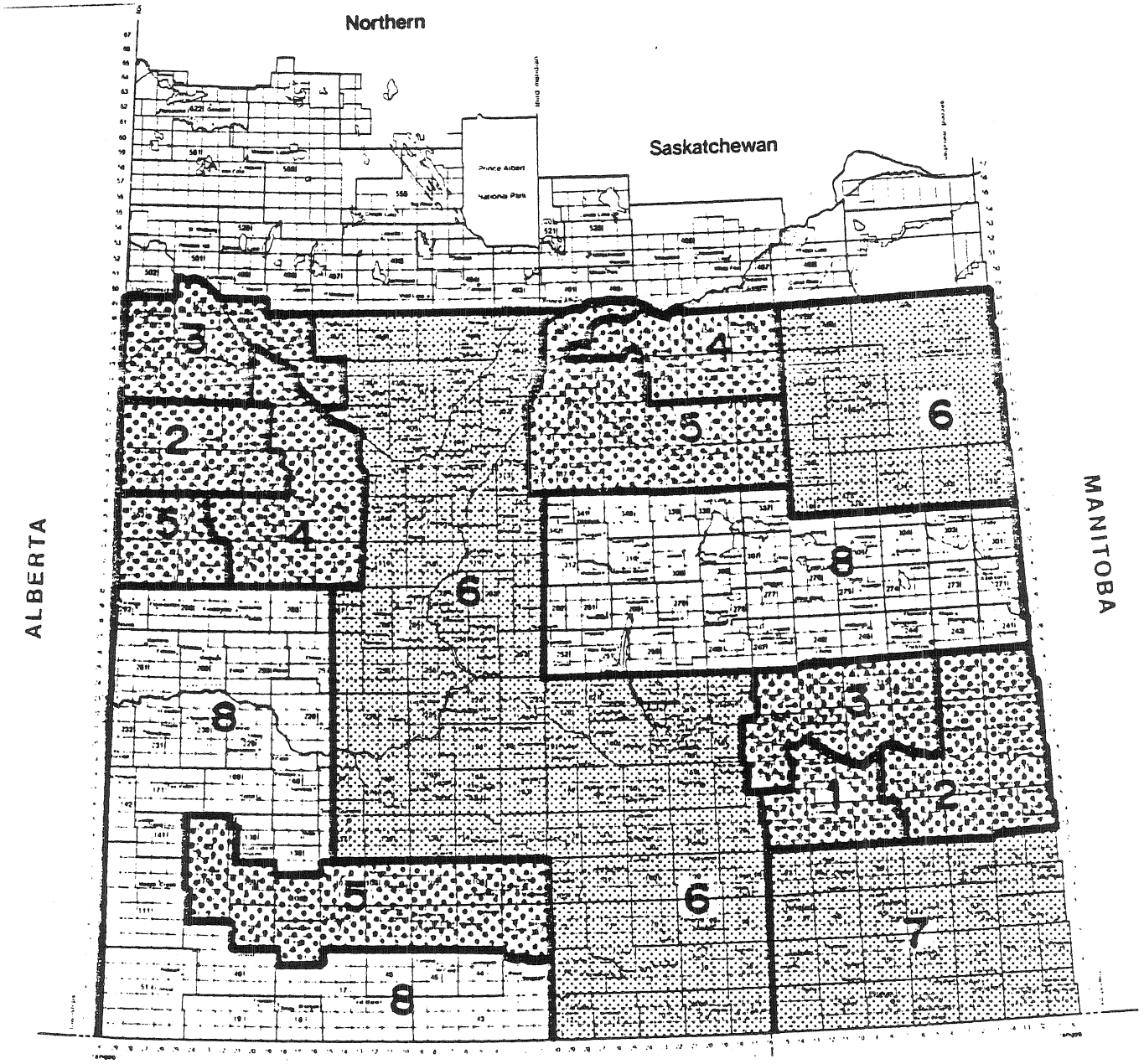

Figure 1. Index to soil surveys in Saskatchewan.

To obtain a more objective assessment, a questionnaire was prepared and distributed at the Indian Head and Glenavon meetings. The farmers were given one month to reply, following which one reminder was sent. The final response was approximately 30% of those attending the meetings. No attempt has been made to reach those that did not attend the meeting.

The questionnaire contained four parts: the first obtained basic information on the respondent such as size and type of farm, age, and extent to which report was examined and read. The second part contained 19 statements to which the respondent could agree or disagree, qualified by mild and strong. These statements were aimed at establishing whether the reader learned anything from the report, learned or saw anything that could be useful in the report, had difficulty in comprehending the material presented and whether the format made this comprehension process easier. The third part tried to evaluate the usefulness and interest value of specific sections of the report and the fourth had the same objective for topics included or considered for inclusions in future reports.

The respondents seemed very receptive to the concept of this type of publication as 63% mildly agreed and the balance strongly agreed with every positive question.

A vast majority agreed either mildly or strongly that they learned more about the soils in their area by reading the report and using the maps (Fig. 2).

A similar majority mildly or strongly disagreed with the statement that, in general, the report is too technical and difficult to understand (Fig. 3). When 7 questions relating to ease of understanding were

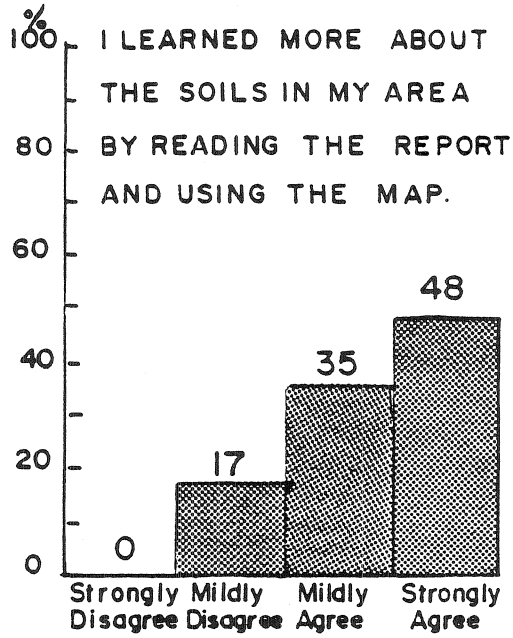

Fig. 2. Distribution of a single variable "I learned more about the soils in my area by reading the report and using the map".

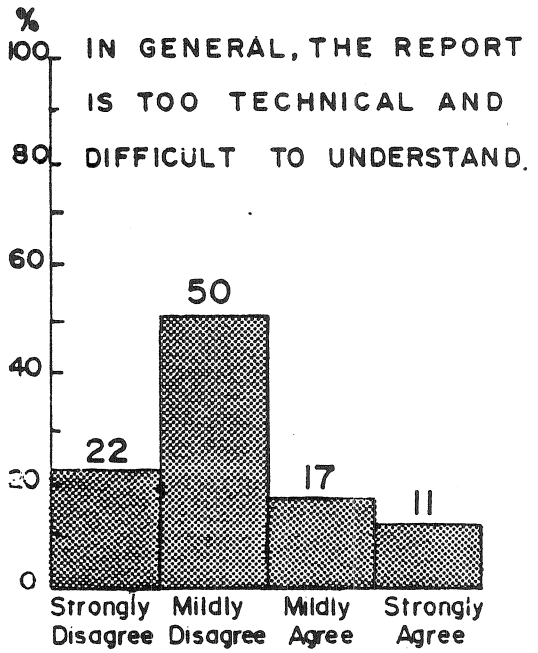

Fig. 3. Distribution of a single variable "In general, the report is too technical and difficult to understand".

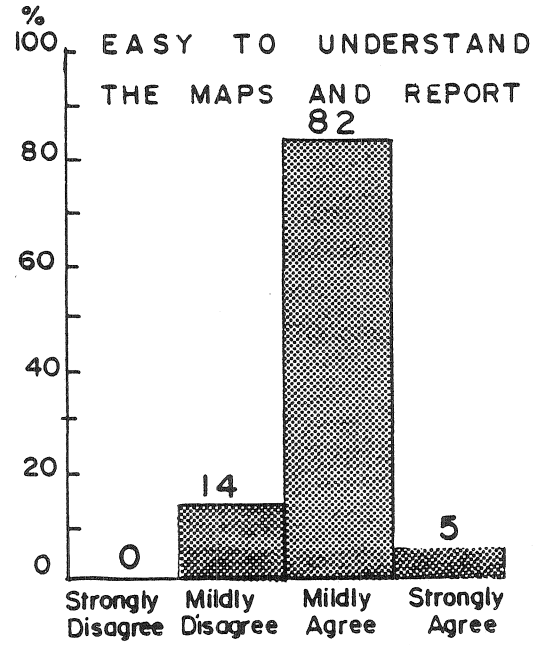

Fig. 4. Distribution of a computed variable (SENSE); the average of seven questions pertaining to the ease of understanding the report (V5, V7, V8, V12, V18, V19, V20) by age group.

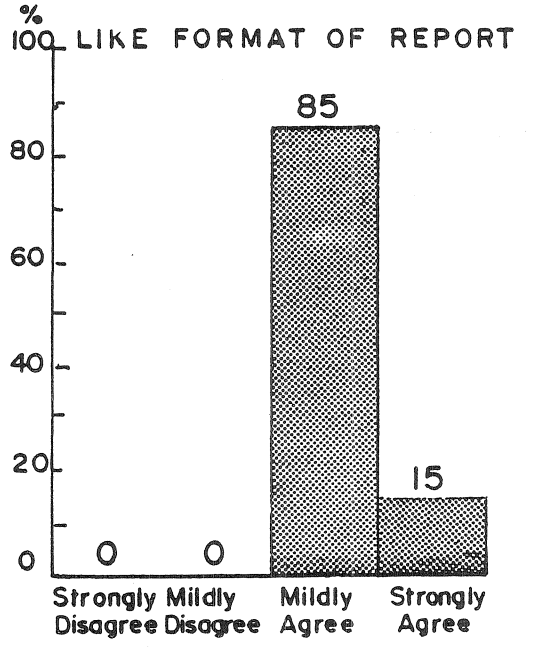

Fig. 5. Distribution of a computed variable (LAYOUT); the average of six questions pertaining to the format of the report (V3, V4, V6, V10, V13, V14).

grouped, we find that very few had or anticipated having serious difficulty (Fig. 4). The format of the report also was greated with a highly positive response (Fig. 5).

The response, as might be expected, was less positive on the usefulness of the information presented. Although 68% indicated agreement to the statement that they will be able to use the soil map for making decisions on their work, when several usefulness questions were grouped, the positive response dropped to 43% (Fig. 6). There was a strong correlation between the age of the respondent and the perceived usefulness of the information, those over 45 years of ago finding greater utility than those younger. Perhaps another measure of the perceived usefulness is expressed in the indication that there were only slightly more people (23%) that would pay $20 or more for the report if they were charged than there were peole (18%) that wouldn't buy it if there was a price on it.

The usefulness of agricultural capability, productivity and salinity maps were judged to be high whereas another interpretation received a mixed response (Fig. 7). A number of topics considered for inclusion in future reports were considered to be useful (Fig. 8), most of them more so than some in the current publications.

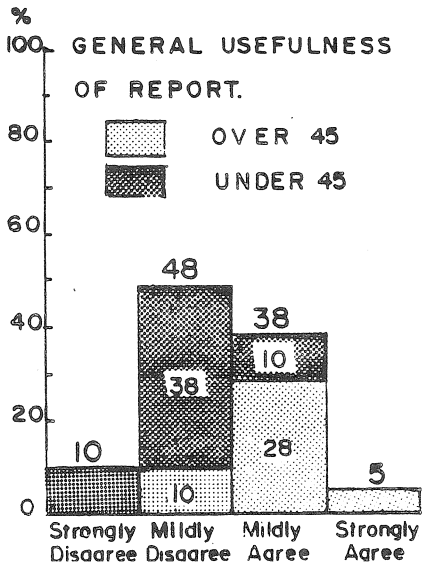

Fig. 6. Distribution by age group of a computed variable (USEFUL); the average of three questions pertaining to the usefulness of the report (V15, V16, V24).

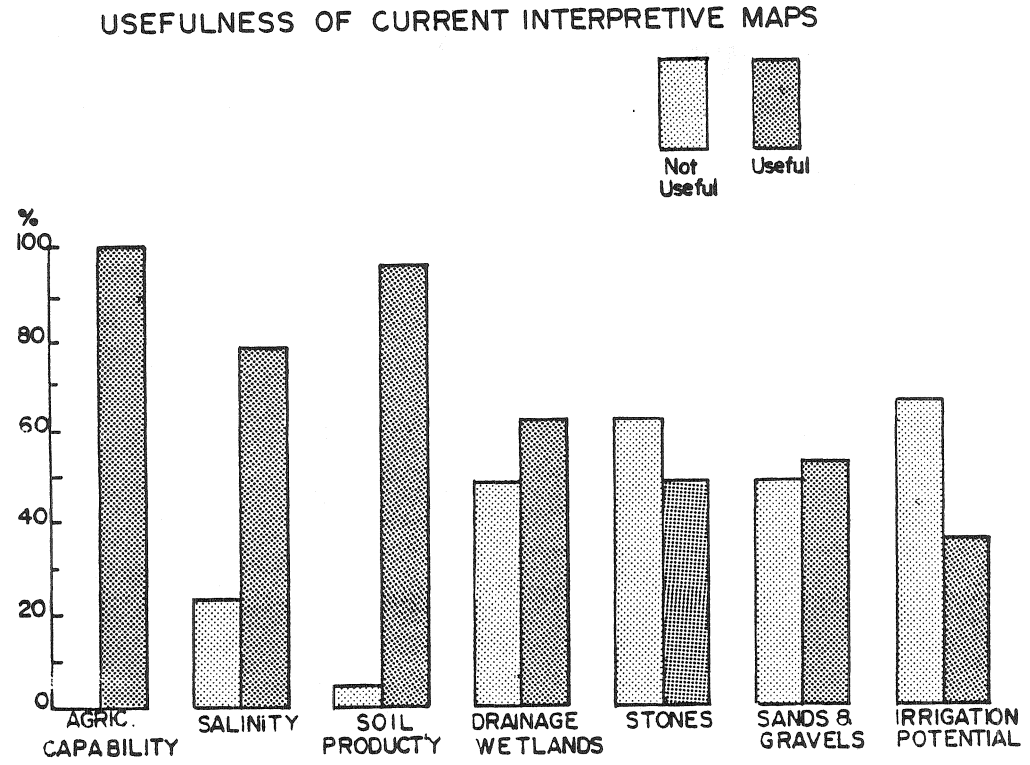

Figure 7. Distribution of responses to the usefulness of various interpretive maps presented in the report.

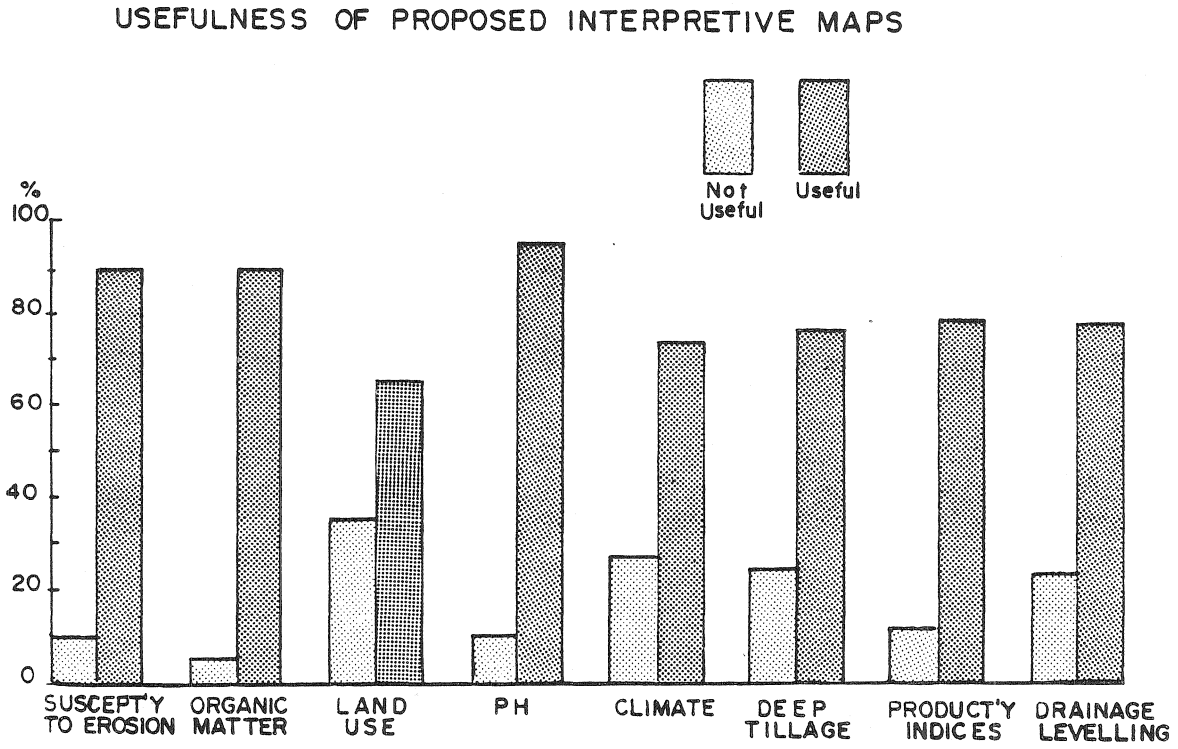

Figure 8. Distribution of response to the perceived usefulness of various interpretive maps considered for inclusion in future reports.

FUTURE DIRECTION

As indicated earlier, reports for 26 R.M.'s in the Melville area, 27 R.M.'s in the Battlefords and 4 in the Melfort area have been prepared in anticipation of publishing in this format. These publications are planned to continue for the R.M.'s in the Melfort and Wood Mountain areas, pending funding.

All data collected as part of the soil surveys in the R.M. format have been entered into an electronic data base and we are currently entering the backlog of data from the NTS Reports. We will soon be in a position to manipulate soil survey information electronically for 75% of the agricultural area. It is hoped we will also obtain the hardware and software capability to do it efficiently. Such a capability will undoubtedly have some bearing on the continuation of this R.M. format of publication.

There is also the question of regional and/or new provincial maps. There are obviously users whose domain is much more than one or two municipalities. Larger map areas are likely more suitable for them. Perhaps we will eventually print soil maps for the Melville, Battlefords and other remaining map areas combining these with a single report to cover all soils in the province. This would mean a report with 16 maps, one for each NTS Sheet, to serve the needs of these regional users.

As indicated earlier, we are constantly increasing the number of interpretive maps. There may be more to come. Recent concerns regarding organic matter content and variability as it relates to trifluralin herbicides would suggest a map showing this parameter may be justified. There is a lot of deep ripping or deep plowing underway throughout the province, often with little apparent rationale. Perhaps once we know more about the response of different soils to this practice, we can include interpretive maps on this theme. One could suggest several others.

SUMMARY

An R.M. format has been developed for soil survey publications in an attempt to increase the utility of land resource information in the province. The multi-colored, atlas-type publication for R.M.'s, or groups of 3 or 4 R.M.'s, presents general information on geology, landforms and soils as well as interpretive information on soil capability for agriculture, soil productivity, soil salinity, surface drainage and wetlands, irrigation potential, erosion potential, pH, stones, and sands and gravels. There is a preliminary report which makes this information available within one year of initiation of mapping. The positive response by the farmer to the contents and format of the final report has been encouraging. A small but strong demand is apparent for the preliminary reports. It is apparent, however, that automated data aystems may eventually displace some of the demand for these publications. Also, there are users that require printed soil maps covering larger areas than a rural municipality.

FARMER QUESTIONNAIRE

Soils maps and a report have been published and are now available for your area. We anticipate that the information in the report will meet the needs of a variety of people interested in the nature and use of soil resources. Finding out how the report is received helps us to evaluate its usefulness and to make changes to increase the utility of future reports. With your co-operation, the following questionnaire should help us in this regard. Information from all questionnaires will be treated statistically and will not be associated with any particular individual, therefore, it is not necessary to write your name on the questionnaire.

A. Different map users may have quite different needs. For this reason we require a small amount of background information.

Your occupation: _____

If you farm, indicate approximate acreages for 1986: Total Acres _____; Fallow_____; Cereal Grains_____; Oil Seeds _____; Specialty Crops_____; Pasture_____;

Approximate Number of Livestock: Cattle_____; Pigs_____; Poultry_____; Other_____;

Your Age _____.

1. How much of the report have you read?

All	3/4	1/2	1/4	None
[ ]	[ ]	[ ]	[ ]	[ ]

2. How closely did you examine the report?

Read Carefully	Read Quickly	Skimmed	Did not look at it
[ ]	[ ]	[ ]	[ ]

B. This section asks you to agree or disagree with a number of statements about the report. Please answer strictly from your own point of view.

3. The report is well organized.

strongly agree	mildly agree	mildly disagree	strongly disagree	not applicable
[ ]	[ ]	[ ]	[ ]	[ ]

4. The report is well written.

Editor's Note: For this and all other questions in this section, the respondent was given the same choices as in question 3.

5. I understand the terminology that is used in the report.

6. The photographs and diagrams help to explain the ideas being presented in the text.

7. I am able to locate particular parcels of land on the maps.

8. The introductory section on the formation of soils helped me to understand other parts of the report.

9. Soil characteristics described in the report are consistent with what I have observed about soils.

10. I prefer the size and format of this report (with maps bound) to a smaller sized report with pockets for the maps.

11. The soil map reinforces what I already know about the soils in my area.

12. I learned more about the soils in my area by reading the report and using the map.

13. The legend is relatively easy to use when looking at the soils map.

14. The color coding of the map symbols makes the soils map easier to read.

15. I will be able to use the soils map for making decisions in my work.

16. The soil descriptions provide as much information about each soil as I need to know.

17. The agricultural capability ratings seem accurate on the basis of what I know about specific areas.

18. The agricultural capability ratings are straightforward and easy to interpret.

19. The section on soil productivity discusses soil texture, soil moisture and soil fertility. I think these ideas are well explained in the text.

20. The text of the report is essential to understanding the maps.

21. In general, the report is too simple and does not help me at all.

22. In general, the report is too technical and difficult to understand.

23. The maps are too small scale (a small area on the map represents a large area on the ground) to be useful to me.

24. There may be specific soil management problems in my area that I was not aware of until reading the report.

Editor's Note: For Parts C and D, the respondent was able to indicate useful, not useful, or not applicable for each interpretive map.

C. Several maps and sections of the report are devoted to specific soil-related subjects. Please indicate whether or not you think that each of these particular sections could be useful to you in your work.

25. Agricultural Capability	26. Soil Salinity	27. Soil Productivity
28. Drainage & Wetlands	29. Stones	
30. Sands & Gravels	31. Irrigation Potential	

D. Many topics are not included in the report, but could be included in future reports. Using the same scale as above, please indicate whether or not you feel that maps and discussion of these specific topics could be useful to you in your work.

32. Susceptibility of Soils to Erosion	33. Soil Organic Matter Content	34. Present Land Use
35. Soil Acidity	36. Climate Information	37. Suitability for Improvement by Deep Tillage
38. Productivity Indices	39. Land Improvements (such as Drainage and Levelling)	

E. Assuming that the information in this report was not available to you, how much would you be prepared to pay to obtain it?

40.	$0.00	$1.00	$5.00	$10.00	$20.00	$50.00
	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

F. Please use this space to make any additional comments that you might have about the report. We are especially interested in knowing about anything that you feel is missing from the report.