PROCEEDINGS

OF THE

TENTH MEETING OF THE

CANADA SOIL SURVEY COMMITTEE

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J.H. Day

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OPENING REMARKS AND WELCOME

W.B. Mountain
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Good morning gentlemen, bonjour messieurs,

On behalf of the Department and especially of the Branch I would like to welcome you all this morning to the opening session of your Canada Soil Survey Committee meetings. I note from the program that you have four very full days ahead of you.

The Department and the Research Branch especially are very much aware of the importance of our soil resource in Canada, a non-renewable resource in some ways, and there is no doubt that its characterization, classification, definition, are all essential components in the total soil program. As Dr. Clark has said I am or will be responsible for the soil survey groups in this department and I'll say more about that in a few moments.

Je suis très heureux aussi à faire bon accueil, au nom de division de recherches, au délégues francophone. On m'a dit que la ville de Québec est en train de devenir bilingue, disant officiellement. Aujourd'hui la langue française n'est pas exactement étrangère ici, exceptement peut'être dans les ghetto qui existent surtout dans l'ouest d'Ottawa et aussi même dans certains bureaux. Pendant vos sessions ici vous pourrez parler en français si vous voulez par ce que c'est votre droit à fair ça, aussi par ce que presque tout le monde ici est bilingue. Pete est bilingue, Fergy est bilingue, McKeague est bilingue et je voudrais vous assurer que leur compétence en français est vraiment merveilleuse, je pense.

One of the things that I would like to do starting, hopefully, in September is to visit some of the soil survey units in the country. I think it is about time I did this. I know that a number of you have expressed some wish to have somebody from Ottawa come out occasionally, apart from Dr. Clark, to see what you are doing and to gain an appreciation of some of your problems. As Dr. Clark mentioned one of my objectives in this job is to try to maintain contact with professionals at least for whom I have responsibility. So in September I plan to visit the Soil Research Institute and as an extension of that I hope to begin visiting you people in the field. So I look forward to seeing you, probably I'll start in the West, I am not sure yet. I look forward very much to seeing you and to getting to know you personally. Dr. Clark, I think I have already talked more than the 10 minutes I was supposed to and I think you have more important things to do than to listen to me carry on so I am going to turn the meeting over to you.

Introduction of New Members and Opening Remarks

J.S. Clark

Before we go on I would like to welcome a number of new members to the Canada Soil Survey Committee. It was our intention to restrict this meeting to a specific and definite planning session. But because of changes in personnel there are a lot of new faces, some visiting speakers and other guests. The first one is Mr. Williams, who is with the Newfoundland Department of Agriculture and Forestry. This is a welcome sign because this reflects the growing interest that Newfoundland is putting into soils activity with a fairly large expansion in that staff. In the next group we have a group of geologists, starting with Dr. MacDonald. Dr. MacDonald is in charge of the environmental social program with the Geological Survey. And for this session two other members of the Geological Survey here, Tony Boydell and Bob Fulton have joined our deliberations. Dr. Fulton has attended a number of CSSC meetings so I think most of you know him very well. Dr. Pat Duffy who is also here has been a member of the Canada Soil Survey Committee for a number of years but when he moved into the astral ranks he abandoned us. I am glad he is back for a visit. The present representation of the Lands Directorate in the Canada Soil Survey Committee, Mike Romaine, is one of our speakers this morning. Mr. John Howden of the Manitoba Department of Agriculture is now representing the Province of Manitoba. Mr. Ghanem who is with the New Brunswick Department of Agriculture has also joined us and we are pleased to see him here. From the coordinating staff we have Dr. Ron Halstead and Dr. Wilf Ferguson. Dr. Halstead will probably be assuming responsibility for coordination of soil survey and land resources program in the Research Branch. Dr. Ferguson also from Research Branch Coordination in Fertility and Management is here to observe and participate in our committee proceedings. And, anticipating what we hope will be the development of a Soils Institute in the province of Quebec, I would like to welcome Professor Bourbeau, Head of the Department of Soil Science at the University of Laval. Paul Skydt is with Parks Branch of the Department of Indian and Northern Affairs and has an interest in recreation and recreation planning. We have also Dr. Herman Dirschl of the Environmental Social Program who has done a great deal of work in the north and coordinated many of the programs here. Both Mr. Skydt and Dr. Dirschl are here as guest speakers in the program.

Development of Objectives for Soil Survey

J.S. Clark

As you can see from the agenda the purpose of this CSSC meeting is to develop goals and objectives for the soil survey program in Canada. This is a timely exercise for several reasons. The first is that until recently, it seems to me, Canada was regarded as a country with unlimited land resources awaiting exploitation. It is now suddenly realized that the productive land resources, and particularly the amount of "agricultural land" in Canada, is limited, and there is concern for the loss of farmland to urban sprawl. The preservation of ecological balance has become an accepted requirement for all new resource development programs. These changed attitudes have led to the development of land policies in many provinces and there is little question that a national land policy will be established soon. Land resource planning and management is a concern of every level of government. The soil survey program must adapt to meet these new needs and challenges.

The second reason is that the extensive soil and soil inventory program fostered by the Canada Land Inventory has essentially been completed. This broad inventory has been the basis of the overall planning and use designation of land. More detailed information is now needed for specific planning purposes and much of Canada has not yet been surveyed. The questions to which we should address ourselves are, what kinds of surveys are required to meet these new needs, and where soil survey efforts should be directed.

During the period of the expanded land inventory, the regular soil survey program was expanded into the non-agricultural areas of the country. Because of the demonstrated usefulness of soil survey information for forest management, recreational planning, ecological impact evaluation, urban planning, and other non-agricultural purposes, a large proportion of the national soil survey effort is now directed to "nonagricultural" purposes. These relatively new directions for soil survey work require that we make some important decisions about our program: What are our priorities and what kinds of surveys and survey information should be included to meet these "new" applications of survey. It is extremely important in my view to make sure that we put our soil survey information out in a way that it can be readily understood and applied by relatively inexperienced users. If we do this I am sure that the demand for soil survey information will expand enormously.

Soil surveys have traditionally been carried out as a cooperative program involving the federal government, the provinces and the universities. The strength of soil survey has been our ability to arrive at common approaches, uniform systems and closely coordinated field programs. As we develop a soil survey strategy for the next few years it is important that this integration of programs should continue. The CSSC, as the coordinating body for soil survey, must adapt to meet present day needs.

During the next few days I hope we can go on to develop a coordinated national soil survey program as a framework in which the various agencies participating in soil survey work can establish their own activities. This kind of exercise is an important one to ensure the most effective use of manpower and other resources available for soil survey. A well developed, coordinated, and fully articulated soil survey program is the best way to ensure continuing and, if necessary expanded, support for soil survey.

What I hope we can do in the next few days is, first of all, explore the needs for soil survey work, then define priorities on a regional basis and finally to structure programs to achieve the priority requirements. Within the federal service this has to be done within the structure of management by objectives, with objectives, goals and programs that are relatively precisely defined. The fourth day of this meeting will be devoted to the development of programs for the federal survey group. At first we were going to keep these as a closed session but at the request of certain provincial units it has been decided to hold an open session to allow provincial input into the development of the federal survey program.

To start this session we are going to have a number of speakers who will outline the needs for soil survey work for a variety of purposes ranging from arctic environmental impact assessments to urban planning. These speakers will also, I hope, tell us how we can apply the discipline of soil survey, and also tell us our shortcomings, and how we might improve soil survey to meet their particular needs.

Soil Survey and Land Planning

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I Introduction

In the past and in general soil surveys have served us well. The resulting data and expertise gained from soil survey programs have provided:

1. Information which has been directly incorporated into the more traditional programs related to agricultural crops and soil management practices.

2. Information which indirectly has served as a spring board for developing and launching other programs, projects and approaches such as; the Canada Land Inventory program, follow-up pilot land use planning projects; and the more recently developed and more complex classification systems such as the Biophysical Land Classification system.

From a users point of view, the most notable use of soil survey information over the past decade can probably be related to the Canada Land Inventory program. Here, the use of existing soil survey information as well as the underlying soil classification system provided a framework for not only launching capability inventory programs, but also and probably more importantly provided the means for devising the soil capability for agriculture and forestry classification systems. Also, in the actual implementation of these two sectors inventory programs, soil survey data, where available served as the basis for field sampling, data collection and resulting capability interpretations and ratings.

Subsequent to the Canada Land Inventory program, soil surveys have continued to play a valuable role in providing basic information upon which to conduct land use planning and land use zoning programs and projects.

In the past, the main role of such programs as the Canada Land Inventory program, and indeed soil surveys were to provide an assessment of the ability of lands to produce goods and services from selected renewable resources.

II Present Requirements

Today, the demand for land, its use and location has shifted in respect to the following:

1. Much of our interest is now directed to the northern part of Canada. In these northern areas we are more concerned with the development of our nonrenewable resources. Due to overriding climatic limitations, our interest in developing renewable resources is secondary - with some significant exceptions such as hydroelectric potential.

2. Due to our present state of environmental awareness we are now concerned about all aspects of the environment, many components of which may be classified as intangibles and for which we are presently lacking baseline data.

3. In the settled portions of Canada, such as urban fringe areas, concern is with a number of parameters in addition to those that are related solely to productivity. Hence information is required on the lands' suitability or nonsuitability for a range of uses. Many of the urban-orientated demands on land are spatial in nature and are more related to the surface qualities of the land than the inherent ability of the soils.

The above three situations have placed us in a difficult position. The short term solution to these problems appears to lie in the recent requirement for environmental assessments to be made on any federally supported or federally approved projects which have significant environmental impacts. In the long run, it is hoped that environmental assessment reviews of major development programs can be done in conjunction with or proceeded by comprehensive land use planning and resource management policies and programs. Major steps are now being taken in this direction, as witnessed by the setting up of requirements for environmental assessments and recent initiatives taken in regards to exploring national policies on land and water use.

In a very general way, the above discussion provides the scope for present and future requirements of base data. It also underlines the difficulty of zeroing in on the specific role that one discipline or agency should play in future programs.

III The Future Direction of Soil Surveys

In order to accommodate the above demands for base information it will be necessary to collect and present data at a range of levels of detail.

1. "Broad Brush" surveys. Base information at a highly generalized level may be required for extensive areas of northern Canada over the next five year period. Present and proposed developments in all seven provinces and the two territories that have northern areas extending beyond the northern most limits of the Canada Land

Inventory boundary are witness to this. Such baseline inventories must be integrated and comprehensive in terms of scope, coverage and approach, if the resulting information is to be used in:

a) applying broad land use policies and regulations within an ecological framework,

b) identifying and selecting broad transportation corridors,

c) identifying the range of diversity to be encountered within these units, thus assisting in the planning phase of follow-up field study design,

d) providing a framework within which to incorporate existing information collected from previous survey endeavours.

2. Reconnaissance Surveys. Base information at a reconnaissance level of detail, i.e., 1:125,000 - 1:250,000 will be required if provinces and territories are to carry out regional land use planning and resource allocation studies and programs. Such surveys while still cursory, must be comprehensive, and must be completed within a short time frame.

In such instances, soil surveys as must other surveys, be in a form that is complementary to other inventory systems, in respect to scale and information detail. For these northern areas, soil surveys must classify and map those parameters that are specific to the problem at hand. That is, such surveys must be purpose orientated.

3. Detailed or Site Specific Information. Detailed investigations i.e., (1:10,000 - 1:60,000) will be required throughout Canada for purposes such as the mile by mile assessment of a pipeline, the identification of site specific areas for processing plants, urban developments or the management of specific areas of land. Such detailed investigations will also require basic and supplemental information on the land, climate and water resources. At present, there are a host of information gaps in respect to how soils perform or respond quantitatively to various land use practices.

IV Future Soil Survey Endeavours and Programs

1. It is proposed that the Canada Soil Survey Committee should consider the formation of a northern soils subcommittee. Such a committee should be composed of pedologists and other resource discipline specialists who have worked in and are familiar with the problems of mapping in the north. The purpose of this subcommittee could be:

a) To review the relevancy and use of existing soil survey information that has been collected in the north.

b) To identify information gaps and to recommend future research requirements and investigations into such aspects as: i) the interrelationship between soil texture, depth, vegetative cover, and thermal regime. ii) the feasibility of mapping soils as to their revegetation potential, species adaptability and sensitivity to surface disturbance.

c) On the basis of the above to review the adequacy of the soil survey classification system to meet these needs.

2. Due to the variety of resource developments and land use planning programs being taken across the country, it is very difficult to determine the specific future role or direction that the Canada Soil Survey should be taking. One thing is clear however, and that is that future programs must be developed in conjunction with other federal and provincial agencies. In order to determine the scope and priorities for future programs, it is proposed that the next step to follow up on this meeting would be to carry out regional workshops with the purpose of identifying the future role and requirements for soil survey programs in relation to land planning needs.

Discussion

Duffy to Romaine - Refering to new government requirement for environmental impact assessment, what reference could be cited to explain what government wants to achieve? In what way could the public participate? Soil surveyors are accustomed to relating their information directly to the public, but they may soon be forced to serve as expert witnesses in courts and before boards of enquiry on projects of major significance. It would be helpful here to touch on that aspect of public participation.

Romaine - I have never been involved in workings of the Environmental Impact assessment, I am not aware of documentation other than that you mentioned.

Shields to Romaine - I am encouraged that Romaine suggests a northern soil subcommittee of CSSC that would involve correlation and coordination. Would this cause any conflicts with activities of Department of Environment?

Romaine - At the moment we have no national group that looks at surveys as a whole nor do we have anybody that looks at soils. There is no conflict. Perhaps such a committee could be part of a larger group, or it may serve as a basis for a group whose composition we would have to consider.

Dumanski to Romaine - Within the northern surveys you said that soil information should be both comprehensive and general. Would you please expand on that.

Romaine - I indicated that surveys had to be comprehensive, they had to cover all the concerns in the north, i.e., endangered species, among all other subject areas. In terms of being cursory, it depends on the project. We may wish to identify key parameters or environmental components.

Soil Survey and Agriculture

R.A. Hedlin

In most, if not all, provinces of Canada soil surveys were initiated by one or more of three agencies, namely, agricultural colleges, federal and provincial departments of agriculture. Soil surveys continue to be funded largely by agricultural agencies despite the fact that many uses of soil survey information have been recognized that have little or no relationship to agriculture. Emphasis on these other uses of soil survey information has diverted the attention of soil survey units from agricultural lands even though there is a good deal of soil survey work to do that relates to agriculture.

In trying to put together some ideas I have talked to people from several but not from all provinces. I hope that this has enabled me to identify the major areas in which work is required. Certainly there was a remarkable similarity of opinions among those polled. The major needs and problems seem to be:

1. A resurvey of areas where existing reports are out of print. Much of the information in the old reports is still useful but in general it is of insufficient detail and may lack the accuracy required, particularly if agriculture has intensified since the initial surveys were completed 30 or 40 years ago. Hence resurveys are required. These will be in varying degrees of detail depending on intensity of agriculture. I hesitate to say how much land needs to be resurveyed but expect that most provinces will do well if they complete resurveys as rapidly as reports go out of print.

   I do not foresee any major new directions in the conduct of soil surveys or the preparation of the traditional soil survey reports. Perhaps the increased use of remote sensing will enable soil surveyors to include more information, increase accuracy and perhaps reduce the amount of time spent in the field. In many areas the original reconnaissance surveys were based on virgin soil profiles. Where cultivation has significantly altered the nature of the profile, e.g., where erosion has been severe, this should be considered in resurveys.

   There is a need for reports other than the traditional ones, particularly for educational purposes. These should be less detailed and less technical than the traditional ones.

2. There is a need for more interpretive work to relate mapped units to agricultural suitability and more particularly to soil productivity. While this need was widely expressed and whereas soil surveyors will have to be involved they will need the assistance of those engaged in soil fertility, soil physics and agrometeorology.

Assessments of soil productivity vary a good deal depending on crops grown and type of agriculture. For example, most farmers have a less accurate assessment of production from hay and pasture than from grain crops. Hence it is usually easier to get information on productivity of land for grain. Where agriculture is extensive in nature fields will normally constitute more than one soil mapping unit. Even if acre yields are known these may not be easily related to a particular mapping unit.

In obtaining the necessary yield data two general approaches come to mind. The first is collection of farm yield data by soil type. This is most likely to be useful where data are obtained from fields where a reasonable assessment of inputs is possible. In Manitoba we are obtaining a good deal of such information through our soil testing laboratory from farmers who use the service regularly. No doubt the same is true of other provinces. Another source of such information is the various crop insurance agencies.

The second approach is the collection and analysis of data from research plots. Dr. Racz (with assistance from Dr. Shaykewich) is engaged in a study in which the yield of wheat and barley are being related to soil and fertilizer nitrogen, water supply and degree days. These variables account for about 80 per cent of the yield of barley and 70 per cent of the yield of wheat. To date they do not have sufficient sites to relate yields to soil type but their approach offers promise. It is very slow and costly to obtain a significant body of information in this way.

One more comment with respect to ratings for productivity. To date work has been restricted mainly to cash crops. There is a need to extend ratings to pasture and hay crops.

3. There is a very large area of organic soils in Canada. In most parts of the country these have not been developed for agriculture although where climate is suitable they represent a potential agricultural resource. I expect we shall wee increased emphasis on the classification and productivity ratings of organic soils in the next five years. For example, in Manitoba we have recently been asked to do a resurvey of an area of organic soils, part of which has been developed for agriculture, and to provide information on its management.

4. Rate at which work will proceed will be dictated by support provided and by the importance attached to competing needs for soil survey information. Since soil survey information is used to a large degree by government agencies, decisions regarding priorities are in a considerable degree political. As a result priorities are subject to rapid changes. However, as mentioned earlier, it is doubtful that in the next five years resurveys of agricultural land are likely to proceed more rapidly than the rate at which new needs develop.

Discussion

Day - Perhaps we could make gains in integrating surveys in southern cultivated areas by having a greater input by agronomists, hydrologists and other specialists in the course of conducting regular surveys. How could we accomplish this Dr. Hedlin?

Hedlin - We have a fairly good working relationship with agronomists in particular. If you don't have such an arrangement I don't know how you impose it. One of the big problems is that mapped soil units are different often from the cropping units. I don't know how soil survey is to meet the needs of others such as hydrologists.

Soil Survey and Urban Planning

J.D. Lindsay

The use of soil surveys in urban planning is not new and appears to be expanding as planners become more familiar with soil maps and recognize their potential as one input into the planning process.

In 1972 Simonson of the USDA reported that soil surveys for urban development were being conducted around the periphery of 100 cities in the United States. At the same time such surveys have been reported from Adelaide, Australia and Rotterdam and Amsterdam in the Netherlands.

This trend, coupled with the fact that demographers are projecting that by the year 2000 some 90% of North Americans will be living in an urban environment, suggests that competition for land around settled areas is and will continue to be a fact of life. The optimum or best use of this land therefore is an important consideration to which the survey can turn attention.

Planning in Alberta is carried out by seven regional planning commissions. These commissions are involved in two types of planning which might be descr bed as regional and local.

The regional planning covers relatively large areas; in the case of Calgary regional planning commission the area within its jurisdiction covers about 10,000 square miles. Such regional planning is designed to compile existing land use information, project the potential demand for each of the major land use categories and generally ascertain the ability of the natural resource base to support land use development.

Local planning, on the other hand, usually involves subdivision of land for residential, industrial or country residence development where the size of the development may range from a 50 foot lot to parcels of 3 acres or more.

These two types of planning obviously suggest that soil mapping at different scales is required. For regional planning our reconnaissance type survey at a scale of 1:126,000 probably satisfies the needs of planners although I am sure they would be pleased to have the information at a scale of 1:50,000 or 1:15,000 if it was available.

For local planning it is becoming more and more obvious that the reconnaissance soil survey is simply of limited value where an area of a quarter section or less is involved. For example, CLI soil capability maps are being used extensively by planners, but we were recently asked to break down a $2^{7}_{t}4\overset{2}{\underset{t}{m}}O^{1}$ area, that covered 8,300 acres,

so that the planner would have a better idea as to where the Class 2 land was located with respect to the Class 4 and the Organic area. Developers are compelled to submit their plans at a scale of 1" = 200 feet

(1:2,400), therefore for maximum usefulness soil maps and interpretative maps of necessity must be of much larger scale than the conventional recommaissance scale.

Another important but perplexing problem associated with soil mapping for urban development is that of the map legend. It is not too difficult, with our present classification system, to compile a complicated map legend even for a small area. Such legends tend to be beyond the understanding of most planners, simply because they are not soil classifiers.

I think the matter of map scales and mapping units for urban development soil surveys is one area that the Canada Soil Survey through its correlators should be examining with a view to establishing some national standards or guidelines.

Some soil properties stand out as being more important to urban development than others. One of major significance is soil drainage. Obviously the costs of construction in poorly drained areas is considerably higher than in well or moderately well drained areas because of the need to implement such practices as adding fill, using piles, installing storm sewers and drainage ditches. As an example of the importance attached to soil drainage by planners, I might cite an experience we had in Alberta where we mapped an area adjacent to one of the cities in 1971 and indicated a fairly high percentage of Gleysolic soils. I think this basically confirmed the suspicions of the planners that the area was somewhat poorly drained but it did not indicate the depth to a presumably high seasonal water table. Subsequently, we were asked to install a series of 14 observation wells to a depth of 20 or 30 feet and to monitor the water table levels for a 12 month period. The observations indicated that the average depth to the water table was about 5 to 6 feet, well within house basement depth. Partly on the basis of this information the city administration undertook a major program of installing interceptor drainage ditches and storm sewers around and within the area. My point here is that perhaps in urban development studies we may have to carry out work past simply mapping the area and attempt to obtain additional information that may be significant to the development of the area.

Another soil property important to planning is soluble salt content, or more specifically soil sulfate content as it affects plant growth and concrete erosion. Some of the earliest corrosion studies in Canada were carried out in about 1927 by Thorvaldson at the University of Saskatchewan. Yet, I wonder how much attention has been given to this problem by soil scientists of our group over the years. Does the occurrence of Solonetzic soils necessarily mean a corrosion problem may develop? Where and on what soils does corrosion occur to the point that it is a problem? Does corrosion only occur in Solonetzic soils characterized by a seasonally high water table? Corrosion also occurs in wet soils and perhaps we should be carrying out resistivity measurements in order to characterize our mapping units in this regard.

By and large, more emphasis should perhaps be placed on the physical analyses of soils rather than chemical. The analyses most commonly reported include field moisture percentage, liquid limit, plasticity index, grain size, mechanical analysis, optimum moisture, maximum dry density, and the Unified and AASHO classifications. From such information interpretations with respect to soil limitations for certain uses can be made. It goes without saying, however, that this information has its limitations and will not eliminate on-site-testing for specific structures. The fact that soil inspections by survey are restricted to a depth of 5 or 6 feet does place a limitation on the extent to which the information can be applied.

One of the most commonly posed questions these days seems to be in regard to the suitability of a particular soil for septic tank operation. In general, it would appear that the conventional auger hole percolation test for evaluating soils for septic tank operation leaves something to be desired in terms of duplication of results. Certainly, research is required in this area. It has been suggested that a more reliable method would be to use the soil map for evaluating the site potential for septic operation. Such an approach would involve the assessment of septic tank operation on the different mapped soils in order to determine on which soils the systems are successful and on which soils failures are common.

A comparatively new approach that requires research involves the use of computers to derive interpretative maps with a view to rating various soil areas for specific uses. Some of this work has been initiated and should be expanded. Such an approach to interpretation, however, will require consultation between the fieldman and the computer expert.

In summary, I would like to suggest that the Canada Soil Survey assign a fairly high priority to a program of soil survey for urban development. I think we can make an important contribution to the planning process and at the same time provide information that will help reconcile a major confrontation between urban development and the preservation of land for future agricultural production.

To avoid frustration, however, it should be kept in mind that soil is only one factor considered in determining the location of new urban development areas. Other factors include location relative to present settlement, location of existing utilities, roadways or highways, and land costs. These economic factors occupy a dominant position in so far as land acquisition is concerned at the present time.

Discussion

Wilson to Lindsay - Lindsay spoke of investigating soils to depth of five to six feet, is it the intention of all soil surveyors to get down to that depth at all sites?

Lindsay - In Alberta the deeper investigations are being handled primarily by environmental geologists in their drilling programs. We don't wish to duplicate these efforts.

McKeague - Water table levels often are inferred by gleying, it is also common practise to measure conductivity of saturation extracts. Why is this not sufficient for prediction of sulfate corrosion of concrete?

Lindsay - In concrete corrosion, water as well as salts are involved. Dry saline soils may not attack concrete. Does solonetzic soil necessarily mean corrosion or do you require a water table plus Solonetz soil?

Soil Survey and Environmental Impact Studies

Dr. Barrie C. McDonald
Terrain Sciences Division
Geological Survey of Canada, Ottawa

I have been asked to comment on two things: (a) the approach of the Terrain Sciences Division of the Geological Survey of Canada to environmental impact studies, and (b) how I perceive the interrelationship of the Geological Survey and the Soil Survey.

The importance of interagency cooperation and coordination in the overall approach to environmental problems should be strongly emphasized at the outset. In the broader content of environmental concerns, it is possible to view the disciplinary interests as parts of a hierarchical chain. The soil unit (pedological sense) is developed on parent materials. In turn, vegetation is developed on the soil, and the faunal elements depend upon this vegetation.

The basic objective of the Terrain Sciences Division is to analyze the terrain in terms of (a) the distribution and complete description of the static terrain elements that make up the land surface and the materials immediately underlying it, whether bedrock or unconsolidated material (organic or inorganic). This includes placing the materials in a stratigraphic framework that leads in turn to a genetic model. It also includes the provision of geotechnical descriptive data for the terrain elements; (b) the dynamic processes, their rates and types currently influencing the form, distribution, and nature of the surface materials; and (c) the reaction of terrain elements to various imposed stresses. The Terrain Sciences Division provides a geologically based fund of centralized knowledge on the terrain in order to promote effective use of the terrain, to identify and understand natural hazards and to facilitate maintenance and restoration of the physical environment.

Our work is multipurposed. For example, we have a responsibility (a) to provide an inventory of nonrenewable resources in the surface materials; (b) to provide information on environmental aspects of national mineral and energy policies (for example, related to open-pit mining of coal, or to radioactive waste disposal and perhaps its future recovery as a resource); and (c) to provide geologically based information on terrain hazards and on terrain reaction to various imposes stresses in order to promote effective use of the terrain.

The term environmental impact can be interpreted in many different ways. Our principal concern in this area is the reaction of the terrain to various stresses that may be imposed on it by man. Environmental concerns generate a need for various types of geological and geotechnical information:

1. Baseline data: A terrain analysis of the static conditions and dynamic attributes in a predevelopment state, against which future changes may be predicted and measured;

2. Case histories: A documentation of change that has resulted from an imposed stress; and

3. Quantitative models: Based on a quantitative understanding of the physical system and the interrelationships of its variables, in order to forecast or predict change that will result from a given stress. Quantitative modelling is a developing area and one in which considerable research effort is still required.

In performing this analysis we have concentrated on methods that are not site specific. Rather the terrain units are sampled in such a way as to generate a "model" of the terrain. Adequate sampling leads to adequate characterization of each unit of the terrain in terms of its geologic and geotechnical properties. This information requirement has led to a staff comprised mostly of geologists, geographers, engineers, paleoecologists, and physicists.

Most of you are aware of the types of information we seek and many of you have participated with us in its collection. The basic document generated is commonly a regional map of surficial geology and landforms from which various thematic maps can be derived. A good example is the work in the Mackenzie Valley Transportation Corridor where maps of terrain sensitivity and slope stability have been derived in large measure from the mapping and analysis of surface materials, supplemented by specialized thermal and engineering studies. The program has had the considerable benefit of soils and vegetation mapping as many of you know and to which many of you contributed. The Mackenzie Highway Assessment exercise has resulted in a considerable and detailed environmental input on a mile by mile basis. This exercise may soon be followed by a similar exercise on a mile by mile basis for the Mackenzie Valley pipeline. The Mackenzie Valley experience may be just the beginning in terms of similar exercises in the north.

A somewhat similar effort on the part of the federal government is now being considered for the eastern Arctic in preparation for a gas pipeline which may soon link gas reserves in the Arctic Islands to southern markets. The pipeline would come southward either on the west or the east side of Hudson Bay. There is a considerable liklihood that associated construction of deepwater ports and railroads on the chosen side of Hudson Bay will result in considerable regional development.

Considerable effort is being directed toward environmental and engineering problems in urban areas. A computerized bank of data has been assembled that contains all available geological and geotechnical data from boreholes in more than thirty of the largest Canadian urban centres. The National Capital Region has been selected for a prototype study of regional geological and geotechnical characteristics. This study, using data from the bank and supplementing it with field observations, is almost complete and will be presented in the form of an Urban Earth

Science Atlas for the area. Similar atlases are being prepared for other urban areas represented in the bank. The hope is that the data banks will be kept up to date and that they and the atlases will be basic documents useful in regional planning.

Other examples where geologic mapping has had a direct input into environmental studies are (a) the geological and geotechnical studies in southern Alberta where strip mining of coal has presented problems of slope stability and land reclamation; and (b) terrain stability problems of the sensitive marine clay of the Ottawa-St. Lawrence Lowland.

Finally, it is possible to outline some major requirements in the next 5 to 10 years that relate to the capabilities of soil survey organizations:

1. Regional resource inventories at scales of 1:250,000 or 1:125,000 in the boreal forest zone and in tundra areas of the Northwest Territories. These would be in support of land-mass management problems related to regional development projects;

2. The influence of thermal regime on physical weathering, soil chemistry, and soil development. The Geological Survey has a very active program of drift prospecting, i.e., using the chemical and mineralogical attributes of glacial deposits to aid in the search for new mineral deposits. An understanding of weathering and soil development processes, particularly in Arctic regions, would greatly enhance the chances for success in this program;

3. Problems of revegetation on mine tailings or over extensive areas in which top soil has been destroyed by operations related to construction of transportation systems or to other forms of resource development. The objective of revegetation could be physical stabilization of the terrain, re-establishment of the thermal insulating layer over frozen ground, or restoration of the terrain for recreational purposes;

4. Co-ordination in the area of engineering behaviour of surface materials related to soil erosion problems, soil moisture studies, and parameters related to excavation and foundation potential;

5. Contribution to the analysis of environmentally important parameters in urban areas; and

6. Co-ordination with geological and botanical specialists in investigation of the application of ERTS data to regional inventory of surface materials.

Soils Survey and Recreational Planning

Paul E. Skydt
Applied Research Division
National Parks Branch
Parks Canada

In opening, I would like to thank the Canada Soil Survey Committee for being given the opportunity to participate in this annual meeting, and to present my thoughts on soil surveys for recreational planning.

This topic is extremely broad in scope and since time is limited and my interests are primarily related to recreational planning in National Parks, I will restrict my comments to that aspect.

Planning for recreational use in National Parks does not carry the same connotation as is thought by most people. It refers to those activities and uses which are compatible with nature and produce minimal impact on the environment. Master planning as it is referred to, actually implies a total planning process which considers and encompasses the theme of a park, the physical development concept, projected visitor use, the interpretation of the resource base to the visitor and the resource preservation and management.

Requirements

Therefore, bearing these elements in mind, I foresee soil surveys firstly providing basic inventory information by:

1) describing and mapping the soil types and their distribution, using terminology and symbolism comprehendable to all professions;

2) documenting the processes responsible for the formation of the various soils as well as the changing dynamics taking place;

3) documenting not only the chemical and physical components, but just as important, the biological component;

4) flagging the "representativeness" or "uniqueness" of the various soil types in the park, region or even nation to ensure present and future preservation for scientific and educational purposes;

5) interpreting the soils to the public for educational purposes to make them aware of the importance of this resource, its characteristics and dynamics.

In mapping soils, the scale employed will depend on the size of the park in question. Generally, 1:25,000 is useful for small- to medium-sized parks from 50 to 600 square miles, whereas in those greater than this, 1:50,000 is adequate.

The biological component has long been absent from soil surveys; this to me is a very serious gap which prevents one from having a fundamental understanding of the dynamic system which is responsible for energy and nutrient supply, degradation and recycling. Greater emphasis must be put on "soil biology".

As an organization, the Soil Research Institute should be concerned with setting aside for future reference and study, representative and unique soils across Canada. An excellent example of this is the very limited areas on the Great Plains where virgin prairie sod still remains. In addition to the preservation mandate just mentioned, I feel that your institute has an educational responsibility to the public. Little has been done to interpret the soils to the public, as is done for wildlife, geology, etc. The average Canadian, except perhaps for certain sectors of the agricultural community, thinks of soil as nothing more than plain "dirt". There is a great need to interpret the evolution of soils from the past to the present, especially in Canada where we depend so strongly on this resource.

In addition to fulfilling a basic inventory need, soil surveys should also provide the necessary data essential in sound and accurate planning of physical development of facilities (service buildings, campgrounds, day-use areas, etc.), transportation routes (roads, trails, etc.), and preservation and management of the resource base as related to visitor use. In this regard we require:

1) a thorough documentation of the physical, chemical and biological parameters important to making successful value judgements with reference to the above. Here I refer to such parameters as drainage, texture, parent material, depth to bedrock, slope, compressive strength, water-holding capacity, pH, carbonates, phosphates, nitrates, iron, organic matter content, decomposition rates, primary and secondary decomposers responsible for mechanical and degradation and nutrient recycling, etc.

2) evaluations related to capability and limitations on such aspects as: engineering characteristics and foundation strength; productivity or fertility not related to crop production or timber harvest but rather to natural vegetative growth; erosion, considering active as well as potential, natural versus man-induced.

3) a thorough review and analysis of the various soils by the pedologist to flag specific types requiring preservation and management, but furthermore we need recommendations as to what steps should be undertaken to achieve this task.

Priorities

In reviewing the previous requirements, I see the following priorities:

1) soil scientists must immediately start exploring ways and means of including the biological component into soil surveys in order to properly document the soil as a living system. Future management of this resource must also consider ecological or as near to natural manipulation rather than mechanical or artifical methods presently employed.

2) attention should be focused on "interpreting" to other scientists and layman the meaning of soils information related to development planning and use as well as management.

3) the formation of a body to periodically review and update the Canadian System for Soil Classification, thus keeping up with the ever changing scope of criteria and definitions employed and the advances in soil science technology and related fields. The revisions foreseen through CanSIS is a tremendous step in this direction;

4) the acquisition of soils information should be structured and planned so as to be part of a total integrated resource inventory program, rather than a separate undertaking.

Approach

In examing alternative approaches useful for carrying out soil surveys, the only practical, economic, and rapid method is by employing a multi-disciplinary team. This allows for the gathering of information in a logical and sequential fashion avoiding duplication of effort and maximizing on field time while minimizing on expenses. The description and mapping of the geologic/geomorphologic features and processes facilitates further documentation of existing landform types with the related soil and vegetation patterns. In this way, data acquisition is always cumulative rather redundant.

With the use of orthophotography and new and innovative remote-sensing tools, soil surveys will more accurately tell us what is on the ground; but just as imperative, they will facilitate a more accurate transfer of information onto maps.

What Soil Surveys Are Required

In assessing our needs, it is clear that soil surveys will be required over the next five years, especially since less than 1/3 of all national parks have adequate soils information. We foresee more involvement from your regional offices, if they become more attuned to our inventory needs, methodology and time frame requirements. It is very conceivable that what will be required on the Soil Research

Institute's part is greater flexibility in manpower movement and willingness of pedologists to be part of a multidisciplinary team approach.

Discussion

Acton to Skydt - Paul spoke of soil surveys for recreational planning and I wonder if he went beyond that to land resource inventories. Does Paul want more biological component as an aspect of soil survey or as a component of a broader land survey?

Skydt - I did intend to say "land resource surveys" with reference to the biological component. I meant that there is a lack of biological phenomena registered to the soil base, e.g., the primary and secondary decomposers of organic materials in the soil.

Nowland to Skydt - What requirement do you see for soil survey to provide information on soil genesis in recreation planning, what was your basis for saying this, was it for education of park visitors?

Skydt - Yes, this information would be for education of park visitors.

Organizing For Interagency Inventory Programs In The Canadian North

H. J. Dirschl
Environmental-Social Program, Northern Pipelines
Task Force on Northern Oil Development
Dept. Indian and Northern Affairs, Ottawa

In the quest for energy, the northern portions of the provinces and the northern territories, i.e., the regions beyond coverage by the Canada Land Inventory, have in recent years become the site for massive proposed or actual development projects. Some of these are among the largest and costliest engineering projects ever planned in Canada, e.g., the gas pipelines from the Arctic Islands and from Prudhoe Bay and the Mackenzie Delta or the Athabasca Tar Sands development. As well as possessing a vast potential for energy production, such projects will cause significant modifications to the existing biophysical and social systems. It thus becomes urgent for responsible governmental agencies to put themselves into a position where they can properly assess the probable environmental, social and resource use implications of these ventures.

Experience with the Mackenzie Valley pipeline program has shown that a comprehensive research program has to be undertaken before the environmental, engineering, social and resource use parameters are sufficiently understood to enable such an assessment. It has also pointed out that the complex interactions and interdependencies that exist within ecosystems should be emphasized by the study program and that this would be best achieved through close interdisciplinary and interagency cooperation in the planning, data collecting and interpretive phases of the work. Close integration not only ensures that all the important parameters are included in the program, but also has the added benefit of producing teams of experts who will be immediately available to Government in order to assess applications from Industry in terms of the whole complex of environmental, social and resource use interactions.

Traditionally, the more usual alternative has been for scientists to work independently within their own discipline and to originate separate products. Because these products have been generated independently, major inconsistencies may subsequently be found when it becomes necessary to relate various single-subject areas with each other, and therefore they may be less than satisfactory for decision-making.

Effective land use planning and management requires an objective means of making the following value ratings on a geographic basis:

1) Identification, within the total region, of areas of contrasting character or significance as components of the natural system;

2) Identification and classification of areas of differing values to man in carrying out land resource development; and

3) Rating of each mapped area in terms of its reaction to use by man and the effect of such use on the natural system.

These geographic identifications and ratings can be best obtained as a derived product from a landscape classification and mapping system which integrates the relevant components of the natural system. Such a system of mapping must therefore incorporate, evaluate and portray the following components of the natural system:

1) The land surface (materials and landforms) and the processes that are active in it;

2) The relationships of water to the land (surface and ground water);

3) Vegetation distribution, its relationships to the landscape, and its reaction to changes in the land; and

4) Wildlife distribution and its relationships to vegetation, water and land.

The resultant integrated maps subsequently provide a base from which, in conjunction with supplementary data, interpretive maps can be derived to portray the following ratings and thus to provide a basis for the value ratings outlined above:

1) Land performance suitability for engineering development (from integrated mapping system + geotechnical data);

2) Terrain sensitivity to natural and manmade disturbance (from integrated mapping system + case histories);

3) Land capability for wildlife (from integrated mapping system + additional information from wildlife distribution and population surveys);

4) Land capability for other renewable resources (from integrated mapping system + relevant resource data);

5) Esthetic considerations; outdoor recreational potential (from integrated mapping systems + additional map and airphoto interpretation).

Although supplementary data are required to generate these derived maps, the nature of the final product is principally determined by input from the integrated mapping system. Interpretive maps derived from traditional sector surveys (such as soil maps) yield acceptable value ratings in that narrow sense but these ratings may be quite inconsistent when one topic is compared with another.

There are two basic obstacles that stand in the way of moving from the prevalent sector surveys to an integrated approach for land inventory surveys in the North. These are:

1) to ensure effective team work among groups of scientists from disciplines such as geology, pedology and plant ecology;

2) to achieve this team work within (or despite) the existing institutional framework.

Achieving a satisfactory degree of teamwork among a multidisciplinary group obviously depends on the individuals involved to closely cooperate and learn from each other. Some people, obviously, are more willing to do so than others and, therefore, personal compatibility has to be considered in forming field teams. However, disregarding personality problems, the common task of trying to understand the functional relationships of a landscape should bring about joint team work.

A greater problem, in my opinion, is the need to achieve close cooperation among present institutions whose administrative priorities and cherished traditions tend to be upset by such multidisciplinary efforts. Lip service is readily given to the desirability of cooperative and integrated multidisciplinary investigations, and many technical discussions and seminars regarding biophysical land classifications have been held over the last decade. However there has been little action within the federal government to submerge existing discipline-based agency structures in favour of interdisciplinary institutions. It would, therefore, seem that *ad hoc* cooperative arrangements of the type undertaken under the Mackenzie Valley program will likely continue.

In order to make real progress at the national level in the development and implementation of sound interagency land inventory programs in the North, a suitable coordinating or steering organization is, therefore, required. A technical workshop*, which was held in Toronto last week and dealt with this topic, concluded that the following institutional framework should be formed:

1) a national technical coordinating committee (similar in function to the Canada Soil Survey Committee) which would coordinate methodologies and approaches to multidisciplinary and interagency inventories throughout the country;

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*Canada's northlands, proceedings of technical workshop. To develop an integrated approach to base data inventories for Canada's northlands. Lands Directorate, Environment Canada. Toronto, April 17-19, 1974.

2) a federal agency (analogous to the Soil Survey of Canada) which would contain the core disciplines required, i.e., geomorphology, pedology, plant ecology, hydrology, soils engineering, and remote sensing and cartographic expertise.

The workshop envisaged that this agency would not replace existing agencies but would rather provide the central focus for integrated land surveys and would coordinate input from current discipline-oriented institutions of federal and provincial governments.

In my opinion, the proposed committee and institution would provide a useful step in bringing about the required move toward multidisciplinary survey pgorams and more effective land use planning for northern Canada. I would, therefore, like to see the proposal discussed by this Committee.

Discussion

Duffy to Dirschl - We have talked of integrated land resource surveys. It is clear that it is technically possible to undertake an integrated survey to meet the needs of many users. However it has been stated that we have institutional problems of getting departments of governments together to organize smooth surveys. Does Dr. Dirschl think that those integrated surveys conducted recently give us a basis to describe an efficient way of running an integrated field survey? Given that diverse agencies will agree that integrated surveys are less costly and yield the required data, have we enough evidence that we can organize these surveys in the field.

Dirschl - I agree that we have not carried these surveys far enough to establish a recipe for how such surveys should be run, but we have enough experience to recognize some of the shortfalls and difficulties of bringing people of different agencies together. We know how not to do it, and now we should propose how to do it. In the Mackenzie pipeline project, although people worked together quite well in the field, they report to different hierarchies in Ottawa and this seems to impede efficient field coordination.

McKeague - I am sure that those involved are keen on having a mechanism to make integrated surveys work properly.

Wilson - Last year I was working on Mackenzie highway as coordinator of geotechnical work. The paradox is that the different terminologies have to be digested, the design decisions have to be taken, but the decision maker may be faced with too much information to cope with before making the decision. There is a need to coordinate and a need to be practical.

New Approaches for Soil Survey

R. Protz
Department of Land Resource Science
University of Guelph
Guelph

What I am about to suggest may not be new, but it is where and how I think Soil Survey in Canada should be directed.

1. Northern Areas

   Cooperative surveys with all resource discipline:

   1. Vegetation
   2. Landforms
   3. Soils - mineral and organic

   We already do this in Biophysical Land Class System.

   Use ERTS imagery to come up with map of all of Northern Canada by 1978. Areas to start should be at least:

   1. Mackenzie Valley - now ongoing
   2. Athabaska tar sands area
   3. East and West sides of Hudson Bay

   These are areas of present or future Northern Development, and we should have "Standard Soil Surveys" in these areas to be ready with information desired. These should also be corridors in which much more detail research work should be done on:

   1. soil variability, genesis and classification
   2. influence of intensive land use on northern Canadian soils
   3. evaluation of multispectral scanning information for predicting possible problems

   This will be necessary as the confrontation between environmentalists and developers must be resolved on good resource information. We have a very important role to play in this area.

11. Urban Areas

   Plans are drawn up on 1 inch to 200 feet. Many people are involved in decisions. Information we have on soils should be presented on an airphoto a format so that people can easily see the problems homeowners face when houses are built in improper areas and how easily it is to avoid these problems.

   We can do this on an orthophoto base. We should move in each province to do a pilot urban area. This should involve a soil surveyor, city engineer, city planner, parks director and possibly financed by C.M.H.C.

   Following development, it should be monitored to get benefit/cost data.

III. Agricultural Areas

When we consider some facts:

1. Soybeans \$12.00/bu
2. Wheat at \$5.00+/bu
3. Beef \$1.00+/lb to consumer
4. World population at 4,000,000,000 and not expected to stop until 7,000,000,000 in 26 years
5. Energy costs going up

We must establish survey methods which can give the extensive farming operations soils information required to switch to intensive farming such that the environment will not be damaged (Excess N applications) and so that costs will not go up too greatly.

IV. Summary

This will mean accurate statements on the heterogeneity of soil mapping units. To do this, we'll need:

1. a northern Canadian soil surveyors team (ERTS - interpreters) and researchers in each province
2. Urban soil specialists-extension personnel
3. Put all soil survey work on a systems basis. No project to take longer than 2 years from conception to completion.
4. To always build on what we know, not continually start anew.

Discussion

Nowland - Agreed that Protz reference to cost-benefit analysis was required for urban-fringe surveys, although the benefits should be so self-evident as to not require the analysis. Disagreed that surveyors should supply information to farmers that would permit them to rationalize production, because we need more refined capability ratings of individual map units that recognize economic factors - land evaluation it is being called by some.

Protz - Agreed with Nowland statement. There are many small, uncounted costs for homeowners that are never related to terrain or soil. This should be brought out.

Skydt - What level of intensity of information would be possible to achieve from ERTS imagery.

Protz - Replied that eventually we will have multiple images of every area, and resolution is bound to improve with time.

Air Photography, Cartographic And Other Support Services For Soil Survey

J.H. Day

I wish to discuss very briefly the requirement for planning in the publication of soil surveys.

1. AERIAL PHOTOGRAPHY

   We have budgetary allocation for purchase of new standard aerial photography. In the fall of each of the last two years I have sent to each federal officer in charge a form letter requesting demands for new flying. Based on this experience a number of requirements are put to you:

   a) A reply is required by the specified date, even though it may be negative.

   b) Demands for flying must be placed at least two years in advance of the commencement of field work in order to permit some budget juggling in the event that there are a large number of demands or requirements for a particular year; to permit ICAS adequate time for preparation of contracts; and to permit enlargement, rectification or other photographic manipulation of imagery, in order for us to provide you with this service.

2. CARTOGRAPHIC SERVICES

   Our cartographic capacity for soil and non-CLI maps is about 17 map sheets per year. This isn't large, but we hope to be able to increase it. To make the most effective use of this capacity it is necessary to introduce a greater degree of planning into all stages.

   a) For each map sheet complete and forward to J.H. Day one of the enclosed forms. The forms distributed are only provisional and will be further developed. These will be used to establish file numbers, prepare map layout, red-line NTS plastic base maps for compilation, etc. They will also be copied and forwarded to Scientific Research Services Section to help them estimate their future editing work load.

   b) It is necessary to send the report, legend and map manuscripts together in order that a coordinated evaluation of the project may be conducted, and to permit the mutually acceptable scheduling of printing of maps and reports. For reports that are not published by CDA it is necessary to plan with us the estimated completion dates to coincide with map production.

c) When you send in the map and legend manuscripts, state clearly the nature of your requirements for soil symbols; give us well-drawn models that exemplify all the kinds of symbols required, these should be in the form of a convention.

If requested we can supply examples of symbols in various styles and sizes. Better to settle those details <u>before</u> we spend the money.

3. OTHER SERVICES

a) As you have heard, or will hear soon, we have acquired a digitizing table and accessories. Once it is operational it will:

i) allow digitized thematic information to be imput to the CanSIS data bank

ii) speed up color separation and reduce errors

iii) allow digitized thematic information and interpretive information (ratings, groupings, etc.) to be converted into single interpretive maps via the Gerber plotter

iv) allow digitized information to be used to calculate acreages of map units.

However, the ability to do iii) above depends on programmers, and time on the Gerber plotter. We shall also be faced with establishing priorities on which of the many published maps should be digitized.

J.H. Day
Supervising Officer
Soil Resource Inventory Program
Carographic Section
CEF, Ottawa, K1A 0C6

PROPOSED SOIL SURVEY REPORT

Establishment ....

Authors ....

Title ....

NTS Sheet Numbers ....

Publication Scale ....

Number of soil maps ....

Photo base or line map ....

Estimated pages of manuscript (8 1/2 x 11, double spaced) ....

Illustrations - Black and white photos ....

Line drawings ....

Coloured photos ....

Is report to be processed by Ottawa editors - ....

Quantity required for distribution in your province

English ....

French ....

Estimated date of submission ....

Regional Programs and Priorities

Atlantic Provinces

J.L. Nowland

This document summarizes the programme priorities and need emerging from the work planning sessions of the Canada Soil Survey Committee, held in Ottawa, April 1974. It is intended as a single flexible reference base for future planning. Any need for elaboration or revision of parts of the programme should be documented through the appropriate regional soil survey committees in order to ensure orderly progression.

INTRODUCTION

The situation with soil surveys in the region has been quite fluid over the past year or so. A number of meetings and consultations have been held, with considerable interdisciplinary and user participation. The New Brunswick Soil Survey Committee was established, and one outcome of the soil survey steering committee appointed by the Atlantic Provinces Agricultural Services Coordinating Committee was the formation of the Atlantic Provinces Soil Survey Committee. Since the latter has not yet met, some of the present priorities might be modified in the near future. In any case it is expected that the priorities will be reviewed quite frequently. They would be affected by availability of outside funding, the level of technical support and personnel changes, among other factors.

This report is the outcome of the working sessions on April 23, and submissions made beforehand, and concerns two organizations, the Newfoundland Soil Survey and the Maritimes Soil Survey. It briefly considers first what are termed Operational Priorities before proceeding to the Programme Priorities.

OPERATIONAL PRIORITIES

1. Improvement of technical support for soil survey

It is appreciated that this serious problem has been discussed at length in the Branch, but the groups feels compelled to reiterate it. Survey units in the region, commonly staffed by one or two pedologists, have operated under great handicaps because of rapid turnover or lack of technical support, and there are huge gains in productivity to be made by assigning one technician to each pedologist, at the very minimum.

We emphasize that the technical support must be of adequate quality, that is, equivalent to EG4 or higher, must be given systematic condensed on-the-job training, and must be offered satisfactory prospects for career progression and some degree of personal specialization.

One individual cannot be expected to develop concordant skills in all three relevant fields, laboratory analysis, mapping and drafting, but competence in two of these should be sought. A mapping oriented technician attached to a pedologist might be expected to improve the rate of coverage by up to 75%, assuming thorough correlation. Contributions of laboratory and drafting technicians will release pedologist man-hours for essential and currently neglected investigations in support of survey, correlation and interpretations.

2. Research

Denied the benefits of university soils departments in the region, the Atlantic Provinces survey units have relied heavily on the S.R.I. for fundamental research. There is a need for a capability within the region to investigate certain soil characteristics, namely those which:

a) are unique or especially significant in the region,

b) warrant documentation on a national or international level,

c) affect interpretations in an uncertain manner.

We are aware of the severe constraints on research imposed by shortage of manpower and material in the region, and the difficulty of having the necessary volume of work done elsewhere, such as in the S.R.I. What cannot be squeezed into the work plans of the survey offices should probably be taken up at the Agriculture Canada research stations. For this to happen, there needs to be much improved communication between soil surveys and the stations on the subject of research priorities, because it is clear that many fields of soil research, including those with immediate applications for increasing agricultural productivity, have not received sufficient attention. Examples are the problems of compact subsoils, soil erosion, surface soil structure, the quantification of soil moisture regimes, and precise soil productivity evaluations.

3. Maritimes Institute of Soils

The proposal by Nowland in November 1972 for a Maritimes (and later Atlantic) grouping was made in the interests of efficiency and economy. Various parts of the package were not viewed favourably by some of the units, but most agreed on the need for an integrat on of effort, a division of labour and responsibility and a means of handling outside funding for special projects. These are regarded as being of high priority in future operations (after qualified acceptance of a special committee report to A.P.A.S.C.C., the matter and the form of its implementation is in the hands of the new Atlantic Soil Survey Committee, subject to approval by the parties concerned).

4. Equipment

Long-stated inadequacies in equipment must be remedied, if the soils information is to be gathered in sufficient volume and intensity of coverage to achieve the necessary accuracy of inventory and interpretations. All-terrain vehicles, excavation equipment (corers and back-hoes), replacement cars, scanning stereoscopes, replacement of Map-o-Graph equipment, and miscellaneous laboratory items are the chief needs.

5. Professional Staffing

Manpower levels are given in the accompanying table (Table 1) in terms of past and present numbers of pedologists, and the numbers required to carry out the top priority plans itemized below in a reasonable span of time. They are divided into federal and provincial affiliations. The figures in the "historical" column are the numbers traditionally involved for large parts of the past decade.

Man/year input estimates were made for each listed project and activity, excluding research, comprehensive surveys item 4 (ii) in Nova Scotia and resurveys needed in New Brunswick, but not slated top priority. These are summarized in Table 2, and should of necessity be regarded as quite general.

The general division of activities of the federal personnel are given in Table 3.

PROGRAMME and PRIORITIES

The programmes are outlined in annotated form for each province, under the headings:

(i) comprehensive surveys (exploratory, reconnaissance, semi-detailed, detailed);

(ii) special surveys;

(iii) special interpretive projects;

(iv) research (beyond that in support of individual surveys).

Within each group the activities are listed in order of priority as of April 1974, bearing in mind that some re-arrangement is currently under consideration.

Table 1. Manpower in soil survey, federal and provincial

	Historical		Present		Under negotiation		Required	
	prof.	tech.	prof.	tech.	prof.	tech.	prof.	tech.
NFLD.								
-fed.	1	0	2	1			2	2
-prov.	1	0	1	0	+2		3	?
N.S.								
-fed.	2	0	1	0			2	2
-prov.	1	0	0	1	+1		1	1
P.E.I.								
-fed.	1	0	1	1*			1	1
-prov.	0	0	1	2			1	?
N.B.								
-fed.	3	1*	2	0			2	2
-prov.	1	0	1	0	+2	+1	3	?
TOTAL	10	1	9	5			15	(15)

* Conrad Veer, EG 7, equivalent to professional.

Table 2. Present and required professional manpower, and impact on top priority part of survey programme, to 1980

Province	Man/yr requirement[1]	Present input m/yr/yr	Est. % of priority programme completed by 1980
NFLD.	43	3	51
N.S.	40	1	14
P.E.I.	16	2	87
N.B.	78	3	27

[1] for top priority programme itemized below.

Table 3. Activities of federal personnel to 1980, man/years per year[1]

Province and Present Incumbent	Inventory[2]	Correlation	Special Surveys	Special Interpretive Projects
NFLD.				
-Heringa	.3	.3	.2	.2
-post-Sudom	.7	.2	0	.1
N.S.				
-Beke	.6	.1	.2	.1
P.E.I.				
-MacDougall	.2	.1	.4	.3
-Veer	.3	0	.3	.4
N.B.				
-Langmaid	.6	.1	.2	.1
-Wang	.6	.1	.2	.1

[1] man/years averaged to 1980.

[2] includes report writing and laboratory work.

NEWFOUNDLAND - comprehensive surveys

1. Avalon Peninsula (2.4 million acres). Reconnaissance level survey. Maps being prepared in Ottawa at 1:100,000. Report shelved due to changed priorities. Manpower constraints very severe in relation to committed work and other projects. Capability maps of St. John's sheet and Trepassey sheet (1:250,000) completed.

2. Bonavista Map sheet (739,000 acres). Capability maps 1:250,000 and write-up completed. Information for soil maps 1:100,000 and manuscript maps partially completed.

3. Port aux Vasques Map sheet (1 million acres). Capability map 1:250,000 and write-up nearly completed. Soil map, capability map and write-up of Codroy Valley area nearing completion.

4. Stephenville Map sheet (1.3 million acres). Capability maps (1:250,000) fieldwork completed. Port au Port soil map, capability map (1:50,000) completed. Report (first draft) shelved.

5. Cormack Area (400,000 acres). Maps and reports nearing completion (first draft).

6. St. Lawrence and Belloram Map sheets (± 2 million acres). Preliminary photo interpretation completed. Capability map 1:250,000 acres and soils map 1:100,000 scheduled to commence in 1974 if sufficient manpower will be available (monies allotted through CLI and DREE).

7. Botwood Map sheet (± 2 million acres). Preliminary air photo interpretation commenced. Soil capability map 1:250,000 scheduled to be completed in winter 1974-75. Soil mapping (1:100,000) in conjunction with capability mapping scheduled to commence in 1974. Possible completion date 1976.

8. Sandy Lake Map sheet (± 3.6 million acres). Capability mapping scheduled to commence in 1975. Target completion date winter 1976-77. Soils mapping (1:100,000) in conjunction with capability mapping schedule to commence at same time. Target completion date 1978.

9. Gander Lake Map sheet (± 4 million acres). Capability mapping scheduled to commence with soil mapping in 1977. Target date for finalizing capability map 1981.

10. Red Indian Lake Map sheet (± 4 million acres). Planned to commence 1979.

Surveys in Port au Port, Codroy Valley, Cormack area and even in the Gander-Gambo area were conducted without correlation (each of these were CLI programs under separate CLI direction at a travelling distance of 7 hours or more). Correlation is a priority project to commence this summer.

The soil mapping will be conducted as part of a four-phase land inventory proposed by Newfoundland Department of Agriculture. The small scale initial capability mapping of Phase 1 will be used to delineate the areas for reconnaissance or detailed mapping in Phase 2. These priority areas have been roughly identified already and both phases are being pursued simultaneously; they have been completed in the Avalon Peninsula. Phases 3 and 4 involve surveys of present land use and ownership in high capability areas, and detailed land use proposals on a farm lot basis.

NEWFOUNDLAND - special surveys

Requests have come in to assist survey and mapping of local improvement projects in the western part of island to assist the newly appointed provincial soil surveyor and land use management specialist.

Requests also have come in to assist in agricultural soil bank reservation surveys. Limited assistance may be provided.

NEWFOUNDLAND - special interpretive projects

1. Suitability of bogs for vegetables.

2. Land evaluation for urbanization and planning, St. John's.

3. Soil testing for farmers and gardeners and fertility recommendations.

4. Soil testing for sport field development and improvement.

NEWFOUNDLAND - research projects

1. Cooperative work with agronomists and horticulturists on improvement in crop production on mineral and organic soils, with special emphasis on plant nutrition on organic soils.

2. Cooperative research on improving permeability of mineral and organic soils.

3. Soil test correlation trials. Field tests conducted in 4 locations across the province. Laboratory analyses to improve the analysis of available nutrients and different extraction procedures, correlated with crop response and crop yield of potatoes and turnips in compound tests with 3 levels of N, P, K and lime.

4. Evaluation on the development of thin iron pans.

5. Evaluation on the development of ortstein soils.

6. Evaluation of drainage and soil moisture classification.

NOVA SCOTIA - comprehensive surveys

1. Colchester County (900,000 ac). Semi-detailed in agricultural areas and reconnaissance in forested land. Currently in progress and 200,000 acres mapped. To be published as 1:50,000 map in three sheets, with interim report and map to be released for one half of the area. Completion date: 1979 with present personnel; 1976-77 with additional provincial pedologist (if appointed), plus 2 additional technicians. The old reconnaissance level 1:126,000 map (1948) is inaccurate, inadequate for most purposes and supplies are exhausted. The area is of considerable agricultural and general economic importance.

2. Pictou County (720,000 ac). Semi-detailed. Not commenced. To be published at 1:50,000, possibly with interim report and map. Completion date 1980 with increased personnel as noted above. The old reconnaissance level map (1950) is not sufficiently accurate or detailed for most uses, (scale 1:126,000), and supplies are getting low. The area has an industrial core and fairly large areas of farmland.

3. Hants County (786,000 ac). Semi-detailed, to be published at 1:50,000. Not commenced. Completion date 1980 or later with increased personnel as noted in # 1.

   The 1:126,000 reconnaissance level map published in 1954 is in need of drastic revision and much greater detail. An interim mimeographed report and unedited provisional map should be considered for half the area covered.

   The area has several claims to attention, including agricultural activity, orchards and commuter pressure from Halifax.

4. Other comprehensive surveys

   These are included here as alternatives to items 2 and 3 above, and commanding almost equally urgent attention.

   (i) Antigonish County - Supplies of the 1954 1:126,000 map and report are low. Important agricultural area, especially in view of expanding milk market projected for nearby Strait of Canso area.

   (ii) Queens, Halifax, Cape Breton Island - Supplies of existing reconnaissance surveys (1959, 1963, 1963, respectively) are exhausted. These are candidates for reprinting in original form.

NOVA SCOTIA - special surveys

1. Cape Breton Highlands (920,000 acres). Reconnaissance survey to be published at 1:50,000 with special emphasis on forestry and recreation interpretations. The only area of Nova Scotia which has never been mapped; it is of great significance in understanding local soils, the influence of elevation on taxonomic features and in forestry and recreation uses. It is possible that a biophysical approach is appropriate in view of the limited resources of the survey group, but the recreational impact on this area will be of an intensity that probably demands more detailed treatment.

2. Strait of Canso development area (200,000 ac). Semi-detailed mapping leading to 1:20,000 coloured map or photomosaics, with special emphasis on interpretations for urbanization, protection of farmland, general planning. This is an urgent project and a perfect candidate for outside support (DREE, N.S. Government, M.R.M.S.). Completion date: not later than early 1976 if the information is to be used in planning development, but this is impossible with own staff.

3. Shelburne Barrens (300,000 ac). Semi-detailed survey in support of re-afforestation programme, in cooperation with N.S. Department of Lands and Forests (and Bowaters?). To be published at 1:50,000 on maps or photomosaics. Survey of Kejimkujik National Park would be a likely addition.

NOVA SCOTIA - special interpretive projects

1. Monograph on soils of Nova Scotia. This is a current project of long standing, but never activated. There is a demonstrable need for two types of province-wide soil essary; first a technical treatment to replace all technical material repeated in each soil report, to be issued with each report sold; second, a guide to the soils of the province aimed at the layman's level of understanding. Perhaps the two could be combined.

2. A series of single-use suitability maps, or land evaluation maps, for the benefit of individual specialized interests and for planners. Ideally these should be computer produced.

3. Special request interpretive information for Soils and Crops Branch, government agencies, planning authorities and other bodies. Contributions to planning seminars and other meetings. Educational functions at N.S.A.C. and on field trips for local groups, including in-service instruction for agronomists and foresters.

NOVA SCOTIA - research projects

The following fields command most urgent attention.

1. Compacted subsoil.
2. Soil erosion - measurement, prevention.
3. Bt horizons - characterization and comparison with other regions.
4. New concepts in mapping units.
5. Soil structure degradation.
6. Soil drainage status classification and moisture regimes.
7. Land evaluation rating techniques.
8. Computer produced interpretive maps.

PRINCE EDWARD ISLAND - comprehensive surveys

Current re-survey of the island (1.4 million ac). Detailed mapping two-thirds completed, scheduled for completion in 1975, to be published at 1:50,000 with detailed data available on open file 1:10,000 photomosaics. The main report will supply the basic inventory plus general interpretations for agriculture and other sectors (planning, engineering, etc.). More detailed interpretive material will be prepared for a supplementary report at a later date. It is important that detailed interpretive work does not delay publication of the basic information required by the agricultural and planning sectors.

PRINCE EDWARD ISLAND - special surveys

1. Detailed land evaluation and development surveys requested for specific small areas by government agencies. A continuing programme.
2. Soil erosion survey.

PRINCE EDWARD ISLAND - special interpretive projects

1. Soil suitability evaluations for land-use planning. This project is intended to provide a simple working document for any type of land use planning and development. It is to provide a rating of the suitability of each given soil and slope, as mapped, for the uses as defined. At present the suitability ratings for the following uses are desired:

i) Agricultural: (a) cultivated crops, (b) forage crops, (c) tobacco, (d) potatoes;

ii) Forestry: tree growth;

iii) Urban, Industrial, etc.: (a) house building with and without sewage disposal, (b) sanitary land fill, (c) pipe and cable lines, (d) highways;

iv) Wildlife: (a) openland habitat, (b) woodland habitat, (c) wetland habitat;

v) Recreation: (a) tenting and picnic areas, (b) trailer park sites, (c) camps or cottages, (d) playing fields, (e) golf courses.

Additional suitability ratings are to be added as new land use planning needs arise. If required, suitability maps could be produced by computer techniques. Completion date: 1979.

2. Special request interpretive information for government agencies, planning authorities and other bodies. Contributions to planning seminars and other meetings. Educational functions at N.S.A.C. and on field trips for local groups, including in-service instruction for agronomists and foresters.

PRINCE EDWARD ISLAND - research projects

1. Soil erosion, measurement, conservation, ratings of soils.

2. Soil structure degradation, compaction by implements.

3. Soil moisture relationships, drainage classification.

4. Land evaluation techniques, interpretive computer-produced maps.

NOTE: As a result of the airline labour disputes, P.E.I. was not represented at the work planning sessions. Therefore the verbatim submission by Dr. Raad is appended.

NEW BRUNSWICK - comprehensive surveys

1. Northern Victoria County - in process of publication.

2. Madawaska County - (project 148/70, 871,000 ac). Reconnaissance soil map at 1:50,000 and report scheduled for submission to Ottawa, January 30th, 1974, delayed by late arrival of redline bases. Completion date (Fredericton) March 1974, publication 1975.

3. Minto-Harcourt-Buctouche - (project 170/73, 1.6 million). Reconnaissance soil map at scale of 1:50,000 and report, scheduled for May 30, 1974. Completion date May 1974 (Fredericton) publication 1975.

4. Richibucto-Rogersville (1 million ac) - Reconnaissance level survey by Wang and Losier to be published at 1:50,000. Completion 1979 (draft map, 1977). Candidate for interim provisional map and report.

5. Gloucester County - Reconnaissance level survey by Langmaid. Held in abeyance due to other priorities for special projects (see below) 200,000 acres mapped.

6. Restigouche County (1 million ac). 292,000 ac mapped. Reconnaissance level survey to be re-activated 1974. Completion date uncertain due to other priorities (see special projects).

7. Completion of province (35% not mapped or being mapped) amounting to 6 million acres; to be mapped at exploratory or reconnaissance levels.

NEW BRUNSWICK - special surveys

1. New Brunswick Soil Survey Committee has stated a special need for detailed special request surveys and soil suitability evaluations for specific crops. Examples include crop production record sites, potential apple orchard sites, development area surveys. This type of work was slated for priority attention of Langmaid and the reason for the slowdown on Restigouche and Gloucester Counties (see above).

2. Fredericton area (8,000 ac). Survey needed for land evaluation as a guide in planning, emphasis on urbanization aspects. No action. With increased manpower, a nominal target date of 1978 could be envisaged. Doubtful if outside technical help would be enough to see it through (sources might be Municipal Affairs and Maritime Resource Management Services).

3. Northern forest area pilot project (50,000 ac). Reconnaissance to exploratory level mapping in co-operation with provincial forestry dept. Aimed at interpretations to establish forest management units. Under consideration by New Brunswick Soil Survey Committee. Completion date dependent on manpower. Goals, objectives, benefits yet to be defined clearly. Forestry may do most of the work and eventually extend the survey to 1 million ac. of forest land (phase 2) and 4 million acres (phase 3).

4. Fundy National Park. Reconnaissance to detailed survey expected to be requested shortly.

NEW BRUNSWICK - research projects

Roughly similar kinds of research to those listed under Nova Scotia and Prince Edward Island, with emphasis on:

1. Soil moisture
2. Ortstein
3. New concepts in soil mapping
4. Soil erosion on potato land, and conservation techniques
5. Quantification of soil inputs, yields and performance ratings
6. Various fields of forest soil relationships

APPENDIX

P.E.I. PROGRAM PRIORITIES IN SOIL SURVEY AND LAND USE

Submitted to the Canada Soil Survey Committee
by
Awni Raad
Department of Agriculture and Forestry

As a result of a meeting with different user agencies in P.E.I. regarding program priorities in soil survey for the period 1975-1980, the following programs are recommended to the committee for endorsement and implementation in co-operation with the province of Prince Edward Island and the Atlantic Soil Survey Committee.

1. Completion of the present project with the publication of the soil survey report at 1:50,000 scale and maintaining additional details on open file at 1:10,000 scale.

2. Development of interpretive land use maps or classification of surveyed land on the basis of technical soil survey data and in co-operation with the Regional Atlantic Soil Survey Committee and the province of Prince Edward Island.

Land use suitability rating work for purposes including agricultural capability (specific crop and general agricultural productivity), housing development, highways, land valuation for tax purposes, environmental impact, recreation, forestry and wildlife.

Detailed land use and soil survey requirements by different user agencies are summarized as follows:

1. Agriculture

Land classification or rating for general agricultural capability to replace or modify the present CLI classification. In addition, the scale and accordingly degree of information detailed obtained from the present soil survey work in P.E.I. allows for generating reliable land rating at the level of specific crop use in localized small areas (i.e., 5 to 20 acres). This requirement seems to complement the work requested for the development of agricultural capability rating of land in P.E.I. The province will use this information to support the development and expansion of the Agricultural Sector.

2. Housing and Cottage Development

Land rating for this purpose should be developed on basis of soil survey information including permeability, frost occurrence, texture, depth to bedrock and other engineering properties.

3. Highways

Land rating for this purpose should be developed on the basis of soil survey information including soil erodability, frost occurrence, moisture, permeability, texture and other highway engineering properties.

4. Land Valuation

Land rating for this use should be based on soil survey information including slope, erodability, drainage, and other engineering properties relating to construction of septic tanks and other utility services (i.e., cottage and housing subdivision).

5. Environmental Control

Land rating for this purpose should be based on soil survey information including drainage, erodability, depth, texture and other relevant properties of land which allow for better appreciation of the land resource and promote its wise use and conservation.

6. Forestry

Land rating for this purpose should be based on detailed soil survey information including drainage, depth to bedrock, erodability, texture and other soil properties of wooded land to allow for better woodlot management and reforestation programs.

The interpretation of present and future soil survey data, in terms of the different land uses mentioned previously, should be the next immediate soil survey program in P.E.I. after the completion of the present program, namely the 1:10,000 soil survey report.

It is my opinion that the Atlantic Soil Survey Committee is the forum and the means to develop and implement the interpretive land use program in co-operation with the province. Subcommittees to develop interpretive classification of land for specific uses (i.e., agriculture, highway, subdivisions, etc.), on the basis of available soil survey data should be started immediately under the auspices of the Atlantic Soil Survey Committee. However, the interpretive classification of land may not be equally used by all the Atlantic Provinces due to differences in levels of soil survey data which are available in the Atlantic Province. It is submitted that P.E.I. will be in good position to use this classification in the immediate future since needed soil survey data are presently available at the desired level (i.e., 1:10,000 scale).

Ontario and Quebec

J.H. Day

In Ontario and Quebec there are some programs that would require organized cooperation between survey organizations of the two provinces. The most important of these would be soil correlation.

However in many other respects it is of little use to speak of regional priorities because the state of survey in each area is significantly different: Ontario has a CDA staff component that is large relative to the OMAF staff component whereas the Agriculture Quebec component is not complemented by a CDA component. Therefore I will present the remainder of these few remarks solely within a provincial context.

Ontario

A. Staff allocation for inventory

CDA Total 5 m.y. professional plus 1 m.y. technical
2 m.y. for mapping
2 m.y. for interpretations research
1 m.y. for correlation and supervision
1 m.y. for technical support

OMAF
2 m.y. for mapping
2 m.y. technical support for mapping and analysis (see NOTE B)
3/4 m.y. for survey (vice Hoffman)

B. Program responsibility

The common viewpoint is that the responsibility for program selection and establishment of medium term goals would be achieved by discussion with user groups within the framework of Ontario Soil Survey work planning annual meeting. It is the federal viewpoint that the responsibility for the planning and conduct of the selected projects will remain with the CDA officer-in-charge and his staff, who generally speaking are likely to be older and more experienced than the OMAF staff, who once employed will function in a complementary role. The CDA officer-in-charge will have over-all responsibility for correlation within the province.

C. Inventory and research priorities

1. Completion of current projects underway, including reprinting of soil maps, writing and publication of soil reports of the northern Ontario projects.

2. Soil resource inventories are planned for Norfolk, Haldimand, Elgin, Kent-Welland, Durham counties and Muskoka and Haliburton districts, approximately in the order stated. These represent, in most cases, intensively utilized agricultural areas that are subject to urban, industrial and recreational pressure. Provided that additional staff is forthcoming from OMAF, the rate of completion would be one county per year.

3. Generalized soil map of Ontario.

4. Soil variability studies - to improve the interpretability of soil maps.

5. Soil capability research on field, orchard and horticultural crops and to establish relationships of productivity to capability subclass.

6. Interpretive classification systems

   - develop definitions and limits for soil and landform parameters to be considered for the various suitability classes established.

NOTE A - <u>Five Year Program for Soil Survey In Ontario, 1975-80</u>

<u>OBJECTIVE</u>:

To obtain a reliable inventory of Ontario's soil resources (nature, extent and distribution pattern) and to interpret the capability of these resources for agricultural and other uses.

1. Completion of current projects underway, including reprinting of soil maps, writing of the soil reports and publication of the northern Ontario projects.

2. <u>Soil Resource Inventories</u>

   Additional soil surveys are urgently required in a number of counties or districts in southern Ontario, NOTE B (Figure 2). These represent, in most cases, intensively utilized agricultural areas which are subject to increasing land development pressures for urban, industrial and recreational uses of land, as well as land for waste disposal purposes. These counties were amongst the earliest soil surveys conducted in the province, and as such the existing soil information is very general in nature and totally inadequate for present and or future land use requirements of the area.

   It is proposed that within a period of 5 years surveys must be completed in the counties of Norfolk, Elgin, Kent and Haldimand. These surveys would be of medium-intensity with publication of the soil map at a scale of 1:50,000.

With committment of existing C.D.A. staff to this program it is anticipated that this goal can be realized with three additional personnel, including two pedologists and one draftsman. This allows one field season for two party leaders (1 CDA + 1 provincial) to conduct the inventory of a county, and a further year for compilation and interpretation of the data, and preparation of the soils report. The completion rate therefore would be one county per year.

A proposal requesting funding for this expanded program is being submitted to the Ontario government (see NOTE B).

3. Generalized Soil Map of Ontario

A soil map of Ontario at a scale of approximately 1:1,000,000 is required to serve an educational function, as well as to provide a suitable base for broad, regional decision-making. It is proposed that this map be compiled utilizing existing data, supplemented with high altitude conventional photography and E.R.T.S. imagery, and limited ground checking throughout northern regions of the province.

4. Soil Variability Studies

The variability of soil mapping units and series as applied to existing soil maps as well as proposed maps at varying scales of publication needs to be evaluated. Studies of this nature would improve the interpretive capacity of soil maps.

5. Soil Capability Research

Soil capability classification systems need to be developed for a broader range of crops including field, orchard and horticultural crops. These studies also should include establishing the relationships of productivity as well as quality to capability class.

6. Interpretive Classification Systems

To obtain consistent interpretation of soil survey information for engineering, recreational, or forestry uses it is necessary to establish interpretive classification systems with guidelines for the soil or landform parameters to be considered, the implications of these parameters to a particular use, and limits for the parameters for the various suitability classes established.

NOTE B - A Proposal for Additional Support for the Ontario Soil Survey Program

INTRODUCTION:

A program to conduct inventories of the soil resources has been carried out continuously for a period of approximately 50 years in Ontario. Traditionally it has been a cooperative program involving support from both the Canada Department of Agriculture and the Province of Ontario, presently through the Ministry of Agriculture and Food. In the early days of this program an informal agreement existed between the cooperating agencies which established an approximately equal cost-sharing arrangement for the two parties. In recent year, Canada Agriculture has strengthened its contribution to the Ontario Soil Survey, whereas the contribution from the province has decreased. Presently, Canada Agriculture personnel includes five professional positions, and one technical, all involved on a full time basis with various aspects of the soil survey program. OMAF support provides approximately one man year professional and one man year technical support for the program annually. The OMAF contribution also includes the provision of office space and stenographic support. The inventory and research phases of the program have been conducted jointly by both parties. In the publication of the soil survey reports, it has been common practice for C.D.A. to bear the cost of cartographic preparation and printing of the soil maps. The Ministry of Agriculture and Food has assumed financial responsibility for printing the soils report, and the distribution of these documents.

It is apparent that additional support to the program in Ontario is essential to overcome immediate shortages of soil maps and reports, as well as to provide certain regions, which presently are deprived of adequate soils information, with the quality of information they require to meet the future needs of intensive and competitive uses of land. The purpose of this proposal is to outline the immediate and long-term needs for soil resource information in the province of Ontario, and to solicit additional provincial government support for these programs. The object in requesting provincial funding is to more closely bring into balance the Federal and Provincial contributions to this program in Ontario.

1. Reprinting of Out-of-Print Soil Maps

The supplies of many county soil survey maps and reports in Ontario are depleted, or are very close to depletion. This situation is serious as it is in these counties, in most cases, where rapid changes in land use are occurring, often resulting in losses of land from agricultural production. As a consequence of land-use pressure, there is an increased demand for soils information by planners, developers and personnel in various government departments who are becoming increasingly involved in making land use decisions. Therefore, it is imperative to immediately commence a program of reprinting the soil map for many Ontario counties, so that the existing soils information is readily available to all users.

It is considered that the quality of information in many of these publications is still adequate to warrant the cost of reprinting. Moreover, it will be a number of years before there is a change of an updated publication being available for these counties, as many other counties will receive priority in any re-surveys which are carried out.

It is generally agreed that the soil maps must be reprinted in colour. Appended to each copy of the soil map issued will be one page of tabular data pertinent to the soils of that county. This information will be of considerable value in the interpretation of the soil survey information.

The following county soil maps are recommended for reprinting. They are listed in the order of priority in Table 1 (See also Figure 1).

County	Report No.	No. of Map Sheets Involved	Size of Map (inches)
1. Peel	18	1	37 X 35.5
2. York	19	1	50 X 38
3. Ontario	23	1	52 X 39
4. Essex	11	1	40.5 X 31.5
5. Perth	15	1	45 X 36
6. Huron	13	2	42 X 33 43 X 32
7. Glengarry	24	1	41.5 X 32
8. Lambton	22	1	50 X 39
9. Grey	17	2	48 X 35 44.5 X 38
10. Bruce	16	2	36 X 30.5 35.5 X 26
		13 sheets	

Cost and Scheduling

A cost estimate obtained by the Information Branch, Ministry of Agriculture and Food, based on a representative soil map was approximately \$1500/1000 copies. The larger maps would be slightly more costly to reprint but not in direct proportion to their size. Therefore, the cost for reprinting 1000 copies of each of the above county maps is approximately \$20,000. Financial support for this program is requested from the Ontario Ministry of Agriculture and Food to enable reprinting to be brought to completion during the current fiscal year.

2. Soil Resource Inventories

Additional soil surveys are urgently required in a total of eight counties or districts in southern Ontario (Figure 2). These include the counties of Kent, Elgin, Norfolk, Haldimand, Welland, and Durham, which for the most part, represent an intensively utilized agricultural area subject to increasing land development pressures for urban, industrial and recreational uses of land for waste disposal purposes. These counties were amongst the earliest soil surveys conducted in the province, and as such the existing soil information is very general in nature and totally inadequate for present or future land use requirements of the area.

Inventories are also required in the districts of Haliburton and Muskoka where there is virtually no soil resource information available at the present time. Present recreational uses and the expected increasing future demands for recreational lands necessitate that soil resource studies be conducted in those areas of greatest recreational potential. Similar reasoning can be applied to certain areas throughout northern Ontario not previously studied. It would be most practical that soil inventories in these areas be ad hoc in nature to concentrate the effort in the region of greatest need.

It is proposed that soil surveys in the areas mentioned above be of medium-intensity with publication of the soil map at a scale of 1:50,000. The soils report will contain, in addition to the characterization of all the soil mapping units, interpretations of these units in terms of soil capability for the major agricultural uses of the area and interpretations for other uses such as recreation, engineering and forestry if appropriate.

A realistic plan would ential completion of the inventories in these areas within a time period of eight years. With commitment of the existing C.D.A. staff to this program it is anticipated that two additional professional positions are required in order to realize this goal. This is allowing one field season for two party leaders (1 CDA + 1 provincial) to conduct the inventory of a county or region, and a further year for compilation and interpretation of the data, and preparation of the soils report. The completion rate therefore would be one county (region) per year.

Cost

The additional financial support which is required on an annual basis for this program can be itemized as follows:-

Salaries	- 2 full-time positions at B.Sc. level	$20,000
	- 1 full-time cartographic assistant	7,500
	- 60% overhead on salaries	16,500
	- 2 temporary field assistants	5,000
Field Expenses		5,000
Car Rental		2,000
		$56,000

Scheduling

A tentative priority list for the required soil inventories is given below. The order presumably could be modified if necessary if it does not adequately reflect present-day needs, or if the demand for information changes in the intervening period prior to commencement of the inventory. The responsibility for final scheduling of the program might best be given to a Soil Survey Steering Committee comprised of OMAF, C.D.A., University of Guelph personnel, and representatives from other Ministries of the provincial government.

Country or Region	Proposed Date to Commence	Proposed Completion Date
Norfolk	1975	1977
Haldimand	1975	1977
Elgin	1977	1979
Kent	1977	1979
Welland	1979	1981
Durham	1979	1981
Muskoka	1981	1983
Haliburton	1981	1983

SUMMARY

An increased commitment to the soil survey program in Ontario is considered essential to make available soil resource information in those counties where the existing information is out-of-print, and for conducting inventories in other areas subject to intensive land-use pressures where the existing information is grossly inadequate for present and future needs.

FIG. 2 - Southern Ontario Counties or Regions Requiring Soil Inventories

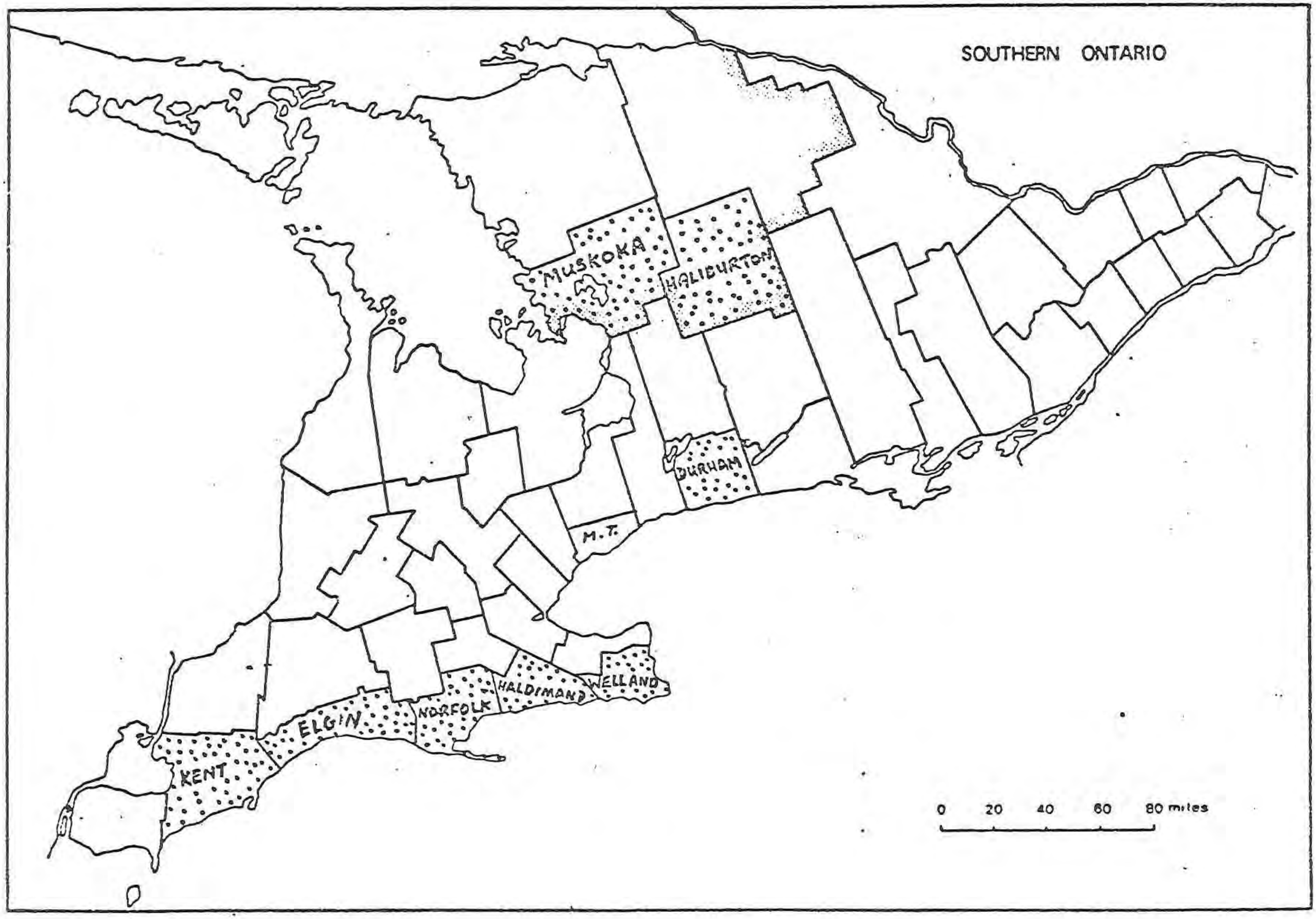
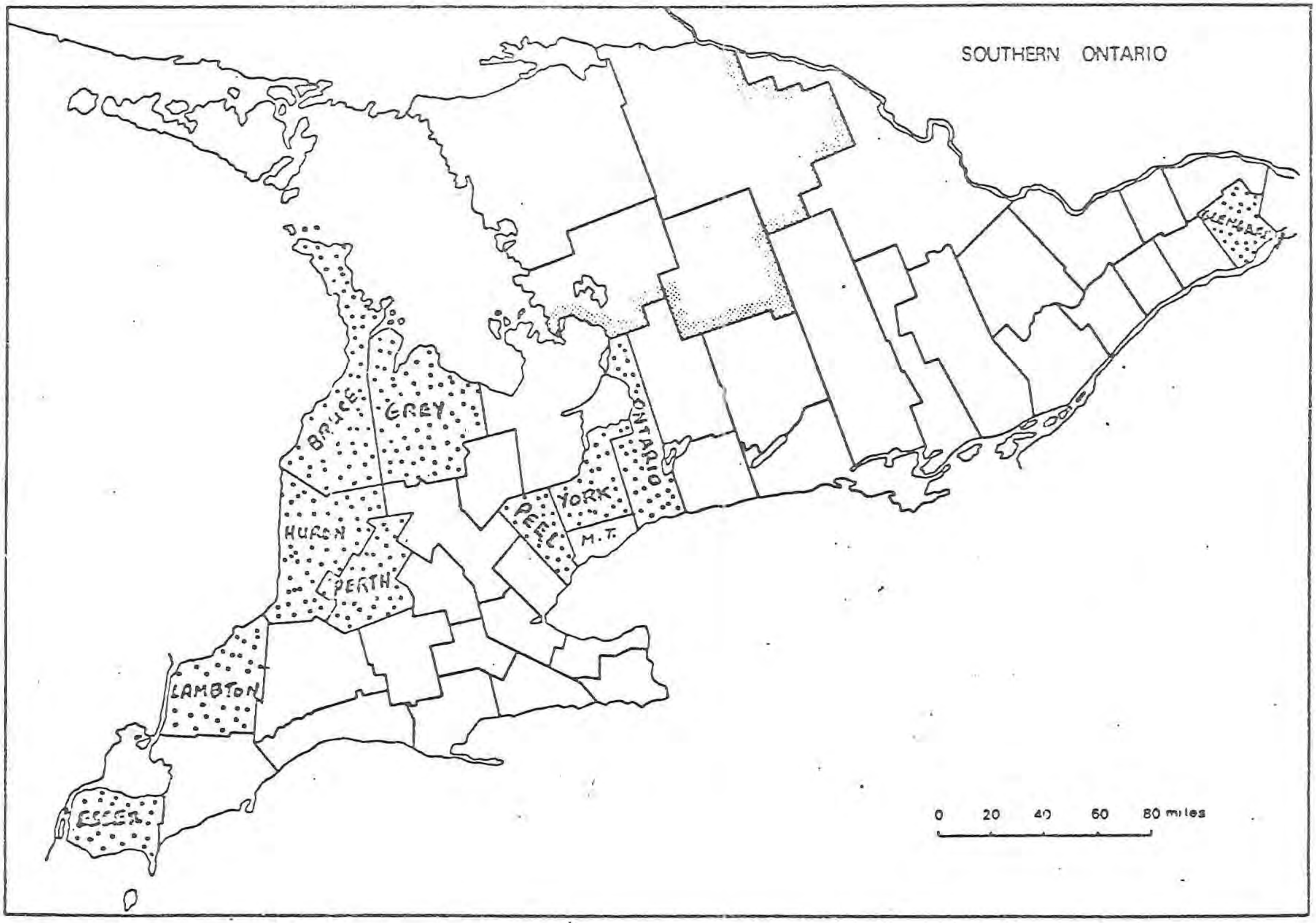


FIG. I - Southern Ontario Counties Requiring Reprinting of Soil Maps and Reports



Approximately \$20,000 is requested in the current fiscal year for the soil map reprinting program. An additional \$56,000 annually is estimated for a period of approximately 8 years, commencing in 1975, to meet the requirements of an expanded soil survey program. It is requested that these funds be provided by the province of Ontario through the Ministry of Agriculture and Food to the Department of Land Resource Science, University of Guelph.

Quebec

Agriculture Quebec, Department of Soil Science of Laval University and Agriculture Canada have recently co-signed a memorandum of understanding to establish a Quebec Institute of Pedology. Under the terms of this agreement the planning and selection of priorities will be done jointly by representatives of the three agencies, and the operation of the assigned survey project areas would be done independently by the Agriculture Quebec Division des Sols and by Agriculture Canada Survey group who would be sheltered at the university.

A. Staff allocation for inventory, subject to budget

Division des Sols

- 8 m.y. for mapping
- 4 m.y. technical support for mapping and laboratory
- 4 students for summer field work
- 8 m.y. support staff
- 2 m.y. for soil management and extension

CDA

- 5 m.y. for mapping
- 6 m.y. support staff
- 4 summer students

B. Program responsibility and inventory priorities are not yet fully developed by consultation with agencies, but current intentions are:

Division des Sols (see NOTE C)

1. Complete surveys in Dorchester, Portneaf, Temiscouate, Iles d'Orleans, Iles aux Grues et Iles aux Coudus and Charlevoix.

2. Concentrate on filling in counties never before surveyed in S.E. Quebec (Arthabaskee, Megantic, Beauce, Wolfe, Frontenac) at scale 1:63,360 or 1:50,000 on NTS map basis.

CDA

1. Complete surveys of L'Islet and Riviere-du-Loup by Baril and Rochefort at 1:63,360 or 1:50,000.

2. Commence resurveys 1:20,000-1:50,000 in Chambly, Iberville, Laprairie, Napierville, Richalieu, Rouville, St-Hyacinthe, St-Jean and Vercheres.

Other activities to be undertaken include resurveys in the eastern townships, and especially the survey of organic soil areas.

C. Research priorities

1. Complete the characterization of fragipan soils.

2. Complete the study of the distribution of Fe + Al in Quebec soils.

3. Complete the study of water tables in the Tilly-Loli-Platon soils.

4. Benchmark soil characterization.

5. CanSIS data input.

Other research priorities remain to be enunciated.

D. Responsibility for correlation

The Institute of Pedology is to create a correlation committee and will frame the terms of reference with regard to its methods of operation and staff composition.

NOTE C: Cartographie et classification suivies et intégrées des sols du Québec

SOUS-TITRE: Etudes pédologiques de cartographie détaillée (1/5,000e-1/20,000e) et semi-détaillée (1/50,000e-1/100,000e) selon les besoins prioritaires des comtés environnant Montréal et des régions agricoles du Québec. Les terres présentant un potentiel agricole certain, y inclus les sols organiques, et celles où l'urbanisation les convoite devraient être cartographiées à grande échelle. Les Hautes Terres Laurentiennes et Appalachiennes pourraient être cartographiées à petite échelle.

BUT DU PROJET

a) Poursuivre un programme de recherches suivi et intégré portant sur l'inventaire fondamental des sols du Québec en tant que ressources. Spécifiquement, ceci comprendra des recherches pédologiques en classification, en cartographie, en morphologie et en genèse des sols du Québec. Les connaissances obtenues permettront de mieux utiliser les sols selon leurs aptitudes ou possibilités à des fins agricoles, forestières, urbaines, récréatives et autres;

b) Favoriser et assurer la coordination des recherches interdisciplinaires concernant les relations sol-plante-animal.

ETAT DES TRAVAUX PEDOLOGIQUES AU QUEBEC: (Travaux en cours, travaux à faire et inventaire des études pédologiques complétées).

La province de Québec a réalisé depuis 1933 des études extensives dans le domaine de la cartographie et de la classification des sols par les équipes de pédologues d'Agriculture Canada et d'Agriculture Québec. Celles-ci ont été réduites d'une part par le retrait des équipes de pédologues d'Agriculture Canada en 1962 et d'autre part par les activités nouvelles suscitées par la réalisation du programme ARDA. La carte ci-jointe (fig. 1) et les tableaux 1 à 6 donnent un compte-rendu détaillé par comté de l'état actuel des travaux pédologiques accomplis ainsi que ceux qui restent à faire dans la province de Québec. Afin de faciliter la localisation des comtés, nous les avons numérotés de façon arbitraire.

A noter que les 10 comtés au sud de Montréal (St-Jean, Chambly, Rouville, Verchères, St-Hyacinthe, Richelieu, Laprairie, Napierville, Iberville) ont fait l'objet, en 1942, d'une étude pédologique plutôt sommaire et pour lesquels durant la période de guerre 1939-45 il fallait cartographier d'une façon rapide les sols afin de reconnaître ceux qui étaient potentiellement bons pour la culture de la betterave à sucre. Les pédologues québécois mettaient alors à l'essai le système américain de classification des sols. Inutile de dire qu'une reclassification de ces dix comtés s'impose. Globalement, ces dix comtés couvrent une superficie de 1,210,720 acres, soit 13% environ de la superficie de la Plaine de Montréal. Une partie, celle à l'ombre de l'urbanisation, peut-être 10 ou 15%, a été retenue pour fins de lotissement.

Mentionnons que les comtés qui ont été les plus durement affectés par l'urbanisation sont ceux de Laval, Châteauguay, Chambly, Terrebonne, Deux-Montagnes et Laprairie, soit une zone ayant un rayon de 15 à 25 milles à partir du centre-ville de Montréal.

Tableau 1. Comtés où des études pédologiques sont en cours en 1974. Echelle 1/63,360e.

Nos.	Noms des comtés	Superficie (acres)
1	L'Islet	494,720
2	Dorchester	538,880
3	Portneuf	921,600
4	Témiscouata	736,640
5	Iles d'Orléans, aux Grues et aux Coudres[1]	---
6	Charlevoix	1,417,600
7	Rivière-du-Loup	462,720
8	Arthabaska	426,240
9	Mégantic	449,200
10	Beauce	921,920
11	Wolfe	435,200
12	Frontenac	876,800

[1] L'Ile d'orléans et autres font partie des comtés de Montmorency et Charlevoix.

Tableau 2. Comtés de la Plaine de Montréal. A reclassifier à l'échelle de 1/20,000e. Cartographie détaillée.

Nos.	Noms des comtés	Superficie (acres)
13	Chambly	88,320
14	Iberville	126,720
16	Laprairie	108,800
17	Napierville	95,360
18	Richelieu	141,440
19	Rouville	155,520
20	St-Hyacinthe	177,920
21	St-Jean	131,200
22	Verchères	127,360
	TOTAL:	1,210,720

Tableau 3. Comtés dans les Cantons de l'Est. A reclassifier. Etudes pédologiques préliminaires faites en 1941-42 à l'échelle 1/126,720 ou 2 milles au pouce. A refaire à 1/50,000e avec photos aériennes.

Nos.	Noms des comtés	Superficie (acres)
23	Stanstead	276,480
24	Richmond	348,160
25	Sherbrooke	152,320
26	Compton	597,120
	TOTAL:	1,374,080

Tableau 4. Les sols organiques (à préciser)

A l'intérieur des comtés mentionnés au tableau 2 ainsi que d'autres étendues près de la ville de Québec, dans les comtés de Lévis, Lotbinière et Bellechasse.

Equipes spéciales de pédologues à former.

Tableau 5. Caractérisation des sols.

Etudes de sols repères (benchmark soils) faites parallèlement aux travaux de terrain:

a) dans les nouveaux comtés;

b) parmi les séries déjà cartographiées et couvrant une superficie importante au point de vue agricole.

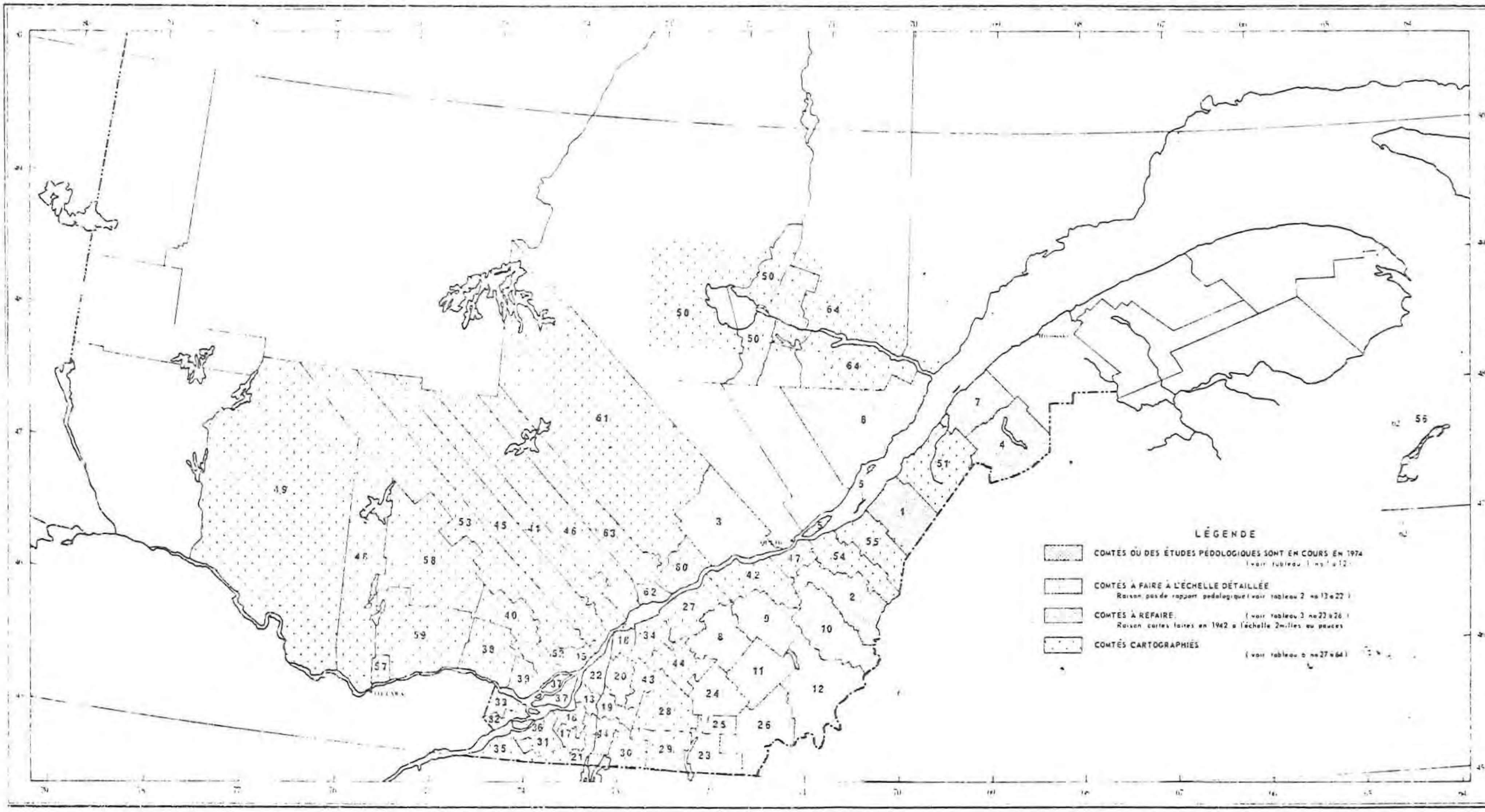
Tableau 6. Comtés pour lesquels une carte pédologique accompagne un rapport pédologique. Echelle 1/63,360e ou 1 pouce: 1 mille. Exception faite des régions du Lac St-Jean et de Chicoutimi, échelle 1/50,000e. (Année de la publication entre parenthèses)

Nos	Noms des comtés	Superficies des comtés(1)(2)	Superficies approximatives cartographiées(2)(acres)
27	Nicolet (1948)	400,640	400,640
28	Sheffort (1950)	362,880	362,880
29	Brôme (1950)	312,320	312,320
30	Missisquoi (1950)	240,000	240,000
31	Châteauguay (1950)	169,600	169,600
32	Soulanges (1950)	87,040	87,040
33	Vaudreuil (1950)	128,640	128,640
34	Yamaska (1954)	233,600	233,600
35	Huntingdon (1954)	231,040	231,040
36	Beauharnois (1954)	94,080	94,080
37	Laval, Montréal et Ile-Jésus (1954)	150,315	150,315
38	Argenteuil (1957)	501,120	501,120
39	Deux-Montagnes (1957)	178,560	178,560
40	Terrebonne (1957)	500,480	500,480
41	Berthier (1957)	1,162,140	431,203
42	Lotbinière (1957)	464,640	464,640
43	Bagot (1959)	221,440	221,440
44	Drummond (1960)	340,480	340,480
45	Joliette (1960)	1,603,840	240,853
46	Maskinongé (1961)	1,521,920	193,435
47	Lévis (1962)	174,080	174,080
48	Gatineau (1965)	1,556,480	1,556,480
49	Pontiac (1965)	6,118,400	887,174
50	Lac St-Jean, Ouest et Est (1965)	15,182,720	1,377,100
51	Kamouraska (1965)	664,320	664,320
52	L'Assomption (1965)	158,080	158,080
53	Montcalm (1965)	2,492,160	556,780
54	Bellechasse (1966)	417,920	798,957
55	Montmagny (1966)	403,200	403,200
56	Iles-de-la-Madeleine (1967)	65,280	65,280
57	Hull (1967)	88,960	88,960
58	Labelle (1967)	1,530,880	1,530,880
59	Papineau (1967)	1,011,840	1,011,840
60	Champlain (1967)	(5,495,040	(570,000
61	Laviolette (1967)		
62	Trois-Rivières (1967)	(1,164,800	(204,323
63	St-Maurice (1967)		
64	Région de Chichoutimi(1971)	11,392,000	1,435,300
	TOTAL	56,920,935	16,965,220

(1) Statistiques agricoles du Québec, 1968. Ministère de l'Industrie et du Commerce p. 182, tableau 14.

(2) A noter que d'après les statistiques du Québec (1968) (voir (1) réf. au-dessus) la superficie totale du Québec est de 335,270,400 acres.

ETAT DES TRAVAUX DE CARTOGRAPHIE ET DE CLASSIFICATION DES SOLS (QUÉBEC)



ECHELLE 1:5,955,840

94 milles au pouce, approximativement

Compilation par Roger W Baril (janvier 1974, sujet à revision)

Prairie Provinces

John A. Shields

A general discussion of regional program and priorities took place according to the following agenda:

1. For purposes of general information, a brief outline of their 1974 program was presented by one representative from each province.

2. A "crystal ball" approach for provincial priorities for 1975-80 were outlined by one representative from each province.

3. Viewpoint on future priorities from a Research Coordinator.

4. A first approximation of "core priorities" as summarized by the discussion leader.

5. Summary of regional "core priorities" (these were presented to the general meeting on Wednesday morning).

Discussion arising from above items is summarized below:

The "crystal ball" approach presented by the provincial representatives generated a great deal of discussion concerning regional priorities. The main thrust of priorities was centered on resurveys encompassing both agricultural and urban lands and on new surveys between the present ARDA boundary and northern provincial boundary. Of equal priority but requiring fewer man-years was the emphasis placed on interpretive aspects including product vity indexing, small scale provincial maps and projects on Land Degradation and Land Evaluation. Attention was also focussed on ways to reduce the number of back-log projects and concern was expressed for the amount of time required in hosting the 1978 ISSC meeting.

In view of the range of priorities established, it was not surprising that there was no initial agreement on the kinds of priority and their relative importance among the three prairie provinces (Table 1). The highest priority in Manitoba was that for new surveys in the north with slightly less emphasis placed on surveys of urban areas and resurvey of the south-central area. In contrast, Saskatchewan placed its highest priority on resurveying areas in need of more accurate soils information with nearly equal emphasis placed on developing improved soil performance ratings for field crops. Alberta also placed high priority on new surveys and resurveys but with a second priority slanted toward interpretive aspects of Land Degradation and Land Evaluation. These interpretive aspects were also recognized by Saskatchewan and Manitoba (Table 1). It is noteworthy that one item stressed repeatedly by all provinces was the need for additional technical support staff.

Table 1. Summary of Relative Provincial Priorities, 1975-80

Manitoba	Saskatchewan	Alberta
1. New northern surveys between ARDA and Provincial boundary.	1. Resurveys of Weyburn, Melville and Yorkton map sheets	1. New and resurveys in Isoegun map area, National and Provincial Parks, Urban Areas, County Nos. 5 and 22.
2. Urban surveys and resurvey of south-central Manitoba	2. Develop improved soil performance ratings for field crops	2. Land Degradation and Land Evaluation Projects
3. Develop soil performance for forage crops	3. New survey in Prince Albert National Park	3. New northern surveys between ARDA and provincial boundary
4. Land Degradation and Land Evaluation Projects	4. Land Degradation and Land Evaluation Projects	4. Small scale provincial soil maps
5. Small scale provincial soil maps	5. Small scale provincial soil maps	
	---------------- Special Projects -------------	
A. Back-log reports	A. Spring wheat project with CCRS	A. Back-log reports
B. Agro-climatic zones	B. Potash salt-dust contamination studies	B. ISSC, 1978
C. Provincial soil data banks	C. Provincial soil data banks	C. Provincial soil data bank

A viewpoint from outside the immediate realm of pedology was asked of Dr. W.S. Ferguson, Research Coordinator, Soil Fertility, who was quick to point out that his outlook was strictly from a personal standpoint and not necessarily that of the Branch. In discussing future priorities, Dr. Ferguson focussed on soil degradation as it relates to environmental impact studies, on land evaluation as it relates to the productivity of our land resources and on data requirements necessary to predict potential yields. He also stressed that productivity levels should be related to management levels and basic recurring economic inputs.

On a somewhat lower tone Dr. Ferguson indicated that we would probably have to tackle our regional priorities on the basis of present numbers of professional staff although he was somehwat more optimistic for additional support staff in the not too distant future.

The exercise attempting to assign professional man-years to the relative priority items designated by each province was a bit too rigid to comply with the wishes of most regional participants. However, it did illustrate that a significant proportion of their professional man-years could be assigned to interpretive aspects without detracting substantially from priorities concerning new and resurveys.

The conclusions of the group at the termination of the afternoon session were slightly fragmented. Many regional participants placed their highest priorities on new surveys and resurveys (including urban areas) but with a growing awareness for the need of interpretive components. Other participants stressed the need for increased emphasis toward interpretations on land degradation, land evaluation and crop yield predictions.

Summarization of Prairie Provinces, Regional Priorities and Programs

Core priorities of the Great Plains Region were grouped into broad objectives and a proportion of the total professional man-years presently available in the region was assigned to each objective (Table 2). By generalizing these priorities, it was desired to attain a regional overview which would be palatable to the participating provinces. This approach permitted the provinces to adhere to the general overall regional plan while at the same time allows them flexibility within their own province.

Table 2. Summary of Core Priorities of Prairie Provinces Region Prepared for Period 1975-80

	Objectives*	% Professional Regional m-y per year
1.	To continue the soil inventory of new and resurveyed areas including urban surveys, within the present ARDA boundary.	40%
2.	To interpret the basic soil inventories for visual causes of soil degradation, small scale provincial maps, land evaluation and to improve existing knowledge of soil performance and mapping as they relate to soil mapping units.	35%
3.	To commence land inventory of northern areas between the ARDA and provincial boundary.	15%
4.	Special projects to extend our knowledge of soils of the Great Plains.	10%

* Each of the objectives includes the aspects of soil analysis, correlation, supportive research and input to CanSIS.

It is of interest to note the proportion of the federal professional man-year/year allotted to each objective is in general agreement with the sum of allotments for the three provinces as presented by the Section Heads during the work planning session on Thursday afternoon. The outcome of that session indicated that about 40% of the man-years were assigned to each of Objectives 1 and 2 with 15% and 5% assigned to Objectives 3 and 4 respectively. This suggests a need for slight readjustment in Objectives 1-3 to provide some more time for special projects that crop up from time to time.

To date the component goals of the given objectives have not been finalized. However, it is hoped that this general exercise will provide the stimulus required to generate the goals required to complete the program proposed for the five years forthcoming.

British Columbia and the North

W.W. Pettapiece

I Although charged with "BC and the North", the major concentration was on the BC situation. The BC people had had prior discussion on the topic and positions were well defined. The working group kept discussions at a relatively generalized level without getting into specifics - generally covering the following:

- Roles of the individual agencies
- Provincial objectives
- Some feeling for priorities and man-year allotments
- Northern surveys
- Data dissemination

The discussions re BC are summarized in attached table and may be highlighted as:

Roles: - BCDA responds to provincial needs and assumes primarily an inventory role

- SRI (BC) should assume greater responsibility in correlation and also provide back-up research

- Univ. has essentially teaching and research roles

NOTE Correlation - it was suggested that the whole of the Cordillera should be considered as 1 unit (i.e., Yukon terriroty)

- concern was expressed re coordination of private sector work but with no conclusion

Objectives - The principal objectives and priorities were:

1. Inventory
2. Applied Research
3. Correlation

Research was repeatedly stressed and included particularly developmental and interpretive objectives such as engineering, remote sensing, productivity, biometeorology, wildlife habitat. Special problems was a category to include many small projects that survey units are requested to do such as collaboration with forestry, lands directorate, urban problems, etc.

It is worth pointing out that the university feels an obligation to fill a coordinating function. This is realistic through its role in the BC Land Resource Committee which comes under the Environmental Land Use Committee and has representation from all public sector resource groups.

II Northern Surveys were felt to have a high priority, and Mike Romaines suggestion of a Northern Soils subcommittee was seconded and recommended to the CSSC. The following terms of reference were included:

1. Collate and review relevancy of existing information

2. Identify information gaps and suggest research

3. 3. Look into interpretive research such as revegetation

4. Foster interagency coordination and cooperation

5. Mapping methodology

6. Soil taxonomy

The need for a strong SRI role was stressed.

III Information dissemination (Reports)

It was recommended, that because it was extremely important to make the information available as soon as possible, that "traditional" soil survey reports be abandoned as an initial product at least.

- base material could be placed on maps and released with expanded legends and possibly interim reports.
- interpretive maps using the same format could follow.
- complete reports could come out as "memoires" when time allows or need arises.
- all base data such as profile descriptions and laboratory analyses would be stored in CanSIS and simply referenced.

IV A further recommendation was that the CSSC take a more active role in coordinating research.

Table 1. Manpower and Priorities

Objectives	Agency	Present m.y.	Future m.y.	Priorities	Proportion of total manpower
Inventory	BCDA(ELUC)	8	12	1	35
	SRI	5	1	3	
Correlation	BCDA	0.5	0.5	2	
	SRI	0.5		1	5
Research	BCDA	1.5	3.0	3	
	SRI	0.5	3.0	1	25
	UNIV	3.0	4.0	2	
Special Projects	BCDA	2.0	3.0	2	
	SRI	1.0	2.0	2	15
	UNIV	-	1.0	3	
Teaching	UNIV	4.0	5.0	1	10
Extension	BCDA	1.5	3	2	
	SRI	<.5	<.5	3	10
	UNIV	0.5	1.0	2	
Data Bank	ELUC				
Coordination	UNIV	<.5	0.5	1	

Soil Correlation

J.H. Day

During the last year the group at Ottawa have discussed in seminar-type meetings the role of soil correlation in soil surveys, but I must admit that I for one am not yet able to offer a concise set of guidelines for correlation procedures that would function well in all parts of Canada for all kinds of surveys.

It is a little difficult for me to discriminate between the requirements of soil correlation and efficient field mapping operations because the former is inherent in the latter.

The party leader is the most important individual among those who contribute to a soil survey, because he is responsible both for supervising and contributing to the field work and for maintaining its quality. Supervisory staff can help him, and they can appraise his effectiveness as a leader, but they cannot give day-to-day direction to the survey and maintain its standards.

Functions of party leader:

- test the soil identification legend and revise it as necessary;

- map the soils and test the legend by experience and modify it as necessary to accomodate all the natural soil landscapes encountered;

- help to solve problems encountered in mapping;

- interpret mapping units and their component soil bodies;

- review the soil maps made by party members for uniformity of detail, soil identifications, accuracy of boundaries, expression of pattern and cartographic legibility;

- reviews samples of field mapping for each individual and causes adjustments to be made as required;

- trains co-workers and members of party in the relationships among soils with a survey area new to them;

- writes profile descriptions, samples soils;

- writes interpretations;

- compares his field and laboratory data with data for similar soils and for closely contrasting soils and documents reasons for identifying soils as "closely contrasting";

- prepares necessary documentation for field reviews.

Thus the duties of a party leader from the start of a survey until the material is submitted for publication focus on maintaining internal quality and accuracy for the published survey. In addition the party leader must have liason with supervisory staff and provincial soil correlator to ensure that the classification, the mapping, the interpretations and the report and map manuscripts conform to standards of the Canada Soil Survey Committee. He must thereby have effectively served as the most important member of the correlation team - the field pedologist who sorts out and documents differences between soils and ensures that series A is significantly different to all competing series.

In addition to the daily supervision of mappers exercised by the party leader, he must prepare the necessary documentation for periodic field reviews. The role and kinds of field reviews required are described in the following section.

THE ROLE OF FIELD REVIEWS IN SOIL CORRELATION

Reviews of soil surveys are made in the field by provincial soil correlators and others, supervisory soil scientists to help party leaders maintain standards that are adequate for the objectives of the survey and that are consistent with those of other surveys. Every science depends on confirmation of conclusions of one man by others to check the validity of findings. Field reviews perform that function for soil surveys.

In a field review, soil correlators go to the survey area to work with the party leader and his staff. From the perspective of their experience, they review conclusions that have been reached and decisions that have been made, and they work with the party leader to decide on adjustments that may be needed in legends and other technical aspects of the work. They examine samples of the field work of party members for soil identification, placement of boundaries, and map detail in relation to survey objectives; and they advise the party leader and other members of the party on ways to maintain mapping of good quality. They help the party leader solve problems he calls to their attention. They review the identification legend, soil descriptions, and supporting data and help the party leader keep the soil classification, nomenclature, and interpretations consistent with surveys of other areas. They also review with the party leader problems related to management and scheduling of the work of the soil survey and advise them of needed improvements.

The report of a field review is a record of the current status of the field work, field observations, conclusions, and recommended actions. It serves primarily as a working document to guide future operations of the field party.

The people who participate in field reviews vary in number and function according to the state of progress of the soil survey, the objectives, the cooperating agencies, and other factors. A realistic balance is needed between the number of people who can contribute and the number that can work effectively; if the number exceeds five or six, the efficiency of reviews is usually reduced. A representative from each of the cooperating agencies should participate in at least some of the more thorough field reviews. Provincial soil correlators of the Federal mapping agency and the principal cooperating provincial agency sometimes divide the workload so that one or the other conducts reviews that do not require the attention of both. The soil survey party leader and a supervisory soil scientist from one of the principal cooperating agencies are essential participants in every field review. Other members of the field party should participate in most field reviews. Their experience in the area contributes much, and the discussions during the review are valuable to guide them in future work and study. Individual soil scientists may participate only in the parts of a review directly related to their work, and if possible, they should participate when samples of their mapping are reviewed.

In addition to the soil scientists directly concerned with the soil survey, people from other disciplines need to participate in some field reviews. In some areas, those skilled in soil management for crop, forest, range, and in engineering can make useful contributions, as can plant taxonomists, geologists, and geomorphologists. Local skilled managers and extension specialists can provide useful information on yields and practices for field and horticultural crops. Representatives of agencies that use the soil survey should participate. Their concern for uses of the survey provides perspective for decisions, and their experience during the reviews contributes to effective use of the information when it becomes available.

Every soil survey needs an <u>initial field review</u> at the start of field work. Each survey also needs a <u>final field review</u> when field work is completed. From one to several <u>progress field reviews</u> are needed for most surveys while the work is under way. All have the same general objectives of quality control, but they differ depending upon the elements of the survey that receive special attention.

INITIAL FIELD REVIEWS

All initial field review is needed at the beginning of each soil survey to insure that legends and other working documents, supplies and equipment are adequate and that objectives and concepts are understood by the party leader and the field staff. It sets the standard for the conduct of the survey and representatives of the principal cooperating agencies should participate.

Prior to an initial field review, all of the initial activities required for mapping of the soils should have been started, though not all need to have been completed. A soil survey work plan defining objectives, scale, and kind of survey should have been completed and approved by all cooperating agencies. If significant changes are made in the specifications for the survey, the work plan must be amended. The party leader should have worked in the area for long enough time to become familiar with it, and he should have assembled and reviewed the existing information about the area and its soils. He should have made enough preliminary studies to prepare a tentative identification legend and assembled enough material for the descriptive legend to support his judgment about the mapping units needed. He should have tested the identification legend by mapping sample areas, keeping notes on the ranges of important soil properties within delineations, surface features and relationships to vegetation that are clues to kinds of soil and the location of boundaries, and the kind and amount of mapping inclusions. Needs for equipment, supplies and base maps should have been determined and these should be at least partly assembled. The staff for the field party should have been assigned, and some members may have started work.

An initial field review should appraise all of these preparations to be sure that they are adequate. A time limit should be set for having a draft of the descriptive legend available for all members of the field party if one has not already been prepared. The review should insure that the latest descriptions and the interpretations for established soil series or soil associations in the area are available to the field party and that descriptions and interpretations of tentative series have been prepared. All of these matters are important, but none is more important than the adequacy of the identification legend. A major part of the time and effort of the initial field review is normally spent on the identification legend, for it largely determines the quality and usefulness of the survey.

The review team usually spends a major part of the time in the field testing the tentative mapping legend against mappable bodies of soil. This is done in part by making transects across mapped areas to determine composition of mapping units. If the soils of the area are like those mapped previously in other nearby areas, testing of the legend may require relatively little time, but it still must be done. For areas having soils unlike those mapped elsewhere, an initial field review requires more careful field investigations.

Prior to the field review, the party leader should have located places where potential mapping units can be seen. Much time of the review team can be saved if soil profiles have been exposed in pits in advance for soils for which classification is in doubt. The review team must depend on the party leader to identify the most serious problems of the mapping legend and to provide evidence to support his judgments about all mapping units, even those he does not consider problems.

After all of the available evidence is assembled, including that prepared in advance and that studied in the field during the review, the review team must examine the naming of the various kinds of soil including phases and complexes and their classification in the taxonomic system. In addition, they consider ad hoc symbols and other devices to produce mappable units that will satisfy the objectives of the survey. Needed adjustments in the legend are made, and the revised legend becomes a part of the field review report and the working document used by the field party for mapping. This starts the process of correlation which continues until the survey is completed.

The review team must provide the party leader with instructions for any special studies that may be needed to answer any remaining questions. These may include collection of samples for laboratory studies, special field investigations, examination of literature not seen previously, or some combination of these. They must also provide instructions about matters that require special attention, such as adequacy of base maps and equipment, cartographic techniques, and other mapping procedures, and recording of field notes. These also should become a part of the field review report and guide for the work of the field party.

PROGRESS FIELD REVIEWS

Progress field reviews are made during the progress of a soil survey to test the classification, mapping techniques, nomenclature, and interpretations and to review and to confirm findings of the field party.

Usually, several reviews are needed during the progress of a soil survey. They range from comprehensive ones that cover all elements of a soil survey to others that provide help on one or more special problems. Comprehensive reviews are scheduled as needed to verify the adequacy of the legend, the classification of soils, the quality of field work and the validity of interpretations. Party leaders should request visits by supervisory scientists whenever they have unresolved problems that would affect the quality of mapping on a significant part of the area.

Prior to a progress field review, the party leader should assemble a list of unsolved problems. He should have prepared a tentative schedule of activities for the period the review team is to be in the area, allocating time for study of special problems, review of mapping, and appraisal of descriptive legends, soil handbooks, and other working documents. He should have up-to-date working documents, such as identification and descriptive legends and interpretive groupings and especially yield and practice tables. He should have located places where mapping or classification problems can be investigated, and he should have prepared exposures and detailed descriptions of soil profiles that the review team must study to solve problems. He should also select sites that exemplify the various land uses--both those that are problems and those that are successful. He should have up-to-date record of mapping progress showing the soil scientists responsible for each completed sheet, and the field sheets and notes of each soil scientist should be available. He should have available the results of laboratory testing of samples selected to guide the classification and mapping of soils. He should be prepared to describe the progress of all tasks listed for action at earlier reviews.

In contrast to initial field reviews which concentrate on appraisal of material assembled in preparation for field work, progress reviews focus on tests of their application in the field. By the time the first progress review is made, enough mapping should have been done to test the mapping legend. The review team and the soil scientists responsible examine the mapping of sample areas for soil identification, placement of boundaries, legibility of the maps, and kinds and amounts of inclusions in delineations. This both evaluates application of the legend by indidivual soil scientists and tests the legend itself and the base maps. Normally, a large part of the time of progress field reviews is spent on field work, though not necessarily all. Some field reviews may deal largely with review of legends and preparation of manuscripts and interpretations. Problems of soil identification and mapping recorded by the party leader may be studied in the field, and solutions are discussed at the sites. Sometimes special field study may need to be scheduled to solve some of the more serious problems.

On the basis of the field studies, the review team revises the identification legend as necessary, and deletes, adds or better defines mappable bodies of soil to satisfy the objectives of the survey. The supervisory soil scientists review with the party leader and other soil scientists the quality and status of the descriptive legend, the soil interpretations, and the classification and nomenclature of the soils. If adjustments or special actions are needed, they jointly decide what must be done. The supervisory scientists appraise the rate of progress and the mapping and field notes of individuals and make recommendations to correct deficiencies. If remapping or revision of mapping of some areas is needed, that is specified. Soils to be sampled for laboratory studies are identified, and if time permits, some or all of the samples can be obtained. The modified identification legend and a list of recommendations and actions become parts of the report of the field review and working documents to guide future activities of the survey and are effective when signed by the provincial correlator. Combinations or dropped mapping units must be carefully recorded to ensure that all symbols that appear on the map can be accounted for when the survey is completed.

A comprehensive field review is made about one year before completion of field mapping. It is similar to a final field review and is often referred to as a pre-final progress field review. The requirements are much the same as that of a final field review. The survey is critically reviewed for deficiencies and progress and <u>all</u> activities are evaluated including items like photographs, block diagrams, and other material for the soil survey manuscript. The field review report should include a progress report on all aspects of the survey; particularly deficiencies and jobs remaining to be done. These are listed for the survey party leader so they may be assigned and scheduled before mapping is complete. At this stage, time remains to correct deficiencies and to obtain additional data.

FIELD STUDIES

The prime objectives of field reviews is really a <u>functional inspection</u> of the soil survey. These reviews also entail some problem solving and extended guidance as by-products. In addition to conducting progress field reviews, provincial soil correlators and other supervisory soil scientists commonly need to visit survey areas specifically to help special problems. A party leader should request assistance when he encounters problems that he and the other soil scientists cannot solve. Frequently, a visit by a supervisory soil scientist for a day can provide solutions that prevent errors which would be costly to correct. These visits are not usually reported as formal field reviews. A written record of the decisions reached during such visits should be provided to representatives of the cooperating agencies and filed by the party leader as part of his record of the survey. Changes in the identification legend or mapping procedures should be made known promptly to all members of the field party. Decisions that affect the legend, classification of soils, or interpretations should be reviewed at the next formal field review and recorded in the progress field review report as part of the permanent record of the survey.

Final Field Reviews

A final field review is needed for every soil survey when the field work is complete or nearly so. It provides a last opportunity to review and confirm the results of the survey in the field. Initial and progress field reviews focus on matters that affect future mapping. Final field reviews concentrate on finding and correcting any deficiencies of mapping and on the adequacy of information for correlation of soils in the national system of soil taxonomy, for publication of the survey, and for special uses of the survey prior to publication.

As for other field reviews, the party leader should have up-to-date copies of all legends, maps, and interpretive material. He should have a list of remaining problems, and he should have a tentative schedule of activities that will satisfy the purposes of the review.

A final field review should also scrutinize the entire identification legend and supporting information to check the validity of mapping units, their names, and the classification and interpretations of soils. This is a final appraisal of the legend in preparation for the field and final correlations. A final field review can usually be conducted concurrently with a field correlation with substantial increase in efficiency. If they are not conducted together, the report of the final field review should contain recommendations for naming and correlation of each mapping unit in the legend for consideration during the correlation. It includes instructions for completing any remaining work and correcting any deficiencies.

FIELD REVIEW REPORTS

Reports of field reviews are needed as records of the status of soil surveys and of decisions that were made at various times during the progress of the work. For example, to know both that a given mapping unit was incorrectly mapped and when the correction was made is important. Knowing the date permits one to identify the field maps on which symbols may need to be changed. Field review reports provide a history of the most important decisions during the progress of a soil survey.

Some kinds of information are required in all field review reports. A standard form is usually used to record such items as the name of the area, its location, its size, the kind of survey, the dates of the review, the acres mapped at the time of the review, the names of the party leader and members of the field party, the names of others who participated in the review, the adequacy of equipment and base maps, and a number of other general facts.

Some of the most important parts of field review reports cannot conveniently be adapted to a standard format and should be included as special sections or attachments. A copy of the first identification legend is an essential part of the initial field review report, as well as a copy of the first draft of the descriptive legend. Drafts of descriptions and interpretations for new soil series proposed at the initial review should be included or instructions for their submission at a later date should be provided. A list of recommendations and instructions for the conduct of the survey should also be included. Notes of observations made during the review about soils or related matters are commonly included as part of the record. Flow charts should be attached to initial field reviews to show when and by whom various tasks related to the completion of the survey will be done. Recommendations for special laboratory or field studies should be recorded, and if possible, schedules for sampling and other work should be listed.

Reports of comprehensive progress field reviews must include the complete identification legend to be used by the field party after the field review, whether or not it has been changed since the last review. When only minor changes are made in the identification legend, only the changes need be listed. Descriptions of new soil series proposed since the last field review should be attached. The report should include a record of deficiencies in the mapping, in the descriptive legend, and in soil interpretations, and a statement of actions including any of an administrative nature recommended to correct them. Any outstanding accomplishments of either a technical or administrative nature should be listed. Special problems investigated and proposed solutions be recorded. Changes in the legend, mapping procedures, base maps, and soil survey interpretations made by the field party since the last field review should be recorded, in addition to those made at the time of the review. The dates of such changes should be given to show that they predate the review. If mapping units and their symbols were used but later dropped, they must be recorded and identified, and the disposition of such symbols on the field sheets must be described.

When supervisory soil scientists visit an area to help resolve a few problems related to identifying and interpreting soils, a written report should be submitted. Reports of such field study trips are documented through memoranda usually directed to the supervisor of the reviewer and the party leader or both, and copies are provided for representatives of cooperating agencies and the provincial and national offices. The memorandum is not a formal document of the survey. The recommended actions are listed in the report of the next formal field review and property documented. Only formal review reports should be used to document the history of a survey.

Reports of final field reviews include the same kinds of attachments as those described for progress reviews. Greater emphasis should be given to the status of maps and information for publication of the survey. Special attention should be given to the status of laboratory data for samples collected for characterization, correlation, and soil interpretations. A list of recommended names of mapping units should be included for consideration during the field correlation. If the field correlation is held concurrently with the final field review, the two reports can be combined.

SOIL CORRELATION

Soil correlation is the process of maintaining consistent definition, naming, and classification and interpretations of kinds of soil and of mapping units they identify. It also coordinates the ranges of interpretations shown in each unit. The correlation process uses evidence to test for similarities and differences among soils at different places. It uses field and laboratory data as evidence of similarities and differences among soils. It also uses evidence of soil behavior under different uses to test the validity of conclusions about similarities and differences. It needs consistent methods of observation and measurement and consistent conventions and terminology to make the necessary comparisons. Thus, soil correlation is concerned with more than defining, naming, and classifying the many kinds of soil identified in soil surveys. It is concerned also with methods, terminology, and conventions used for describing and defining soils. It is also concerned with conventions used to name and identify mapping units and with the usefulness of mapping units for soil survey interpretations.

A large number of criteria and guidelines have been prepared to assist in maintaining uniformity of correlation. The "System of Soil Classification for Canada" describes terminology and conventions for describing and characterizing soils and landscapes in the field, and also defines the national taxonomic system and the diagnostic limits for taxa above the soil series.

Reports of C.S.S. subcommittees define methods, classes, or limits for analytical methods, landforms, interpretations and others. The CanSIS soil data code manual contains the data forms and codes used for the national data system, and the name file is the registry of soil names already in use.

The correlation procedure both informal and formal requires much judgment in the interpretation and testing of evidence on which correlations are based. The correlation process continues from the beginning to the end of each survey. The informal procedures are those quality control activities and mapping decisions carried out by the party leader and the field scientists throughout the period that field work continues. The results are so important that they are re-examined critically by supervisory soil scientists of broad experience when the mapping has been completed and before the survey is submitted for publication. The formal aspects of correlation involve the activities of supervisory soil scientists in field reviews, field correlations, and final correlations. The formal correlation is normally done in two steps. The first is a re-appraisal of the mapping units and the information assembled about them by supervisory soil scientists who have had much experience in nearby areas like that of the soil survey. This is commonly done in the field where specific sites can be studied to resolve questions. This is called a Field Correlation. The second is a review of the recommendations of the field correlation by supervisory soil scientists who are responsible for correlations within a much larger region of which the survey area is a part. This is the Final Correlation, and its conclusions are the bases for publication of the soil survey.

CORRELATION WHILE FIELD WORK IS GOING ON

The process of soil correlation in a soil survey starts with preparation of the first draft of the identification legend. As a party leader describes soils at different places during preliminary studies of an area, he is assembling evidence to be used in correlation. He uses such evidence to compare and contrast sets of properties of soil at different places. If he concludes that a soil identified and named in another soil survey is of the same kind as a soil of the area in which he works, he uses the same name. The first identification legend is a product of these kinds of tentative correlations.

The process of correlation continues as field work progresses. At the initial field review, supervisory soil scientists examine the evidence and test the tentative correlations represented by mapping units in the legend. They test the legend against the background of their knowledge and experience in terms of both the classification of soils and the usefulness of the mapping units. As the survey progresses, the soil scientists continually test the correlations represented by defined mapping units against sets of properties of soils that they observe in the ground. The field party accumulates soil descriptions, records of observed soil performance under different uses, and other field data. Soils are sampled and are analyzed by laboratory methods to provide other evidence. As the evidence accumulates from all of these sources, definitions and names of some mapping units usually need to be adjusted, some new units need to be named and defined, and others are combined or dropped. Each such action is a refinement of the correlations of a soil survey. Each successive field review results in a more refined correlation of soils of the survey. Each interpretation of the survey for applied purposes tests the validity of judgments about similarities and differences among the kinds of soil that have been identified and the usefulness of mapping units for applied purposes.

THE FIELD CORRELATION

Field correlations are conducted by a provincial soil correlator, the party leader, and others who can contribute. The soil correlator should be familiar with the soils of the province where the area is located or with the soils of contiguous provinces. Other members of the field party usually take part, and representatives of the cooperating agencies may participate. Representatives of other disciplines, such as foresters, range specialists, extention specialists, or engineers may assist if their knowledge can contribute to a validity of judgments. Soil scientists responsible for surveys of adjacent provinces participate if they can make useful contributions. The field correlation and final field review are usually conducted concurrently for their functions are complementary.

The party leader should provide a complete legend that lists all mapping unit symbols that have been used on the field sheets, complete descriptions of all mapping units, descriptions of the main component soil series defining their properties as observed in the area, copies of laboratory data assembled for soils of the area, drafts of soil interpretations and interpretive groupings for the objectives of the survey, and measurements or reliable estimates of the extent of mapping units. He should have available the supporting field notes and data on which these documents are based. The filed maps of the area should be available. Copies of descriptions of soil series and interpretations for them and the mapping units identified in the area should be available. Most of the information needed should have been assembled in the descriptive legend and a soil handbook for the area at this stage of a survey, and for some areas, the first draft of the soil survey manuscript may be available.

As much as possible of the field correlation should be completed in the survey area. For some surveys, all recommendations can be prepared in the area; for others, information not available in the field office must be consulted by the supervisory soil scientist before final decisions can be made on some problems.

The full list of mapping units used during the course of the survey must be checked during a field observation. Some mapping units used on the maps may not be clearly distinguishable from others and may be combined with similar units under one name; others may not be needed for the purposes of the survey and can also be combined. Combinations must be recorded so those who compile the manuscript map can identify the areas by the same symbol for the published map. Provision must be made for accurate description of such combined units for the manuscript for the published soil survey.

The validity of phases within a soil series or a taxon of a higher category must be checked with special care. The justification for phases rests on behavior of soils under use. For each such phase within a soil series or a taxon of a higher category, at least one statement about soil behavior must be unique, and differences in behavior must be large enough to exceed normal errors of observation.

Those conducting field correlations must be on guard against direct conversion of classes of soil properties, such as slope, into phases. Classes of properties that serve as phase criteria are given in the "System...." as guides for potential class intervals that are useful for some kinds of soil in some surveys. All are not necessarily useful for all kinds of soil of all surveys. The usefulness of each phase must be tested from the beginning of the survey and verified during the field correlation. Phases of a single taxon that do not differ significantly in behavior are combined as single more broadly defined phases of the taxon. Similar phases of different taxa may also be combined if no useful purpose is likely to be served by retaining them. These are usually named as undifferentiated soil groups. The interpretations prepared during the course of the survey provide evidence for verification of similarities and differences in behavior among mapping units. The interpretations for mapping units are checked against interpretations for similar units elsewhere and adjusted as necessary. Some phases that reveal important genetic or morphologic soil relationships may be retained even though they do not have unique behavior or response under use.

Recommendations are made during field correlations for naming the mapping units that will appear on the published map. The descriptions by the field party of soil series used in a survey must be checked against standard descriptions of these series. Many of the series concepts used may have been identified with series named in other areas, but the identification must be checked. Descriptions of new series proposed in the area must be compared with standard descriptions of similar series within the same and closely related families. Recommendations must be made either for recognition of a new series or for correlation with one already named. Suggestions for modification of definitions of established series to accommodate soils of the area must be reviewed. The definitions of all series used in the area must be checked against the limits of diagnostic criteria of the soil taxonomy, and all series must be classified in the system. Finally, recommendations must be made for naming mapping units as phases, complexes, soil associations, undifferentiated soil groups, kinds of areas without soil, and the like in accordance with standard conventions.

A field correlation memorandum must be prepared as a record of the recommendations and should be approved by and distributed to representatives of the principal cooperating agencies. This memorandum should include as a minimum:

1. A complete identification legend, and
   - (a) The soil name used in the field to identify each mapping unit symbol.
   - (b) The recommended name for each field mapping unit symbol as it is to appear on the published map.
2. Explanatory notes for all recommended correlations for which justification is not obvious from the evidence submitted for the field correlation.

3. A complete list of conventional signs and symbols, and special soil symbols used to identify unmappable spots of contrasting soils, and their definitions or a reference to a published source of definitions.

4. A record of correlation of pedons that were analysed in the laboratory, including those tested for engineering properties.

5. Evaluation of current draft of the Soil Survey manuscript.

6. List of series recommended,

   (a) for revision of descriptions and interpretations,

   (b) to be established,

   (c) to be dropped, or

   (d) to be made inactive.

FINAL CORRELATION

A final correlation is a critical review of the recommendations of the field correlation. It should be conducted by a regional soil correlator experienced in soil correlation and classification in a region large enough to include most of the soils which will be correlated in the survey area. A correlator who is familiar with the soils and the status of correlation in the entire Northern Great Plains, for example, should conduct the final correlation of a survey in that region. Assisting him are the party leader and a provincial soil correlator and representatives of the principal cooperating agencies. Usually they participate in person but some may make their contributions by correspondence.

The field correlation memorandum and its supporting evidence provide the basic information needed for final correlation. Additional evidence is drawn from standard descriptions of soil series related to those of the survey area, from soil correlation samples collected in the area, from published soil surveys, soil interpretations, and laboratory data for similar soils of other areas, and from personal knowledge of those participating, especially that of the party leader.

In final correlations, special attention is given to classification and interpretations of soil series. The content and adequacy of descriptions and interpretations for soil series recommended for correlation are appraised in relation to the official descriptions. Descriptions for proposed new series are examined most carefully. They are studied for possible conflicts with other established or proposed series and for ranges of properties that would exceed limits of diagnostic properties defined for taxa in the "System of Soil Classification for Canada". The recommended classification of each series in higher categories is reviewed for conformity with the diagnostic criteria of the "System of Soil Classification for Canada".

The proposed correlations of mapping units for publication are reviewed to insure that similarities warrant the proposed combinations and that differences among the units retained are large enough to justify retaining them. The nomenclature must be checked to see that it conforms to established conventions, and definitions of units must conform to established standards. Usually, a sample of the proposed mapping units is tested. These are drawn partly at random and partly to compare those units that are most closely related. If the mapping units of such a sample prove to be consistently acceptable, others may not be tested as thoroughly but all are reviewed and checked. If the testing reveals inconsistencies, testing of additional units is continued until all are satisfied that all mapping units proposed for publication are defined adequately, interpreted correctly, and named properly. If questions that arise cannot be answered by the evidence at hand, they should be referred to soil scientists in the province of the survey area for additional information. Some may require additional field investigation or laboratory studies.

A final correlation memorandum is prepared as a record of decisions that are reached. The essential elements are:

1. A complete identification legend, and,
   (a) The soil name used in the field to identify each mapping unit symbol, and
   (b) The correlated name and symbol of the mapping unit for soil to appear on the published soil survey.
2. Notes explaining decisions for which justification is not evident in the documents supporting the field correlation.
3. A complete list of conventional signs and symbols as well as special symbols and their definitions for unmappable spots of contrasting soils and instructions for deleting or retaining them on the published soil map.
4. Classification of all of the correlated series, including those sampled for laboratory analysis and engineering tests.
5. Any special instructions for map compilation.
6. A list of soil series,
   (a) Established,
   (b) Dropped, or
   (c) Made inactive.
7. A statement on joining of field sheets to adjoining published surveys.

Sometimes review of a final correlation by individuals who did not participate or new evidence that becomes available after the correlation was completed reveals a need for some changes. Such changes are recorded as amendments to the final correlation memorandum and become part of the record used for preparation of the map and text of the published survey.

The final correlation memorandum identifies and names the mapping units that are to be shown on the published soil map and are to be described and interpreted in the accompanying text. It shows the correlation of field mapping units with the approved units for the published soil survey. Cartographers use it as the basis for compiling from the field sheets a soil map for publication. Those who write the text for the published survey use it to identify the mapping units to be described and interpreted. It remains as a record of decisions and the bases for them at the conclusion of a soil survey. It serves as a reference to answer questions about the survey that may arise in the future. It establishes new soil series in the national system of soil classification.

REFERENCE SAMPLES FOR SOIL CORRELATION

Soil samples are needed for two purposes in soil correlation. One is to serve as part of the long-time record of the nature of soils of the country. The other is to provide part of the evidence for completing final correlations for individual survey areas. Some samples serve both purposes.

A collection of samples of the soil series of the survey area may be kept in the provincial office. In addition to their function as part of the long-time record on the nature of soils, samples are used to test the reliability of profile descriptions. They also permit more precise comparisons of the norms for competing series than do descriptions alone.

The extent and importance of the map unit determines the number of pedons that need to be sampled for the national collection. If the soils of a series are extensive, samples of from three to five pedons are needed. If the soils of the series are of small extent, samples from one pedon are enough.

Samples that represent the series in an individual survey area aid in the correlation of the soils and form part of the evidence for correlation. After the correlation is completed, the samples not required as part of a permanent collection are discarded.

KEEPING RECORDS AND DEFINITIONS OF SOIL TAXA

The taxonomic system of soil classification provides the basic definitions and reference names of soil taxa which were to identify soil mapping units. Keeping definitions and names of soil taxa up-to-date is essential for identification of mapping units, for correlation of soils nation-wide, and for transfer of information about soils at one place to similar kinds of soil elsewhere.

Definitions and names of soil taxa can be kept by different procedures which may be modified from time to time. All require some kind of centralized system by which data from the field and laboratory can be assembled for study, conclusions that reflect nation-wide perspective can be reached, and information can be disseminated to the field. These procedures are more appropriately subjects of special documents, which can be revised as necessary, than subjects of this communication. Only general aspects are described here.

TAXA OF CATEGORIES ABOVE SOIL SERIES

The "System...." and amendments define and name taxa of the categories of orders, great groups, and subgroups. It defines limits of diagnostic properties of soil families within subgroups and gives conventions for their names.

The "System...." is a basic reference for soil identification, classification, nomenclature, and correlation for categories above soil series. It is also a basic reference that defines limits of many properties of soil series. Soil series identified in individual soil surveys must be classified as members of specific taxa of soil families and higher categories. The limits of properties of soil series cannot exceed the limits of diagnostic properties of soil families and taxa of higher categories in which they are classified.

Although an immense amount of data was studied as the basis for the definitions of taxa above soil series, testing of the system is a continuing process. The system is not a model of absolute truth for all time. As we learn more and as new problems arise, changes are necessary. The diagnostic criteria are used to define the limits of many properties of soil series, but each time a soil described in the field is classified in the system the system itself is tested against properties of the soils as they appear on the ground.

During the course of a soil survey, the taxonomic system is tested and retested many times. The results of these tests are reported at field reviews and at the field correlation. Inconsistencies between the system and properties of soils observed in the field and problems of mapping or identification created by the application of the system should be reported in field review reports and correlation memoranda. They should be called to the attention of soil scientists responsible for keeping the system up-to-date. This would normally be done by soil correlators who participate in field reviews and correlations, after appraising inadequacies of the system reported by the field party.

Conflicts between the taxonomic system and field mapping or identification of soils are not ordinarily adequate bases for modification of the system. As tests continue, evidence to support need for specific changes to make the system more useful is certain to accumulate. Supervisory soil scientists are responsible for appraising such evidence and for proposing changes in the system if the data appear to justify the action.

Any proposal for a change in the system should be tested before final action is taken. The proposed change should be communicated to regional soil correlators responsible for surveys in various parts of the country. They should determine both the consequences of such a change for the classification and mapping of the specific kinds of soil that would be affected directly and the impact on classification and mapping of other related kinds of soil. For many proposals, special field and laboratory studies may be needed to test their validity.

If testing determines that any part of the taxonomic system should be modified, the decision should be communicated promptly to all who actively participate in the Canada Soil Survey Committee. Any change can have an impact on field work, especially if it affects limits of diagnostic properties, which define limits of many soil series.

SOIL SERIES

Soil series have been used as the reference taxa for naming most mapping units of detailed and some reconnaissance surveys throughout the history of soil surveys. Over time, the concepts of the category of soil series and of individual series have changed, but definitions and names of nearly 4000 series are now consistent with the taxa of higher categories. These definitions and names, collectively, represent the framework within which most of the detailed information about soils of Canada is identified with specific places. They provide the principal medium through which detailed information about the soil and its behavior at one place is projected to similar soils at other places.

The Canada Soil Survey Committee must maintain rigorous standards for definitions of soil series, and the names for the same kinds of soil must be consistent among individual soil surveys. This is a major objective of the correlation process. The category of soil series is not static. As new knowledge is acquired, definitions of some established series must be modified. New series must be defined for newly recognized kinds of soil. Changes in criteria or limits of taxa in categories above the soil series to accommodate new knowledge require modification of definitions of member series. Keeping records of series names and up-dating definitions of series is a continuing process. The changes must be accomplished in ways that detract the least from the predictive value associated with the definitions and names of the past. Some centralized system is necessary.

The soil survey uses a national system for keeping records of soil series, soil association and soil complex names and definitions. The process provides that both names and definitions of new soil series are initiated, reviewed and approved before they are released for general use in the soil survey. The procedure may change from time to time, but the objectives remain the same.

STANDARD SOIL SERIES DESCRIPTIONS - Every soil series used in Canada must be defined as fully and accurately as existing knowledge permits. This principle applies to proposed new soil series used in an individual survey as well as to series established as kinds of soil identified in the system of classification of soil of Canada. To assure that essential information is included and to permit comparisons of series definitions by different people, a standard format calling for specific kinds of information is needed.

The soil survey uses "standard soil series descriptions" to record definitions of soil series and other relevent information about each series. The format and kind, and amount of detail may be changed from time to time, but certain basic kinds of information are needed. The detailed definition of each series is essential. In addition, information that is descriptive but not specifically definitive is needed to aid the reader in identifying the soil in the landscape and relating it to other kinds of soil.

Definitive parts of a standard series description should include at least the following:

1. Placement of the series in the current classification system at all categorical levels. This defines limits of properties that are diagnostic for the series as well as for taxa of higher categories.

2. A description of a typifying pedon identifying horizons and describing each in as much detail as necessary for visualizing its properties. Those that are diagnostic for classifying the pedon must be described.

3. A statement of the ranges of properties that distinguish the series from other soils of the same family. This with Item 1 defines the limits of the series in relation to those of all other known series. Ranges of other properties may be needed, such as those used to estimate diagnostic criteria that cannot be measured directly in the field.

4. A statement that defines the bases for distinguishing the series from "competing series" with which it might be confused. Competing series are mainly those that share common limits with the series described or are members of the same family.

5. A statement that identifies at least one place where a reference specimen represents a norm for the series - a "type location". A type location should be described precisely enough that another person can locate it in the field.

Parts of a standard series description are not required to define the series, but they are important aids to a reader. All are not equally important for all soils. Most standard descriptions should include the following:

1. The landform and physiographic position of the series, including its position relative to other landscape elements with which it is associated.

2. Parent material--the kind of mineral or organic material in which the soil formed, including kinds of rock from which the regolith was derived if that can be estimated.

3. Drainage of the soil, such as drainage class or other means of identification within standard soil moisture regimes. Seasonal wetness or dryness may be important.

4. The other kinds of soil with which the series is commonly closely associated geographically.

5. The major uses of the soil and dominant kinds of vegetation that grow on it. Native plants should be identified if known.

6. Distribution and extent. The known geographic distribution and whether the soil occupies a large, small, or intermediate aggregate area should be given.

7. The year and the soil survey area where the series was proposed or established.

8. The identify of the persons who prepared and approved the series description and the date it was prepared or approved.

In addition to, but not a part of, the description is a sheet showing interpretations by phases for the expected uses of the soil.

SOIL SERIES NAMES - A new kind of soil that cannot be accommodated by any known soil series is described and is named tentatively. This is usually done by the party leader of a soil survey or by a provincial soil correlator. The national list of soil series names should be available, and a name that is not currently in use should be selected. Names of places or other geographic features at or near the area where the soil is first identified are usually used. Guidelines for selecting names are given in the List of Canadian Soil Names.

Each name must be recorded in a national register to avoid duplication, and names selected locally must be checked at the national level to be sure they have not been reserved for another series elsewhere. Even though revised national lists of series names are issued periodically, the name may have been used elsewhere since the latest revised list was distributed.

When a name is proposed for a new series, a request to reserve it must be forwarded promptly to the office responsible for national records. A description of the soil in a standard format must accompany the request. The description may be an initial draft subject to review and revision. Names that would be difficult to pronounce or spell or that could have undesirable connotations must be avoided. If a name must be rejected, the soil scientist who proposed it is advised to select another. If the substitute name is approved, it is entered in the national list of soil series as a reserved name. At this stage the name is reserved for a tentative soil series, and it cannot be used for another kind of soil until it is determined that the tentative series is not needed.

THE REVIEW OF SOIL SERIES DESCRIPTIONS - A standard soil series description is usually prepared in a first draft by the party leader of a soil survey area where the series has been identified or by a soil correlator. The first draft is likely to reflect perspective of a soil and its relationships to other kinds of soil in an area of relatively small extent. The description should be reviewed by soil scientists familiar with soils of other areas where the same series or others related to it may be found.

Procedures for review of soil series descriptions may change, but an orderly system is needed to provide consistent critical review from both local and national perspective. Copies of the first draft of the description and attached interpretations of each new series and of revised descriptions of established series and their interpretations should be sent to all soil scientists responsible for soil classification and correlation in provinces or in a region that have similar kinds of soil. These soil scientists should examine the descriptions and interpretations for conflicts with series used in the areas for which they are responsible. They should recommend whatever adjustment are needed to be consistent with the classification and use of soils where they work. They may recommend that the proposed series be combined with a tentative or established series which the soil described closely resembles. The reviewers should give special attention to the parts of the description that define ranges of characteristics and that differentiate the series from similar soils. They should also study the description and interpretations for clarity, completeness, proper use of terminology; and classification of the soil in categories above the soil series should be verified.

A revised draft should be prepared on the basis of recommendations and suggestions of reviewers if the series appears to be a unique kind of soil. This is usually done by the person who prepared the first draft or by a provincial correlator. The revised draft with a summary of comments by reviewers should be submitted for further review by a regional soil correlator responsible for the classification and correlation of soils of the region. After this review and any needed revision, the description should be reviewed by supervisory soil scientists of other regions for possible conflicts with series of those areas. A final draft including all of the revisions needed to identify the series and differentiate it from others may then be approved, reproduced, and distributed by the national office. Although a series description is approved, the series may remain in tentative status until it has been correlated in a completed soil survey. It is then recognized as a unique kind of soil of significant extent for the national soil survey.

THE STATUS OF SOIL SERIES - The status of a soil series may change or the definition of a series may have to be revised as knowledge about soils increases. When a series name is first reserved, knowledge that it stands for a unique kind of soil among all soil series of Canada is lacking, as is knowledge that the area is large enough to justify naming is a unique kind in the national classification system. Even though it is unique, a soil series having a total extent of 40 ha (100 A) usually cannot be justified unless it is most unusual. Normally, 800 H (2000 A) is required to justify establishing a series. Conversely, new knowledge sometimes shows that a soil series is no longer needed, and the name is removed from the list. The Ottawa office charged with the soil survey of Canada must keep a record of the status of reserved soil series names.

When a series name has been reserved and a draft description of it has been submitted, the name is entered in the national list. If the series has not been correlated in a specific area, it is identified as a <u>tentative series</u>. This implies that the kind of soil defined is still being tested for uniqueness and extent to determine whether it is a valid taxon in the national system.

If a tentative series is determined to lack uniqueness or is of too small extent, the name is dropped from the national list. Records of <u>dropped series</u> are kept separately, and contain the name, where and when the series was proposed, a standard series description, the date when the series was dropped, information that explains the decision to drop the series, and the final disposition of the soils named for the series. Such records are useful to answer questions that arise about soil surveys long after original concepts and actions are forgotten.

Dropped series are no longer a part of the national classification system and the names may be used again, for another kind of soil. Usually, several years should elapse before the name is used again, and it should not be used in the legend of a soil survey where it was used earlier for a different kind of soil. The risk of people confusing concepts of the dropped series with the new concepts for which the name may be used must be carefully considered. When a tentative series is dropped, all soil scientists who may have had reason to refer to it are notified promptly, and documents about the series are removed from active files.

If thorough testing demonstrates that a tentative series is a unique kind of soil and has a significant area, the series may be <u>established</u>. An <u>established series</u> is listed as a taxon in the national classification system. A series is usually formally established during the final correlation of a soil survey where it has been used as a tentative series.

A series is established only after (1) it has been verified as a unique kind of soil, (2) it has been shown to occupy an area large enough to be a significant taxon in the national soil classification system, (3) a standard series description has been reviewed and approved, and (4) the series has been identified as a valid taxon in a final correlation of at least one soil survey. Under some circumstances, items 3 and 4 may be waived. For example, a soil may need to be identified by name in a research report to be published before the review of the series description is complete or before the series has been established in a final correlation of a soil survey. If the evidence is convincing that the tentative series is unique and is extensive, it may be established for the research report.

When the definition of a soil series established at some time in the past is inconsistent with new knowledge or new conventions arising from new knowledge, the standard series description must be revised or the series should be made <u>inactive</u>. Many definitions of soil series established before the "System...." was published in 1970 permitted ranges of characteristics beyond limits imposed by diagnostic criteria of higher categories of the "System....". This did not make most established series useless, but it restricted their ranges and required review and approval of <u>revised standard series descriptions</u>. The central concept remained the same for most series, the mapping delineations remained about the same, but greater amounts of inclusions outside the newly defined ranges of the reference series are recognized.

Some series established early in the soil survey had broad concepts and included several unique kinds of soil by current concepts of the category of series. These must be divided into several series to conform with current standards of the category. For some such series, less confusion results if new names are selected for all of the series. The old name is then made inactive rather than retained for a small segment of the range of properties is formerly implied. Sometimes two series established in different parts of the country are determined to have the range of properties suitable for a single series. One of the names is then removed from the list of series in current use, and a new standard series description is prepared for the combined soils.

When a series name is removed from the list of series in current use, it is designated as an <u>inactive series</u>. Mapping units identified in terms of inactive series remain on published soil maps and are described in published surveys. The name may not be used again for a different kind of soil, at least until soil surveys using new names have superceeded the published surveys in which the name of the inactive series was used.

A separate record is kept of all inactive series. That record includes the name of each inactive series, where and when it was established, a copy of the last approved series description, the date it was made inactive, and a statement about the reasons it was made inactive.

CONTINUITY OF SOIL SURVEYS

Both the quality and efficiency of soil surveys are usually increased by uninterrupted operations by the same soil scientists on a systematic schedule that will complete the work in a few years. The term progressive soil survey is used to convey the idea of continuity in time and space so that mapping that proceeds systematically across contingguous areas. Over a short time span, a soil survey party can keep concepts and procedures uniform and produce a map of uniform quality.

Rapid progress toward completion of a soil survey contributes to good quality and efficiency in several ways. The soil scientists gain understanding of the relationships among soils and landscapes with experience in the area which enables them to plan and execute their work efficiently and uniformly. Over a short time span concepts and techniques will remain uniform which contributes to uniformity of mapping. Changes in field staff will be fewer, and likely a single party leader will direct the entire survey and few or no changes will be made in the remainder of the staff. This also contributes to the uniformity and efficiency of the work.

To the extent feasible, mapping is scheduled so that each mapper proceeds systematically across contiguous areas. When a soil scientist returns each day to the place he stopped the day before, he has predetermined facts as references. He has boundaries that were projected tentatively into the area the day before as predictions to be verified. He already understands the soil patterns and the clues that interpret the immediate landscapes. Mapping systematically across contiguous areas contributes greatly to both efficiency and maintaining quality.

The objectives of some soil surveys require mapping of small individual operating units, such as individual widely separated farms or ranches, over an area to service an action program. The standards for legend design and field techniques are similar to those of progressive soil surveys. Even though such soil maps are well suited to planning on the individual tracts for the immediate objectives for which they are made, they are poorly suited for preparing a published soil map. The mapping usually continues over a span of ten or more years--long enough for concepts and techniques to change. Individual mappers who map in widely separated areas on succeeding days have little chance to become familiar with soil and landscape relationships so that uniformity and efficiency are not attained. When mapping continues over a long period, changes in staff result in less uniformity and efficiency in mapping. Usually such mapping will need to be revised or redone before it is suitable for publication. When the decision to publish is made, revision of the work plan, identification legend and descriptive legend is usually required. If the mapping has continued over a long period and many soil scientists have worked in the area, more efficiency and uniformity and better quality can usually be attained by remapping with a revised legend on new airphotos.

RELIABILITY RATINGS OF SOIL MAPS

The names of different kinds of soil maps imply different methods and different detail of investigation, and a great deal about the reliability of boundaries and identification of soils. A considerable range of detail is included within each kind of survey. The scale implies something about the detail of investigation, but this is not an infallable guide. The complexity of the soil pattern and the extent to which it is reflected in landscape features that are easily observed also influence reliability and are not fully revealed by the kind of map or its scale. An experienced person can infer some elements of reliability from the shapes and patterns of soil boundaries on the map. Most users lack the skill and understanding required to evaluate the reliability of soil maps, and they do need some measure of the reliability of many soil maps.

For detailed soil maps, the criteria described in Chapter 1 and the standards of purity of mapping units, given in Chapter 6, provide minimum standards of reliability which a soil scientist should strive to equal or exceed. If parts of a surveyed area had special conditions that made the information for them less reliable than for others, the difference in reliability should be shown in some way. For example, soil boundaries cannot be plotted as accurately in heavily forested areas as in open country where the elements of landscapes are clearly visible. The text should then give some indication of the degree to which the forests affected reliability of the mapping. If some mapping units of an otherwise detailed map are delineated by general mapping methods, they must be identified in the legend. The published soil survey should describe how the survey was made. Such a description helps map users appraise the reliability of mapping in the same way that the section on methods in a report of laboratory research helps readers. Samples areas of some detailed surveys are investigated very thoroughly after mapping is completed to determine the kind and amount of inclusions in mapping units. If such data are available, they should be reported in descriptions of mapping units.

For general soil maps, including those made by field methods or those compiled from other sources, the map units are less precisely defined. The text should describe the methods used, including the kind and spacing of field examinations and the criteria used to project boundaries to unseen areas if the map has been made by field methods. Sources of information other than field studies should be listed. For compiled maps, the methods of compilation and the sources of information should be given, and the kinds and bases for correlations should be described.

Many general soil maps, and especially maps of exploratory surveys and schematic maps, should have their reliability rated on some scale--as a minimum, "good", "fair", or "poor". If parts of a map differ in reliability, a sketch map showing those parts separated by a boundary and labelled as to reliability is useful. The rating is judgment which is subject to tests of reliability, and the basis of that judgment should be given as well. The judgment is commonly based on (1) the amount, detail, and reliability of information used for predictions, and (2) the amount of field investigations to verify predictions.

END OF CHAPTER

Soil Survey Manual, pp 4-47 unpublished, "not to be quoted, copied or distributed".

DISCUSSION

Shields - commented that the system of correlation would work well if there were sufficient correlators. He considered it important that the correlator be involved in the initial field review. He asked for clarification of the roles of the provincial and federal correlators because he had the impression that his main role was to attempt to achieve taxonomic uniformity. Shields stated one of his main current concerns was to achieve greater uniformity in mapping units, but the main responsibility for achieving this lay with the provincial correlator. He considered his major function was to correlate along provincial boundaries.

Nowland - stated that little correlation had been done in the Atlantic provinces in the past. He considered that the proposed system would require modification to make it work in the Canadian context but that as a starting point it was a good proposal.

Ellis - stated that correlation was achieved in the past through the effort of party leaders. He considered that mapping systems might be better integrated. He stated that he considered the role of a correlator was to carry information and concepts from one province to another and for that reason could not understand why the western correlator was not located in Western Canada.

Day - stated that the small staff and the need to exchange information across Canada almost required that all the present correlators be in one location. Many chores such as the book "Soils of Canada" and responses to requests for information could not be effectively carried out if the small correlation staff was scattered.

Nowland - stated that the concept of regular field reviews was an essential part of good soil survey management. General correlation he considered to be simply the exchange of information between provinces. The process of correlation should be divided into two parts.

Day - responded that a good data base was essential for correlation, and standards must be maintained throughout survey operations.

Beke - stated that he considered correlation to involve the exchange of information between provinces but presently all manpower is committed to ongoing field programs. He wondered where the necessary manpower for adequate correlation would come from.

Day - stated that one of the duties of the officer-in-charge of a unit was correlation. One solution in the Maritime provinces he suggested would be to establish an amalgamated regional survey unit.

Clark - pointed out that one of the problems soil survey has to face is a historically-limited budget. To attempt to increase budgets and manpower these days was he felt amost impossible. He stated that soil survey must make some decisions about priorities. He pointed out that provincial activity in soil survey was increasing rapidly and this required greater efforts in correlation and research from the federal soil survey units and suggested correlation may have to become a more important function for the federal survey units.

Dumanski - expressed the opinion that the lack of clearly stated systematics and procedures for survey have been a source of difficulties. He stated that even the naming of map units after taxonomic units on the one hand, or the failure to name these units on the other, can create difficulties with CanSIS and some sound philosophic basis for establishing and naming map units would be helpful. He pointed out that it was also necessary to establish methods for describing and rating land units for agricultural engineering and other uses.

Development of National Programs for Soil Survey

J.S. Clark

The Chairman opened the session on the development of national program with general remarks touching on:

a) the need to clarifying the role of the federal provincial and other organizations undertaking soil survey;

b) the nature of the soil correlation function in the Canadian context;

c) the backlog of soil survey reports awaiting publication;

d) the general priorities for research;

e) the possibility of contracting soil survey.

Mr. Duffy stated that it was his view that the national soil survey program assume as its major responsibility the coordination of land surveys. The problem of a large number of agencies even in the federal government alone, with only partial mandates for carrying out land resource surveys, is the main reason that there is need for a strong coordinating body. In view of the fact that those associated with the CSSC have the competance for carrying out land resource surveys, they should give leadership to the establishment of a coordinated national program. He recommended that the CSSC should prepare a paper outlining the need for a coordinated resource survey program and the structures required to carry it out. In developing this "position paper" Duffy also recommended that the cooperation of GSC, Forestry, Lands and other agencies should be sought.

Duffy stated that the coordination should involve a combined planning of land resource survey programs so that a unified program could be developed and duplication avoided.

Peters substantiated the need for coordinated planning and stated that the adequate coordination of the work of the participating resource specialists was one of the most difficult problems encountered in the surveys of Watertown and Yoho National Parks.

Howden expressed concern that the division of function suggested previously might hamper the operation of small survey units such as those in Manitoba. In Manitoba he considered that no distinction should be made in the function of federal, provincial and university staff.

Beke stated that supplying more specific information to operators of viable farms would require the institution of adequate consulting services.

McKeague interpreted Duffy's remarks as suggesting broadening the membership of CSSC to include specialists in disciplines other than soil survey.

Duffy pointed out that the CSSC had the permanence to serve as a structure to coordinate land surveys and to ensure coordination of the disciplines necessary to carryout these surveys.

Clark agreed that the CSSC should broaden its technical coordinating function.

Bourbeau stated that adequate coordination and correlation would require regional as well as national structures.

Romaine added that the concerns of the CSSC had up to the present been primarily with soil survey and that it was now being looked to as an organization to encompass the broader concerns of land resource surveys. The CSSC, with its regional ties, could serve a useful role in this connection. A committee to investigate this broader role for the CSSC was suggested.

The membership supported the formation of a subcommittee under Clark to investigate a role for the CSSC and Soil Survey as a coordinating organization for land resource surveys.

Subcommittee for Soil Survey Program

J.S. Clark

The active and proposed subcommittees and current or potential chairman of the CSSC are the following:

1.	Soil taxonomy	J.A. McKeague
2.	Miscellaneous land types	J.G. Ellis
3.	Benchmark soils	J.A. McKeague
4.	Soil water regime	E.E. MacIntosh
5.	Landforms	D.F. Acton
6.	CanSIS	J. Dumanski
7.	Soil degradation	J.A. Shields

Mapping units - small scale surveys

It was agreed to terminate the subcommittee and to transfer its task to 12 below.

The interpretations subcommittee was judged to be too large a task for one person and therefore it is to be divided into four smaller subject areas.

8.	Soil survey interpretations for land planning	
9.	Soil survey interpretations for forestry	
10.	Soil survey interpretations for engineering and urban uses	G. Wilson
11.	Soil survey interpretations for recreation	C.J. Acton
12.	Northern soils and resource surveys sub-committee	W.W. Pettapiece
13.	Land resource surveys coordination	J.S. Clark
14.	Land evaluation	J.A. Shields
15.	Research priorities	L. Lavkulich
16.	Education	

Chairmen of subcommittees should:

1. be active in the subject area

2. be familiar with the gamut of problems of importance in the subject area that conceivably could be partially solved by the application of pedology

3. be familiar with the objectives, w th the methodology and publications of soil survey

4. be capable of establishing rapport with subject area specialists, with information users and with pedologists, and of leading programs to test and evaluate proposals.

5. have sufficient financial support and authorization to be able to travel across Canada to attend CSSC planary and workshop sessions from time to time.

Chairmen would be expected to:

1. select subcommittee members to achieve regional or provincial representation

2. establish objectives of the subcommittee and organize programs to achieve the objectives

3. report periodically to CSSC planary meetings on

   a) progress
   b) recommendations for future activity

Research Priorities

J.A. McKeague

The scope for research related to soil survey is almost limitless. In the past a large proportion of the research in this area was laboratory oriented and it was notivated at least as much by personal interests as by overall priorities. Some good work resulted but certain important areas of research were left almost untouched; for example:

1) Field-oriented research on soil-geomorphology-hydrology inter-relationships in various regions.

2) Research designed to evaluate the bases of interpretations of soil data for various applied purposes.

3) Research designed to evaluate procedures for carrying out soil surveys at various scales, for developing the legend and for presenting soil information on maps and in reports.

4) Research on the characterization and genesis of the physical attributes of soil.

5) Research on soil capability for various uses (forestry, field crops) soil productivity and economic returns.

Some of these areas of research require mainly fieldwork; others, office work; others, laboratory work; and most some combination of field, office and laboratory work. Many research problems related to soil survey are of such complexity that inputs from several kinds of specialists, specialized equipment and facilities are required. Manpower to do such research is severely limited. Thus a CSSC subcommittee on research could usefully seek to fulfill the following objectives:

1) The statement of specific research needs in soil survey.

2) The establishment of priorities.

3) The dissemination of findings on research needs to University departments with graduate students in soils.

4) The fostering of cooperation among the appropriate specialists involved in research on complex topics. Recommendations on research priorities would be made to CSSC.

Proposals

A research subcommittee with one member from each survey group and one from the SRI in Ottawa should be established. The members should be involved in research and preferably some would be federal employees, others university employees. The members would choose a chairman and proceed to try to meet the general objectives stated and to develop specific objectives. Members would be responsible for discussing with

Tentative tasks suggested for the subcommittee were:

1) The statement of specific research needs in soil survey.

2) The establishment of priorities.

3) The dissemination of findings on research needs to University departments with graduate students in soils.

4) The fostering of cooperation among the appropriate specialists involved in research on complex topics.

5) Investigating possible means of funding this research.

The proposed membership of the Subcommittee was as follows:

One from each of B.C. soil survey or U.B.C.; Alta. Inst. of Pedology; Sask. Inst. of Pedology; Man. Soil Survey of U. of Man.; Ont. Soil Survey or Guelph U.; SRI, Ottawa; Que. Soil Survey or Laval U.; Two from Atlantic Provs. Soil Survey; one representing soil geography; one representing forestry.

The meeting supportd the establishment of this subcommittee and its suggested membership. After some discussion, it was agreed that the chairman of CSSC would designate the subcommittee chairman. Subsequently L.M. Lavkulich, Soils Dept., U.B.C. was named as chairman.

pedologists in their areas the research needs in soil survey and for informing them of committee activities. Membership might be:

1) One from either B.C. soil survey or U.B.C.

2) One from Alta. Inst. of Pedology.

3) One from Sask. Inst. of Pedology.

4) One from Man. Soil Survey or U. of Man.

5) One from Ont. Soil Survey or Guelph U.

6) One from SRI, Ottawa.

7) One from Que. Soil Survey or Laval U.

8) Two from Atlantic Provs. Soil Survey.

9) One representing soil geography.

10) One representing forestry.

Research Priorities Subcommittee Report

The general reason for the establishment of this subcommittee hinges on the facts that: (a) there is unlimited scope for research related to soil survey but the manpower to do such research is limited; (b) some important areas of research related to soil survey have not received adequate attention. Such areas are:

1) Field-oriented research on soil-geomorphology-hydrology interrelationships in various regions.

2) Research designed to evaluate the bases of interpretations of soil data for various applied purposes.

3) Research designed to evaluate procedures for carrying out soil surveys at various scales, for developing the legend and for presenting soil information on maps and in reports.

4) Research on the characterization and genesis of the physical attributes of soil.

5) Research on soil capability for various uses (forestry, field crops), soil productivity and economic returns.

It was thought that a Subcommittee on Research Priorities might stimulate research on some neglected areas and encourage a more efficient use of the limited manpower devoted to research related to soil survey.

Canada Land Evaluation Research Program

Discussion Leader: J.A. Shields

As indicated by John Day in his memo of April 5, 1974, this topic was suggested as a possible new subcommittee for the CSSC. Interest in this topic was generated from the work published by FAO which in turn stimulated activity in developing a Land Evaluation Program for the Prairie Region. However, before looking at the current prairie program we should first look at land evaluation from the following standpoints:

WHAT: Land* evaluation is the process of collating and interpreting basic inventories of soil, climate, vegetation, geomorphology, crop potential and other aspects of land in order to identify and make a first comparison of promising land use alternatives in simple economic teams (FAO, 1973).

WHY: To provide a uniform format for grouping and mapping natural land units at a scale suitable for administrative, educational, agronomic, and planning purposes.

To define different land utilization types for the land mapping units on which they occur in terms of crop suitability, productivity and quality.

To evaluate the defined land units in terms of crop suitability, productivity, land quality and land utilization types.

HOW: By a multidisciplinary team approach involving three work phases: It is noteworthy to emphasize that these work phases should all be initiated early in the program and then proceed concurrently.

1) preparation of a land unit map showing soil-geomorphic units within the different agro-climatic subregions.

2) collating the land utilization types occurring on the land units demarcated and general economic manifestations of these land utilization types.

3) determining site productivity characteristics of the land units.

By initiating pilot study areas in different regions of Canada.

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*Land as used in this context is defined as a specific geographic area of the earth's surface. Characteristics of land embrace all reasonably stable or predictably cyclic attributes of the biosphere vertically above and below this area including the atmosphere, the soil, the underlying geology and hydrology, the plant and animal populations and the results of past and present human activities to the extent that these attributes exert a significant influence on present and future uses of land by man.

WHO: Coordinated by the Soil Research Institute in co-operation with climatologists from CBRI, resident pedologists, provincial agronomists and economists.

Land evaluation may be expressed in terms of either qualitative or quantitative classifications of the suitability of lands for a defined use. Evaluations regarding change in land use may be in respect to a developmental stage (agriculture, forestry, recreation, urban) or in adjustment to changing needs of developed agricultural areas (grain farming, livestock, special crops). These evaluations are therefore based on an understanding of both the physical and human aspects of the environment and are coupled with basic recurring economic considerations as well. The overall aims of land evaluation are to answer the following questions:

1) What consequences favorable or unfavorable can be forseen if present land use practises are to remain unchanged (indirectly this implies reference to recognition of soil degradation where land is misused)?

2) What other socially-economic relevant uses of the land are physically possible?

3) What limitations and/or adverse effects are associated with each land use alternative?

4) What recurring inputs are necessary to minimize limitations and adverse effects?

5) What are the benefits of each use?

Approaches - It is suggested that this program be designed to encompass a number of lesser projects including mapping and classifying landforms, preparation of small scale provincial soil maps, mapping of soil degradation and mapping crop signatures identified by remote sensing techniques. It could be further expanded to include interpretations for forestry, recreation and land planning. These components from the pillars which support the broad canopy of the overall land evaluation program. Integration of these "pillar projects" beneath the broader canopy avoids duplication among projects resulting in greater efficiency to the total program. It is manditory that the CanSIS facility will be developed to collate and integrate the data collected and generate output for the program.

Recommendation - Following a brief discussion concerning the background information presented to the meeting, it was recommended that a chairman and a small subcommittee be established to study the ultimate objective, the procedures presently available and the systematics required to generate a suitable Land Evaluation Research Program for Canada. It was further recommended to establish some guidelines for executing the land evaluation process at different levels of stratification.

Motion - The motion to accept the above recommendations was passed by the members of the CSSC and J.A. Shields named as chairman. The subcommittee membership was left to the disgression of the chairman.

Soil Survey Reports

Discussion from the floor focused on the problem of classifications, merit and promotion opportunity, and the effect on these of the publish or perish syndrome.

Hedlin - voiced the hope that the system of professional evaluation of federal persons will not diminish their involvement in provincial programs.

Clark - replied that he would take all possible steps to avoid any diminution of such involvement.

Smith - recommended that we adopt a different method of publishing soil survey data so as to hasten the release of data to a narrow spectrum of users, by examining, evaluating, and possibly adopting the methods used by the Geological Survey of Canada for their "open file" maps and legends.

Sprout - stated that in BC the release of information to a restricted spectrum of users upon completion of the field program is phased in four stages.

1. Landform map (black and white) and simplified legend, tailored after the GSC Terrain Sciences system, accompanied by a few simple interpretations of soil materials. These are in demand by forestry road engineers. This information is released by the spring following completion of the initial field work.

2. Soil classification map (black and white) and legend is released within the year following the completion of field work and completion of soil descriptions and analyses. The interpretations of the soil map units are to accompany the soil map (agriculture, forestry, wildlife, recreation and engineering).

3. General description of soils, landform, drainage, vegetation that usually constitutes the introductory section of the soil report. Completion of the soil report manuscript and completion of color separation process, and ultimate publication of the whole within a period of about two years.

Shields - commented that he has already proposed the following procedure for interim publication of a block of 10 BC Peace River maps which constitute part of the backlog.

1. Publication of black and white soil map with legend including general description of the area, characteristics of the main soils, composition of mapping unit, geological material and topographic expression, significant characteristics, soil drainage. The maps are

prepared by using standard SRI cartographic procedures and are of quality suitable for digitizing for CanSIS. Fifty ozalid copies are prepared for distribution.

2. Abbreviated soil survey report.

3. Interpretations of the soil materials and mapping units.

McKeague - recommended that the Ottawa correlators should be charged to work out, in close cooperation with federal and provincial units, the kinds of interim reports and maps that should be scheduled for early release to a restricted spectrum of users, and also establish the appropriate norms of cartographic quality and technical content.

There was general acceptance of this recommendation.

International Congress of Soil Science

A short discussion on the 1978 Congress of the International Society of Soil Science was opened from the floor by Dr. J.A. Toogood. Dr. Toogood emphasized the need for help and participation by all Canadian soil scientists to make the congress a success. A CSSC subcommittee was proposed for soil tours with an Albertan as chairman who could work closely with the planning committee in Edmonton. Multiple tours of interest to those in fertility, management, land use planning, forest soils, salinity and so on were suggested. Tours could include some better farms. A tour group should consist of only one busload and not a fleet of buses. A tour from Montreal to Toronto, Winnipeg to Edmonton, or simply short tours out of Guelph, Winnipeg, Macdonald College and other centres were also proposed as possibilities that should be considered. The possibility of special irrigation tours, to northern Canada and the arctic were also mentioned.

Dr. Toogood made a number of points:

1. It was hoped that existing data and information on Canadian soils would in general be adequate;

2. Tour and guide books could be designed to be of continuing usefulness;

3. Solicitation of funds should be done by the central committee to avoid duplication;

4. Slide and photo sets of soils should be considered.

Dr. Clark - suggested the formation of a general CSSC subcommittee on the International Congress.

Dr. Ferguson - agreed with Dr. Toogoods comment on the desirability of combined tours based on the Australian experience. He also suggested postponing the formation of a Congress subcommittee until the structural organization was better established.

Dr. Toogood - agreed with the idea of postponing the formation of a committee and concurred fully with the need for wide representation of interests and disciplines on all tour planning committees.

Dr. McKeague - stated that the initiative for any input from CSSC should be left to Dr. Bently and his organizing committee. Dr. McKeague expressed the opinion that the analysis available on Canadian soils was not adequate; much of it is out of date because mineralogical and chemical techniques have changed. Furthermore he considered that the micromorphology on most Canadian soils was not adequate.

Protz - supported the contention that much existing information on Canadian soils was not adequate for the standards of an International Congress.

Day - emphasized the need for reactivating the Benchmark soils project to provide the kind of data required. He pointed out that a set of 100 high quality slides of soil profiles were available but he expressed concern for manpower required to produce a guide book, prepare for the tour, to undertake the necessary translation, etc. Day emphasized the need for a strong coordinating committee to ensure that tours embrace as wide a variety of interests as possible.

Shields - considered it would be unfortunate if the Congress disrupted the regular soil survey activities and hoped that this would not occur.

The possibility of forming a CSSC soils committee to provide a contact for the national organizing committee was discussed. The consensus of the CSSC was that action be postponed until the national congress organizing committee approached CSSC with specific plans.

List of Participants

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