

14th Congress of the International Society of Photogrammetry,  
Hamburg 1980

Commission IV  
Working Group 7

NON-TECHNICAL PROBLEMS IN THE EVOLUTION  
OF A RENEWABLE RESOURCE INFORMATION SYSTEM

Invited Paper by

Angus C. Hamilton  
Ian K. Isaacs

Department of Surveying Engineering  
University of New Brunswick  
Fredericton, N.B., Canada

ABSTRACT

A policy decision to move from laissez-faire to intensive management of agricultural land requires a many-fold increase in the amount and in the types of land-related data. A summary of the status of land-related data shortly after such a decision was taken in the Province of New Brunswick is presented along with a report on a farm land inventory undertaken in the summer of 1979.

Even with the considerable resources available to the Province it is apparent that the needed background data on planimetry, topography, soils, climatology, properties and farm fields will not all be available for many years. This slow evolution is due primarily to the fact that it calls for a new attitude towards land information by many individuals in many agencies at all levels of government.

It is hoped that this documented case study will be of use to those concerned with intensive management of agricultural land in other developing regions.

## INTRODUCTION

The rationale for the development of a renewable-resource information system in New Brunswick was set forth in a paper by one of the authors (Hamilton, 1978) in a paper presented at the International Symposium on New Technology for Mapping in Ottawa in October, 1978.

The Province of New Brunswick, through the Department of Agriculture and Rural Development, has realised the need for such a system and is currently taking the first steps toward such a system (Dillon and Trenholm, 1979).

In this paper we will discuss the non-technical problems facing the designers and implementors of such a system. For this one can consider the conceptual model (Figure 1) of an agricultural information system as suggested by Hamilton. This model contains five data bases which exist in some form in New Brunswick and which were examined by Dillon and Trenholm in a proposal for the organization of an agricultural information system. The model is a simple one that shows in some detail the major components of an agricultural information system from sensors, to data bases, to the decision process.

There are two main types of applications anticipated for the agriculture segment of the renewable resource information system. One type of application is for regional analyses requiring large amounts of data and rather sophisticated procedures. The other application is for decision-making with respect to individual farms. In the latter, relevant data for each farm would be retrieved, merged appropriately and presented in the format most useful to the farmer and those who make decisions about individual farms.

An examination of the status of the data for the data bases (Figure 1), revealed that the most urgent need was to make an inventory and collect data for the agricultural data base. This stimulated officials in the Department of Agriculture to apply for funds to undertake such an inventory. These were approved and the field work done in the summer of 1979. Before discussing the inventory in more detail it will be helpful to discuss the status of the data bases shown in Figure 1.

### THE STATUS OF FARM LAND DATA IN NEW BRUNSWICK IN 1979

*Topographic and planimetric mapping.* As indicated in Table 1 the only complete topographic map coverage in N.B. is that of the National Topographic Series at 1:50,000; this series has not been up-dated for many years. There are two planimetric series (1:15,840 and 1:31,680) that were made by enlarging the planimetric detail of the 1:50,000 and adding distinctive planimetric changes; needless to say these are not suitable for depicting details of farmland.

In 1968 the predecessor of the Land Registration and Information Service initiated an orthophoto map series at a scale of 1:10,000. One edition of this series is being published (see Figure 2a) with some enhancement and with contours; without contours the series serves as a base for property mapping in the rural part of the province.

AN AGRICULTURE INFORMATION SYSTEM

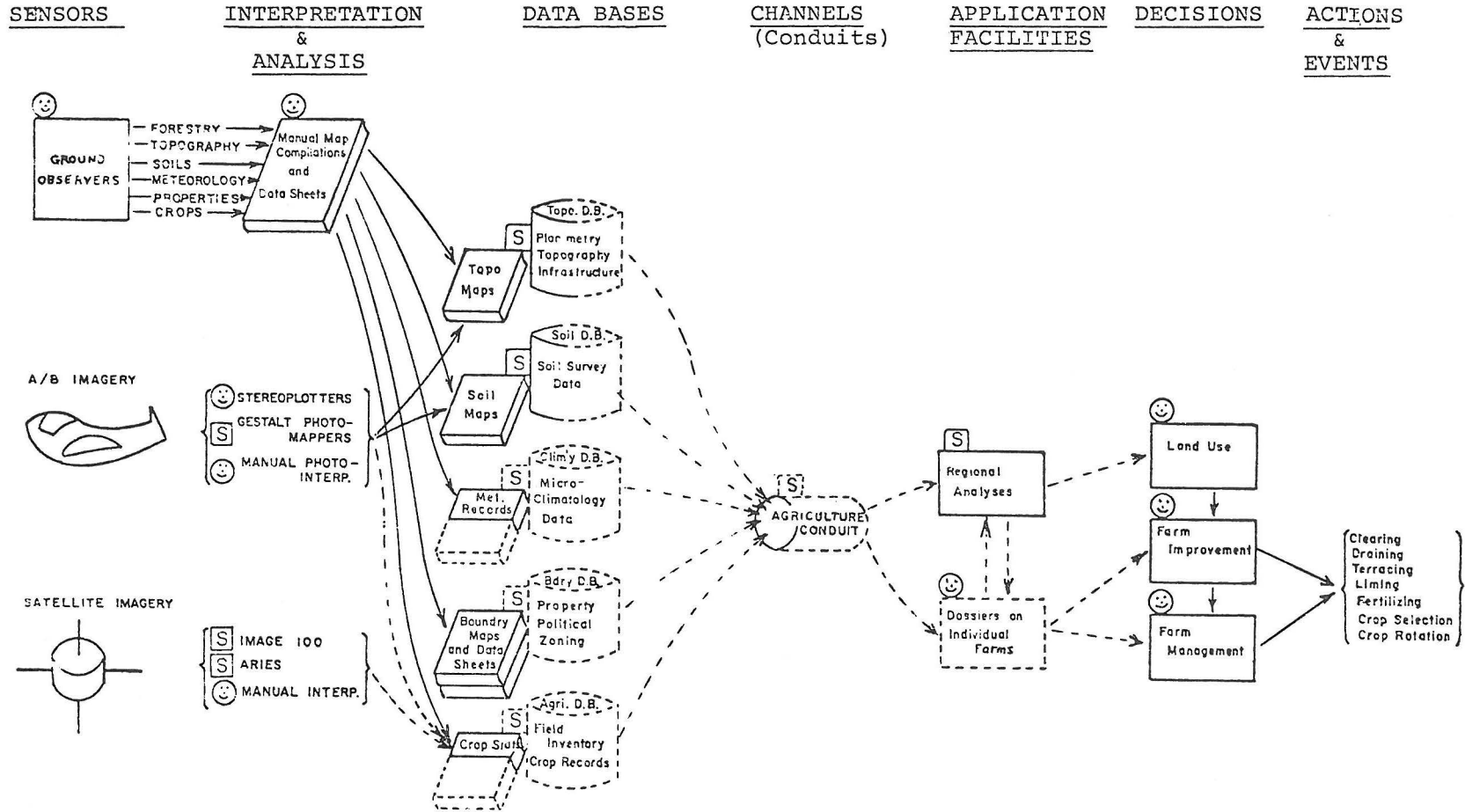


Figure 1.  
(Hamilton)

Signifies major human input  
 Signifies a major software package  
 Existing facilities or data  
 Proposed facilities or data  
 Present data flow  
 Proposed data flow

*Property Mapping.* The term "property mapping" is being used in Canada to describe maps similar to the cadastral maps common in most European countries. In Canada and in the United States this type of mapping was neglected for nearly a century. Just over a decade ago property mapping was re-commenced in several places in Canada; the progress in New Brunswick to March 31, 1979 is shown on Figure 2b. As mentioned above, in rural areas this is compiled as an overlay on the 1:10,000 orthophoto mapping. Comparison of Figure 2b with Figure 2d shows that property mapping is still not available for many of the farming districts.

*Soil Mapping.* Soil surveys have been conducted sporadically in New Brunswick for many years as indicated in Figure 2c. These are at varied scales using varying classification guidelines and by modern standards do not provide sufficient information. The Federal Government completed a soil capability study for a major portion of Canada in the 1960's. This was published as the Canada Land Inventory (C.L.I.) series at a scale of 1:250,000. The aims of the C.L.I. as applied to agricultural lands were "... an inventory of agricultural soil resources and a guide to better land use in New Brunswick" (Canada Land Inventory, 1968).

Soil surveys of a few areas have been done at scales of 1:25,000 and 1:10,000 by the Provincial Government but there is no systematic large scale soil mapping program. Thus at present as illustrated in Figure 2c this data base is not in a homogeneous condition.

*Climatological Mapping.* As it is only in the last few years that a serious effort has been made to collect meteorological data for agricultural purposes the data is still at a primitive level. As indicated in Table 1 some climatological maps at 1:250,000 are being prepared but as yet none are available. Needless to say, it is likely to be quite some time before micro-climatology maps at a scale of 1:10,000 become available.

*Farm Land Identification.* Prior to April 1979 the only graphical portrayal of farm land in New Brunswick was the very small scale sketch shown in Figure 2d. There were no large scale maps whatsoever depicting farm locations or farm production. Broad policy decisions were (and still are) made using only the small scale soil maps and the decision-maker's intuition. Decisions at the individual farm level were made on the spot drawing on the decision-maker's experience and memory supplemented by visual input. Here it should be stressed that this procedure is valid for many circumstances but it fails on several counts:

- i) It is a very ineffective way of choosing *which farms warrant investment.*
- ii) Long term trends, such as declining site productivity, can rarely be detected this way.

Needless to say, without large scale (1:10,000) maps identifying the location of the cropped land it was not possible to undertake a field crop inventory or a site-related tabulation of field crop attributes.

In view of an ambitious agricultural development program defined by Parks (1978) and cited by Hamilton and by Dillon and Trenholm it was easy to see the need for a thorough inventory of cleared land in New Brunswick.

Fig. 2a

Status of Resource Mapping in New Brunswick

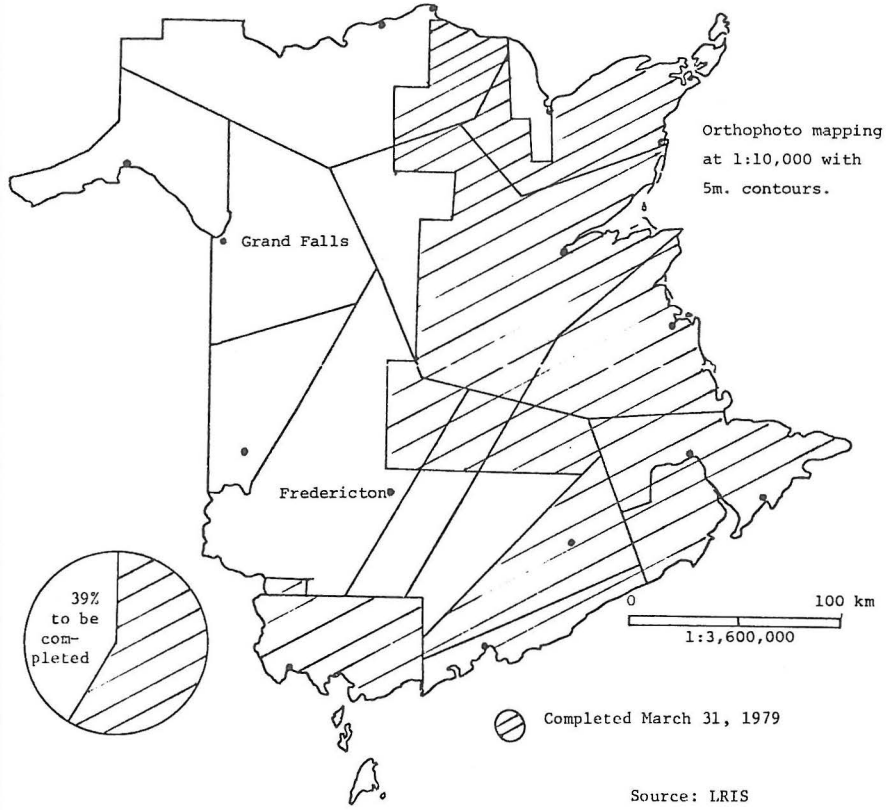
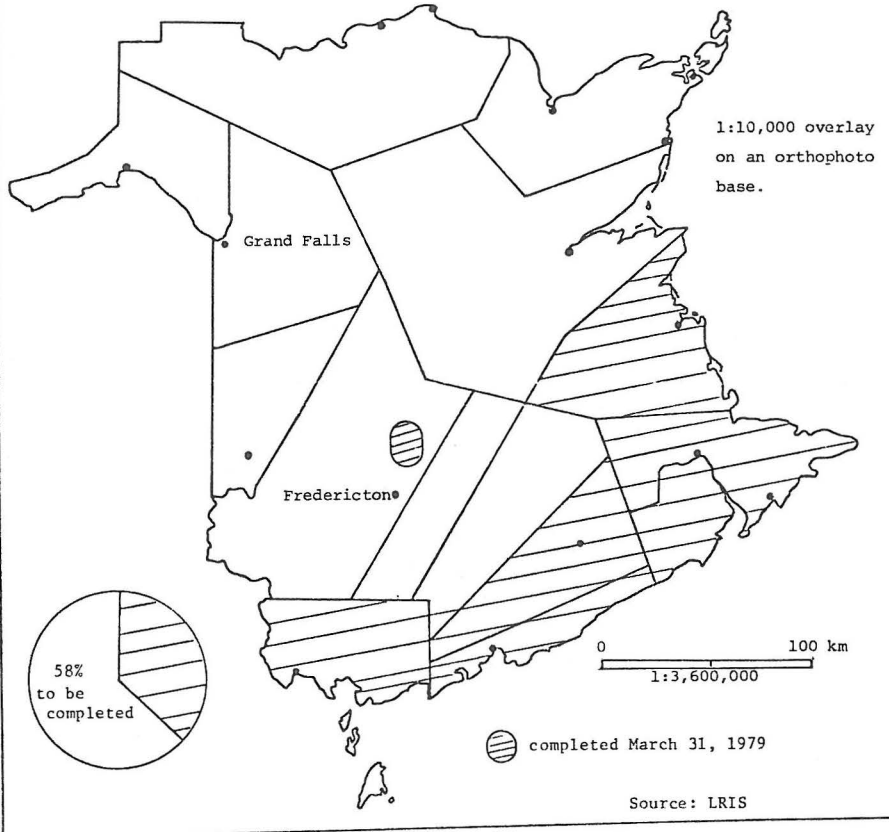
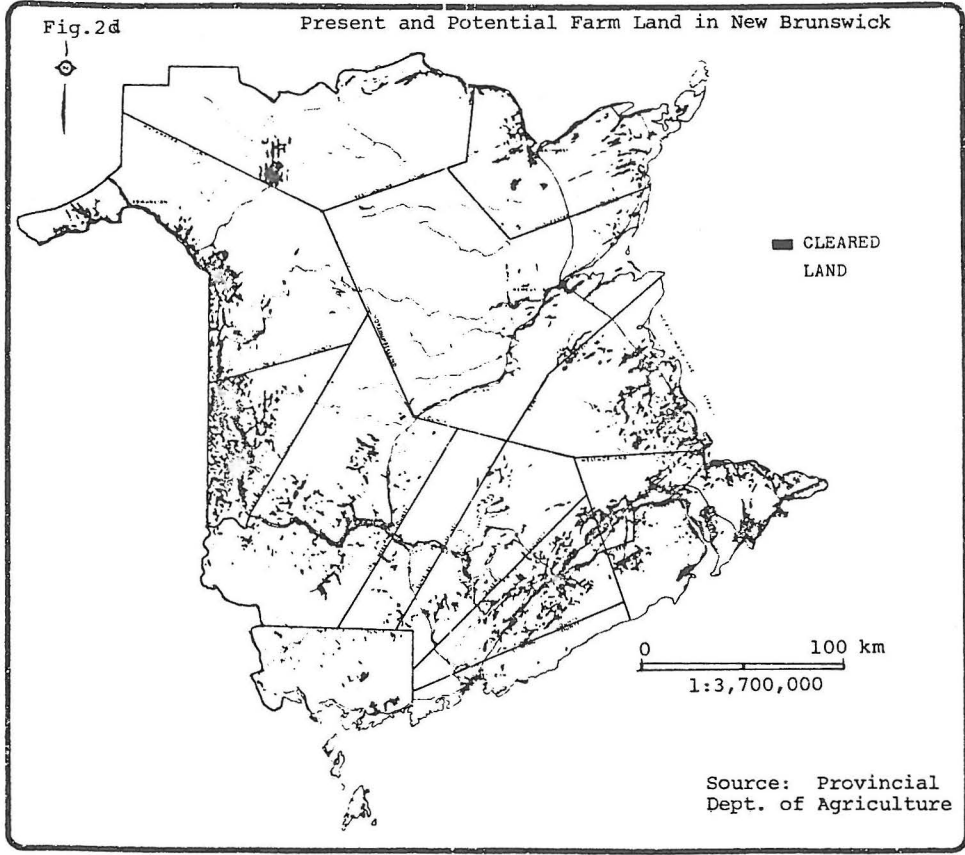
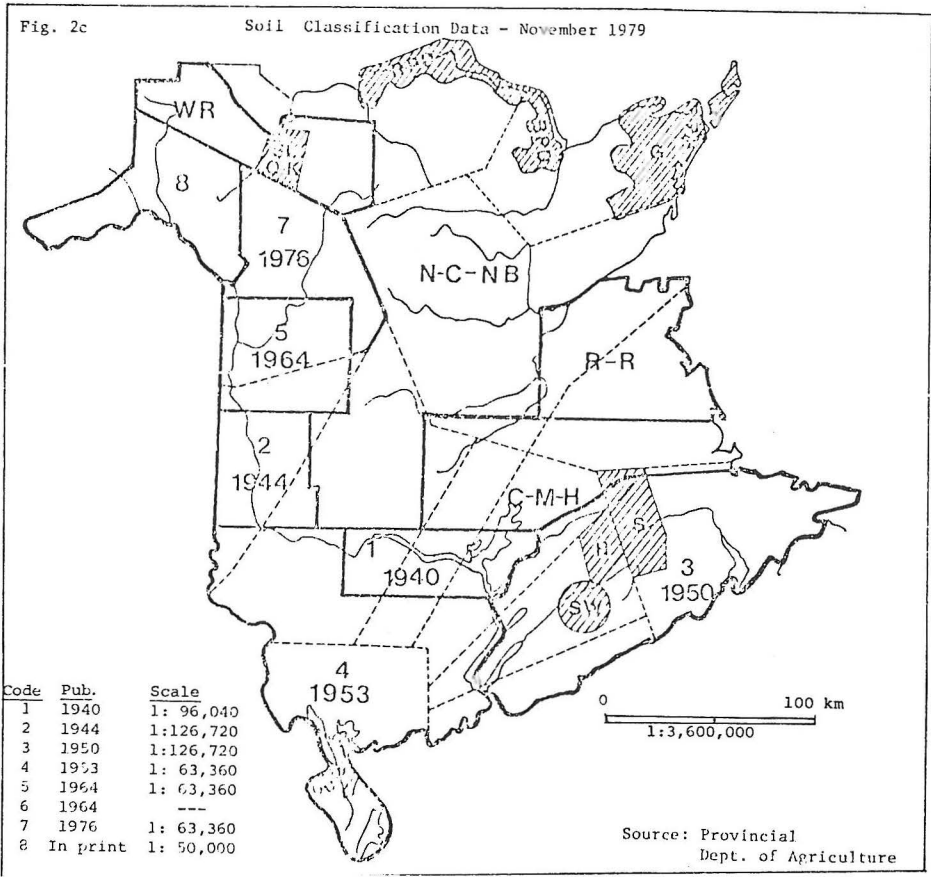


Fig. 2b

Status of Property Mapping in New Brunswick





Early in 1979 the resources for such an inventory became available through a joint funding agreement between the Federal and Provincial Governments.

### THE NEW BRUNSWICK FARM LAND INVENTORY

The farm land inventory was designed with two goals:

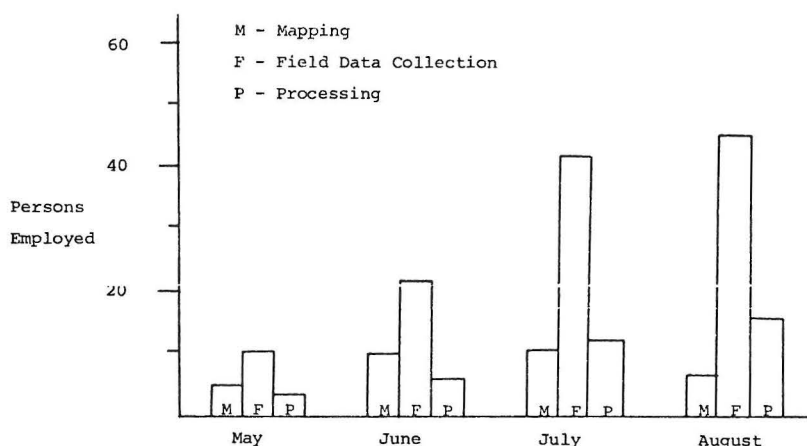
- (i) immediate utilization,
- (ii) as baseline data for a long-term monitoring program.

The inventory program began May 7th, 1979 and the field work terminated on August 31st, 1979. The objective was to visit each farm, delineate each field on a map and indicate what each field was being used for: along with the graphical record a detailed questionnaire was completed giving a comprehensive list of farm attributes.

The number and the allocation of staff is shown in Figure 3. One group was responsible for compiling photo-mosaics for those parts of the province for which ortho-photo maps were not available (see Figure 2a). Six groups were organized for the inventory itself; each group under a manager was responsible for a sector of the province. One group was responsible for compiling the data from the questionnaires and one was assigned to experiment on methods for digitizing the map data.

Figure 3

Employment by month & sector for the  
New Brunswick Farm Land Inventory 1979



One feature of the program that was not emphasized but has subsequently been widely used is a series of low level oblique aerial photographs which cover most of the farm land in the province. During the summer a file of 35 mm colour photographs was prepared portraying most of the farms in N.B. This was intended for use in on-farm planning of various agricultural programs. This file has been used extensively by many sectors of the Department of Agriculture and has brought to their attention the impact of remotely sensed data.

By the end of the season some 5000 questionnaires had been collected and tabulated. This data, along with the file of colour slides is meeting the immediate utilization goal much more effectively than could have been anticipated. Its effectiveness as base line data for a long-term monitoring program obviously cannot be determined yet. As outlined by Hamilton (1978) and as discussed in more detail by Derenyi (1980) collection of this baseline data is an essential step in the development of a method to utilize Landsat imagery for monitoring crop type and acreage each year.

#### COMMENTS ON THE STATUS OF THE SYSTEM AT A TYPICAL SITE

In Figure 1 an idealized flow of land-related information is depicted; in Figure 2 the status of four of the main map series is shown for the Province. However, when a decision is to be made on a particular site it is the status of the data for that specific site that is relevant. To illustrate this point the Grand Falls area was selected and a tabulation of the status of the various types of data for this area was made (Table 1). It should be noted that the Grand Falls area is one of the major potato growing areas in New Brunswick; its location is shown on Figure 2a.

From this tabulation and by referring to Figure 2 the following observations can be made:

- (i) There is no coverage whatever of the area at 1:10,000 (the ideal scale).
- (ii) The anticipated availability of only the basic themes at the ideal scale is:
  - Orthophoto with contours - 1983
  - Property Mapping - 1986
  - Soil Mapping - not yet programmed
  - Climatology - not yet programmed
- (iii) Monitoring by Landsat will not be effective in the Grand Falls region until at least 1986. This is because as discussed by Derenyi (1980) Landsat monitoring for small acreage is contingent upon knowing from ground surveys the coordinates of each field. This cannot be obtained with adequate accuracy from mosaics.
- (iv) At present only experimental work is being done on large scale soil and climatological mapping. This is because until recently the need for this data had not been identified. Although these needs have now been recognized by some individuals they are not as generally understood as, say, the need for topographic mapping.
- (v) Building an effective information system for agricultural land management is a long-term task. Even though production of orthophoto mapping in the Province started 10 years ago, and recognizing that significant resources and skills are available, it is still not possible to predict the year in which all the basic data will be



available and an annual monitoring procedure can be put in place throughout the Province.

*General comment.* The transition from laissez-faire management of agricultural land to intensive management of it calls for a similar transition with respect to the management of land information. This, in turn, calls for a new attitude towards land information by many individuals in many agencies at all levels of government. In effect, it calls for a change in the *culture* of the group. This is not a technical matter but it has had a major influence on the evolution of an effective land information system in New Brunswick and can be expected to have a similar influence in the evolution of similar systems anywhere.

*Final comment.* This case study has been presented in some detail not to discourage those who are just starting but simply to make them more aware of the magnitude of the task they are undertaking.

#### REFERENCES

- The Canada Lands Inventory, Soil Capability Classification for Agriculture. Report No. 2, Ottawa, 1965.
- Derenyi, E.E. Role of Remote Sensing in the New Brunswick Farm Land Inventory Project, ISP 14th Congress, Commission VII, Hamburg, 1980.
- Dillon, M.J. and W.R. Trenholm. Organization of Agricultural Resource Information. New Brunswick Department of Agriculture and Rural Development, October 1978.
- Hamilton, A.C. Towards a Renewable-Resource Information System for use at the Regional and Local Level. Proceedings of Symposium on New Technology for Mapping, ISP Commission IV, Ottawa, October 1978.
- Hamilton, A.C. Remote Sensing for Renewable Resource Monitoring in the Maritime Provinces. Technical Report No. 62, Department of Surveying Engineering, University of New Brunswick, Fredericton, 1978.
- Parks, A.C. The Report of the Agricultural Resources Study, 1977. Queen's Printer, New Brunswick, Fredericton, 1977.

PRODUCT	SCALE	PUBLICATION Year & Format	ANTICIPATED Year & Format	IDEAL Frequency & Format	JURISDICTION
Planimetric Mapping	1:15,840	1966, line	Discontinued	-----	Prov. Dept. of Natural Resources
Planimetric Mapping	1:31,680	1971 & 74, line	Discontinued	-----	Prov. Dept. of Natural Resources
Planimetric Mapping	1:4,800	1971, line	Incomplete	Should be revised every 3 years	Prov. Dept. of Natural Resources
Grant Maps	1:31,680	1974 & 76, line	Discontinued	-----	Prov. Dept. of Natural Resources
Topographic	1:50,000	1968 & 69, Multi-colour map	1980, Hard copy/ Digital	10 year cycle, digital	Federal Dept. of Energy, Mines and Resources
Photo Mosaics	1:10,000 F	1979, B & W	To be replaced by Orthophoto Maps		
Orthophoto with contours	1:10,000	Not Available	1983, B & W	3 - 5 years, B & W	Land Registration Information Service
Soil Mapping	1:63,360	1976, line	?	20 years, Digital	Federal Dept. of Agriculture
Soil Mapping	1:10,000	Not Available	Presently under consideration	5 years if necessary	Prov. Dept. of Agriculture
Soil Capability	1:250,000	1968, Multi-colour map	Discontinued	-----	Canada Land Inventory
Climatology	1:250,000	Being prepared, line	?	-----	Federal Dept. of Agriculture
Climatology	1:10,000	Not Available	-----	Time Series, Digital Form	
Property Mapping on Orthophoto Base	1:10,000	Not Available	1986, B & W	Annually, B & W	Land Registration Information Service
Farm Field Boundaries	1:10,000	1979, Overlay on Photo Mosaics	5 year update cycle	3 years, Digital	Prov. Dept. of Agriculture Canada Centre Remote Sensing
Field Crop Inventory	1:10,000	1979, Overlay on Photo Mosaics	Annual update from a combination of landsat, low level oblique imagery & farm boundary verification by tax assessor.	Annually, Digital	Prov. Dept. of Agriculture
Field Crop Attributes	Not applicable	Questionnaire	Annually	Time Series, Computer Storage	Prov. Dept. of Agriculture Statistics Canada Canada Centre Remote Sensing

[B & W - Black and white photography]

Table 1. List of Maps and map-related data relevant to Agricultural management in the Grand Falls area of New Brunswick.