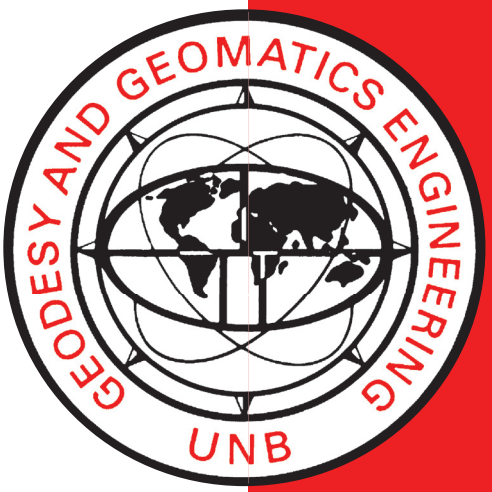
A LAND INFORMATION NETWORK FOR NEW BRUNSWICK

DAVID PALMER

September 1984



TECHNICAL REPORT
NO. 111

PREFACE

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September 1984

Latest Reprinting January 1988

Technical Report No. 111

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ACKNOWLEDGEMENTS

Many people assisted in the preparation of this thesis by providing me with an understanding of land information in general, and of the problems facing land information managers in New Brunswick in particular. While only a few people can be acknowledged by name, I wish to thank all those who contributed to this research.

In particular, I wish to acknowledge the contributions made by Roger Gaudet, Ron Richaud and Chris Robbins of LRIS, Plen Dickson of the Department of Municipal Affairs, Franklin Cardy of the Department of the Environment, Michael Dillon of the Department of Agriculture and Rural Development, Bill Griffin of the Department of Natural Resources, and Brad Fay of MRMS. I also would like to extend my appreciation to the members of the New Brunswick Surveys and Mapping Committee.

I wish to thank Angus Hamilton for his assistance and support. Special thanks goes to my supervisor, John McLaughlin, for his advice, encouragement, and support.

Financial assistance from the Natural Sciences and Engineering Council is also gratefully acknowledged.

EXECUTIVE SUMMARY

A LAND INFORMATION NETWORK FOR NEW BRUNSWICK

1. INTRODUCTION

Concern about regional economic disparity and the need to make the best possible use of resources has spurred New Brunswick to place its land information management on a formal and systematic basis. Interest in utilizing land information in decision making processes is leading to the development of land information systems in the province.

A land information system may be defined as a combination of human and technical resources, together with a set of organizing procedures, which results in the collection, storage, retrieval, dissemination, and use of land information in a systematic fashion. Land information systems may be classified according to the nature of the information managed. This gives, for example:

a) environmental information which is concerned with environmental zones of unique physical, biological, or chemical natures.

b) infrastructure information which relates to man-made improvements to the land.

c) cadastral information which focuses on rights, restraints, and responsibilities associated with the land.

d) socio-economic information which is concerned with human and economic geography.

These distinctions, however, are by no means clear cut.

Most recently, attention has focused on improving co-ordination between systems through a land information network. A network may be described as a confederation of land information systems. While a land information system may be regarded as an attempt to improve the effective flow of information within an organization, a land information network may be viewed as an attempt to improve the effective flow of information between organizations.

A land information network requires information exchange standards and special co-ordinating mechanisms. It also requires an understanding of the functions and needs of the land information community. A land information network is characterized by heterogeneity. It brings together people of different backgrounds, needs, and beliefs. It utilizes technology in widely disparate forms. A long term commitment by a multi-disciplinary team of land information managers is required if the individual heterogeneous elements are to be melded into a cohesive unified whole.

2. LAND INFORMATION MANAGEMENT PROGRESS

New Brunswick's long standing involvement with the design and development of land information techniques has resulted in the province being in a fortunate position compared with many other jurisdictions. For example:

a) a province-wide control survey network has been completed.

b) large scale base mapping and property mapping is virtually complete.

c) a comprehensive computerized land inventory is almost complete and is in a continual state of maintenance.

d) a province-wide computer and telecommunications network exists.

e) keen interest, awareness, and enthusiasm has been displayed by those involved with land information management.

f) technical expertise is available within the province.

In addition, political openess to recommendations and proposals regarding change presently exists in the form of the Office of Government Reform.

3. LAND INFORMATION MANAGEMENT PROBLEMS

Despite the advances made, significant problems still exist. For example:

a) land information is often inaccessible to users in remote locations.

b) differences in information standards and classification schemes sometimes preclude information collected by one organization from being used by others.

c) land information required by some is unavailable at times either because the information has not been collected, or because it is regarded as confidential by the organization collecting it.

d) technical differences such as incompatible hardware and software impede the sharing of information.

e) activities of land information managers are not co-ordinated.

f) no clear policy regarding land information exists to guide land information managers.

4. SPECIFIC RECOMMENDATIONS

Several specific recommendations are proposed in order to assist land information managers:

a) That a photograph library be established in New Brunswick to make aerial photographs more easily available.

b) That mapping requirements of users be determined through the establishment of map user groups and that map production be rationalized.

c) That LRIS parcels and parcel identifiers be used whenever possible.

d) That agency administrative regions be comprised of integral numbers of a basic unit such as the enumeration area.

e) That the Land Titles Act and the Survey Act be introduced throughout the province in order that control over the quality of cadastral documents can be enforced.

f) That standard classification schemes for land information be developed and adopted.

g) That the extent of duplication of land-related information activities be determined and that methods for minimizing the cost of duplication be developed.

h) That the functions of the Survey Office, Registry Office, Assessment Branch, and Community Planning Branch be co-ordinated.

i) That the adoption of recommended hardware and software standards be promoted.

j) That the responsibilities of organizations involved with management of land information be clearly defined.

5. RECOMMENDATIONS FOR A LAND INFORMATION NETWORK

It is recommended that the flow of information between users be placed on a more formal basis through the establishment of a land information network. This requires the clear identification of what information is required by whom, and how frequently. Fundamental policy issues concerning

control of land information in the network and responsibility for co-ordinating activities of network users have to be addressed.

It is recommended:

a) That New Brunswick adopt a policy encouraging the use of information resources to provide maximum economic and social benefits to the people of New Brunswick.

b) That a land information policy be adopted which will guide the collection, storage, retrieval, dissemination, and use of land information within the framework provided by the Information Resources Policy.

c) That a policy co-ordination body be established to ensure that objectives of policies, programmes, and legislation impacting on land information are not conflicting.

d) That a land information network support centre be established to co-ordinate collection, processing, and dissemination activities relating to land information.

e) That special interest groups and consultative committees be established to co-ordinate requirements of network users.

f) That a research co-ordinating body be established to co-ordinate research on land information and its management.

Chapter 1

INTRODUCTION

> We have not yet arrived at a universal understanding of the value of the information asset. Some have, of course. Most have not. Most still perceive that the information processing activities of the organization are but the record-keeping aspects of the asset and not the asset itself.
>
> (Kenniston W. Lord, 1983)

1.1 LAND INFORMATION MANAGEMENT

The concept of information as a valuable resource has received considerable publicity during the past two decades. The importance of information in society and the economy has been discussed by scholars such as Bell (1973) and Porat (1977). This awareness of information and a concomitant perception of an "information society" has stimulated interest in the development of sophisticated techniques for managing land information.

Land information management, however, is not new but has existed for as long as man has expressed interest in developing the land. In ancient Egypt, for example, the annual Nile flood cycle regularly obliterated all land marks and required annual re-surveying, tax-assessing, and record-keeping. This spawned an early version of "information explosion" and an enormous bureaucracy (Kretzschmann, 1980).

As a concept, land information management is independent of technology. Many of the problems presently experienced in countries such as Canada and the U.S.A. result from a lack of good land information management practices (e.g., compulsory registration and examination of cadastral documents, and compulsory connection of monuments to survey control networks). In countries which have an European heritage (as distinct from an English one) some of these problems do not exist to the same extent. The early Surveyors-General and Registrars in these countries were effective land information managers, not because they employed sophisticated technology, but because they used sound and sensible management techniques and practices.

Interest in modernizing land information management began initially with a desire to improve the record-keeping functions of organizations. More recently, attention has focused on the role of land information management in decision making. This re-appraisal of land information management results from two concerns. Firstly, a perceived need for more careful stewardship of the land and more intensive use of its resources is leading to an increased demand for information about the land. Secondly, recognition that information needed to solve societal problems can be more easily correlated when different information sources share the same reference frameworks is leading to an increased demand for information about diverse

themes to be referenced to the land. To a large extent, both these concerns are rooted in a desire to improve social and economic development.

Considerable effort has been made in an attempt to place land information management on a formal and systematic basis through the design and development of land information systems. More recently, attention has focused on the co-ordination of individual systems through a land information network.

Management of land information involves management of human, financial, and technical resources. A land information manager must be aware of actual and potential demands for information. He must be involved with the substance of land information as well as with its procedures. This requires an understanding of the purpose for which the information is collected. Information needed for planning and policy formulation is different from information required for regulation and administration. The land information manager will have to address many issues e.g., What type of information is needed for the decision making processes? How are the decisions made? What information required for decision making can be stored in a computer database and how should access be provided to it? What information defies explicit definition needed for coding and how is that information to be managed?

1.2 NATURE OF LAND INFORMATION

Attempts to improve land information management frequently have concentrated on the implementation of technology. The nature of land information itself seldom has been commented upon. Land information items are not passive or isolated; instead they interact with one another. As such, improvements to one component of land information cannot be made without considering other components.

Land information interacts horizontally. Programmes and policies of a variety of organizations impact on the land. Information about conditions pertaining to the land cannot be recorded alone. The relationships between conditions also must be known as changes in one condition can affect the demand for information about others. Land information also interacts vertically. Planning directives of an organization influence what information is to be collected. The information collected affects future directives. Information is aggregated as it proceeds up the organizational ladder. What is regarded as information at one level may be considered data at a higher level.

A land information manager must be aware of how his information affects, and is affected by, other information. Failure to do so will prevent land information from being used as productively as it might.

1.3 SUBJECTIVITY OF ASSESSMENT OF LAND INFORMATION

Land information systems and networks can be regarded as attempts to model reality. As such, they rely on the introduction of abstractions. As the level of abstraction increases, so does the possibility of different people interpreting the same phenomenon differently. Whether or not data are valued highly enough to result in their inclusion in a land information system depends on the attitudes, emotions, and goals of individuals.

It is implicit in the concept of a land information network that information is shared by many users. Before such sharing can occur, users must adopt common standards, procedures, and classification schemes. Development of common standards is impeded by the different values that users place on information items. Shared use of land information also has important political implications. In addition to commonality and inter-dependence, the political constraints of land information must be identified. It is possible that controversy over the design of a land information network will reflect a struggle for control over it.

1.4 MULTI-DISCIPLINARY APPROACH

Because of the horizontal interactions of land information, land-related information problems have legal, political, environmental, and social and cultural implications. Solutions to such problems then cannot be found simply or quickly by a single dicipline or profession. A long term commitment by a multi-disciplinary team of land information managers is required.

A land information network is characterized by heterogeneity. It brings together people of different characters, backgrounds, needs, values, and beliefs. It utilizes technology in widely disparate forms. The challenge is to co-ordinate these individual heterogeneous elements into a cohesive unified whole. The land information management team has to arbitrate and negotiate between legitimate needs of users, and must balance the subjective assessments of single disciplines.

The role of the surveyor in such a team is potentially a key one. The surveyor is interested in land information in all its forms and should be in a position to recommend to users the accuracy and tolerance with which information should be referenced to the land. He is concerned with mapping information themes. He is also concerned with ensuring that textual information from different sources can be correlated through their spatial components.

1.5 LAND INFORMATION IN NEW BRUNSWICK

New Brunswick has had a longstanding concern about the management of its land information. This has led to a number of endeavours to develop and improve land information systems. Attention is now focusing on the development of a land information network by improving co-ordination between existing systems.

In this regard, New Brunswick is in a fortunate position when compared with many other jurisdictions because:

a) a province-wide control survey network has been completed.

b) large scale base mapping and property mapping of the province is virtually complete.

c) a comprehensive land inventory in the form of the LRIS database is almost complete, and is in a continual state of maintenance and improvement.

d) a province-wide computer and telecommunications network exists.

e) keen interest, awareness, and enthusiasm has been displayed by those involved with land information management.

f) expertise is available within the province (e.g., the Departments of Surveying Engineering, Economics, and Computer Science at the University of New Brunswick have made significant contributions to the LRIS programme).

g) political openess to recommendations and proposals by citizens presently exists in the form of the Office of Government Reform.

In this thesis, the development of a land information network for New Brunswick is considered. In Chapter 2, the nature of land information in a network environment is reviewed from a managerial perspective. In Chapter 3, some of the difficulties in assessing requirements of users of a land information network are identified.

Chapter 4 presents an overview of land information within New Brunswick. Information used in this analysis was derived from questionaires completed for a Land Data and Map Inventory Study commissioned by the provincial Surveys and Mapping Committee, and from interviews with some of those involved with land information management in the province.

Some of the problems facing land information managers in New Brunswick are identified in Chapter 5. Based on this analysis, a land information network is proposed in order that some of these problems may be eliminated or minimized.

Chapter 2

LAND INFORMATION IN A NETWORK ENVIRONMENT

> The public stock of knowledge is not simply the sum of what is known by the separate individuals in the world; it is at once more and less than that. It is less, simply because much of what individuals know has not been, and never will be made public. It is more, because much of what is known may be known to no-one... It is odd to speak of things being known, though known to no-one... What makes it odd is the fact that what can be recorded is not knowledge, but only a representation of knowledge. If I write a message to myself, recording some fact that I fear I may forget, and do forget, I can recover the knowledge by reference to my note, but the piece of paper does not know that I have forgotten. It bears a message, but it is not the bearer of knowledge. Where there is knowledge, there must be a knower; pieces of paper know nothing. This makes it fiction to speak of knowledge that no-one has. But it is highly useful fiction.
>
> (Patrick Wilson, 1977)

2.1 INTRODUCTION

Concern for the more efficient utilization and management of land has led to an increasing demand for information about its resources. Frequently this demand has not been adequately met. Land resource managers have been thwarted by a lack of timely, accurate and relevent information. Land resources cannot be properly utilized if information on the resources is poorly managed.

A similar concern over the rapid profusion of information has led to an increasing demand for linkages to convert scattered pieces of data into a coherent structure. Data are defined by McLaughlin (1982) as a body of facts or figures which have been gathered systematically. Information is data which have been processed into a form that is meaningful to the recipient and is of perceived value in current or prospective decisions. Shannon (1948) concluded that data can provide answers to four of the six interrogatives (i.e., who, where, what, and when) and that information can answer the other two (i.e., how and why). Data from many sources may be linked together using any one of the four "data interrogatives" in order that answers to the other interrogatives may be provided. (Table 2.1).

The complexities of information interactions preclude any single interrogative from providing the best linkage system under all conditions. Combinations of interrogatives may be required at times. The attributes required for the transformation of a casual observation into useful information (i.e., theme or who/what, location or where, and time or when) can be identified as a three part structure: one attribute is held constant, the second is permitted to vary in a controlled way, and the third is measured for its variation within the second level controlled attribute (Sinton, 1978). (Table 2.2).

TABLE 2.1

Examples of Information Linkages

INTERROGATIVES	INFORMATION LINKAGES	INDEX
Who	People-related	Grantee-Grantor
Where	Land-related	Parcel
What	Product-related	Assessment value
When	Time-related	Tide-table

TABLE 2.2

Information Structure

(adapted from Sinton, 1978)

	CONSTANT	CONTROLLED	MEASURED
Geological Map	Time	Theme	Location
Census Data	Time	Location	Theme
Weather Report	Location	Time	Theme
Tide Table	Theme	Location	Time

All of man's activities and interests share a common element in that they are ultimately related to the land, which is taken here to include the marine environment. (See Green, 1977; Ziemann, 1978). Thus in many cases, data from diverse sources may be satisfactorily linked if they are referenced to the land. In some cases the land component will be predominant and in other cases it will be supportive. (See Figure 2.1). Land information may be classified according to its nature. This gives, for example:

a) environmental information which focuses on zones of unique physical, biological,or chemical natures.

b) infrastructure information which concentrates on man-made improvements to the land.

c) cadastral information which is concerned with rights, restraints, and responsibilities associated with the land.

d) socio-economic information which focuses on human and economic geography.

Information is required for the better management of land resources. Land referencing is needed for the better management of information resources. In this thesis, land information will be regarded as any information that can be usefully and meaningfully referenced to a point or area on the earth.

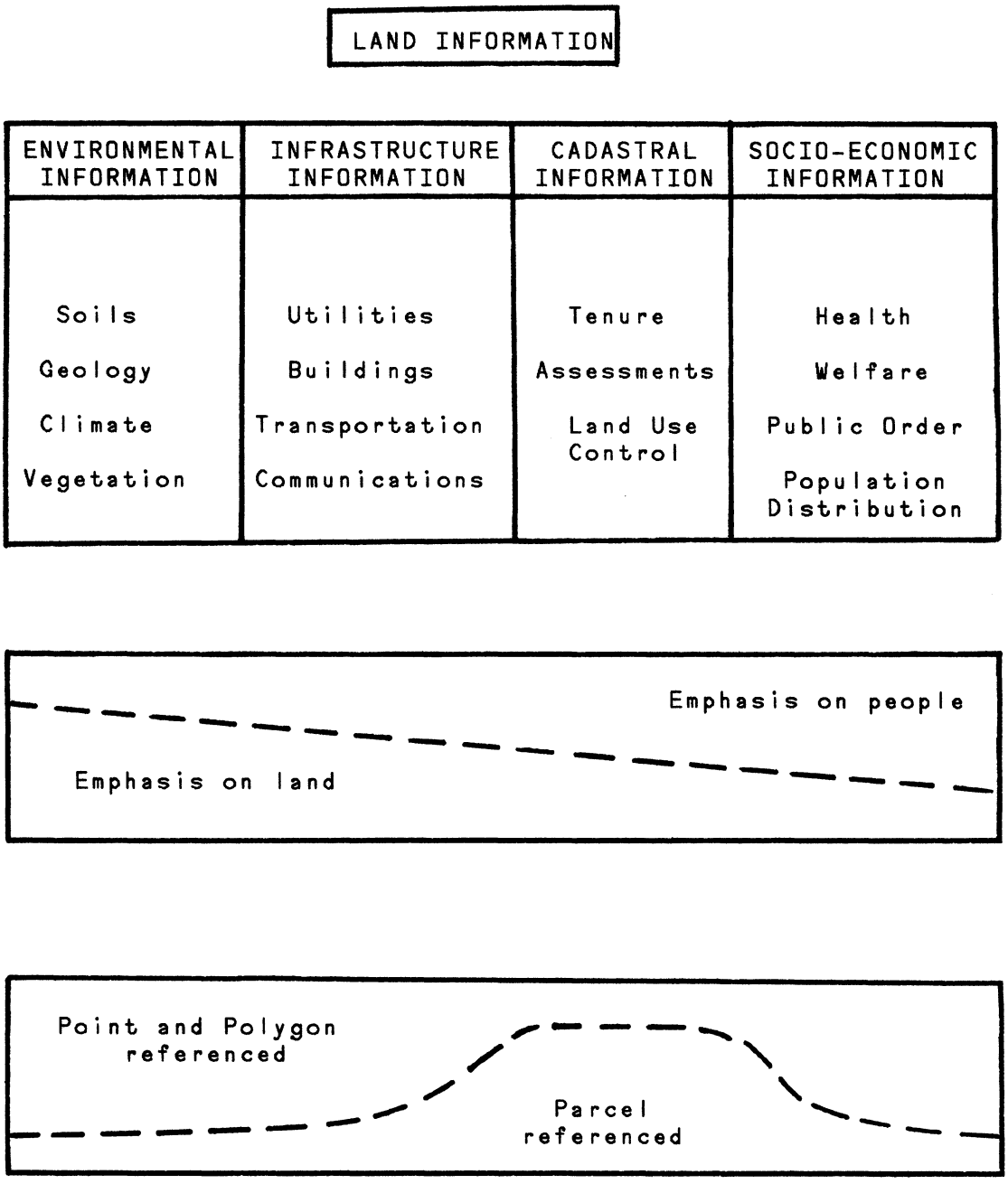


Figure 2.1: Land information

The responsibility of responding to the need for better management of information has fallen to a new community of land information managers (LIM). The emergence of this community, and its role, has been described by McLaughlin (1982). Land information managers have been involved with the design and implementation of land information systems (LIS) which facilitate the improved collection, dissemination and use of land information. More recently, attention has been focused on the concept of a network linking together the individual systems.

The involvement of the land information manager extends beyond the recording of information; he must also be aware of the demand, both actual and potential, for the information. As a manager he is concerned with the substance of the information, and not just with the procedures associated with it. He has to be aware of the nature of the information and the dynamic effects of its interactions. This understanding is needed perhaps more for the development of a network than for the individual systems. The network does not serve one organization, but instead a broad cross-section of the community. Consequently, there exists a greater chance of conflict arising between users from different backgrounds and with different objectives.

2.2 HOLISTIC APPROACH TO LAND INFORMATION

The potential productivity of land is based on many factors and is limited by many constraints (See, for example, the Land Use Policy Task Force report, 1983). However, information about these factors and constraints may be separated into discrete compartments of vertically structured organizations. This separation, caused by models that have oversimplified the complex interactions of land information, has created an undesirable fragmentation. For example, Clapp and Niemann (1977) have commented that there has not been widespread recognition that knowledge of proprietory interests in land as well as that of environmental characteristics is vital to intelligent decisions about the land. Consequently, previous efforts in the development of land information systems in North America have concentrated mainly on physical resources.

There has been a recent change in attitude brought about by recognition that problems facing society cannot be solved in isolation. However, if planners and policy makers are to take a global view of society and its environments, they must be provided with compatible information on conditions, and their causes and effects. The land information specialist cannot disregard the socio-economic structure that his network of systems will ultimately serve. Instead, he must be aware of the structure and functions of the information that he manages and the society which uses that

information. This requires the development of a common understanding of the land and information environments and of the social and economic needs and responses for this information (McLaughlin and Wunderlich, 1982). Surveyors traditionally have been involved with providing information for those whose interests are on the "land" aspect of the continuum. An opportunity exists for the surveyor to play an equally important role in the "socio-economic" aspect as well.

In particular, recognition of the importance of the multipurpose cadastre has caused a significant shift in emphasis on land information. Land ownership has always been considered a socio-economic concept: Furubotn and Pejorivich (1972) have described the system of property rights as a set of social and economic relations defining the position of each individual with respect to the utilization of scarce resources. (See, for example, also McLaughlin, 1982; Moyer, 1980b; Wunderlich, 1973). Despite the fact that the fundamental arrangements of property transfer have not been affected, this socio-economic concept recently has been included in a land based information system through the change from a people-referenced linkage (i.e., grantee-grantor index) to a land-referenced linkage (i.e., parcel index). Similarly, equitable assessment, a desired aim of the multipurpose cadastre, is firmly rooted in socio-economic concerns. If a change in perception of

one socio-economic characteristic can occur, the possiblity exists that others may be similarly affected in the future.

This paradox of including socio-economic data in an essentially land based system occurs because environmental and social concerns have been regarded as separate entities. Instead, it can be argued that the environmental and social aspects of land information form a continuum. (See Figure 2.1). The close inter-relationship between land and socio-economic conce extends far beyond the theoretical or conceptual level. Both types of information are used when working on both ends of the continuum. For example, population density (socio-economic) and assessed property value (cadastral) are used to model demands for water, sewerage and solid waste services (infrastructure). Assessed property value and the number of crimes against property along with information on income have been used to determine community need (Isserman and Brown, 1980).

2.2.1 Socio-economic aspect of land

The important role that land plays is well recognized at the federal level of government in Canada:

> Land use is a determinant of the quality of life for present and future generations. The wise utilization and management of the land resource is fundamental to achieving the political, social and economic goals of society because land is a source of food, fibre and shelter and is inherent in the balance of nature. Consequently the way in which land is used shapes the way in which a society functions. (Environment Canada, 1980)

In New Brunswick the provincial government's Land Use Policy Task Force (1983) has noted the key role of land use in the social and economic strategy of the province, and has further identified land as the ultimate foundation of the economy.

The inter-relationship of man's need for land and his collective and individual social and economic needs has been identified by McLaughlin (1981; 1982). Information is only collected for anthropocentric reasons such as the enhancement of human material and cultural welfare. Soemarwoto (1977) has argued that even ethical questions such as the protection of endangered species are debated as to their validity as scientific or genetic resources for future development programmes, and most importantly, if they are economically beneficial. As such, information on the physical aspects of land cannot be separated from the socio-economic aspects.

2.2.2 Land aspect of socio-economics

Parks foresaw the change in perception of tenure from a socio-economic based concept to a land based concept when he noted in 1926 that

> since so much that students of society are ordinarily interested in seems to be ultimately related to position, distribution and movement in space, it is not impossible that all we conceive as social may eventually be construed and described in terms of space. (Parks, 1926)

This increasing need for spatially referenced social information has resulted from changes in the ways in which information is collected and the purposes for which it is used.

Firstly, while the basic concern of social information is with people, reporting units other than people are required such as geographical units (i.e., cities, regions) or establishment types (i.e., schools, hospitals). Unlike economic information, social and environmental information lack a common unit of measurement (United Nations, 1979b). Land-referenced information provides at least one unifying link.

Secondly, until recently low priority was often given to policies designed to reduce social disparities. Policy makers thus were not interested in obtaining information about varying conditions in different parts of the country or region (United Nations, 1979b). These varying conditions cannot always be represented on small scale maps as has been suggested by the U.S.A. National Research Council (NRC, 1983) amongst others. Isserman and Brown (1980) have argued that

> the metropolitan landscape is comprised of communities so different from one another that the common practice of making comparisons between central cities and their suburbs in aggregate is usually a ludicrous exercise based on a non-existent artifact. (Isserman and Brown, 1980)

Land information has significant political implications. Most political conflicts in industrial urban society are

partly due to geographic externalities (Cox et al, 1974). Changes in patterns and densities of settlements and the distribution of industries have contributed to problems with which political systems previously have not had to deal.

These planning problems have led to an increasing interest in Social Impact Assessments. (See, for example, Riley and Sturgeon, 1979). However, when such assessments are made, they are usually considered separately from environmental impact assessments. It is then difficult for both the ecologist and the social scientist to collate their information (Soemarwoto, 1977). The determination of these varying conditions is the role of the scientist or environmentalist. Ensuring that they can compare information from various parts of the region is the role of the surveyor.

2.3 INTERACTION OF LAND INFORMATION

Information cannot be viewed as isolated or passive. Instead it interacts dynamically with other information. This interaction has become increasingly noticeable through use of the multipurpose cadastre. For example, while cadastral information can be used by police, fire and health departments amongst others in their programmes (NRC, 1983), the nature of that information may affect the outcome of not only land policy, but also policies for income and wealth taxation, welfare and public investment (Wunderlich, 1973).

2.3.1 Horizontal Interaction

Social development, economic development, and land use are inherently inter-related. Decisions in one area affect and are affected by others. These effects on the land are sometimes unexpected: while some programmes are designed specially to affect land use, the most substantial impacts on land tend to be secondary effects of programmes intended to achieve other results (Environment Canada, 1980). This has been of particular concern to the private sector as these ancillary effects are discovered only after the programme has been implemented (Ontario Real Estate Association, 1979).

Land use can be affected by several means at the disposal of the government e.g., regulation (licensing, zoning, planning), taxation, subsidization (CMHC mortgages) or investment (infrastructure) (Environment Canada, 1980). These government influences react with influences in the private sector. For example, increased ownership of cars and a higher standard of living have interacted with the better road infrastructure to expand the urban fringe.

The Land Use Policy Task Force (1983) has hypothetically illustrated the effect of horizontal interaction on the land by the New Brunswick government. As a result of approving residential subdivisions adjacent to a farm (Provincial Planning Committee and Department of Municipal Affairs), the government has impeded its own agricultural development

programme (Department of Agriculture) and has also restricted the farmer's options on his own land (through actions of the Departments of Health and Environment). The government has also accepted the costs of paving and maintaining the subdivision roads. It will also have to take over the operation and maintenance of the water and sewer system if one is put in by the developer and he elects to hand it over. It probably will also incur increased costs for school busing, policing, fire protection and health.

Because of the horizontal interaction of land information, changes in information collected by one organization can have an affect on the information recorded by another. For example, the New Brunswick Department of Agriculture introduced a Farm Lands Identification Programme (FLIP) in an attempt to preserve agricultural land. As an incentive to farmers to join the programme, the provincial government has set aside provincial taxes on cleared land registered in the programme. A significant increase in the number of farmers from a particular area joining FLIP was noticed. On closer inspection it appeared that valuations of a new assessor assigned to that region were higher than those of his predecessor. The resultant higher property taxes then made the FLIP programme seem more attractive (Dillon, M., 1983).

If the network and its component systems are to be used for the benefit of society, they cannot just record information on conditions. The relationships between conditions must be known as well for changes in one may affect demand for information about others. These relationships may not be readily apparent. For example, the interaction between tenure and housing conditions in England in the 1840's was observed by Engels. Contractors who built houses for the working class did not own the land but leased it. At the expiration of the lease, the land reverted to the possession of the original holder who payed nothing for improvements to the land. Because this system of tenure prevailed, the lessees then ensured that improvements were to be worth as little as possible when the lease expired. As a result cottages fell rapidly into ruin and uninhabitableness (Engels, 1845).

While tenure may affect conditions on the land, it is also affected by those conditions. For example, water conditions may play a major role in the change of tenure in the western U.S.A. To accommodate the growth of Arizona's cities, central Arizonion farmers have agreed to limit the amount of ground water they use - a possible first step towards a state purchase and retirement of their lands after the year 2000 (Adler, 1981).

2.3.2 Vertical Interaction

In the classical model the functioning of an organization is along strict hierarchical lines. The strategic level of the organization is responsible for determining the ends with goals and policies, and the resources needed to achieve those goals. The management level then has the responsibility of devising means and organizing programmes to ensure that the goals are achieved. Finally, the operations level is concerned with the daily routine of running the programmes.

Determining the horizontal interaction of the effects of policies is compounded by the fact that policies themselves may not be clearly recognized. In practice the land information manager may have difficulty discerning the distinction between policy and non-policy:

> The incumbent of an office who is making decisions under a policy rule promulgated by higher authority in turn establishes a set of rules as to how he intends to interpret and proceed under the over-riding rule. For those affected by them, these sub-ordinate rules are policy rules too. With the cascade of authority there also flows a cascade of evermore subordinate policy decisions. What constitutes a "policy" depends entirely upon where the observer cuts into the inevitable hierarchy of policies. (Hartle, 1979)

The vertical aspect of information is also dynamic. Information is passed up the organizational ladder in the form of reports and summaries, and is disseminated downwards in the form of planning directives (Lucianovic, 1973). In doing so it reacts with itself: planning directives

influence what data are reported and summarized; the contents of the reports affect the directives.

Vertical information also forms a continuum. In proceeding up the organizational ladder, information at a lower level may become data at a higher level. Most micro data can be further disaggregated and most aggregate data can be further aggregated. For example, in local government the aggregation of data occurs as questions shift from the nature of housing violations, to the number of inspectors required for a given number of structures, to whether the city should demolish or rehabilitate severely deteriorated structures (Bernhard et al, 1983).

2.4 INTEGRATION OF LAND INFORMATION

The ability to integrate information from a variety of sources is important if unnecessary and costly redundancies in data collection, policy formation and programme design are to be avoided. This sharing also ensures that a single set of master data is maintained and updated in lieu of multiple sets of potentially redundant, inconsistent, and incompatible data maintained in compartmentalized locations (Horton, 1979). Furthermore, the value of land information in meeting the needs of modern society is almost always improved by integration of all information relating to a given area of land (Smith, 1977).

2.4.1 Integration for Routine Use of Information

Bureaucratic growth has led to an increasing number of government programmes which are increasingly difficult to manage and which require an increasing number of civil servants to administer (Horton, 1979). In managing these programmes, the federal, provincial and local levels of government have independently developed their own unique information requirements. Consequently, inevitable duplication and overlap of data collection has occurred because these requirements have not been co-ordinated. Similar facts collected by organizations and at different levels are often inconsistent and incompatible. This impedes the sharing of information between organizations and so affects the quality of decision making as well as the efficiency and effectiveness of programmes.

2.4.1.1 Sharing of Information Common to Several Programmes

The U.S.A. National Research Council (NRC, 1983) has dealt with the common interest in cadastral information shared by a wide variety of users, while Moyer (1980a) has illustrated the commonality of data contained in fiscal, juridical and environmental systems. The duplication of collection of this information has been documented by Clapp and Niemann (1977), Classen (1977), and Larsen et al (1978) amongst others. Much information about the land is common to the routine functioning of programmes of various agencies.

Typically, each organization invests a large amount of resources in separately collecting and maintaining information sufficient to meet its own needs. Valuable resources are often wasted through this duplication of effort as the same basic information about essentially the same areas of land is repeatedly collected.

This duplication has occurred frequently in New Brunswick. For example, the Department of Natural Resources, Department of Municipal Affairs (Assessment Branch) and Department of Agriculture have each compiled an inventory of forest resources. As might be expected, significant differences exist between these inventories (Land Use Policy Task Force, 1983).

Information not routinely used by an organization in its programmes at present may be regularly incorporated in the future simply because integration has made that information more easily available. For example, the city of Stuttgart has been able to integrate meteorological information with urban planning and management information on a routine basis. By controlling building heights and prohibiting development along natural fresh air channels, the city has been able to maintain high quality of air despite unfavourable topography and concentrated development (Lang and Arbour, 1980).

2.4.1.2 Vertical Integration to Support Programmes

The manner in which most current systems collect and process information has limited the usefulness of their information products to the levels for which they were collected. Traditionally, within the levels of government a dichotomy in the demand for data has existed: for planning and policy formation, the demand has been for an overview in the form of aggregated information; for regulation and administration, micro data on specific cases has been needed.

Typically, managers of micro data have had neither the incentive nor the means to relate their data to those at the policy level, while policy makers, faced with incompatible data sources, have tended to ignore past work and to seek new data for each new need (United Nations, 1979c). Consequently, aggregate data and micro data on the same condition are often incompatible. Because information can be aggregated, Clapp and Niemann (1977) have recommended that the network should be designed so that information can flow from the detailed and large scale local requirements to the more generalized and small scale regional and federal requirements.

If land information is to serve a multipurpose function, it should be retrievable by arbitrarily defined geographic units (Boisvenue and Parenteau, 1982). Many current cadastral systems lack the ability to integrate information

for vertical purposes. Parcel systems are normally designed to allow the location of information on a specific parcel. They are, by themselves, not well suited for aggregate analysis even though they contain information needed at higher levels.

2.4.2 Integration for Non-Routine Use of Information

2.4.2.1 Co-ordinating Policies and Programmes

The federal government has a wide range of policies and programmes that bear on the land (e.g., fiscal policies, sectoral support programmes, regional development programmes, federal land management programmes, regulatory policies in transportation, and research and information activities). Because of the division of responsibility, these policies and programmes are often unco-ordinated and mutually damaging (Environment Canada, 1980).

Similar conflicts exist because the policies and programmes of the New Brunswick government do not share common objectives (Land Use Policy Task Force, 1983). In particular, the rural areas are managed by many different agencies, with each having a particular responsibility to protect or reserve land, to provide services, to administer grants or assistence, or to collect taxes, royalties or other revenue.

Concern about this lack of co-ordination has also been expressed in the private sector. The Ontario Real Estate

Association (1979) has noted that there exists no central comprehensive organization of the statutes affecting the rights of the property owner, and has called for greater co-ordination not only between all levels of government, but also between governments and the private sector. As Hayek (1944) commented, the more the state plans, the more difficult planning becomes for the individual. Property rights have become increasingly limited to the point where the individual can only find out at great personal expense what rights he does hold (Clapp and Niemann, 1977).

In an attempt to minimize policy and programme conflicts, the federal government has introduced a mechanism whereby conflicts can be reported to the Interdepartmental Committee on Land (Environment Canada, 1982). Under the federal land use policy, departments are required to identify the effects of their activities on the use of public and private land. Federal departments and agencies are also required to co-ordinate their activities to ensure that information needed by the public can be provided in the most effective and efficient manner.

Similar provisions are being considered at the provincial level. The Land Use Policy Task Force (1983) has recommended that the New Brunswick government establish a Lands Resource Development Office to co-ordinate land resource programmes, and to actively promote the development and exchange of information.

An agency established to encourage co-ordination of policies and programmes will require aggregate data to ensure that there are no conflicts in policy. It will also require micro data to monitor the combined effects of the programmes to determine if conflicts have occurred. At present information required for resolving conflicts is often unavailable when needed. In many cases the required information does exist, but is lost in the mass of data collected regularly by agencies. Time constraints prevent the selection and conversion of this routinely collected data into useable information (Land Use Policy Task Force, 1983). If conflicts on the land are to be minimized, the land information network must assist with this selection and conversion.

There is evidence that the co-operative use of shared data tends to minimize conflicts by automatically focussing staff efforts on policy rather than on conflicting views of the nature of the problems. Gilbert (1983) has reported that the shared database of the Regional Information System in Lane County, Oregan U.S.A., encouraged the development of strong horizontal lines of communication between the users. Consequently, co-operation between departments, agencies and the public and private sectors has improved.

2.4.2.2 Detecting Trends or Patterns in Events

In many cases, causes of problems may be determined only if the data are spatially related. In some cases, the problems themselves may only become apparent once the data are referenced to the land. Such problems occur in a variety of fields.

Identification of areas with high and low crime rates using land-referenced crime data allows decisions to be made regarding the allocation of resources to the proper areas. Analysis of these data can show trends in crime that may be present and the relationship of crime increases and decreases to other variables. Patterns of traffic accidents can be used to identify areas of abnormally high accidents rates, thus allowing the necessary measures to be taken (Classen, 1977). Social problems can be similarly highlighted.

In medical applications, land information has been used since the time of Hippocrates. Modern epidemiology, dating from perhaps the early nineteenth century has used land-related approaches such as John Snow's use of a spot map and classification of water sources to define the epidemiology of cholera some 50 years before the organism was discovered (White, 1984). More recently, Riley and Sturgeon (1979) have documented work done in Zambia where cases of carcinoma of the cervix were plotted by location. A pattern emerged which revealed two areas where the problem did not occur.

Investigation revealed that the tribes occupying these areas required a ritual wash to be taken by both parties before and after sex. Burkett (1968) has described how the plotting of cases of previously unconnected tumours in East Africa showed a correlation of tumour distribution to climatic factors. This led researchers to suspect a virus to be the responsible agent. Classen (1977) reported that through land-referencing, certain types of cancer were found to be more prevelent in areas with a high concentration of chemical processing.

Currently, work being done in New Brunswick by the Task Force on Chemicals in the Environment and Human Reproduction Problems is being related to the land to allow intra-provincial comparisons to be made (White, 1984).

2.5 LAND INFORMATION SYSTEMS

Because of the complex nature of land information, attempts have been made to place its collection, maintenance and management on a systematic basis. Early attempts of management involved rationalizing existing operations of routine tasks where most of the vast volume of data was being processed. More recently, the need for better stewardship of the land, and better use and management of resources has resulted in new demands being placed on the management of land information (McLaughlin and Wunderlich, 1982).

The need for a systematic processing of information has resulted in considerable development in the field of land information systems. McLaughlin (1982) has described an information system as a combination of human and technical resources, together with a set of organizing procedures, which results in the collection, storage, retrieval, dissemination and use of data in a systematic fashion.

The data to be collected, and the way in which it is processed, are determined by the problems to be solved. The purpose that the information system will serve must be identified. Even though this may appear self-evident, many difficulties have been attributed to a lack of analysis in the initial design effort of the purpose for which the information is to be used (Lucianovic, 1973). It appears that many information systems can supply neither the operations level personnel (Schoech and Schkade, 1981) nor the managers (Salerno, 1981; Kraemer et al, 1981) with the information that is required.

The trend towards using information systems for decision making makes the analysis of use even more critical. In an attempt to provide information for better decision making, planners have developed complex, abstract and formal policy modelling methodologies (McLaughlin, 1980). Ackhoff (1967) has argued that the complexity of management models is a function of comprehension: the less a problem is understood, the greater the number of variables required to explain it.

Ouchi (1981) has commented that Western management is characterized by an ethos where

> rational is better than non-rational, objective is more nearly rational than subjective, quantitative is more objective than non-quantitative, and thus quantitative analysis is preferred over judgements based on wisdom, experience and subtlety.

Notwithstanding their complexity, these models and their associated information systems often fail to provide managers with the information upon which decisions will be based. One reason for this failure is that as Henry Adam noted, practical politics consists of ignoring the facts (in Mensch, 1979). Despite the fact that information on all aspects may be collected, the location finally chosen for development is sometimes the site around which the least protest can be generated by those displaced (Wolpert, 1970). There does not seem to be much point in spending vast sums of money collecting the latest and most accurate information in order to choose the location for something like the Fredericton land fill site if that information is to be ignored. A single overlay showing areas of least resistance provided by the land information managers may prove more valuable.

2.5.1 Explicit Information Systems

There often has been an assumption that improvement of the land records situation is strongly tied to the adoption of new and sophisticated technology (Portner and Niemann,

1982). Consequently, while some attention has been given to the development of conceptual models of information flow, attempts to modernize have mostly involved the introduction of computer based information systems containing explicitly defined information.

When computers were first installed in governments for land information purposes, they were mainly used by lower level staff for routine tasks such as keeping assessment and registry office records. Many of these automated tasks were found to contain information useful to managers e.g., statistics on foreign ownership of land. Computer use was then extended to restructure operations information into management reports either through routine reports or as responses to special inquiries.

Dangermond (1983b) has identified some of the considerable benefits that result from the use of automated systems: data are maintained in a physically compact format at a lower cost per unit and can be retrieved at great speed; a variety of types of manipulation by map measurements, map overlays, transformations, graphic design and of the database are possible; rapid and repeated analytical testing of conceptual models can be performed; change analysis can be performed for different time periods; graphic and attribute data can be manipulated simultaneously; interactive graphics design and automated drafting tools can be applied to cartographic design and

production; certain forms of analyses can be performed cost-efficiently that could not be done by manual means; there is a resultant tendency to integrate data collection, spatial analysis and the decision making process into a common information flow context.

There is evidence to suggest that computers have increased the technical quality of information and its accessibility. Computer operations have required consistent and well-defined data, and computers have provided the capability for automatic error checking, immediate correction and rapid access to large data files (Kraemer et al, 1981). This need for explicitly defining data is both a strength and a weakness. It enables information to be unambiguously defined and readily understood by many. It also means that subtleties cannot be captured. The total information content is diminished in some way.

Computer based information systems designed to assist decision makers have met with limited success. Despite the proliferation of these systems, much of the information needed for government decision making still is not available to those who need it (Kraemer et al, 1981). To date, such systems have had a limited impact on the land management process and have remained an expensive toy of the planning community (McLaughlin, 1981). However, even when planners do use computer based systems, it is often for purposes such as identifying non-conforming land use and not for policy decisions.

The inability of Management Information Systems (MIS) to effectively assist decision making led to the concept of Decision Support Systems (DSS) in the 1970's. While both types of systems use databases established and maintained by transaction-processing activities, a distinction has been drawn between the "decision" oriented characteristics of the DSS and the "information supply" bias of the MIS (Brookes et al, 1982). In contrast to the structured nature of the MIS, the interactive nature of the DSS allows decision makers to address semi-structured and unstructured problems where analysis aids and management judgement are essential (Jaffe, 1983). A DSS design would thus take into account the decision style of a particular decision maker as well as the specific problem details. However, because of present inadequacies, Salerno (1981) has argued that such systems, whether they be MIS or DSS, act as accumulators of information in a world where information may already be too abundant. As more computers produce more data, human beings are required to spend more energy dealing with the data and so can absorb, retain and use less and less information.

2.5.2 Implicit Information Systems

While computer based information systems have provided a valuable service for many functions, they have failed to adequately satisfy the requirements of planners and managers. This failure can be attributed in part to the

growing pains of a still maturing field of study. It is also due to the fact that much of the information required by these decision makers cannot be expressed explicitly enough to store in a database. Implicit information may result from intuition, speculation or supposition and may be based on years of experience. It includes unquantifiable ideas and subtle relationships between the occurance of events and problems under consideration. This implicit information may be vital to the effectiveness of an organization. To ignore it is to avoid a fundamental problem. However, the role of implicit information in land management decision making has not been widely commented upon. The word "implicit" is preferred to "informal" as the management of this information, which cannot be defined explicitly, should be placed on a formal basis.

Most analyses of information systems recognize the existence of implicit or informal information systems, but do not take them into account in their studies. This may be because the poorly defined nature of this type of information makes it difficult to handle in a highly quantified and compartmentalized environment:

> formal information allows one to extract from the recipient the processing and/or conversion procedures for producing information from data. On the other hand, the value of informal information is arbitrarily assessed by its recipient. The form and content of informal information are both subjective and unstructured, and the process which converts data to information cannot be separated from the recipient. (Burch et al, 1983)

Implicit systems will develop as a defensive measure regardless of the intentions of the designer of an information system. Such systems allow the dissemination of opinions and ideas through the interaction of individuals sharing common concerns and perspectives. They will evolve to circumvent problems caused by inadequate computer information systems (Schoech and Schkade, 1981). Even if the computer system functions adequately, implicit systems will be developed by managers to ensure that they are well informed about what is really going on in the organization (Downs, 1967).

Mintzberg (1975) and Ouchi (1981), both professors of management, contend that management is too much an art and too little a science for its procedures to be prescribed by scientific analysis. Despite this, implicit land information systems have not been developed as tools for managers. Instead, designers of information systems generally have concentrated their efforts on specialized functions of the organization where the procedures can be more easily analyzed (Mintzberg, 1975). Consequently, computer based information systems tend to be routine and deterministic, whereas the problems that they are intended to address are frequently non-routine, unique and far from determinable (Witzling, 1980).

Although computer systems are available, managers apparently still seek information by word of mouth

(Mintzberg, 1975). Among research scientists, informal communication has been estimated to account as much as 80% of information transfer (de Solla Price, 1975). This "soft" information is preferred because it is timely i.e., today's gossip may be tomorrow's fact. It is also preferred because managers identify decision situations and build models, not with aggregated abstractions provided by an MIS, but with specific pieces of data (Mintzberg, 1975). Implicit information systems allowing the dissemination of this type of information must be formally designed.

Churchman (1975) has described a hidden information system which operates within managers. It has a sensitivity to ambient conditions such as the manner in which something is said, or knowledge of an event which has no direct link with the problem. This information cannot be quantified and packaged in a computer but instead is stored in the brains of its users. The strategic databases of an organization exist then not in the memories of computers but in the minds of its managers (Mintzberg, 1975).

Ouchi (1981) has commented that computerized information systems are barely known in the largest Japanese companies, whereas they are commonplace in even small businesses in the west. In his study of American firms which had characteristics similar to Japanese firms, Ouchi found that while they had modern information and accounting systems and other formal mechanisms of control characterizing the

typical American firms, these systems rarely dominated in major decisions. By contrast, managers in typical American organizations frequently complained about feeling powerless to exercise their judgement in the face of quantitative analysis, computer models and numbers.

At present human judgement cannot be eliminated from the application of results of computer analyses. The decision maker has to "sense" as well as to calculate decisions rationally (Ewald, 1975). The bigger the role of judgement in the final decision, the greater the probability that a wise man will make the right choice without the help of a comprehensive computerized system (Downs, 1967). However conciencious the effort, the explicit information made available will be inconclusive. Ultimately the decision maker must step from the quantified and reasoned, across what cannot be known.

2.5.3 Connection Between Explicit and Implicit Systems

In their taxonomy of knowledge, Berry and Cook (1982) define procedural knowledge as the way in which (i.e., how) an organization uses its factual knowledge (concerning relations among objects of interest i.e., what) or implements its judgemental knowledge (concerning the wisdom used to determine which factual and procedural knowledge is relevent to a given decision i.e., why). They further identified two categories of procedural knowledge i.e., algorithmic and heuristic.

Algorithmic knowledge is used whenever problems can be solved by repeatedly applying rules of procedure. It can be expressed as steps in a computer program. Heuristic knowledge is used to solve problems or to react to situations when a particular algorithmic solution is not possible because the solution is discovery oriented and the procedures are difficult, uneconomical or impossible to articulate. It involves using rules-of-thumb that have been compiled during years of experience.

The explicit information system employs an algorithmic procedure, whereas the implicit information system uses a heuristic procedure. However, the demands for these two procedures are not unchanging. Over a period of time, solutions of a heuristic nature may be able to be defined algorithmically; similarly, should an algorithmic model no longer reflect reality, there may be a need to revert to a heuristic approach.

The information provided by both systems is required for the functioning of the organization. The possibility of access to computer based information has led to a change in the perceived need for this kind of information. Where good quality and conveniently accessable data are available, planners and policy makers do make use of them (United Nations, 1979c). There is a need for the explicit and implicit to exist in a state of balance in which both provide complementary information to the users.

2.6 LAND INFORMATION NETWORKS

A land information network may be defined as a confederation of individual member systems. While a land information system may be regarded as an attempt to improve the effective flow of information within an organization, a network may be viewed as an attempt to improve the effective flow of information between organizations. (See Figure 2.2). A network requires sophisticated communication technology, data exchange standards, and most importantly, special co-ordinating mechanisms. As with implicit and explicit information systems there is a need to link together the implicit and explicit information networks.

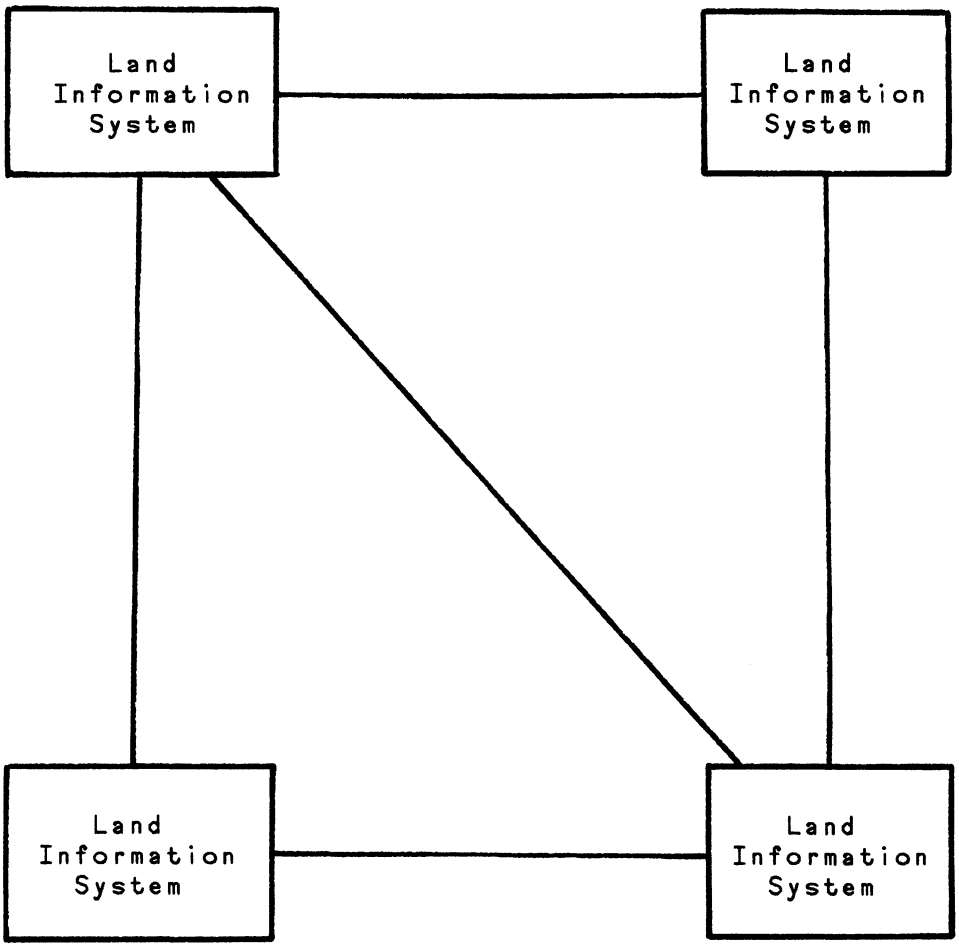


Figure 2.2: Land Information Network

2.6.1 Explicit Land Information Networks

Efforts in the early 1960s were devoted to building centralized information systems. In such a system, all transactions of an organization were to be handled on one large computer. This design was dictated by the existing state of technology. The cost of computing power precluded individual departments from buying their own systems, while a large central system was seen as the only feasible way of integrating vast amounts of data.

Problems of both a technical and non-technical nature came to light later. The hardware did not provide acceptable speed and soon became overloaded due to the increase in file complexity. The software did not provide acceptable flexibility or power which resulted in a system that lacked adaptability and responsiveness to user needs. The data stored were often poorly edited, invalid and out of date because of a lack of clear inter-agency guidelines. Furthermore, such systems were not attractive to individual government departments which did not trust them, nor were they attractive to politicians who feared the cost (Hayes and Fauquier, 1983; Simpson, 1982).

The subsequent dramatic decrease in computing costs and the increase in computing power provided a solution to some of these problems. Individual departments and agencies were then able to develop their own independent systems. More

recently, attention has been given to the concept of a Virtual Total Information System, or a network linking the individual systems. The impetus for this move has been the high cost associated with duplication of data collection, and the need to integrate data from diverse sources.

Under the network concept, data ownership is retained by the functional owner or primary user of the data, even though the data may be shared with others and replicated in many geographically dispersed locations and in many technically disparate forms (Horton, 1979). This sharing of data means that other agencies, or secondary users, will have access to information that they need, without having the responsibility of acquiring and editing the data or of the ongoing task of updating and maintaining these data. The land registry system may be considered the primary user of land ownership information, while the property assessment system is a secondary user of that information.

The economic benefits that result from sharing data can be substantial and have replaced economies of scale in hardware as the primary reason for the continuation of co-operative computing. Swank (1982) has estimated the savings due to data sharing in Lane County, Oregon U.S.A., to exceed $1 million per year.

The problems encountered in the development of multi-computer configurations are considerable. They include overcoming the problems of incompatiblity between database

structures and between computers themselves. This problem has been exacerbated by the proliferation of commercial turnkey systems. Another major problem faced when sharing information is the varying interpretations by the users of the data and its standards. In a network, the integrity of the data should be maintained regardless of when it is used, by whom and for whatever purpose (Horton, 1979). The success of this depends on a design in which the particpants can co-operate with one another to the mutual benefit of all.

2.6.2 Implicit Land Information Networks

Mintzberg (1975) has commented that the strategic data banks of organizations are located not in machines but in the minds of the managers. It is people, not machines, that organize knowledge (Horton, 1979). These resources must be linked together if managers and policy makers are to get the implicit information that cannot be provided by computer based information networks.

Although implicit information networks have been documented, they have seldom received official recognition in the design of networks. Crane (1972) explored the role of non-formal information channels through her so-called "invisible colleges" in the scientific community. Her findings showed that most scientific disciplines are organized into tight social circles of specialists who exchange information on their work on a regular basis.

The role of networks connecting people has been recognized in industry as well. For example, in its corporate philosophy, Intel considered its "Intel teams" to be an integral part of the company's work ethic environment (Ouchi, 1981). Another form of an implicit information network used for disseminating information and knowledge is the Japanese Quality-Control Circle (Q-C Circle). These circles have been very effective in sharing with management the responsiblity for locating and solving problems of co-ordination and productivity (Ouchi, 1981).

Perhaps the most successful formal implicit land-related information network has been the development of Special Interest Groups as an integral part of the Western Australian Land Information System. At present, an informal network exists between interested personnel in the middle management level of some New Brunswick government organizations. This network has allowed these managers to obtain information required for their problem solving, and has ensured that they share common objectives. However, for this network to play a more effective role, an environment which encourages growth in the number of participants must be provided.

Chapter 3

USER REQUIREMENTS IN A LAND INFORMATION NETWORK

> This interaction of individuals, possessing different knowledge and different views, is what constitutes the life of thought. The growth of reason is a social process based on the existence of such differences.
>
> (Friedrich Hayek, 1944)

3.1 INTRODUCTION

The need to effectively use land information has been a longstanding concern of surveyors and others involved in land information management. The common themes of integration, unification, and co-ordination, so essential to a network, often have been stressed at conferences of the Institute of Modernization of Land Data Systems, the Urban and Regional Information Systems Association, and in the recent reports of the U.S.A. National Research Council, amongst others. Despite this encouragement, and notwithstanding the genuine progress made in the development of both conceptual and functional models, attempts of large scale integration of information have met with limited success.

One of the major problems to be overcome in the design and implementation of a land information network has been the mismatch between vertical systems designed to serve the

needs of single organizations and the horizontal sharing of information to meet the needs of a wide cross-section of users. (See Clapp and Niemann, 1977). Traditionally, organizations have operated in isolation and their analytical requirements have developed independently. The network concept involves the sharing of information between organizations. For this to occur, organizations must share common standards for information. These standards must be determined by an analysis of the decision making process.

The success of a network would appear to depend more on the development of consensus amongst users than on the adoption of new technology. Judge Fanton (1976) of the Massachusetts Land Court has noted that

> Fundamental change in the present land records system will beneficially result only from a confluence of continuing multi-discipline dialogue, co-operation and action premised on the actual, not surmised needs of the user of the system and general public understanding and acceptance that the advantages of what is proposed exceed the disadvantages of what is disregarded.

It has been suggested by Portner and Niemann (1982) that failure to address the social component of the land records problem may result in a more technologically sophisticated version of the present problem. Too often the requirements of users have been identified only superficially and sporadically. An ongoing commitment to a detailed analysis of user requirements is essential to the success of the network.

3.2 LAND INFORMATION MANAGEMENT TEAM

Concern over the availability of timely, accurate and relevent information needed for decision making is leading to the emergence of a community of land information managers (LIM) to assist the user in his search for land information. This community includes not only surveyors, who have traditionally played a major role in the land information field, but also systems engineers, computer scientists, economists, lawyers, property assessors and others (McLaughlin, 1982). Because of the horizontal effects of information, land-related problems have legal, political, economic, environmental, and social and cultural components. It is through the collective expertise of the LIM team that these diverse implications can be considered together.

The land information community is concerned with the technology for gathering and processing information, with the design and development of land information systems and networks, and with the policies and strategies for effectively and efficiently using land information (McLaughlin and Wunderlich, 1982). The LIM team has to transcend organizational boundaries and provide the link enabling users to communicate with one another. It plays a role in assisting users in the identification of their land information needs and in advising them on standards and procedures. Most importantly, the responsibility falls upon the LIM team to take the lead in creating an environment in

which consensus amongst users can be developed. (See Figure 3.1).

The role of the surveyor in the LIM team is potentially a key one for he is involved both with the mensuration or engineering perspective, and the information analysis or geographic perspective. This view of the surveyor was pioneered in New Brunswick with the development of the programme of land information management at the University of New Brunswick and has been promoted by the Canadian Council of Land Surveyors and the American Congress on Surveying and Mapping. The surveyor, more than most members of the team, is concerned with land information in all its forms and should be in a position to recommend to users the most appropriate presentation of the information.

It is through the co-ordinating efforts of the LIM team that information collected by one user is properly packaged, thus allowing it to be used intelligently by others.

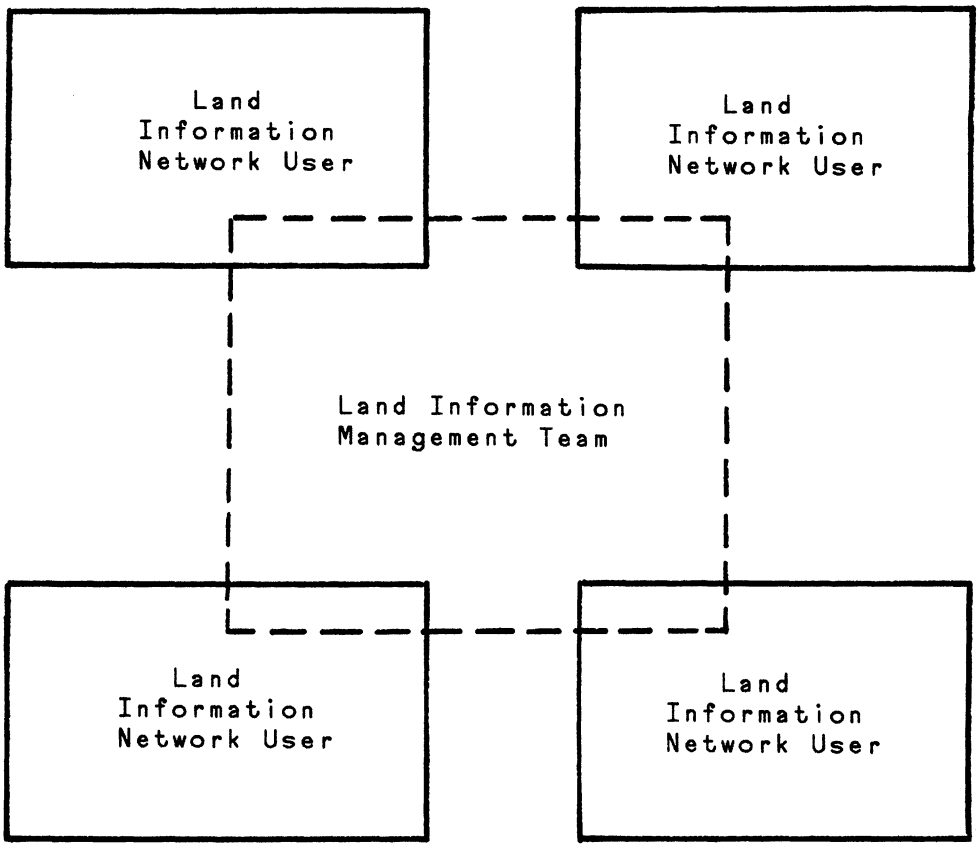


Figure 3.1: Central role of the LIM team

3.3 IDENTIFICATION PROCESS

A land information network should be designed to effectively improve decision making of a wide cross-section of users by providing them with the necessary information, while it efficiently minimizes duplication of effort. The lack of success of information systems has been attributed in part to the fact that the focus of information management often has been on methods to process data and not on the information products themselves (Kettinger, 1980). The same is true for a network which can only be as good as its component systems. However, the problem is exacerbated by the diverse nature of the information users and products of the network.

In changing the focus of attention, the LIM team has to address a number of issues: determining what information is required, how it is to be collected, and by whom; defining boundaries of areas for which various data are to be collected; identifying the amount and level of detail to be collected; establishing the manner in which the data are to be processed; co-ordinating the flow of information with the need for it; determining the conditions of access to the information; establishing the procedure for disposing of information no longer required (McLaughlin, 1982; Kettinger, 1980).

3.3.1 General Design of the Network

The analysis of network objectives and requirements must extend beyond the development of faster techniques for processing information and the creation of larger databases. It must also include an analysis of the decision makers and their aims. This task requires a measure of diplomatic skill: it is likely that much of the controversy over the design and management of the network will reflect the power struggle for control over it (Downs, 1967).

To avoid conflict, the need for the network and its objectives must be identified. For an information network to be effective, its purpose should be defined in terms of the people who use it, their needs, and their behaviour patterns (Witzling, 1980). A network may actually hamper problem solving if it does not account for the different characteristics of its users and their problem solving situations. Ackoff (1967) has argued that when organizations have inappropriate measures of performance which put them in conflict with one another, communication between them may be counter-productive. Organizational structure and performance measure must be taken into account before permitting the free flow of information between organizations.

The rapid evolution of land information technology has not been matched by a corresponding increase in the understanding of how natural systems work (Dangermond,

1983a). Forrester (1969) has commented that complex systems are often counter-intuitive and respond to changes in directions opposite to what may be generally expected. Experience and intuition are developed almost entirely from contact with simple systems where cause and effect is closely related. In a complex system, short term responses to changes sometimes can be opposite to long term effects. This can lead to the implementation of a series of steps, each appearing beneficial, but which constitute an incremental design that can result in undesirable behaviour. If fundamental causes are ignored and merely the symptoms treated, resources will be wasted as conflicting forces are set into action against one another.

Problems of inappropriate performance measures in the field of land information have been documented by Portner and Niemann (1982). The irrationality which manifests itself in the problems of duplication, integratibility, and availability does not result from irrational behaviour, but instead from rational, though unco-ordinated, behaviour by individuals within the network. Rational individual behaviour which optimizes individual benefits is encouraged even if it incurs high collective costs. This is due largely to the fact that primary benefits of such behaviour are derived by the individual while the costs are distributed amongst the public at large. Conversely, the cost of acting collectively rational would be assumed

primarily by the individual while the benefits of such behaviour would be derived by the public at large.

If the network is to assist decision makers, it must lessen their problem and not increase it. Ackoff (1967) has argued that the manager's problem is not a lack of relevent information, but instead an overabundance of irrelevent information. The consequence of changing the emphasis from supplying relevent information to eliminating irrelevent information is considerable. In the former case, attention is placed on constructing databases, coding, indexing, updating files, access languages, etc. The theoretical ideal of this concept is a complete bank of data from which a manager can retrieve any information that he wants. However, if the information problem results from an overabundance of irrelevent information, then evaluation and condensation become important functions of the network.

3.3.2 Identification of Users

By definition a network is a multi-purpose structure and hence it will have many potential users. Identifying these users in practice is no trivial task and requires significant knowledge by the LIM team of the way in which the organizations function. Users of the network can be categorized according to whether they primarily collect information (e.g., registrars), whether they primarily use information (e.g., planners), or whether they are involved

with the collection and use of information (e.g., property assessors).

The public sector, with its great number of programmes, will be a major user of a land information network. The U.S.A. National Research Council (NRC, 1983) has identified the following as potential uses of the multipurpose cadastre: administration, assessments, building inspections, court administration, deed recordation, engineering, finance, fire and emergency services, forestry, health, housing code enforcement, natural resources, parks and recreation, planning, police, pollution control, school districts, traffic control, surveying, transportation, utilities, voter registration, water and sewers, and zoning.

A network should also be designed to serve individuals as well as government agencies. For example, individuals and citizen organizations presently are demanding an increased role in the planning and decision making which affects their neighbourhoods and thus their lives (Williams, 1981). If citizens are to participate effectively in the local policy making process, they must have access to the information upon which the decisions are based.

In a multipurpose network, information will move both horizontally and vertically. Furthermore, the horizontal transfer of information should be able to occur at any vertical level. For example, the assessment system may have to exchange information with the registry system at the

level of the individual parcel, and at the same time with a forestry system at an aggregated regional level. It is thus important that users of information from all levels of the organizations be involved. Information systems are often seen to be oriented towards management as opposed to operations level personnel. This sometimes makes it difficult for the latter, who are often the interface between the organization and the public.

3.3.3 Identification of Information Needs

Cheap computer storage has been regarded at times as a substitute for the precise definition of problems and their information needs. However, this assumption that computers can collect and store all information that could be required leads to increasingly large databases with irrelevent, obsolete, and inaccurate data clogging the storage and processing channels (Horton, 1979). Not only is it costly to maintain data, it also becomes costly to quickly locate data that are required.

To prevent this situation from occurring, the LIM team has to look not only at the efficiency aspect, or procedural information management, but also at the effectiveness, or substantive information management. The latter emphasises how information is used within a programme and how it contributes to an individual programme's success. For example, the early registry offices in New Brunswick

concentrated on procedural information management. They were concerned only with the manner in which the deeds were filed, stored, and retrieved, but had no regard as to the substance, or information content of the deeds themselves. Consequently, the questionable quality of the registered information limited the effective use of the ownership information in decision making.

A major problem facing those in the information community is a conceptual one of what information users require to carry out their functions. Information resources cannot be used effectively unless steps are taken to close the gap between raw data flows and the desired results (Horton, 1979). If data are to provide insights to activities under examination, they must be arranged within a well defined policy framework (Bernhard et al, 1983). However, restraints on the flow of information are imposed as a result of the incremental and fragmented process by which decisions are made (Ingram, 1973). These restraints have to be catalogued and described, and the factors that affect the channels of information determined. To accomplish this, tools must be developed to enable the actual and potential use of information within the programme to be identified (Kettinger, 1980).

The actual information needs of users may prove difficult to determine. As may be expected, policy makers (Bernhard et al, 1983), managers (Lucianovic,1973), and operations

level personnel (Schoech and Schkade, 1981) all appear to have difficulty in specifying their requirements.

Ackoff (1967) has stated that most designers determine the information required by asking managers what information they would like to have. This, however, is based on a seldom fulfilled assumption that the manager has an adequate model of each type of decision he makes. Information for decision making cannot be specified until an explanatory model of the decision process and the system involved has been constructed and tested. Each type of decision required by an organization should be identified and the relationships between them flowcharted. Such analysis reveals decisions that are being made by default as well as interdependent decisions that are being made independently. This process has been criticised because of the inability to know what information will be required. However, if a user cannot specify his needs before a database is created, he may have difficulty picking a starting point after it is created (Lucianovic, 1973).

This uncertainty is caused in part by the intricate nature of real world problems. Churchman (1975) has illustrated the complex problem of determining the information requirements for an inventory system. These requirements appear simple: the manager needs to know the likely demand on the inventory, the cost of holding the inventory, the cost involved if an item is not in stock when

it is required, the time needed to order and receive the item, etc. However, decisive information about demand has to be based on an analysis of the marketing system and not just on past records. Similarly, the cost of holding items in the inventory requires an analysis of the financial system. Thus solving the inventory problem of the organization requires the determination of information needs for the financial and marketing problems, and probably also for the labour and legal problems as well. To successfully solve the land information management problem, a similar approach is required.

3.3.4 Identification of Standards

Once the information requirements of organizations have been identified, standards for that information must be established. While organizations may require the same kind of information, their needs may differ with regard to spatial interests, temporal interests, coverage, attributes, precision, linkages, and accessibility (NRC, 1983). If information is to be easily shared between organizations, then they must have compatible standards for that information. The establishment of standards requires a detailed knowledge of why the information is required and how it is processed.

In this identification process, the LIM team is involved with establishing procedures for data classifications,

definitions, codes, and linkages. These concepts lie at the heart of the framework for the integration and analysis of data (United Nations, 1979a). They provide the means for vertical integration by allowing micro data to be aggregated, and for horizontal integration by specifying the relationships between the concepts and classification systems. Attributes of land can be described as being continuous, discrete, or dichotomous. Furthermore, descriptions of attributes can be qualitative or quantitative, and subjective or objective.

The task of developing sets of classification systems with their accompanying concepts and definitions is a major undertaking. To date, the only significant contribution has been the classification schemes for the exchange of digital topographic data developed by the Canadian Council on Surveying and Mapping (1982). Much fundamental work remains to be done in other areas of land information.

3.4 SUBJECTIVITY OF IDENTIFICATION

Information systems can be regarded as an attempt to represent reality. However, unlike man's direct interaction with other human beings and the environment, information systems and networks have to rely on symbols and their manipulations (Horton, 1979). This recorded information thus reflects a static view of reality, creating a mismatch between the information content of the systems and the

reality they are supposed to mirror. Moreover, by influencing the way in which decision makers view the situation, information affects those realities it is supposed to reflect. As such, information contains the seeds of its own inadequacies (Horton, 1979).

In the land records area, Wunderlich (1974) described the increasing level of abstraction in land ownership (i.e., from walking on the turf and defending it with a stick to representing the land on a map and defending it by law) and concluded that theory has created its own reality. Perception no longer affects reality, it becomes reality.

An individual understands, describes and interprets the real world through the use of symbols (Horton, 1979). The symbols are associated with rules-of-thumb to simplify reality in order to distinguish between good and evil (or that which is in one's own interest and that which is not) without having to consider the evidence in detail in order to arrive at some balanced judgement on ethical and other issues (Hartle, 1979). Increasing the level of abstraction increases the possibility of different people interpreting the same phenomenon differently.

3.4.1 Subjectivity of General Need

The LIM team involved with the perception of the general need for the network gives the programme its initial goals and objectives. A predilection for a particular type of

land-related product could force the network to have a bias in one aspect, thus preventing it from providing a truely multipurpose service. A similar bias in the identification of users could result in an inadequate network. Some users may not be consulted while the contribution of others may be discounted.

Hartle (1979) has argued that words like "goal" and "objective" imply a normative imperative, but that it is impossible to determine non-subjectively whether a particular goal is good or bad: the goal is either assumed to be good, or it is assumed that it was arrived by some process that ipso facto makes it good. Pursuit of these "good" goals is therefore good; the more effectively they are pursued the better.

This places a burden on the LIM team to ensure that the goals of the network are comprehensive. This may be problematic for as Hayek (1944) observed, everyone is in some measure a specialist, and each thinks that his personal order of values is not merely personal but is the right one. In the real world of fragmented, inconsistent, and often incoherent policy, not every interest group participates in decisions that affect its concerns (Ingram, 1973). The focus of interest of those involved is then likely to be where access and impact most easily can be achieved. The perception of the decision and what is at stake affects what information is generated and transmitted.

Dangermond (1983a) has suggested that interest in land information technology has tended to start at the technical level of an organization, before spreading to middle and top management. This diffusion has often caused problems. Scientists and engineers are specialists and visual thinkers by nature, whereas politicians and managers are generalists and verbal thinkers (Ewald, 1975). Engineers have often initiated programmes without considering the non-technical aspects, and have caused others to misinterpret their intentions (Vollebergh, 1981). The LIM team has to consider the power pay-offs when designing the network. Users will not accept or use the network effectively unless it is offered to them in a way that takes their own interests into account (Downs, 1967).

3.4.2 Subjectivity of Users

The land information network must be designed to serve its users if it is to be effective. However, the user's behaviour is frequently overlooked in the design (Witzling, 1980). The manner in, and extent to, which people use an information network is a function of the organizational environment. Different users will have different perceptions and images of the organization for which they work.

An aim of the network is to serve the public interest. However, "public interest" can be widely interpreted.

Hartle (1979) has taken the view that the public interest is what the government of the day, through its ministers and appointed department agency officials, decide. The mismatch between government directives and interests of the private citizens can be attributed in part to a loss of contact between the real world of the private sector and the actions and decisions taken by public officials (Horton, 1979).

Portner and Niemann (1982; 1983) have shown that a major problem in establishing rational collective behaviour (as opposed to rational individual behaviour which culminates in irrational collective behaviour) is the existence of disparate belief systems which exist amongst the individuals within the network environment. However, considerable value differences can exist within an organization. Research by Luttbeg and Ziegler (1966) showed that significant discrepancies exist between the beliefs of members of an organization and those of their leaders, and between the actual beliefs of members and the leaders' perceptions of those beliefs. Thus whether the leaders based their actions on their own values or on their perceptions of the values of members, they were not acting as true representatives of the organization.

The decision of an individual to use an information system is not a free choice but is linked to the organization's setting, goals and problem solving processes, as well as to small group behaviour and interpersonal

communications (Witzling, 1980). Mooers (1960) illustrated convincingly the organizational constraints when he defined Mooers' Law:

> An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it.

Mooers anticipated the land records problem identified by Portner and Niemann (1982) when he stated that work done, even in duplication, is rewarded whereas work saved is seldom recognized. Ingram (1973) has identified some constraints that users place on an information system with regard to source, content, and timing of the information, the character and learning capacity of the user, and the rules and regulations of the organization.

Imperatives that govern an individual's actions are learned at an early age, and thus that which is learned is not critically examined (Hartle, 1979). Disparity in beliefs is then further increased if the backgrounds of the users differ to any significant degree. Whether or not data are to be valued as information depends on the situation of each individual. This is a function of his attitudes, emotions, and goals, all of which vary in time. The answer to the question as to whether the network pay-offs can be considered positive or negative, and to what extent, will depend upon whose values are used in the calculations (Downs, 1967). Some potential users may not feel that they should participate because they do not perceive a problem,

or because they feel that their views will not be sympathetically received. If no overall consensus exists as to what the collective problem is and how it should be addressed, individuals will attempt to solve it in ways which are consistent with their beliefs.

3.4.3 Subjectivity of Information Needs

The different perspectives of users have a major effect on the values associated with information, and hence the need for information. The intelligence value of the network, as perceived by the users, bears on the collection of information.

Shared use of databases has important political implications as control of data definitions, planning models, and data cannot be considered value free. The normative values needed to manage data for a single organization are different from those required for shared data (Gilbert, 1982). The analytical requirements of decision makers must be determined before information can be shared. Commonality, interdependence, and political constraints of information cannot be identified without the prior establishment of linkages of the information flow.

It is implicit in the concept of a land information network that duplication of collection is to be minimized through the authorization of one agency (i.e., the primary user, or statutory source) to be the collector of certain

information. This allocation of responsibility can have repercussions. Organizations may be interested in the same information theme, but in completely different characteristics of that theme. For example, if agriculturalists are given responsibility for providing soil information, the product may not include a description of the organic surface which is a soil attribute of interest to foresters. Furthermore, while resource specialists may be interested in soil nutrients, soil strengths may be required by engineers. Similarly, Ingram (1973) has described how in the U.S.A. collection of water quality data was the responsibility of the Department of Health, Education and Welfare. Consequently, information collected was of value to studies on the spread of diseases through water supply, but was of little use to those involved with aesthetics, recreation, and wildlife habitat.

Mabbs-Zeno (1982) commented that government researchers have been hampered in their efforts to compile a database on land values by a lack of consensus on definitions. This profusion of definitions has resulted in part from the wide variety of applied research purposes that deal with the economic role of the land. It is obvious that all information needs cannot be met with a single parameter, regardless of how complete the data on that parameter might be. Nevertheless, without any form of classification and standardization, the similarities and differences between these parameters will not be known.

3.4.4 Subjectivity of Standards

Given the problems in identifying the information theme requirements, it is not surprizing that McLaughlin and Wunderlich (1982) have commented that information standards are not widely accepted. Standards for land use classification, accuracy and precision in measurement, naming and addressing, for example, are typically used only within one organization. A datum as apparently simple to define as the area of a house may have as many different interpretations as there are users of the information (Hayes and Fauquier, 1983). For example, assessors may require annual updates of such a value while the building or fire department may need more frequent revisions.

Different classification variables and different values of those variables cannot be used if the information is to be shared. In many cases, the small differences in existing standards of users result from historical accidents and not as a consequence of any analytical need (United Nations, 1979a). Some users may be able to alter their standards to accommodate others with little or no trouble whereas others may be contrained by institutional or administrative factors.

Once the definition of the data item has been agreed upon, the procedures required to calculate its value must be determined. One can seldom work with the basic data collected at first hand, but instead must use data that have

been processed in some way. For example, the area of a parcel stored in a database as a "basic data item" for future integration with other data, may be calculated from data on distances and bearings collected by the surveyor in the field. Similarly, the value of the parcel is based on the selection and combination of some of its many attributes.

Mabbs-Zeno (1982) has given the example that such a datum as "the average farmland value per acre in the USA in 1981 was $796" may have been derived from a set of procedures including identifying a set of realtors to survey, describing to the realtor what data was sought, weighting responses from several states, and numerous other actions. Consequently, the value $796 represents the procedures used more than it does the average farmland per acre in the U.S.A. in 1981. Use of the data should be based on an understanding of what numbers are generated by the procedures rather than merely on a need for the data.

Through the explicit definition of data relationships (as opposed to implicit definition through co-ordinates), users may be able to extract more usable information from the network's "virtual database" than they entered. However, in constructing this virtual database one does not manufacture information that is not contained in the original individual databases of the various systems. There is a danger that if the construction is not done rigourously, and if users are

not aware of the origins of the data, the results may be misinterpreted (United Nations, 1979c). Milton and Milton (1983) have warned that the network concept will allow original data to be combined in a variety of ways, some of which may alter its quality drastically yet unobtrusively.

The Lincoln Institute of Land Policy (1982) reported that the two factors most often rated high in importance for the successful implementation of a land information system are a defined responsibility for the sources and accuracy of each record, and standards for the quality of data that may be entered. There is a need to know the reliability of the information to ensure that it is properly used. Sinton (1978) has commented that data for which no record of its precision or accuracy exists should be suspect, for once it is entered into a database it assumes an aura of respectibility. Berry and Cook (1982) have referred to this data on data as metadata, and have introduced similar concepts of metainformation and metaknowledge.

Information on quality will become increasingly important as more use is made of interactive graphic information systems for mathematical analysis such as the selection of suitable sites. For example, the criteria for a land-fill site may include impermeable subsoil, minimum distance from water courses, not on good agricultural land, and within a specified distance of a town and road. The selection is done by overlaying themes representing these criteria.

The reliability of the product (i.e., the site chosen), however, is dependent upon the probabilities that the components as represented in the overlays are recorded in their correct positions. As more components are added, the possible range of defects in the final product increases. Degrees of correctness become important when grades of sites (e.g., good, marginally acceptable, or unacceptable) are considered. This concept is important when dealing with themes such as soil types or natural vegetation lines where the boundaries are not clear but "fuzzy". The criteria for success should take into account the effects of wrongly classifying a site as good when it is only marginal and vice versa (Milton and Milton, 1983).

A major concern regarding the integration of information is that of privacy and confidentiality. Privacy has been viewed by Wunderlich (1974) as "contrary to the need for information". Management of information requires a balance between the public's right to know, the individual citizen's right to privacy, the taxpayer's right to efficient government operations, and the civil servant's right to good programme information (Kettinger, 1980). All these are highly subjective: the problem can only be studied in detail once the information requirements have been identified and claims against them have been made.

3.5 DETERMINING USER REQUIREMENTS

3.5.1 Short Term Studies

User requirements traditionally have been assessed using short term studies such as benefit-cost and user inventory studies. These have been popular, for they do not require an extensive commitment, but give the appearance of much work being done, and yield visible results in the form of lengthy reports. The fact that these results frequently do not provide satisfactory solutions to the problems is conveniently ignored. As Oppenheim (1966) noted, "survey literature abounds with portentious conclusions based on faulty inferences from insufficient evidence wrongly assembled and misguidedly collected". In essence, these studies are often superficial assessments of long term problems facing the users.

User inventories have limitations in that they list only what is done and not why. They provide a useful directory of where the information is, but are limited in their description of the information. The data collected usually cannot be used for determining standards or the flow of information between users.

Benefit-cost studies have often involved a more detailed analysis of requirements, and have been useful in identifying the costs. However, there is reason for treating the results of such analyses with caution. In these studies, the determination of user requirements is not

usually undertaken in its own right, but as a secondary aspect of another study. Ingram (1973) has described the purpose of these studies as providing the rationale for not undertaking certain projects while being flexible enough to supply a justification for projects that have strong support.

As Marshall (1965) has noted,

> one of the principal uses of benefit-cost analysis is to clothe politically desirable projects in the fig leaf of economic respectibility.

Because of the possible political manipulations, one has to be suspicious of the requirements identified, and of the relative emphasis placed on them. Weeks (1977) has described a benefit-cost analysis of the U.S.A. Corps of Engineers

> involving a large scale dam where, on the first approximation, the annual costs exceeded the annual benefits by $800 000. The Engineers were not at all impeded by this and at once put in an additional benefit, "tourism", which by remarkable coincidence was estimated to provide exactly $800 000 annually.

The complex inter-relationship of information has meant that decision making in the public sector has often led to conflict. In an attempt to avoid such conflicts, public hearings have been used to assess the public's ideas and attitudes of the situation and their choice of action. However, an analysis by Swanson (1969) of six public hearings on water resources showed that witnesses representing government agencies greatly outnumbered those

representing themselves or local organizations. The aura that surrounds official hearings is often intimidating to those unaccustomed to them. Furthermore, much information is often of a technical nature, and is meaningful only to a certain informed segment of the public.

The New Brunswick Land Use Policy Task Force (1983) identified a problem experienced when evaluating requirements for Environmental Impact Assessments. Since these are done on a once-off project basis they tend towards conflict, as a project outline has to be developed before the impact can be assessed. If there is adequate information on a project design, the decision is seen as already made; if insufficient information is developed, the public considers the government secretive.

A more recent initiative in Canada has been the holding of conferences and seminars on user requirements. In many cases, these conferences are attended only by senior officials, and users who do have important contributions to make are excluded because they are at a lower organizational level. These conferences normally have the format of presented papers and there is limited opportunity for those attending to participate actively. Consequently, issues facing users cannot be discussed in detail. Furthermore, being infrequent or irregular, they lack continuity.

3.5.2 Long Term Studies

The solution to the problems associated with land information will not be found simply or quickly by a single discipline or profession. Furthermore, one cannot simply alight upon some problem like some deus_ex_machina and carry out a quick survey with a team of specialists (United Nations, 1979b). The proper identification of user needs requires a sustained effort on the part of both users and the LIM team.

The complex interaction of land information, and the subjective attitudes of its users demand a participative process. Assembling a team of users to work co-operatively on their problems is no easy task:

> the team brings together members of different intellectual species, and some species rarely mix. They will use words differently, attribute different importance to various aspects, and have different views of their own and others competences and interests. (Alonso, 1971)

Managers within a large organization tend to develop "local objectives" that further the performance of their local operations, but which may have negative effects for the organization as a whole (Ouchi, 1981). Because of the different backgrounds of users, the likelihood of such local objectives developing within a network are considerable. The extent of these differences are not insignificant as Portner and Niemann (1983) have illustrated. The most important function of the LIM team is to assist in providing the environment in which these difficulties can be overcome.

Time and energy have to be devoted to developing the interpersonal skills necessary for effective group decision making, and for showing users how to identify problems, opportunities, and resources available. A network involves sharing which can occur only if there is a commitment to a co-operative approach by the users. However, before commitment can occur there must be understanding.

> Understanding comes from the open expression of skepticism through a process of debate and analysis. An incentive to dig into old assumptions and ask hard questions must be there as well as a sufficient level of trust so that individuals will speak candidly to peers, subordinates and superiors. Above all, co-operation comes before any of these things. (Ouchi, 1981)

Thus before information requirements for the network can be determined, there has to be a process of education. Users must become knowledgeable about the beliefs of others if a consensus is to be obtained. This process should allow users in different agencies to see how their services complement one another, and how each agency provides only a portion of the total service to the public. In many cases, this may be the first opportunity that users in one agency have to meet with those of other agencies and so gain a new perspective of land information. Many users of land information are not familiar with the concepts of a modern information network and have to be provided with an explanation of its workings. They must also be provided with the opportunity to develop an understanding of technical matters such as digitizers, databases, and relative and absolute accuracy.

This may be a time-consuming process, but the time invested ensures that users are able to make an effective contribution to the design and implementation of the network. Successful involvement of users is not restricted to any particular environment: Ouchi (1981) has described its effectiveness in a highly technical environment, while Toomey (1984) has documented similar success in a rural environment. Special Interest Groups set up to determine solutions to problems facing users could serve the same purpose. Such groups may focus on general problems such as technical or administrative issues, or on issues specific to a section of users e.g., a property map users group. Information gathered by these groups can be disseminated to other users through general workshops, newsletters and similar means.

The commitment to assessing user requirement is an ongoing one. Groups created to assist in the design of the network cannot be dissolved, but instead must be reconstituted to assist with the maintenance of the network.

Requirements are not static but instead respond to changes in society and technology. Increased knowledge in the form of both information and imagination (McLaughlin and Wunderlich, 1982), and increased ease of access (Nora and Minc, 1978) produce new needs for information. The fact that classification systems are living dynamic things does not mean that investment in them quickly becomes obsolete.

Once logical and consistent classifications have been developed, their revision to accommodate new types of information and new concerns is an easier task (United Nations, 1979a).

Users themselves are not unchanging. New users in existing member organizations and new organizations themselves will respond to needs by using the network. An ongoing process of education will be required to ensure that the new users share the common philosophy of values and beliefs.

An ongoing commitment is required in order to provide lines of communication through which users can inform producers of any errors discovered e.g., lines incorrectly plotted on a map. If too many errors exist, and users feel that they have no control over the quality of the product, they will lose confidence in it.

The purpose of a land information network is to provide a service to the users. A need exists to monitor the efficiency and effectiveness of the network i.e., the contribution that the network is making to society. Horton (1979) has defined information efficiency as the ratio of information collected to the information used, and information effectiveness as the ratio of information used to the information of value. The extent to which policies, programmes, and projects have benefited from the network through the maximization of benefits and the minimization of conflicts must be determined continuously.

Chapter 4

LAND INFORMATION IN NEW BRUNSWICK

> Get your facts first, then you can distort them as much as you want.
>
> (Mark Twain, 1866)

4.1 INTRODUCTION

New Brunswick's attempts to develop satisfactory land information systems have occurred throughout the province's history. The Province of New Brunswick was formed in 1784, and the second act introduced in the first Assembly was the Registry Act. The intention of this act was to prevent fraud in transferring, conveying, and encumbering freehold land (Roberts, 1959). However, low value of the land, rapid settlement, and scarcity of surveyors resulted in land grants not being adequately demarcated. In 1916, legislation to introduce the Torrens system of registration was passed but not proclaimed. Legislation has remained substantially unchanged since 1784. The Registry Act allowed virtually any instrument affecting land to be registered provided its execution was in accordance with the Act. No responsibility was given to the registrar as to the legal effect of the instrument. In cases of conflict, precedence was given to the deed registered first.

Although a Land Surveyors Act was passed in 1884, the first major improvement in survey affairs only occurred in 1954 when the newly formed Association of New Brunswick Land Surveyors assumed control over entrance and membership qualifications. The province assumed responsibility for maintenance of information only for Crown land, even though less than half of the province fell in that category. Consequently, records and plans covering freehold land subsequent to original grants are at times incomplete or non-existent. Surveys and recording of freehold land remained the responsibility of municipalities until 1964 when the provincial government accepted in part administration of registry offices and control surveys.

The first comprehensive mapping programme was initiated in 1945. Base maps, produced at a scale of 1:15 840, were reduced to 1:31 680 and 1:126 720 and were mainly used for forestry purposes. Major problems experienced during the early mapping programmes were the lack of adequate survey control, and the high cost of photography, mainly incurred because an aeroplane had to be brought to the province to take the aerial photographs (Roberts, 1959).

In 1959, New Brunswick initiated a programme of large scale monumentation. Approximately 6 200 control survey monuments were placed between 1959 and 1968. Early use was made of emerging technologies such as Electronic Distance Measurers and computers, as well as the expertise provided

by the recently opened Department of Surveying Engineering at the University of New Brunswick (Roberts, 1959).

The evolution of government structure has significantly affected the manner in which land information is collected and used. County governments, constituted through the Counties Incorporation Act of 1877, played a major role in the provision of services. Subsequent legislation extended some of this responsibility to incorporated cities, towns, villages, and local improvement districts. Concern over the inability of the municipal government structure to provide an acceptable level of services due to post-Second World War urbanization, resulted in the 1962 Byrne Commission proposing major changes to the system of government.

In 1967 county governments were abolished, and responsibilities for services were divided between the provincial government and local authorities. The province became responsible for providing public health, education, welfare, justice, property assessment, tax collection, and emergency measures services, while municipalities were to be responsible for fire and police protection, streets, and garbage collection and disposal, etc. This division of responsibility for decision making has affected the demand and supply of land information within the province.

4.2 PHILOSOPHY OF LAND INFORMATION

In 1966, Roberts (then New Brunswick's Director of Surveys) proposed a Land Titles and Data Bank for each of the Atlantic Provinces (i.e., New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland). The proposal stated that:

> The establishment and maintenance of a Basic Data Bank involves consideration of all those measures necessary to increase our knowledge of our natural resources and their present ownership to ensure their fullest possible use for the benefit of all the people of the Atlantic Provinces...
>
> A data bank for each Atlantic Province will offer many opportunities for advancement. It will be our chief asset and on its proper use and maintenance will depend on how well we live. It will contain an indisputable amount of knowledge capable of yielding information for economic planning and development of our natural resources. The progressive development of each data bank will present an opportunity for capable persons to do work which is productive and in which they can take pride. (Roberts, 1966)

Roberts proposed that this objective be reached through a series of four phases. Once Phase I had been initiated, it was envisaged that the other phases would be progressively initiated, with all phases running concurrently within 5-7 years. The four stages were:

a) Phase I: Co-ordinate system of surveying. Control monuments were to be placed with a density of 1 000 feet in cities, 2 000 feet in suburban areas, and 1 mile in rural areas. It was estimated that a further 25 years and $2,4 million would be required to complete the phase in New Brunswick.

b) Phase II: Large scale mapping. Used in conjunction with the co-ordinate system and a proposed Land Titles system, the mapping would be of value to all levels of government for cadastral mapping, forest management, tax assessment, land use, population, transportation and building studies in town and community planning, school location studies, and in the administration of zoning by-laws, wild life areas, conservation areas, mining claims, and licences. In addition, they were seen as tools for private and government agencies dealing with the assessment or development of water, land, forest, mineral, or recreational resources. A photo library established in each province would have the facilities for production and processing of prints and diapositives. It was estimated that the phase for New Brunswick would require 30-50 years and $2,7 million.

c) Phase III: Land Titles System. Complete and accurate information relating to title would be provided by the Registrar of Titles, while insurance would be provided to anyone who had suffered because of errors on the part of the Registrar. It was proposed that the Torrens System would be made applicable to the whole province and mandatory in integrated areas. Administration of the registry system would be transferred from the Attorney General's Branch to a

Land Management Commission. A Boundaries Act was to be introduced to simplify the settlement of boundary disputes, and so reduce the cost to the public. A proposed Land Titles Act would allow titles to be graded into three classes i.e., one subject to insurance, one under active study, and the third would be the same as their present status. As the quality of land information improved, titles in the lower classes would be upgraded to the insurance class. The Act was to apply to Crown land as well as freehold.

Both Acts were to be administered by a Director of Lands. Although Land Titles would be registered and recorded in a central office in Fredericton, direct access to lawyers and the general public would be provided through the establishment of 6-8 regional offices. These offices would accept conveyances for registration, give advice, and issue certificates of title. Over a period of time they would replace the 15 County registry offices. It was estimated that it would require 10 years and $3,2 million to implement this phase in New Brunswick.

d) Phase IV: Data Bank. It was envisaged that the successful implementation of the first three phases would automatically, and without further cost, form the basis of a Data Bank. The Bank would include freehold and Crown land, and would contain information

on each parcel e.g., location, ownership, dimensions, area, encumbrances, etc. To each such header, additional information such as land use, soil classification, forest resource, mineral resource, assessment, community planning, and municipal services could be added. This information would be readily available to any interested party by plotting each land parcel on a map, by assigning to each parcel an unique identifier, by microfilming and indexing all source documents, by storing on a computer an abstract of data and the microfilm index under the parcel identifier, and by allowing remote access to the computer system.

4.3 APSAMP AND LRIS

Concern that lack of a proper land tenure system was having a detrimental effect on industrial development projects led to the Atlantic Development Board (ADB) signing separate agreements with each province to undertake surveys and mapping programmes. The programmes consisted of four phases, substantially similar to those proposed earlier by Roberts, although Phase IV was not clearly defined.

In March 1968, ADB committed $3 997 000 over a two year period. The following year, ADB was terminated and the federal Department of Regional Economic Expansion (DREE) assumed the federal government's responsibility. Relatively

little co-ordination existed between the provinces, with each setting its own technical and management standards. In an attempt to make the effort more uniform, work was centralized into the Atlantic Provinces' Surveys and Mapping Programme (APSAMP). In 1970, APSAMP received $4 975 000 from DREE for a further two years.

Also in 1970, APSAMP Management Committee commissioned a benefit-cost study on a land property information and control system. Based on the recommendation of the study (Larsen, 1971), the Maritime Provinces (New Brunswick, Nova Scotia, and Prince Edward Island) agreed to adopt a computerized land titles system subject to satisfactory financial agreements being reached. Federal/provincial discussions resulted in the proposal that the newly formed Council of Maritime Premiers (CMP) and the federal government enter into a ten year agreement, effective April 1972, to continue the APSAMP programme. Funding for the first five years were to be approved at the start of the venture, with subsequent funding being subject to negotiation. Because of delays in reaching an agreement, funding for APSAMP was extended by one year.

In 1973, the three provinces signed an agreement with CMP, wherein they transferred the functions of control survey and topographic mapping to CMP. Under the agreement, CMP also was to develop an improved land registration system and investigate the potential of a regional land information

system. In turn, CMP signed an agreement with the federal government, wherein they agreed to create the Land Registration and Information Service (LRIS) to implement the programme. The federal government agreed to pay 75% of the $21 872 000 estimated expenditure for the first five years. Programme changes and inflation necessitated the allocation of a further $6 million in 1977, again on a 75/25 ratio. LRIS services were to be regionalized with a Directorate and Systems Planning Division in New Brunswick, a Surveys and Mapping Development Division in Prince Edward Island, and a Land Titles Division in Nova Scotia (LRIS, 1977).

At the time of the 1973 Agreement, 54% of control surveys and 60% of urban mapping in New Brunswick had been completed under APSAMP funding. Under the new agreement (CMP, 1973), Phase I was scheduled to be completed in 1977, with urban mapping of Phase II expected to be completed in 1978 and resource mapping in 1983 for the province. Property mapping, which had started in 1971, was to be completed in 1979. No deadlines were set for Phases III and IV. March 1978 marked the end of the first five year funding agreement and a further $5 325 000 one year agreement on the same funding formula was negotiated with DREE. In September 1978, the federal government announced that it would cease funding in March 1979, after which the provinces would have to bear the full cost of the programmes. However, DREE did provide a further $500 000 for the fiscal year ending March 1980 (CMP, 1980).

The provincial governments then re-appraised the situation, and entered into a new agreement with CMP in 1980. The LRIS programme was redefined to be:

a) Phase I: The emplacement and maintenance of a co-ordinate system of control surveys.

b) Phase II: The production and revision of aerial photography, large scale maps, and property maps, and the establishment and maintenance of a parcel index file.

c) Phase III: The provision of assistance in the implementation of an improved system of land registration.

d) General: The provision of such other services as are agreed upon by the provinces and the Council of Maritime Premiers from time to time.

The Land Data Bank, which was the main element in Robert's proposal in 1966, had now been officially discarded.

As of March 1984, after 17 years of involvement in the APSAMP and LRIS programmes, the status in New Brunswick was:

Phase I: 20 429 survey control monuments have been placed and co-ordinated. This represents 100% coverage. However, original placement of monuments occurred several years before a maintenance programme was initiated, and there exists a backlog of monuments to be added or replaced. Co-ordinates are stored on the University of New Brunswick (UNB) computer and several users including the Department of

Transportation, NB Power, and CN Rail have direct access to the Co-ordinate Master File.

Phase II: 2 348 resource maps at 1:10 000, and 2 778 urban maps at 1:1 000 and 1:2 000 or their imperial equivalents have been produced. This represents 100% coverage. Some 337 000 parcels have been mapped through the process of "initial lift". This represents 89% of the estimated 378 000 parcel in the province. Property mapping in ten counties representing 287 000 parcels has been completed. These counties are now in "parcel indexing". Two other counties (Victoria and Carleton) representing 29 000 parcels are in transition between initial lift and parcel indexing. Madawaska County is in the stage of initial lift, while Sunbury and York Counties (except for the city of Fredericton which has been completed) are in the planning stages.

"Initial lift" is the term used to describe the tasks of assessing all source documents, delineating all parcel boundaries on property maps, and listing all data to be entered in the property database. When all property maps in a county are current to a common date, the county is considered to be in maintenance mode, and ready for parcel indexing. When this stage is reached, a number of listings containing attribute information indexed against the parcel identifier (PID) become available on a routine basis. A more detailed account of the property mapping process can be found in Hamilton et al (1983).

Phase III. Preparation for a Land Titles pilot project in Albert County began in 1982. The project, which will run for a period of 18 months, was due to become operational in January 1984. However, opposition by lawyers and others caused the starting date to be postponed to July 1984.

Four regional offices have been opened in Bathurst, Edmundston, Moncton, and Saint John. The opening date of the Fredericton Regional Office has not been finalized. The province has chosen to leave these offices, at least temporarily, under the administrative control of LRIS. New Brunswick has indicated that property mapping should be completed in 1986. However, should the opening of the Fredericton Regional Office be delayed much longer, York and Sunbury Counties could be completed as late as 1987. The second round of resource maps is scheduled to begin in 1984 while urban map series revision will begin in 1986. Both these series are to be produced using a computer mapping system.

The cost sharing arrangements for the LRIS programme prior to 1982 corresponded to a general per capita formula for funding activities (i.e., New Brunswick 41,8%, Prince Edward Island 7,3%, and Nova Scotia 50,9%) with the exception of regional offices which were funded by the province in which they were located. This formula reduced the flexibility of provinces for varying completion rates of different portions of the programme. In 1982, CMP adopted a

new funding formula which allocates funds to various programme elements on the basis of provincial requirements (CMP, 1983). As a result, LRIS has become more of a service agency than a co-ordinating co-operative force.

4.4 PROVINCIAL POLICY FRAMEWORK

4.4.1 Cabinet Committees

The Government of New Brunswick has adopted a cabinet committee approach to policy making and resource allocation. An intended aim of the committee system is to improve decision making by causing issues to be viewed in a broader context. The committee system has resulted in a greater dissemination of information (Leger, 1983). Several major cabinet committees have been established.

A Policies and Priorities Committee reviews legislative proposals for dealing with federal-provincial relations in the broadest sense, and for dealing with policies not covered by the Economic or Social Development Policy Committees. An Economic Development Policy Committee is responsible for developing strategies for improving the economy and economic sectors, while a Social Development Policy Committee undertakes a similar role of policy formulation, resource allocation, and federal-provincial negotiations regarding social policy. The Treasury Board is a statutory committee responsible for setting and administering policies for financial and administrative management of the government.

Three committees of officials also have been convened i.e., the Officials' Committee on Policy and Priorities, the Officials' Committee on Economic Development, and the Officials' Committee on Social Development. These run parallel to their respective cabinet committees and consist of deputies of agencies represented on the senior committees. Officials' committees are responsible for reviewing policy matters. This ensures that inter-departmental consultation occurs before an issue reaches cabinet committees. Occasional officials' co-ordinating committees, e.g., the Committee on Land Use Policy, are convened to develop policy in matters that impact on more than one policy field.

4.4.2 Office of Government Reform

Concern that the evolutionary growth of government agencies and their functions had not resulted in the provision of efficient and effective services prompted the New Brunswick Government to undertake a comprehensive review of services. An Office of Government Reform (1983) was established with a two year mandate which expires in March 1985. The Office undoubtedly will have a major effect on the development of a Land Information Network, and until it has made its recommendations it is probable that conditions will remain uncertain.

General objectives of the Office are to promote efficiency and productivity in the administration and delivery of services and to ensure equity in their range and quality, to encourage public involvement in setting regional priorities and developing programmes, to provide better co-ordination of services and programmes, to provide greater opportunity for the private sector to participate in the delivery of services and programmes, to improve access to services, and to ensure more clearly defined areas of responsibilities for government agencies.

Work is currently being undertaken on several fronts. A review of Central Government Agencies includes an assessment of the Information and Communication role in the light of public information dissemination, communications systems and technology, translation and interpretation, printing, and systems design and data processing operations. Under a Social Programme Review, duplications or gaps in existing social programmes are to be identified, and modifications proposed.

An Economic Programme Review parallels the work done in the Social Programme Review. Major issues being considered by the Office of Government Reform (1983) include:

a) potential elimination of "Fish and Wildlife" and "Recreation Management" functions from the Department of Natural Resources in favour of a consolidated group of leisure related functions.

b) potential rationalization of a number of "inspection" functions.

c) potential merger of the Departments of Environment and Municipal Affairs.

d) potential rationalization of the government's survey and mapping functions.

e) feasibility of a comprehensive provincial land use policy instead of the present 5-7 regional land use plans based on separate socio-economic units.

f) feasibility of a comprehensive provincial water use policy in view of the separate and sometimes competing interests of NB Power and the Departments of Environment, Fisheries, Municipal Affairs, Natural Resources, Tourism, and Transportation.

g) feasibility of a provincial Statistics Act with a single agency managing the province's statistical data.

h) involvement in research and development undertaken in New Brunswick.

The administrative changes which led to the abolition of county governments in 1967 resulted in certain services being centralized under provincial government agencies, but on the basis of different regions. Regional organization is being reviewed by the Office of Government Reform (1983) in the light of technological advances. Major issues under consideration are:

a) rationalization and standardization of regional boundaries of the different departments' administrative units.

b) identification of socio-cultural and economic resources in order to situate service delivery and regionalization within a context conducive to development.

c) definition of ways to delegate appropriate decision making authority to the regions.

d) planning of the organization of service facilities e.g., by grouping services provided by several departments in one building, using telecommunication links, etc.

4.4.3 Surveys and Mapping Committee

In 1979, an informal committee evolved to provide LRIS with feedback from provincial agencies having an interest in surveys and mapping. By 1981, the need for a more formal co-ordinating body was recognized, and a proposal to the Officials' Committee on Economic Development resulted in the establishment of a Surveys and Mapping Committee. The committee reports to the Officials' Committee on Land Use Policy. Its responsibilities are to ensure that all provincial government monumentation, surveying, land-related data collection, and mapping is co-ordinated within the framework of a co-ordinated policy, and that it develops a

long term policy for co-ordination of resources needed to optimize the management of land information.

Terms of reference are to develop and maintain an inventory of surveying, mapping and land information collection activities; to develop schedules with recommended short and long term priorities of mapping requirements; to provide opportunities for the user community to maintain awareness of relevent technological developments; to recommend relevent research proposals; to recommend strategies by which users can be provided with land information on a timely and economic basis; to provide policy standards for the collection, storage, interpretation, and availability of data.

The committee currently has a membership of 16 and represents the interests of the Treasury Board , the Office of Government Reform, NB Power, LRIS, and the Departments of Agriculture, Environment, Justice, Municipal Affairs, Natural Resources, Tourism, Transportation, and Youth and Recreation.

4.5 RECENT INITIATIVES

4.5.1 Land Use Policy Task Force

A Land Use Policy Task Force was established in September 1981 by the Officials' Committee on Land Use Policy with the charge to draft a Land Use Policy and to make recommendations for its implementation. The report of the

Land Use Policy Task Force (1983) expressed concern that there is no co-ordinated comprehensive policy on land use, that responsibility for administering land use development programmes is fragmented among several agencies, that unresolved conflicts exist between objectives of different programmes, that land information collected by different sources cannot be easily correlated, and that the land is not being used as productively as it could.

The Land Use Policy Task Force (1983) consequently recommended that it be the policy of the New Brunswick Government "to encourage the productive use of land to provide the maximum social and economic benefits to the people of New Brunswick on a continuing basis." The following recommendations were made to the government:

a) That the proposed Land Use Policy be discussed and formally adopted.

b) That a Land Resource Development Office be established to ensure co-ordination of land resource development programmes and to encourage improved utilization of land. These co-ordinating activities include reviewing existing and proposed programmes from the Land Use Policy perspective to identify overlaps and conflicts; reviewing existing and proposed regulations to determine possible conflicts in land use; reviewing land use implications of Social and Economic Development proposals; co-ordinating collection and

dissemination of land use information; monitoring changes in land use and recommending policy adjustments; liaising with research institutions to promote and co-ordinate the adaption of new technologies to land resource development; promoting means of implementing new ideas for increasing land productivity; liaising with federal and other provincial governments on land use matters.

c) That a detailed programme plan for implementation of the adopted land use policy be prepared.

d) That the Land Resource Office actively promote the development and exchange of information needed to achieve New Brunswick's land resource potential. This includes actively supporting preparation and dissemination of information, and other related activities, possibly through a Land Resources Information Centre attached to the Land Resources Office.

e) That public involvement be actively encouraged in the earliest stages of land use decision making.

f) That the Government prepare and implement a rural area development policy combining the desires of citizens, the potential of land resources, and government programmes within an effective administrative framework.

The proposed policy and recommendations presently are being reviewed by the Office of Government Reform in the light of reform objectives and possible administrative changes such as the co-ordination of survey, registration, and assessment activities.

4.5.2 Land Data and Map Inventory Survey

A survey on provincial government land information products was commissioned by the Surveys and Mapping Committee, and was undertaken in 1983-84 by the Maritime Resource Management Service (MRMS), an agency of the Council of Maritime Premiers. Despite prompting by MRMS, questionaires were not completed as quickly as anticipated. This resulted in a delay in the project. MRMS finally presented its report to the Surveys and Mapping Committee in April 1984, after a project period almost twice as long as initially anticipated.

The final product, "The New Brunswick Index to Land Data and Maps", is a compilation of information collected as a result of the questionaires and personal interviews. It is comprised of 5 sections, viz, land data types, land data and map needs, base and thematic maps, land related reports, and an agency source and contact person index. With the exception of some federal information products, only information generated or maintained by the New Brunswick government is included. Universities, consultants,

municipalities, and the private sector were not consulted. Furthermore, some agencies provided poor responses, despite their obvious involvement with land information. Nevertheless, the Index provides the first broad overview of provincial land information and so provides a valuable service. A number of respondents considered the survey an excellent idea, wanted the results to be communicated to them, and strongly supported the concept of an accurate, comprehensive, and up-to-date index of land information (MRMS, 1984). However, the real value of the inventory may be in that it provides a basis on which to build a more detailed understanding of land information in New Brunswick.

4.5.3 Land Information Workshops

A series of workshops has been sponsored annually by the Department of Surveying Engineering, University of New Brunswick. The first workshop was held in 1979. It had as its theme "Renewable Information Resource Systems for the Maritimes" and focussed on forestry and agriculture. The second workshop in 1980 addressed cadastral and infrastructure sectors as well as the renewable resources sectors. It established as the theme for subsequent workshops the development of consensus of the type of land information network that should exist in the region by 1990. The 1981 workshop attempted to create an economic model of the land information environment through a unit-cost matrix

for various types of mapping. The workshop held the following year tried to determine the expectations of the forestry, agriculture, land management, and economic development sectors for the 1990 land information network.

In 1983, the workshop concerned itself largely with reviews of land information projects being conducted in New Brunswick, with considerable interest being expressed regarding the closer co-ordination of activities. A Resolutions Committee was convened for the first time and resolutions adopted included a call for a land information inventory to be prepared, and for working groups investigating the feasibility of a land resources information centre, and problems of land parcel definition to be established (Palmer and Guo, 1983). The workshop had now taken on a life of its own, with working groups assuming responsibility between workshops. This willingness by those attending to participate actively reflected the awareness by land information users of problems confronting them.

Much of the 1984 workshop was devoted to development of a network type model linking individual land information systems in New Brunswick. This represented the first attempt to place the various types of land information in the context of general information needs of the province. Resolutions adopted included a call for the province and concerned institutions to establish a Resource Information Centre; for the parcel-related information group to continue

its work and for agencies creating parcel files to use the LRIS PIDs; for working groups investigating the role of land titles in the development of a Land Information Network, and the duplication of databases to be established; for the Office of Government Reform to give high priority to creating a more integrated structure for all land information activities (Dillon, E., 1984).

The early workshops played an important education role. By allowing discussion to occur between producers of information and users, and between users themselves, participants were able to develop a common understanding of land information and its associated problems. At the same time, an opportunity was provided for participants to develop an understanding of technological matters such as computer mapping, remote sensing, databases, and digitizers. Such a process is time-consuming: the first significant contributions made by participants occurred in the fifth workshop. Nevertheless, without a process of education, participants are unlikely to contribute in a meaningful way.

The workshops have played a major role in the determination of user needs in New Brunswick. Needs are invariably difficult for users to express and articulate, and questionaires on needs are notoriously poorly answered. Through their role as a forum, the workshops have promoted discussion between users and producers of land information and have allowed needs to be identified. The growth in

importance of resolutions in recent years bears testimony to this.

4.6 CURRENT SITUATION

Land information in New Brunswick is reviewed in the context of the classifications introduced earlier i.e., environmental, infrastructure and improvements, cadastral, and socio-economic information. Figure 2.1 attempts to illustrate that these distinctions are by no means clear cut. Building characteristics, for example, are required by assessors for the cadastral function of property assessment; they are also required by health and welfare officials for the socio-economic function of determining need for services, as well as by building inspectors for the infrastructure and improvements function of evaluating safety of the structure. Land information should be considered a continuum. Nevertheless, as Galbraith (1973) noted in his analysis of the economic system, classification is the first step towards clarity even though it involves arbitrary lines.

Information used in this analysis was derived from questionaires completed for the Land Data and Map Inventory Survey commissioned by the Surveys and Mapping Committee, and from interviews with some of those involved with land information in New Brunswick.

4.6.1 Aerial Photographs

Although large scale provincial coverage has been available for forty years, most of the photographs of New Brunswick are not kept within the province. The first series of photography was flown between 1944-45 at a scale of 1:15 840. The photographs, which were used for large scale mapping, are kept in the National Air Library in Ottawa. A second and third series, flown during the periods 1951-55 and 1962-65 respectively, were used for updating and expanding the map coverage. Both series are maintained by MRMS.

Photography for LRIS mapping was flown during the period 1970-83, with scales varying from 1:5 000 in urban areas to 1:40 000 for complete provincial coverage. Photographs are kept by MRMS. During the same period (specifically between 1974 and 1976), the Department of Natural Resources provided provincial coverage at a scale of 1:20 000. This is the only set of photographs stored within the province.

Two unrelated series of photographs began in 1982. The Department of Natural Resources (Forest Management Branch) has undertaken a programme of provincial coverage of colour photographs at 1:12 500. The series is scheduled to be completed in 1985. Photography at 1:35 000 to support the second round of resource mapping by LRIS has also started. Both series are intended for the production of digital maps, the former at a scale of 1:12 500 and the latter at

1:10 000. All photographs will be maintained by MRMS in Nova Scotia.

Much and diverse use is made of the photographs. Users include the Departments of Agriculture and Rural Development (Engineering, Farm Adjustment, Planning, and Potato Divisions), Commerce and Development, Environment, Fisheries, Municipal Affairs (Assessment, and Emergency Measures), Natural Resources (Crown Lands, Forest Management, and Forest Extension Services), Tourism (Field Services, and Planning), and Transportation.

4.6.2 Mapping

The rationalization that was to occur when New Brunswick essentially passed over its mapping needs and staff to LRIS in 1973 has not yet materialized. In terms of the 1973 CMP/Province Agreement, LRIS was to be responsible for the production of topographic (base) and property maps. No arrangement was made for thematic maps, and in the absence of a central provincial mapping agency, these maps have been produced by whatever agency can manage the task.

Urban mapping (initially scheduled for completion in 1978) and resource mapping (scheduled for 1983) were only completed by LRIS in 1983 and 1984 respectively. These delays were not the fault of LRIS but were due to the ubiquitous budget restrictions as well as to programme modifications designed to provide a more useful product.

Originally, it was not planned for contours to be shown on the 1:10 000 series but these were added to assist the province with its resource management (particularly the forestry sector). Similarly, the earlier specification that communities with populations over 1 000 be included in the urban mapping programme was revised to provide large scale mapping of communities greater than 300. Nevertheless, complete base map coverage by LRIS occurred 11 years after the transfer of the province's mapping facilities. During that period users required provincial coverage to carry out their functions. Consequently, several agencies are involved with base map preparation, but with no overall provincial control. The roles of agencies involved are described below.

4.6.2.1 Federal Mapping Agencies

Energy, Mines and Resources Canada (EMR) National Topographic Series base maps at scales of 1:250 000, 1:50 000, and 1:25 000 (where available) are used extensively by many provincial agencies. The small scale 1:500 000 base map is also used. Canadian Hydrographic Service Charts are commonly used by NB Power, and the Departments of Environment and Fisheries.

Apart from geological, geophysical, and geochemical maps produced by EMR, other federal thematic maps in use are produced by/for Agriculture Canada, Environment Canada

(including the Canada Land Inventory series), and Statistics Canada. These maps are generally at a small scale, although Statistics Canada does produce a large scale series showing urban Enumeration Area boundaries. For example, Moncton is mapped at a scale of 1:3 600 and St Stephen at 1:4 800.

4.6.2.2 Maritime Mapping Agencies

LRIS has completed first round base mapping at scales ranging from 1:1 000 to 1:10 000. Scales have not been consistent throughout the programme. Initial 1:1 200 and 1:2 400 scales were replaced by 1:1 000 and 1:2 000. Even though the introduction of metrication did not alter the resource map scale of 1:10 000, it did result in a different map sheet size.

The major thematic map series produced by LRIS is that of property mapping. Initially, property mapping was scheduled for completion in 1979, but now it is possible that completion may not occur before 1987. LRIS also produces flood risk hazard maps using information supplied by the Department of Environment. MRMS has produced a variety of thematic maps for users in the public and private sectors. Contracts have included the production of coastal zone, geological, soil, and tourism maps.

4.6.2.3 Provincial Mapping Agencies

Two series of base maps exist in the province although neither is subject to major revision. The Department of Natural Resources (Crown Lands) updates the road network on the original 1:31 680 base map. The Department of Transportation (Planning) took over the 1:15 840 series which was not being supported by Natural Resources and photographically reduced it to form base maps at more suitable scales.

The Department of Transportation (Planning) has become the major service mapping agency in the province. Maps are produced for a number of agencies including Education, Municipal Affairs (Assessment, Municipal Services, and Planning), and Tourism. The Department is also responsible for producing Indian Reserve maps and Electoral maps. Two mapping units i.e., Highway Mapping, and Cartographic Unit, exist within Transportation.

Several agencies including Agriculture and Rural Development (Engineering), Natural Resources (Mineral Resources, and Forest Management), and Transportation (Planning) are involved with meeting their own requirements. Mapping ranges from limited enhancement to the entire production of maps. Some maps remain in-house, while others such as the Grant map series produced by the Department of Natural Resources (Crown Lands) are widely distributed.

Because of the fragmented nature of the present regional organization, more than fifty different administrative maps are used by government agencies. In many cases, the boundaries are drafted in-house, and on base maps of different scales.

An indication of the variety of map scales presently in use in New Brunswick is given in Appendix I. This proliferation is due in part to the introduction of metric scales relatively late in the mapping programme; it is also due to a lack of co-ordination in mapping activities. A more technical version of this lack of co-ordination has recently manifested itself. While the majority of maps have been produced manually, there is an increasing trend towards computer mapping techniques. LRIS has acquired a CARIS system, while MRMS uses a GeoBase System and the Department of Natural Resources (Forest Management) has an ESRI System. NB Power has recently acquired an Intergraph system, although it has not yet been used for mapping applications. At present these systems are not compatible and in general, data generated on one system cannot be routinely loaded onto another.

4.6.3 Environmental Information

A large rural population and an economy based on extraction, processing, and primary and secondary manufacturing has caused resource-based land information to have a higher profile in New Brunswick than in many other jurisdictions.

In 1971, some 88% of the province was covered by trees (Select Committee on Rural Life and Land Use, 1977). Consequently, forestry and associated concerns e.g., soil, water, climate, and possible pollution due to spraying, maintain a high profile. There is also considerable concern regarding the agricultural base. During the period 1951-1981, the number of census farms declined from 26 431 to 4 063, while the farm area declined from 1 404 354 ha to 437 888 ha (Statistics Canada, 1981). Measurements in the mid-1970s indicated that of the 594 300 ha of cleared land in the province, only 36% fell in census farms, and 53% fell within "blocked areas" (i.e., land in CLI classifications of classes 2, 3, and 4 which occurs in large continuous blocks). Some 64% of cleared land is outside census farms, and "in all probability is lying idle" (Select Committee on Rural Life and Land Use, 1977).

Environmental Information, its producers, and its users are shown in Appendix II.

a) Agricultural Information.

Information on agriculture and agricultural production is available from two federal agencies (Agriculture Canada and Statistics Canada), MRMS, and the Department of Agriculture and Rural Development (Planning, and Plant Inventory).

In an effort to preserve agricultural land, the New Brunswick government introduced the Farmlands Identification Programme (FLIP). As an incentive to farmers, provincial

taxes have been set aside on cleared land registered in the programme, while registered wooded land is given a preferred rate. Approximately 75% of farms are registered. The Farmer Identification Registration Programme (FIRP), also administered by Agriculture and Rural Development, enables registered farmers to be exempt from provincial sales tax on certain purchases. Every five years, Statistics Canada undertakes an Agricultural Census. A comparison between information gathered through the FLIP and FIRP programmes and that collected by Statistics Canada is shown in Table 4.1.

b) Climatic Information

Environment Canada is the major supplier of climatic information, including temperature, rainfall, snowfall, and frost details. The Department of Environment also provides information on climatic conditions for flood and fire hazard forecasting, and on acid rain.

c) Ecology, Environmental and Wildlife Information.

Environment Canada provides small-scale coverage on subjects such as wildlife ungulates, wildlife waterfowl, sportfish, eco-regions, and environmental characteristics through the Canada Land Data System (CLDS). More detailed coverage for environmental impact assessments is provided by the Departments of Environment and Natural Resources (Crown Lands, and Fish and Wildlife).

TABLE 4.1

Comparison of agricultural information

	Agriculture		Statistics Canada
	FLIP	FIRP	
Crops	6 types		36 types
Trees			7 types
Berries			7 types
Vegetables			27 types
Pasture	x		x
Swamp, marsh	x		x
Blueberries	x		x
Sugarwood	x		
Wooded	x		x
Managed Woodlot	x		
Christmas Trees	x		
Recreational land	x		
Crop area	x	x	x
Passenger cars		x	x
Trucks		x	x
Tractors		x	x
Farm equipment		x	x
Livestock		x	10 types
Poultry			6 types
% time active farming		x	x
% income active farming		x	
Spraying			x

d) Forestry Information.

The Department of Natural Resources (Forest Management) provides much of the information on forestry conditions, including forest inventory, stand type, logging roads, and forest production. Natural Resources (Forest Utilization) supplies information on forestry production as does Statistics Canada.

e) Land Capability Information

Agriculture Canada and Environment Canada are involved with small-scale coverage. The Department of Agriculture and Rural Development (Planning, and Plant Industry) supplements this coverage down to the farm level.

f) Geology and Mineral Resources.

Energy, Mines and Resources Canada has supplied some information on the province. Other agencies involved are MRMS and the Department of Natural Resources (Geological Survey). Natural Resources (Mineral Resources) is in the process of developing a computerized mineral resources system.

g) Soil Information.

Small-scale coverage is provided by Agriculture Canada and Environment Canada through CLDS. The Department of Agriculture and Rural Development (Plant Industry) conducts detailed soil surveys at the farm level to supplement the federal Canada Soil Inventory System (CanSIS). Agriculture

(Engineering) collects information on soil erosion and conservation, also at the farm level. The Canadian Forestry Service and the Department of Natural Resources (Forest Management) collect forest-oriented soil information. The Department of Transportation has detailed soil information along highway routes, while the Department of Health records information on soil percolation tests where septic tanks have been installed.

Information is collected on a variety of soil characteristics including soil mixture, depth to compaction, texture and structure of B and C horizons, nutrient status of organic and B horizon, soil conservation, load bearing capabilities, and drainage (conductivity and porosity).

h) Vegetation Information.

Information is provided by the Department of Agriculture and Rural Development (Plant Industry) and the Canadian Forestry Service. The Department of Environment (Environment Services) provides details on the level of vegetation contamination.

i) Water Information.

The Department of Environment (Water Resources) along with Environment Canada are the major suppliers of water information through the NAQUADAT system. Information is available on flood risk hazard, ground water, hydrology, surface water, water quality, water supply, and water well

logs. Details are collected on discharge, sediment, chemical properties, nutrient status of run-off, extent of resources, water utilization, and water pollution.

4.6.4 Infrastructure and Improvements Information

Responsibility for provision of services is divided between the province and municipalities. As most of the information used in this study was obtained from provincial agencies, there is a lack of detail on infrastructure and improvements information produced by local governments. Some producers, users, and information products are given in Appendix III.

a) Building Information.

The Department of Municipal Affairs (Assessment) collects information in considerable detail on assessed buildings through its Property and Taxation System (PATS). The Department of Supplies and Services (Engineering) maintains records on government owned buildings. In addition, Statistics Canada collects information on housing every 5 years in the census. NB Housing has records on housing with which it is involved, while the federal Central Mortgage and Housing Corporation (CMHC) recently conducted a survey on housing in rural New Brunswick. A comparison of information collected by Municipal Affairs (Assessment), Statistics Canada, and CMHC is given in Table 4.2.

TABLE 4.2

Comparison of building information

	Assessment Branch	Statistics Canada	CMHC
Type of building	x	x	x
Year of construction	x	x	x
Condition of building	x	x	x
Number of rooms	x	x	x
Number of bathrooms	x	x	x
Heating equipment type	x	x	x
Heating - dwelling	x	x	x
Heating - water	x	x	x
Electrical payments	Commercial Properties	x	x
Heating payments		x	x
Service payments		x	x
Mortgage	Price	Payment	Payment
Purchase Price	x		
Building value	x		
Land value	x		
Assessed value	x	x	
Property tax	x	x	x

b) Communications Network Information.

NB Tel and NB Power (through a radio net) maintain extensive communications networks as does the RCMP.

c) Dump Information.

Information on this sometimes emotional issue is provided by the Department of Health, in conjuction with the Departments of Environment, Municipal Affairs, Natural Resources, and Transportation.

d) Infrastructure Information.

Major record keepers are NB Power (power sources and transmission systems) and NB Tel (telephone cables). These utility companies share the use of about 220 000 poles in the province, but each assigns its own unique pole number. LRIS maps are frequently used for infrastructure information as the maps are at sufficiently large scales to show the positions of some types of features.

e) Land Use Information.

Agriculture Canada, Environment Canada, and Statistics Canada provide small-scale coverage. Information is provided at the county level, and where confidentiality is not threatened, at the parish level. MRMS has undertaken a number of land use surveys of rural and urban natures. The Department of Municipal Affairs (Planning) supplies information on present and proposed land use, and the criteria for land planning, while the Assessment Branch

collects land use information through its property assessment programme. The Department of Agriculture and Rural Development collected details on agricultural land use during the period 1979-1981. Approximately 90% of rural cleared land was covered.

f) Municipal Utilities Information.

The Department of Municipal Affairs (Municipal Services), along with the Departments of Environment and Health, have information on communal water and sewerage facilities. Individual municipalities maintain records on the services they provide.

g) Public Facilities Information.

The Department of Municipal Affairs (Municipal Services, and Planning) provides information on public service facilities. Along with the Department of Tourism (Planning), it supplies details on recreational facilities. Municipalities record information on the facilities for which they are responsible.

h) Transportation Network Information.

Information on Designated Highways (e.g., route, grade, alignment, and condition) is available from the Department of Transportation (Planning) through the Designated Highway Classification and Mapping Programme. Transportation is also involved with identifying anomalies between roads shown on Grant Maps, LRIS orthophoto maps, Municipal Affairs

assessment maps, and its own highway maps. This project was 60% complete in November 1983. The Department of Tourism also provides information on the road network, while the Department of Natural Resources (Forest Management) keeps records on logging roads. Information concerning the rail infrastructure is supplied by CN Rail.

4.6.5 Cadastral Information

Because of the major role that cadastral information plays in the administration of property in the public and private sectors, it is the most clearly documented type of land information. Partly due to lack of co-ordination, many agencies are involved with managing cadastral information. Some producers, users, and information products are given in Appendix IV.

4.6.5.1 Fiscal Information

Appraisals are undertaken by private appraisers and the Department of Natural Resources (Crown Lands). Assessment information is collected by the Department of Municipal Affairs (Assessment), while sales details are distributed by the Department of Justice (Registry), LRIS, and Assessment Branch. Tax information is provided by the Department of Finance in conjunction with Assessment Branch.

4.6.5.2 Juridicial Information

According to the Land Use Policy Task Force (1983), the only activities that land owners can pursue without a licence or some other qualification are the cultivation of crops, the non-intensive raising of livestock, and the occupation of land. Licence information is generally provided by the Department of Justice (Registry). Other departments involved include Natural Resources (Forest Management, and Mineral Resources) for timber licences and mining claims respectively, and Tourism. Ownership information is collected by a number of agencies including Justice (Registry), LRIS, Municipal Affairs (Assessment), Natural Resources (Crown Lands), Supplies and Services (Properties and Buildings), and Transportation (Right of Way), as well as by New Brunswick Land Surveyors. Subdivision approval information is obtained from Justice (Registry) and Municipal Affairs (Planning) who also supply zoning information.

4.6.5.3 Title Survey Information

Information on boundaries, legal plans, and subdivision plans is provided by the Departments of Justice (Registry), and Municipal Affairs (Assessment), and LRIS, as well as through the services of New Brunswick Land Surveyors. Boundary information is also supplied by the Department of Natural Resources (Crown Lands), while Transportation (Right

of Way) and NB Power make available their survey plan information as well.

4.6.5.4 Property Inventories

A number of property inventories exist. The only register with legal status is maintained by the Department of Justice (Registry). Two other inventories i.e., those of LRIS and Municipal Affairs (Assessment) are designed to provide provincial coverage. Two comparatively major property inventories were created by the government some 8 years after the introduction of the LRIS programme. They are the register of government properties maintained by the Provincial Property Data Centre (PPDC) of the Department of Natural Resources (Crown Lands) and the register of properties administered by the Department of Supply and Services (Properties and Buildings). These four inventories are described in further detail in Section 4.7.

Each parcel has been assigned a different identifying number for each inventory. A comparison of some identifiers and locational identifiers is given in Table 4.3.

A comparison of some of the ownership characteristics stored in the same inventories is given in Table 4.4 .

These inventories all serve different purposes. Furthermore, many are used mainly, or only, by the recording agency. Unless it is provided with on-line enquiry facilities, an unique register will not afford the high degree of accessibility currently available.

TABLE 4.3

Comparison of property identifiers

	Property Inventories							
	LRIS	DMA	DNR	DSS	DARD		STATS CAN	
					FLIP	FIRP	Agric	Person
Property address	x	x	x	x	x	x	x	x
Parish/municipality	x	x	x	x	x	x	x	x
County	x	x	x	x	x	x	x	x
Enumeration area							x	x
School district		x						
Tax authority	x	x						
LRIS map number	x	x	x	x	x			
LRIS PID	x	x	x	x	x			
Tax number	x	x	x	x	x	x		
DNR number		x	x	x				
DSS number		x		x				
FLIP number		x			x			
FIRP number					x	x		

Note:

DMA - Department of Municipal Affairs (Assessment)

DNR - Department of Natural Resources (PPDC)

DSS - Department of Supply and Services

DARD - Department of Agriculture and Rural Development

STATS CAN - Statistics Canada's agricultural and personal census

TABLE 4.4

Comparison of ownership information

	Property Inventories							
	LRIS	DMA	DNR	DSS	DARD		STATS CAN	
					FLIP	FIRP	Agric	Person
Owner's name	x	x	x	x	x	x	x	x
Owner's address	x	x	x	x	x	x	x	x
Owner's telephone					x	x	x	x
Ownership type	x	x					x	x
Registry data	x	x	x	x	x			
Encumbrances	x	x	x	x				
Parcel area	x	x	x	x	x	x	x	
Access		x	x					
Use		x	x	x	x	x	x	x
Frontage			x					

DMA - Department of Municipal Affairs (Assessment)

DNR - Department of Natural Resources (PPDC)

DSS - Department of Supply and Services

DARD - Department of Agriculture and Rural Development

STATS CAN - Statistics Canada's agricultural and personal census

a) Department of Justice (Registry). This register of land ownership, transfers, mortgages, leases, etc, is a manual, sequential file with a grantee-grantor index. That is, it is not parcel-based. However, recent documents do include the LRIS parcel identifier.

b) LRIS (Land Titles and Property Mapping). This is a major computer based property inventory designed to turn the registry system into a parcel-based system.

c) Department of Municipal Affairs (Assessment). This major computer based system is designed to support property assessment and taxation.

d) Department of Natural Resources (Crown Lands). This is a computer based inventory designed to record information on freehold and crown land held by the government.

e) Department of Supply and Services (Properties and Buildings). This is a manual inventory of all land owned or administered by the Department.

f) Department of Transportation (Right of Way). This is a manual inventory of properties acquired by the Department since 1890, with an index of properties of interest, such as gravel pits and easements.

g) Department of Tourism (Field Service). This is a manual inventory of properties owned by the Department including records of land acquisitions, dispositions, permits, leases, and agreements.

h) Department of Commerce and Development (Industrial Development). This is a manual record of land ownership and use of properties in industrial parks.

i) Community Improvements Corporation (Finance and Administration). This is a manual inventory of lands purchased, sold, leased, or transfered by the Corporation.

j) NB Power (Environmental Planning). This is a computer based record of properties acquired by the utility company.

k) Downtown Development. This is a manual inventory of properties located in the downtown area of Fredericton.

l) Public Works Canada (Real Estate Service). The Central Real Property Inventory is a computer based registry of land owned by 32 federal agencies. About 500 requests for specialized information retrievals are made annually. Information can be retrieved in several ways including by ownership type, by agency, by province, by constituency, by asset classification, by land use, and by size of parcel. Other details recorded include non-building improvements, non-federal interests, date of acquisition, and types of buildings.

Other provincial agencies with the right to own and administer land include Agriculture and Rural Development,

Education, Health, NB Housing, NB Liquor, and NB Community College.

4.6.5.5 Subdivision Applications

The highly regulated nature of land parcel administration has forced co-ordination of activities of, and hence the flow of information between, many agencies. This interaction includes not only agencies involved primarily with cadastral information, but also those agencies concerned with environmental, infrastructure and improvements, and socio-economic information. The process of subdivision approval is a case in point and emphasises that improvements to one component of land information cannot be made without considering the other components.

A key co-ordinating role in the subdivision process is played by a development officer, who is the chief administrative officer appointed by a local district commission, or in his absence, the Director of the Planning Branch of Municipal Affairs. The development officer liaises with the various agencies on behalf of the developer.

The first step requires the preparation of a Tentative Plan showing the proposed boundaries; the location, width, and names of existing streets abutting the proposed subdivision; dimensions and layouts of other proposed parcels and their intended uses; the nature, location, and

dimensions of existing and future easements; natural and artificial features such as railways, highways, and streams adjacent to the proposed subdivision; available water and sewerage facilities; the nature and porosity of the soil; contours to enable determination of street grades and drainage of the land; the proposed location of every building.

Should it be necessary, the Tentative Plan is submitted for approval to:

a) The District Planning Commission (or Planning Advisory Committee) for consideration on public and future streets, land required for public purposes, variance, suitability of land for subdivision, and access if the parcel does not abut a public street.

b) The Provincial Planning Committee for consideration on the same aspects as the Planning Commission above.

c) The Municipal Council for consideration on future streets, land required for public purposes, non-public utility easements such as drainage, and the provision of services.

d) The Minister of Transportation for consideration on future streets and for required easements such as drainage.

e) The Minister of Municipal Affairs for consideration on land for public purposes, and in connection with water and sewer systems in unincorporated areas.

f) The Minister of Health for consideration on water and sanitary sewer systems in unincorporated areas.

g) The Minister of the Environment for consideration on water and sanitary sewer systems in unincorporated areas.

h) NB Power for consideration on utility easements.

i) NB Tel for consideration on utility easements.

Once all necessary consents have been obtained, the development officer approves the Tentative Plan. A New Brunswick Land Surveyor prepares the subdivision plan in accordance with the specifications of the Community Planning Act. If necessary, the plan is sent to the Municipal Council, the Minister of Transportation, and the Minister of Municipal Affairs for approval. The plan is then approved by the development officer. If the subdivision is in an integrated area, the plan must be approved by the Director of Surveys. The plan is then checked by the Registrar of Deeds for compliance with the requirements of the Community Planning Act before it is registered.

4.6.5.6 Land Administration - Human and Financial Resources

The institutional nature of cadastral information has meant that its costs in labour and money are more clearly defined than with other types of land information. A number of government programmes are directly concerned with land administration and property management. The 1984 Main

Estimates (Ordinary Account) of the New Brunswick Government (1984) show an estimated expenditure of over $40 million on such programmes with an involvement of over 500 civil servants. In addition, over $200 000 has been budgeted for MRMS, and almost $4 million for LRIS. This includes funds for all phases of the programme. (See Table 4.5).
In return, it is estimated that such land administration will gross over $240 million, almost all of it from property taxation. (See Table 4.6).

Forty-eight members of the LRIS staff are employed in the New Brunswick regional offices. In addition, the LRIS Directorate staff of 25, Surveys and Mapping staff of 55, and Legal Division staff of 4 are partially involved with work in New Brunswick.

A number of people in the private sector are involved with cadastral information. Approximately 70 New Brunswick Land Surveyors are engaged in private practice. There are also about 160 registered estate agents and 490 salespersons in the province (Department of Commerce and Development, 1984). Approximately 975 lawyers practice in New Brunswick, but as they cannot advertise their field of specialization, the number involved in land information cannot be easily determined (Barristers Society, 1984).

It has not been possible to ascertain the number of those involved with land administration in the many municipalities, or those in the federal government who are

TABLE 4.5

Estimated Expenditure by New Brunswick Government

Programme	Department	Staff Years	Expenditure
Registry Offices	Justice	55,3	1 328 500
Crown Lands Mgmt	Natural Resources	53,7	1 855 200
Land Inventory	Supply & Services	3,0	77 700
Mapping	Transportation	18,3	526 200
Property Tax	Finance	19,8	1 060 400
Assessment	Municipal Affairs	180,0	6 037 400
Farm Adjustment	Agriculture	15,0	4 425 900
Property Mgmt	Commerce and Dev.	0,0	752 000
Expropriation	Justice	1,0	74 800
Land Regulations	Municipal Affairs	11,0	387 200
Parks	Tourism	18,0	692 400
Right of Way	Transportation	30,8	1 078 400
Buildings	Supply & Services	18,7	200 000
Property Transfer	Supply & Services	5,0	182 200
Rent Administration	Supply & Services	4,0	128 400
Rent - leases, tax	Supply & Services	0,0	7 821 700
Rent - operation	Supply & Services	0,0	2 225 400
Building operations	Supply & Services	92,0	8 846 500
Building maintenance	Supply & Services	0,0	3 061 700
LRIS	General	0,0	3 967 000
MRMS	General	0,0	209 000
TOTAL		525,6	$44 938 300

TABLE 4.6

Estimated Gross Revenue for New Brunswick Government

Product	Department	Revenue
Maps, photos	Municipal Affairs	4 000
Maps, photos	Natural Resources	250 000
Provincial tax	Finance	95 020 300
Municipal tax	Finance	115 974 300
Transfer tax	Justice	1 350 000
Registry fees	Justice	2 750 000
Farm leases	Agriculture	60 000
Building rent	Commerce and Dev.	38 000
Building rent	Supply and Services	810 000
Building sale	Supply and Services	350 000
Land sales	Community Impr.	5 000
Leases, rent	Natural Resources	118 200
Wild land sale	Natural Resources	40 000
Mineral leases	Natural Resources	350 000
Mines - royalty	Natural Resources	15 393 500
Mines - royalty	Agriculture	3 000
Timber - royalty	Natural Resources	12 550 000
Parks	Tourism	1 289 200
TOTAL		$246 355 500

primarily involved with New Brunswick. Nevertheless, it is possible that several thousand people are involved with land administration information alone in New Brunswick.

4.6.6 Socio-Economic Information

Socio-economic information is seldom available in a form allowing it to be readily used and correlated with other information. One reason for this may be that surveyors have rarely provided assistance to those collecting socio-economic information on a land-related basis. Some producers, users, and information products are given in Appendix V.

The Department of Health geographically references all information routinely collected for the registration of health care providers, recipients, and vital events. The Standard Geographic Code (SGC) has been adopted by all divisions of the Department as the basic "building block" for land-related boundary designations. (The SGC is a four digit code designed by Statistics Canada to uniquely identify the census subdivision (parish/village, town) level). Much of the land information processed by Health is used in-house, but some is provided to other agencies.

Other information used on a land-related basis is provided by the Departments of Education, Historical and Cultural Resources, and Labour and Manpower.

Statistics Canada is the major supplier of socio-economic land information. The most recent census was taken in 1981 after consultation with some 3 000 private and public organizations about their census information needs. Information on over 150 variables was collected. Access to the information is provided by standard publications, computer printouts, and microfilm. Direct access is possible to Statistics Canada's database CANSIM.

An hierarchical structure for referencing information to land is used. Information is always available for Census Divisions, which in New Brunswick are represented by the 15 Counties. It is frequently available for the 285 Census Subdivisions i.e., parishes, towns, and villages. The smallest building block is the Enumeration Area (EA) which ranges from a maximum population of 375 households in urban areas to a minimum of 125 in rural areas. Enumeration Areas are bounded by easily identified features such as streets, roads, railways, rivers, and lakes. There are 1 215 EAs in New Brunswick. Rural EAs are shown on EMR 1:50 000 maps while urban EAs are depicted on maps at whatever scale is considered suitable. Statistics Canada information may be unavailable for small areas in order to protect confidentiality.

Because of their larger populations, more detailed information is routinely provided for Saint John and Moncton. Each city block face is assigned a co-ordinate

value, and a centroid co-ordinate is assigned to each EA. This geo-coding allows users to retrieve information for user-specified areas such as school districts or traffic zones. These non-standard areas can be created by arithmetically manipulating standard areas, by simple shapes about a point such as circles or squares, or by polygons created by digitizing.

4.6.7 Legislation

Legislation affects the management of land information in many ways. It may prescribe that information be collected, and specify the manner in which it is to be undertaken; it may indirectly require that information be collected in order that some other objective may be realized; it may prescribe that unrestricted access be provided to information; it may also prevent the dissemination of information to unauthorized users.

A major piece of legislation affecting Crown Land is the Crown Lands and Forests Act which was passed in 1982. The intention of this act is to increase the productivity of Crown Lands. Other acts affecting Crown Lands include the Mining Act, the Quarriable Substances Act, and the Forest Fires Act. Freehold land is affected by the Community Planning Act, the Health Act, the Clean Environment Act, the Surveys Act, and the Registry Act. Land titles legislation will have a substantial impact on land information. The

Highways Act, the Electric Power Act, the Parks Act, and the Telephone Companies Act also affect land and therefore land information.

More generally, the Right to Information Act which came into effect in 1980 provides for access to government-stored information. Under the Act, every person is entitled to access to information relating to the public business of the province. However, several classes of information are exempt from the Act. For example, information which has been given on a confidential basis to the government cannot be divulged. The federal Access to Information Act and Privacy Act have the same general objectives as the New Brunswick Act.

Some of the existing and proposed provincial and federal legislation which impact on land information management are given in Appendix VI. The effect of these Acts range from minimal to major.

4.6.8 Computing Facilities

Much of the computing performed by government agencies is done on the provincial UNIVAC. A communications network provides access to users in 26 cities and towns throughout the province. Major centres are linked to Fredericton by 9 600 baud digital Dataroute lines, and the remainder are linked by 4 800 baud dedicated leased analogue transmission lines. Major users of the computer service include the

Departments of Finance, Health, Justice, Municipal Affairs, Social Services, and Transportation, as well as NB Power.

The University of New Brunswick's IBM computer provides services to federal and provincial agencies, and private companies, as well as to educational institutions. The LRIS Offices in Summerside are linked to Fredericton by a communications line. LRIS has 3 terminals, and NB Power has 11. The Department of Transportation also makes use of the computing facilities. A number of other provincial departments do not have terminals permanently connected to the mainframe, but instead make use of dial-up facilities.

NB Power has access to several computers. Two DEC VAXs and two IBMs are linked together and are used mainly for administrative purposes. Engineering applications are done on the provincial UNIVAC and UNB's IBM. Use is also made of a UNIVAC at Mactaquac for flood forecasting. NB Power has over 200 terminals at its disposal.

Several systems allowing analysis of digital data are available to users in New Brunswick. The Department of Surveying Engineering, UNB, has a Dipex ARIES II system which allows interactive manipulation of scanned data e.g., satellite imagery. A CARIS computer mapping system, running on a DEC PDP minicomputer, has been acquired by LRIS to produce digital maps of the Maritimes as part of the second round coverage. CARIS was developed at the University of New Brunswick. Energy, Mines and Resources Canada in Ottawa

has mapped about one-third of New Brunswick using an Intergraph computer mapping system. The Intergraph system runs on a DEC VAX minicomputer. NB Power has recently obtained an Intergraph system for engineering applications but which eventually may be used for land information activities as well. An ESRI system running on a Prime minicomputer is being used by the Department of Natural Resources (Forest Management) to assist with compiling and updating the forest inventory. Several private timber companies have expressed interest in purchasing ESRI systems. MRMS has been using a GeoBase computer mapping system for about four years to assist with the management of resource information.

The provincial UNIVAC is linked to UNB's IBM by a 4 800 baud leased line. Several agencies e.g., Transportation and NB Power, have terminals to both computers. A CARIS system in the Department of Surveying Engineering is also connected to the IBM. An exchange programme developed jointly by the Department of Surveying Engineering and EMR enables topographic data digitized on an Intergraph system to be loaded on a CARIS system. Work is currently underway to allow the conversion of data from the CARIS format to that of Intergraph. In addition, the Department of Surveying Engineering is developing an exchange programme allowing raster data from the ARIES II image analysis system to be loaded on CARIS. LRIS has announced its intention to eventually link CARIS to the GeoBase system of MRMS.

4.7 PARCEL-BASED INVENTORIES

4.7.1 LRIS Inventory

The LRIS inventory is a major undertaking in which details on all parcels in the Maritimes ultimately will be stored in a computer database. As of March 1984, approximately 76% of the estimated 885 000 parcels in the three provinces had been entered in the database. Approximately 89% of the parcels in New Brunswick have been "mapped". The estimated number of parcels in the province has been increasing at about 2% per year for the last three years.

Information relating to parcels is entered on the UNB's IBM computer. Approximately 1,2 billion characters have been allocated for use by LRIS. Not all of this allocation is used at present, as it includes space reserved for future expansion. The database is an hierarchical one, with direct access being provided by the Parcel Identifier (PID). Each parcel is assigned an unique PID. The PID serves only as an identifier and has no other function. However, a block of PID numbers is assigned to each county, and newly created parcels are given PIDs from that county's block.

A Master File contains 15 attributes for each parcel i.e., PID, record status code (active or retired), name and address of the primary owner, ownership type, ownership descriptor code, owner's country code, parish/municipality and county codes, tax number, taxing authority, parcel location, parcel area, a map sheet number, and references to

registered documents of each type (e.g., deed, mortgage, survey plan, etc.).

Four secondary files are used to store supplementary information viz, Name File, Document File, Map File, and Statistics File. The Name File records the names of additional or secondary owners of parcels. There is no limit to the number of owners that can be attributed to an individual parcel.

The Documents File is used to record all instruments registered against a parcel since its "initial lift" into the database. Instruments are stored by date per parcel with no limit to the number of instruments that can be attributed to one parcel. For example, after only ten years of their being recorded in the database, some parcels in Saint John have had about 100 documents referenced against them. The Document File is in essence an historical file, and represents a computerized chain of title. However, most parcels have not been in the system long enough for the file to be used as such.

The Map File contains a sequential list of map numbers against which PIDs are referenced. Should a parcel fall on more than one map sheet, its PID will be recorded against each relevent map number. In Northumberland County, for example, some 28 extremely large freehold parcels fall on 20 map sheets. The Statistics File is used mostly for producing internal reports. It contains statistics on

matters such as the number of parcels in counties, foreign ownership, etc.

4.7.1.1 Parcel Definitions

Several types of properties are regarded as parcels by LRIS.

a) Freehold parcels. These are continuous areas of land, each described in a single deed description or as a number of lots on a registered plan of subdivision, separately owned either publicly or privately, and capable of being separately conveyed.

   Each portion of a property capable of being separately conveyed is assigned a PID as is each lot shown on a registered, approved subdivision plan regardless of whether or not it has been sold by the original owner. Land included in subdivision areas for municipal purposes e.g., parks, are considered as separate parcels with ownership being assigned to the municipality. Land under one ownership which is divided by a road, railway, stream, etc., is assigned one PID.

b) Condominiums. All units of a condominium capable of individual ownership are assigned separate PIDs, while all common elements not included in the individual units receive a single PID. Registered condominium plans showing units and common elements are filed as property maps, while PIDs associated with common

elements are shown on conventional property maps, with the word "condominium" drafted within the parcel boundaries.

c) Indian Reserves, National Parks, and National Historic Sites. Each reserve, park and site is assigned a PID. Land is indexed as "disputed" when deeds to reserves record ownership to parties other than Indian bands.

d) Railways. Parish and municipal boundaries are used to create parcels of railway land, with all railway subdivsions within a parish or municipality being assigned PIDs.

e) Expropriated land. When an agency has acquired through expropriation various parcels of land, or portions of parcels (for example, for highway widening), the whole of the expropriated area is assigned one PID.

f) Local Commons. When an area of land to which title is in doubt, and for which it appears that adjacent owners have a right or interest (e.g., as a fire lane), the area is termed a local common and is assigned a PID.

g) Crown Leases. Ungranted Crown Land, which is leased and for which an approved survey plan or legal description exist, is mapped as a separate parcel.

h) Water Lots. These lots, and crown reserves adjacent to water, are assigned PIDs.

i) Squatting. An area designated as Crown Land, but occupied by an individual is mapped as a parcel with the Crown shown as the owner and the occupier recorded in the additional owners' field.

Several areas of land for which rights exist are not assigned PIDs. For example, Crown Reserved roads are only shown on property maps and are designated as such. Streets, highways, and roads under municipal jurisdiction are also shown on the maps and are designated by the names or numbers assigned by municipalities. Easements are not represented on property maps although features such as transmission lines may show as planimetric detail.

4.7.1.2 Ownership Definitions

The owner of a parcel as recorded in the registry office is coded as the owner. Occupants under special mortgage conditions, long-term leases, or squatters on Crown land are coded in the Additional Owners field, with the ownership descriptor being coded "in care of" to indicate the relationship between the occupant and the owner. In the case of local commons, the owner's name is given as "local common" with the owner descriptor being coded as "unknown".

The ownership descriptor is used to provide more details regarding the owners. Types of ownership identified include et ux, et vir, et al, in care of, joint tenants, tenents in common, church, and estate amongst others. Lands owned by

the federal government are identified by the controlling agency. A similar description is used for lands held by the New Brunswick government.

4.7.1.3 Instrument Type Definition

The database contains an index of registry information (e.g., year of registration, instrument number, and book and page reference) and field survey plan information (e.g., plan year, number, and file reference) for each parcel. Some 51 different instrument types can be recorded. These fall under the classifications of transfer of ownership, transfer of ownership rights, change to ownership information, encumbrances and their discharges, agreements, and condominium documents. The source of recorded information is documented. That is, whether it came from the computer tax file, Assessment Office files, the Registry Office, or the public. Nine different types of survey plans (e.g., subdivision, lease, condominium, etc.) can be recorded. Information on the filing system used where the plans are located is also documented.

4.7.1.4 Updating

Documents being processed in registry offices are monitored weekly by the LRIS regional staff. Changes to the status of a parcel are coded on an Update form which is sent to the Head Office to be used in updating the database. The

regional office also updates property maps should the approval of a document require redrafting of boundaries.

It would be difficult for anyone not familiar with the cadastral structure of New Brunswick to fully appreciate the step forward that was taken through the LRIS programme. For the first time in almost two centuries of the region's history as a province, it is possible to locate the existence of a parcel in relation to surrounding parcels, and to determine at a glance its area, location, and owner's name and address. Certainly there are errors in the LRIS products. That is to be expected when registration of ownership has not been compulsory, let alone examinable. And even when deeds have been registered, it is difficult to plot on a map a parcel for which neither the shape nor the dimensions has been defined.

4.7.2 Municipal Affairs (Assessment) Inventory

A centralized parcel-based assessment inventory was started in the mid-1960s when the province assumed responsibility for property assessment. The earlier computer-based inventory has been recently replaced by a joint Property Assessment and Taxation System (PATS). Planning for PATS began in 1979 and the system became operational in December 1983. Approximately 325 000 parcels are in the system. The database is an hierarchical design and all processing is

done on the provincial UNIVAC. PATS provides on-line access through 65 terminals in the 11 regional assessment offices, the assessment head office, and the Tax Administration Branch. Low speed printers are located in users' offices with high speed printing facilities being available at the computer facility.

The main functions of PATS are to issue annual assessment/tax notices, to calculate and report on assessed values, to allow on-line recording and updating of property characteristics, to manage delinquent accounts, to provide automated payment acceptance from the cash-handling system, and to provide specialized transactions to facilitate tax benefit programmes. There are 62 record types in the database, and some 600-650 different fields. Approximately 120 000 transactions per month were handled in the first two months of its operation (Morrison, 1984).

Each property has been assigned an eight digit identifier or tax number. This number has no geographical significance. Unlike LRIS PIDs, the tax numbers are not blocked into counties. Should a parcel in the north of the province be created immediately after one in the south, it will receive the next available number. LRIS PIDs are not used as the Assessment Branch does not share the same allocation policy as LRIS regarding parcels. In addition, LRIS had not completed assigning PIDs to parcels throughout the province when PATS become operational.

4.7.2.1 Property Definition

The Assessment Act defines real property in terms of assessment and taxation. Assessment properties thus include land, land and buildings including machinery, installations and equipment for providing services to the buildings, non-building structures such as cables, towers, and poles which form part of a telecommunication or electric power distribution system, machinery which forms part of a gas storage or distribution system, oil pipelines, mobile homes, trailers, and land on which mobile homes or trailers are located.

Land used as a public right of way is excluded from the definition of real property by the Act.

4.7.2.2 Ownership Definition

In general, the owner of a parcel is regarded as the taxpayer. There are some exceptions. For example, a parcel need not be assessed in the name of its owner if it forms part of an estate, if it is held in trust, or if it belongs to an infant. An owner of a mobile home is assessed as the owner even if he does not hold the land on which the home is located. Persons using or occupying leased Crown land are assessed as if they are the owners of the property. When a mortgagee is in possession of mortgaged land, it is regarded as the owner. If no deed is registered, the Assessment Act makes provision for the property to be assessed "in the name

of the person, who, in the opinion of the Minister, is the proper person to be assessed".

4.7.2.3 Instrument Type Definition

A considerable amount of registry information is stored in PATS. Some 58 types of transactions, including deeds, mortgages, timber licences, mineral licences, agreements of sale, and discharges can be recorded. The database also contains details concerning the date of transaction, instrument number, and book and page numbers.

4.7.2.4 External Identifiers

PATS allows cross-referencing of several identifiers to a tax number. External identifiers recorded include those of LRIS, PPDC, Supply and Services, FLIP, Transportation, and the federal government. Other identifiers for which provision is made include the CMHC number, CN lease number, Flood Zone identifiers, NB Housing number, subdivision and lot number, and Veterans' Land Act number. Urea Formaldehyde properties can also be identified.

These identifiers cannot be used to retrieve information from PATS. The only access keys available are the PATS tax numbers and the tax numbers assigned under the previous system.

4.7.2.5 Assessment and Tax Roll

Of the information collected and recorded, only that which appears on the assessment and tax roll can be made available to the public. The rest is considered confidential. The roll currently shows the tax number, the location and description of the property, the name and address of the person assessed, the assessed value portions (e.g., residential and non-residential) and total assessed value, the amount of exemption eligible, the net assessment for taxation, and the tax rate, tax amount, tax class, and taxing authority.

Some of the information recorded in PATS is given in Appendix VII.

4.7.3 Natural Resources (Crown Lands)

In 1980, the provincial government gave approval for the Department of Natural Resources to establish a central public land registry. The intention of this registry is to allow information on government owned land to be obtained from one source. The Provincial Properties Data Centre (PPDC) became operational in mid-1981. Although the PPDC was initially established to maintain an inventory on departmentally-controlled land, it later assumed responsibility to include information on all Crown land as well.

The procedure initially adopted was to map land belonging to all departments in a particular area. Work began in Albert and Westmorland Counties where LRIS had completed property mapping. Problems were experienced as agencies are not always oriented to counties in their filing systems, and some agencies have priority areas in which they wish to work. Updating was also difficult to control on a regional basis.

The procedure was changed and departments, not areas, are dealt with on an individual basis. As of March 1984, the properties of NB Housing, NB Liquor, Community Improvement Corporation, and the Departments of Health, Historical and Cultural Resources, and Tourism have been completed. This respresents some 3 400 parcels. It is anticipated that land held by all agencies with the exception of Natural Resources, Supply and Services, and Transportation, will be completed by the end of 1984.

The PPDC information is stored on the provincial UNIVAC. Details similar to those recorded by LRIS are collected. They include the LRIS PID and map sheet number, tax number, controlling department and address, parish, county, parcel location, parcel area, instrument type and number, book and page number, date of registration, and survey plan number. Additional information included is the PPDC identifier, parcel land use, departmental file reference, name of the grantor, access (i.e., river or road), and the frontage.

The parcels are located using LRIS property maps. The PPDC created its own numbering scheme because LRIS PIDs were not available for the entire province when the Centre became operational. To a great extent, the PPDC is providing a quality control check on LRIS products. It is ensuring that government controlled land are properly identified, and that information stored against the PIDs is correct.

4.7.4 Supply and Services (Properties and Buildings)

While the Department of Natural Resources is responsible for administering ungranted Crown Land, land with which buildings are associated are in general administered by the Department of Supply and Services. Approximately 2 500 properties worth $3 million are managed by the Department, which also administers tax sales and leasing of land.

A property inventory was created in September 1981 to assist with the management of these properties. Information for the inventory initially was obtained from the Assessment Branch. The system is a manual one at present. Information currently recorded includes the LRIS PID and map sheet, department index and file number, tax number and assessment map number, parcel locality and address, parish, county, user department, land use and improvements, parcel area, frontage, grantor, instrument number and date, book and page numbers, survey plan numbers, and the original grant lot, map, and deed numbers. The information is mostly used in-

house but is made available to other agencies should they require it.

4.7.5 Co-ordination

A Document Flow project was introduced at the operational level in Kings County in 1981 to minimize the duplication of information processing by the Assessment Branch and LRIS, and to facilitate the continual updating of information. The project, which has been extended to another 3 counties, is to be automated.

As part of its updating process, LRIS retrieves information on transfer documents from the registry offices on a weekly basis. This information is then entered in the database and necessary changes are made to property maps. Updated document listings, alphanumeric listings, and sales analysis sheets are then sent to the Assessment Branch for use by assessors. In order to obtain this flow of information it has been necessary to develop a cross-referencing system between LRIS PIDs and tax numbers.

The PPDC is working with LRIS to ensure compatibility of records wherever possible. In the absence of a LRIS Fredericton regional office, LRIS maps and listings for Fredericton are maintained at the PPDC where they are made available to the public. Parcel information recorded by the PPDC is checked against LRIS records where they exist and LRIS is advised of discrepancies. Close co-operation also

exists between the PPDC and the Department of Supply and Services.

Chapter 5

NATURE AND DESIGN OF THE LAND INFORMATION NETWORK

> Information, as the concept is now generally understood among scientists and communication engineers, denotes the removal of uncertainty... Knowledge goes beyond information in that it is interpreted and processed according to a point of view, preparing the receiver for appropriate actions... Understanding goes beyond knowledge in that it reflects the comprehender's awareness not only of what he knows but also of what he does not know and needs to know... Wisdom goes beyond understanding in that it not only prepares a person to act but guides and evokes appropriate action at the "right" time and place on the basis of knowledge and understanding... Others would distinguish between wisdom and virtue, reserving "wisdom" for merely knowing what to do next, and "virtue" for doing it.
>
> (Manfred Kochen, 1975)

5.1 INTRODUCTION

Increasingly active involvement by participants in the Land Information Workshops and enthusiastic responses by some to the Land Data and Map Inventory Study suggest that there is a desire among users to improve the management of land information in New Brunswick. In this chapter some of the problems facing land information users are identified and reviewed. Several recommendations for dealing with these problems are proposed. It is suggested that land information activities could be better co-ordinated through

a formal land information network and the characteristics of such a network are discussed. Some of the processes required for the design and implementation of the network are then identified.

5.2 PROBLEMS

It is clear that despite the progress that has been made, users of land information are still not provided with information that they require. There are many reasons for this. Some generic problems, along with specific issues, are identified in this study.

5.2.1 Duplication

Duplication of information collection, processing, storage, and retrieval facilities is normally only a problem if it incurs unnecessary expenditure. Duplication by users can arise to circumvent the problems of inaccessibility of information and incompatibility between information requirements.

5.2.1.1 Inaccessibility

Information recorded on paper medium is not easily accessible to users located some distance from the storage site. For example, many of the parcel inventories are needed for frequent in-house use by the collecting agencies. To have to retrieve information from some central depot

every time it is required would prove time-consuming and inconvenient.

The perception of the user has influenced the location of information storage and hence its accessibility. LRIS, for example, chose a regional, decentralized system of (eventually) five regional offices to be close to the source of information (e.g., registry and assessment offices) and the users (e.g., assessors, lawyers, and surveyors). Property maps are updated locally in regional offices. This process causes difficulties for users who are not situated near the regional offices e.g., those in central agencies in Fredericton who require maps of the entire province. The converse situation also occurs. For example, the Provincial Property Data Centre (PPDC) updates its maps in Fredericton. It is then difficult for users in regional centres to quickly obtain copies of updated paper maps.

5.2.1.2 Incompatibility

Duplication of resources frequently results from differences in the standards and classifications established by the individual agencies. Information products are designed to meet similar but yet still different objectives. In general, an agency will only use information collected by another if it is perceived to be sufficiently accurate.

a) Mapping.

The long time taken to complete first-round provincial coverage under the APSAMP and LRIS programmes has meant that several departments (e.g., Natural Resources, and Transportation) had to continue producing base maps, while others (e.g., Municipal Affairs in conjunction with Transportation) had to continue producing property maps.

The transition from chain scales through English imperial scales to metric scales has resulted in a proliferation of different map scales, all of which are currently in use. After more than two decades of continual mapping, the province still does not have uniform large to medium scale coverage. Large scale urban mapping is a mixture of imperial and metric scales. While metrication did not cause a change in the scale of the 1:10 000 resource map series, it did result in the introduction of a different map sheet size. This lack of standardization has created difficulties for many users, particularly those that use map referencing in land management activities.

The slow rate of mapping revision may increase the extent of duplication. Urban second-round coverage is scheduled to begin in 1986 and will concentrate in the northern part of the province in order to give that section uniform metric coverage. In meeting that need, however, other needs are being ignored. Base mapping for the Moncton area was done in 1967 with APSAMP funding. The maps are then 17 years

old, and it is possible that it will be close to a decade before the area is remapped by LRIS. A key function of LRIS is to co-ordinate base mapping and so avoid strip mapping with its inherent dangers of duplication and singularity of purpose (e.g., mapping just a road without the surrounding drainage). If map revision is not undertaken so that users' needs are met, it is possible that strip mapping will increase.

It is possible that additional duplication problems may result from the second-round mapping. The largest scale planned is 1:2 000, a reduction from the present 1:1 000 or 1:1 200. This was done on recommendation of the Surveys and Mapping Committee partly in an attempt to reduce the number of maps. While the smaller scale may be adequate for provincial planning purposes, it may not be suitable for use in daily operations of municipalities who are major map users. This is inspite of the fact that in the joint LRIS/DREE evaluation, urban mapping was viewed as being

> intended for planners working in the built-up areas who require information at a larger scale. These include the civic administrators, utilities people, etc., and particularly the property mappers... The detail of urban mapping (or line maps as they are most commonly known) is such that the positions of things as telephone poles, individual buildings and other man-made features can be recorded with precision. In addition, contour lines depicting the slope of the land and the height above mean sea level are also plotted. (LRIS, 1977)

Engineering applications and the small parcels found in urban centres may not be adequately represented at the

smaller scale. The City of Halifax has requested that LRIS collect data at 1:1 000 to allow for the possible enlargement to 1:500 in parts of the urban core for use in managing underground utilities and in other daily operations. Data collected at a scale of 1:2 000 in the urban cores in New Brunswick may preclude its accurate use at an enlarged scale. In addition, municipalities may be unwilling to transfer their information from the 1:1 200 maps currently in use onto the smaller scale maps.

b) Administrative Reporting Units

Different administrative regions adopted by government agencies hinder the collation of land information from these different sources. Regional descriptions are as varied as the regional boundaries. For example, the City of Edmundston falls in part of the District of Edmundston, Region of Edmundston, Northern District, Northwest District, District of Grand Falls, Region A, Region 1, Region 4, and Region 5 amongst others (Office of Government Reform, 1983).

The combined effect of multiple region boundaries and descriptions makes it difficult to correlate information collected by agencies for their own regions but which cover the same general area. Information already collected is thus ignored in decision making, or if it is required, is collected again to different specifications. Regional boundaries are not fixed, but instead change according to needs perceived by the agencies. Temporal comparisons then become difficult if not impossible.

The Land Use Policy Task Force (1983) has commented that

> more information should be made available for general use from the massive amounts of data that are collected regularly by Government and other agencies. Time and effort are required to convert the data into useable information but ways to find this time are required.

The Office of Government Reform (1983) is addressing the problem of regionalization. However, it is unlikely that all agencies will be able to share the same boundaries: human service agencies concentrating in populated areas have different priorities from those agencies concerned with natural resource management.

c) Parcel Inventories

Despite the large number of property inventories kept within the province, there still does not exist a complete, comprehensive, and accurate inventory on properties and land ownership. The only offical record, that of the county registry offices, is not parcel-based but instead utilizes a grantee-grantor index. The LRIS inventory is the only one that is generally available to outside users, but as it has not yet been completed, it is of limited use. Furthermore, it is not currently designed for on-line use. The other inventories have been compiled by agencies to satisfy their own requirements.

The proliferation of inventories has resulted in the creation of different codes and indicies. For example, "Albert County" is encoded as "AL" in the Assessment Branch

database and as "01" in the LRIS database. In addition, a parcel may have indicies assigned by a number of agencies such as LRIS, Assessment Branch, Transportation, PPDC, Supply and Services, Agriculture, NB Housing, CMHC, CN Rail, and the federal government.

More serious, however, are the differences in classification. For example, the Assessment Branch inventory may record the taxpayer's name (e.g., a lessee) instead of the name of the registered owner. In addition, PATS records only the name of the primary owner. LRIS on the other hand records the names of all those registered as owners. If it is considered necessary, LRIS stores the taxpayer's name as a "secondary" owner of the parcel, and a note is added to that effect. Nevertheless, while it is more convenient for the Assessment Branch to deal with taxpayers than owners, it will probably continue to have an inventory different from that of LRIS.

Because the inventories are used for a variety of purposes, agencies such as LRIS, Assessment Branch, Crown Lands, Transportation, and NB Housing have different interpretations of what constitutes a parcel.

A working group established as a result of a resolution at LIS '90, 1983 to examine the problem of parcel definition found that while the majority of people who deal with land parcels use the legal definition as described in a deed, problems are experienced through the inconsistency of

application of the definition, and the lack of guidelines to follow. Problems are also experienced when dealing with very large freehold parcels which extend over many mapsheets.

The Assessment Branch defines properties according to valuation and taxing requirements. Agencies which interact closely with the Assessment Branch (e.g., the Department of Agriculture with its FLIP programme) have to work with the definitions of assessment properties as well as with registry definitions.

Designated highways are divided into "highway sections" by the Department of Transportation. The sections are on average less than a kilometre long and are bounded by easily identified features. Highway section plans are filed in the registry offices.

Ungranted Crown Land is divided into management units based on resource management decisions. The Department of Natural Resources defines the units using map sheet boundaries of the 1:10 000 series, except where Crown Land abuts freehold areas.

Significant differences exist in "parcel" definitions even when the parcels involve the same freehold land. For example, the Assessment Branch includes mobile homes as properties but excludes road parcels, whereas LRIS takes the opposite view. In addition, several legal (LRIS) parcels may be regarded as one property for assessment purposes

e.g., when several farm units are farmed as one, or when a large building is erected over several parcels. This problem is partly due to the fact that amalgamation or consolidation of several contiguous parcels under the same ownership is not a simple process. However, the introduction of an amalgamation process will not solve the problem when land is not under the same ownership e.g., when development has taken place on land that is partly owned and partly leased. Conversely, a legal parcel may be regarded as several assessment properties e.g., portion of a parcel held by a tax-exempt organization but which is used for commercial purposes must receive a separate tax number. At present, there is no quick method of determining the extent to which this mismatch has occurred.

Information collected by one agency will be used only by others if it meets their standards. LRIS produces an Error Report Count twice a year to assist with controlling quality of information recorded for counties in parcel indexing. The January 1984 Error Report Count for the 263 988 parcels in the 9 counties then completed showed that over 15% of the parcels either had the tax code missing, or were incorrectly coded with "no tax code". This ranged from a maximum of 26% in Albert and Kings Counties (which were among the first to be property mapped) to 5% in Kings County. Thus without even considering the mismatching of definitions, considerable difficulties will be faced when attempting to

correlate LRIS and PATS databases. The Error Report Count also shows that while less than 0,5% of the parcels listed have the owner's name or address missing, almost 5% have the parcel area missing. About 17% have no documents on file and an additional 6% have missing or incorrect instrument book and page entries.

The Error Report Count lists missing entries. It cannot highlight incorrect entries. Despite the many checks performed by LRIS on the work of property mapping technicians, errors do exist in the database. This is understandable considering the sometimes inferior quality of information with which technicians had to work.

d) Other Incompatabilities

Duplication of information management activities occurs with information other than cadastral. For example, Statistics Canada and the Department of Agriculture and Rural Development are both involved with collecting farm-related information. However, significant differences exist e.g., the definitions of a "farm", the criteria by which farms are included in the inventories, the temporal differences in the surveys, and the different codes used. Building-related information is being collected by the Assessment Branch, Statistics Canada, NB Housing, and CMHC amongst others. While land use information is collected by several agencies e.g., Agriculture, District Planning Commissions, Environment, Municipal Affairs, Natural Resources, and

Regional Industrial Commissions, there is no comprehensive view on it.

5.2.2 Unavailability

Despite the energies expended on collecting information within the province, information required by users still may not be available to them. This unavailability may be due to non-collection of the information or to confidentiality requirements.

5.2.2.1 Non-Collection

Trenholm and Wood reported in 1974 that very few types of land information were consistent in availability and quality across New Brunswick, and that more information existed for the Saint John River Basin than for the rest of the province. The problem was succinctly stated:

> It can be generally stated that there is an inverse relationship between the demand for increased detail and the availability of information. In many cases, there is an abundance of facts and figures for the province as a whole, but as the area unit of interest gets smaller, the information base gets weaker. (Trenholm and Wood, 1974)

It is not known to what degree the situation has improved during the intervening decade.

The photo library envisaged by Roberts in 1966 has not yet materialized. Users of photographs have difficulties in easily obtaining copies as the only ones available from within the province are the Natural Resource series of

1974-76. Those wanting to use photographs in conjunction with LRIS maps must obtain them from Nova Scotia. The same applies with the colour series commissioned by the Department of Natural Resources (Forest Management).

There appears to be a need for an intermediate scale between the 1:10 000 series produced by LRIS and the federal 1: 50 000 series. Where they are available, the 1:20 000 Natural Resources (Forest Management), the 1:25 000 partial coverage by EMR, and the 1:31 680 Natural Resources grant maps are used extensively. The recent survey commissioned by the Surveys and Mapping Committee indicates that a middle-order scale (1:20 000 to 1:31 680) would have support from a number of agencies including Transportation (Planning), Municipal Affairs (Emergency Measures), Natural Resources (Crown Lands, and Mineral Resources), as well as the District Planning Commissions.

LRIS base and property maps, and the parcel inventory have been well received by users in New Brunswick. However, the use of these products has been restricted through lack of provincial coverage. Delays in completing the mapping through the possible postponement of the opening of the Fredericton regional office could adversly affect the acceptance of LRIS products. The slow rate of revision, and the possible lack of suitability of second-round coverage scales described earlier could have the effect of making the products for all intents and purposes appear unavailable. A

similar attitude prevails with computer mapping products. Approximately one-third of the province has been mapped digitally. However, the non-collection of data for the remainder of the province has resulted in users not being prepared to invest in computer mapping facilities. Consequently, the data already collected are not used effectively.

5.2.2.2 Confidentiality

Even though land information has its focus on land and not people, it is still subject to confidentiality restraints at times. The Assessment Act of New Brunswick stipulates that any information not required to be entered on the assessment and tax roll is confidential. The contents of the roll are prescribed by regulation. Any change to what is considered "public information" requires the consent of Cabinet.

All information compiled by Statistics Canada is subject to the provisions of the federal Statistics Act. In order to maintain the confidentiality constraints imposed by the Act, Statistics Canada has implemented a system of random rounding on the last digit of every cell in tabulations produced for external use. In addition, individual cells of a tabulation below a given threshold value may be suppressed (Statistics Canada, 1981). Agricultural information collected by Statistics Canada at times is not of much use to the Department of Agriculture. The provisions of the Act

sometimes result in the parish, and not the enumeration area, being the smallest unit for which agricultural census information is available in sparsely populated rural areas.

Other agencies also have confidentiality constraints imposed on them. For example, the Department of Natural Resources (Mineral Resources) is provided with information by private companies to assist with its planning and management. This information is supplied in confidence and cannot be made available to other companies or the general public.

5.2.3 Financial

The economic restraint which has characterized the last few years has had a retarding effect on certain aspects of land information. Other developments, such as the Assessment Branch's Property and Taxation System, were implemented but at great expense. PATS was intended to be a major investment lasting many years. It is possible that the economic restraint may force a land information network to initially accommodate PATS in its present form.

Collecting information is an expensive process. Bright and Prior (1982) in referring to the 1981 Statistics Canada census commented:

> The common experience, in terms of labour and other costs, as well as inflation, was that the various types of surveys including censuses, are increasing in costs at an alarming rate. Alternatives must be investigated to perhaps replace in the future what are fast turning out to be very expensive survey-type programmes.

It is also expensive to store data. For example, it costs the Assessment Branch over $8 000 per month to store its data on disks. In addition, it costs between $0,05 and $0,10 for each transaction or between $6 000 and $12 000 per month (Morrison, 1984).

There are many other hidden costs for which the tax payer ends up paying. For example, under the present system of deeds registration a laborious and expensive search back to a good root of title is required. It is estimated that one-quarter of the expenses for a recently proposed pipeline project was for property information searching (Finlay, 1984). Not only is searching time-consuming, given the grantee-grantor index, it also has to take place in the registry offices.

Providing on-line access to scanned documents stored on optical disks will not remove all the problems of accessibility. To be readable, a document would have to be scanned with a pixel size of about 0,2 mm. Since much of the document does not contain "information" (e.g., the margins and between the lines), many scan lines will contain little or no data. Even if the costs of storage are decreasing, storing non-existent data may prove expensive considering that there are approximately 10-11 million documents in the county registry offices (Finlay, 1984).

A major benefit of providing on-line access to such documents is that they could be available to any user in the

province who has a terminal. It is possible that transmitting a fully-scanned document will be expensive, both in transmission time and cost. Data compaction techniques such as run-length encoding could be used to reduce the amount of data managed. Software would then have to be available at receiving terminals to expand the data and so recreate the document by inserting blanks in all the right places.

The present registry system makes it necessary to have access to all historical documents relating to a parcel. That is, many deeds, mortgages, etc, would have to be "active" or "on-line". Under a Land Titles system, ordinarily only the most recent document is required to be active. All previous historical documents can be archived without direct on-line facilities being provided to them. Furthermore, by intelligently designing the document, it can be computerized without having to be scanned. This will result in a much smaller file and correspondingly smaller storage, retrieval, and transmission costs. British Columbia is in the process of automating its Land Titles system. On-line access is to provided to the database.

5.2.4 Technical

It has been shown that the recording of information on paper medium greatly restricts the use of that information by others. However, computerization of information may not

necessarily increase its accessibility. Data cannot be easily moved between databases of different designs (e.g., between those based upon hierarchical and relational models) even if the databases reside in the same computer. Should the data be stored in different computers, the interchange will be impeded by different computer architectures and data structures. Databases in New Brunswick have been designed to use different access keys. For example, the LRIS database cannot be entered using the parcel tax number, while access to the PATS database cannot be directly obtained with the LRIS PID.

When attempting to link turn-key type systems, the problem is exacerbated by the veil of secrecy drawn over systems by vendors. There are currently four computer mapping systems in the region i.e., CARIS (LRIS), ESRI (Natural Resources), GeoBase (MRMS), and Intergraph (NB Power). In the absence of a common "best" data structure agreed upon by vendors, each of the computer mapping systems generates data in different data structures. This precludes on-line interaction between these systems at present. The Canadian Council on Surveying and Mapping has established draft standards for the transfer of digital topographic data and the American Congress on Surveying and Mapping has been focusing on standards for digital cartographic data. Once industry standards have been established, it is up to the users to apply pressure on the vendors to adopt them.

5.2.5 Political

One problem arising from the creation of LRIS is the perception by some that an outside agency is involved with internal affairs. New Brunswick has been content to leave the management of the LRIS regional offices under the control of the agency. Although there are no indications to the contrary, the situation in future may change as it did in Prince Edward Island.

PEI has assumed responsibility for administering the Island regional office. LRIS procedures are continued and data are kept in the LRIS database. The data are entered directly from a terminal in the regional office. The office, which is under the Department of Highways and Public Works (Properties and Surveys Section), also has consolidated a number of land-related activities. It is the provincial map library for PEI, stocking EMR and LRIS maps, and it also maintains transportation Right-of Way records. The government property manager is located in the regional office and property records are kept there. The office is also responsible for the verification of government parcels on LRIS maps i.e., the same role as that performed by the PPDC. Close co-operation is also maintained with the assessment programme which uses LRIS PIDs as the root for tax numbers.

5.2.6 Co-ordination

To a great extent the problems described above are due to lack of co-ordination. On one hand, opportunities for multiple use of land information are restricted because it is used by controlling agencies only to meet the objectives of their own programmes. On the other hand, fragmentation of programmes occurs with agencies being responsible only for portion of a programme. For example, the subdivision of land requires the involvement of the Department of Municipal Affairs (Community Planning Branch) which among other activities indicates what information is to be shown on the survey plan, the Department of Natural Resources (Crown Lands) in approving plans in integrated areas, the Department of Justice (Registry) in registering the plans and accompanying deed of transfer, and LRIS in using plan and deed information to update its property maps and database. Similarly, property tax administration involves LRIS in mapping the parcels in consultation with the Department of Justice (Registry), the Department of Municipal Affairs (Assessment Branch) in assessing the value of the parcels, and the Department of Finance in collecting the revenue. No single body has responsibility for the programmes at the provincial level.

The lack of co-ordination is clearly seen in mapping activities. Several agencies (e.g., LRIS, Natural Resources, and Transportation) are undertaking base mapping,

while thematic mapping is generally done by whatever agency can manage the task.

Different standards and classification schemes employed by different agencies when collecting the same information theme frequently are due to a lack of co-ordination, rather than to differences in the requirements of decision makers. For example, the experience of Prince Edward Island has illustrated that an assessment programme can adopt many of the standards developed for a registry system.

If the users of land information are themselves not co-ordinated, it is perhaps not surprising that their information requirements are unco-ordinated. The Surveys and Mapping Committee, which is the only official co-ordinating body in New Brunswick, appears to suffer from two limitations. Firstly, committee members have other full-time positions which demand their attention. Secondly, the committee is biased in its perception of users' needs in that all its members represent provincial government agencies. Civic administrators and utility people who were viewed as users of the urban mapping series have no direct representation on the Surveys and Mapping Committee. Consequently, LRIS products are geared towards provincial administrative needs and not those of local authorities. This is inspite of the fact that 48% of the population of New Brunswick lives in the six cities, with 36% of the population living within the urbanized cores of the cities

(Statistics Canada, 1981). Other private interests, such as those of professional institutes, are not represented either.

5.2.7 Policy

The lack of co-ordination results, at least in part from a lack of direction. There is no statement of intent or clear comprehensive policy regarding land information. If anything, New Brunswick appears to be losing ground. In the 1973 Canada-Maritimes Agreement on Natural Resources and Land Registration, a land data system (Phase IV) was incorporated to ensure that maximum benefits were derived from the first three phases. In the 1980 Maritime Provinces-Council of Maritime Premiers Agreement on the land registration and information programme, Phase IV was discarded and replaced by a vague general statement that the LRIS programme would include "the provision of such other services as are agreed upon by the provinces and the Council from time to time."

The Land Use Policy Task Force (1983) noted that the federal land use policy has already had a noticeable impact on some socio-economic projects in Ontario. They expressed concern that New Brunswick may be placed in a disadvantageous position for lack of a land use policy of its own. This comment is interesting, as one of the major arguments in favour of the original APSAMP proposal almost

two decades ago was that it would encourage economic development within the region. Not only does New Brunswick not have a land use policy, it also does not appear to have an understanding of how or where such a policy would fit in or interface with other land information.

If there is no statement of intent, the roles played by agencies cannot be clearly defined. For example, what is the relationship between the property inventories of LRIS, Assessment Branch, Supply and Services, and PPDC, and what will be the relationships should on-line access be provided to the LRIS database? Unless the objectives of users are clearly stated, it can be expected that the management of land information will remain in a state of confusion. The responsibilities of agencies must complement one another in an overall land information paradigm.

5.3 SPECIFIC RECOMMENDATIONS

Several recommendations are presented in order that the effectiveness of land information management in New Brunswick may be improved:

a) That all future aerial photography, including that of LRIS, be made more easily available to users through the establishment of a provincial photograph library having facilities for the processing and production of prints and diapositives.

b) That the mapping requirements (i.e., scale, content, and format) of users be determined through the establishment of map user groups, that the production of maps within the province be rationalized possibly through the creation of a central mapping agency, and that the process of cyclic revision be replaced by one of continuous revision.

c) That the land parcel designated by LRIS and the LRIS parcel identifier be used wherever possible, particularly by government agencies and that other interests be regarded as internal management or administrative units of the agency that created them, that the registered highway section be recognized as the parcel definition for highways and that if necessary a similar approach be taken to manage railways, pipelines, and powerlines, that an amalgamation process be introduced whereby several contiguous parcels under common ownership could be easily and simply amalgamated to form one parcel, and that the property mapping by LRIS be elevated to an official status within the government on its completion.

d) That agency administrative regions be comprised of an integral number of basic units such as the census Enumeration Area (EA), that the enumeration boundaries be shown on a reference index map, and that the LRIS

PID and street address be referenced to the unique EA number. The land parcel will remain the basic reporting unit, but land characteristics could be aggregated to the EA level before being aggregated to the regional level. Because agencies would share the same regional sub-units i.e., EAs, even though they might not share the same regional units, information collected by one agency could be more easily correlated with that collected by other agencies and by Statistics Canada.

e) That the provisions of the Land Titles Act and the Survey Act be extended to cover the entire province in order that the Registrar of Titles and the Director of Surveys can enforce control on the quality of future land-related documents, and that users provide control on the quality of existing documents by advising LRIS of textual or graphical errors in its products.

f) That standard classification schemes for land use and other land information which are satisfactory to all users be developed. Traditionally, classification schemes have been hierarchical in design. This structure exhibits great inflexibility and often cannot be modified should new needs be identified. It is suggested that the feasibility of a relational classification scheme be investigated.

g) That the extent of duplication of land-related information activities, including aerial photography and mapping, be determined either quantitatively or qualitatively through an audit of information requirements, and that methods of minimizing the cost of duplication be determined.

h) That functions of agencies such as the Survey Office, Registry Office, Assessment Branch, and Community Planning Branch be analysed to ascertain if some of the functions could be better performed by a central agency, or else by several agencies working in close co-operation and under a comprehensive multi-agency policy.

i) That the adoption of recommended hardware, software, and data structure standards be promoted, that the implementation of computer systems be co-ordinated, and that co-ordination be provided so that software developed for the private sectors meets the requirements of both the professions and the statutory authorities.

j) That the responsibilities of agencies involved with the collection and use of land information be clearly defined within a comprehensive land information paradigm by the provincial government.

5.4 LAND INFORMATION NETWORK CONCEPT

In order to assist with the management of land information in New Brunswick, it is proposed that a land information network be established. Through the network concept the needs of the users can be co-ordinated, thus resulting in increased accessibility of land information while simultaneously minimizing the extent of duplication of activities. The more efficient and effective management of land information hopefully will be transformed into more efficient and effective action by those using it.

While it is desirable that the private sector and local governments play a major role in the creation of the network, it is inevitable that the provincial government will have to bear much of the responsibility for providing infrastructure of the network and the information itself. Indeed, no less a proponent of free enterprise than Hayek (1944) argued that the state can do much to help the spreading of knowledge and information. Involvement by the government does not necessarily mean an increase in the labour force with its associated increase in costs. Instead, the personnel required for the network can be recruited from within the public service as a result of rationalization of activities, much as the staff of the Office of Government Reform was seconded from existing provincial agencies. This approach was adopted in Western Australia, where the land-related information developments

were achieved with a net increase of only two permanent positions in the public service (Humphries, 1982).

5.4.1 Networked Land Information Systems

Within the context of the network, each land information system serves an unique, distinct objective. Maintenance of a system is the responsibility of the organization mandated to be the statutory source, or in its absence the primary collector, of the information managed within the system. In general, it is suggested that when there is sufficient demand for external use of information managed by an organization, then that system becomes part of the network.

While a government agency may be responsible under statute for maintaining the integrity of information, the actual ownership of information is seen as being held by the government. Through the network this information is held in trust for the use of others. Nevertheless, each land information system will be subject to the confidentiality contraints imposed by its controlling organization. For example, the perceived sensitive nature of certain assessment information precludes free and unrestricted access by external users to all assessment information.

A number of land information systems will be required to assist with management of land information. Several "cadastral information systems" can be identified e.g., a registry information system, a title survey information

system, and an assessment information system. It is envisaged that the registry information system will include a single, accurate, and comprehensive register of all publicly and privately owned land parcels including roads, waterways, and Crown lands, and of all rights, restrictions, and administrative interests registered, or intended to be registered, against the parcels or their owners. The survey information system will focus on legal and subdivision plans and the associated survey records including fieldbooks, calculations, co-ordinates, and survey reports. The assessment information system will be concerned with the information deemed necessary for the equitable valuation of properties.

Other land information systems that may be included are a soil information system (perhaps similar to CANSIS, the federal Canadian Soil Inventory System), and a water information system similar to that developed by Environment Canada. The diversity of applications of land use information may result in the need for more than one land use information system e.g., rural and urban systems. There also appears to be a need for a mineral resources information system, a highway and roads information system, and an electric power infrastructure information system amongst others.

Underlying all other systems, and providing the framework in which information collected in different systems can be

correlated, are the control survey co-ordinate system and the mapping information system.

The land information network can be regarded as a confederation of these decentralized but related land information systems. The network provides the means by which users can obtain information collected by others so improving the effective flow of information between organizations. It can also relieve organizations of some of the burden of distributing information while ensuring that organizations receive financial credit for supplying information.

It appears inevitable that computer and telecommunications technology will play an increasingly important role in all aspects of land information. Organizations including LRIS, Assessment Branch, PPDC, Forest Management, and NB Power have already made investments regarding computerization, while others such as Transportation have expressed a desire to computerize their records once the Office of Government Reform has made its recommendations. Several organizations in the private sector, including timber companies and land survey firms, have also signalled their intentions to invest in computer technology. Such interest is limited at present but it can be expected to increase as computer systems become more affordable. The flow of information within the network must be designed to accommodate those seeking computerized

solutions. However, it will be many years before all, or indeed many, users are able to take advantage of the benefits provided by such technology. The flow of information must also accommodate those who require "conventional" information products.

The decisions regarding storage media, storage location, and hence the flow of information between users must take into account a number of factors. In some cases, regional storage of information may prove more satisfactory, while in other cases the reverse may be true. Storage may have to be duplicated if many users require frequent and rapid access to information collected by an organization. For example, it may be more economical to duplicate the storage (but not collection) activities of land ownership information in the assessment and survey information systems and the records of property managers than to constantly retrieve it from the external registry information system.

It is probable that duplication will not be eliminated. However, the network can ensure that there is controlled redundancy. Nevertheless, the duplicated information must be derived from a single, easily accessible, but yet authoritative source. Not much appears to be gained from having instant on-line access to the LRIS database if the information retrieved has to be validated by a lengthy manual search in a registry office before it can be used with professional integrity.

Several alternatives can be considered for the distribution of information to its users. One possibility is for users to obtain all information directly from the organizations managing the relevent information systems. Organizations would have to be equipped with "external interfaces" to allow them to deal with these external requests for information. If information is in a computerized form, all organizations would have to be linked directly to one another, and users would be required to know how to gain access to the different databases.

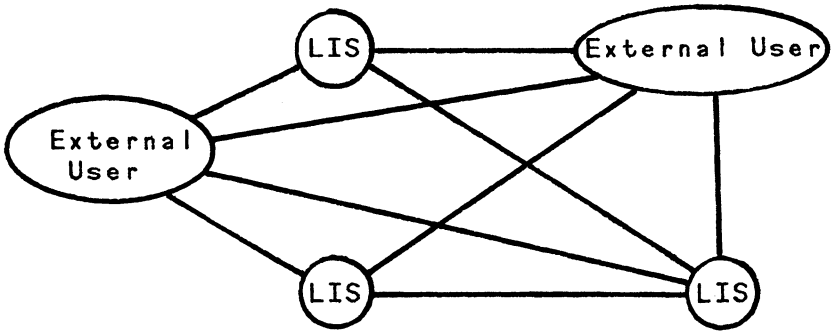
Another possibility is for users to obtain access to information through a network information centre. Organizations managing information systems would only have to liaise with one "external user" (i.e., the centre) and users would only have to know how to deal with one "external interface". This approach is similar to the on-line database services offered by Dialog (1983) and Compuserve (1983) in the U.S.A. where a call to one number provides access to many databases maintained by different organizations.

Alternatively, a position somewhere between these two extremes may be adopted. For example, organizations which share large volumes of routine information regularly, as might be the cases with the assessment, registry, and survey offices, may be connected by direct channels of information flow. Requests for information by more casual users may be

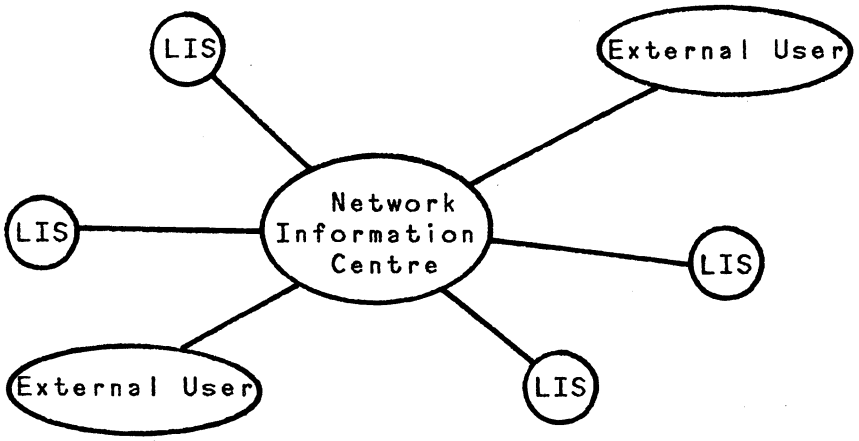
dealt with more easily through a network information centre acting as an agent for organizations controlling the information systems. These alternatives are illustrated in Figure 5.1.

The exact nature of the distribution component cannot be determined until it is known who needs what information, how frequently, and where. Through the intelligent design of interfaces between various land information systems, external users need not be affected by modifications to component systems of the network, and in fact may even be unaware that changes have been made. Standardization of external interfaces will ensure that new information systems can be added to the network without requiring extensive modification to existing systems.

a) Decentralized.



b) Centralized



c) Hybrid

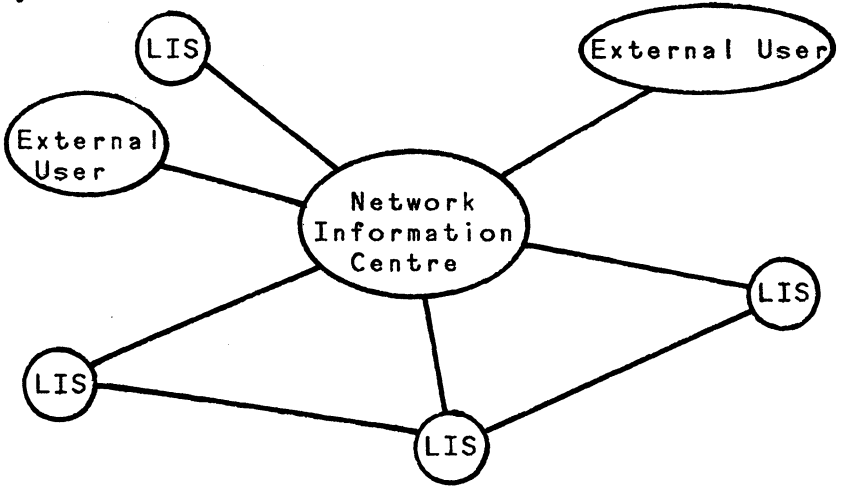


Figure 5.1: Network alternatives for disseminating information

5.4.2 Network Co-ordination

Through the network, information retrieved from one information system can be merged with that retrieved from other systems to produce a new information product. A number of special co-ordinating mechanisms have to be in place for this "value-added processing" to occur. While individual systems may be decentralized, the control of the network must be centralized. The lack of clearly defined management lines of communication can significantly retard the progress of the programme. For example, the haphazard development of standards, formats, and procedures could result in the time-consuming and expensive process of having to modify the information to meet the requirements of others. To be effective, co-ordination must take place in several areas e.g., network policy, management, user interface, and research. (See Figure 5.2).

5.4.2.1 Land Information Policy Co-ordination

A mechanism is required to assist with co-ordination of government policies which affect land information to ensure that they share common objectives and are not mutually damaging. This mechanism could be an extension of the existing Officials' Committees which are responsible for reviewing policies and for ensuring inter-departmental consultation before issues reach the Cabinet Committees.

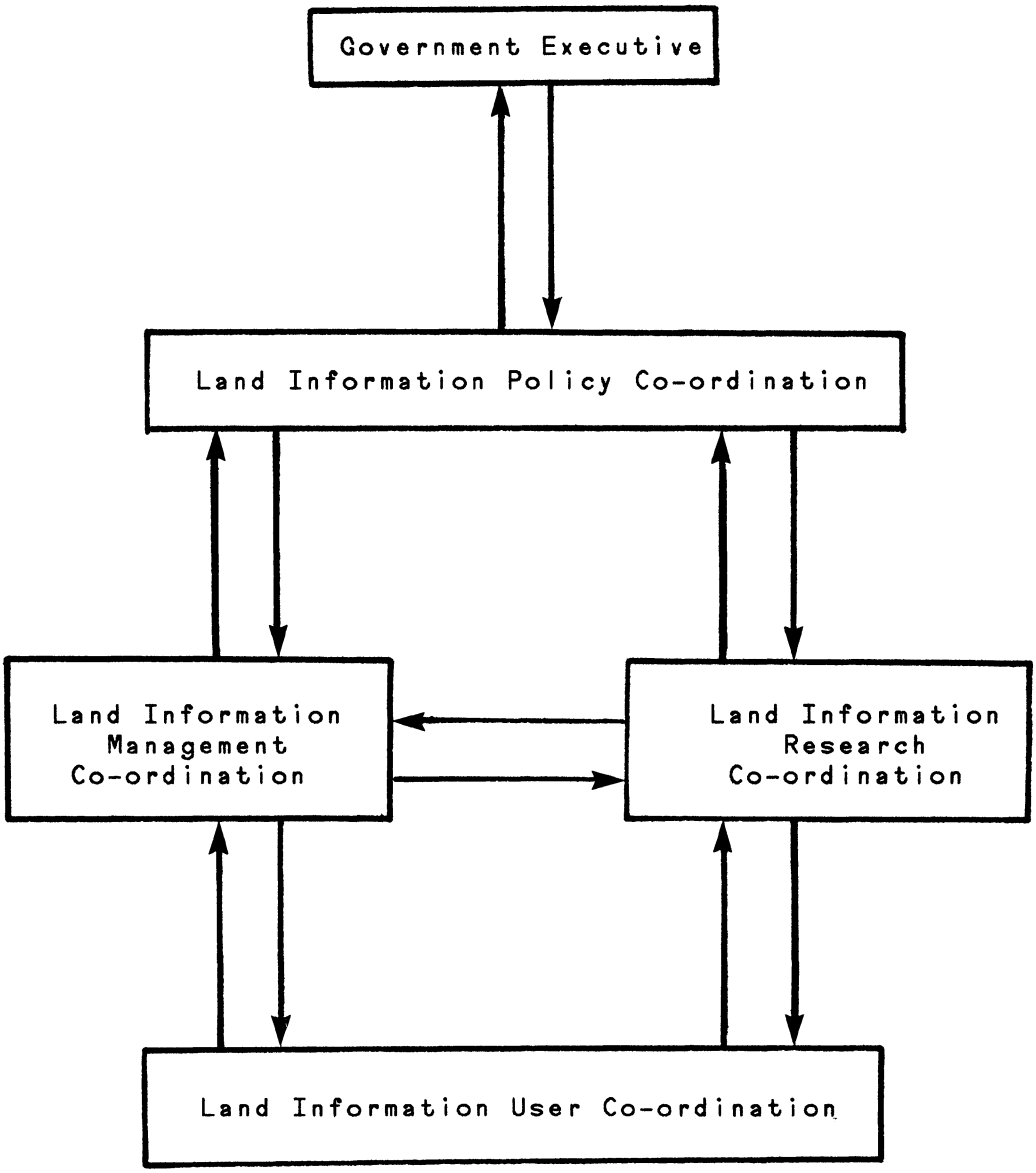


Figure 5.2: Network Co-ordination

Similarly, programmes which influence the management of land information must be monitored to ensure that gaps, overlaps, and conflicts do not occur. In addition, the effects of federal and provincial legislation, both existing and proposed, must be determined.

The long-term and short-term policies regarding the land information network itself must be co-ordinated. This includes a review of administrative, financial, and technical contraints. The Policy Co-ordination Body must carry sufficient authority for its recommendations to be effective. It must be independent of the control of any particular line department, but must be sensitive to the needs of the Cabinet Secretariat, the individual agencies, and the private citizens.

5.4.2.2 Land Information Management Co-ordination

Collection, processing, and dissemination of information can be co-ordinated through a land information network support centre. It is necessary that the staff of such a centre have a broad, generalist, inter-disciplinary view of land information as they will be involved with co-ordinating the requirements of individual users within the constraints of government policy.

The centre will have to deal with a number of co-ordinating issues including software, hardware, computing facilities, data standards, format standards, ownership of

information, privacy and confidentiality, demand/supply of information, public relations, and education. The centre can assist with the preparation of departmental, inter-departmental, and private sector plans regarding land information, and can act as a consultancy service to assist users in solving land information-related problems. Should there be sufficient demand, the centre can also provide a bureau service for users who cannot afford sophisticated technology such as computer mapping systems.

Several management skills must be developed if the network is to be properly managed:

a) Business Management Skills. Regardless of the form that it takes, a network will require a substantial investment of time and money. Consequently, it must be run as a business venture with its managers being accountable to the investors.

b) Technical Management Skills. Many technical problems will have to be solved if information requirements of users are to be co-ordinated. Because of the specialized nature of some land information-related problems support from vendors may not be forthcoming. Local developments may be necessary. The centre will also have an education role to play in developing technical expertise among users and so allowing them to recognize equipment contraints, to critically examine claims of vendors, and to evaluate possible options.

A major cause of incompatibility is the use by vendors of original equipment manufacturer (OEM) products which run only on the hardware for which they are designed. The centre, in concert with their counterparts across the country, could play an important role in applying pressure on vendors in an attempt to get them to use operating systems, data structure formats, etc., which are machine-independent.

c) Personnel Management Skills. While the two skills mentioned above deal with financial and technical constraints, this is concerned with social constraints. The development of interpersonal and communication skills often has not been a priority issue when developing land information systems. This is probably a major oversight as such skills have had significant impacts on programmes of far greater magnitude. For example, it has been suggested that the management and motivation of the team chosen to spearhead the research and development effort of the Japanese Very Large Scale Integration microchip programme (which was initiated by the government and brought together five large electronic companies) contributed much more to the success of the programme than did the more easily quantifiable contributions of money and technical resources (de Jonquiers, 1984).

The network bring together users with different backgrounds, interests, and perspectives. Interpersonal skills have to be developed if consensus is to be reached and if a common understanding of problems, a common perspective of products, and a common communication language is to be achieved. The issues of priorities, policies, procedures, and standards will require negotiation and arbitration between the legitimate needs of users.

Ouchi (1981) has commented that participative decision making requires open communication at all levels between participants. Consequently, scepticism must be invited, for sceptics outnumber "true believers" and their reservations must be openly debated before change can occur. Openess also allows a realistic appraisal of problems and achievements and promotes trust or understanding that long-term compatible goals are shared.

5.4.2.3 Land Information Research Co-ordination

Research of both a theoretical and practical nature must be co-ordinated within the general framework of the network. In addition to co-ordinating original research, an important service can be provided through the identification and evaluation of new products and services, and the subsequent dissemination of this information to users. The

universities and the private sector in the province can play an important role in this regard.

5.4.2.4 Land Information User Co-ordination

Co-ordination of policies, administrative and technical issues, and research activities cannot be done satisfactorily without adequate provisions to co-ordinate public and private involvement in matters relating to land information. An effective mechanism is required through which users can state their needs and concerns.

The state of Western Australia appears to have such a mechanism in the form of the Land Information System Advisory Committee (LISAC) and its Special Interest Groups i.e., Administration, Rural, Technical, Urban, and Utilities (Humphries, 1982).

The Ordnance Survey of Britain has had a long-standing commitment to meeting the requirements of users and has attempted a number of approaches. In an admirably frank account of the organization, Seymour (1980) has described in detail Ordnance Survey's struggle to identify their users and to determine the ways in which their needs could be defined. It has been the experience of Ordnance Survey that better consultation can be secured only by transferring the initiative and much of the responsibility to users. In 1974 three such consultative committees were formed: the Royal Society Ordnance Survey Committee was sponsored by the Royal

Society to represent the interests of the scientific community, the Local Authorities' Ordnance Survey Committee was sponsored by the Association of County Councils, and the Standing Committee of Professional Map Users was sponsored by the Royal Institute of Chartered Surveyors (RICS). This last committee has representatives from RICS, the Royal Town Planning Institute, the Royal Institute of British Architects, the Institution of Civil Engineers, the Institution of Water Engineers, and the Institution of Municipal Engineers. In 1975, a fourth committee was added to cater to recreational interests under the sponsorship of the Central Council of Physical Recreation.

Special Interest Groups or Consultative Committees are essential if users are to play a role in the determination of information needs, standards, procedures, and policies. However, these groups also can be used to serve another purpose. Verbal information is often preferred by managers because it is timely i.e., by the time an item of information has been verified, standardized, classified, and codified for entry into a formal information system it may no longer be relevant. In addition, some information required for decision making defies explicit definition but must still be communicated. These groups can act as a catalyst stimulating the cross-flow of ideas which is so essential for managerial decision making. Ideas are difficult to define explicitly and store in a database to be

retrieved when required. Mintzberg (1975) has argued that because verbal information is in the brains of people, the strategic databases of organization are not in the memories of its computers but rather in the minds of its managers. These strategic databases must be linked together in some form of implicit information network.

5.4.2.5 Operation and Maintenance

The co-ordination activities described above can never be regarded as being completed. Management of land information is an evolutionary process requiring constant monitoring of progress and continual adjustment of goals and methodologies.

User requirements are not static but respond to changes in society and technology. The changing demand for information must be monitored. Permanent lines of communication must be provided between producers of land information and users. In addition to co-ordinating the demand and supply of information, they allow users to play an active part in quality control of products. There is a need for an ongoing education service. New users have to be educated so that they share the same consensus, while existing users have to be advised on new technology, new products, and new services. The effectiveness of the network must also be continually monitored to ensure that it provides the service for which it was intended.

On-going close liaison should be developed with other co-ordinating bodies such as the Alberta Land-Related Information Services Group and the Western Australia Land Information System Support Centre in order to stimulate the cross-flow of ideas and to learn from the experiences of others.

5.5 DESIGN AND DEVELOPMENT

Potential users of the proposed network should have a clear understanding of its capabilities and limitations if unrealistic expectations are to be avoided. An information network already exists in New Brunswick. If it did not, organizations could not exist as they do. It is then important to determine the advantages of a formal land information network compared with those of the existing ad hoc network.

It must be recognized that a computer-based information network will not automatically provide better information for decision making, will not necessary reduce labour costs, and will be expensive. Ackoff (1967) has argued that in most managerial decisions there are too many possibilities to expect experience, judgement, or intuition to provide good guesses, even with perfect information. Thus merely building larger databases or processing paperwork more quickly will not contribute significantly to better quality decision making. In addition, the implementation of

computer systems can cause problems beyond initial cost considerations. These include inflated life cycle costs, failure of expected benefits to be realized, and unexpected political consequences (Kraemer et al, 1981).

A formal network, particularly if computerization is involved, can result in an improvement in the technical quality of information, and in its accessibility to those who require it. Through the adoption of common standards the network can result in "value-added processing" of information by users. Co-ordinating activities can result in the identification of anomalies and the subsequent refinement of administrative procedures.

While the performance quality of computing is contingent on the tasks for which it is used, studies indicate that it is far more dependent on management policy i.e., how computing is implemented and the organizational context within which it is managed (Kraemer et al, 1981). Greater benefits will be derived from the network if wealth-creating applications are implemented instead of the wealth-transfer ones normally implemented. Kretzschmann (1980) has described the latter as being manipulative models, where the perceived "benefits" are at the expense of something or someone else, or even against the organization itself at a later point in time. The former are applications which contribute to the generation of real wealth, such as those that provide information to minimize resources expended per unit of production.

It appears that three types of problems must be solved when designing the network:

a) Political problems. Political and personal conflicts must be arbitrated before the network can be created. Even if the network does not require statutory or organizational change, it does represent change. Many land information empires have been built over the years. These empires are not easily dismantled.

b) Information requirement problems. Once organizational co-operation has been agreed to in principle, parties have to agree on information products, standards, and procedures.

c) Technical problems. The network infrastructure problems affecting the flow of information through the network have to be solved.

It is strongly recommended that the solutions to these problems be made as simple as possible. Simple solutions are in general cheaper, easier to implement, and less prone to failure than complex solutions. There is a prevalent perception that our society has passed from the certain, simple world of the past into the uncertain, complex world of the present, and that solutions to modern problems require complex, abstract, and formal modeling methodologies. (For example, see Batty, 1979). However, it has been suggested by Ackoff (1967) that many variables are required to model a phenomenon only when that phenomenon is not clearly understood.

Gschwind et al (1982) in their review of the Milwaukee land information system described the obstacles to the progress of the project as politics, apathy, personnel problems, lack of organized management leadership, bureaucratic labyrinth, personalities, equipment failure, equipment obsolesence, and lack of funds. It is interesting to note that of the nine "obstacles" only two are directly related to technology. This has been recognized by computer specialists such as Champine et al (1980) and Chorafas (1980) who have regarded the real problems when establishing and running computerized solutions to be of an organizational and psychological nature. Unless these problems are satifactorily addressed, the success of the network would appear to be limited.

The following sections describe some of the steps considered necessary for the development of a land information network.

5.5.1 Information Policy

Land information is just one member of a family of information services that are required by the end-user. Very few activities require only land information. Instead, users have to merge that information with other information products. Any paradigm for land information in New Brunswick should be developed within an overall paradigm for information management within the province.

The state of Western Australia has recognized the value of this concept and has attempted to group together similar computing requirements (e.g., land, accounting, justice-welfare, education and health) into functional units to introduce global efficiencies. Thus in addition to a Land Information System Support Centre, there is also a General Accounting System and a Justice Information System Support Centre. A Computing Policy Committee recommends policies on the use of technology in government agencies while the Treasury monitors and enforces the policies (Humphries, 1982).

Amongst the functions of central government agencies presently under review by the Office of Government Reform (1983) is that of Information and Communication including the aspects of public information dissemination, communications systems and technology, translating and interpreting, printing, and data processing (systems design and operation). A general policy regarding information could allow the co-ordination of activities of the Treasury Board, Supply and Services (Data Processing), New Brunswick Information Service, and the provincial Statistics Agency proposed in the Statistics Act, as well as those of information users.

Considering land information as a subset of the larger set of information within the province has benefits other than co-ordination; it also allows advantages to be taken

regarding economies of scale. Irrespective of whether information storage is centralized or decentralized in regions, the information will always be required elsewhere. Computer databases and communication systems can make it possible for users throughout the province to gain immediate access to official records of information.

Slow transmission rates could cause lengthy delays thus negating some of the advantages provided by on-line query facilities. It is unlikely that land information itself could justify the additional expenditure on faster transmission media. If, however, multi-department regional centres are established (a proposal under consideration by the Office of Government Reform), then the high volume of combined information generated e.g., through the use of electronic mail, may justify laying a faster medium.

A possible scenario is for departmental offices in Fredericton to be connected through a Local Area Network (LAN). Fibre optic cables could then link the LAN to the regional centres. External users could gain access to data anywhere in the province by dialing the regional centre number and having their requests routed from there. (Computer and telecommunications technology is discussed in more detail in Appendix IX).

It is recommended that the province adopt a policy encouraging the use of information resources to provide maximum economic and social benefit to the people of New

Brunswick. The policy would provide guidance concerning the technology of gathering and processing information, the design and development of information systems and networks, and the design and development of strategies for efficiently and effectively using the information. While the success of a land information network may not be impeded by the absence of a comprehensive information paradigm, it will almost certainly be enhanced by the presence of one.

5.5.2 Land Information Policy

The concept of a land information policy or philosophy is not new. The LRIS "philosophy" has been exported throughout Canada and around the world, and now apparently back to New Brunswick. A land information policy gives a uniform, integrated set of ideals against which decisions can be measured. As such, it should include the objectives of the network concept, the operating procedures, and the socio-economic constraints placed on the network. That is, both the means and ends are specified.

Seymour (1980) has described the development in the 1960s and 1970s of Ordnance Survey's philosophy of service to the user.

> Hitherto the convenience and the economy of (Ordnance Survey's) internal operations had dominated its attitude to short-term demands, but now the recognition of the value of maps in a changing world, not as an intermittent historical record, but as a means of providing information that had to be in time if it was to be of any use, carried with it the obligation to do everything possible to provide what was wanted when it was

> wanted. The realization that up to date information must flow into the hands of the user was perhaps the most important aspect of the reappraisal. (Seymour, 1980)

This philosophy resulted in the following concepts: maps were to be revised continuously and no longer on a 20 year cycle; information was to flow immediately and uninterruptedly from the field survey to the users through a service called the Supply of Unpublished Survey Information (SUSI); map users were to play a larger role in fashioning both policy and detailed products (Harley, 1975).

It is recommended that a Land Information Policy be adopted by the Province which will guide the collection, storage, retrieval, dissemination, and use of land information within the framework provided by the Information Resources Policy.

5.5.3 Land Information Management Team

A multi-disciplinary team of land information managers will be required to accept overall responsibility for directing and co-ordinating the design and development of the land information network. The team will have to consult with users from diverse backgrounds, and will have to act as negotiators and arbitrators in the attempt to develop a consensus on land information issues. They will have to provide lines of communication and authority. Once established, the land information network support centre will assume most of the responsibility of the team.

The vision, motivation, and leadership for land information systems often have been provided by one person. If the network is to survive, let alone prosper, the desired expertise must be developed by a team. That is, the network soon must become independent of any single personality.

5.5.4 Identification of Network Users

Users outside the immediate circle of proponents are often ignored. If the APSAMP programme could be faulted it was because it catered predominantly to the needs of surveyors. More recently, the Surveys and Mapping Committee established to advise LRIS as to the mapping requirements of New Brunswick is represented only by provincial government agencies. Despite this, there exists at present a spirit of sensitivity towards end users on the part of the provincial government. One of the terms of reference of the Office of Government Reform is to encourage public involvement in the setting of regional priorities and the development of provincial government programmes.

Attempts were made to contact over 80 provincial government boards, branches, commissions, corporations, and divisions for the recent Land Data and Map Inventory Study. Users of land information are not restricted to provincial government agencies. Local governments are also important users and the NB Association of Cities and the NB Association of Towns should be consulted. It is possible

that federal agencies such as Statistics Canada may purchase information generated through the network if it conforms to their criteria.

Users in the private sector must also be identified. The interests of the legal and surveying professions should be represented as they both generate and use land information. Other potential users include the Real Estate Council, the Federation of Agriculture, the Federation of Woodlot Owners, appraisers, property insurance agents, and cable TV stations.

Sale of information to the private sector could produce operating revenue for the network. In other parts of Canada private associations have made substantial investments of their own because government information was not easily available. For example, the Real Estate Board of Greater Vancouver (1983) has developed a database which includes cadastral information obtained from the British Columbia Assessment Authority. Registered members of the Board are able to conduct on-line searches of this information using the street address or tax number. Similarly, the Insurers Advisory Organization (IAO) of Canada has created their own database containing rating information on about 250 000 parcels (Belton, 1984). Information is gathered about construction features, building codes, occupancy, special hazards, geographic location, hydrant positions, and fire fighting and prevention facilities. Instead of information

flowing from the statutory or primary source, the reverse occurs. The IAO makes recommendations to municipalities for improvement of public fire protection facilities on the basis of its studies. The database is also used to determine property values for insurance purposes.

One of the problems faced in the Land Data and Map Inventory Study was that in some agencies the staff either did not know that they were using land information, or that they could be using it. If the network is to be successful, a large customer base must be established. The Land Information Management Team will have to raise the level of consciousness of land information among users.

5.5.5 Support and Involvement

a) Users. To be effective, the network must not only be designed for its users, it must be designed by its users. In 1967 Ackoff warned that managers who failed to invest their time in the design of information systems were not likely to use the systems well, and that in turn, the systems would abuse them. Empirical research some 14 years later (Kraemer et al, 1981) confirmed that cities experienced computing problems when their managers shied away from computing and left the management of this resource to data processors. However, when managers took an active role in determining policies and strategies for the

implementation of computing, cities achieved success without great problems.

b) Management/Executive. Organizations which have implemented information systems/networks e.g., Milwaukee (Gshwind et al, 1982) and Western Australia (Humphries, 1982), consultants (Reddin, 1977), and academic researchers (Ouchi, 1981; Kraemer et al, 1981) have all stressed the need to get the commitment of top management when implementing an information network type programme. The concept of a land information network implies change. It can threaten the existence of empires and prejudice the survival of pet projects. The network cannot succeed as long as there are those with influence who intend to thwart it.

c) Political. The provincial government is the major collector or producer of land information and any network will have to co-operate closely with it. Furthermore, because of the economic and demographic characteristics of New Brunswick, it is unlikely that the private sector will undertake any major initiative.

If there is to be a land information network in New Brunswick, sufficient political support must exist. Support must not be partisan but instead must come from all political parties. The network then must be

shown to benefit all citizens e.g., by removing inequities in the tax base, by saving time in determining ownership details, zoning and building restrictions, by improved flood forecasting, etc. Ayers (1982) has noted that decisions made by politicians for the expenditure of large sums of public funds on a land information network would be more forthcoming if they were bolstered by support from major industries and businesses, bankers and mortgage companies, lawyers, realtors, surveyors, news media, and others.

5.5.6 User Requirements

Land information is a service and not an end in itself. Collection of land information is a meaningless and costly exercise unless that information can serve some useful activity. A land information network represents a major investment of time and money. Accordingly, it should be treated as a business venture with the intention of optimizing profits, either tangible or intangible.

Optimization can occur only if the network provides products needed by users. As in business, there must be a sensitivity to the market place. One can have a product but if it meets no need it has no meaning. Determing users requirements may be a complex, difficult exercise. Nevertheless, Joselyn (1977) has argued that the

consideration should never be as to how much marketing research one can afford, but rather as to how much one can afford not to do.

Various approaches have been suggested for ascertaining user requirements. In the classic "top-down" approach, once organizational objectives have been identified, managers can establish their own needs (Lucianovic, 1973). Schoech and Schkade (1981) have argued that operations level personnel are the primary information users as information generated at the operations level/public interface is the primary input into an organization. Consequently, they have advocated that the "top-down" approach be combined with a "bottom-up" approach.

Scrimgeour (1979) has suggested that to prevent a system from becoming introverted, an "outside-in" approach should be tried instead of "top-down" or "inside-out" approaches. This approach requires a keen understanding of the problems facing users of land information products, and a determination of solutions. An outside-in design appears to have some merit. Sobel (1983) in his history of IBM noted that the company always started with its customer base and worked out from there; other electronic companies began with science and technology, and then having developed their products, sought potential buyers.

Ackoff (1967) has recommended several steps to assist in the determination of user requirements. Each type of

organizational decision required should be identified. Relationships between these decisions should be identified and flowcharted. This step reveals important decisions that are being made by default and identifies interdependent decisions that are being made independently. Information requirements can be determined from models constructed to represent the decision processes. Functions with the same or largely overlapping information requirements should be grouped together as single organizational tasks to minimize information flow.

At this stage, a number of activities and their information requirements will have been identified. Some of the information characteristics to be determined are:

a) source - where it originates and whether from a statutory or primary source.

b) users - who uses it, where, and how frequently.

c) application - why it is collected and how it is used.

d) collection - how it is generated.

e) volume - how much is generated.

f) maintenance - how frequently it is updated.

g) transmission - what is shared by users and by what means.

h) reference - how it is referenced with respect to location, time, and other information.

i) storage - how and where it is stored.

j) form - how it is presented.

k) importance - how valuable it is to users.

l) urgency - how quickly it is required.

m) accuracy - how reliable it is.

n) coverage - what area it is collected for.

o) aggregation - how small its spatial and temporal units are.

The LIM team will be faced with task of arbitrating between users in an attempt to establish common standards, and so minimize the extent of duplication of collection. This will not be an easy task. Data quality standards should be established to enable users to know with what confidence they can manipulate or merge data. Common coding and classification schemes will have to be developed.

Having identified tasks and information products, the next step is to assign priorities to them. Wealth-creating applications and those that are beneficial to a number of influential users should be among the applications implemented first. Highly visible applications should be implemented to raise the profile of the network. Early success, even if small, will instill confidence in the network's investors. The decision flow analysis is instrumental in determining what groups of applications should be implemented together. Potential benefits probably will be reduced if only portion of an integrated, sequential group of applications is implemented.

This process of consultation will provide the basis for the establishement of special interest groups and consultative committees.

5.5.7 Technical Developments

Information collection, storage, retrieval, and dissemination techniques must be developed. Computer and telecommunications technology promise significant advantages over traditional manual methods and the network should be designed to ultimately make full use of these benefits.

Several general requirements for a computer network have been identified by Champine et al (1980) and Chorafas (1980):

a) Reliability, or the provision of satisfactory network performance for each type of utilization. The network should be operational when required and should provide for survival and recovery from failures and errors, and for data integrity.

b) Availability, or the provision of information at the required places in the required formats. The network should allow the attachment of non-compatable hosts, terminals, and communication systems, and should be able to be connected to other networks.

c) Responsiveness, or the ease and efficiency with which operations are maintained. Cost-effective response times acceptable in the operating environment must be provided.

d) Security, or the support of functions necessary for protection. Access to information should be provided only to authorized users.

e) User Interface, or the ease with which the network can be used without extensive training. Users should be independent of the operations of the network, so allowing each user to be implemented separately.

f) Accountability, or the assurance of correct accounting procedures.

In addition, the computer network should offload the communication burden from the connected host computers and so free them for application processing.

The technical characteristics of the network have to be designed around the flow of information between users. This flow is affected by the geographical distribution of users and their organizational approach to land information management. In general, the location of information (which affects the subsequent flow) should be aimed at reducing communication costs by minimizing the number of communication lines as well as the number of alien (non-local) references. However, it is merely speculative to talk of centralized or distributed databases until the volume of data, the frequency of reference, and the geographical distribution of users are known.

A number of design issues have to be considered. These include the location of nodes, data, directories, processing

and storage applications; the communications topology and bandwidth; the extent of load sharing; the role of intelligent terminals and microcomputers and whether access should be provided by batch, remote batch, or interactive methods; the security precautions required. This requires an analysis of file parameters (e.g., number of copies, size, query rate, update rate, and file dependencies), transmission characteristics (e.g., retrieval time, link capacity, message queueing, message length, message priority, and message arrival time), node characteristics (e.g., processor speed, main storage size, mass storage size, and program execution), and costs (e.g., storage costs, communication costs, query and update costs for nodes and communication systems, and reconfiguration costs). (Champine et al, 1980).

These design issues interact with one another. For example, increasing local mass storage has the effect of reducing the need for non-local access and so reduces the bandwidth required for the communication system. Future needs also have to be considered e.g., whether increased data loads at computer sites would be better managed by many micros, a few minis, or one mainframe computer (Chorafas, 1980).

Once user requirements have been identified, the complete network can be designed at the logical level and then mapped onto available hardware and software products. Procedures

and programs must be written to implement desired functions. The identified hardware and software products must be obtained and installed and then the network must be brought to an operational status (Champine et al, 1980).

5.5.8 Operation and Maintenance

The responsibilities of the LIM design team are then handed over to the policy co-ordination body, the network support centre, the research co-ordination body, and the special interest groups and consultative committees. Continuity is expected as the members of the LIM team should continue to participate actively in these co-ordinating proceedings.

Chapter 6

SUMMARY AND CONCLUSIONS

> To attain knowledge, add things every day. To attain wisdom, remove things every day.
> (Lao Tzu, fifth century B.C.)

6.1 LAND INFORMATION MANAGEMENT IN NEW BRUNSWICK

Significant progress has been made by New Brunswick through investment in programmes such as those of APSAMP and LRIS. For example, for the first time in almost two centuries of the region's history as a province it is possible to locate the existence of a parcel in relation to surrounding parcels, and to easily ascertain its area, location, and owner's name and address. LRIS products also have been well received by civic administrators, utility and infrastructure managers, and natural resource specialists.

Despite advances made in the past two decades, major problems still exist. Land information is often inaccessible to users in remote locations because it is recorded on paper medium. Duplication of information processing sometimes occurs because differences in standards and classifications preclude information collected by one organization from being used by others. Land information required by some is unavailable at times either because the

information has not been collected, or because it is regarded as confidential by the organization collecting it. Technical problems such as those caused by incompatible hardware and software impede the sharing of land information, while political problems constrain the flow of information. The present economic restraint may possibly retard future land information management developments.

To a great extent, the problems facing land information managers result from lack of co-ordination. Responsibilities of organizations involved with managing land information are not clearly defined. Activities of land information users are not co-ordinated. The provincial Surveys and Mapping Committee represents only provincial government agencies. Other interests, such as those of local authorities and professional institutes, are ignored.

A major reason for lack of co-ordination between users, and hence their requirements, is lack of direction. There is no statement of intent or clear comprehensive policy regarding land information in New Brunswick. Consequently, the management of land information remains in a state of confusion.

6.2 SPECIFIC RECOMMENDATIONS

Several specific recommendations are proposed in order to assist land information managers. These recommendations are summarized below.

a) That a photograph library be established in New Brunswick to make aerial photographs more easily available.

b) That mapping requirements of users be determined through the establishment of map user groups and that map production be rationalized.

c) That LRIS parcels and parcel identifiers be used whenever possible.

d) That agency administrative regions be comprised of integral numbers of a basic unit such as the enumeration area.

e) That the Land Titles Act and the Survey Act be introduced throughout the province in order that control over the quality of cadastral documents can be enforced.

f) That standard classification schemes for land information be developed and adopted.

g) That the extent of duplication of land-related information activities be determined and that methods for minimizing the cost of duplication be developed.

h) That the functions of the Survey Office, Registry Office, Assessment Branch, and Community Planning Branch be co-ordinated.

i) That the adoption of recommended hardware and software standards be promoted.

j) That the responsibilities of organizations involved with management of land information be clearly defined.

6.3 RECOMMENDATIONS FOR A LAND INFORMATION NETWORK

A land information network is proposed to assist with the management of land information. Through the network, individual land information systems can be co-ordinated.

Network co-ordination must take place in several areas. A Policy Co-ordination Body will be required to ensure that objectives of policies, programmes, and legislation impacting on land information are not conflicting. Through a network support centre, the collection, processing, and dissemination of land information can be co-ordinated. Such a centre will have to deal with financial, technical, and social constraints on the management of land information. Requirements of network users have to be co-ordinated through the establishment of Special Interest Groups and Consultative Committees. Research on land information and its management must be co-ordinated within the general framework of the network by a Research Co-ordinating Body.

Three types of problems must be overcome when designing the network.

a) Political problems. A network can threaten the existence of land information empires and prejudice the survival of pet projects. It cannot succeed as long as there are those with influence who intend to thwart it.

b) Information requirement problems. Products, standards, procedures, and classifications have to be agreed upon.

c) Technical problems. Network infrastructure problems affecting the flow of information have to be solved.

It is recommended that New Brunswick adopt a policy encouraging the use of information resources to provide maximum economic and social benefits to the people of New Brunswick. It is further recommended that a land information policy be adopted which will guide the collection, storage, retrieval, dissemination, and use of land information within the framework provided by the Information Resources Policy.

As many potential users as possible must be identified to ensure that the network has a large customer base. Support and involvement of users, of management/executive, and of politicians must be sought in the design and implementation of the network.

The requirements of users regarding the nature, frequency, and volume of information to be shared must be identified. These requirements must be translated into

common standards, procedures, and classification schemes. The technical characteristics of the land information network must be designed around the flow of information between users.

Finally, arrangements have to be made for the implementation of the network, and for its subsequent operation, maintenance, and monitoring.

New Brunswick already has many of the elements necessary for a land information network. Large scale quality mapping and a comprehensive cadastral database are virtually complete. An extensive computer and telecommunications network is in place. Many of those actively involved with land information are aware of the problems and have expressed a desire to improve the situation. A wealth of expertise exists within the province, and the Government of New Brunswick presently is open to recommendations and proposals regarding change. However, little advantage presently can be taken of the sophisticated technology because the land information community has failed to clearly identify what information is required by whom, and how frequently. Fundamental policy issues concerning control of land information in the network and responsibility for co-ordinating activities of network users have not yet been adequately addressed.

It remains to be seen as to whether or not the land information community in New Brunswick is prepared to accept

the challenge facing it and to assume responsibility for satisfactorily addressing issues which are crucial to effective management of land information in the province.

REFERENCES

Ackoff, R.L. (1967). "Management Misinformation Systems". Management Science, Vol 14, No 4, pp. 147-156.

Adler, J. (1981). "The Browning of America". Newsweek, February 23, pp. 26-37.

Alonso, W. (1971). "Beyond the Interdisciplinary Approach to Planning". Journal of American Institute of Planners, May, pp. 169-173. (quoted by Lang R. and A. Armour (1980). p 286).

Ayers, E.H. (1982). "Developing Necessary Political Support For a Modern Land Records System". Proceedings. Urban and Regional Information Systems Association, pp. 345-351.

Barristers Society (1984). Barristers Society of New Brunswick. Personal communication.

Batty, M. (1979). "On Planning Processes". In Resources and Planning, B. Goodall and A. Larky (Eds.) Pergamon Press, Oxford.

Bell, D. (1973). The Coming of Post Industrial Society. Basic Books, New York.

Belton, E. (1984). "Computer Provides Rapid Information Required to Set Property Rates". Globe and Mail, May 18.

Bernhard, A.S., R.A. Gschwind and W.E. Huxhold (1983). "Developing Policy Management Information Systems: The Milwaukee Experience". Proceedings. Urban and Regional Information Systems Association, pp. 225-234.

Berry, J.F. and C.M. Cook (1982). "Managing Knowledge as a Corporate Resource". In Information Management in Public Administration, F.W. Horton and D.A. Marchant (Eds). Information Resources Press, Arlington, Virginia, pp. 478-498.

Boisvenue, A. and R. Parenteau (1982). "The Geocoding System in Canada and Its Area Master File". Proceedings. Urban and Regional Information Systems Association, pp. 226-232.

Bright, D. and K. Pryor (1982). "1981 Census of Canada". Proceedings. Urban and Regional Information Systems Association, pp. 43-56.

Brookes, C.H.P., P.J. Grouse, D.R. Jeffery and M.J. Lawrence (1982). Information System Design. Prentice Hall of Australia, Sydney.

Burch, J.G., F.R. Strater and G. Grudnitski (1983). Information Systems: Theory and Practice. John Wiley and Sons, New York.

Burkitt, D. (1968). "A Children's Cancer Dependent on Climatic Factors". In Environments of Man, J. Bresler (Ed.). Addison Wesley Publishing Company, New York.

Canadian Council on Surveying and Mapping (1982). "National Standards for the Exchange of Digital Topographic Data". Energy, Mines and Resources Canada, Ottawa.

Champine, G.A., R.D. Coop and R.C. Heinselman (1980). Distributed Computer Systems. North Holland Publishing Company, Amsterdam.

Chorafas, D.N. (1980). Computer Networks for Distributed Information Systems. Petrocelli Books, New York.

Churchman, C.W. (1975). "What is Information for Policy Making?". In Knowledge for Action, M. Kochen (Ed.). Academic Press, New York.

Clapp, J. and B. Niemann (1977). "North American Land Information Systems: An Overview with Recommendations". Proceedings. FIG, Stockholm.

Classen, R. (1977). "An Introduction to Geographic Information Systems". Computers and Industrial Engineering, Vol 1, pp 131-138.

Compuserve (1983). Executive Information Service. Compuserve, Columbus, Ohio.

CMP (1973). "Canadian-Maritime Agreement on Natural Resources and Land Registration". Council of Maritime Premiers.

CMP (1980). "Estimates of Revenue and Expenditure". Council of Maritime Premiers.

CMP (1983). "Estimates of Revenue and Expenditure". Council of Maritime Premiers.

Cox, K.R., D.R. Reynolds and S. Pokkan (1974). Locational Approaches to Power and Conflict. John Wiley and Sons, New York.

Crane, D. (1972). Invisible Colleges: Diffusion of Knowledege in Scientific Communities. University of Chicago Press, Chicago.

Dangermond, J. (1983). "Some Trends in the Evolution of GIS Technology". Draft copy.

Dangermond, J. (1983). "Software Components Commonly Used in Geographic Information Systems". Draft copy.

de Jonquieres, G. (1984). "Japanese microchip feat partly achieved by drinking". Globe and Mail, May 18.

Department of Commerce and Development (1984). New Brunswick Government. Telephonic communication.

de Solla Price, D. (1975). "Comment in Information Networks for Human Transformation". In Information for Action, M. Kochen (Ed.). Academic Press, New York.

Dialog (1983). Information Services Incorporated. Dialog, Palo Alto, California.

Dillon, E. (Ed.)(1984). Abbreviated Proceedings of Land Information Systems 1990, No. 5. Department of Surveying Engineering, University of New Brunswick, Fredericton.

Dillon, M. (1983). (Department of Agriculture and Rural Development). Personal communication.

Downs, A. (1967). "A Realistic Look at the Final Payoffs from Urban Data Systems". Public Administration Review, Vol XXVII, pp. 204-210.

Engels, F. (1845). The Condition of the Working Class in England, translated from German by Granada Publishing Ltd, London, 1969.

Environment Canada (1980). "Land Use in Canada". Environment Canada, Ottawa.

Environment Canada (1982). "The Identification of Impacts of Federal Programs on Land Use". Environment Canada, Ottawa.

Ewald, W.R. (1975). Information, Perception and Regional Policy. National Science Foundation, Washington D.C.

Fanton, J.E. (1976). "Keynote Address". Proceedings. Land Records Symposium, University of Maine, Orono. pp. 3-4.

Finlay, R. (1984). (Records Management Division, New Brunswick Provincial Archives). Personal communication.

Forrester, J.W. (1969). "Overlooked Reasons for Our Social Troubles". Fortune. December, pp. 191-192.

Furubotn, E. and S. Pejovich (1972). "Property Rights and Economic Theory: A Survey of Recent Literature". Journal of Economic Literature, 10, pp. 1137-1162.

Galbraith, J.K. (1973). Economics and the Public Purpose. Mentor Books, Boston.

Gilbert, A.L. (1982). "Data Sharing as Politics: Policy, Tools and Access". Proceedings. Urban and Regional Information Systems Association, pp. 353-357.

Green, D. (1977). To Colonize Eden. Gordon and Cremonesi Publishers, London.

Gshwind, R.A., R.K. Allen and W.E. Huxhold (1982). "Creating MAGIC - an evaluation in retrospect of the Milwaukee Automated Geographic and Cartographic System". Proceedings. Urban and Regional Information Systems Association, pp. 282-302.

Hamilton, A.C., D.W. Palmer, and R.J. Gaudet (1983). "Procedures and Unit Costs for Property Mapping". Proceedings. Second South East Asia Survey Congress, Hong Kong.

Harley, J.B. (1975). Ordnance Survey Maps. Ordnance Survey, Southampton.

Hartle, D.G. (1979). Public Policy Decision Making and Regulation. Institute for Research on Public Policy, Toronto.

Hayek, F.A. (1944). The Road to Serfdom. University of Chicago Press, Chicago.

Hayes, E.E. and J.E. Fauquier (1983). "Organizing the Cleveland Land Data System around Microcomputers". Proceedings. Urban and Regional Information Systems Association, pp. 194-208.

Horton, F.W. (1979). Information Resource Management: Concept and Cases. Association for Systems Management, Cleveland.

Humphries, B. (1982). "Western Australian Land Information System Reference Guide". Land Information System Support Centre, Perth.

Ingram, H.M. (1973). "Information Channels and Environmental Decision Making". Natural Resources Journal, Vol 13 No 1, pp. 150-169.

Isserman, A.M. and M.A. Brown (1980). "Community Need: Its Measurement and Incidence". Regional Science Association, Urbana Illinois, Vol 45, pp. 139-158.

Jaffe, M. (1983). "Decision Support Systems for Manufacturing". Infosystems, Vol 30 No 7, pp. 112-114.

Joselyn, R.W. (1977). Designing the Marketing Research Project. Petrocelli Books, New York.

Kettinger, W. (1980). "Information Resource Management in Local Government: Direction for the 1980s". Proceedings. Urban and Regional Information Systems Association, pp. 24-40.

Kraemer, K.L., W.H. Dutton and A. Northrop (1981). The Management of Information Systems. Columbia University Press, New York.

Kretzschmann, H.M. (1980). "Computer Models and Intuition". Proceedings. 82 AGM Canadian Institute of Mining and Metallurgy, Toronto.

LRIS (1977). "Five Year Joint DREE/LRIS Evaluation". Land Registration and Information Service, Fredericton.

Land Use Policy Task Force (1982). "Land Use Policy - A Positive Approach". Report for New Brunswick Cabinet Committee on Economic Development, Fredericton.

Lang, R. and A. Armour (1980). Environmental Planning Resource Book. Environment Canada, Ottawa.

Larsen, B. et al (1978). Land Records: The Cost to the Citizen. Department of Administration, Madison, Wisconsin.

Larsen, H.K. (1971). "An Economic Study of Atlantic Provinces Control Survey, Mapping, Land Titles and Data Bank Program". Report for the Atlantic Provinces Surveys and Mapping Program, Fredericton.

Leger, P.C. (1983). "The Cabinet Committee System of Policy Making and Resource Allocation in the Government of New Brunswick". Canadian Public Administration, Spring, pp. 16-35.

Lincoln Institute of Land Policy (1982). "National Survey of Opinions of Attributes of Land Data System". Lincoln Institute Monograph 82-4, Cambridge, Massachusetts.

Lucianovic, W.M. (1973). "Managerial Information Needs: Missing Ingredients in Urban Information Systems Design". Proceedings. Urban and Regional Information Systems Association, pp. 270-282.

Luttbeg, N.R. and H. Ziegler (1966). "Attitude Consensus and Conflict in an Interest Group". American Political Science Review, Vol 60, pp. 655-666.

Mabbs-Zeno, C.C. (1982). "Taxonomy of Land Value Concepts". In Land - Something of Value, G. Wunderlich (Ed.). Lincoln Institute of Land Policy, Massachusetts.

Marshall, H. (1965). "Politics and Efficiency in Water Development". Water Research, 294. (quoted by Ingram, H (1973) p 155).

McLaughlin, J.D. (1980). "The Development of Multipurpose Land Information Systems: The Challenge for the Next Decade". In Planning and Engineering Interface with Modernized Land Data Systems, M.G. Warren (Ed.). American Society of Civil Engineers, Denver, Colorado.

McLaughlin, J.D. (1981). "Education for an Expanded Surveying Profession: A Canadian Perspective". Proceedings. Commonwealth Association of Surveying and Land Economy, Ottawa.

McLaughlin, J.D. (1982). "Notes and Material on Land Information Management". Dept of Surveying Engineering, University of New Brunswick.

McLaughlin, J.D. and G. Wunderlich (1982). "Concepts and Approaches to Land Information Management: A North American Perspective". Proceedings. FIG XVIII, Sofia, Bulgaria.

Mensch, G. (1979). Stalemate in Technolgy. Ballinger Publishing Company, Cambridge, Massachusetts.

Milton, L.E. and J.M. Milton (1983). "Elements of Reliability Modelling for Environmental Planning Systems". Proceedings. Urban and Regional Information Systems Association, pp. 11-26.

Mintzberg, H. (1975). "The Manager's Job: Folklore or Fact". Harvard Business Review, July-August, pp. 49-55.

Mooers, C.N. (1960). "Mooers' Law or why some retrieval systems are used and others are not". American Documentation, Vol XI No 3, p ii.

Morrison, W. (1984). (Assessment Branch, Department of Municipal Affairs). Personal communication.

Moyer, D.D. (1980). "A Multipurpose Land Data System: Content and Capabilities". Proceedings. Urban and Regional Information Systems Association, pp. 185-196.

Moyer, D.D. (1980). "Property, Information and Economics: A Foundation for Land Information Systems Evaluation". GeoProcessing, Vol 1, pp. 275-295.

MRMS (1984). "Report to New Brunswick Surveys and Mapping Committee on Land Data and Map Inventory Study". Maritime Resource Management Service, Amherst.

New Brunswick Government (1984). "Main Estimates 1984-85". New Brunswick Government, Fredericton.

NRC (1983). Procedures and Standards for a Multipurpose Cadastre. National Research Council, Washington D.C.

Nora, S. and A. Minc (1978). The Computerization of Society, MIT Press, Massachusetts.

Office of Government Reform (1983). "Overview of the Government Reform Process". New Brunswick Government, Fredericton.

Ontario Real Estate Association (1979). Losing Ground. Ontaria Real Estate Association, London, Ontario.

Oppenheim, A.N. (1966). Questionaire Design and Attitude Measurement. Basic Books, New York.

Ouchi, W.G. (1981). Theory Z. Avon Books, New York.

Palmer, D. and I.J. Guo (Eds.)(1983). Abbreviated Proceedings of Land Information Systems 1990, No. 4. Department of Surveying Engineering, University of New Brunswick, Fredericton.

Parks, A (1926). "The Urban Community as a Spatial Pattern and a Moral Order". In The Urban Community, E.W. Burgess (Ed.). University of Chicago Press, Chicago. (quoted by Cox, K.R., D.R. Reynolds and S. Pokkan, 1974).

Porat, M. (1977). The Information Economy: Definition and Measurement. Department of Commerce, Washington, D.C.

Portner, J. and B. Niemann (1982). "The Social Component of Problems in Land Records". Proceedings. International Symposium on Land Information at the Local Level, University of Maine, Orono. pp. 153-162.

Portner, J. and B. Niemann (1983). "Belief Differences among Land Records Officials and Users". Proceedings. Urban and Rural Information Systems Association, pp. 121-135.

Real Estate Board of Greater Vancouver (1983). "The Vandat System". Real Estate Board of Greater Vancouver, Vancouver.

Reddin, W.J. (1977). "Confessions of an Organizational Change Agent". Group and Organization Studies, Vol 2, No 1, pp. 33-41.

Riley, N.W. and K.B. Sturgeon (1979). "Manipulating Geo-coded Data". South African Survey Journal, December, pp. 9-23.

Roberts, W. (1959). "Address to Canadian Institute of Surveyors". LRIS collected papers, Fredericton.

Roberts, W. (1966). "Preliminary Report on a Proposed Land Titles and Data Bank". LRIS collected papers, Fredericton.

Salerno, L.M. (1981). "Keeping Informed". Harvard Business Review, Nov-Dec, pp. 8-24.

Schoech, R. and L. Schkade (1981). "Human Service Workers as the Primary Information System Users". Proceedings. Urban and Regional Information Systems Association, pp. 71-81.

Scrimgeour, J. (1979). "A Survey and Tabulation of Computer Science and Process Control Courses Offered in Canadian Universities". Canadian Pulp and Paper Association. (Quoted by Kretzschmann, H.M., 1980).

Select Committee of the New Brunswick Legislature (1977). "Third Report on Rural Life and Land Use". New Brunswick Government, Fredericton.

Seymour, W.A. (1980). A History of the Ordnance Survey. W.A. Seymour (Ed.). Wm Dawson and Sons Ltd, Folkestone, Kent.

Shannon, C.E. (1948). "A Mathematical Theory of Communication". Bell System of Technical Journal, Vol 27, pp. 632-656.

Simpson, L.R. (1982). "Progress by LRIS in the Maritimes". Proceedings. Second Users Conference on Land Information Systems, Edmonton, pp. 9-11.

Sinton, D.F. (1978). "The Inherent Structure of Information as a Constraint to Analysis". First Int Advanced Study Symposium of Topological Data, Harvard Papers on GIS, Harvard.

Smith, W. (1977). "The Preservation of Information". In Surveys for Development, J.J. Nossin (Ed.). Elsevier Publishing Company, Amsterdam.

Sobel, R. (1983). IBM - Colossus in Transition. Bantam Books, New York.

Soemarwoto, O. (1977). "Ecological Aspects of Development". In Surveys for Development, J.J. Nossin (Ed.). Elsevier Publishing Company, Amsterdam.

Statistics Canada (1981). "1981 Census of Canada". Statistics Canada, Ottawa.

Swank, R.J. (1982). "Data Sharing through ADLIB: An Organizational Model". Proceedings. Urban and Regional Information Systems Association, pp. 358-362.

Swanson, D. (1969). Public Hearing and Attitude Perception Studies. Energy, Mines and Resources Canada, Ottawa.

Toomey, G. (1984). "The Rural University". International Development Research Centre Report, Vol 12 No 4, pp. 22-23.

Trenholm, W.R. and P. Wood (1974). "Land Use Planning Information Project". Department of Agriculture and Rural Development, Fredericton.

United Nations (1979). Studies in the Integration of Social Statistics, Series F No 24, United Nations, New York.

United Nations (1979). Improving Social Statistics in Developing Countries, Series F No 25, United Nations, New York.

United Nations (1979). The Development of Integrated Data Bases, Series F No 27, United Nations, New York.

Vollebergh, J.J.A. (1981). "Microelectronics and the Evolution of Society". Microprocessing and Microprogramming, January.

Weeks, E.P. (1977). "The Project Cycle - An Overview". The Project Cycle, Ed. I. McAllister and E. Langille. Institute of Public Affairs, Dalhousie University, pp. 5-11.

White, F.M. (1984). (Head, Dept of Community Health and Epidemiology, Dalhousie University). Personal communication.

Williams, A.E. (1981). "The Community Information System". Proceedings. Urban and Regional Information Systems Association, pp. 97-107.

Witzling, L.P. (1980). "The Users of Information Systems". Proceedings. Urban and Regional Information Systems Association, pp. 66-77.

Wolpert, A. (1970). "Departures from the Usual Environment in Locational Analysis". Annals of Association of American Geographers, Vol 60, pp. 220-229. (quoted by Cox K.R., D.R. Reynolds and S. Pokkan, 1974).

Wunderlich, G. (1973). Who Owns America?. Draft copy.

Wunderlich, G. (1974). "Property Rights and Information" Annals of Political and Social Science.

Ziemann, H. (1978). "Spatial Partitioning in Land Data Management Systems". First Int Advanced Study Symposium on Topological Data, Harvard Papers on GIS, Harvard.

Appendix I

MAP SCALES USED BY NEW BRUNSWICK AGENCIES

Scale		Agency (Producer or User)
1:5 000 000	-	Environment (Water Resources)
1:4 000 000	-	Statistics Canada
1:2 000 000	-	Statistics Canada
1:1 000 000	-	Municipal Affairs (Assessment)
	-	Agriculture (Plant Industry)
	-	Environment Canada (land capability)
1:500 000	-	Natural Resources (Forest Extension)
	-	(Forest Management)
	-	(Mineral Resources)
	-	(Crown Lands)
	-	Agriculture (Land Planning)
	-	Municipal Affairs (Assessment)
	-	Health
	-	Commerce and Development
	-	Education
	-	Tourism (Field Services)
	-	Environment (Water Resources)

Scale		Agency (Producer or User)
1:500 000 (cont)	-	Transportation (Planning)
	-	NB Power
	-	Environment Canada (Inland Waters)
	-	Statistics Canada
1:250 000	-	Energy, Mines and Resources Canada
	-	Municipal Affairs (Assessment)
	-	Natural Resources (Mineral Resources)
	-	Environment (Water Resources)
	-	Environment Canada
	-	Agriculture Canada
	-	Statistics Canada
1:200 000	-	Municipal Affairs (Assessment)
1:190 080	-	Natural Resources (Crown Lands)
1:126 720	-	Natural Resources (Crown Lands)
	-	(Mineral Resources)
	-	Agriculture (Plant Industry)
	-	NB Power
1:96 040	-	Agriculture (Plant Industry)
1:63 360	-	Natural Resources (Crown Lands)
	-	Agriculture (Plant Industry)

Scale		Agency (Producer or User)
1:50 000	-	Energy, Mines and Resources Canada
	-	Municipal Affairs (Community Planning)
	-	Historical and Cultural Resources
	-	Natural Resources (Crown Lands)
	-	(Mineral Resources)
	-	Agriculture (Plant Industry)
	-	Environment (Environmental Services)
	-	LRIS (control monuments)
	-	Environment Canada
	-	Statistics Canada
1:40 000	-	Transportation (Planning)
1:31 680	-	Natural Resources (Crown Lands)
	-	Education
	-	Municipal Affairs (Community Planning)
	-	Agriculture (Plant Industry)
1:25 000	-	Energy, Mines and Resources Canada
	-	Environment
	-	Restigouche District Planning Commission
	-	Belledune Planning Commission
1:20 000	-	Natural Resources (Forest Management)
	-	(Mineral Resources)

Scale		Agency (Producer or User)
1:15 840	-	Municipal Affairs (Assessment)
	-	(Community Planning)
1:12 500	-	Natural Resources (Forest Management)
1:12 000	-	Agriculture (Plant Industry)
1:10 000	-	LRIS
	-	Municipal Affairs (Assessment)
	-	(Community Planning)
	-	(Emergency Measures)
	-	Agriculture (Plant Industry)
	-	(Planning and Development)
	-	Transportation (Planning)
	-	Environment (Water Resources)
	-	Natural Resources (Crown Lands)
	-	Restigouche District Planning Commission
1:5 000	-	LRIS
(1:4 800)	-	Transportation (Planning)
	-	Municipal Affairs (Assessment)
	-	Natural Resources (Crown Lands)
	-	Environment (Water Resources)
	-	NB Power
	-	Restigouche District Planning Commission
	-	Madawaska Planning Commission

Scale		Agency (Producer or User)
1:2 000	-	LRIS
(1:2 400)	-	Municipal Affairs (Assessment)
	-	Natural Resources (Crown Lands)
	-	Environment (Water Resources)
	-	Restigouche District Planning Commission
	-	Madawaska Planning Commission
1:1 000	-	LRIS
(1:1 200)	-	Municipal Affairs (Assessment)
	-	Natural Resources (Crown Lands)
	-	Environment (Water Resources)
	-	Agriculture (Engineering)
	-	Chaleure Regional Industrial Commission

Appendix II

ENVIRONMENTAL INFORMATION

Producer	User	Product
Agriculture Canada	Agriculture (Potato)	Agric Production
	Environment (Services)	Land Capability Soils
Agriculture (Planning)	Agriculture (Potato)	Agric Production
	Municipal Affairs (Assessment)	Agric Production
	District Planning Commissions	Land Capability
	NB Power	Agric Production
	Environment Canada (CLDS)	Agric Production
	Statistics Canada	Agric Production
Agriculture (Plant Industry)	Agriculture (Planning)	Land Capability
	Agriculture (Engineering)	Land Capability
	Agriculture (Farm Adjustment)	Soils
	Agriculture (Potato)	Agric Production Land Use Soils
	Environment (Services)	Land Capability Soils
	District Planning Commissions	Land Capability Soils

Producer	User	Product
Agriculture (Plant Industry) (Cont)	Natural Resources (Forest Ext)	Land Capability Soils Vegetation
	Transportation (Highway)	Soils
	NB Power	Land Capability Vegetation
Canadian Forest Service	Natural Resources (Forest Ext)	Soils Vegetation
Environment Canada	Agriculture (Engineering)	Surface Water
	Agriculture (Planning)	Land Capability
	Agriculture (Potato)	Climate
	Energy Secretariat	Climate
	Environment (Services)	Land Capability
	Environment (Water Resources)	Climate
	Municipal Affairs (EMO)	Climate
	Tourism (Field Section)	Climate
	Tourism (Planning)	Climate Land Capability
	NB Power	Climate Land Capability
	District Planning Commissions	Climate

Producer	User	Product
Environment (Services)	Commerce and Development	Environmental
	Environment (Pollution)	Surface Water
	Health	Vegetation Contamination
	Municipal Affairs	Municipal Environment
	Natural Resources (Crown Lds)	Pesticide Control
	NB Power	Environmental
	Public	Acid Rain Pesticide Control Surface Water Vegetation Contamination
Environment (Pollution)	Environment (Services) Municipalities	Air Quality Sanitary Waste

Producer	User	Product
Environment (Water Resources)	Agriculture (Engineering)	Ground Water Surface Water Water Well Logs
	Agriculture (Potato)	Water Supply
	Environment (Pollution)	Ground Water Surface Water Water Well Logs
	Fisheries	Ground Water Hydrographic Surface Water Water Supply
	Health	Ground Water Water Supply
	Energy Secretariat	Ground Water Hydrology Surface Water
	Municipal Affairs (Planning)	Surface Water Water Well Logs
	Municipal Affairs (EMO)	Flood Hazard Surface Water Water Well Logs
	Municipal Affairs (Engg)	Ground Water

Producer	User	Product
Environment (Water Resources) (Cont)	Natural Resources (Crown Lds)	Ground Water Water Well Logs
	District Planning Commissions	Ground Water Hydrology Surface Water Water Supply
	NB Power	Flood Hazard Ground Water Hydrology Surface Water
	Commerce and Development	Ground Water
Natural Resources (Geological Surveys)	Municipal Affairs (Planning)	Geology
	District Planning Commission	Geology Geophysics
	NB Power	Geology Geophysics Minerals
	NB Research and Prod. Council	Minerals
	Public	Geology Geochemistry Geophysics Minerals

Producer	User	Product
Natural Resources (Fish and Wildlife)	Commerce and Development	Environmental
	Environmental (Services)	Ecology Wildlife
	Fisheries	Wildlife
	Municipal Affairs (Planning)	Ecology Environmental Wildlife
	District Planning Commissions	Ecology Environmental Wildlife
	NB Power	Ecology Environmental Wildlife
Natural Resources (Forest Mgmt)	Agriculture (Farm Adjustment)	Forestry
	Commerce and Development	Forestry
	Environmental (Services)	Forestry
	Municipal Affairs (Assessment)	Forestry
	Municipal Affairs (EMO)	Forest Protection
	Natural Resources (Forest Ext)	Forestry
	Natural Resources (For Utiliz)	Stand Type and Roads
	Natural Resources (Crown Lds)	Forestry
	Tourism (Field Services)	Forestry
	District Planning Commissions	Forestry Vegetation

Producer	User	Product
Natural Resources (Forest Mgmt) (Cont)	NB Forest Products Commission	Forestry Production Facilities
	NB Power	Forestry
Natural Resources (Forest Util.)	Energy Secretariat	Forestry Production
	Natural Resources (Forest Ext)	Forestry Production
Natural Resources (Mineral Resources)	Commerce and Development	Coal Minerals
	District Planning Commissions	Minerals
	NB Power	Coal Minerals
	NB Research and Prod Council	Coal
Statistics Canada	Agriculture (Planning)	Agric Production
	Agriculture (Potato)	Agric Production
	Natural Resources (Forest Ext)	Forestry Production

Appendix III

INFRASTRUCTURE AND IMPROVEMENTS INFORMATION

Producer	User	Product
Agriculture Canada	Agriculture (Potato)	Land Use
	Agriculture (Regional)	Land Use
Agriculture (Planning)	Agriculture (Engineering)	Land Use
	Agriculture (Plant Industry)	Land Use
	Agriculture (Regional)	Land Use
Education	Municipal Affairs (Planning)	Infrastructure
Environment Canada	Agriculture (Potato)	Land Use
LRIS	Commerce and Development	Road Infrastructure
	NB Forest Products Commision	
	NB Power	
MRMS	Agriculture (Potato)	Land Use
Municipal Affairs (Planning)	Health	Housing Public Facilities
	Tourism (Field Service)	Land Use
	Tourism (Planning)	Land Use
	District Planning Commissions	Land Use

Producer	User	Product
Municipal Affairs (Municpal Services)	Health	Public Facilities
	Tourism (Planning)	Recreational Facilities
	Transportation (Planning)	Municipal Utilities
	District Planning Commissions	Public and Recreational Facilities
NB Housing	Energy Secretariat	Housing
NB Power	Commerce and Development	Communication Network and Infrastructure
	Municipal Affairs (EMO)	
	Municipal Affairs (Planning)	
	Natural Resouces (Crown Lds)	
	Transportation (Planning)	
	NB Tel	
NB Tel	Municipal Affairs (EMO)	Communications Network and Infrastructure
	NB Power	
Statistics Canada	Agriculture (Potato)	Land Use
	Energy Secretariat	Housing
	District Planning Commissions	Housing
Tourism (Planning)	Commerce and Development	Road Network
	NB Forest Products Commission	Road Network
	NB Power	Recreational Facilities

Producer	User	Product
Transport-ation (Planning)	Education	Designated Hwys
	Fisheries	Designated Hwys
	Health	Designated Hwys
	Justice (Services)	Designated Hwys
	Justice (Registry)	Designated Hwys
	LRIS	Designated Hwys
	Municipal Affairs (EMO)	Designated Hwys
	Municipal Affairs (Plan)	Designated Hwys
	District Planning Comm.	Designated Hwys
	Municipalities	Designated Hwys Prov-Mun. Roads
	NB Power	Designated Hwys Prov-Mun. Roads
	NB Tel	Designated Hwys Prov-Mun. Roads
	RCMP	Designated Hwys Prov-Mun. Roads
	Supply and Services	Designated Hwys Prov-Mun. Roads

Appendix IV

CADASTRAL INFORMATION

Producer	User	Product
Appraisers	Commerce and Development	Land Appraisal
	Tourism (Field Services)	Land Apparisal
	Transportation (ROW)	Land Appraisal
Finance	Commerce and Development	Land Tax
	Natural Resources (Crown Lds)	Land Tax
	Supply and Services	Land Tax
	Tourism (Field Service)	Land Tax
	NB Forest Products Commission	Land Tax
	Municipalities	Land Tax
Justice (Registry)	Agriculture (Farm Adjustment)	Land Ownership Legal Plans Boundaries Subdivision Plans
	Commerce and Development	Land Ownership Land Sales
	Community Improvement Corp.	Land Ownership Licences
	Fisheries	Legal Plans

Producer	User	Product
Justice (Registry) (Cont)	LRIS	Land Ownership Land Sales Legal Plans Boundaries Subdivision Plans
	Municipal Affairs (Assessment)	Land Ownership Land Sales Legal Plans Boundaries Subdivision Plans
	Municipal Affairs (Engineering)	Legal Plan Subdivision Plans
	Municipal Affairs (Planning)	Legal Plans Subdivision Plans
	Natural Resources (Crown Lds)	Land Ownership Land Sales Legal Plans Boundaries Subdivision Plans

Producer	User	Product
Justice (Registry) (Cont)	Supply and Services	Land Ownership Legal Plans Boundaries Subdivision Plans
	Tourism (Field Service)	Land Ownership Legal Plans Licences Boundaries Subdivision Approval
	District Planning Commissions	Subdivision Approval
	NB Power	Land Ownership
	Public	All
LRIS	Agriculture (Planning)	Boundaries
	Agriculture (Farm Adjustment)	Boundaries
	Commerce and Development	Boundaries Land Ownership
	Municipal Affairs (Assessment)	Boundaries Land Sales
	Natural Resources (Crown Lds)	Boundaries Land Ownership Land Sales
	Natural Resources (Forest Mgmt)	Boundaries

Producer	User	Product
LRIS (Cont)	Supply and Services	Boundaries Land Ownership
	Tourism (Field Service)	Boundaries Land Ownership
	Transportation (Planning)	Boundaries Land Ownership
	NB Power	Boundaries Land Ownership
	Public	Boundaries Land Ownership
Municipal Affairs (Assess-ment)	Agriculture (Engineering)	Boundaries
	Agriculture (Farm Adjustment)	Land Assessment
	Agriculture	Land Ownership Land Sales
	Agriculture (Planning)	Land Assessment Land Ownership Subdivision Plans Boundaries
	Commerce and Development	Boundaries Land Assessment Land Sales Subdivision Plans
	Community Improvement Corp.	Land Assessment

Producer	User	Product
Municipal Affairs (Assessment) (Cont)	Environment (Services)	Subdivision Plans
	Environment (Water Resources)	Land Assessment Subdivision Plans
	Finance	Land Assessment
	Natural Resources (Crown Lds)	Land Assessment Land Sales Land Ownership Boundaries
	Supply and Services	Boundaries Land Ownership
	Tourism (Field Services)	Boundaries Land Assessment Land Ownership Land Sales
	NB Forest Products Commission	Boundaries Land Ownership
	NB Power	Land Assessment Land Ownership
	District Planning Commissions	Boundaries
	Municipalities	Land Assessment

Producer	User	Product
Municipal Affairs (Planning)	Commerce and Development	Zoning
	Environment (Services)	Subdivision Approval
	Health	Subdivision Approval Zoning
	Justice (Registry)	Subdivision Approval Zoning
	Municipal Affairs (Engg)	Zoning
	Tourism (Field Services)	Subdivision Approval Zoning
	Tourism (Planning)	Zoning
	District Planning Commissions	Zoning
	Municipalities	Zoning
Natural Resources (Crown Lands)	Agriculture (Farm Adjustment)	Boundaries
	Agriculture (Planning)	Boundaries
	Community Improvement Corp.	Appraisals
	Education	Boundaries
	LRIS	Boundaries Land Ownership
	Municipal Affairs (Assessment)	Boundaries
	Municipal Affairs (Services)	Boundaries
	Natural Resources (Forest Mgmt)	Boundaries

Producer	User	Product
Natural Resources (Crown Lds) (Cont)	Natural Resources (For Utiliz)	Boundaries Land Ownership
	Tourism (Field Services)	Boundaries Land Ownership
	Transportation (Planning)	Boundaries
	NB Power	Boundaries
Natural Resources (Forest Mgmt)	Natural Resources (Crown Lds)	Timber Licences
	NB Forest Products Commission	Timber Licences
Natural Resources (Mineral)	Natural Resources (Geological)	Mineral Claims
New Brunswick Land Surveyors	Agriculture (Farm Adjustment)	Boundaries Legal Plans Subdivision Plans
	Commerce and Development	Boundaries Land Ownership Legal Plans Subdivision Plans
	Health	Subdivision Plans
	Municipal Affairs (Assessment)	Boundaries Legal Plans Subdivision Plans

Producer	User	Product
New Brunswick Land Surveyors (Cont)	Municipal Affairs (Planning)	Subdivision Plans
	Natural Resources (Crown Lds)	Subdivision Plans
	Tourism (Field Service)	Boundaries Legal Plans Subdivision Plans
	Transportation (Planning)	Subdivision Plans
	Transportation (Right of Way)	Boundaries Legal Plans Subdivision Plans
NB Power	Transportation (Planning)	Legal Plans Subdivision Plans
Supply and Services	Fisheries	Land Ownership
	Natural Resources	Land Ownership
	Tourism (Field Services)	Land Ownership
Tourism (Field Services)	Natural Resources (Crown Lds)	Licences
Transport-ation (Planning)	Natural Resources (Crown Lds)	Legal Plans
	Tourism (Field Services)	Land Ownership
	Transportation (Planning)	Legal Plans
	NB Power	Legal Plans

Appendix V

SOCIO-ECONOMIC INFORMATION

Producer	User	Product
Education	Municipal Affairs (EMO)	Education
	Health	School Dist.
	Natural Resources (Forest Ext)	School Dist.
	District Planning Commissions	Education
Health	Education	Dental Health
	Municipal Affairs (EMO)	Health
Historical & Cultural Resources	District Planning Commissions	Historical and
	NB Power	Cultural sites
Labour & Manpower	Health	Labour

Producer	User	Product
Statistics Canada	Commerce and Development	Demographic Economic Labour Social
	Education	Demographic
	Municipal Affairs (EMO)	Demographic Health
	Municipal Affairs (Planning)	Economic Social
	Tourism (Planning)	Demographic Labour
	District Planning Commissions	Demographic Labour

Appendix VI

LEGISLATION AFFECTING LAND INFORMATION

VI.1 PROVINCIAL LEGISLATION

Agricultural Rehabilitation and Development Act

Air Space Act

Assessment Act

Clean Air Environment Act

Commerce and Development Act

Community Improvement Corporation Act

Community Planning Act

Condominium Property Act

Crown Lands and Forests Act

Drainage of Farm Lands Act

Easements Act

Ecological Reserves Act

Elections Act

Electric Power Act

Emergency Measures Act

Expropriation Act

Farm Adjustment Act

Farm Products and Marketing Agencies Act

Farm Products Marketing Act

Fences Act

Fish and Wildlife Act

Fisheries Act

Flood and Storm Drainage Act

Forest Fires Act

Forest Products Act

Health Act

Highways Act

Historic Sites Protection Act

Industrial Development and Expansion Act

Land Titles Act

Mechanics' Lien Act

Mining Act

Municipalities Act

Municipalities Thoroughfare Easements Act

National Parks Act

New Brunswick Housing Act

Oil and Natural Gas Act

Ownership of Minerals Act

Parks Act

Pesticides Control Act

Pipeline Act

Plant Diseases Act

Potato Disease Eradication Act

Property Act

Public Utilities Act

Quarriable Substance Act

Quieting of Titles Act

Real Property Tax Act

Real Property Transfer Tax Act

Registry Act

Research and Productivity Council Act

Reserved Roads Act

Residential Property Tax Relief Act

Right to Information Act

Sale of Lands Publication Act

Schools Act

Statistics Act

Telephone Companies Act

Territorial Division Act

Tourism Development Act

Trespass Act

Unsightly Premises Act

Water Act

Waters Storage Act

VI.2 FEDERAL LEGISLATION

Access to Information Act

Aeronautics Act

Agricultural Products Board Act

Agricultural Products Co-operative Marketing Act

Agricultural Rehabilitation and Development Act

Agricultural Stabilization Act

Canada Elections Act

Canada Land Surveys Act

Canadian National - Canadian Pacific Act

Canada Water Act

Canada Wildlife Act

Central Mortgage and Housing Corporation Act

Electorial Boundaries Readjustment Act

Escheats Act

Experimental Farm Stations Act

Expropriation Act

Farm Credit Act

Farm Improvement Loans Act

Financial Administration Act

Fisheries Act

Fisheries Development Act

Forestry Development and Research Act

Historical Sites and Monuments Act

Indian Act

Industrial Research and Development Incentive Act

International Boundary Commission Act

Migratory Birds Convention Act

Municipal Grants Act

National Housing Act

National Parks Act

Privacy Act

Statistics Act

Surplus Crown Assets Act

TransCanada Highway Act

Veteran Lands Act

Appendix VII

ASSESSMENT BRANCH DATABASE

In addition to the information listed below, the Assessment Branch's Property Assessment and Taxation System (PATS) also records other information such as Journal and General Ledger functions.

VII.1 GENERAL PROPERTY INFORMATION

Owner's name, address, and postal code

Special Owner ID (150 categories including CMHC, Irving and non-residents of Canada)

Registry transaction date and type (58 categories)

Document, book, and page numbers

Sales price

Assessment at transfer

Previous owner

Sales analysis indicator (7 categories)

Tax number

Property location and description

County

LRIS map sheet

External Identifiers (15 categories)

Type of land (9 catgories)

Land use (9 categories)

Type of property (142 categories)

Type of Land holding (11 categories)

Land value

Classification for Assessment (6 categories)

Estimated lot size, and source of information (7 categories)

VII.2 BUILDING INFORMATION

Building number and description

Building class (134 categories)

Age

Replacement cost

Net condition

Depreciated value

Value per building

Storey height (15 categories)

Number of residential units

VII.3 CONSTRUCTION INFORMATION

Date of commencement

Date of completion

Actual cost, and source of information (5 categories)

Type of builder

Description

VII.4 RENTAL INFORMATION

Source of information (5 categories)

Landlord expenses

(heat, electricity, repairs, water, sewers, janitorial, snow-removal, garbage removal, management, advertising, etc)

Total rent collected

Economic rent

Rental unit type (14 categories)

Lease termination

Services (9 categories)

VII.5 ASSESSMENT INFORMATION

Assessment Region

Assessor

Status (8 categories)

Year first assessed

Year terminated, and reason (8 categories)

Partial assessment (not yet complete)

Current and future assessment

Residential and non-residential net assessment

Appeal against assessed value

Property damage, date, assessed damage and insurance payments

Neighbourhood code description

Market adjustment group, description, factor, and year

VII.6 TAXATION INFORMATION

Taxing authority name and type (9 categories)

Taxing authority sub-unit name and description

School district

Tax levy year

Tax class (9 categories)

Tax credit (9 categories)

Tax credit flag (3 categories)

Exemptions

Residential and non-residential school, municipal and provincial taxes

Tax certificates

FLIP contingent amount due