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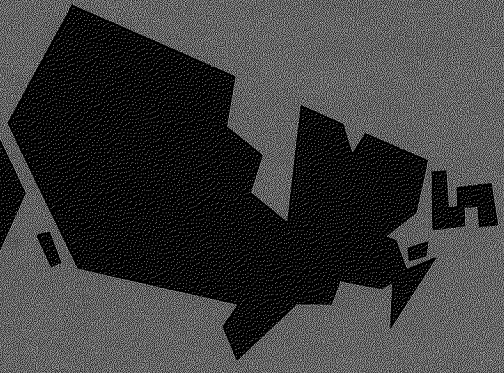
CANADA LAND INVENTORY



THE CANADA LAND INVENTORY IN PERSPECTIVE

by

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THE CANADA LAND INVENTORY IN PERSPECTIVE

The Canada Land Inventory (C.L.I.) was initiated through a federal-provincial agreement under the Agricultural Rehabilitation and Development Act (A.R.D.A.) of June 1961[1] and remains one of the most far-reaching national programs for land and resource planning ever to be undertaken. Indeed, while the main elements of this federally sponsored initiative are now in their terminal phases, the full impact of the C.L.I. on the way Canadians perceive something so fundamentally a part of our national self-image as natural resources will not be known for many years.

Even without a clear picture of the future, however, it is not too soon to review the objectives and structure of the original program, and to examine the effect it has had on public policy and institutions for resource management in at least one province that seems to have responded fully to the opportunity presented by the C.L.I.

BACKGROUND

The need for the Canada Land Inventory evolved as a result of increasing regional economic disparity, wide-spread improper land use, and a variety of emerging resource and land-use conflicts in all of the provinces. These problems had grown increasingly acute since the Second

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[1] Amended to Agricultural and Rural Development Act, 12 May 1966.

World War, aggravated by the rapid "urbanization" of Canadian society. By 1957 the Senate of Canada Special Committee on Land Use had stressed the need for an inventory of land according to its suitability for specified uses. Further impetus was provided by the "Resources for Tomorrow" Conference of 1961 (Resource for Tomorrow, Background Papers and Proceedings) which focussed on regional approaches to economic development, and stressed the interdependence of the use, development and conservation of renewable resources. The recommendations of this conference suggested that a comprehensive land capability survey was a necessary prerequisite for the sound future management of Canada's land resources, and the evolution of policy for economic and social development in all regions of the country.

All these factors assisted the passage of A.R.D.A. (1961) which authorized the Minister of Agriculture to enter into agreements with the provinces to engage in rural resource management and research projects. Since a major goal of A.R.D.A. was to facilitate adjustment in land use in order to improve social and economic conditions in depressed areas, the potential benefit of a nation-wide land capability inventory was again clearly underscored. Accordingly, various meetings and seminars, involving soil survey organizations and other relevant disciplines, were held to develop and refine terms of reference, objectives, and organizational form for such a project. These activities culminated on October 3, 1963, when the Government of Canada officially approved undertaking the Canada Land Inventory under the A.R.D.A. administration. Finally, formal federal-provincial consideration of the inventory occurred

in November 1963 when the A.R.D.A. administration submitted a detailed proposal to the Canadian Council of Resource Ministers. The C.C.R.M. approved the proposal in principle and recommended that the inventory proceed on the basis of working agreements between individual provinces and A.R.D.A. The C.L.I. has therefore been an active and influential element in Canadian resource management for thirteen years, surviving several reorganizational shifts among federal departments. As the inventory enters its final phases in 1976 the remaining federal responsibilities are administered by the Department of the Environment.

ORGANIZATION AND STRUCTURE OF THE INVENTORY

A complete description of the inventory program has been published in the C.L.I. Report Series (various dates) now available from Environment Canada. We will therefore only summarize these considerations here.

Overall Goals and Objectives

In the spirit of A.R.D.A., the overall goal of the C.L.I. was to facilitate the orderly adjustment from inappropriate uses of land to more rational ones, reflecting the transition of the national economy from a rural-agricultural to an urban-industrial base. A necessary first step seemed to be a comprehensive inventory of lands in the settled portions of rural Canada, and in adjacent land areas affecting income and employment opportunities of rural residents.

The general objectives therefore, were:

1) to survey and classify all such lands according to their inherent productive capability for use in agriculture, forestry, recreation and wildlife production (ungulates and waterfowl),

2) to map the approximate extent and location of each class, and

3) to encourage the use of these basic data in planning.

A system for classifying and mapping the capabilities of waterbodies for sports fish was also developed for use by resource managers, though no maps for this sector were to be published. Finally, mapping data for "present land use" and socio-economic classifications were to be generated. This latter capability would enable planners to relate socio-economic factors and historic land-use patterns to the physical capability data for a given region, an essential requirement for any comprehensive planning process. Indeed, with the subsequent development of biophysical inventory techniques and an operational computerized "geo-information system" for data manipulation, the overall C.L.I. program comprised at least theoretically, a formidable set of new tools to achieve the goal of rationalizing resource and regional planning in Canada.

Organization and Administrative Arrangements

As previously noted, the C.L.I. was undertaken as a co-operative federal-provincial research project, and clearly reflects the rather inelegant structuring of the Canadian federal system respecting resource matters. Whereas the central government might recognize an issue of great national significance in land and resource management, it has little direct jurisdiction over those same resources. Thus Ottawa was

in effect reduced to providing both the financial lubrication required to persuade the provinces to do something, and the co-ordination necessary to ensure an acceptable level of uniformity for the program across the country. The following summarizes the basic division of responsibilities as agreed to in principle:

The Government of Canada agreed to:

1) sponsor and co-ordinate the planning and development of the inventory, and undertake publication of the results on a national basis at a map scale of 1:250,000;

2) provide technical assistance to the provinces and finance all additional expenditures of the provinces in the conduct of the inventory;

3) provide interprovincial co-ordination of survey methods and data presentation;

4) provide a system for data processing and map compilation.

The provincial governments agreed to:

1) establish a Provincial Inventory Committee to provide technical and administrative co-ordination for the inventory within the province;

2) undertake the planning, development, and conduct of the inventory;

3) undertake publication of results of the inventory which may be of particular interest to the province;

4) provide the federal government with all inventory data required for compilation and publication of results on a national basis.

The basic agreement was extended in 1967 to enable the provinces to initiate pilot land-use planning projects utilizing C.L.I. data, with federal government support.

If the C.L.I. would seem an ambitious undertaking in the best of political worlds, under the British North America Act and subsequent federal-provincial resource agreements, it becomes a daring and formidable task!

The C.L.I. Resource Sectors

Obviously, it was necessary to develop specific objectives, evaluation criteria, etc., for each resource sector to be considered. These can be summarized as follows:

Agriculture

The objective of the agricultural land inventory was to provide a soils and climate classification system useful to planners in the identification of the full range of highly productive to sub-marginal agricultural lands. Such data would be useful in determining areas of potential future agricultural activity, in facilitating the consolidation of sub-marginal farming operations into viable units, and in delineating areas where urban-industrial land uses might occur with minimal impact on agricultural production.

Forestry

In the forestry sector, objectives and criteria were directed toward providing a classification system rating the "potential (productive)

capability of the land under indigenous (native) tree species growing at full stocking and under good management". This system was therefore designed to aid in the identification of lands where the intensive management practices associated with commercial forestry would be justified.

Recreation

The recreational land classification program was intended to provide " a reliable estimate of the quality, quantity, type and distribution of outdoor recreation resources within settled parts of Canada ..." The data were intended for use in the formulation of recreation policy and plans, and in facilitating inter-sector comparisons for integrated resource management and planning.

Wildlife

While "wildlife constitutes a separate resource with its own values, decisions on land use will generally be made in the context of recreational requirements". Thus, the separate classification systems for ungulates and waterfowl were designed to indicate the range and quality of habitats and land requirements of wildlife at different stages of their annual and life cycles. This information is intended to be useful in the management of the wildlife resource through the identification of areas essential for production, and by inference, suitable areas for viewing, photographing, and harvesting.

C.L.I. Land-Use Capability Mapping

Lands assessed by the C.L.I. were evaluated, classified, and mapped separately for each of the resource sectors under consideration. Mapping data were compiled from soil surveys, maps and other published sources, aerial photographs, and from field studies in samples plots on the ground. Seven classes of land ranging from very high (Class 1) to virtually zero capability (Class 7) were recognized for each sector.

For the agricultural, forestry and wildlife components, the classes are based on the degree of limitation (biological, climatic, physical) of the resource base affecting productivity in the sector under consideration. For example, in the agricultural sector, Class 1 land would have no significant limitations for the production of a wide variety of field crops, while Class 7 lands have such severe limitations that there is no capability for arable culture, or even for permanent pasture. Sub-classes in these sectors (except in Class 1 where there are no sub-classes) are identified by specifying in code symbols the major types of limitations for each class.

In the recreational sector, on the other hand, classes were established on the basis of the intensity (quantity) of outdoor recreational use which might be sustained per unit area, i.e., on the basis of positive resource attributes. Here, sub-classes indicate the specific features of the resource providing opportunity for recreational use. This structural inconsistency and the implicit difference in perspective

between resource analysts in the recreation sector relative to the other components is worth emphasizing here. It contributes to the difficulty in making trade-offs and other comparisons in resource allocation among sectors, discussed more fully in a later section.

The product of the capability mapping program consists of five map sheets for each geographic area covered by the inventory (one for each resource sector including separate maps for ungulates and waterfowl), and is intended to provide a basic physical input to the regional land-use planning process on a broad scale or "reconnaissance" level. Special considerations sometimes required differences in format between provinces. For example, because of British Columbia's highly variable topography, maps in the Forestry and Agriculture Sectors for that province are published at a scale of 1:125,000 by special agreement with Ottawa (compared to 1:250,000 for other sectors and areas). While these scales represent the minimum requirement for data compilation, it should be pointed out that soils, biophysical and landform information for some areas are stored at a much finer scale in the provincial C.L.I. data base files.

The Biophysical Land Classification System

Early in the C.L.I. program the need was perceived for land inventory and classification systems based on and displaying the biological and physical (geoclimatic) features of the land resource, without reference to any particular land use. Some sort of descriptive analysis of the resource base is of course implicit in the C.L.I. land

capability classification system, but the necessity of an explicit, systematic, base-line inventory for classification purposes emerged only after the capability mapping program was underway in different parts of the country.

Accordingly, a national biophysical land classification program was designed to "differentiate and classify ecologically significant segments of the land surface rapidly and at a small scale" (reconnaissance level) (Canada Dept. of Fisheries and Forestry, Guidelines for Biophysical Land Classification, 1969). This inventory is intended to serve as the ecological basis for capability rating (classification) for future management of land for agriculture, forestry, recreation, wildlife, and water yields. The major advantage of such an approach then, is that properly executed, it can provide the basis of capability ratings for a limited range of related foreseeable land uses. Of course, where very different competing uses are contemplated, separate but integrated biophysical inventories may be required for the same area to assure that the full range of relevant (eco)systems components are included.

Significantly, unlike sector-specific capability classifications (i.e., those designed for specific resource uses) a biophysical inventory is relatively value-free, and less subject to the vagaries of changing social and economic values.

The Canada Geographic Information System (C.G.I.S.)

C.L.I. planners recognized early that the program would generate massive amounts of physical resource, and socio-economic data. The development of a versatile computerized data storage, processing, and

retrieval system was therefore regarded as a critical component of the inventory program. Unfortunately, the technological capabilities required for the system envisaged by the C.L.I. were still embryonic in the early 1960s and only after nearly 10 years of forced evolution did the C.G.I.S. finally become operational in 1972.

The objectives of the C.G.I.S. were to design a system that would accept data from both maps and statistical tables for efficient storage and manipulation. Paramount was the capability to display comparisons between sectors or between geographic regions, and to correlate socio-economic with biophysical or other stored data. The system was also required to provide output in both map or statistical form (C.L.I. 1970, Report #1).

Accordingly, the present C.G.I.S. is capable of manipulating any data with characteristics similar to those of the C.L.I., i.e., map data composed of bounded areas (any closed polygons) and a description for each polygon /see Canada (undated) for details/. If required, the system can store data for points and lines and interface the latter with that for areas. The C.G.I.S. accepts map data at scales of 1:370 to $1:10^6$ in the Universal Transverse Mercator (U.T.M.) projection. Output maps are generated at any scale in U.T.M.

As required, the system is capable of comparing and correlating data from stored coverages within areas through a program called Overlay. Thus data from one set of polygons (e.g. agricultural capability) may be superimposed on information drawn from another (e.g. census tracts), and corresponding cross-tabulations produced. Up to eight coverages may be overlaid simultaneously, and additional "layers" can be generated (if

necessary!) by superimposing subsequent overlay operations. Users may also manipulate the overlay data base in various other ways - for example, maps of any combination of the variables included in a given operation, may be produced.

In general, output from the C.G.I.S. system can be in map, tabular, or digital form depending on the requirements of the user. Additional operational flexibility is achieved through "interactive retrieval" of maps and tables whereby the latter are displayed by Cathode Ray Tube (C.R.T.) at a keyboard entry terminal "while you wait".

Clearly even from the above brief description, the C.G.I.S. now provides the scope and flexibility for a wide range of potential applications in resource and land-use planning. In this light, the early technical and manpower difficulties are particularly unfortunate. Such consequent problems as high costs, excessive rates of map (input) rejection and initial output format not sensitive to the needs of planners disenchanted many potential users (including provincial C.L.I. units!) in the 1960's, and long before the C.G.I.S. could be considered operational. Thus while the system is being applied to an increasingly diverse range of problems, and efforts continue to improve accessibility, and cost, the C.G.I.S. has not yet completely re-established its credibility.

One positive effect of all this is that some provincial C.L.I. units have developed their own computerized data handling systems that naturally reflect the special requirements of the individual provinces. Since these have evolved in close communication with the C.G.I.S., it is not too

optimistic to hope that we will some day have an integrated geo-information system (or at least complementary components) operating at both the national and provincial levels.

MERITS AND LIMITATIONS: A CRITIQUE

Obviously the introduction of the C.L.I. was not without its complications, technical and otherwise. Indeed problems experienced by some individual users have led to serious questions regarding the value of the inventory as a tool in land-use planning. The following paragraphs examine a few of the weaknesses inherent in the C.L.I. but also show that some of the difficulty is external to the inventory.

Orientation and Focus

The economic impetus and the particular land uses chosen as foci for C.L.I. purposes, clearly reflect the socio-economic values of 1960's middle-class Canada in transition. Agriculture and forestry were the dominant economic uses of land in the rural parts of Canada. The decision to undertake a recreational land inventory however, was a response to the rising and increasingly significant demand for various forms of outdoor recreation by a rapidly urbanizing North American population. Given the economic bias in other sectors, it is hardly surprising that the C.L.I. wildlife sector focusses on ungulates (deer, moose, etc.) and waterfowl (ducks and geese) - species that support a flourishing continent-wide sporting industry.

While this narrow focus on contemporary economic values in land use is understandable in the framework of A.R.D.A., it does pose some questions concerning the long-term utility and relevance of much of the data. For example, it is not at all certain that the cubic-foot volume of wood that can be harvested each year from a forested area will always represent its chief value to society, or even its chief economic value. Certainly other valid criteria for forest classification can be identified - even purely aesthetic values are beginning to have a significant impact on forest management practices elsewhere (see U.S. Forest Service 1973; Litton 1974; Yeomans 1976).

On the positive side, the subsequent development and refinement of more nearly value-free biophysical inventory techniques as a result of the C.L.I. provides a means to extend capability classification to additional uses, as needs and values change. In this light, the existing capability maps might be viewed as preliminary results or "pilot" studies in themselves. They do provide some immediately useful data for specific resource sectors, but more important in the long run, they demonstrate a flexible methodology for future use and adaptation in integrated resource management.

Accuracy, Relativity and Precision

Certain reservations about the C.L.I. revolve around the "accuracy" of the mapped classifications. In this context it must be remembered that each classification was single purpose in objective with a separate set of evaluation criteria, and that the rigour with which the latter

could be applied varies from sector to sector. This is further complicated by the fact that different analysts were involved in preparation of the inventory, between sectors and between geographic areas within provinces. In short, there may be disagreement between analysts (or later, between analyst and user!) over particular class ratings, or the relative position of a whole classification on the scale of one to seven.

The question of relativity in particular acquires another dimension when we consider a problem inherent in the C.L.I.'s goal of a national classification system. Because of the extremes of biophysical variability between provinces, the full range of which is encompassed within the seven classes for each sector, some provinces may have only a narrow spectrum of capability classes for some uses. In this case, the C.L.I. classification though technically "correct" may not reflect local perceptions or values. In Manitoba for example, the capability ratings for forestry and recreation on the C.L.I. national scale were found to be too low to account fairly for local importance, when these sectors were weighted relative to other uses. This difficulty was overcome by "rescaling" the forestry and recreation classifications for the purposes of Manitoba's pilot land-use planning project (W.K. Harper, 1972, pers. comm.).

Problems of subjective differences in interpretation and relative ratings are sometimes confused with the separate question of precision or map scale; for example, the failure of a specific site to conform to the C.L.I. classification. In this context it should be recognized that

C.L.I. maps are generalized presentations at the "reconnaissance" level and not intended for site specific planning. Use of C.L.I. data at other scales may therefore require creative adaptation by planners.

In Ontario for example, C.L.I./Ontario Land Inventory (O.L.I.) data have been widely used at the provincial, regional and local area levels. /An important factor here has been the incorporation of that province's pilot land-use planning project into its on-going regional development program (see Ontaric 1970)./ Ontario planners have found the C.L.I. map data too detailed for broad scale plans and therefore further generalize the information into three aggregate classes for that purpose. At the other extreme more detailed information than that provided by C.L.I. must be acquired from the O.L.I. for local area planning (R. K. Burgar 1976, pers. comm.).

A final consideration related to "accuracy" is not so readily circumvented. The fact is that C.L.I. maps do contain "absolute" errors as the inevitable result of human frailty in the interpretation of limited data, such as aerial photographs. This has undoubtedly added to the frustration experienced by some users already overwhelmed with the complexities and inherent weaknesses of the system. Unfortunately not much can be done about "real" errors on published maps except to point out that such mistakes do occur and must be taken into account in the planning process. In some cases where this has proved a significant problem, the inventory analyses are being repeated with improved techniques.

Compatibility of C.L.I. Classifications

Assuming that problems of accuracy and precision are understood and in hand, an important question remains concerning the "comparability" of ratings between sectors. Consider for example that capability classes in forestry are established along a simple linear productivity scale in which the "best" lands are unambiguously those with the greatest economic potential. Classes in recreation on the other hand, are based on potential "intensity" (density) of use, and while this may constitute a valid "production" index, few people would argue that highest density recreation is necessarily the "best" recreation. Indeed, since "outdoor recreation" includes so many activities, it is obvious that the "best" lands for certain of these (land extensive activities such as hiking), will receive the lowest capability ratings!

Even without this apparent contradiction, we would still have no wholly satisfactory mechanism for reducing "equal" class ratings in the different sectors to some common "social value" scale for comparison purposes. The C.L.I. system by itself simply does not account for the interrelationships or trade-offs, environmental or social, among the different resource sectors. Each capability map can therefore be described as an independent, static representation of an only more or less objective assessment of the land resource for a single purpose at a particular point in time. In short, the difficult task of interpretations and allocation in the light of contemporary socio-economic conditions is quite properly left to the user-planner. In some cases, as between forestry and agriculture, conflict resolution might be

somewhat simplified by reduction of the parallel classifications to a common economic scale. But what about comparisons involving recreation where pricing is difficult and the ratings prejudicial to certain activities? Is a superb hiking trail in a Class 4 recreation area really of less social value than the forestry Class 2 rating for the same area would suggest? Clearly this should not be our automatic conclusion - other factors such as the relative scarcity of a particular resource in a particular area must also be considered. In short, planners must understand fully the criteria developed for each sector, and the differences between sectors if valid comparisons and trade-offs are to be made (between sectors) in the land allocation process. If necessary they should contact provincial resource analysis personnel for assistance in interpreting the biophysical data base in the light of associated socio-economic data. Only in this way can the capability classification be integrated constructively into the comprehensive planning process.

"Inherent Capability" and Comprehensive Planning

The C.L.I. capability ratings are based on inherent potential for economic production. External market factors such as present access or location have been explicitly excluded from consideration in land classification. This assumption of "perfect market conditions" has become the focus of certain criticism much of which illustrates a misunderstanding of the way C.L.I. data were intended to be used.

Consider, for example, a system in which class ratings in any sector did reflect accessibility at the time field work was completed.

Under these conditions published maps would quickly become obsolete as new roads were constructed or other modes of access become available. Such maps would clearly be of limited use in determining subsequent patterns of access and land use. With the existing classification system on the other hand, access and location factors can later be superimposed using an overlay technique. In this way inherent capability (which is static so long as criteria remain valid) and external socio-economic factors (which are constantly changing) can be considered together in decisions regarding the programming of future access and land use. Ideally the map data would remain valid in the long term, while the socio-economic "overlays" continued to evolve.

A related criticism is that the C.L.I. capability maps are simply invalid as a basis for planning on any scale. This clearly is the case if the capability ratings are the only input used for land-use prescription. It is equally clear, however, that the capability ratings were never intended to be the only input. The C.L.I. had other sectors concerned with present land use and socio-economic land classification, and computerized geo-information systems have been developed to enable planners to inter-relate these various kinds of data. Unfortunately the technical and other difficulties involving socio-economic data and the computer information system resulted in the uneven development of the inventory program as a whole. The early availability of certain capability maps led to their misuse in broad-scale planning decisions without adequate consideration of other equally important factors. As understanding of the C.L.I. and

experience with the type of approach the system has developed increase, it should be possible for planners to avoid this type of error in the future.

THE BRITISH COLUMBIA EXPERIENCE

The preceding discussion outlined the general structure of the C.L.I. and touched upon some of the problems that emerged in the development of the inventory, and subsequent application of the data. In summary there are some real conceptual and structural weaknesses that require creative responses by planners, and might be avoided were it feasible to redesign the system today. On the other hand, much frustration with the C.L.I. can be traced to the unrealistic expectations of users and the failure of many to familiarize themselves with the objectives, conceptual basis, and appropriate uses of the data. In any event, it is a major contention of this paper that even with all these drawbacks the C.L.I. has had a significant and permanent beneficial impact on land and resource management in Canada.

Since it isn't possible here to render a province by province account, we will illustrate this premise through an examination of the evolution of the program and its "spin-offs" in a particular province. This will illustrate how the general features of the C.L.I. equally applicable elsewhere, have actually been used, and at the same time demonstrate some of the extensions and adaptations of the basic approach that emerge in response to peculiar circumstances.

I have chosen British Columbia for this analysis partly because of ready access to information and the openness of the relevant provincial authorities in discussing their work. More importantly however, the province has in recent years experimented with some highly innovative legislative and institutional approaches to resource management and regional land-use planning involving B.C.-C.L.I. data, and benefits from the continuing activities of a highly creative resource inventory unit.[1]

There were of course a number of general circumstances that made B.C. fertile soil for germinating seeds of the C.L.I. in the mid 1960's, some shared to a greater or lesser extent with the other provinces:

1. Most of the province was (and is) undeveloped or "rural" in character. The dominant land uses are forestry, agriculture and recreation, the last having a major focus on the province's wildlife and fisheries resources.
2. British Columbia was undergoing rapid urbanization, characterized by major shifts in population and economic activity. This resulted in increasingly severe pressures on relatively scarce agricultural lands in urban areas, and the need for the reorganization of such lands in the rural hinterland.
3. Domestic and foreign demands on B.C.'s renewable and non-renewable resources by a full range of competing consumptive and non-consumptive uses continued to increase with no long-term limit in sight.

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[1] No claim is made that the B.C. experience is exceptional, or for that matter even typical. Time and space limit us to acknowledging only that there are differences between provinces (Ontario for example intends to phase out the Ontario Land Inventory by March 31, 1977). These will have to be considered elsewhere.

Simultaneously, and not wholly coincidentally, there was a significant shift in environmental attitudes as more people became ecologically "aware" and better tuned to aesthetic and other intangible values. These trends provided irresistable pressure for the development of innovative approaches to integrated resource management.

4. An unusually high 95% of the land (and associated resources) in British Columbia is publicly owned, and while much forested and grazing land is leased out, the responsible provincial government agencies are in an excellent position to exercise control or direction over development of the whole of this area.

5. The province had been organized into 28 "Regional Districts" charged with the responsibility for comprehensive planning in the unincorporated areas of the province. While controversy over their conflicting mandates continues in the relationships between the regional districts and the provincial line agencies, progress is being made through effective compromise. Significantly the regional districts are at the appropriate spatial scale for generalized land-use planning of the type envisaged by the C.L.I.

6. Each regional district had a "Technical Planning Committee" usually consisting of the local field personnel of relevant provincial service and resource management agencies, including all sectors covered by the B.C.-C.L.I. This committee seemed an appropriate administrative mechanism for the co-ordination of activities of the provincial agencies and for the resolution of conflicts between

local concerns and provincial interests.

The Institutional Setting

The British Columbia Land Inventory organization was formed in 1964 under the federal-provincial C.L.I. agreement, as a relatively independent unit within the Department of Agriculture. For ten years this group organized and conducted the various sectoral resource inventories as required for the settled areas of the province. This was an important period of trial and experience-gathering during which many of the refinements necessitated by the province's extreme and varied topography and climate were developed and tested. Meanwhile, in July of 1971, the Social Credit government of W.A.C. Bennett initiated a series of institutional innovations that was to change radically the intra-governmental relationships of the B.C.L.I. unit. In an attempt to co-ordinate and improve decision-making respecting resource development and environmental quality, while maintaining the integrity of individual departments, the provincial government created a special "Environment and Land Use Committee" (E.L.U.C.), of Cabinet Ministers from all departments whose activities affect the resource base.[1] Subsequently, the New Democratic Party government of David Barrett perceived the need to set up a permanent staff or "working arm" of the E.L.U.C. to establish this arrangement as an effective alternative to a "Department of the Environment". Thus, in January 1974 the "E.L.U.C. Secretariat" became

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[1] Under authority of The Environment and Land Use Act, Statutes of B.C. 1971, Chapter 17.

functional with three divisions - Resource Planning, Special Projects, and the Resource Analysis Unit (R.A.U.) - and a mandate to "examine problems and potentials in the resource development field, to identify alternatives and to assess the direct and indirect consequences associated with each alternative" (E.L.U.C., undated). The R.A.U. was of course the former B.C.L.I. working group, by then 94 persons strong.

Significantly, the R.A.U. now reported through the director of the Secretariat to a committee of ministers encompassing the full scope of the unit's activities, rather than to the Minister of Agriculture and indirectly to the interdepartmental A.R.D.A. committee of deputy ministers. The new arrangements greatly facilitated the flow of inventory-related information among line departments and agencies, and between the latter and the R.A.U. In addition to stimulating more and efficient use of original inventory data, improved communication and understanding promise increasingly to motivate the expansion of the scope and depth of the unit's activities. It is to be hoped that this momentum will be maintained in the face of administrative changes being implemented by the recently elected Social Credit government of William Bennett.[1]

Advance Through Application

Regional and Resource Planning

To document in any detail the routine application of B.C.L.I. data would be a forbidding task, but a few examples will be given to illustrate

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[1] The E.L.U.C. Secretariat has now (1976) been incorporated into a new "Ministry of the Environment". Thus it enjoys the distinction of being an interdepartmental unit housed in a single ministry, but still reports directly to a committee of Cabinet.

the utility and evolution of resource analysis and planning techniques in recent years. The basic inventory data have been used widely in the preparation of regional land-use plans in many of the province's regional districts and as the potential utility of the data is recognized some of these have requested special studies to aid in their continuing planning efforts. For example, the Capital Regional District asked that a particularly comprehensive inventory and analysis of resource potentials be undertaken by the B.C.L.I. in conjunction with their development of regional options. The resultant study required the co-operation of the Canadian Forest Service and the Canada Dept. of the Agriculture well beyond the usual C.L.I. requirements, particularly respecting aspects of climate, topography, hydrology and fisheries potential, and native vegetation (B.C.L.I., 1973). The data and maps on native vegetation were subsequently republished in a slightly different form by the forest service (McMinn et al., undated), and include suggestions for compatible land uses. This information is now a routine part of the district's planning data base and additional biophysical studies (e.g. of shorezone processes) are on-going in several areas.

Broad-scale data covering whole regions cannot of course be used for site specific planning. On the other hand the detailed information collected and experience gained by the analysts in the preparation of broad-scale summaries enables them to state that "detailed aspects ... can often be handled by questioning individual authors. As example(s) ... engineers could request environmental impact and soils mechanics information for a particular head or pipeline location" (Benson, 1973).

It is easy at first reading to dismiss this claim as an obviously biased over-statement, particularly respecting the data requirements of urban land uses. On the other hand it is precisely because of such requests and the increased activities of the Resource Analysis Unit in urbanized regions, that additional capability ratings have been developed for urban land uses. In 1974 for example, the Land Inventory Division undertook at least 7 special projects involving urban suitability ratings considering such factors as slope stability and such land uses as septic tank installation (E.L.U.C. Secretariat, 1974).

Significant advances in generalized resource management in British Columbia have also been made through the adoption in 1969 of "resource overlay folios" (a technique derived from the overlay methods of the B.C.L.I.) in planning forest land use. Under this system map data on forest inventory, recreation, fish and wildlife, water resources, etc., are compared and utilized by the B.C. Forest Service, in consultation with other resource agencies, in the location of timber sale licenses within the Public Sustained Yield Management Units. The shape, size, location and orientation of stands to be logged are thus determined with due regard to other forest-related values such as spawning streams and winter ungulate range. Not surprisingly there have been problems in implementing this sweeping new system so that "other resource agencies have reacted to the folios as an approach to the resolution of resource conflicts with a mixture of concern and guarded optimism" (Crook and Crook, 1976, p. 28). In any event folio planning has certainly replaced more interdepartmental referral at the level of watersheds and above.

To date some 400 folios are planned for the province of which over 200 are underway or completed.

With folio planning, B.C. has taken a major step toward true integrated management of the forest resource, and a revolutionary one in a province renowned for its hardnosed-approach to forest practice. This is to be contrasted with the situation in Ontario, for example, where the forest service is conspicuous for its lack of acceptance of the Ontario/C.L.I. While maps and data from the B.C.L.I.R.A.U. make up as much as 80% of the total physical planning package under the folio system (W.A. Benson, 1976, pers. comm.), forestry in Ontario makes no use of Ontario/C.L.I. data, relying instead on a Forest Resource Inventory (R.J. Burgar, 1976, pers. comm.). B.C.'s momentum in integrated management seems likely to gather as socio-economic analyses are gradually introduced to "fine-tune" resource trade-offs and increase economic efficiency in priority and special study areas (see O'Riordan, 1975, 1976).

At a much broader scale than that considered by folio planning problems of resource use conflict and jurisdictional disputes are now considered by Regional Resource Management Committees of senior agency officials. Seven Resource Management Regions and Committees were established in 1975 covering the whole of the province, with boundaries determined using biophysical and operational criteria. While it is too early to assess the effectiveness of these committees, it is to be hoped that their activities will improve inter-agency co-ordination, and contribute to the increased effectiveness of their representatives on the Technical Planning Committees of the Regional Districts.

Land Capability Analysis

In the late 1960's the provincial C.L.I. unit developed a unique system for land capability analysis, using C.L.I. sectoral maps and related physical data. For this purpose, a special Land Capability Analysis Committee was established (approximately 24 persons) for each analysis area, composed of representatives of relevant federal (from B.C.) and provincial agencies, plus B.C.L.I. project leaders, and the supervisors of crews that worked in the area.

Land capability analysis maps were compiled using an overlay technique involving "prime use areas" (generally the first three classes for each sector) for the five capability sectors. A given sectoral prime use area was indicated on the map except when two or more were coincident. In areas where no high "prime use" capability was evident from the first overlay, lower capability groupings were added. Finally in all cases of intersectoral overlap, conflict was resolved in committee, by reverting to class ratings and making trade-off comparisons between sectors. While only a single use is shown on the finished map, it is recognized that other uses are possible (and even desirable); compatible uses may be mentioned in the accompanying text.

The resulting land capability analysis map is thus basically an evaluation of physical land capabilities, and shows the "best" prime use of land from an ecological viewpoint, within the narrow range of choice provided by the original resource sectors. Social and economic factors are explicitly excluded from the analysis, thus there is no pretense that this system comprises an overall land-use planning process.

The first land capability analysis map was produced for the Prince George Special Sales area. The experience gained in that project resulted in improved procedures that were subsequently applied to the East Kootenay, Bulkley-Nechako, and several other areas. Maps for these regions have been published, and resource atlases for Bulkley-Nechako and East Kootenay are available to Regional Districts and other relevant agencies. The atlases include the usual B.C./C.L.I. sectoral data plus other thematic maps (e.g. mineral potential, water licenses, proposed dams, land status, etc.) that enable planners to experiment with the capability analysis in a gaming situation.

It should be noted that this program was undertaken in B.C. in lieu of a pilot land-use planning project.

Recreation Capability Analysis

B.C.L.I. recreation data have been widely used in the identification and planning of provincial and regional parks in British Columbia (the C.L.I.-related mapping was completed in 1972). As might be expected frequent difficulty has been encountered in the interpretation of the original classification system for the reasons outlined earlier, resulting in errors of application, and the accusation that some quality recreation areas have been ignored. These problems are probably particularly acute in B.C. with its unparalleled range of recreation features (and sensitivity to use), from ocean beach to alpine meadow.

Accordingly, the Resource Analysis Unit has developed a modified recreation classification system that retains the best features of the original but

1. provides more detail, and

2. attempts to minimize the confusion between quality and quantity as a basis for classification.

Since inventory classifications are now being undertaken beyond the original C.L.I. area, and earlier work is being updated, future recreation capability classifications will encompass both a

1. features inventory that identifies the type and location of recreation resources and gives an estimate of their quality, and a
2. physical carrying capacity inventory that uses landform, soil, climate and biological data to estimate the quantity of recreational use per unit area that land units are capable of sustaining.

The carrying capacity inventory features five classes compared to seven in the original C.L.I. approach. These classes are now based on the degree of limitation to recreational use and therefore now conform conceptually to the classification system for the other resource sectors. Thus, "Class 1" carrying capacity indicates areas of potential intensive use in a wide variety of activities. Such lands (e.g. an ocean beach) have no significant limitations and will suffer little or no damage under "normal" recreational use. At the other extreme, Class 5 units have essentially no recreational potential (see E.L.U.C. Secretariat, 1975). Even though it is difficult to quantify and operationalize the concept of carrying capacity except in relative terms, this improved approach simplifies classification for the analyst and facilitates the planner's task of validating trade-offs among resource sectors.

Terrain Classification

As indicated above, the need for a biophysical land classification system independent of any particular resource or land use was recognized early in the C.L.I. program. This was particularly true in British Columbia which is characterized by extremes of topology, geomorphology, climate and vegetation. Consequently the B.C.L.I./R.A.U. have continuously emphasized the development of a flexible, integrated biophysical system that formed the basis for much of the original capability mapping program in forestry, agriculture, recreation and wildlife (not the case in most of the other provinces where capability mapping preceded any formal biophysical analysis). Most recently the Resource Analysis Unit has developed a preliminary but comprehensive "Terrain Classification System" (E.L.U.C. Secretariat, 1976) in an attempt "to generate an empirically supported qualitative geological base for both geological and multiple resource purposes." This is in keeping with B.C.'s long-term objective of extending capability analysis into all forms of "rural" and urban land-use planning.

The British Columbia Land Commission and the B.C.L.I.

Perhaps the single most dramatic and significant example of application of C.L.I. data in Canada is in the designation of Agricultural Land Reserves by the British Columbia Land Commission. The commission was officially established on May 18, 1973 by proclamation of Section 2 of the Land Commission Act (see Statutes of British Columbia, 1973, ch. 46) with the principal objective of preserving agricultural land for farm use.

The latter is defined as "... the occupation or use of agricultural land for bona fide farm purposes, as well as certain other uses (that) are compatible with the preservation of land for farm use. Closely related to this is the encouragement and preservation of family farming and family farms" (B.C. Land Commission, 1974).

The circumstances leading to the establishment of the Land Commission pertain to burgeoning world populations, increasing uncertainties in international food markets, and rapid growth and urbanization in B.C. that had consumed nearly 10,000 acres of prime agricultural lands in B.C. per annum in the preceding 20 years. The overriding philosophy was increased sensitivity to the need to keep future land-use options open. Since this rationale is detailed elsewhere (Baxter 1974; B.C. Land Commission 1974, 1975a; Lane 1975) we will confine the present discussion to consideration of the commission's activities in relation to the B.C.L.I. Most significantly, "... the identification of all land with agricultural potential within the short time constraints of the Land Commission Act, necessitated as it was by the quickening pace of alienation of farm land for urban purposes, would have proved an unsurmountable problem had it not been for the existence of the Canada/B.C. Land Inventory" (B.C. Land Commission, 1974).

The Agricultural Land Reserves (A.L.R.'s) were established in the following way /W.T. Lane (first Chairman of the Land Commission), 1976, Pers. Comm./:

1. The B.C. Department of Agriculture initially prepared suggested A.L.R. plans based on B.C.L.I. agricultural capability data.

Agricultural Classes 1 to 4 were protected in most parts of the province while Classes 1 to 6 were included in ranching areas where Class 5 and 6 lands were in proximity to home ranches. In the vicinity of towns and villages an area equivalent to the land already urbanized (i.e. generally subdivided down to two acres and less) and of low agricultural potential was shown as sites for future urban expansion. In addition potential park and conservation sites were indicated based on other B.C.L.I. resource capability data.

2. The Commission, armed with this "first-cut" reserve system visited nearly all the Regional Districts with a standard interpretive presentation to each Regional District board and staff. This was later produced in slide/tape form for use at the more than 200 public meetings the Regional Districts held in the preparation of their suggested revisions of the proposed A.L.R. plans. Each Regional District was then required to adopt its modified A.L.R. plan by by-law for submission to the Land Commission for formal consideration.

3. The Land Commission staff reviewed these submissions, indicated conflicts, recommended changes, and advised the Commission on means to achieve more or less standardized approaches to resolving similar land use problems across the province.

4. The Land Commission then submitted recommended A.L.R's to Cabinet for consideration. The Cabinet, on advice of E.L.U.C., assisted by the E.L.U.C. Secretariat, approved a final version of the A.L.R.'s which where thereupon officially designated by the Land Commission. The land freeze imposed by Order-in-Council under the powers

of the Environment and Land Use Act, before the passage of the Land Commission Act, was released region by region as the A.L.R.'s were adopted. At this writing the designation of A.L.R.'s in the 28 Regional Districts is essentially complete.

It might reasonably be argued that designation of A.L.R.'s almost solely on the basis of agricultural capability ratings is a misuse of these data, that other resource sectors and relevant socio-economic factors were not sufficiently taken into account in an integrated or comprehensive regional planning process as originally envisaged by the C.L.I. The counter argument here is that agricultural lands in farm use are presently undervalued and that the latter will in fact emerge as the highest and best social use of these lands in the forseeable future. It should also be kept in mind that only about 5% of the province is protected by the A.L.R.'s. In any event, the A.L.R.'s are not a wholly inflexible designation since it does not prohibit compatible use and there is considerable opportunity for change. Private and public bodies have the right of appeal, and the Land Commission itself as well as the Cabinet are empowered to relax the strictures of the Act or to initiate changes of their own volition.

While the identification of potential A.L.R. lands was the single most important use of B.C.L.I. data, several other aspects of the Land Commission's operations deserve comment in the context of the C.L.I.. The Commission is able to draw upon a special fund established by statute for the purchase of agricultural lands. As of March 1975, fifteen farms, orchards and ranches had been so acquired (B.C. Land Commission, 1975b).

The purpose here is to facilitate the consolidation of farm lands and to encourage younger farm families through career farm leases. This is clearly in conformity with the original objectives of the C.L.I. agricultural sector cited earlier.

Many other special projects of the Commission, from assisting in routing rail and road rights-of-way through land assembly for experimental spray irrigation projects, further these same objectives and utilize data provided by the various divisions of the Resource Analysis Unit. Finally it should be noted that the secondary objectives of the Land Commission Act pertaining to the identification and acquisition of greenbelt, land bank and park lands, to which the Commission is now turning its attention, are also greatly facilitated by the availability of B.C.L.I./R.A.U. data.

Whether this most controversial piece of land-use legislation will survive the test of time is a topic of continuing debate, but whatever the ultimate outcome B.C. has obviously set off on a new rack. In the final analysis it will be remembered that the whole grand adventure would not have been possible without something like the course first plotted by the C.L.I.

IN RESTROSPECT

The C.L.I. was launched with great enthusiasm and lofty aspiration. Potential users naturally hailed the program with matching, i.e. equally unrealistic, expectations. Under these circumstances it is hardly surprising that the myriad conceptual, technical, constitutional, and

communications problems that subsequently emerged have resulted in a certain disillusionment and something of a critical backlash. However, this should not be allowed to obscure the positive aspects of the program. In spite of many valid reservations concerning the structure and quality of C.L.I. data, we can still argue that the program has contributed immensely to a revolution in land and resource planning in Canada.

Apart from a basic planning framework and large quantities of data, the C.L.I. has provided a number of indirect benefits to environmental management. As we have seen, these include; a medium for improved communication (and perhaps reorganization) of administrative and management agencies in the resource field; a stimulus for the development of improved approaches both to resource inventory itself and to land use through integrated management; and an impetus for revision of land-use legislation, regulation and procedures. Clearly the C.L.I. has served well to underscore the inadequacy of former approaches.

Most important in the long run however, is the C.L.I.'s contribution to the development of human resources in the natural resource field. Growing awareness of biophysical resource interrelationships tempered by socio-economic realities among managers and planners, will go a long way toward destroying existing institutional barriers to more rational resource allocation and land-use planning.

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