Corporate Land Use Classification System for British Columbia: Justification and Specification

November 1996

Resources Inventory Committee

British Columbia

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Corporate Land Use Classification System for British Columbia: Justification and Specification

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Resources Inventory Committee

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Abstract

This report, prepared by Westland Resource Group, summarizes the work undertaken by the Land Use Task Force of the Resources Inventory Committee, and explains the need for a corporate land use inventory, the status of existing inventories, and provides a structure, format, and data model for a standardized land use classification for use in the province.

The research undertaken for the Land Use Task Force clearly shows a significant demand for standardized land use inventory information. The report indicates ways that present initiatives can be used to support the creation of an improved approach to land use inventory. The recommended approach is directly linked to the identified needs for land use information, so that the corporate inventory will have a ready market for resulting data and maps.

Acknowledgments

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The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments as well as from First Nations peoples. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report "The Future of our Forests".

For further information about the Resources Inventory Committee and its various Task Forces, please refer to: http://www.for.gov.bc.ca/ric

Land Use Task Force

Preparing this report required a committed effort by many people. I would like to express my thanks to all of the individuals who provided assistance to the project team as we researched and wrote the document. Most of all, I would like to thank Rob Menes, the Chairman of the Land Use Task Force, who provided guidance when it was most needed during the preparation of the report and genuine technical support of many elements of process. Rob must also take credit for initiating the land use inventory initiative, an action that will prove important to the provincial government's efforts to improve data availability for decision making.

This report is an initial step in creating a corporate land use classification system for British Columbia. The Land Use Task Force can take full credit for the progress that was made. Responsibility for the errors and other flaws in the report rests with the authors.

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Table of Contents

Abstract i
Acknowledgements ii
List of Tables and Figures iv

Part 1 Justification, Structure and Implications of a Corporate Land Use Inventory

1. Need for a Corporate Land Use Classification 1
   A. Historic Uses of Land Use Information 1
   B. Growing Demand for Land Use Information 1
   C. Impediments to Achieving Resource Management Goals 2

2. Goals of the Corporate Land Use Classification 6
   A. Goals of the Resources Inventory Committee 6
   B. Goals of the Land Use Task Force 7

3. Defining Land Use 8
   A. What is Land Use? 8
   B. Major Land Use Inventory Problems 9
   C. What criteria should be used to evaluate a land use inventory system 10
   D. What are the boundaries between sue and capabiliyy? 10
   E. Multiple Activities 11
   F. How should land use inventories deal with planned land use? 11
   G. How should water be included in land use? 12
   H. Land cover versus activities on the land? 13
   I. Scale and Base Mapping 13

4. Description of Existing Land Use Classification Systems 15
   A. Federal Government Systems 15
   B. Provincial Government Systems 16
   C. Regional Districts and Municipalities 17
   D. Nongovernment Organizations 25
   E. Initiatives that Require Land Use Information 25
   F. Regional Activities 28
   G. Purpose of Existing Land Use Inventories 29

5. Land Use Inventory Users and Their Needs 31
   A. General Findings 31
   B. Summary of Inventory Generator Survey Results 33

Part 2 Specification for the Land Use Inventory

6. Recommended Land Use Inventory Data Model 41

7. Categories of Information for the Inventory 45

8. Information to Support the Inventory 59
A. Optimum Methods of Capturing Land Use Data 59
B. Priorities for Filling Data Gaps 63
C. Centralized Versus Decentralized Inventories 64
D. What agency should have the mandate for land use data collection and management? 65

9. Data Management 66
A. Quality Control 66
B. Information Management Elements Unique to the Land Use Inventory 68

Part 3 Implications of Implementing the Land Use Inventory

10 Effects of Adopting a Uniform Corporate Land Use Strategy on Agency Programs 73
A. Encouraging adoption of the land use inventory standards 73

11. Potential Pitfalls of Action Alternatives 75
A. The need for a pilot project 77

References 79

Appendices

Appendix A – Glossary of Terms 85
Appendix B – Land Use Inventory Questionnaires 88
Appendix C – Summary of Data User Survey Responses 98
Appendix D – Summary of Data Generator Survey Responses 115
Appendix E – Formal Data Model 132
Appendix F – Metadata Requirements 134
Appendix G – Examples of Land Use Classification 136
Appendix H – Land Use Coding 144
Appendix I – Land Use Task Force Members 145
Appendix J – Preparers of the Report 146

List of Tables and Figures

Table 1 – Data Topics Covered by RIC Task Forces 3

Table 2 – Suggested RIC Inventories That Have a Land Use Component 4

Table 3 – Map Scales and Data Resolution 14

Table 4 – Characteristics of Existing Land Use Inventory Systems 18

Table 5 – Commission of Resources and the Environment Information Categories 26

Table 6 – Major Georgia Basin Issues 27

Table 7 – Human Use Categories Identified in Coastal Zone Inventory Review 28

Table 8 – Land Use Inventory Purposes 29

Table 9 – User Survey Respondents 31

Table 10 – Uses of Land Use Data 31

Figure 1 – Importance of Database Characteristics 32

Figure 2 – Users of Land Information 34

Figure 3 – Data Collection Ratings 35

Figure 4 – Data Processing Ratings 36

Figure 5 – Information Storage and Retrieval Ratings 36

Figure 6 – Information Transfer to Other Agencies 37

Figure 7 – Information Acquisition from Other Agencies 37

Table 11 – Conceptual Data Model for Corporate Land Use Inventory 43

Table 12 – Names of Categories for the Land Use Activity Entity Group 46

Table 13 – Names and Categories of Jurisdictions and Tenures 56

Table 14 – Examples of Land Use Regulations 56

Table 15 – Examples of Names and Categories of Land Use Interests 57

Table 16 – Categories for Cover Attributes 58

Table 17 – Appropriate Land Use Data Collection Technology as it Relates to Scale 60

Table 18 – Rough Costs of Data Capture Using Various Technologies 60

Table 19 – Sources of Information for Land Use Activities and Declare Interests 61

Table 20 – Components of Data Quality 66

Table G-1 – Hierarchies of Agricultural Land Use Categories 136

Part 1 Justification, Structure and Implications of a Corporate Land Use Inventory

Land Use Classification System

1. Need for a Corporate Land Use Classification

A. Historic Uses of Land Use Information

In the western world, possibly the earliest land use inventories conducted by governments were the County Reports commissioned in Great Britain in 1793 to map agricultural characteristics and activities. The first nation-wide land use study was Dudley Stamp's famous First Land Utilization Survey of Britain, prepared in 1930 on the basis of field mapping conducted by school teachers and children. Stamp later directed the World Land Use Survey in 1951, and chaired the 1956 Commission on World Land Use Survey. These initiatives responded to the growing demand for standardized information on how the land, water, and associated resources are used. The globalization of the world economy following World War II stimulated this approach.

In Canada, wide-coverage land use mapping began in 1950 under the Geographical Branch of the Department of Mines and Technical Surveys. Their approach was generally compatible with the recommendations of the World Land Use Survey. The Canadian survey used five scales, from 1:1,000,000 to 1:50,000, and 10 land use classes (Mitchell 1989).

As the land use mapping initiatives of the federal government proceeded, many municipalities and regional governments, too were developing land use inventory schemes. The categories of land use mapped by these jurisdictions, and the scales of collection and presentation, were often quite different from those of the senior governments.

Land use classification systems have evolved rapidly at the regional level, where general categories of land use are applied to resource management, and at the local level where complex land use information is collected for larger scale planning purposes.

The approach to regional-level land use inventory has changed dramatically with the improved quality of remotely sensed imagery and interpretation technology. At small scales (1:250,000 and smaller), image interpretation and spectral analysis have become common methods of collecting land use data. A large scales (1:10,000 and larger) most agencies still rely on field research to obtain land use data.

Land use inventories prepared by assessment authorities provide a good example of information collected at a very large scale. Used as a basis of taxation, assessment information must be accurate for individual parcels of land. This degree of specificity has been accompanied by a proliferation of land use categories.

B. Growing Demand for Land Use Information

The increasing demand for biophysical resources and the resultant stress on the lands and waters of the planet have motivated many governments to invest in improved land use

monitoring and mapping programs. British Columbia has not been exempt from the problems and issues of land allocation and resource use. Private groups and public agencies have called for improved inventories of the province's lands and waters, their capability, and their use.

The provincial government is not alone in its search for better land use information. Many of the most vitriolic conflicts over land allocation and use occur in municipalities and regional districts in British Columbia. Accurate, large-scale land use information is regularly collected and interpreted by these governments as part of their legally-mandated official planning process. Industries and Crown corporations, too, are major users of land use information. Site selection processes for industrial facilities, route selections for electrical transmission lines and gas pipelines, and compliance with provincial and federal impact assessment and permitting processes require high quality land use information. Site selection and investment decisions for all forms of private sector economic development, from tourism facilities to shopping centres and subdivisions, also rely on land use data. Public interest groups also use land use information to support their particular fields of interest. The Garry Oak Meadow Society, for instance, has recently mapped areas of oak habitat that could be affected by changes in urban land uses.

C. Impediments to Achieving Resource Management Goals

Inadequacies of past land use inventories. The basis of resource allocation and management decisions in British Columbia were criticised for several decades by pubic organizations, especially environmental groups, that contended that provincial agencies focused excessively on industrial demands for extractive use of land and water. These concerns were largely supported by the findings of the Forest Resources Commission (FRC) report, *The Future of Our Forests* in 1991. The FRC suggested that in response to broader public expectations regarding the use and management of British Columbia's land and water, a Forest Resources Inventory Committee should be established to improve the quality of inventories in the province.

Findings of other agencies regarding inventories. At the same time that the FRC was finding that society's demands for inventory information exceeded the capabilities of the inventories, other agencies were reaching similar conclusions. The Round Table on the Environment and the Economy's *Sustainable Land and Water Use* (1991) identified the need for comprehensive baseline information on resources and human activities. *Towards a Strategy for Sustainability* (1992) recommended "that integrated land and water planning be implemented as a major component of a comprehensive land and water strategy" (p. 21), with supporting data collection and environmental monitoring. The Old Growth Task Force found that several categories of socially-important vegetation were not monitored or mapped. The *Outline for the Canada –British Columbia State of the Environment Report* identified many land use categories that need to be measured in order to understand conditions and trends in the environment. The *Land Use Strategy for British Columbia* (1992) of the Commission on Resources and the Environment proposes to build consensus on the appropriate distribution of land uses in the province. The Commission is using land use information in its three regional planning areas to support its process.

The common theme running through all of these reports and findings is that land use information is crucial to land and water allocation decisions and for effective resource management. The reports also recognize that present inventories of land use are inadequate for society's needs.

Resources Inventory Committee Initiatives. The Resources Inventory Committee (RIC), as the Forest Resources Inventory was renamed, has been working for the past year to fulfil its mission of facilitating inventory integration in British Columbia. The goals of RIC are to identify information needs and oversee development, testing, and province-wide implementation of common standards and methods for sampling, classifying, and storing resource inventory data.

The Land Use Task Force was the last of RIC's seven task forces to be established. The other six (Atmospheric, Marine/Coastal, Aquatic, Cultural, Terrestrial, and Earth Sciences) have prepared their initial reviews of data needs and gaps, and identified categories and scales of information to be included in their inventories (Table 1). The Land Use Task Force was created when it became apparent that the topics addressed by the other Task Forces left a gap in coverage: the comprehensive inventory of human use of land and water.

Table 1 - Data Topics Covered by RIC Task Forces

Task Force	Data Topics
Atmospheric	Weather
	Climate
	Air quality
Marine-Coastal	Oceans
	Inter-tidal
	Anadromous fish
Aquatic	Freshwater fish
	Lakes and streams
	Riparian
Cultural	Recreation
	Tourism
	Cultural
Terrestrial	Wildlife
	Forests
	Range
	Soils
Earth Sciences	Archaeology
	Surficial geology
	Bedrock geology
	Ground water
Land Use	Human activities
	Legal and administrative boundaries

Table 2 presents a partial list of inventories that have been advocated by other RIC task forces having a land use or related land cover component.

Table 2 - Suggested RIC Inventories That Have a Land Use Component

Name	Scale
Aquatic biophysical	1:50,000
Aquaculture	1:250,000
Aquifers	1:20-50,000
Archaeological site locations	1:50,000
Baseline Thematic Mapping	1:250,000
Contaminated sites for water quality	no scale recommended
Fish use	1:250,000
Fisheries management practices	1:250,000
Geological mapping	1:50,000
Heritage trails	1:50,000
Land ownership and tenure	multiple scales
Point sources of air pollution	local scales
Protected areas	1:20-50,000
Range types, general	1:40,000
Range use	1:250,000
Range improvements and infrastructure	1:20,000
Recreation and tourism facilities	1:20,000
Soil series and soil associations	1:20-50,000
Soil landscapes	1:1,000,000
Surficial geology	1:20,000
Timber administration	1:10-20,000
Timber tenures	1:10-20,000
Traditional use	1:20-50,000
Trapping, hunting, and wildlife viewing	multiple scales
Water use	no scale recommended
Wildlife biophysical	1:50,000

Many other recommended inventories deal primarily with distribution of biophysical phenomena or with resource capability, and do not have a substantial land use element (Resources Inventory Committee 1992).

Corporate resource inventory initiatives. The government of British Columbia has launched several initiatives intended to address the data quality, analysis, and application needs being identified by RIC Task Forces. The Corporate Resources Inventory Initiative (CRII) will upgrade and integrate inventories of 6 provincial ministries by improving data collection infrastructure (staff, base mapping, technology) and increasing data collection to meet identified needs. The ministries involved are:

- Ministry of Aboriginal Affairs
- Ministry of Agriculture, Fisheries, and Food
- Ministry of Energy, Mines, and Petroleum Resources
- Ministry of Environment, Lands, and Parks
- Ministry of Forests
- Ministry of Tourism and Ministry Responsible for Culture.

Priorities for data collection will be set by the Cabinet Committee on Sustainable Development. The Land Information Strategic Committee (LISC) is an interministerial committee that provides central coordination of the provincial government's Corporate Land Information Strategic Plan (CLISP) for encouraging the sharing and exchange of land-related data among government agencies. CRII and the RIC Technical Committee (the RIC Task Forces) will encourage the interministerial cooperation needed to standardize collection and exchange of information.

LandData BC. LandData BC has been established by the Ministry of Environment, Lands, and Parks, Surveys and Resource Mapping Branch to deliver integrated land use and other resource information to users of corporate information throughout the province. In designing the delivery of the Corporate Land Information Strategic Plan, LandData BC is developing operating policies, standards, procedures, and guidelines. To make the "single window" approach to information work, data collected by all participating government agencies must be in transferable formats. To achieve this transferability, the Spatial Archive and Interchange Format (SAIF) has been developed. SAIF is being developed and tested by the Surveys and Resource Mapping Branch Geomatics Unit, MacDonald Dettwiler, and Sierra Systems. By the end of this decade, LandData BC plans to have its data access and delivery system functioning throughout the province. A scaled-down, operational prototype version of the target production system will be in operation beginning in the Spring of 1993.

2. Goals of the Corporate Land Use Classification

The Land Use Task Force's activities and decisions need to achieve a set of goals that comply with and support RIC's goals.

A. Goals of the Resources Inventory Committee

The Resources Inventory Committee's overall goal is to foster credible and comprehensive information about all resources. Credible and comprehensive information is essential as British Columbia moves toward the goal of sustainability. The following objectives and activities have been identified to support RIC's broad goal.

Objectives:

1. Determine what information is vital for effective land management, at what levels of detail, at what scales, and for what purposes;
2. Define how this inventory information can most efficiently be acquired in a manner that minimizes duplication, promotes cooperative data collection, and encourages broad application and long term relevance.

Activities:

1. Determine the resource inventory information that is being or has been collected, by whom, to what standards, using what procedures, and at what costs.
2. Identify the information products that will be most needed by resource managers and associated inventory users.
3. Test these standards and procedures in the field.
4. Encourage their application, including training and extension, in both government and private data collection programs.
5. Cost a staged completion of a coordinated multi-resource inventory of the forest land base over a ten- year period of time.

B. Goals of the Land Use Task Force

The Land Use Task Force's primary goal is to deliver to RIC the specification for a corporate land use inventory for British Columbia. The specification will contain the following elements:

- existing land use sources in government
- a corporate land use classification
- a method for acquiring land use information
- inventory data model for storage and representation
- inventory management plan
- links to existing inventories.

The goal of delivering the specification to RIC must be achieved by March 31, 1993. This report summarizes the Task Force's efforts to design a corporate land use inventory.

C. Goals of a Corporate Land Use Classification

The goals for the corporate land use classification system for British Columbia have not yet been formalized. The participants in two workshops scheduled by the Task Force have helped to define the goals of the classification.

The following goals of a corporate land use classification have been reviewed by workshop participants and form the basis for decisions made by the Land Use Task Force.

1. To improve allocation, use, and sustainable development decisions affecting public and private lands and waters in British Columbia, especially shared-decision negotiating and planning processes;
2. To ensure that the full range of resource values are considered in land use classifications;
3. To standardize categories and formats for collecting, processing, transferring, and presenting land use information;
4. To enable accurate and efficient monitoring of changes in land use patterns and practices;
5. To facilitate the improved exchange of land use information among government agencies and other users and generators of data;
6. To satisfy user needs by creating a hierarchy of land use categories and scales of data collection and presentation;
7. To improve the efficiency of data collection and processing by identifying and addressing duplication and gaps in land use information;
8. To design a land use classification system that can be adapted to foreseeable changes in information requirements and advances in data collection, processing, and presentation technology.
9. To recommend procedures for updating the inventory to ensure that its information remains timely.

3. Defining Land Use

A. What is Land Use?

Few of the other RIC Task Forces have faced the challenge of the Land Use Task Force in defining the parameters of their mandated topic. For example, soil, water, atmosphere, and fish are well-defined. "Land use," however, is a much broader and more subjective concept.

The Task Force Business Plan (1992) contains the following definition:

> Land use, in its strictest sense, is the description of the human cultural activities on the land and water. While most efforts in resource inventory are focused on what biophysical components are present in an area, land use deals with the activities [that use] the biophysical components.

The Land Use Classification for British Columbia (Ministry of Agriculture, Fisheries, and Food and Ministry of Environment 1986) uses a three-part definition:

> Land "use" is defined in terms of a specific combination of land activity and land cover. Land "activity" is regarded as the active use man makes of the land. It is not to be confused with other variables, such as tenure, ownership, economic activity or land value. Land "cover" is regarded as the vegetative, natural or artificial construction covering the land surface.

Participants in a land use workshop were asked to consider these definitions and determine if they provide an adequate definition of land use. They raised the following issues:

- The difference between present and proposed uses need to be clarified
- Both land cover and land activities need to be included
- Land cover complicates the inventory and is unnecessary
- Actual use, interests in land, and related topics that affect land capability should be reflected in the inventory
- "Culture," as used in the Task Force's initial definition, is a complex term requiring definition.

Recommended land use definition. Based on these workshop comments and other information, the following amended definition of land use is suggested for purposes of the Land Use Task Force.

Definition of Land Use:

Land use is the description of human enterprises on the land and water, and may have the following components:

- activities (the actual use of land and related structures and modifications to the landscape)
- use-related land cover (where cover implies a use or is important to interpreting patterns or impacts of use)
- declared interests in the land (where use decisions may be affected by such interests)
- legal entities (legal boundaries, tenures, and regulations that affect use).

B. Major Land Use Inventory Problems

The Land Use Task Force initiative included a survey of users and generators of land use data, and conducted workshops to delve into land use activities, problems, and solutions. The results of these initiatives are summarized in this section. A glossary of commonly used inventory, mapping, and database terms are provided in Appendix A as an aid to understanding this report.

Workshop participants and survey respondents identified a variety of limitations and problems that afflict land use inventories in British Columbia. Users of land use data who responded to the survey identified the following categories of problems, listed in order of frequency of response:

- timeliness (data out of date, conditions change too quickly to be monitored effectively)
- content (land use categories vary among databases, use categories not relevant to respondent needs)
- scale (information too general or, occasionally, too specific to be useful)
- transferability (poor coordination between agencies, data collected or stored in incompatible ways)
- format (inconsistent base maps and ways of presenting information)
- coverage (province or area of interest not well represented)
- accuracy (data were unreliable, poor quality control in collection and presentation).

Generators of land use information raised the following set of problems and issues:

- conflict between need for larger scale information and cost of collection
- need for a hierarchical land use system that links categories to scale of collection and presentation
- lack of centralized land use inventory agency
- lack of standards for collection
- lack of interagency coordination and cooperation (turf wars).

Workshop participants reiterated many of the points mentioned in the surveys and raised the following new issues:

- there is no agreement on underlying principles of land use data organization

- each agency collects data for its own use (often for single projects) and neglects other agency needs, standards, or ability to share data
- standardized categories must address varied user demands for land use information
- British Columbia is too geographically complex to represent with a single land use system
- many resource uses relevant to successful planning are not captured in existing systems (e.g, aboriginal activities)
- agencies will not support a central land use registry, but individual agencies have no mandate to update land use information.

C. What criteria should be used to evaluate a land use inventory system?

Workshop participants reviewed the criteria established by Kim Isles for the Timber Task Force and suggested the following set of criteria for the land use inventory:

- facilitate and support decision-making
- keep data entry and output simple
- provide complete provincial coverage, but first focus on areas having severe resource conflicts
- be responsive to user needs
- provide training to inventory users
- design the system to be flexible
- strive for accuracy and consistency
- create hierarchical sets of categories
- allow for a broad range of analysis and manipulation of data
- be verifiable by outside agencies
- maintain historical and out-of-date information
- develop quick, responsive reporting capabilities
- store information in a flexible database
- maintain quality control procedures
- be compatible with other geographic information systems
- enable decentralized data input
- update inventory on an ongoing basis.

Several questionnaire respondents and workshop participants questioned the willingness of government to fund data collection efforts needed to create a provincial land use inventory. The high cost of continuous data monitoring needed to maintain a timely land use database also was identified as a potential constraint to providing needed information.

D. What are the boundaries between use and capability?

Many inventories of land and water focus on the resource capability for human exploitation. The Canada Land Inventory is exemplary, in that most of its classifications emphasized the capability of the land to support ungulates, agriculture, forestry, waterfowl, recreation, or related human activities.

Land use, however, describes what is occurring on the land or water rather than focusing on the capability of those features. The categories of a land use inventory would be "agriculture" or "recreation" instead of "agricultural capability" or "recreational capability."

Given this distinction between use and capability, what is the appropriate classification of an area that is not used for human purposes, but is heavily used by moose as winter range or by trees for growing? If it is classified as "ungulate range" or "forest," are these surrogate capability classifications? Must land use be completely anthropocentric, focusing solely on human use of land and water?

Discussions at the workshop indicated that the land use inventory should focus on present human use. Capability ratings should remain within the realm of the other task forces.

E. Multiple Activities

What land use category is appropriate where multiple activities occur on a parcel of land? If an energy transmission corridor passes through a farm, what is the appropriate classification if scale precludes showing both uses? In the case of underground activities (such as a pipeline beneath a farm), two-dimensional mapping prevents representation of such circumstances without a proliferation of multiple use categories (e.g., "pipeline beneath farm," "pipeline beneath playfield").

As scales of mapping or data collection become smaller, determining primary uses versus other uses becomes more important. Hierarchies of land use categories are the traditional method of dealing with data presentation, but hierarchies do not alleviate the need to make decisions about the primary use of land and water in a given parcel. Specific uses that cover large areas can be mapped at small scales, but general classes of use are not mappable at large scales.

Discussion at the workshop indicated that several options are available for dealing with multiple activities:

- record each use independently at large scales, using a "predominant use" protocol when scales become too small to meaningfully represent individual uses;
- apply a defined dominant use definition (e.g., proportion of land affected, value of uses);
- if the inventory can use an "object-oriented" database, then identify all uses as attributes to a defined land use polygon;
- identify each use as a "data layer" in a complex geographic information system.

The "electronic approaches" of storing each use as an attribute or a data layer would be effective for data storage and, potentially, for analysis. This approach does not, however, solve the problem of representing multiple uses on mapped output.

F. How should land use inventories deal with planned land use?

Land use inventories typically focus on present use. However, the lags between data collection, processing, and presentation mean that an inventory may be out of date before it is published. In some cases, the designated land use may be different from today's use. For instance, a parcel may used for vegetable production today, but a shopping centre will be built on the site tomorrow. How should the parcel be classified?

If the land use inventory is to be used as a monitoring or historic tool, then the present land use is all that should be considered. If the inventory is a planning tool, however, then planned or likely land use is more important than the present use that is bound to change. This issue of "forward looking" versus "backward looking" inventories is critical to classification decisions.

The issue of certainty of change is also critical. If a farm is to be replaced by a shopping centre for which the plans are approved and construction is imminent, then a strong case could be made for designating the land as commercial. But what if the rezoning is pending and the shopping centre may be rejected? Protocols need to be established for deciding the level of certainty necessary to designate a parcel something other than present use. The protocols need to apply to urban uses, approval of logging plans, designation of parks and ecological reserves, and energy or mining projects.

The predominant view expressed at the workshop was that the land use inventory should focus on present land use, not planned or future land use. The database, therefore, would identify actual land use only at the time the inventory was conducted. Archaelogical sites, which are evidence of past, present or even future activities, should be identified by a notation.

Planned or future land use was determined to be an important element to many data users, and the following options for presenting such information were suggested:

- update the inventory frequently, so that changes in present land use are represented in a timely manner;
- create a separate data layer in a corporate geographic information system that would represent planned or likely future land uses;
- treat planned uses as attributes in an object-oriented database;
- create a "land in transition" category to map uses that are changing at the time the inventory is conducted.

G. How should water be included in land use?

The Land Use Task Force intends to address the use of water as well as land in its mandate. Several issues need to be addressed in determining the appropriate inventory of water. How should human activities on the land beneath water (beds of streams, lakes, and the sea) be classified and mapped? Should the classification of water use include such purposes as hydroelectricity generation, sale of water as a commodity, diversion for irrigation, use for recreation or fishing, and impoundment for aesthetic purposes?

Workshop participants agreed that human uses of water should be included in the land use inventory. They did not agree, however, on the treatment of unused water. Some participants felt that water will be included in the aquatic task force database, and so could be directly referenced by the land use inventory. Other participants, however, argued that unused water is important as a delimiter of land, that other task forces may not represent water in a form that is appropriate to the land use inventory, and that water information enhances the ability to use land use information (e.g., riparian area analysis). Eliminating large "empty" areas on the land use map would have value for analyzing total land areas.

The recommended approach to including water in the land use inventory is to identify activities that involve water (reservoirs, domestic supply, etc.), but not water as an unused physical entity (streams, lakes, the ocean). Water features that do not have present human use would be classified as "no evident use," the same as unused land. If information on unused

water features is required, it should be obtained directly from the relevant biophysical inventories, or water features may be shown on base maps. If appropriate, water should also be identified as a land cover attribute, ancillary to an activity.

H. Land cover versus activities on the land?

Many land use classification systems contain categories that are not human use but land cover. Categories such as "snow and ice," "forest," or "environmentally sensitive land" appear as land use categories. If land use is defined as human use, should all other categories be classified as "unused land?"

Clearly, some cover classifications have implications for human use. "Mature forest" may be used for forest harvesting, recreation, or watersheds; "snow and ice" can be used for recreation, water supply, and scenic amenity. Should these land cover classifications, therefore, be replaced by potential or actual human uses? The answer has a profound effect on the definition of land use and on the nature of data included in the inventory system.

Workshop participants generally agreed that land cover information collected by other Task Forces should be integrated with the land use inventory, but it should be treated differently from other land use classes. Substantial scepticism was voiced about the wisdom of designing a land use inventory that relies on the provision of accurate, timely, and convenient integration of data from other inventories.

Because cover is recognized as an important component of the land use inventory, the recommended approach is to create a separate class of land cover descriptions that can be associated with land use activities. Specific cover categories and names can be drawn from the data dictionary associated with the vegetation inventory being prepared by the Terrestrial Task Force.

I. Scale and Base Mapping

A major issue to be resolved in preparing a consistent provincial land use classification is the selection of base maps and scales of data collection and presentation. Scale of data presentation is less important for geographic information systems (GIS), in which information can be presented at the scale appropriate for a given use. Even in a GIS, however, data needs to be georeferenced to a base map acceptable to collectors and users of information.

Scale of data collection is very important because it affects the ability to integrate the data with other thematic data, and it affects reliability of data presentation and analysis. Whereas information may be aggregated to smaller scales without losing data reliability, it cannot be disaggregated or presented at scales larger than the scale of collection without substantial risk to data reliability. Algorithms are being developed to facilitate the aggregation of large scale information into smaller scales (but such algorithms have yet to be applied effectively). Hence, data should be collected at the largest relevant scale, considering the cost-effectiveness of data collection and the homogeneity of the phenomenon being studied.

The land use categories needed by inventory users vary not only by the application of the inventory, but also by the level of detail required and the resulting scale of data collection and information presentation. For instance, a category "agriculture" at a scale of 1:250,000 may be adequate for an inventory user conducting regional land allocation, but a Crown

corporation seeking to minimize compensation costs for a transmission line may need to know the nature of agricultural operations (unirrigated field crops, intensive berry production) at a scale of 1:10,000. Hence, the nature of the land use categories vary according to the position of the user within a hierarchy of scales and user needs.

The scale of data collection also has cost implications. At small scales, large areas can be inventoried using remote sensing technology. The unit costs of data collection can be relatively low. At some point, however, scale becomes too large to permit accurate application of such technology. When site inspections are necessary to map land use, costs per unit area increase greatly.

Table 3 is presented as an aid in understanding the effects of scale on map resolution and land use information.

Table 3 - Map Scales and Data Resolution

Map Scale	1 cm^2 = ha	km2	CORE Planning Hierarchy Class	Categories of Use That Can Be Displayed
1:2,000,000	40,000	400	Provincial	Ecoregions, gross land use classes
1:1,000,000	10,000	100	Provincial	Ecoregions, gross land use classes
1:500,000	2,500	25	Regional	Generalized land use activities and cover
1:250,000	625	6.25	Regional, Subregional	Generalized land use activities and cover
1:100,000	100	1	Local	Aggregated groups of activities and cover
1:50,000	25		Local	Aggregated groups of activities and cover
1:20,000	4		Local, site	Specific classes of activities and kinds of cover
1:10,000	1		Site	Specific, block-based information and groups of species
1:5,000	0.25		Site	Detailed, lot-specific information and groups of species

Relative versus positional mapping. Data quality and usefulness for different users is also affected by the choice of positional or relative representation of land uses. Relative representation presents land use polygons relative to adjacent or nearby features or polygons. Positional representation references all polygons in a database or on a map sheet to fixed geographic point that can be linked to other databases or maps. If land use data are to be obtained from more than one source (as would be the case with the corporate land use inventory), then positional accuracy relative to a consistent base map is needed. Most land use information collected by municipal and regional governments is relational rather than positional, which could affect the ability to integrate those data into a provincial system (Moon pers. comm.).

4. Description of Existing Land Use Classification Systems

Many land use classification systems and programs have been prepared worldwide. Scace (1981) summarized 46 land use systems, focusing primarily on Canada and the United States. Many more systems have been developed in other countries and by international organizations. Municipal and regional land use mapping programs would probably add hundreds of additional initiatives in Canada, and thousands in the rest of the world.

Describing all of the extant land use classification systems is beyond the scope of this project. The Land Use Task Force has determined that the project should focus on provincial classifications or federal systems that have provincial applications. This section provides an overview of the relevant land use inventory systems.

A. Federal Government Systems

The Government of Canada has generated land use information primarily for monitoring purposes, and to provide a uniform set of baseline data for the provinces and territories. The scale of federal land use information ranges from 1:50,000 for Canada Land Inventory (CLI) Present Land Use information to 1:1,000,000 for the Canadian Land Use Classification. At these scales, regional and provincial patterns in broad land use categories can be discerned. The Present Land Use (PLU) Inventory was designed to provide information for resource development planning at the municipal, provincial, and federal levels. Because the CLI is no longer maintained by the federal government, the PLU Inventory was turned over to the Ministry of Environment, Lands, and Parks for continued use in British Columbia.

Statistics Canada carries out an enumeration of all farms in Canada every 5 years. This program is the most comprehensive database for farm holdings in British Columbia with respect to agricultural production. The Ministry of Finance and Corporate Affairs is the provincial agency responsible for coordinating access to Statistics Canada data in British Columbia.

Two of land use inventory classification systems summarized on Table 4 were developed by the federal government during the 1960s and 1970s. The framework for these land use classification systems was provided by the World Land Use Classification System created in the 1950s by the International Geographical Union.

- The Canada Land Inventory Present Land Use (PLU) classification system was developed in 1964 with the objective of providing information for resource planning at the federal, provincial, and municipal levels of government. The classification system was designed to permit rapid mapping at a scale of 1:50,000 from aerial photography with a minimum of field checking. Approximately two-thirds of British Columbia was mapped under this program between 1965 and 1972.

- The Canada Land Use Monitoring Program (CLUMP) classification system was developed during the 1970s by Environment Canada to support a land use monitoring program having these objectives:

a) to monitor land use trends in relation to national goals and objectives;
b) to monitor the amount, location, and type of land use change on a national, regional, and provincial basis;
c) to monitor land use change in specific areas, such as urban centred regions and flood plains.

The CLUMP land use classification was hierarchical; it had a several sub-categories of land use that can be aggregated to form generalized land use categories at a smaller scale. The CLUMP classification can be related to the PLU by drawing on the CLUMP hierarchy that best describes the PLU class. The CLUMP categories clearly distinguish between land use and land cover. Use is defined in terms of one activity and one kind of cover. The CLUMP classification was used in British Columbia in monitoring land use change in selected areas, such as the study of land use change in the lower Fraser Valley between 1980 and 1987 (Moore 1990).

B. Provincial Government Systems

Provincial land use information is collected for three main purposes; to fulfil statutory requirements, for resource management, and for research and monitoring.

Statutory inventories. The parcel-based land use inventory of the British Columbia Assessment Authority is the broadest inventory with a statutory mandate. Other agencies, such as the Ministry of Forests, are required by law to understand the nature of their resources, thereby implying that an inventory needs to be maintained.

Management inventories. The resource agencies collect land use information as part of their mandate to manage the biophysical resources of the province. The Ministry of Forests maintains land use inventories of timber tenures, operable forest, and recreation sites. The Ministry of Environment, Lands and Parks' inventories of streams, protected areas, oil spill preparedness information, and wildlife viewing areas, among others, can be considered land use inventories.

Research and monitoring inventories. All land use inventories have a research and monitoring component, but the structure and intent of some inventories suggest that they are designed to test new technologies or are focused on a specific research or monitoring goal. For example, the Baseline Thematic Mapping (BTM) project of the Ministry of Environment, Lands and Parks was designed to test the application of LANDSAT TM image data to production of a land cover and use map that meets the needs of a broad range of users. Since the completion of the initial prototype work, BTM has become an operational product. The Sierra Club's map of forest cover change from 1954 to 1990 had specific monitoring aims. Although both of these inventories had resource management as a goal, neither were initiated in response to specific requests by resource agencies.

Examples of provincial inventories. Designed in 1986, the British Columbia Land Use Classification (BCLU) represents a modification of the CLUMP classification system. The BCLU focused on the rural settled areas of the province. The land use categories were hierarchical, and the mapping scale proposed was 1:20,000. The BCLU incorporates the

CLUMP emphasis on separate categories for land use and land cover, because one cover may encompass several land use activities. BCLU coding represents land use defined as specific combinations of one activity and one cover.

The other land use inventory classification systems listed on Table 4 have been developed by provincial agencies to aid in conducting specific regulatory, resource management, or information storage and dissemination activities. For some of the listed inventories, land use data are collected and classified within biophysical boundaries such as watersheds, protected areas, or ecoregions, but most land use data collection is organized within administrative boundaries determined by the agency preparing the inventory. The extent of provincial coverage is specific to the land use inventory systems. The scale at which land use data are mapped ranges between 1:10,000 and 1:250,000, with associated differences in the complexity of land use categories.

C. Regional Districts and Municipalities

Much land use inventory activity occurs at the level of municipal and regional governments. The needs of these users are primarily determined by the mandated planning requirements of the Municipal Act and by the need of government staffs to understand and manage land use change. The Municipal Act does not require land use inventories, but it does call for preparation of official community plans. Preparing these plans typically begins with a review of existing conditions and trends, which requires land use information. The scale of mapping and categories of land use selected varies according to the intensity of development in the given jurisdiction. Inventories in the Greater Vancouver Regional District or Capital Regional District or their member municipalities is likely to be detailed, with scales as large as 1:2,000. In rural jurisdictions, scales of 1:10,000 or 1:20,000 are common, and a smaller number of land use categories are used.

Land use mapping is commonly used as the basis of decisions dealing with road construction and servicing. Services include sewers, storm drainage, fire and police protection, schools, and recreation facility siting. The location and service level of roads and highways is directly linked to the land use pattern. The Ministry of Transportation and Highways makes frequent use of municipal and regional land use information in planning and design of highways.

Table 4 - Characteristics of Existing Land Use Inventory Systems

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
Ministry of Agriculture, Fisheries and Food	AQUACULTURE LICENSING AND REFERRAL SYSTEMS	Data on regulation of industry and development of resources, collect license revenues, collect industry statistics. Data is presented on a cadastral map base.	1. Aquaculture 2. Finfish, shellfish 3. Marine plants	1989 update is ongoing	British Columbia	Various scales Primary (field work) and secondary (tabular and mapped) sources.	mainly 1:20,000	Spatial data - QUIKmap Tabular data - electronic database hardcopy reports
Ministry of Attorney General	AUTOMATED LAND TITLE OFFICE SYSTEM (ALTOS)	Official survey plans for ownership of land and subdivided parcels. Includes the location and extent of registered titles, easements and utility rights-of-way, and surveyed highways and forest roads.	1. Development 2. Right-of-ways	update is ongoing	British Columbia	Data is collected by Improvement District. Primary data sources - field work	1:20,000	Spatial data - hand drawn maps Tabular data - hard copy reports
Ministry of Energy, Mines, and Petroleum Resources	PETROLEUM TITLES SYSTEM	Manages information on Provincial petroleum and natural gas tenures.	1. Subsurface Resource Tenure 2. Mineral land use maps	1950 update is ongoing (daily)	British Columbia	Primary data sources	1:50,000 1:200,000 1:250,000	Spatial data - hand drawn maps Tabular data - electronic database
	MINERAL DATA ADMINISTRATION SYSTEM (MIDA)	Manages information on provincial mineral tenures	1. Mineral claims and leases 2. Placer claims and leases	1991 update is ongoing(daily)	British Columbia	Data area collected by Ministry administrative unit. Primary data sources.	1:50,000	Spatial data - digital (Intergraph) is not currently linked to MIDA database. Tabluar data - Electronic database, PowerHouse/RDB relational database.
Ministry of Environment, Lands, and Parks - Surveys and Resource Mapping	CANADA LAND INVENTORY PRESENT LAND USE (PLU)	Present land use and land cover.	1. Urban 2. Agricultural Land 3. Woodland 4. Wetland 5. Unproductive Land 6. Water	1965 never updated	Two-thirds of British Columbia	1:50,000 Primary (air photo interpretation and field work) data sources.	N/A	Manuscript maps only.

Land Use Classification System

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
Ministry of Environment, Lands, and Parks - Surveys and Resource Mapping	BASELINE THEMATIC MAPPING (BTM)	Land use, ground cover (vegetation), topography. 1:20,000 & 1:250,000	1. Ground cover 2. Topography 3. Land use	1991 update schedule has not been determined	Vancouver Island, 2 mapsheets near Quesnel; Penticton	1:100,000 1:250,000 Primary (image interpretation, field work) and secondary mapped sources.	mainly 1:250,000	Spatial data - IGDS GIS Tabular (attribute) data dBASE III +
Ministry of Environment, Lands, and Parks - Surveys and Resource Mapping (cont'd)	TERRAIN RESOURCE INFORMATION MANAGEMENT (TRIM)	Three dimensional positionally correct topography and planimetric features for the province of BC.	1. Jurisdictional Boundaries 2. Positioning 3. Referencing 4. Topographic 5. Geology 6. Water 7. Architectural Structure 8. Transportation Utilities 9. Communication Utilities 10. Energy Utilities 11. Water Works Utilities 12. Sewage Utilities	1986 annual updates will commence in 1994.	British Columbia is complete at 1:250,000 and 1:2,000,000 The province will be 50% complete at 1:20,000 by Mar. 31, 1993	1:60,000 1:70,000 (for 1:20,000 presentation only) Primary data source (air photo interpretation).	1:20,000 3-D (x,y,z) 1:250,000 2-D (x,y) 1:2,000,000 3-D (x,y,z)	Spatial data - positional files in Ministry of Environment & Parks format Representational Files in MoEP format and IGDS GIS Attribute data - electronic database
MoELP - Surveyor General	ADMINISTRATIVE BOUNDARIES MANAGEMENT SYSTEM	Database of six administrative boundaries on private and crown lands.	1. Electoral Boundaries 2. School Districts 3. Assessment Areas 4. Land Title Districts 5. Land Management Districts 6. Provincial Boundary	1992 not determined as yet	Southeastern British Columbia	1:250,000 Primary (image interpretation) and secondary mapped sources.	1:250,000	Spatial data - ARC/INFO GIS Tabular data - electronic database
MoELP - Surveyor General (cont'd)	CADASTRAL DATABASE MANAGEMENT SYSTEM (CDMS)	Database of Crown land parcels, tenures, administration boundaries, and some forest tenure data by Regional Land Management Districts and Land Districts.	1. Land Act Tenures 2. Administrative Boundaries	1992 update is ongoing	British Columbia	1:20,000 Primary (image interpretation) and secondary mapped sources	1:20,000	Spatial data - ARC/INFO GIS

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
	CROWN LAND REGISTRY INFORMATION SYSTEM (CLRIS)	Text data on all Crown land parcels, encumbrances, survey plan and administrative area data. Contains data on parcels for sale and other ministry uses and tenures; revenues, expenditures and production control.	1. Cadastral 2. Jurisdictional Boundary 3. Taxation 4. Land Use 5. Referencing	1984 update is ongoing	British Columbia	Secondary attribute data from Land Titles Office, BCAA, and other land based information systems. Some of the attribute data is georeferenced.	N/A	Tabular (attribute) data - electronic database hardcopy reports
MoELP - Parks	GREEN FILES	B.C. Parks park boundaries, locations of facilities and recreation features	1. Permit areas 2. Park facilities 3. Biophysical Units 4. Recreational Features	1978 update is ongoing	All Park Act designations and Ecological Reserves	1:20,000 1:250,000 Primary (image interpretation, field work) and secondary mapped sources.	various	Spatial data - QUIKmap, hand drawn maps Tabular data - dBASE hardcopy reports
MoELP - Parks Branch & MoF- Forest Science Research Branch	PROTECTED AREAS GAP ANALYSIS	Series of maps showing ecosystem diversity, degree of human modification, existing protected areas, and land protection objectives.	1.Biogeoclimatic, ecological boundaries 2. Mature/ Immature Forest 3. Forest Tenure 4. Existing Protected Areas 5. Protected Area Strategy Study areas 6. Other protected area proposals (as of Sept. 1992) 7. Topography 8. Watershed Boundaries	1992 update schedule has not been determined	Vancouver Island Cariboo Forest Region Kootenay Forest Region	1:250,000 Primary (image interpretation, field work) and secondary mapped sources.	1:250,000	Spatial data - PAMAP GIS Tabular data - electronic database
Ministry of Forests	FOREST RESOURCES INVENTORY	Provides polygon specific information about the timber resource by tree species, stand age and height, volume, and area statistics.	1. Forest 2. Non-forest	1960 updated bi-annually	British Columbia	1:15,000 1:20,000 Landsat Primary (field work, image interpretation) & secondary mapped sources.	1:15,000 1:20,000	Spatial data - IGDS GIS Tabular (attribute data) ASCII

Land Use Classification System

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
Ministry of Forests	FOREST RECREATION INVENTORY	Recreation facilities and capability of Crown land for recreation.	1. Biophysical Features 2. Cultural Features 3. Miscellaneous Features 4. Feature Related Recreational Activities 5. Management Code 6. Feature Significance 7. Management Class 8. Resource Opportunity Spectrum Class (ROS) 9. Landscape Features	1981	1/2 of the provincial Forest Districts have completed the inventory.	1:20,000 Primary (field work) and secondary mapped sources.	1:50,000	Spatial data - IGDS GIS Tabular data - electronic database
Ministry of Forests	FOREST TENURE ADMINISTRATION SYSTEM (FTAS)	The corporate database provides data on Crown land forest tenure and guidelines, as well as data for administrative functions. The data is collected by the Forest Districts.	1. Range 2. Recreation 3. Client Management 4. Timber Tenure 5. Work Management 6. Small Business Projects and Planning 7. Timber Mark Registry Program	1989 /92 updates vary depending upon the nature of the information	British Columbia	1:15,000 1:20,000 Primary (field work) and secondary mapped sources.	N/A	Tabular data - hard copy reports electronic database (ASCII compatible)
Ministry of Municipal Affairs, Recreation & Housing	MUNICIPAL, REGIONAL DISTRICT & IMPROVEMENT DISTRICT LEGAL BOUNDARIES	Legal boundary information	1. Administrative Boundaries	1890 update is ongoing	British Columbia	1:2500 1:5,000 1:10,000 Secondary mapped sources	1:2,500 1:5,000 1:10,000	Spatial data - hand drawn maps Tabular data - hardcopy reports
Agricultural Land Commission	AGRICULTURAL LAND RESERVE	Definition of ALR boundaries based on CLI capability classes and historical land use patterns. The information is overlain on a Cadastral/ Legal map base.	1. Agricultural Land Reserve designation 2. Cadastral	1973 updated quarterly	British Columbia	1:5,000 1:10,000 1:50,000 Primary and Secondary sources	1:10,000 1:50,000	Spatial data - hand drawn maps Tabular data - hardcopy reports

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
British Columbia Assessment Authority (BCAA)	COMPUTER ASSISTED PROPERTY ASSESSMENT SYSTEM (CAPAS)	Parcel-based classification of present land use, using 6 general classes in 27 Assessment areas.	1. Residential 2. Farm 3. Commercial 4. Industrial 5. Transportation, Communication & Utilities 6. Civic, Institutional, & Recreational	1975 updated continuously during the field seasons	British Columbia	Data collected at the individual parcel level. Primary sources - field work	1:20,000	Tabular data - hardcopy reports electronic database microfiche
Capital Regional District	URBAN CAPACITY INVENTORY	Identify housing growth capacity of metro Victoria	1. Commercial 2. Commercial with residential 3. Environmentally constrained 4. Industrial 5. Institutional 6. Lake 7. Large Lot Rural 8. Multi-family attached 9. Native Lands 10. Public Forest Lands 11. Redevelopment 12. Single Family detached 13. Special Status	1991 update schedule not yet determined	Capital Regional District	1:2,000 1:5,000 Primary (field work) and secondary mapped and statistical sources.	various	Spatial data - MAP INFO Tabular data - dBASE LOTUS
	RETAIL CENTRE INVENTORY	Inventory and classify retail floor space > 10,000 sq.ft.	1. Retail 2. Office 3. Automotive 4. Service Commercial	1986 periodic updates	Capital Regional District	Various scales Primary (field work) and secondary statistical data.	various	Spatial data- Manual site specific maps Tabular data -Hardcopy reports Electronic database, dBase
	INDUSTRIAL LAND INVENTORY	Inventory of all zoned industrial sites and identify potential for use or change	Zoned Industrial Land	1983	Capital Regional District	Various scales Primary (field work) and secondary mapped and statistical sources.	N/A	Tabular data - Hardcopy reports

Land Use Classification System

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
	BUILDING PERMIT DATABASE	Monitor construction of new dwellings, industrial, commercial, and institutional buildings.	1. Industrial 2. Commercial 3. Institutional 4. Residential	1975 updated monthly	Capital Regional District	Various scales Primary (field work) and secondary statistical sources.	N/A	Tabular data- Hardcopy reports Lotus Spreadsheet
Environment Canada Canadian Wildlife Service	CANADA LAND USE MONITORING SYSTEM (CLUMP)	Present land use and land cover to monitor change on the urban/rural fringe.	Land Activity: 1. Agriculture 2. Forestry 3. Wildlife/Fisheries 4. Extraction 5. Recreation 6. Dwelling 7. Transportation/ Communications 8. Manufacturing and storing 9. Commercial 10. Institutional 11. Conservation, Flood Control, Drainage 12. Unused Land (former idle) 13. No perceived activity 14. Land in Transition Land Cover: 1. Woody Vegetation 2. Grasses 3. Denuded surfaces 4. Constructed cover 5. Water	1981 Final year for data updates was 1986	Vancouver, Chilliwack, Victoria	1:20,000 1:40,000 Primary data sources - image interpretation and field work	1:50,000	Spatial data -SPANS GIS Tabular (attribute) data - ASCII hard copy reports

System		System Contents	Categories / Datagroup	Year Initiated and Update Schedule	Coverage	Data Sources	Data Presentation	
Agency	Inventory Name						Scale	Format
Okanagan Valley Tree Fruit Authority (OVTFA)	ORCHARD INVENTORY	Maintains an up-to-date status on the physical make-up of orchards	1. Agriculture 2. Fruit Trees 3. Commodity 4. Variety 5. Age 6. Rootstock 7. Spacing 8. Tree count	1991 updated annually	Okanagan Valley, Similkameen Valley, Creston, Grand Forks	1:2500 1:5,000 1:10,000 Primary (field work), aerial photo interpretation, and secondary data sources	1:10,000 1:20,000	Spatial data - PAMAP GIS Tabular data - dBASE IV

D. Nongovernment Organizations

Many nongovernment organizations rely on government for land use information. Residential and commercial developers typically obtain land use information from municipal or regional district offices. Tailoring developments to fit prospective land use conditions requires information on present and planned uses. Neighbourhood and environmental organizations often use the same land use information as developers in assessing the suitability of proposed land use changes.

Crown corporations depend on both provincial and local land use information. BC Transit, for instance, uses local land use information for route selection, planning future service levels, and decisions regarding the purchase of buses. BC Hydro and BC Gas use local land use information for forecasting energy load growth and in selecting routes for energy distribution. Long-distance transmission route selection relies on provincial, regional, and local land use information.

E. Initiatives that Require Land Use Information

The provincial and regional planning initiatives that are presently being undertaken or considered have land use information requirements that are specific to their mandates. Some of the major initiatives are described in this section.

Commission on Resources and the Environment (CORE). CORE is now establishing negotiating "tables" on Vancouver Island, the Cariboo-Chilcotin, and the Kootenay Regions. The objectives of the CORE process are to achieve:

1. broad land allocation according to land and resource management zones (at 1:250,000);
2. socioeconomic mitigation and adjustment for communities affected by allocation recommendations;
3. establishment of priorities for subsequent planning at subregional and local levels;
4. implementation and monitoring of the regional plans (CORE 1993).

In its regional planning activities, CORE's focus is on resource land, not settled land. Other CORE initiatives, however, address priority issues that must be addressed through community-based planning processes or special studies. CORE also seeks to create a consistent framework for planning from local to provincial scales. Identifying land use compatibilities and conflicts is an important element of the regional planning approach (CORE 1992).

Through its function as a provider of information to the regional negotiating process, CORE has assembled a set of maps, many of which pertain to land use. The maps show existing conditions as represented by available information. They will be used as a starting point for identifying land use compatibilities and conflicts, and important element of CORE's regional planning approach (CORE 1993).

Although the negotiating teams are expected to identify the need for additional information, Table 5 shows the categories of information collected to date.

Round Table on the Environment and the Economy. The Round Table is preparing a set of specific strategies for achieving sustainability in British Columbia. These strategies include involving participants in identification of information needs and ensuring that the information collected is easily communicated, comprehensive, and is compiled over the long term.

Table 5 - Commission of Resources and the Environment Information Categories

• Administrative	• Natural Areas
• Cabinet Approved Study Areas	• Protection Proposals - Public
• Community Water Supplies	• Range
• Ecological Boundaries	• Recreation Capability
• Energy	• Socio-Economic Features
• Existing Protection and Conservation	• Soil Capability for Agriculture
• First Nations	• Timber Destinations
• Forests	• Tourism Capability
• Forest Capability	• Tourism Facilities and Travel Routes
• Forest Tenure and Inventory	• Trapline and Guide Outfitter Territories
• Heritage and Archaeology	• Wildlife
• Major Land Act Tenures and Reserves	

The Round Table's initiatives call for a set of indicators of sustainability that will record changes in the environment and chart the effects of human activities. These indicators will be related to the environment, social well-being, and the economy, with a goal of linking the indicators to established targets for sustainability.

State of Environment (SOE) Reporting. The SOE program, jointly sponsored by the governments of Canada and British Columbia, has outlined a wide range of topics to be monitored and reported to indicate the status and trend of environmental conditions. For each environmental component (atmosphere, water, biota, and land), a set of important topics was identified, for which several indicators were suggested. For the land use topic, for instance, the suggested indicators were:

- proportion of land area allocated for preservation and for extractive use or development;
- changes in proportion of land base allocated for forestry, mining, settlement, parks, agricultural, and other uses over time;
- length of impounded versus wild rivers; and
- area of land in protected status.

Table 6 - Major Georgia Basin Issues

1. Population Growth and Management
2. Governance: Structure and Process
3. Public Awareness and Education
4. Integrating Transportation and Land Use
5. Restoring and Protecting Natural Habitats/Biodiversity
6. Managing the Transition to a Sustainable Economy
7. Water Quality
8. Waste Management
9. Renewable Resource Management
10. Economic Diversification and Sustainability
11. Aboriginal Interests
12. Air Quality
13. Paying for Sustainability
14. Diverse and Changing Values and Expectations
15. Housing - Density and Affordability
16. Urban Containment
17. Demands for and Costs of Physical Infrastructure and Human Services
18. Social Well-Being
19. Standards, Monitoring and Enforcement
20. Risk of Environmental Accidents
21. Supply and Use of Energy
22. Global Economic Changes
23. Technology and Communications

Source: Round Table on the Environment and the Economy 1993

The Round Table has identified the following steps to achieve sustainable management of the Basin:

- link the involved individuals, organizations, and government in the creation of a common vision,
- integrate sustainability principles in decision making, recognizing that environment, economy and social issues are linked, and
- define the broad priorities and strategic steps that are necessary for a sustainable future.

A background paper prepared as a discussion document for the Georgia Basin Workshop points out that the Basin could be defined by the way its land and water are used (Nelson, 1992). The paper also identifies the lack of a basin-wide inventory of categories of use. A recent American initiative will alleviate this lack of land use information in Washington state. Washington's Growth Management Act requires counties and cities to prepare comprehensive plans to direct land use and economic development in a manner consistent with state goals. Each plan will be developed at a local level but each county and city must adopt comprehensive plans that are consistent with neighbouring jurisdictions. Data to be collected will cover the general categories of urban growth areas, rural areas, resource lands (agricultural, forestry, mineral extraction) and critical areas (wetlands, aquifers, fish and wildlife habitat, floodplains, and geologic hazard areas) (Nelson 1992).

Coastal Zone Management. A provincial interagency initiative is now being conducted that will determine the need for strategic direction in coastal zone management. The goals of this project are to summarize the issues that surround coastal zone management, identify what a coastal strategy should do, and determine how such a strategy would relate to the other provincial planning initiatives. The project team will use this information to decide whether a coastal strategy for British Columbia is needed and, if so, select an appropriate implementation structure.

Coastal Resource Inventory Review. RIC established a Task Force on Marine and Coastal Resources in 1992. As part their mandate the Task Force conducted a survey to determine the status of coastal inventory programs and the use of these inventories in British Columbia.

The Task Force reached the following conclusions, based on an analysis of the survey results:

- There is a high demand for human use information, as well as for physical and biological data.
- The greatest use of coastal resource information is for multiple levels of planning (e.g. strategic and site planning).
- User product requirements are shifting from hard copy maps and reports to electronic formats.
- The collectors of coastal resource information are the Federal and Provincial governments, Crown Corporations and consultants. BC Environment is the major provincial collector and user of coastal data.
- The many organizations that are collecting coastal resource information indicate the need for a strong coordination and liaison strategy.

The survey conducted during the Coastal Resources Inventory Review included the following categories of human use:

Table 7 - Human Use Categories Identified in Coastal Zone Inventory Review

- Aquaculture Sites
- Hatchery / Salmon Enhancement Program sites
- Archaeology / Heritage Sites
- Marinas / Launches
- Lodges / Resorts
- Charter Operations
- Communities
- Parks / Ecological Reserves
- Indian Reserves
- Military / Crown Reserves
- Commercial Harvesting
- Non-Commercial Harvesting
- Diving
- Kayaking
- Anchoring
- Other Recreational Use

The Task Force identified many issues facing coastal resource inventory users and collectors, especially the lack of data collection and classification standards. The lack of a standardized system causes the duplication of inventory efforts and the inefficient use of limited inventory dollars. The need for mapping classification systems and for methods to identify appropriate criteria for interpretation were also raised (Howes 1992).

F. Regional Activities

Two key initiatives that are being developed are the Protected Areas Strategy (PAS) and the Land and Resource Management Planning (LRMP) program. These interministerial initiatives operate at regional and subregional levels, and include both biophysical and socioeconomic analyses. Although the PAS and the LRMP have not yet been fully developed, they may require large amounts of specific kinds of land use information.

G. Purpose of Existing Land Use Inventories

The inventories listed in Table 4 can be organized according to the purposes they are designed to serve (Table 8). Agencies hold land use inventories for the purposes of resource management, monitoring, regulation and valuation, and planning and administration. These purposes reflect the mandates of the relevant agencies. Users of land use data (government and nongoverment) have indicated that land use data is essential for negotiating conflicts and conducting impact assessment of policies, projects, and programs.

Table 8 - Land Use Inventory Purposes

Purpose	Inventory Name and Agency	Scale
Resource Management	Orchard Inventory (Okanagan Valley Tree Fruit Authority)	1:20,000
	Agricultural Land Reserve (Agricultural Land Commission)	1:50,000
	Petroleum and Mineral titles (Ministry of Energy, Mines, and Petroleum Resources)	1:50,000
	Forest Tenure Administration System (Ministry of Forests)	1:20,000
	Grazing Lease Tenure Management (Ministry of Forests)	1:50,000
	Aquaculture Licensing Revenue Administration (Ministry of Agriculture Fisheries and Food)	1:20,000
Monitoring	Canada Land Inventory Present Land Use (Environment Canada and Ministry of Environment, Lands, and Parks)	1:50,000
	Canada Land Use Monitoring System--CLUMP (Environment Canada)	1:50,000
	Baseline Thematic Mapping (Ministry of Environment, Lands, and Parks)	1:250,000
Valuation or Administration	Property Assessment System (British Columbia Assessment Authority)	1:20,000
	Crown Land Registry Information System (Ministry of Environment, Lands, and Parks)	1:20,000
	Cadastral Database Management System (Ministry of Environment, Lands, and Parks)	1:20,000
	Land Title Office System (Ministry of Attorney General)	N/A
	Legal Boundaries (Ministry of Municipal Affairs, Recreation, and Housing)	1:2,500 and 1:10,000

Purpose	Inventory Name and Agency	Scale
Planning and Land Allocation	Protected Areas (Ministry of Environment, Lands and Parks)	1:250,000
	Timber Supply Areas (Ministry of Forests)	1:250,000
	Green Files, Park Boundaries (Ministry of Environment, Lands, and Parks)	N/A
	Land Claims (Ministry of Aboriginal Affairs)	1:250,000
	Baseline Thematic Mapping (Ministry of Environment, Lands and Parks)	1:250,000

5. Land Use Inventory Users and Their Needs

The contents, scale, and structure of land use classification systems vary according to the demands of their users. A User Needs Survey, distributed as part of the Land Use Task Force initiative, provided details on the needs of a variety of land use information users. A data generators' survey was also distributed. Copies of both questionnaires can be found in Appendix B. The following sections summarize the findings of the land use information survey and other comments received from land use information users. A more complete presentation of user needs survey responses is found in Appendix C, and data generator responses in Appendix D.

A. General Findings

Survey composition. Of the 142 user needs surveys distributed by FAX, 52 were returned, for a 37 percent response. Table 9 shows the number of respondents by category of data user. Almost half the respondents were from the provincial government, with the remaining three groups (local government, consultants, and other nongovernment organizations) each forming less than one-fifth of the sample.

Table 9 - User Survey Respondents

Group	Percent	Number
Senior Government	46	22
Local and Regional Government	16	8
Consultant	19	9
Other nongovernment	19	9
TOTAL	100	48

Uses of land use information. Table 10 presents the responses to the question, "How does your organization use land use information?" The strong government representation in the sample is shown by the kinds of activities supported by land use information: resource management, planning, monitoring, and regulation were all mentioned by more than half the sample. Transportation planning, research, and "other" uses were all cited by one-third to one-half of the sample. Typically private sector activities, facility location, purchasing and sales, valuation, and marketing were all mentioned by fewer than one-third of respondents.

Table 10 - Uses of Land Use Data

Category	Percent	Number Of Responses
Resource Management	67	32
Planning	65	31
Monitoring	58	28

Category	Percent	Number Of Responses
Regulation	56	27
Transportation	46	22
Research	44	21
Other	33	16
Facility Location	31	15
Purchasing / Sales	31	15
Valuation	29	14
Social Planning	25	12
Marketing	6	3

Important database characteristics. Figure 1 shows the importance placed by respondents on various characteristics of land use information. The four most important characteristics were timeliness (called "very important" by all local government respondents and 75 percent of the total sample), standardization of format, affordability of output, and ease of updating the database. The cost of TRIM mapping was specifically mentioned as an issue by several respondents.

Digital maps and paper maps were deemed to be equally important among survey respondents. This response suggests that although geographic information systems-oriented people may consider paper maps to be outmoded, most data users still demand paper maps for their work. For databases, users are more inclined to demand digital output than paper output.

Broad geographic coverage was not as universally important as other database characteristics. The cumulative effect of each respondent's emphasis on local and regional coverage, however, is that provincial coverage is an important goal.

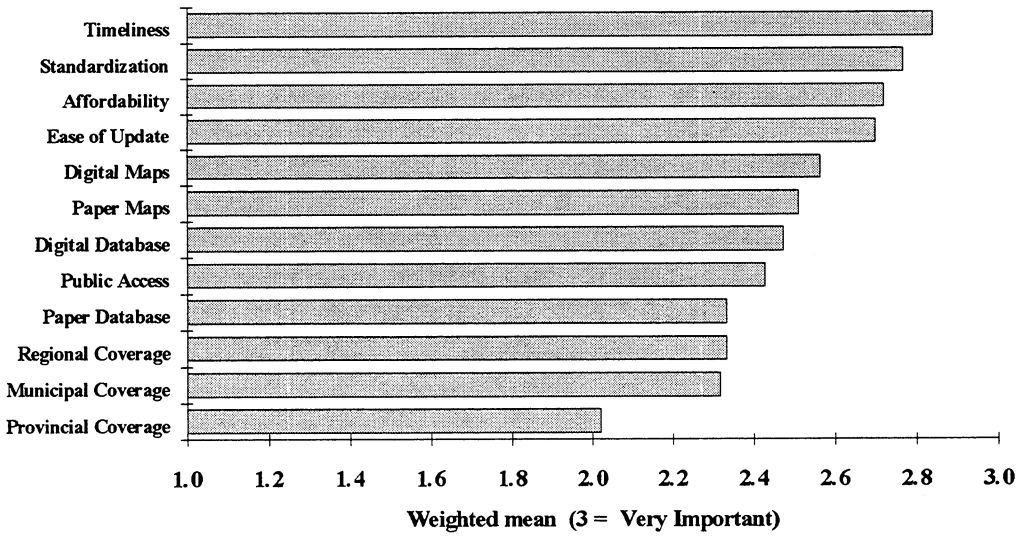

Figure 1 - Importance of Database Characteristics

Need for provincial land use inventory. In answering the question "Do you feel there is a need for a regularly-updated, province-wide land use inventory," 83 percent of respondents said "yes," 12 percent said "no," and 5 percent did not answer. They noted that land use planning and resource management required up-to-date inventory information, old data cannot be used to solve new problems, and that such information is necessary to protect provincial interests in local land use matters. Land claim negotiations, land monitoring, and consultative planning initiatives all were cited as needing land use inventory support.
Some respondents did not feel that an updated provincial inventory would be useful. They cited concerns about the usefulness of small scale surveys and the cost-effectiveness of large scale surveys. One respondent recommended putting resources into production and updating of base information such as aerial photographs and topographic maps.

Vital kinds of land use information. Respondents identified a wide range of information needed to support their mandated goals. Some of the demands dealt with planned future uses ("projected" tourism use, potential urban growth areas, community plan designations) and biophysical capability (forests, agricultural soils, habitat associations). Tenurial boundaries (forests, ALR) were commonly mentioned, as were many agency-specific requests (grazing, traffic zones, property histories). These findings suggest that the corporate land use inventory should endeavour to provide a baseline of generally useful land use descriptions, recognizing that most data users will need to supplement inventory information with more detailed or specific information.

Expected changes in information needs. The responses to the question "How do you expect your organization's needs for land use information to change in the next decade?" fell into two general categories. Two-thirds of responses could be classified as emphasizing increased demand for land use information (more detailed information, different kinds of information, or changed formats). One-third of responses mentioned creation or adoption of a geographic information system or related digital data processing facility.

General comments from inventory users. Some respondents provided the following specific suggestions that do not fit into other categories but are nonetheless valuable.

- A centralized mapping agency and clearinghouse (like Maps B.C.) would work better than a variety of independent agencies.
- Lower the price of digital mapping products, particularly 1:20,000 TRIM.
- Conduct one or two pilot projects before agreeing to a specific system or standard.
- Consider how and by whom information will be updated.

B. Summary of Inventory Generator Survey Results

Out of 50 questionnaires distributed to generators of land use inventories, 28 were returned. All but one of the respondents were provincial government agencies or regional governments.
Use and structure of databases. The survey respondents manage land use databases that are used for the following purposes (in order of frequency of response):

- monitoring
- inventory of land conditions
- resource administration or management

- analysis of financial or economic conditions
- assessment of resource capability.

Nearly 60 percent of respondents said that their inventories were collected to satisfy a legislated mandate, and the remaining 40 percent of inventories are collected for other reasons.

Figure 2 shows the results of a question asking who uses the land use inventory information. Provincial government agencies were the biggest single user of data among respondents, but this figure in part represents the dominance of provincial agencies in the structure of the sample. The "other" category is surprisingly large, and private groups and the federal government are surprisingly small users of land use information.

The inventories are based overwhelmingly on administrative boundaries. Nearly 90 percent of respondents said administrative boundaries formed the basis of their inventories, whereas 10 percent are based on biophysical or ecological boundaries.

The categories of land use information contained in the reported inventories vary according to the use of the database. They range from two-category databases (Crown land versus private land in the Crown Land Registry) to the Canada Land Use Monitoring Program's 19 categories of activity and cover.

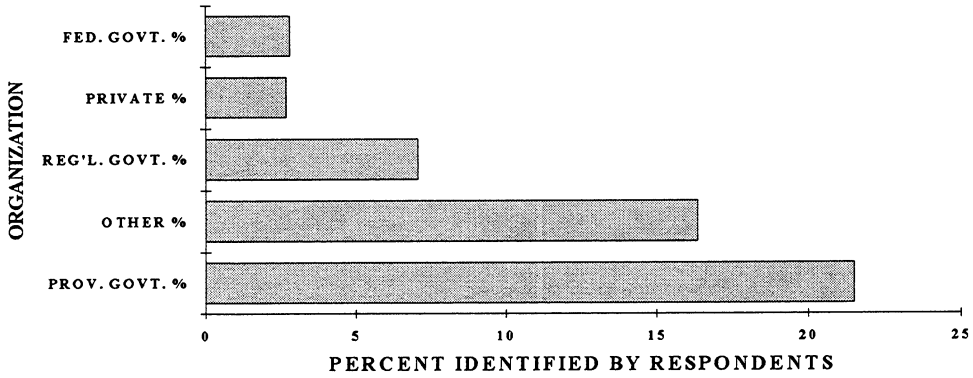

Figure 2 - Users of Land Information

Data management characteristics. Almost 80 percent of the reported inventories are in digital geographic information system format. The remainder are either tabular, non-georeferenced data or are based on hand-drawn maps. Tellingly, 13 different GIS systems are used by the responding data generators.

Data are obtained for the inventories from a mix of primary and secondary sources. The scales of data presentation range from 1:1,200 to 1:6,000,000. The scale of data collection ranges from individual land parcels and 1:1,000 scale maps to Landsat imagery and 1:250,000 maps.

The cost of developing the reported databases range from $10,000 to $5 million and average $1.3 million. Operating costs for the systems range from $15,000 per year to $9 million per year, and average $920,000 per year. If the Ministry of Forests' $9 million Forest Inventory

program is dropped, the average operating cost drops to $298,000. More than half of the reported systems cost less than $100,000 per year to operate.
The survey asked data generators how satisfied they are with data collection, processing, storage-retrieval, and transfer. Almost 70 percent of respondents found data collection methods to be "somewhat satisfactory" (Figure 3). Only 16 percent each found it very satisfactory or unsatisfactory. A similar pattern was found with data processing, except that no respondents found it unsatisfactory (Figure 4). For both collection and processing, respondents cited rising expectations, weak standards for data quality, and changing technology as major problems.

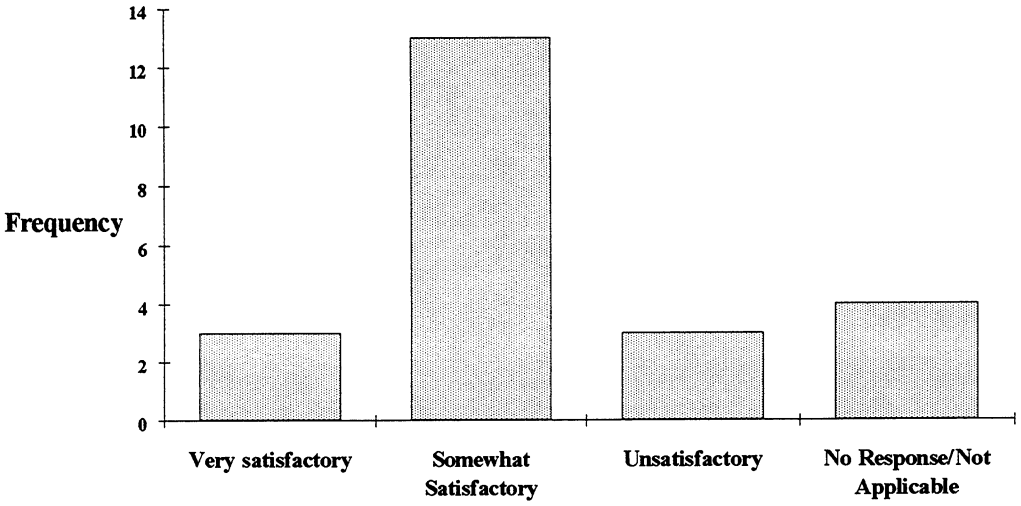

Figure 3 - Data CollectionRatings

Respondents seem to be relatively pleased with information storage and retrieval systems (Figure 5). Almost 41 percent found storage and retrieval to be very satisfactory, 45 percent somewhat satisfactory, and only 14 percent unsatisfactory. Many respondents noted their happiness with digital technology and their dissatisfaction with manual storage systems. Slightly more respondents are pleased with data transfer to other agencies than they are with transfer from other agencies. Nearly 30 percent of respondents were very satisfied with transfers to other agencies and one quarter of respondents were dissatisfied (Figure 6). For data acquisition from other agencies, only 11 percent were very satisfied and almost 30 percent were unsatisfied (Figure 7). Major problems cited include poor integration of different geographic information systems, lack of standardized transfer formats, and inconsistent land use categories. Poor cooperation among agencies was a commonly cited obstacle to acquiring data. Not everyone sees electronic data transfer as a blessing; one respondent said "Everything is difficult on GIS."

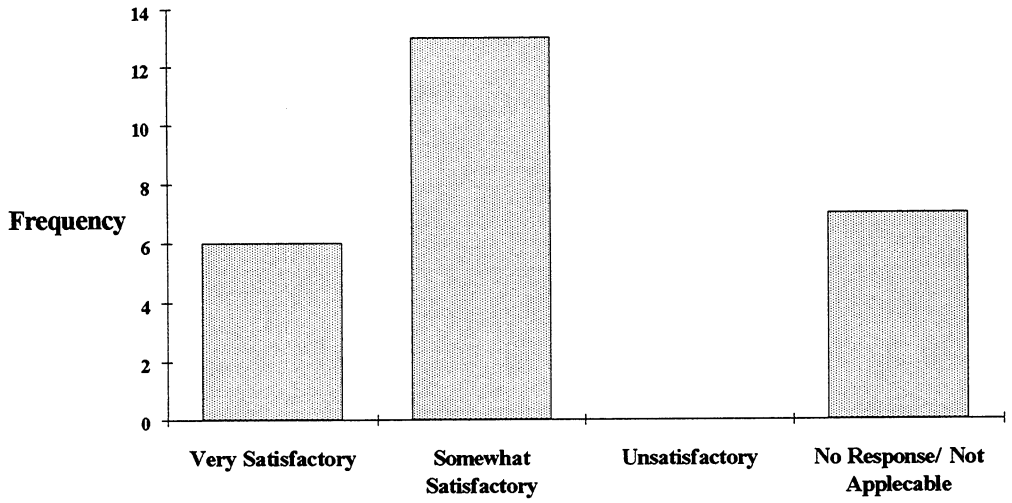

Figure 4 - Data Processing Ratings

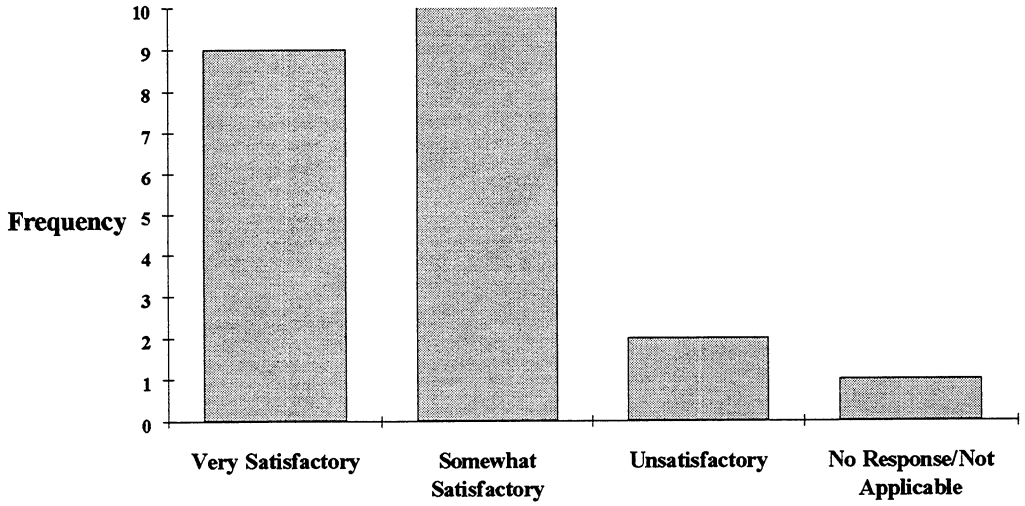

Figure 5 - Information Storage and Retrieval Ratings

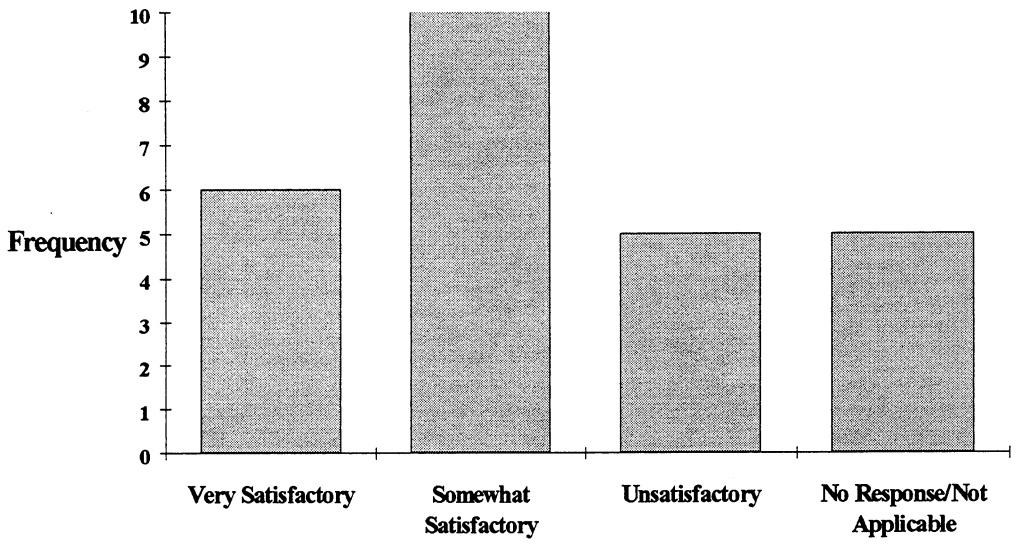

Figure 6 - Information Transfer to Other Agencies

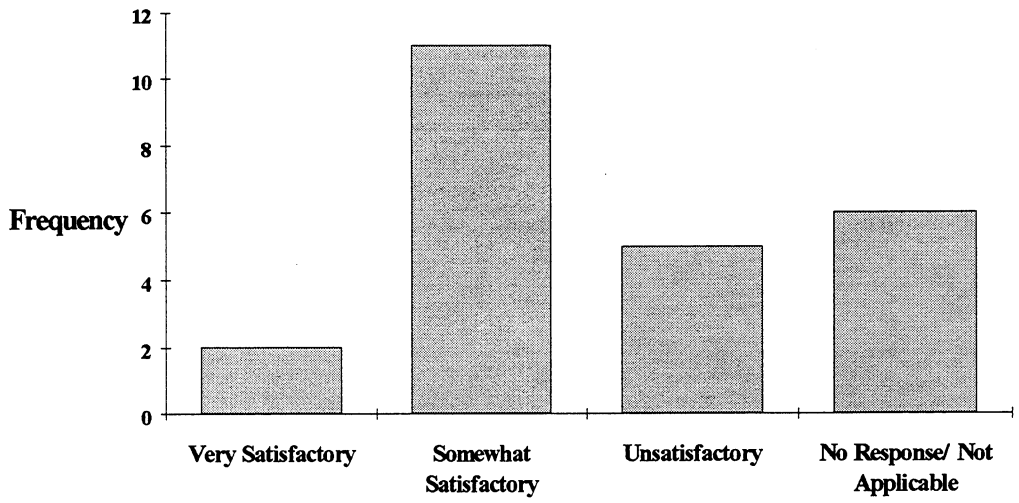

Figure 7 - Information Acquisition from Other Agencies

Centralized versus decentralized inventories. Some workshop participants and survey respondents expressed the view that a central data collection and distribution agency would be highly desirable. Most participants in this project, however, felt that such centralization is unrealistic, and that decentralized data collection, accompanied by a central clearinghouse for land use information would achieve the goals of the Task Force. Such decentralized data collection demands adherence to clear standards and guidelines for land use categories, scales, and quality control.

These guidelines will complement the corporate data base access system now in place at the Ministry of Environment, Lands and Parks' LandData BC program. LandData BC will

facilitate the use of decentralized data collection and storage throughout the provincial government and, potentially, other sources of land use information. LandData BC will allow users to determine what data is available, order tabular or mapped output, and retrieve it in a consistent format.

Decentralized data collection such as proposed for LandData BC requires rigorous conformance to data quality, collection, and storage format standards. (Nonconforming data will also be listed in the LandData BC database, but will not be available online.) Some of the obstacles to collecting timely land use information on a continuing basis (lack of funding, project-driven inventory initiatives, uneven spatial coverage) would not be resolved by the LandData BC process.

Quality control. Many land use data users were critical of the quality of information available, so we asked data generators what quality control measures were used for each database. Of the 27 databases represented in responses, 30 percent reported that data are field checked. Approximately 63 percent use "internal" checks (peer review, checks for compliance with standards, or manual data entry checking). Almost one-fifth of the databases are subject to "electronic" checking by software routines designed to detect inconsistent or impossible data fields. Three databases (11 percent of responses) were reportedly not checked for quality.

Expected changes. Respondents were asked how they expect information acquisition and management to change in the next decade. Of the 38 identified changes expected, 45 percent related to expanded agency programs or enlarged database content. These responses included providing more site-specific information, implementation of land use data collection plans, and moving toward land use data rather than land use mapping. About one-quarter of responses dealt with improved technology, primarily adoption of geographic information systems or elaboration on existing systems for collecting, processing, or transferring information. One-fifth of responses dealt with changes in internal procedures, such as producing sensitivity maps, serving "multiple use clients," and providing increased user access to data by users. Only 11 percent of respondents identified increased geographic coverage as likely in the next decade. One response suggested that regular monitoring of large areas would cease to be conducted while resources are being shifted to GIS support.

Recommended changes. Respondents were asked to suggest changes to the land use inventory system to remedy identified problems. Improved cooperation and coordination of land use inventory efforts were most commonly voiced. These suggestions often lauded RIC and CRII and encouraged greater funding for those initiatives. Coordinating provincial and junior government land use inventories was suggested. Provision of standards for data collection, processing, and presentation was also a common theme. Other recommendations that did not fit into discrete categories include:

- creating two levels of data--a corporate level and more specific levels focused on specific agency needs;
- focusing on improving existing data rather than collecting new data;
- providing improved direction and larger budgets for corporate inventory.

Part 2 Specification for the Land Use Inventory

Land Use Classification System

6. Recommended Land Use Inventory Data Model

The heart of any inventory is the kind of data it contains. Because land use information has such a wide variety of applications, identifying the appropriate categories of land use information for the corporate system is not a trivial exercise. This section describes the structure and content recommended for the corporate land use inventory. Table 11 summarizes the organization, structure, and categories of information in the data model; the formal and complete description of the data model is presented in Appendix E.

The data model and associated categories of land use identified in this chapter require thorough field testing and refinement prior to broad application to land use inventory preparation across the province.

Linking structure to needs. The utility and value of any land use classification depends largely on the categories and organization of its information. The corporate land use classification needs to satisfy the demands of information users for present and expected decisions and agency functions. The results of the surveys and information obtained from the workshop are the basis for defining user needs. The land use categories have been tailored to future resource management and land allocation demands rather than to the priorities of the past. The data model is structured to take advantage of recent improvements in data handling and presentation technology.

Land use entity groups. The entity groups were selected on the basis of satisfying needs for land use information. As shown in Table 11, the five entity groups are:

1. **Activity**, the actual manifestation of human activity on the land when an inventory is conducted. Present activity is what most people have traditionally expected to find in a land use inventory.
2. **Jurisdiction and tenure** describes how society has allocated land for use and has organized land administration among political jurisdictions and resource tenure holders. This information is necessary for determining the agencies and persons that influence land use decisions. Names of individual property owners are unlikely to appear in this entity group unless an individual holds a significant provincial resource tenure.
3. **Regulations** can directly affect the use of land and will be summarized in the land use inventory. Applicable regulations from all levels of government should be capable of being stored in the database.
4. **Declared interests** in the land can be important information for land use decisions. A declared interest may be as formal as a rezoning application or as informal as a public group's proposal that is under study by a government agency. Because the inventory is to be a British Columbia corporate initiative, only those interests that have been recognized or registered with a government will be included in the database. Because land claims are important to land allocation in British Columbia, special efforts should be made to identify First Nations interests for inclusions in the inventory.
5. **Cover** is the biological communities or physical materials on a site at the time of inventory. Cover is important to understanding some categories of land use.

Land use class attributes. For each land use entity, several attributes need to be described in the corporate inventory. The recommended attributes include the following.

1. **Name**. The name of each entity in the database will be selected from a range of categories provided. The available names or categories will be linked to the scale of data acquisition. For example, five categories of agricultural activity are available at the regional level, but 28 activities can be listed at local scales.
2. The names or categories of information are specific to each entity group. Activity and declared interest entities share a set of potential names, although some names that are specific to declared interests are also suggested. Jurisdictions, regulations, and cover have their own sets of recommended names.
3. **Scope**. The scope of the characteristics that apply to each named land use polygon, line, or point are described by this attribute. The three categories of scope data to be contained in the database are:
4. Time of data relevance. Because human activity on land and water changes, the corporate inventory highlights the time period covered by data entered for each entity. This information will be helpful in interpreting information in the database.
5. Date of data capture. The time that the inventory information was captured will be used to identify whether the inventory information is the most current information available or archive or historic information. The value should not represent the date of publication of information, but rather the date of collection of primary information. For example, land use information mapped in 1975 based on 1970 aerial photographs would have a listed date of data capture of 1970.
6. Scale of data capture. As discussed earlier, the scale of data capture is important to reliability and, hence, interpretation of land use information. The scale of data capture may also vary among entities, so the land use data model calls for scale of data acquisition to be presented for each class of land use information.
7. **Representation**. Land use information may be represented in a database or map as an area, line, point, or icon. Identifying the means of representing attribute information aids in interpreting and representing the data, manipulating data in geographic information systems, and presenting information on hard copy maps.
8. **Metadata**. The technical information necessary to understand the sources and nature of information in the database needs to be appended to each data item or group of items in the database, and so is included as a component (a set of attributes) for each land use entity.

Table 11 - Conceptual Data Model for Corporate Land Use Inventory (showing hypothetical data)

Land Use Entity Groups	Name	Land Use Entity Attributes			Representation	Metadata
		Scope				
		Time of Data Relevance	Date of Data Capture	Scale of Data Capture		
Activity	Vegetable crops	1990-1993	1993	1:5000	Area	
	Annual forage crops	1956-1993	1993	1:5000	Area	
	Grazing on improved land	1956-1990	1990	1:10,000	Area	
	Housing livestock	1956-1990	1990	1:10,000	Area	
	Clearcut logging	1945-1956	1960	1:63,360	Area	
Jurisdictions and Tenures	District of Surrey	1993	1993	1:10,000	Area	
	Surrey Irrigation District	1988-1993	1993	1:10,000	Area	
	Greater Vancouver Regional District	1968-1993	1993	1:50,000	Area	
Regulations	Zoned A1	1974-1993	1993	1:2000	Area	
	Agricultural Land Reserve	1973-1993	1993	1:5000	Area	
Declared Interests	Rezone for golf course	1991-1993	1993		Area	
	First Nations Land Claim	1992-1993	1993		Area	
	Residential development	1985	1986		Area	
Cover	Upland forbs	1993	1993		Area	
	Upland tall shrubs	1993	1993		Area	
	Mature coniferous trees	1950	1952		Area	

Some hypothetical information has been entered in some of Table 11's cells to indicate how a completed database record might look. No information has been entered in the metadata column, which would contain many fields determined by LIMF and LandData BC (see Appendix F for names of metadata).

Corporate base mapping scales. The Land Use Task Force discussed the issue of base mapping and appropriate scales of representing land use information, and concluded that the following three scales would form the basis of land use data presentation.

- Provincial -- (scales range from 1:1,000,000 to 1:7,000,000, commonly 1:2,000,000)
- Regional scale -- (1:125,000 to 1:500,000, commonly 1:250,000)
- Local scale -- (1:2,000 to 1:50,000, commonly 1:20,000).

These scales are commonly used for provincial purposes, and base mapping is available or will be available shortly for regional and provincial scales. The 1:20,000 TRIM maps may not be ready for all areas of the province for some time. The Land Use Task Force recommends that these scales guide data collection and presentation, recognizing that larger scale data collection allows for more flexibility in data presentation and analysis than small scale collection. Most information presented on the 1:2,000,000 base would be aggregated from larger scale data collection.

7. Categories of Information for the Inventory

Within the structure of the data model a variety of categories of land use information must be collected and processed. The selection of the categories affects the long-term utility of the inventory, its flexibility in adapting to change, and the cost-effectiveness of data acquisition and information output.

Criteria for selecting land use class categories. The following set of criteria were applied to selecting categories of use within each class of land use.

1. Relevance to greatest range of users. For the corporate land use classification to be useful, it must provide information demanded by the users. The demands for land use information were identified by respondents to the user needs survey and the data generator survey.
2. Minimum overlap of categories. The categories need to be discrete. Overlap and duplication are inefficient and are to be minimized under the RIC objectives.
3. Hierarchical nature. The land use categories selected should be capable of displaying greater and lesser detail as scales and user needs vary.
4. Use data from existing collection programs. The cost effectiveness of preparing the classification will be greatly enhanced by building on existing data collection, storage, analysis, and presentation activities of provincial, federal, and junior government agencies.

Table 12 presents a proposed set of names of land use activity categories to be included in the corporate land use system. The categories have been selected on the basis of user needs surveys, workshop results, and professional experience in land use data collection and application.

Although three levels of data detail are shown on Table 12, additional detailed levels of data collection may be (and are) conducted in the province. These large scale data collection efforts are very valuable and sometimes legally mandated. For purposes of the provincial inventory, however, it is important that categories of large scale land use mapping be capable of being aggregated into the smaller number of corporate categories.

The levels of categories shown in Table 12 are meant to be guidelines. The hierarchies may not relate directly to the scale of information that can be shown on a map. Mapping of activities will be determined in part by the size of uniform use areas and the kinds of information needed at a given level. For example, "grazing on unimproved land" is shown as an appropriate category for local scale mapping, but large areas of grazing may be shown on regional or even provincial scale maps in some parts of the province.

The categories represent the kinds of information typically used for land use analysis at differing levels (provincial, regional, or local). The categories can be used independently of scale if deemed appropriate by the information user.

The activity codes shown beside each proposed category are intended to provide information as well as facilitating data entry. The letter in each code is a mnemonic device linked to the name of the Level I activity (e.g., H for Heritage, R for Recreation). The number of "significant figures"

represented in the code shows the level of detail of data collection. At the provincial scale, all codes end in "000," at the regional scale 100, 200, etc., and at the local scale 110, 120, etc. If more detailed information is available, then additional significant figures could be added (111, 112, etc.).

Table 12 - Names of Categories for the Land Use Activity Entity Group

Note: The table identifies "Activity" groups, the divisions of which are based on:

- logical differentiation
- ability to nest, local, regional and provincial activity levels

Level I: Provincial	Level II: Regional		Level III: Local	
A000 Agriculture/Aquaculture * Farming	A100	Field crop production	A110	Grains and cereals (e.g. wheat, canola, barley, corn)
			A120	Tree fruit crops (e.g. apples, pears, cherries)
			A130	Vine and small tree fruits (e.g. blueberries and grapes)
			A140	Forage and pasture crops (e.g. silage, hay, grazing)
			A150	Vegetable crops (e.g. root and cole crops, tubers, garlic)
			A160	Floriculture (including bulbs)
			A170	Specialty crops (e.g. ginsing, herbs, sod, nuts, mushrooms)
			A180	Nursery - general (including ornamentals, shrubs & trees)
			A190	Unspecified/other crops (including unplanted crops)
	A200	Housed crop production	A210	Vegetables
			A220	Floriculture (including bulbs)
			A230	Tropicals, ornamentals & other specialty plants
			A240	Mushrooms
			A250	Nursery - general
			A290	Unspecified/other crops
	A300	Housed and site based animal production (i.e. barn, feedlots, paddocks)	A310	Livestock (e.g., dairy, beef, horses, swine, sheep, other)
			A320	Specialty livestock (e.g., Emu, Llama, Ostrich, Bison)
			A330	Poultry (e.g., broilers, egg producers, turkeys, ducks)
			A340	Game (includes ungulates; game birds like pigeons & quails)
			A350	Fur-bearing animals (e.g. rabbits & mink)
			A360	Beekeeping and honey production
			A390	Unspecified/other

Level I: Provincial	Level II: Regional		Level III: Local	
	A400	Free-range animal production	A410	Livestock (e.g. dairy, beef, horses, swine, sheep, other)
			A420	Specialty livestock (e.g.Emu, Llama, Ostrich, Bison)
			A430	Poultry (e.g. broilers, egg producers, turkeys, ducks)
			A440	Game (game birds like pigeons & quail, & ungulates)
			A450	Fur-bearing animals (e.g. rabbits & mink)
			A490	Unspecified/other
	A500	Freshwater aquaculture	A510	Finfish
			A520	Shellfish
	A600	Marine aquaculture	A610	Finfish
			A620	Shellfish
			A630	Plants
	A700	Farm structures and ancillary activities	A710	Structures for crop, chemical, machinery, tool, and/or general storage
			A720	Ancillary processing (small scale on farm)
			A730	Animal training, petting and boarding (e.g. riding ring, petting farm, kennel)
			A740	Composting facility
			A750	Manure facility
			A760	Crop protection (hail netting, shade cloths)
			A770	Irrigation
			A780	Drainage
			A790	Unspecified/other
	A800	Inactive agricultural land and facilities	A810	Fallow farm land
			A820	Cleared land, not in production
			A830	Abandoned or neglected farm land
			A840	Abandoned or unused farm structures
			A890	Unspecified/other
S000 Human Settlement	S100	Residential	S110	Urban and suburban detached and duplex
			S120	Rural, large lot residential (>2acres)
			S130	Attached (apartment and townhouse)
			S140	Mobile homes
			S150	Ancillary residential (combined with commercial or other use)
			S160	Construction and resource employee camps
	S200	Commercial and service facilities	S210	Retail, services, office
			S220	Wholesale and warehouse facilities
			S230	Hotels and motels
			S240	Cultural and entertainment

Level I: Provincial	Level II: Regional	Level III: Local
	S300 Industrial	S310 Light industry
		S320 Medium and heavy industry
		S330 Food processing (including wineries)
		S340 Oil and gas storage tank farms
		S350 Outdoor material and equipment storage
		S360 Auto wreckers
	S400 Institutional	S410 Government
		S420 Churches and cemeteries
		S430 Hospitals and medical centres
		S440 Education facilities
		S450 Jails, prisons, other correctional facilities
		S460 Meeting and assembly halls
	S500 Communications and transportation	S510 Highways
		S520 Railways
		S530 Airports
		S540 Marinas and docks
		S550 Resource roads
		S560 Telecommunications facilities
		S570 Marine passenger and shipping routes
	S600 Utilities	S610 Energy transmission and distribution
		S620 Solid waste facilities
		S630 Liquid waste facilities
		S640 Domestic water tanks and distribution facilities
	S800 Military	S810 Military training
		S820 Military testing
		S830 Other military
R000 Recreation	R100 Intensive facility based recreational activities	R110 Municipal and regional parks, picnic areas, zoos, sports fields and gardens (usually characterised by distinct boundaries)
		R120 Golf courses
		R130 Indoor recreation and sports facilities
		R140 Sports tracks, courts, race courses, shooting ranges
		R150 Walking and bicycle trails and corridors (resurfaced - paved, gravel or chip)
		R160 Fairgrounds, amusement parks
		R190 Other intensive recreation

Level I: Provincial	Level II: Regional		Level III: Local	
	R200	Viewing and collecting (passive outdoor recreation)	R210	General scenic, astrological, cultural and historic site viewing
			R220	Fauna viewing (including birds, wildlife, insects)
			R230	Flora viewing (trees, plants)
			R240	Marine & aquatic life viewing
			R250	Beach combing
			R260	Rock & fossil hunting
			R270	Beach combing
			R280	Mineral panning
			R290	General gathering & collecting
	R300	Air sports	R310	Hand gliding
			R320	Paragliding
			R330	Skydiving
			R390	General air sports
	R400	Water sports	R410	Beach activities
			R420	Boating and sailing (non-motorized)
			R420	Boating (motorized - including water skiing, jet boating, & cruising)
			R430	Kayaking and canoeing
			R440	Scuba and snorkelling
			R450	Surfing and sailboarding
			R460	Rafting and tubing (particularly river)
			R470	Swimming/bathing
			R490	General water sports
	R500	Snow sports	R510	Downhill skiing, telemarking, & snowboarding
			R520	Cross-country skiing & touring
			R530	Sledding, tobogganing, tubing
			R540	Ice skating
			R550	Snow shoeing
			R560	Dog sledding
			R590	General motorized snow sports (including snowmobiling, snow-cat, all-terrain vehicle touring)

Level I: Provincial		Level II: Regional		Level III: Local	
		R600	Land-based adventure activities (summer activities)	R610	Hiking and backpacking
				R620	Exploring, caving (spelunking)
				R630	Mountain climbing and mountaineering (including rock and ice climbing)
				R640	Mountain biking
				R650	Horseback riding
				R660	Orienteering and survival games
				R670	General motorized trail and all-terrain activities (e.g. 4wheel driving, trail-bike & all-terrain vehicle riding)
				R690	Other
		R700	Fishing & hunting	R710	Sport fishing
				R720	Ice fishing
				R730	Shellfish fishing
				R740	General fishing
				R750	Game hunting
				R760	Bird hunting
				R770	General hunting
		R800	Camping, lodges, tourist trailer parks and ancillary recreational facilities and activities	R810	Camping
				R820	Cabins, cottages and huts
				R830	Wilderness picnic and rest sites
				R840	Plane and helicopter access sites
				R850	Snow-cat and all-terrain vehicle access site and routes
				R860	Backcountry storage and holding facilities (for fuel and other supplies)
				R870	Other
L000	Wildlife and related activities	L100	Wildlife management	L110	Wildlife reserves
				L120	Trapline areas
				L130	Guide-outfitter territories
				L140	Managed wildlife breeding areas
				L150	Managed migratory bird stopover areas
		L200	Finfish management	L210	Fishing areas
				L220	Fish ladders
				L230	Fish hatcheries
		L300	Shellfish management	L310	Shellfish harvest areas
				L320	Shellfish areas permanently closed to harvesting
F000	Forestry	F100	Logging and related harvesting activities	F110	Clearcut logging
				F120	Selective and other logging
				F130	Prescribed burn areas
				F140	Dryland log sorting and storage
				F150	Aquatic log booming grounds

Level I: Provincial		Level II: Regional		Level III: Local	
		F200	Research and seed production	F210	Designated seed tree sites (points)
				F220	Nurseries and greenhouses
				F230	Research trials and demonstration forests
		F300	Immature forest activities[1]	F310	Forest plantation, not free to grow (<10 years old)
				F320	Forest plantation, free to grow
				F330	Naturally restocked, not free to grow (<10 years old)
				F340	Naturally restocked, free to grow
				F350	Not satisfactory restocked (>10 years old)
				F360	Non-commercial immature forest
F000	Forestry	F400	Pre-harvest mature forest[2]	F410	First growth forest, logging within 10 years
				F420	First growth forest, logging after 10 years
				F430	Second growth forest, logging within 10 years
				F440	Second growth forest, logging after 10 years
				F450	Third growth forest, logging within 10 years
				F460	Third growth forest, logging after 10 years
				F470	Other pre-harvest forest
		F500	Christmas tree production	F510	Growing Christmas trees
				F520	Recently-cut Christmas tree areas
		F600	Other forest disturbances	F610	Forest fire areas
				F620	Pest-damaged forest
Z000	Hazardous waste site (point)	Z100	Hazardous waste site (point)	Z110	Hazardous waste site (point)
W000	Water management activities	W100	Reservoirs	W110	Hydroelectric generating impoundments
				W120	Water supply impoundments
				W130	Multi-purpose impoundments
		W200	Other open fresh water activities	W210	Water supply lakes and streams
				W230	Lakes and streams used for other purposes
				W250	Irrigation facilities
				W260	Non-irrigation canals
				W270	Diversion channels

1 The categories identified in Level III refer to the management activities required in these identified forest contexts.

2 The categories at Level III refer to the management activities required in the identified forest contexts.

Level I: Provincial		Level II: Regional		Level III: Local	
		W300	Managed wetlands	W310	Managed fresh water wetlands
				W320	Managed salt water and brackish wetlands
		W400	Water supply watersheds	W410	Designated community watersheds
				W420	Undesignated water supply watersheds
E000	Resource protection and research activities	E100	Government resource research and protection activities	E110	Government terrestrial research activities (including agriculture)
				E120	Government terrestrial protection activities
				E130	Government marine research activities
				E140	Government marine protection activities
		E200	Private resource research and protection activities	E210	Private terrestrial research activities
				E220	Private terrestrial protection activities
				E230	Private marine research activities
				E240	Private marine protection activities
		E300	Flood protection areas	E310	Flood protection areas
G000	Energy and heat generation	G100	Hydroelectric generating facilities	G110	Dams and related generating facilities
				G120	Penstocks and run-of-river generating facilities
				G130	Other hydroelectric generating facilities
		G200	Fossil fuel generating facilities	G210	Diesel generating facilities
				G220	Other oil generating facilities
				G230	Natural gas generating facilities
				G240	Other fossil fuel generating facilities
		G300	Other sources of energy generation	G310	Hogfuel and other forest products waste generating facilities
				G320	Solar generating facilities
				G330	Geothermal generating facilities
				G340	Wind power generating facilities
				G350	Other generating facilities
M000	Mineral and petroleum extraction	M100	Surface mining and quarrying	M110	Open pit metal mines
				M120	Open pit coal mines
				M130	Quarries--rock and industrial minerals
				M140	Peat extraction
				M150	Topsoil removal
				M160	Extraction of gravels and sands
				M170	Other surface extraction

Level I: Provincial	Level II: Regional	Level III: Local
	M200 Underground extraction	M210 Land and water beneath which petroleum extraction takes place
		M220 Land and water beneath which mineral extraction takes place
	M300 Extraction site activities	M310 Petroleum pumping
		M320 Tailings and waste handling
		M330 Extracted material handling
		M340 Placer mining
		M350 Other surface activities
	M400 Exploration activities	M410 Seismic networks
		M420 Other exploration activities
N000 First Nations use	N100 Band settlement areas (current use)	N110 Band housing
		N120 Band administration
		N130 Commercial and industrial activities
		N140 Band utilities and communications
		N150 Band education
		N160 Band assembly
		N170 Other band settlement activities
	N200 Traditional use activities	N210 Ceremonial/religious
		N214 Supernatural
		N217 Service
		N220 Cultural landform
		N230 Commercial
		N235 Cross cultural interaction
		N240 Domestic
		N250 Food harvesting
		N260 Material harvesting
		N270 Non-renewable resource activity
		N275 Renewable resource activity
		N280 Traditional history
		N290 Transportation
		N299 Unspecified/other traditional use activities
H000 Heritage **(consitent with the Provincial Heritage Registry)	H100 Archaeology	H110 Habitation
		H120 Earthwork
		H130 Trail
		H140 Cultural Material
		H150 Human Remains
		H160 Pictograph
		H170 Petroglyph
		H180 Petroform
		H190 Subsistence Feature
	H200 Build heritage (structures)	H210 Residential/habitation
		H220 Social
		H230 Educational
		H240 Farming & Ranching
		H250 Commercial/Industrial
		H260 Communications/ Transportation
		H270 Government
		H280 Medical
		H290 Religious

Level I: Provincial	Level II: Regional	Level III: Local
U000 No apparent use	U100 No apparent use	U110 No apparent use

Rationale for recommending specific categories. Each group of categories has a supporting set of assumptions or principles that are outlined in this section.

Agriculture. The agricultural categories contained in Table 12 were developed on the basis of the following considerations.

- Annual crops are separated from perennial (multi-year) crops to facilitate monitoring of land use activities over time.
- Site-based agriculture (activities not specifically related to land capability) are addressed in a separate category. For example, housed agricultural production (animal, poultry, greenhouse) is separated from production in the open.
- The classification system can be related at some level with the categories of existing inventory systems, such as CLUMP, BCLU, Statistics Canada and the BCAA. The categories presented in this study are based predominantly on the system developed for the BCLU and the CLUMP.

Human settlement. The human settlement categories are typically found under the "urban" title in other land use classifications. it is intended to reflect the kinds of activities that occur in intensively used or developed areas of the province. The specific categories have been integrated from several of the inventories described in Appendix G.

Recreation. The recreation category includes all kinds of recreational activities, from highly urban activities (tennis, track and field) to wilderness recreation. Because provincial or national parks are listed in the legal and administrative land use class rather than as an activity, the various kinds of human activities that occur in parks need to be described using (primarily) the recreation categories.

Some of the categories can be based on clearly-identified mapped information (campgrounds, downhill skiing facilities) whereas the boundaries of other activities (marine mammal watching areas, boat and canoe touring and camping) are subject to interpretation. Nonetheless, the general activity areas are intended to capture the full range of human recreation activities, not just those that are officially recognized.

Wildlife, fisheries, and related. Only wildlife and fisheries features that are affected by human activity are included in the activity categories. Wildlife habitat and capability characteristics are expected to be included in inventories prepared by other RIC task forces.

Hunting was not included in the land use inventory because, although it is a human activity, it is so widely conducted across the province that it would be difficult to represent meaningfully. Areas open and closed to hunting change in response to management requirements, so maintaining accurate land use information would necessitate very frequent updates of the database.

Forestry. The forestry categories have been designed to reflect the sequence of change that occurs in the forest as a result of forestry activities, from logging to silviculture to immature and mature forests. Mature forest is included in the land use inventory as an indication of the management or planning necessary for logging or other forestry activities. Cover information not directly related to use can also be included in the database, and should be inherited from other RIC inventories, such as the cover classification scheme being developed by the Vegetation Inventory Working Group of the Terrestrial Ecosystem Inventory Task Force.

Hazardous waste sites. Hazardous waste storage is an important use of land, and needs to be identified at all scales. Because the sites are usually small, they would typically appear as points on mapped output.

Water. Water as a land cover is included in the land use inventory, but it is not identified as an activity in itself. If, however, water or aquatic features are used or managed (including wetlands, canals, and water supply watersheds), then those features are considered activities.

Resource protection and research activities. These categories are based on the BCLU activities titled "Land for ecological research, conservation, flood control, and drainage." They have been reorganized to reflect the private and public activities affected land and water.

Energy and heat generation. These categories reflect the major sources of energy used in the province. Energy transmission facilities are included in the utilities category of human settlement.

Mineral and petroleum extraction. These categories are based generally on the BCLU system. Surface extraction is treated separately from underground mineral and petroleum extraction. Site-related mining support activity is a separate category, as is exploration.

First Nations. Aboriginal activities have been categorized according to contemporary band settlement activities, traditional resource use, and traditional ceremonial, religious, and medicinal activities. The kinds of activities listed have been based on the more extensive list recently prepared in draft form by the RIC Cultural Task Force for Culture. Some of the categories could be considered sensitive or confidential, and may not be available for general publication, but the inventory provides for including these elements if available.

Heritage. The heritage features included in the land use inventory have been designed to be compatible with the RIC Cultural Task Force categories, which are more extensive. The recommended categories recognize heritage landscapes (nonstructural areas, groups of structures or communities) and heritage structures (individual buildings).

Categories for the Jurisdiction and Tenure Entities. A preliminary list of boundary categories to be included in the Legal and Administrative Boundary land use class are presented in Table 13. Many of these boundaries are part of the Ministry of Environment, Lands, and Parks Administrative Boundaries Management System, and others are contained in databases prepared by the Ministry of Forests, the Ministry of Agriculture, Fisheries, and Food, and the Ministry of Municipal Affairs, Recreation and Housing.

Table 13 - Names and Categories of Jurisdictions and Tenures

1. Agricultural Land Reserve boundaries
2. Alienated land
3. Aquaculture leases
4. Archaeological sites
5. Areas affected by interim protection measures
6. Census area boundaries from Statistics Canada
7. Community watershed boundaries
8. Ecological reserves
9. Ecosection, ecoregion, or ecoprovince
10. First Nations Land Claim areas
11. Foreshore leases
12. Government reserves
13. Grazing tenures
14. Heritage buildings and sites
15. Hydroelectric flooding reserves
16. Islands Trust jurisdictional boundary
17. Improvement districts
18. Indian reserves
19. International boundaries
20. Interprovincial boundaries
21. Irrigation districts
22. Joint stewardship areas
23. Land districts
24. Mile posts
25. Ministry of Forests preharvest planning areas
26. Ministry of Forests timber tenures (timber supply areas, tree farm licences, timber berths, etc.)
27. Municipal parks
28. Municipalities
29. National parks
30. Protected Area Strategy study areas
31. Provincial parks
32. Railway land grant lots
33. Railway sublots
34. Recreation areas
35. Regional District boundaries
36. Regional parks
37. School districts
38. Sewer enterprise boundaries
39. Surveyed and unsurveyed township boundaries
40. Surveyed timber licences
41. Use Reserved for Enjoyment of the Public (UREP) areas
42. Water districts
43. Water licenses
44. Wildlife management areas

Categories for the Regulations Entities. Because regulations affecting land can be adopted by all levels of government, a very large number of regulation names is possible. A preliminary list of approved attribute names is shown in Table 14.

Table 14 - Examples of Land Use Regulations

1. Zoning bylaw designations
2. Subdivision bylaw designations
3. Official Community Plan or Local Area Plan designation
4. Official Regional Plan designation
5. Tree cutting regulations
6. Fill placement regulations
7. Riparian, aquatic, or marine setbacks
8. Fish-forestry guideline areas
9. Development permit areas
10. Land use contract areas
11. Heritage Conservation Act regulation areas or structures
12. Agricultural Land Reserve designation
13. Waste Discharge Permit terms
14. Areas closed to shellfish harvesting

Categories for Declared Interests Entities. The Declared Interests categories need to allow for substantial flexibility in identifying the kinds of interests that could affect land use decisions. In most cases, declared interests could be described using the names from Table 12 (Activities). In other cases, more formal kinds of interests need to be shown. Table 15 shows some examples of these potential interest categories.

Table 15 - Examples of Names and Categories of Land Use Interests

1. Mining exploration areas	4. Proposed park areas
2. Areas subject to energy project reviews	5. First Nations Traditional Territories
3. Areas subject to major project reviews	6. First Nations Land Claims
	7. Mine reclamation areas

Categories for the Cover Entity Group. The land cover information needed to support the land use inventory can be obtained from the inventory being designed by the Vegetation Inventory Working Group of the Terrestrial Ecosystem Inventory Task Force. Table 16 shows the categories contained in the draft vegetation inventory. From the perspective of the land use inventory, the addition of categories that describe general classes of agricultural crops (grasses, orchard trees, vegetables, agricultural shrubs) would be desirable. Preliminary versions of the vegetation inventory contained urban, industrial, and agricultural cover as categories, but the Land Use Task Force feels that these categories would be described more appropriately and in greater detail in the land use inventory.

Table 16 - Categories for Cover Attributes

- **I. Vegetated land**
  - A. Greater than 10 percent tree cover

    Description and delineation of these categories will be provided by attributes and modifiers from various sources for tree cover and other vegetation components.
  - B. Less than 10 percent tree cover
    - 1. Forest land (0-10 percent tree cover)

      Description and delineation of these categories will be based on attributes provided through silvicultural surveys.
    - 2. Wetlands
      - a. Estuary
      - b. Wetland herb
        - i. Wetland forb
        - ii. Wetland graminoid
      - c. Wetland shrub
        - i. Wetland tall shrub (> 2m)
        - ii. Wetland low shrub (< 2m)
      - d. Wetland nonvascular
    - 3. Upland
      - a. Upland herb
        - i. Upland forb
        - ii. Upland graminoid
      - b. Upland shrub
        - i. Upland tall shrub (> 2m)
        - ii. Upland low shrub (< 2m)
    - 4. Alpine
      - a. Alpine herb
        - i. Alpine forb
        - ii. Alpine graminoid
      - b. Alpine heath
      - c. Alpine Krummholz
      - d. Alpine shrub
- **II. Nonvegetated land (less than 6 percent cover)**
  - A. Water
    - 1. Lakes
    - 2. Rivers
    - 3. Ponds
  - B. Mineral
    - 1. Gravel and sand
    - 2. Rock
      - a. Parent rock
      - b. Talus
    - 3. Cutbank
    - 4. Exposed mineral soil
  - C. Snow and ice
    - 1. Permanent snow
    - 2. Glacier

8. Information to Support the Inventory

The large amount of information needed to create a corporate land use inventory cannot be supplied by a single source. The data needed to populate the inventory can be obtained in one or more of the following ways:

1. capturing data through a discrete provincial land use inventory program;
2. acquiring data collected by other provincial agencies as part of their governmental activities;
3. acquiring inventory information recommended for collection by other RIC task forces; or
4. acquiring data collected by the federal government, junior governments, Crown corporations, or private sector organizations.

No matter what option is selected, the quality and ability to apply data to a corporate inventory depends on having:

- a uniform base map and protocols for georeferencing information collected;
- standard categories of data in each land use class, so that information can be used directly or aggregated from larger scales of collection into the provincial classification;
- rigorous data quality protection to ensure that high standards of validity, accuracy, and reliability are maintained; and
- provision of metadata to allow review of the sources, dates of collection, and related information about the data.

A. Optimum Methods of Capturing Land Use Data

The data model for the land use inventory identifies three levels of data collection: provincial, regional, and local. Appropriate methods for capturing land use information may differ according to the scale of the inventory and the availability of staff and technology.

Linking technology to scale. The Land Use Task Force reviewed available technology and summarized appropriate methods of data capture in Table 17. The ratings reflect the degree of resolution presently available with the various technologies and the amount of detail considered appropriate for each scale of investigation. The following assumptions were made in preparing Table 17:

- satellite imagery refers to SPOT or LandSat TM products and resolution;
- aerial photographs refer to commercially-available middle-elevation photos;
- field mapping is field-scale review by trained personnel;
- site enumeration refers to parcel-by-parcel or even structure-by-structure data collection;
- for all technologies, ground truthing or related data checking is assumed to be necessary.

Table 17 - Appropriate Land Use Data Collection Technology as it Relates to Scale

Scale of Investigation	Utility of Technology			
	Satellite Imagery	Aerial Photographs	Field Mapping	Site Enumeration
1:7.5 million	Excellent			
1:2 million	Excellent			
1:250,000	Excellent			
1:125,000	Excellent			
1:50,000	Very Good	Excellent		
1:20,000	Good	Excellent	Good	
1:10,000		Excellent	Very Good	Good
1:5,000		Good	Excellent	Very Good
1:2,000			Excellent	Excellent

The pattern revealed in Table 17 shows that data collection technologies need to be linked to the scale and level of detail expected of the inventory.

Cost of data collection. The cost of collecting information reflects the degree of detail required and the efficiency of available technology. Table 18 summarizes some costs of data capture and the varying levels of detail that can be provided.

Table 18 emphasizes the relationship between detail and cost. It is important to determine the amount of information needed from a land use inventory before embarking on a data collection program, so that the most cost-effective techniques can be employed. These decisions need to be periodically reviewed because as technologies change, the efficiency and level of detail available from some data collection methods will also change.

Table 18 - Rough Costs of Data Capture Using Various Technologies

Method of Data Capture	Number of Land Use Categories Collected	Typical Scale of Presentation	Approximately Cost of Data Capture per Unit
Satellite Imagery	Small	1:250,000	$0.03 per ha
Aerial Photography with Field Mapping	Moderate	1:20,000	$3 per ha
Site Enumeration	Large	1:5,000	$25.00 per parcel[1]

Source: Land Use Task Force members

Present sources of information for the inventory

Survey responses, workshop results, study team experience, and discussions with members of the Land Use Task Force reveal that land use information is collected by a wide variety of agencies or organizations. Table 19 presents some potential sources of information for the corporate land use inventory. Primary data sources, printed in bold type, are identified as the

1 This value represents an average that includes urban parcels (that can be small) and rural parcels (that can be very large), and includes mapping of different uses on a single parcel and identification of uses within buildings if necessary.

agencies with the most complete, timely, and accessible information for each inventory entity group.

The organizations listed in Table 19 should be considered preliminary. Field testing of the land use inventory structure is likely to result in a significantly revised list of sources. The quality and kind of data available from agencies--even on the same topic--can be expected to vary significantly. As a result, substantial effort will be necessary to ensure that the inventory contains only high quality information or that the limitations inherent in a data set are thoroughly described.

Table 19 - Sources of Information for Land Use Activities and Declare Interests

Inventory Entity Group	Data Source
Human settlement	**Municipalities** [2]
	British Columbia Assessment Authority
	Statistics Canada (at moderate to small scales)
	TRIM data
	Regional districts
	Ministry of Finance
	Ministry of Economic Development, Small Business, and Trade
	Ministry of Energy, Mines, and Petroleum Resources
	Ministry of Transportation and Highways
	Ministry of Municipal Affairs, Recreation, and Housing
	B.C. Hydro
	BC Gas Ltd.
	B.C. Rail
	B.C. Tel
	Coast Guard
	Department of Transportation
	B.C. Ferry Corporation
	Department of National Defence
Agricultural activities	**British Columbia Assessment Authority**
	Environment Canada
	Ministry of Forests (for range information)
	Statistics Canada
	Ministry of Environment, Lands and Parks, Lands Branch
	Ministry of Agriculture, Fisheries, and Food
	Agriculture Canada
	Municipalities
	Regional districts
	Agricultural Land Commission
	Farmers' organizations
	Okanagan Tree Fruit Authority
	Marketing boards
Forestry activities	**Ministry of Forests**
	British Columbia Assessment Authority (for private lands)
	Environmental organizations
	Council of Forest Industries

[2] Items listed in **bold** print are primary sources of information.

Inventory Entity Group	Data Source
Recreation	**Ministry of Forests** **Ministry of Environment, Lands, and Parks, Parks Branch** Ministry of Tourism and Ministry Responsible for Culture British Columbia Assessment Authority Regional districts Wilderness tourism operators Environmental organizations Sporting organizations
Wildlife, fisheries, and related activities	**Ministry of Environment, Lands and Parks, Fisheries, Wildlife, and Integrated Management Department** **Department of Fisheries and Oceans** **Ministry of Agriculture, Fisheries, and Food** Environment Canada Regional districts Salmon Enhancement Program Ducks Unlimited Environmental and wildlife organizations
Hazardous waste sites	**Ministry of Environment, Lands, and Parks, Environmental Management Department** Environment Canada Regional districts
Water activities	**Ministry of Environment, Lands, and Parks, Water Management Division** **Environment Canada** **B. C. Hydro** Ministry of Agriculture, Fisheries, and Food Ministry of Energy, Mines, and Petroleum Resources Ministry of Forests Water districts Irrigation districts Ducks unlimited Environmental organizations
Resource protection and research activities	**Ministry of Environment, Lands, and Parks; Fisheries, Wildlife, and Integrated Management Department; Planning and Conservation Services** Ministry of Forests Ministry of Agriculture, Fisheries, and Food Environment Canada Universities Environmental organizations
Energy and heat generation	**Ministry of Energy, Mines, and Petroleum Resources** B. C. Hydro BC Gas Ltd. Ministry of Forests Environment Canada
Mineral and petroleum extraction	**Ministry of Energy, Mines, and Petroleum Resources** Environment Canada Geological Survey of Canada BC and Yukon Chamber of Mines Petroleum Producers Association

Inventory Entity Group	Data Source
First Nations	**Ministry of Aboriginal Affairs**
	Indian and Northern Affairs Canada
	Ministry of Tourism and Ministry Responsible for Culture
	Council of BC Indian Chiefs
	Tribal Councils
Heritage	**Ministry of Tourism and Ministry Responsible for Culture, Cultural and Historic Resources Department**
	Municipalities
	Department of National Defence

Jurisdiction and tenure boundaries. Most of the information necessary to populate the legal and administrative boundaries class can be obtained from the following databases:

- Administrative Boundaries Management System (ABMS, Ministry of Environment, Lands, and Parks),
- Cadastral Database Management System (Ministry of Environment, Lands, and Parks);
- Forest Tenure Administration System (Ministry of Forests);
- Aquaculture Licensing and Referral Systems (Ministry of Agriculture, Fisheries, and Food);
- Petroleum Titles System (Ministry of Energy, Mines, and Petroleum Resources).

The Ministry of Environment, Lands, and Parks databases are the most comprehensive in their coverage, but are also still in the development and implementation stages. When completed, the ABMS and the associated boundary databases should provide the data to populate the jurisdictions and tenures entities in the land use inventory.

B. Priorities for Filling Data Gaps

Even though this project benefitted from having an extensive set of completed data generator surveys, it is infeasible to identify all gaps that exist in land use information. Workshop participants were asked to identify gaps in the following three kinds of land use information.

Topics, categories, attributes. What land use topics, categories, or data attributes are not covered adequately (or at all)? The following topical gaps could be considered the most significant for the corporate land use inventory:

- no information on aboriginal uses;
- inadequate information on agricultural activities;
- no provincial land use activity coverage;
- coverage and small scale aggregation of forestry information is lacking;
- inadequate information on seismic line clearing.

Geographic coverage. What areas of the province are not adequately inventoried? Some workshop participants estimated that only about 5 percent of the province has good land use coverage. The cost implications of studying the remaining 95 percent could be significant.

Temporal series. Many land use information users noted that timeliness of data is very important. How often is land use data presently collected and reported? What is the optimum interval for land use information collection and reporting? Many of the land use inventories identified in the data generators survey are very recent--often less than 2 years old. Prior to the recent provincial interest in resource inventories, much information was based on mapping conducted in the 1960s and 1970s. In the intervening 20 years, most land use information was collected in response to projects or programs of limited geographic coverage. Hence, there are significant and widespread gaps in temporal land use data coverage at all scales.

When asked how data gaps should be filled, workshop participants agreed that priority areas should be inventoried first. These high priorities included CORE areas and areas subject to severe land use conflict. The definition of areas of greatest conflict tended to vary according to resource sector. Forestry issues are most contentious where harvesting abuts park proposals. Agricultural conflicts are usually the greatest at the urban-rural interface and where wildlife (both ungulates and waterfowl) conflict with agriculture. First Nations issues are linked to aboriginal claim areas. There also was no agreement on whether the gaps should be filled first at 1:250,000 or at much larger scales (1:20,000, 1:10,000).

C. Centralized Versus Decentralized Inventories

Workshop participants and questionnaire respondents emphasized the importance of having guidelines or standards for land use classification categories and scales, especially for decentralized data collection. Land use inventory guidelines would complement standards being developed as part of LandData BC. LandData BC will facilitate the use of decentralized data collection and storage throughout the provincial government and, in the future, in junior governments and the private sector. The system will allow users to determine what data is available, order tabular or mapped output, and retrieve it in a consistent format.

Decentralized data collection such as proposed for LandData BC requires rigorous conformance to data quality, collection, and storage format standards. (Nonconforming data will also be listed in the LandData BC database, but will not be available online.) Some of the obstacles to collecting timely land use information on a continuing basis (lack of funding, project-driven inventory initiatives, uneven spatial coverage) would not be resolved by the LandData BC process. Until LandData BC becomes fully operational (after 1996), standards prepared by LIMF can provide the basis for inventory data collection and processing.

Maximizing cost-effectiveness. Information is expensive to collect, process, transfer, and publish. The large amount of information needed to create a comprehensive provincial land use inventory compounds the issue of cost. Excessive cost has been identified as a persistent and significant impediment to land use inventory at all levels of government. The cost effectiveness of the proposed corporate land use inventory can be maximized through the following steps:

- Use existing information whenever available, subject to quality control criteria. The promise of RIC, CRII, and LandData BC is that information collected by one agency can be accessed by others. This approach will permit cost-effective population of the land use inventory data model without collecting an entire new data set.
- When data gaps are identified, focus on critical areas first. The locations and topics where land use information is most critically needed should be studied first. The goal of complete provincial coverage at the 1:250,000 scale, however, should not be abandoned.

- Use B.C. Assessment Authority (BCAA) field staff to conduct large scale data collection. The BCAA presently has a significant number of trained land use inventory personnel in the field throughout the province. They would be capable of collecting high quality information in a systematic manner in a relatively short time. The marginal cost of collecting corporate land use information while fulfilling the legal mandate of the BCAA would be lower than any other identified methods of capturing large scale land use information.
- Use remote sensing as the basis of small scale data capture. Satellite and aerial photographic images provide excellent economy and breadth of coverage. Extensive ground truthing is necessary to ensure accuracy.
- Charge user fees to offset the cost of the land use inventory. The full costs of designing, preparing, and maintaining a land use inventory may generate user fees that discourage access by nongovernment users, but a modest fee for system access or information preparation would probably be acceptable. (N.B., the high cost of TRIM mapping was criticized by several respondents to the user needs survey.)
- If the cost of a corporate land use inventory is determined to be too high to obtain funding within a single agency, then co-funding among interested agencies may be appropriate. Because land use information is valuable to many agencies, such co-funding may be justified. Federal participation in such an initiative should be sought.

D. What agency should have the mandate for land use data collection and management?

The land use inventory for British Columbia should encompass both private and Crown land. Hence, the Land Use Task Force has suggested that the custodian for the corporate inventory could be one or more of the following:

- the Ministry of Finance and Corporate Affairs (has had experience with land use mapping; is outside of existing inventory "turf wars");
- the Ministry of Economic Development, Small Business, and Trade (deals with development of private and public land; has a user's perspective on data); or
- the British Columbia Assessment Authority (an autonomous agency with a large field staff that already collects land use data on private land; BCAA is has established a marketing arrangement with BC Tel for its existing data).

Although it would be most efficient to have a single agency act as custodian for the inventory, actual data collection and management could be conducted efficiently by several different agencies. The data-supplying agencies could be selected from those controlling data sets specified by the Land Information Strategic Committee (LISC).

9. Data Management

Data management for the land use inventory system has the following goals:

- to ensure the quality of the data in the inventory;
- to create identify and address gaps in existing land use information;
- to facilitate efficient transfer of information to data users inside and outside of government;
- to protect the privacy of individuals and the integrity of sensitive sites through respect of confidentiality of data;
- to maximize the cost-effectiveness of data collection, processing, storage, transfer, and output.

Each of these goals will be addressed briefly.

Quality of the inventory. Table 20 presents a set of parameters that define data quality for all manner of databases, including the land use inventory and other RIC initiatives.

Table 20 - Components of Data Quality

Component	Description
Validity	Logic of representing reality in a particular measure; the degree of coincidence between what is measured and what is intended to be represented.
Precision	Fineness of the measurement scale; the number of significant figures justified in a measurement.
Accuracy	Closeness of a measurement or observation to a true value or to the values accepted as true.
Reliability	Consistency of measures from several replications. May be independent of accuracy and validity but may be influenced by precision standards.

Source: Banting 1993

A. Quality Control

A major challenge of integrating information from a variety of sources into a single corporate land use inventory is to ensure a comparable level of data quality among the sources as indicated by Banting's four components. Just as the strength of a chain is established by its weakest link, so a data set's quality is determined by the poorest element of the set. In the land use inventory as in all information management functions, the decision to include or exclude information from the database will be based on the availability of alternative information, the seriousness of quality limitations, the importance of the data to the inventory, and the implications of gaps left by excluding the data.

The decision to include information in the present activity entity group needs to be based on confidence that the listed use is the actual use of the land. Similarly, the jurisdiction and tenure entities and regulation entities need to reflect the accurate position of boundaries. The accuracy of cover information will largely be determined by the information obtained

by field workers for large scale assessments and by remotely sensed imagery for small scale work.

Preparing quality control guidelines for the declared interest entity group will be more challenging than for the other groups. Declared interests differ from the other entity groups in that they change rapidly and the precision of boundary definition varies among the kinds of interests to be included in the inventory. For some declared interests, such as rezoning applications, boundaries can be clearly defined, but the period of validity of the interest extends only until the application is approved or rejected. (If approved, the new zoning would be reflected in a change to the regulations entity; if rejected, the rezoning application becomes an archived declared interest.) In rapidly growing areas, scores or hundreds of rezoning applications are processed by governments with annually, and accurately representing these declared interests would challenge the capabilities of the corporate land use inventory. The categories of declared interest, such as First Nations Traditional Territories, change very little over time, but determining the boundaries of these areas is challenging. Hence, even though only declared interests that have been registered (formally or informally) with a government agency are to be included in the inventory, dealing with the numbers, rate of change, and boundaries of these areas will prove demanding.

Metadata requirements. The Land Information Management Framework (LIMF) identifies requirements for providing metadata that describes the data that supports LandData BC. Names and descriptions of metadata are presented in Appendix G. The Land Use Task Force recommends that these metadata standards be adopted and applied to the land use inventory, recognizing that the full array of metadata information may be unavailable for historic land use entities.

Efficient transfer of information. The Government Land Information Data Exchange (GLIDE) program is charged with administering the LIMF. The LIMF operating document (completed in 1991) outlines the policies and procedures for sharing land information in British Columbia. A major component of LIMF is the Spatial Archive and Interchange Format (SAIF). SAIF uses an object-oriented framework for storing and transferring information in a standard format that facilitates the interchange of data among disparate users and systems. When SAIF is fully operational, it will facilitate the province-wide information access foreseen under the LandData BC program.

LandData BC will be capable of integrating the various databases containing the categories and attributes of data recommended for the corporate land use inventory. If the 1:20,000 Terrain Resource Information Management (TRIM) maps are accepted as the base mapping standard for the land use inventory (and other RIC inventories), then a major obstacle to data integration and transfer will be overcome. Additional accurate base maps will also be necessary at 1:250,000 and probably at a smaller scale (1:1,000,000 or 1:2,000,000).

Confidentiality. At large scales and with small populations, publicly releasing information can jeopardize privacy. As scales of presentation become smaller, confidentiality becomes less of a concern. Statistics Canada has developed protocols for dealing with confidentiality of small samples. Those procedures should be studied for their application to the land use inventory.

Some sites cannot be publicly identified because of the risk of vandalism. Archaeological sites are particularly sensitive in this regard. The locations of archaeological sites, some First Nations religious sites, and sensitive ecological areas need to be protected from publication. Such sites should not be shown at all on large scale maps (1:20,000 and larger), and locations should be generalized on medium and small scale maps.

Bill 50, the Freedom of Information (FOI) Act and Protection of Privacy Act was passed by the legislature on June 23, 1992. When proclaimed in the fall of 1993, Bill 50 will apply to all provincial agencies and Crown corporations. The Ministry of Attorney General is presently preparing a policy manual for the legislation. Once proclaimed, the act may be extended to apply to municipal and regional governments. Participants in the land use workshop concluded that the FOI and related confidentiality issues are operational problems that do not constitute significant obstacles to implementing a corporate land use inventory.

B. Information Management Elements Unique to the Land Use Inventory

Although most information management guidelines derived by LIMF and LandData BC will apply equally to all RIC inventories, the land use inventory has certain characteristics that require special consideration in data management.

Variety of sources. As Table 19 indicates, information that can be applied to the land use inventory comes from a variety of sources, many of which are non-provincial sources. Information management guidelines for the land use inventory, therefore, need to be acceptable by all suppliers of inventory data.

Links between databases. The land use inventory data model contains whole entity groups that are to be populated by other databases. For instance, the cover and jurisdictions and tenures entity groups contain information that would not generally be collected as part of a land use inventory, but would be constituted from information in preexisting databases. For the land use inventory to function effectively, links between databases need to be precise and efficient. Additional links are needed between provincial sources of land use information and the diverse range of sources from outside of the provincial government.

Georeferencing. The many data layers or databases that will be linked to create a corporate land use inventory require precise and consistent georeferencing. Unless each attribute field can be accurately located on a consistent base map (and, hence, on the ground), the information will not be useful for land use decisions. The Land Use Task Force recommends that NAD 83 become the standard for georeferencing of all inventory data. Translators to convert existing coordinate systems to NAD 83 should be developed so that non-NAD 83 databases can be used on an interim basis in the inventory.

Timeliness requirements. Users of land use information emphasized the need for timely data. Some of the entity data (especially the declared interests) fluctuate rapidly, and require frequent updating to be useful. Through a pilot study, the frequency of updating necessary to maintain the usefulness of the land use inventory entities and attributes should be established.

Importance of standards. One of the most valuable results of the Land Use Task Force activities is the establishment of standards for land use inventory in British Columbia. The standards identified for land use category names, organization of land use information, and for scales of base map presentation could be valuable not only for provincial land use data collection, but for other governments and agencies as well. Standards established for the land use inventory should be evaluated periodically to examine their acceptability and relevance to the many collectors and users of land use information.

Accuracy and interpretation. Many land use activities are not easily identified from remotely sensed images or even from casual field observation. Accurate interpretation of actual land use activities requires careful field checking. Some jurisdictional and tenurial

boundaries may not be surveyed (e.g., community watersheds), and the accuracy of boundaries may depend on topographic or other relational information.

Market value of information. The land use inventory has a potentially significant market value. The value depends on the accuracy and timeliness of the inventory, so the costs of regular updating, rapid publication of new information, and rigorous quality checking need to be considered in relation to their effect on the market value of the database.

Part 3 Implications of Implementing the Land Use Inventory

Land Use Classification System

10. Effects of Adopting a Uniform Corporate Land Use Strategy on Agency Programs

The RIC initiative will affect the ways all ministries collect, process, and present inventory information. Standards for RIC inventory data sets are being established through the Corporate Land Information Plan (CLISP). CLISP was established by the government in 1989 and is being implemented through the B. C. Land Information Strategic Committee (LISC), to which RIC reports. LandData BC, which replaces the Land Information Infrastructure (LII) system, will provide the operational means for agencies to access, share, and exchange land-related data among the land-related inventory systems used in government. For the system to be effective, land-related data will need to be collected and processed using accepted standards.

The RIC initiative has been designed to improve provincial decision-making capabilities, but some agency activities will be affected in the process. RIC and the Land Use Task Force wish to anticipate and mitigate any potentially negative effects on agency activities, and optimize the benefits of the improvements in inventory.

Workshop participants reviewed the following questions and provided their comments on the implications of the land use inventory.

Effects of freer flow of land use data on agency autonomy. A major identified goal of RIC and the Land Use Task Force is to foster a freer flow of land use information among data users and generators. What effect will achievement of this goal have on the autonomy of agencies in making decisions, carrying out their mandates, and achieving strategic agency objectives? Some participants felt that the autonomy of individual agencies could be reduced by the corporate land use initiative, but overall the effects were deemed to be beneficial. Several participants felt that the integrated nature of the initiative would force agencies to communicate, consider each others' mandates and objectives, and meet agreed standards of data quality.

Potential effects of uniform standards and defined inventory responsibilities on agency programs. Adoption of a corporate land use classification and supporting recommendations for implementation could affect the ways agencies collect and use land use data. Workshop participants generally felt that agency programs would eventually benefit from a corporate inventory program through improved sharing of information and an end to overlaps in data collection. Workloads were thought to increase in some agencies and decline in others, resulting in an overall increase in government efficiency in collection and use of land use information. On the negative side, meeting the requirements of a corporate inventory could slow the delivery of mandated services and impede implementation of programs and projects.

A. Encouraging adoption of the land use inventory standards

The effectiveness of the corporate land use inventory initiative depends on adoption of the recommended standards by generators of land use data. What incentives can be provided to encourage adoption of the inventory standards?

Compatibility with existing systems. Most agencies that collect land use information would be understandably reluctant to abandon their existing inventory system in favour of the corporate approach. In recognition of this impediment to adopting a corporate inventory, the land use activity categories and other entity groups have been structured to allow existing land use information systems to be linked to the proposed corporate classification. Hence, an agency's data may be aggregated or the categories may be slightly altered to allow the data to be included in the corporate classification. Over time, as agencies see the value of the corporate approach, individual data formats are expected to "migrate" closer to the corporate scheme. The standards being developed by LandData BC and the present LIMF standards will help to encourage this standardization of land use inventories.

11. Potential Pitfalls of Action Alternatives

The results of the surveys conducted as part of this project, the comments of workshop participants, and a review of the land-related initiatives being undertaken by the province all highlight the need for improved land use inventory information and data management in British Columbia. This report outlines an approach to land use inventory that is designed to satisfy most of the outstanding needs for such information in the province. Implementing the proposed approach would, nonetheless, pose some problems that will be outlined in this section.

Mapping comprehensive land use information. The data model described in Table 11 and Appendix E provides an efficient structure for organizing large volumes of diverse land use information. The model will facilitate analyzing information and integrating data from other databases.

The sheer amount and variety of information, however, makes mapping of land use information difficult. For a map to be useful, it needs to be clear and easily interpreted. Overlapping areas complicate the presentation of information (generally, 3 overlapping polygons are the maximum that can be clearly presented on a map). The cartographic implications of integrating spatial information of varying scales are also significant.

The variety of land use information available to data users requires a high degree of sophistication in map production. A data user may no longer be able to request that a standard hard copy "land use map" be supplied. The user will need to specify the desired information. Although more accurate and useful maps can be produced under the new system, the users may require time and training to get accustomed to defining map contents and legends whenever a map is requested.

Varying scales of data capture also affect the information that can be appropriately mapped. Although the data model can accommodate data from many scales, data quality and resolution considerations affect which ones can (or should) be presented on a map of a given scale. For example, the boundary between urban and agricultural uses identified from satellite imagery at 1:250,000 should not be presented as a line but rather as a zone at 1:20,000. Conversely, the density of information collected at 1:5,000 may be impossible to represent on a map at 1:125,000. Substantial improvements in computer programs designed to aggregate mapped information from large scales to small scales will be needed to resolve this problem.

These and other issues related to mapping of land use data have not been resolved. Pilot studies and field testing of the methodology will be needed to refine procedures for mapping land use information. Other RIC inventories, too, are expected to face similar issues of data presentation.

Maintaining timely land use information. Much land use information is time-sensitive, and its utility for decision making declines rapidly following its collection. The importance of timeliness of land use data was noted by many user needs survey respondents. The problem is most acute in urban areas, at the urban-rural fringe, and similar areas where the pace of land use change is rapid. In more stable parts of the province, land use information needs updating less frequently.

The "perishability" problem differs according to the purpose of collecting land use information. At the regional level, broad patterns of resource use can be inventories using satellite imagery to show major land use categories. Periodic updating of regional information (perhaps every 5 years) could be adequate to show the pattern of logging, urban expansion, or changes in agricultural land.

At the parcel level, the British Columbia Assessment Authority database provides regularly updated information on specific uses. By georeferencing this information and integrating it into the land use database, detailed information that is timely can be made available.

For site-specific studies, however, the corporate land use database may need to be supplemented or updated to meet the scale or category needs of the user. The present pattern of collecting and then discarding land use data may persist for site-specific studies. If the provincial standards for collection are followed, however, then an opportunity exists for integrating data collected on specific sites to be included in the corporate database.

Coping with First Nations issues. The treaty negotiating process in British Columbia is still being designed. Once the negotiations begin, new needs for land use information may be identified. The data model and land use categories identified by the Land Use Task Force have considered broad First Nations concerns, but the full range of First Nations issues and land use data needs could not be identified during the preparation of this report. During the pilot project, the needs of First Nations should be addressed and the corporate inventory system amended as appropriate.

Methods of linking databases. The land use inventory data model is based on the assumption that databases held by specific agencies or planned to be prepared by other RIC Task Forces will be available for integration with the land use database. The land use inventory design will be limited by poor integration of other databases. Until the LandData BC system becomes fully operational later this decade, an interim design and operating system for the land use inventory may be necessary. Because a coherent, organized system of collecting and providing land use information is needed now, implementing the land use inventory should not await full integration of databases, but the standards and category elements of the system should be initiated immediately following pilot testing.

Addressing the needs of CORE and other users. CORE, the State of the Environment reporting initiative, the Round Table on the Environment and the Economy, the Georgia Basin Initiative, the Protected Areas Strategy, and related initiatives of the provincial government can all make use of the land use inventory as designed by the Land Use Task Force. The needs of these high-profile users change rapidly, and so the land use inventory design process needs to include measures for monitoring the needs of data users and adjusting the collection and delivery of land use information accordingly.

Encouraging adoption of revised standards. Many data users and data generators lamented the lack of provincial standards for land use information. The corporate land use inventory contains standards for categories of land use, organization, base mapping, and other aspects of land use inventory. Once pilot testing has been completed, the large numbers of agencies and governments that collect land use information will need to be encouraged to adopt the new standards. Incentives may be provided, such as cost-sharing for inventory programs, training for land use inventory personnel, or reduced charges for obtaining land use

information from the provincial database. Disincentives for those who ignore the standards may also be needed (such as withholding funding for noncompliant inventory work). Any incentive or disincentive programs need to provide encouragement for land use information collection--merely punitive measures will probably prove ineffective.

Hostility toward a complex system. The proposed corporate land use inventory is more complex than most land use data users have seen. Complaints about the system may be expected initially, but providing customer support, preparing and distributing educational materials, and improving the "user friendliness" of the system in response to user comments can eliminate or reduce opposition to a new system.

A. The need for a pilot project

The identified pitfalls of implementing the land use inventory can be addressed and potentially avoided by conducting a pilot project to implement the system in specific areas. The reasons for conducting a pilot study include:

- determining whether the identified categories of land use are suitable and capable of being identified efficiently;
- testing the best methods of collecting information at varying scales;
- obtaining the views of data users on the final products of the inventory;
- testing new technology for data collection, storage, processing, and transfer;
- identifying detailed guidelines for producing land use maps from the database;
- gaining the confidence of data users that the corporate land use system will work and will meet their needs.

If the pilot study is conducted in an area of resource conflict, then the land use data collected can support efforts to reach appropriate decisions on land and resource use.

Suggested pilot study areas. The Land Use Task Force feels that two pilot studies should be undertaken to test the inventory system at large and small scales. The choice of a specific area for a pilot study will be affected by the availability of funds to conduct the project and the usefulness of project results to resource managers and decision makers.

- A small scale pilot study should be linked to the Surveys and Resource Mapping Branch completion of Baseline Thematic Mapping (BTM) for Vancouver Island. The BTM project covering the southern half of the island was completed last year, and funds have been approved to use satellite imagery to survey land uses on the island's northern half. By applying the categories recommended by the Land Use Task Force, the utility of the system for CORE decisions and related regional planning initiatives can be tested. Discussions with BTM staff indicate that Level I (provincial) activity categories are very likely to be feasible using satellite imagery, and some of the Level II (regional) categories can also be discerned. The pilot project would determine the limits to satellite imagery interpretation for identifying the recommending land use categories, and the costs of the project could be accurately monitored.
- In addition to the satellite imagery component of the BTM pilot study, data from other sources would also be sought to determine other database elements that are not

recognizable from the air. The pilot study should attempt to produce a full database of land use information.

- A large-scale data collection pilot study should also be conducted, using British Columbia Assessment Authority staff and personnel from other appropriate agencies to conduct a parcel-based inventory of uses in a portion of the province where such information could be applied to decision-making. To allow the testing of the integration of large-scale and small-scale data, a pilot site within the BTM study area would be desirable. A mix of low-level aerial photography and parcel-based site enumeration would provide a good mix of techniques to be tested in the large-scale pilot project. A full set of information at the Level III (local) level would be sought.
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The pilot studies should be funded and initiated during the summer of 1993 so that the contents of the land use inventory system can be revised and prepared to implementation in British Columbia by 1994.

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APPENDICES

Land Use Classification System

Appendix A – Glossary of Terms

Attribute: A distinctive, descriptive characteristic associated with a spatial feature. For example, a species type and population density may be associated with a bird resource polygon. Many attributes may be associated with a single spatial feature.

Base Maps: Maps that generally depict planimetry - natural and man-made physical features; topography - contours and spot heights; and cadastral information - legal boundaries and lot lines.

Biogeoclimatic Zones: Zones of the province determined by similar climatic, vegetation and soils features.

Biophysical Mapping: Maps that provide information on natural resource features such as soil, terrain, vegetation, climatic and aquatics.

Cadastral Maps: These maps are an assembly of Land Title Office plans and Land Act plans which show subdivisions of district lots, surveyed road and highway rights-of-way, railway and power rights -or-way, and place names. They do not show contours.

Computer Assisted Design and Drafting (CADD): A software system that manages graphic information. While related to GIS, CADD systems deal with the creation and display of visual data rather than with the underlying physical/spatial reference of the data.

Commission on Resources and Environment (CORE): An independent committee established to report jointly to the public and cabinet on new ways of managing B.C.'s natural resources and of resolving disputes. CORE will develop and support the implementation of a provincial resource strategy and regional local processes for making resource management decisions.

Corporate Land Information Strategic Plan (CLISP): The B.C. government plan to establish an overall strategy and concept for the coordination of land-related data, applications and supporting technologies within the B.C. government.

Data Base Management Systems (DBMS): The primary means of managing non-graphic information of government. Applications may include a DBMS, or they may be built on top of a DBMS, utilizing the ability of a DBMS to efficiently organize and access data.

Data Model: A descriptive model incorporating the spatial and attribute information stored in a GIS. Typically, a classification scheme groups geographic features with similar attributes as entities and then describes the relationships and interactions between the various entity types. The data model also includes a spatial or topological description. For example, whether a particular type of feature is represented as point of polygon data.

Digitizing: Refers to the process by which spatial information is captured into a digital mapping format. Usually this involves manual tracing of linework and point locations from source maps using a digitizing tablet. Other methods for digital data capture include scaling conversion using specialized scanners and conversion software. Data may also be loaded by other methods including from geographic coordinates in computer files, by downloading from

an electronic device that records positions, and from word-processor mailing lists of addresses and postal codes.

Feature: A geographic object about which a GIS maintains spatial and attribute information. Features are represented by geometric entities (points, lines and polygons). Examples would be trails, archaeological sites, tourist accommodation areas, shoreline units etc.

Geographic Information Systems (GIS): GIS describes a branch of computer technology, primarily software, that deals with the management and analyses of spatial information. GIS software is available for microcomputers through to mainframes and with a range of capabilities ranging from simple display systems to complex analytical systems capable of handling very large data sets.

Government Land Information Data Exchange Unit (GLIDE): An arm of the Ministry of Environment, Lands and Parks responsible for producing the policies, procedures, standards and guidelines contained in the Land Information Management Framework (LIMF). GLIDE liaises with ministries planning, initiating, developing or operating land-related systems.

Labels: Descriptive information which is associated with a graphic feature. Labels are constructed from information stored in the attribute database and are automatically updated with the database. The link to the attribute database differentiates labels from annotation. Labels may be considered "intelligent" annotation.

Land Information Infrastructure (LII): Provides those data, applications and technologies that will enable the exchange and sharing of land-related data among ministries. It includes a physical system, consisting of hardware, software and data, as well as a system specification and development plan.

Land Information Infrastructure Repository (LIR): A facility for documenting the information resources of the LII. Similar to a library or databank it contains all necessary information to identify what data or systems are available in the LII and where they are.

Land Information Management Framework (LIMF): The operating policy for LII - it provides the necessary policy, procedure, standards and guidelines that will direct and enable land information sharing within the province.

Land Information Strategic Committee (LISC): The committee responsible for coordinating and implementing CLISP. LISC reviews and endorses government land-related information systems submissions and proposals prior to review by Treasury Board. It acts as an interagency committee, encouraging cooperation and consistency in land-related data sharing across government.

Layers (also called **Levels, Overlays** or **Themes**): Sets of data which, while referring to the same geographic area of mapsheet and related through a common coordinate system, each deals with a specific type of information. For example, one layer might represent the shoreline, another water bodies and a third roads. Information in layers may or may not be associated attribute information in the database (i.e. may or may not contain features).

Metadata: Data which describe other data. For example, the ranking of data quality, the date of and operator responsible for the last updating, and estimates of data accuracy and precision, are data which describe other data.

NAD27 and NAD83: Refer to the North American Datum of 1927 and 1983 respectively. All mapping, both computerized and manual, is based on a definition of the shape of the Earth, i.e. the parameters of the Earth's spheroid. NAD27 refers to a set of parameters defining the Earth's spheroid for mapping of the North American continent that was the result of an international conference in 1927. These parameters are the basis of most available mapping including the current National Topographic Series maps. However, with the availability of satellite technology it became apparent that these parameters required updating. Accordingly, a new set of parameters was developed at a conference in 1983. These parameters are referred to as NAD83 and by international agreement have been adopted as the basis for mapping of North America.

National Topographic System of Mapping: A national system used to divide Canada for mapping purposes. The largest divisions are 4 o latitude by 8o longitude quadrangles. These quadrangles can subsequently be divided into mapsheets with scales ranging from 1:500,000 to 1:1,000.

Planimetric Maps: These maps are prepared from vertical air photographs tied to existing ground control such as triangulation stations, highways and railway surveys, cut base lines and other ground surveys.

Point: A geometric entity having no area or length. These are typically "spot" observations such as a locations where a legal sample is collected, the location where an cultural site is found or a spot measurement of water temperatures.

Polygon: A closed geometric entity used to graphically represent an area with homogeneous or associated attributes. Polygons are almost always features. Polygons have geometric properties including a surface area and perimeter and topological properties including inside/outside and adjacency.

Raster: A method of representing spatial information by partitioning the map coverage into a regular pattern of rectangular cells. Each cell has the same area and is associated with map features and the related attributes. Geographic features are defined by the cells comprising them.

Resource Inventory Committee (RIC): A committee appointed by the provincial government to review the status of current resource inventories and develop mechanisms to rectify problems. RIC oversees the seven resource task forces.

Spatial Archive and Interchange Format (SAIF): A mechanism to communicate computerized geographic information between agencies, regardless of the type of computer system of software used by the agency. SAIF has been developed under the LandData BC program of the BC Lands' Surveys and Resource Mapping Branch.

Terrain Resource Information Management (TRIM): A major B.C. Ministry of Environment, Lands and Parks program that is producing new 1:20,000 scale, digital mapping of the Province from new aerial photography. The project will complete approximately 7,000 map sheets.

Topographic Maps: These maps show drainage features, relief, culture such as place names, roads, railways etc., cadastral features such as administrative boundaries, land lot surveys, and land status to date of publication.

Appendix B – Land Use Inventory Questionnaires

Land Use Information Survey

The **British Columbia Resource Inventory Committee's Land Use Task Force** is studying the kind of land use information employed in the province. Land use is defined as the description of human activity on land and water. The Task Force would like to identify who uses land use information and for what purpose. The results of this survey will help the province to collect and distribute better land use information.

We realize that you may have received a similar questionnaire from another Task Force, and apologize for asking for more of your time. However, this survey applies specifically to land use data, and completing the survey is important.

The survey only takes a few minutes to complete. If you have any questions (or would like to relay your responses to us by telephone), please call **Westland Resource Group** at (604) **592-8500** and mention this survey. Please FAX the completed form to Westland at (604) **592-1633** prior to our deadline of 5:00 PM, February 2, 1993.

Name:	_____	Title:	_____
Organization:	_____	Phone:	_____
Address:	_____	FAX:	_____
	_____		

1. For which of the following purposes does your organization use land use information? (Check all that apply)

   ___ land or resource management

   ___ land use regulation

   ___ land use planning

   ___ monitoring of land use conditions or trends

   ___ research or academic activities

   ___ purchase or sale of property

   ___ land valuation or assessment

   ___ housing or social planning

   ___ selecting facility locations

   ___ transportation planning

   ___ marketing or sales of goods

___ other(specify)

_____

_____

2. Do you feel there is a need for a regularly-updated, province-wide land use inventory? (Please explain.)

_____

_____

_____

3. What is the source and description of the land use information your agency uses? (Fill all cells that apply.)

Source Agency (e.g., Assessment Authority)	Inventory Title (e.g., Assessment Data)	Maps (M), Tables (T), or Both (B)

4. How useful do you find the following land use inventories, and why?

Rating:
1 = very useful
2 = somewhat useful
3 = not useful
0= do not use

Inventory	Rating	Reasons
Canada Land Inventory (CLI)		
BC Assessment Authority Information		
Other (specify)		
Other (specify)		

5. What major gaps or problems do you perceive in land use information?

_____

_____

_____

_____

6. What kinds of land use information are vital to achieving your agency's mandate and goals?

_____

_____

_____

7. How do you expect your organization's needs for land use information to change in the next decade?

_____

_____

_____

8. How important is each of the following general land use categories that you use now or would like to have?

Rating
1 = very important
2 = moderately important
3 = unimportant.
0 = do not use or do not know

Please enter a 1, 2, or 3, or 0 in the importance columns. Also please tell us what map scale you use or would prefer for this information (e.g., 1:10,000, 1:150,000).

Land Use Category	Use Now		Like to Have	
	Importance	Scale	Importance	Preferred Scale
Urban uses (housing, commercial, institutional)				
Agriculture food processing				
Forestry and related processing				
Mining, petroleum, and allied industry				
Other manufacturing and industry				

Transportation, communications, utilities				
Aquaculture and fishing				
Conservation, flood protection, ecological reserves				
Parks and recreation				
Terrestrial attributes (soils, topography, geology)				
Vegetation				
Wildlife and fish				
Water, snow, and ice				

9. For which of the general categories you identified in Question 8 do you use subcategories of land use information (e.g., apartment and townhouse under the urban category)?

_____

_____

_____

_____

10. Please rate the importance of the following characteristics of land use information to your organizations' activities.

Rating
1 = very important
2 = moderately important
3 = unimportant

a. timeliness (data reflect current conditions)..... ___

b. standardized data collection and presentation ..... ___

c. complete provincial coverage..... ___

d. complete regional coverage..... ___

e. complete municipal coverage ..... ___

f. maps available:

- in digital (computer, GIS) form ..... ___
- in printed (hard copy) form ..... ___

g. tables or statistical data available:

- in digital form..... ___
- in printed (hard copy) form ..... ___

h. ease of updating maps and data ..... ___

i. accessible by the public ..... ___

j. affordability ..... ___

11. Do you have any other comments or suggestions for improving land use information or for the Land Use Task Force in general?

_____

_____

_____

_____

Thank you for your cooperation.

Please FAX this form to:

Westland Resource Group at

(604) 592-1633

Land Use Inventory Data Generator Survey

Name: Title:

Organization: Phone:

Address: FAX:

Description of Land Use Inventory

1. What is the full title of the land use inventory that you manage?

_____
_____
_____

2. What are the overall objectives of the inventory (What is it intended to do)?

_____
_____
_____

3. When was the inventory initiated (year)?_____

   When was the land use data collected (year or years)?_____

   How often is it updated? _____

4. What geographic area does the inventory cover (all of B.C., coastal areas, Vancouver Island etc.)?

   _____

   What percentage of the target area is completely inventoried? _____ %

5. Are your data collected by administrative or biophysical boundaries?

   ___ Administrative ___ Biophysical

   Please identify this administrative or biophysical unit (eg., Improvement District; Wildlife Management Unit).

   _____
   _____

6. What are the principle land use categories included in the inventory?

_____
_____
_____
_____
_____
_____

Operations

7. Is there a legislated mandate for the collection of your inventory data?

___ Yes ___ No

If so, what percentage of the data in the inventory is collected to fulfil your agency's legal mandate?

_____ %

8. Is the data you generate spatial (mapped), tabular or both?

___ Spatial ___ Tabular ___ Both

9. How is the land use inventory information stored?

___ In an electronic database
___ In a geographic information system
___ In hard copy reports
___ In hand-drawn maps
___ In maps plotted from electronic sources
___ Other

If other, please specify _____

10. If you have digital spatial data:

a) Is the data in GIS format? (i.e. polygons are closed)

____ Yes ____ No

b) What GIS system do you use? (i.e. PAMAP, Terrasoft, ARC/INFO, etc)

_____

c) What is the map base (or other control) used to georeference data (i.e. based on TRIM, Terrain Resource Information Management System 1:20,000 or Energy, Mines, and Resources digital NTS(1:250,000 etc.).

_____
_____
_____
_____

d) Is the system referenced to NAD 83 or NAD 27?

____ NAD 83 ____ NAD 27

e) Can your digital land use data be transferred to other electronic formats?

_____ easily _____ with difficulty _____ not at all

Please explain. _____

_____

f) At what scale(s) are the data digitized? _____ _____ _____

g) At what scale(s) are the data presented? _____ _____ _____

11. If your data are tabular, what format is it in (Oracle, DBase, Paradox, ASCII, printed tables etc.)?

_____

_____

12. What quality control and verification measures are in place to ensure the integrity and accuracy of the inventory?

_____

_____

_____

_____

_____

Your Source Data

13. Is the data in your inventory

___ collected entirely by your agency (primary) ___ based entirely on secondary sources

___ a mix of primary and secondary sources

14. How are the data acquired?

___ Image interpretation___ Field work ___ Secondary mapped sources

___ Secondary tabular/statistical data ___ Other

If other, please specify

_____

15. At what scales are the raw data collected?_____

16. How much did the inventory system cost to develop (dollars, staff time)?

_____

_____

_____

_____

17. How much does the inventory system cost to operate annually (dollars/staff, FTEs)?

_____

_____

_____

Use of Your Inventory Information

18. Is your land use inventory information used by other agencies?

_____ (Yes/No)

Who are the main users of the inventory (percentage use by user category - eg. 50% Ministry staff; 50% private organizations)

_____

_____

_____

In what form is the information transferred?

___electronic files ___hard copy maps ___reports

19. What percentage of the information in the inventory is confidential or subject to restricted access? _____ %

20. Is the inventory system described by manuals or similar documentation?

___ Yes ___ No

Assessment Of Future Land Use Inventory Needs

21. How do you expect your agency's acquisition and management of land use information to change in the next 5 years?

_____

_____

_____

_____

_____

_____

_____

22. The following activities are basic to all land use inventory information systems. How would you rate the current standards associated with each of these steps, and why?

Rating: 1 = very satisfactory
2 = somewhat satisfactory
3 = unsatisfactory

Activity	Rating	Reasons
Data collection		
Data processing		
Information storage and retrieval		
Information transfer to other agencies		
Information acquisition from other agencies		

23. Are you aware of other problems that affect land use inventory in British Columbia? Please specify.

_____
_____
_____

24. How would you suggest changing the land use inventory system in British Columbia to address these problems?

_____
_____
_____

Thank you for your cooperation.

Please FAX this form to:

Westland Resource Group at

(604) 592-1633

Appendix C – Summary of Data User Survey Responses

Land Use Information Survey Responses

Question 1. Other uses of land use information.	
Survey	Response
1	Land development leading to land administration regarding tenures
2	Tourism planning; socio-community or socio-economic impact assessments
4	Land use policy development, as it affects aboriginal interests in both a general and a treaty-making environment
7	Exploration for minerals (placer and lode); hazards (landslides, earthquakes)
9	Tracking of silviculture obligations
13	Responsible for revising and approving amendments to local government boundaries (servicing)
14	Settling of land claims with First Nations
15	Providing information to other groups in the community
17	Flood potential/history
19	Drainage
25	We produce land-use products for the above purposes
27	Core and PAs
32	Land Claims negotiations
33	Research land use with a view to potential sources of contamination of soil and/or groundwater
35	Environmental assessments, allocation of resources
36	As they are intimately related
37	Transit planning
38	Referrals between agencies; selection of water quality criteria
42	Environmental Assessment

Question 2. Need for updated, provincial land use survey?	
Survey	Response
3	Yes. Worthwhile land use planning and resource management is possible only with an accurate up-to-date inventory of pertinent resources.
1	Yes. Can't rely on old data for new issues.
2	From the perspective of our firm, updated land use inventory information would be very useful for some of the projects we are involved in; but it isn't a necessity. The main benefit is that it would save us having to track down the information we need because it would be accessible through the inventory. Conversely, the usefulness would be somewhat limited as the proposed scale of 1:250,000 is too general for most of what we do.
4	Yes. Would facilitate clear discussion of various interests. Would help in arriving at satisfactory resolution of actual or potential land use conflicts.
6	Yes.
7	Yes. Information becomes available, but is not readily available to most users because there is poor coordination in advertising the most recent data.
8	Yes. Monitoring land management issues requires an understanding of the surrounding use influences.
9	Yes. This will enable better planning and managing of the Forest resources.
10	Yes. Such an inventory has to be detailed enough for land use planning purposes; it also has to be up to date and accurate. The format is also very important. It has to enable graphic display and analysis (GIS).
11	Perhaps.
12	Yes. This would avoid duplication of effort with data collection.
13	Yes--in order to protect the Provincial interests when making decisions on local land use matters.
14	Parties to the treaty negotiations (Canada, B.C., First Nations, Third Parties) would benefit, if consistent and reliable information were available.
15	Yes. We do not have any adequate way to monitor extent of non-conforming uses (BCAA data not up-to-date). We use zoning as a proxy for land use. I get many requests for land use data.

16	Yes, provided that it detailed enough to be relevant to local government planning.
17	No, just readily available information.
19	Yes. We need to know how planned land use around Mackenzie might affect Mackenzie.
20	Yes. This would be useful, depending on the scale used, and how activities are disaggregated. It will also be valuable only if the database and maps are kept current.
21	No. Rather than doing it province-wide, why not regional for the ease of relaying information that pertains to specific areas.
22	Yes. We are often called upon to advocate land uses by private concerns. We are viewed as their liaison with landowners.
23	Yes. There is a need to know what available information is present and where to get it (e.g., contracts, and basic information).
24	Yes. A requirement for land use planning and management Supply/Demand studies.
25	I see the need for a strategic level product with Province-wide coverage which is regularly updated.
26	No. Depends on scale and detail as to whether or not the municipality would make use of such data.
27	No. Depends on level of detail. Okay for 1:2000000, but too costly for larger scales to warrant effort, except on an as-needed basis.
28	Yes.
29	Yes.
30	Yes. In order to keep in touch with changes or trends elsewhere. In addition, this relates to economic development planning on a provincial and local basis.
31	Yes.
32	Yes. The type of consultative planning increasingly demanded by the public requires accurate, up-to-date and comprehensive inventory.
33	I'm not sure what a land use inventory is. If you mean maps summarizing standard land use within an area, then yes, that would be of use.
34	No--only if it is detailed enough to serve municipal needs.

35	Yes. More and more staff are required to make environmental assessment (land, air, water) and recommendations with limited or absent information. Some inventory (biophysical) is needed, but need not be regularly updated.
36	Yes. A few days ago I tried to find out how much of our land in B.C. was habitable so I could make direct comparisons with planning efforts in Switzerland. Our topography is similar to Switzerland. Crown Lands, Ministry of Finance-U.Vic told me, "We don't know." The Swiss Embassy said they adhere to strict standards for information, and they are going to have to improve these to bring them up to E.C. standards. We should try global harmonization so we can compare our performance to others.
37	Yes--such an inventory would be a valuable tool for transportation, transit and land use planning.
38	Yes. Use it to assess effect or potential effect of municipal or individual development.
39	Yes. To provide an overview of changes in land use occurring over time. To assess impact on natural environment, habitats, open space, opportunities for recreation, and conservation.
40	Yes. There is a growing need to monitor our land base on a regular basis.
41	Use of GIS is in infancy in most places, so need **now** is not great. Should start now to develop a common base so that for once data availability will not be an insurmountable (???) problem for new applications.
42	Only if the areas of land use drastically change.

4A. Canada Land Inventory "Reasons"	
Survey	Response
3	Somewhat useful in finding northeast archaeological sites.
1	Land Administration uses, but it is often inaccurate.
2	On the occasions we have need for the type of information in the CLI, it is somewhat useful. However, its focus on biophysical capability limits its applicability to what we do.
6	Indicates capability--not present land use.
8	Too small scale
11	Consistent information over large area of Province.
12	Planning might use, but not generally useful to Moth.

13	Who are they?
14	Limited use only.
15	Don't have enough information about it.
16	Quite general.
20	Most comprehensive data available, but quite dated.
21	Back-up information--generally related
23	Limited use in Fisheries Assessment = Land does not = Fish
24	Present Land Use maps are out of date (late 1960's and early 1970's). Do not confuse with capability maps.
27	Too old, too general.
32	Only source available for some/out-of-date.
34	Rarely use.
35	Scale not effective for land use planning at local/regional level.
42	Environmental Assessments

Question 4B. BCAA "Reasons"	
Survey	Response
2	This information is quite useful for specific projects (i.e., socio-community impact assessments), but is somewhat time-consuming to access in the form we need.
6	Gives good information on assessment classes and values, but does not indicate specific land use, especially on large parcels only partly used.
8	Land use classification codes were not accurate.
10	Lack of geographic base; poor information on Land use and Land Area.
12	Properties Branch might use.
13	Good data/helpful staff/required information for financial impact analysis.
14	Accessible through database.
15	Not as timely as we would like (e.g., to monitor areas in transition). I do like the categories they use. We don't have system set up to extract information easily.
16	Related to each parcel.

17	Establishes to some degree housing values for flood claims.
19	Lot pricing, taxes.
20	Useful for database, especially if transferred into a GIS.
21	Not specific to us.
23	Don't know.
26	Required for municipal function.
27	Not digital.
30	Comparison to other communities.
34	In specific cases for a property.
36	Must notify public landowners adjacent to a proposed transportation project when having a planning meeting.
37	Assessed property value used in evaluating existing and planned transit facilities.
39	Useful in determining ownership; indication of Market Value; type of existing Land use.
40	Accurate data
42	For use of comparable data in valuing land, land size, use and zoning

Question 4C. Other Inventory Title and "Reasons"	
Survey	Response
2	Includes extensive data--some of which is quite useful for us. However, only some of it is available in hard copy form which is generally what we work with. Much of the other data in the system is difficult to access, especially if you require a specific category of information.
3	Can be very detailed but depends on the local government in question--some have very poor land use mapping--most have good.
8	Too small scale; no linked database.
11	Varied quality of information for portions of Province.
15	Zoning--not detailed enough; doesn't show actual use, non-conforming use. Is very timely.
19	Planning.
20	Very useful <u>if</u> available, but availability is normally a problem.

21	Management Resources utilize information pertaining to Reserves, Specific claims, etc.
23	Terrain and Hazard Mapping.
26	Required for municipal function.
30	Woodlot areas/Forestry tenures of all kinds.
32	No recent mapping; database requires search by individual lot.
35	Scale useful (1:50,000) for local planning considers climate, soil, geology and vegetation as it relates to land resources (wildlife).
39	Recreation inventory (R.O.S.); forest covers; land ownership.
42	Always need most recent certificates of title. Eliminates trips to Land Titles Office.

Question 4D. Title and "Reasons"	
Survey	Response
1	Wanted; not in present use.
8	Inventory out of date; over five years old.
11	Varied quality of information for portions of Province.
15	GVRD's land use inventory was very good, but has not been updated since 1988. Commercial and Industrial floorspace inventory is useful, but is not a comprehensive record of land use. Just the major commercial and industrial categories.
19	Planning.
20	Forest Service, etc. sometimes has useful maps.
21	Management Resources and Planning monitor land use Inventories.
23	Soils mapping.
26	Used in neighbourhood studies.
42	Always require copies of plans, documents of charges.

Question 5. Major gaps or problems.	
Survey	Response
3	For archaeology--incomplete inventory for large parts of province. Currently most land info is not easily shared. CRII and LISC are good initiatives for this reason.

1	No central tenure record for mines, water, land, timber, trappers, roads, zoning.
2	It's not at a detailed enough level to be useful. 1:250,000 is a good start, but it's just too vague for any kind of site specifics or locally focused work. Also, the associated database information (if it has any) often lacks attribute information which would be useful to us.
4	Difficult at present to reconcile "systems"--some ministries have digital mapping, high tech systems, others plot maps by hand, using hard copy files--some maps at 1:250,000--others at quite different scales. "Age" of inventories varies.
6	Not uniformly available for all areas of province; reliability of data; different coding classes.
7	Need of a comprehensive listing (updated regularly) of all land-use information.
8	The data is extremely costly to gather and input into a system; therefore, it is not done.
9	Timber inventories are out of date.
10	Out of date; not accurate; too general.
11	(1)Inconsistent quality control; (2)too much emphasis on GIS approaches with varied software used; compromising data input to meet needs of GIS system; (3)need faster production of TRIM topographic mapping throughout Province.
12	Current, complete base data is absent.
13	Many potential users with a myriad of needs; no central information agency; many existing land use agencies with various responsibilities and informational capabilities.
14	Access and standardization due to different sources/owners. Requirement for up-to-date micro (regional) information.
15	Detailed information is not timely; timely information is only of general nature. Need a good way to deal with multiple uses.
16	Resource mapping in urban areas.
19	Lack of ability to digitally process and transport maps.
20	Inconsistent database; poor general coverage of province; no consistent map base or format.
21	Potential provincial park proposals and extensions of Municipalities should be included.
22	Not known.

23	Consistency across the province: same scale and detail.
24	Out of date; incomplete coverage; variety of scale; sector bias.
25	Problems: Lack of strategic level product. Diversity of data holdings relevant to land-use. Difficulty in accessing and integrating existing information. Problems with maintaining currency.
26	Municipal records are usually more accurate and up-to-date.
28	Being up-to-date and accurate.
29	Inadequate inventories of quantity and quality of forage available on Crown range.
31	Topographic maps should be available all at the same scale.
32	No consistent scale coverage (in terms of areas, data format) forest land inventory out of date, done when economic timber extraction the only priority, no wildlife habitat inventory, etc.
33	Land use inventories, as you describe them, do not provide the sort of detailed land use information (including past tenants, activities on-site, etc.) which we require.
35	Lack of coordination between and within agencies (i.e., scale, comparison of data, overlapping data collection ???? coordination). Data not compiled in consistent and available format.
36	Land use changes far too quickly--can't plan. Whole planning problem would be feasible if greater checks were put on land use free-for-all going on out there.
37	Lack of detail; lack of definition/consistency in data.
38	Coordination between Ministries.
39	Current data does not cover the whole province in all cases--or is not coordinated to facilitate easy use.
40	Difficult to estimate land uses, activities on a regional basis. This is essential for transportation planning, regional land use planning, reasonable environmental planning.
41	Inconsistency classified; inconsistency updated; not available in geocoded form.
42	Information received may be useless to user. Only specific information should be available to user requests. User should be able to extract only the necessary information.

Question 6. Information needed for mandated goals.	
Survey	Response
3	Archaeological site data and maps, many kinds of environmental data, and data concerning proposed land altering activity of any kind.
1	No central tenure record for mines, water, land, timber, trappers, roads, zoning.
2	Tourism land use; projected land-use; existing land-use (i.e., residences, industry, etc.)
4	Everything that could affect the resolution of treaties--we need not have everything in our office--but necessary information should be accessible for line ministries (as experts) and for consultation with interested parties--as well as for actual negotiating table.
6	Agricultural land use potential--soils, climate, CU, suitability, etc.; current land use; current zoning by local government; current Official Community Plan or other designation by local government.
7	Good, up-to-date topographic maps (1:50,000 and 1:250,000) for use as base maps.
8	Second level detail (as described in Runka/Sawicki Land Use Classification for B.C.).
9	Good record of where harvesting is done so we can follow with required silviculture work.
10	Up-to-date, accurate and geographically-based Land use inventory--preferably parcel-based Inventory.
11	Nothing is "vital" because if it doesn't exist, we will go get it.
12	Resource--environmental data for project planning and impact assessment; utility information; Land Use and Community Plans.
13	An understanding of who is the land use jurisdiction for all property in the Province: Provincial/Local Government. What is the Province's mandate (ALReserve/Treefruit/etc.)
14	Integration of comprehensive land use information, such as that being developed by CORE.

15	Need geographic information on broad land use categories, including trends. More detailed land use information valuable for Town Centre--currently gathered by field work. Would like: detailed and timely land use information on a Geographic Information System, along with a relational database management system to extract reports quickly and easily.
16	Both specific land uses for regulation and more general for planning purposes.
17	Population density--housing values--government responsible for land use in that area.
20	Current land use, even if generalized, provided it is developed in a systematic manner, is constant, and properly maintained. Digital information would be very useful.
21	The land and Sea Question for the Nuu-Chah-Nulth people has not been resolved. We are looking at areas for the future developments of our goals.
22	Ownership permitted uses; regulatory agencies governing uses.
24	Forest classification, Agriculture, Urban development.
26	Municipal government requires as much land information as possible to function properly.
27	Parks mapping.
29	Policies and regulations pertaining to use of Crown lands for cattle grazing.
31	We need maps detailing biological/vegetation type information.
32	Comprehensive forest land inventory at large scale for intensive planning/management, and at small scale for regional level planning.
33	Any sources which provide names of past tenants or of their activities on-site; descriptive or visual sources of this type of information.
34	Most information we need is available at City Hall. It is not easily accessible at the moment, but GIS will solve this over time.
35	Inventory of land and water resources to effectively participate in other agency planning/allocation processes.

36	Need to establish "Traffic Analysis Zones" (TAZ's)--these can be Enumeration Areas from Federal Census. Also, zoning and legal lots is vital to functional classification of road system. No transportation planning can take place without appropriate functional classification. If land use is predictable over a 20-year period, then transportation planning becomes feasible. In Europe, land use patterns do not change rapidly like they do here; therefore, one is able to plan the transport system.
37	Identification of major transit demand generators; monitoring urban growth trends; zoning changes at municipality level.
38	Resource inventories, habitat associations, existing and proposed Land uses.
39	What is presently going on with the land; what are the pressures to change.
40	The mandate of our (??) organization is to promote wise and efficient land use. We look at supply of land for housing and other uses, intensification, changes to land use, underutilized land, etc.
41	Planning transit need to be aware of potential markets, new growth areas, plans, etc.
42	See Question 1 answer.

Question 7. Expected changes in information needs.	
Survey	Response
3	Sharing digitized map and text data between agencies will be key to our future role in resource management and land use planning (GIS)
1	I need maps that show what is developed vs. vacant. TRIM and user friendly GIS is critical.
2	More detail--faster turnaround--ability to perform a variety of analyses with the information.
4	They will accelerate as the "treaty business" gets under way throughout the province. A tremendous need for information that is accessible for consultation/discussion with interested parties, particularly in regional negotiations.
6	Move towards electronic as opposed to manual mapping and GIS systems.
8	Within the next year we may begin land use mapping for the Okanagan, Similkameen and Creston areas to meet our needs.

9	Needs to become completely accessible via computer.
10	We are in the process of research and developing a parcel-based, comprehensive land use database for the Metropolitan Vancouver Region.
11	Not sure.
12	No.
13	Specific land use interest groups may require Province to reconsider Provincial Planning Involvement again. A closer coordination between land use and servicing authorities is needed.
14	It will increase significantly over the next ten years (due to treaty negotiations).
15	There is an increased demand for more detailed information in general. At present, we are unable to meet the demand for land use information.
16	We will convert to GIS this year so the sky is the limit! We are preparing a tree cutting bylaw, hence resource information would be useful.
19	Transfer our existing data into a GIS base.
20	Much greater emphasis on GIS compatibility.
21	The future is to go through the GIS mapping and obtain information that will be useful for our purposes.
22	Not known.
23	Greater detail will be required for Hydrology. Hydrological, terrain stability information.
24	To increase, with society's need to better allocate and manage our conflicting resource requirements.
25	No perceived change.
26	Expect to need data in digital form to use with GIS system.
27	Will need more information on what is actually done rather than broad types.
28	Accessibility of information to be quicker and more accurate.
29	This will depend on the outcome of the CORE process and Protected Area strategy.
30	Probable increase in population and industrial or commercial activity; need good information to incorporate in our planning and marketing strategies.

31	We will be creating our own maps!
32	Completely computer-based sources on-line for data extraction by user.
33	I suppose the number of people requiring this sort of information will grow, and the search for documentation on land use will become more in-depth.
34	We will need improved GIS/Census interface. We will need to display social trends.
35	Increase with greater demands for multiple/single uses of land base in conjunction with changed public values/needs.
36	Increase.
37	Increased monitoring of urban growth; expect to be more involved in development application process.
38	Increase astronomically.
39	More information and greater detail will be required to meet future planning demands.
40	There is a growing move toward regional planning, urban growth boundaries, and intensification and densification.
41	GIS-based planning systems linking transportation data and transit ridership and service with census block face data sets addition of land use data significant benefit.
42	Continued or increased usage.

Question 9. Subcategories of land use information.	
Survey	Response
1	Subdivisions and legal plans and building encroachments or easements will be "urban."
2	Urban uses, Forestry, Parks, vegetation, wildlife.
6	Terrestrial attributes; urban uses; transportation, communications, utilities.
7	Terrestrial attributes: surficial geology, mineral exploration potential; ??????? potential; hazards mapping.
8	All.
9	Forestry and related processing.

10	(1)Urban (residential, industrial, commercial, institutional); (2)Open and undeveloped area (low density, high density, rural residential); (3)Parks--recreational.
11	Parks and Recreation (e.g., protected areas, capability, facilities). Wildlife and Fish (habitats, species, capability).
12	Species information, population for Fish and Wildlife Age classes, values--Forestry Terrestrial--soil types, geologic information Urban--zoning Snow--avalanche data
13	Road Networks/Regional Boundaries (Schools/Highways/etc.) Local government Boundaries/Utility Services
15	Urban uses.
16	Urban uses.
17	General information only.
19	Urban use--zoning--lot address Transportation and Utility--water--sewer--storm--gas--Hydro--BC Tel.
20	Subcategories are used on a project specific basis, but is generally more defined in urban/ metropolitan areas.
22	Agriculture: Soil classification Mining: Claims mapping Aquaculture: Tenure maps.
24	Agriculture, Forestry, Terrestrial, Vegetation.
25	Agriculture, Forestry, Vegetation.
26	Urban uses--Parks and Recreation
27	Forestry, Parks
28	Urban uses, Conservation, Vegetation.
30	Aquaculture and fishing (processing)
32	Forestry, Wildlife and Fish, Vegetation.
33	Manufacturing and industry: heavy, light, large or small scale. Agricultural and food processing are entirely different and should be in separate categories--one doesn't require permits for farming, while one <u>does</u> when processing fish, etc.
35	See number above (i.e., question 8).

36	Urban, Transportation Other manufacturing. Need to know what percentage of land is available for transportation in B.C. Need to know what percentage of land is currently used for transport in B.C. How does that compare with other nations, e.g., Swiss?
37	Urban uses, Transportation, communications, utilities, Terrestrial attributes.
39	Parks and Recreation--separate by jurisdiction (Federal, Provincial, Municipal or Regional); Terrestrial--vegetation--separate types or biological regions; Wildlife--separate species distribution.
40	Use subcategories for urban uses and other manufacturing and industry.
41	Urban uses; transportation; industry.

Question 11. Other comments	
Survey	Response
3	Lower the cost of digital mapping, particularly 1:20,000 TRIM. Continue funding of CRII program.
1	Good Luck--glad you asked!
2	Good luck!
4	Sorry to be so vague--our mandate is extremely broad, but we rely on line agencies for specific, expert advice.
6	Land use information is more meaningful when linked to parcel or lot information at 1:5000 or 1:10000 scales--anything above 1:500,000 has little utility.
8	Good luck! This is an extremely important, yet optimistic project.
11	Put more importance on producing and updating base information such as air photos, topographic maps, etc.
12	Need appropriate level of detail for user (scale, accuracy and precision); require a consistent base coordinate system.
13	A centralized mapping (like Maps B.C.) agency would work best rather than a number of agencies. A centralized Inventory (Clearing house) which is timely.
14	We expect to increasingly become a user of land use information.

15	GVRD is exploring the use of B.C. Hydro's client information database. This would not cover land uses that do not involve Hydro hook-up, but would provide detailed information on most urban land uses.
16	Good luck!
19	Provincial-wide standards on a GIS.
20	Do one or two pilot projects before agreeing to a specific system or standard, and give special attention to how the data will be maintained and by whom. Also, scale detail is more critical in settled areas, hence 1:250,000 may be acceptable for resource/more remote areas of province.
21	Do you have some background information on the Land Use Task Force? What is your mandate? How do you propose to put all the information together?
22	Standard GIS throughout all Ministries and Crown Corporations.
23	Keep it simple.
24	One agency to be responsible for coordinating Land Use Classification and mapping procedures. More regional land use maps from satellite data, scale from 1:100,000 to 1:500,000, updated periodically (say every five or ten years).
30	Please have existing studies correlated to provide a composite picture for us. Forests, Crown Lands, Parks, Transportation, etc. Relationships, juxtapositions are important.
32	Complete biophysical inventory of the province is critical.
33	None.
36	International harmonization of standards with B.C. and Pacific Rim.
38	Publish and circulate a newsletter or E-mail bulletin.
39	This would seem to be a good start. For the benefit of all concerned, would you define what the Land use inventory is going to inventory. There is potential for confusion between Land Use, Land Capability, resource inventory.

Appendix D – Summary of Data Generator Survey Responses

Land Use Inventory Generator Survey Responses

Question 1. Full title of inventory	
Survey	Response
1	Agricultural Land Reserves
2	Orchard Inventory
3	Biogeoclimatic unit maps
4	The senior Real Estate Advisor in RESB helps manage the Land Inventory System, Crown Land Inventory Program and Crown Land Registry Information System
5	Computer Assisted Property Assessment System (CAPAS) - Actual Use
6	Cadastral
7	Forest Inventory
8	Petroleum Titles
9	Release sites for biological agents for weed control
10	Apiculture (Beekeepers) Registration and Apiaries location of bee yards
11	Cadastral Database Management System
12	Omineca Fish and Wildlife Reserves Inventory
13	Land Titles (Attorney General)
14	Canada Land Use Monitoring Program (CLUMP)
15	Fort Nelson-Liard Regional District
16	Green Files
17	Wetlands of the Fraser Lowland, 1989: An Inventory
18	We do not have an entire land use inventory; rather, comments on land use are included in our Fish Habitat database.
19	Municipal, Regional District and Improvement District legal boundaries and mapping for same

20	G.V.R.D. Land use Data Base (proposed)
21	Baseline thematic mapping
22	Mineral Potential Project
23	Urban Capacity Inventory initiated 1991; collect - 1993 Retail Centre Inventory (1989) initiated 1986; last collected - 1989 Industrial Land Inventory (1983) initiated 1981; last collected - 1983 Building Permit Database (1975) - by month to current year
24	Crown Land Registry
25	MINFILE

Question 2. Objectives of the inventory	
Survey	Response
1	Identify land with potential for agriculture
2	Maintain an up-to-date status on the physical make-up of orchards (yearly updates)
3	Divide the province into ecological units
4	List lands of Potential (Use) to public for sale or lease (LIS). List lands belonging to agencies of the Crown that are titled (CLIP). Provide a history of Crown land activity (CLR)
5	To identify each individual parcel and its actual use and code this information in the database. This allows for costing and analyzing information by property class.
6	Link with BCAA data
7	To provide polygon specific information about the timber resource by tree species, stand age and height, volume and area statistics
8	Record and maintain data on all petroleum and natural gas tenures issued by the Ministry
9	To identify precise geographic location of 1000s of agent releases
10	Identify precisely the location where bees are kept
11	To maintain a complete database of cadastral parcels, land tenures, administration boundaries, and some forest tenure data to provide support to the administration of Crown lands
12	Monitor location, management activity on Fish and Wildlife resources

13	We accept, pass judgment and deposit a variety of official survey plans, i.e., Subdivision Plans, Statutory Right-of-Way Plans, Strata Plans, Easement Plans, etc.
14	Monitor change on the urban/rural fringe
15	Inventory used for information purposes only to facilitate in such processes as creation/management of Rural Land Use Bylaw, etc.
16	To identify boundaries of areas BC Parks has administrative responsibility for and to identify major land tenures or commitments within these areas
17	Determine location, size, class and status of remaining wetlands in Fraser Lowland
18	Provide an overview of a stream from Fisheries thematic and other related themes, such as land use
19	Statutory obligation to maintain an up-to-date legal boundary and map for above
20	-To develop a region-wide comprehensive Land Use inventory with full GIS capabilities -To serve regional Land use and Transportation planning
21	Regional scale (1:250,000) mapping of land use, land cover and topography in a GIS-ready form
22	Assess mineral resource endowment and value
23	Identify housing growth capacity of Metro Victoria area Inventory/classify retail floor space in centres of 10,000 square feet and over Inventory all zoned industrial sites and identify potential for use/change, etc. Monitor construction of new dwellings/industrial/commercial and institutional buildings
24	To identify our assets to manage our Crown and to generate revenue
25	To document and provide mineral, geological and bibliographical information on metallic mineral, coal and industrial mineral occurrences in B.C.

Question 5. Administrative or biophysical unit	
Survey	Response
1	Local government jurisdictions--municipalities and regional districts

2	B.C. Assessment Authority jurisdiction and Roll No.
3	Our data are ecological boundaries
4	Legal descriptions
5	B.C. Assessment Authority's 23 Assessment Areas
6	Regional District
7	TSA (Timber Supply Area), maps, forest district
8	Data is not constrained by administrative boundaries; it is organized under the Petroleum and Natural Gas Grid and the Dominion Survey System
9	Ecology-based
10	Wherever bees are kept
11	Regional land management districts, Land Districts
12	Omineca portion of Northern Region of B.C. Env.
13	Improvement Districts within B.C.
14	Urban-Centred Region (UCR)
15	Fort Nelson-Liard Regional District
16	Park, Ecological Reserve
17	Data collected for lowland (below 150m contour) but reported by municipality or regional district
18	Subdistrict
19	Municipal, improvement district and regional district
20	Municipalities for the administrative boundaries; Green Zones for the biophysical boundaries
23	-Legal lot for retail and industrial -Collection of legal lots (polygons) for UCI -Municipality or electoral area for Building Permit Database
24	Land Title Offices
25	NTS (National Topographic Areas)

Question 6. Principle land use categories	
Survey	Response
1	Agricultural Land Reserve Designation, overlain on cadastral/legal mapping

2	Agriculture: fruit trees; commodity, variety; age; rootstock; spacing; tree count
3	Biogeoclimatic zones/sub zones/variants
4	Industrial - institutional Commercial - other - lands not alienated or in use Recreational - i.e., vacant Crown Land Residential Agricultural
5	There are six principal land use categories: (1) Residential; (2) Farm; (3) Commercial; (4) Industrial; (5) Transportation, Communication and Utilities; (6) Civic, Institutional and Recreational
6	Zoning, ALR, Legal Survey, Flood Plan
7	Forest and non-forest (Alpine, NPB and cleared land)
8	Subsurface Resource Tenure
9	Climatic zones
10	(1) Location of bee yards (apiaries)--geographic (2) Address of beekeepers (3) Number of hives per apiary
11	Land Act Tenure, Administration boundaries
12	Crown land reserves for Fish and Wildlife
13	Development, Right-of-Ways--for building and ownership of land
14	Land Activity: Agriculture; Forestry; Wildlife/Fisheries; Extraction; Recreation; Dwelling; Transportation/Communications; Commercial, Manufacturing and Storing; Treating/Disposal of Wastes; Institutional; Conservation, Flood Control, Drainage; Farmer/Idle; No Perceived Activity; Land in Transition; Urban Undifferentiated (Built-up) Land Cover: Trees; Shrubs, Bushes and Vines; Row Crops; Close Grown crops; Improved grass/legumes; Unimproved grass, reeds/sedges; Denuded surfaces; constructed cover; water; urban undifferentiated (Built-up) (Includes Canada Land Inventory (CLI) Land Capability for Agriculture at 1:50,000)

15	Zoning information Oil and gas fields (non-digital) Forest Resource Emphasis Zones (non-digital) Logging schedules (non-digital) Guide Area and Trapping Boundaries Assessment Information
16	Permit areas, park facilities, biophysical units, recreational features
17	Canadian Wetland Classification System: Bog, Fen, Marsh, Swamp, Shallow Water, Vegetation Type Habitat Rating (1,2,3) based on level of disturbance
18	Urban development; mining; dams; linear development; agriculture; landfill
19	Since all of BC covered by Regional district and then further municipalities - land use would be everything in BC but not through my office (through Regional Districts).
20	- Low density residential - Medium density residential - High density residential - Commercial - Industrial - Institutional - TCU - parks and recreational - Green zone - Open and undeveloped land - Other
21	Land use categories that can be interpreted from LANDSAT TM Satellite data such as:
22	Geological tracts are outlined based on their rated potential ability to contain mineral deposits
23	Urban Capacity - commercial, commercial with residential, environmentally constrained, industrial, institutional, lake, large lot rural, multi-family attached, native lands, public forest lands, redevelopment, single family detached, special status Retail Centre - retail, office, automotive, service commercial Industrial Land Inventory - Building Permit - industrial, commercial, institutional, residential (with subcategories of single family detached, duplex, apartment, townhouse, mobile)
24	Crown Land versus Private Land

Question 9. Other uses of inventory information	
Survey	Response
3	Ecosystem field guides, land management reports
5	Microfiche
7	Master forest cover mylars
12	Topographic maps
13	All Plans are drawn by Professionals--British Columbia Legal Surveyors
23	Building Permit Database - only stored as electronic database/spreadsheet and hard-copy reports

Question 10e. Transferral of digital land use data	
Survey	Response
3	Everything is difficult on GIS
4	Avoided and in database so large only specific report information can be downloaded in IRIS--a special Program is written for production of the Crown Land Marketing Calalogic listings
6	Using Terrasoft Translator
7	(1) Spatial Graphics: IGDS leading to GIS formats (2) Attributes: ASCII leading to database formats
11	ARC/INFO has translators for several formats of other vendors' software
13	Would require all Plans to be digitized
14	SPANS is quad tree format (raster)--since land use maps too complex to be vectorized--other system would have to import raster
15	Data is transferred from intergraph (.DGN) format to AutoCAD (.DXF) format
17	DXF
20	It should be able to be transferred to all the formats supported by ARC/Info.
21	Available in IGDS and dBASE III+ and formats
22	Spatial data can be exported to DXF; tabular data can be exported to flat ASCII files
23	Uncertain

25	ASCII format

Question 11. Format of tabular data	
Survey	Response
1	Printed tables
2	dBASE IV
3	Printed tables, summary reports
5	The information resides on the IBM Mainframe at BCSC and can be obtained in ASCII format
7	Attribute data is ASCII
8	COBOL programs accessing on R & D database on the BCSC VAX cluster
9	On computer and in printed form and on maps
11	Printed tables
12	Table--WordPerfect
14	ASCII
15	dBASE IV
16	dBASE
17	dBASE III
18	Ingres
19	In hard copy map and in legal boundaries by Order in Council and Letters Patent in WordPerfect computers
20	DBF (FoxPro?)
21	dBASE III+
22	dBASE and ASCII
23	dBASE; Lotus
24	BC Systems - Victoria
25	dBASE (FoxBase+); ASCII

Question 12. Quality control measures used	
Survey	Response
1	Manual verification checks

2	Logical data checks, physical verification by grower
3	Nothing systematic
4	In LIS and CLIP--Programs must link to Master Information in CLR In CLIP--must have LTO Title before entry can be made Surveys
5	Field checks by the individual appraiser visiting each site
6	Legal Survey Plans
7	Both visual field and computer software systems are established to ensure all captured spatial and attribute forest resources data meets defined specifications and standards
8	System edit checks--manual audit and industry monitoring of system reports and manual map reloads
9	Physical verification
10	Official application forms
11	The software package contains topological checking and editing routines
12	Peer scrutiny
13	Surveyor General's Regulations
14	Airphoto interpretation was field checked extensively, transfer into GIS was checked for impossible codes, comparisons to original photos
15	Guidelines for LOGO Base Mapping followed are Procedures and Specifications for Cadastral Compilation (Surveyor General Branch) Assessment Data is authenticated by the B.C. Assessment Authority All Surveys are registered and checked for proper closure
16	Standards developed by Surveys and Resource Mapping for Land Inventory Information (LII)
17	Extensive field checking to confirm airphoto interpretation; extensive cross-checking airphotos to dBASE file to graphics file
18	Scientific authorities in divisional offices
20	To be determined
21	Field validation and published error analysis on a class-by-class basis
22	Project geologists review geological inventory; mineral potential product is carefully reviewed

23	Urban Capacity Inventory - some degree of error is acknowledged due to requirement to interpret poorly documented information. Data is confirmed by Municipal Planning staff and by CRD consultants who are using it. Retail Centre/Industrial Land Inventory - confirmed with field checks Building Permit Data - assumes source is accurate
24	D.E.V. (Data Entry Verification) - done manually
25	Automatic checks and ranges; expert review

Question 14. Other methods of acquiring data	
Survey	Response
1	ALR is primary mapped data
4	Land title office--Surveyor General Branch Land Survey Information--BCAA--other land-based information systems
6	Registered plans from Land Titles Office
8	Generation of new subsurface titles
18	Literature reviews and personal communication
20	Secondary sources plus verifications such as field checking
23	Input from various agencies/individuals, such as municipal staff, B.C. Assessment, property owners
25	Extensive research

Question 21. Expected change in information acquisition and management	
Survey	Response
1	Move more to electronic mapping and GIS systems interrelated to local government and other provincial agencies
2	It is anticipated we will produce a land use inventory for our mandate area and area of interest within it
3	Maps will be revised annually, used as an analytical base for a lot of other information
4	The database has recently been reviewed for integrity--by private contractors--the maintenance and upgrading is an ongoing process, as money provides
5	The B.C. Assessment Authority is currently undertaking a Systems Plan into the year 2000 and beyond. This plan includes the use of GIS on a provincial basis

6	Conversion from NAD27 to NAD83 Additional digitized areas
7	Responding to collect more detailed and site specific information and improved access to data files by users
8	Much more demand for other agencies' data to be used in strategic planning and resource management decisions. Would like to develop the capability of producing sensitivity maps to identify areas where access constraints will apply to exploration and development activities
9	Use of GPS
10	More automated
11	Greater area coverage; better data distribution; more GIS application development; more positionally accurate data; better reconciliation between spatial and attribute databases
12	No
14	Will be done in cooperation with other agencies with emphasis on habitat mapping for specific areas; unlikely to be conducting regular monitoring on large area basis any more; emphasis on design of inventory data collection to work in GIS
15	Would like to see increased information in digital format in this region. Would also like to have information about Forest Stands, Wildlife, etc. to be incorporated into GIS
16	Interconnection with other databases--through LII
17	See previous survey sheet
19	No changes are anticipated
20	Yes! The G.V.R.D. is in the process of researching and developing its proposed comprehensive land use database.
21	LANDATA BC should result in much easier access to data, which will allow composite inventories, such as LAND USE to be created or customized with less effort.
22	Will acquire more data - geophysical Development of models to assess mineral resources Data and products to be made available in digital form and compliant with MGLP-LII Products will focus on multiple use clients
23	Use of map information rather than manual map bases More use of BCAA electronic data
24	More toward computer-assisted mapping

25	Networked; multi uses; system development; database growth

Question 22A. Data collection "Reasons"	
Survey	Response
1	Everything is done manually with hard copy maps distributed to other agencies. No means of electronic transfer or GIS integration
2	Not enough qualified contractors
3	Excellent field staff, experience staff working on clean maps at 1:250,000 in digital form
4	300+ appraisal staff in the field
7	Changing demands
8	Improving
11	Primary data is on hand and readily accessible
13	No skewing--information very accurate
14	Need to establish standard classification and methodology; also approach to transfer from photos, images, paper, other digital to new base map and GIS
15	Not much data for this region
16	Not enough attention given to this in the past
20	No systematic mechanism and data source
23	Usually needs of collector will establish a standard relative to their data
24	Manual collection
25	Professional research - costly

Question 22B. Data processing "Reasons"	
Survey	Response
1	Everything is done manually with hard copy maps distributed to other agencies. No means of electronic transfer or GIS integration
2	Poor support in Valley
3	Excellent field staff, experience staff working on clean maps at 1:250,000 in digital form
4	Sometimes slow

5	200+ clerical staff keying daily
7	Capacity available but more rigor is needed in quality assurance (currently being addressed)
8	Improving due to PC technology
11	Applications appropriate to data processing requirements
13	Manual
14	Most database managers and GIS can handle this
15	Time consuming
21	The input data comes from many domains and is not necessarily difficult to integrate, but because of translations and transformations required between systems, there is a large overhead to data processing.
25	Full-time administrator

Question 22C. Storage and retrieval "Reasons"	
Survey	Response
1	Everything is done manually with hard copy maps distributed to other agencies. No means of electronic transfer or GIS integration
2	The GIS is an excellent tool for analyzing spatial problems
3	Excellent field staff, experience staff working on clean maps at 1:250,000 in digital form
4	Again, sometimes slow but very accessible
7	Data on-line and available throughout the province. Access speed and rates of download vary
8	There is a multiplicity of non-conforming systems and formats
11	On-line computer storage of data with standardized access (Librarian), sufficient capacity, regular backups
13	Not on any electronic system (ALL MANUAL)
14	Digital graphic files (thematic and base map) very large and difficult to store and retrieve easily
15	Computer helps tremendously in this area
16	Serves one's needs and is being improved
23	Very specialized to source agency Lack of coordination/financial support of other agencies Not always a common definition of land use categories, etc.

25	PC-based; search routines

Question 22D. Information transfer "Reasons"	
Survey	Response
1	Everything is done manually with hard copy maps distributed to other agencies. No means of electronic transfer or GIS integration
2	Other users are not familiar with the role they have
3	Not a lot of experience electronically
7	Via tape/cartridge/diskette--no on-line access
8	Onus on receiving agency to reformat flag files
11	Can provide in most popular formats. Standardized procedure for distribution of data
13	Must come to each office and get hard copies
14	Need standard database and graphic exchange format so that all information goes across 100%
15	Work closely with Peace River Regional District
16	This is being done more frequently now
23	Very specialized to source agency Lack of coordination/financial support of other agencies Not always a common definition of land use categories, etc.
24	Hard copy only
25	Sold on floppy diskette

Question 22E. Information acquisition "Reasons"	
Survey	Response
2	Slow
7	Cadastre production (NAD83) does not meet demand in a timely manner
8	No data capture; no consistent formats
11	Some delay or incomplete data
13	None is required
14	Need standard database and graphic exchange format so that all information goes across 100%

15	Work closely with Peace River Regional District
16	Improving as agencies become more involved in integrated resource issues
20	More cooperation between agencies and more data exchange will happen in the future
23	Very specialized to source agency Lack of coordination/financial support of other agencies Not always a common definition of land use categories, etc.
24	Hard copy only
25	Legislation-driven reports

Question 23. Other problems	
Survey	Response
1	Lack of coordination between agencies Re: standards of mapping, scales, etc., lack of good, reliable legal parcel information. Most land use inventory information is collected at too small a scale
4	94% of Crown Land maybe 3-5% surveyed--cost to identify en mass. This is a very simplistic question--details should be provided by SG Branch
7	Lack of coordination and standards for inventories and data base management
8	There are no funds available, or recognition of the costs within B.C. Ministry budgets to effectively exchange data
11	Too many diverse interests--how detailed do you get?
13	The old Plans are not as accurate as the newer ones and the Old Plans are still current until a new subdivision is deposited
14	Lack consistently used land use classification system; has to work at many scales (hierarchical)--meet detail needs of many agencies
16	Lack of specific inventories--e.g., old growth
20	No comprehensive, up-to-date and accurate land use information available, which can be used for planning. No systematic data collection mechanism. Lack of data standards.
21	Will discuss this at the workshop
22	Not enough detailed digital base maps at 1:20,000 No digital base maps at 1:50,000

23	Lack of information about exactly what is available; usefulness to CRD/local needs
24	No central agency; no central standards; no public involvement

Question 24. Suggested changed to inventory system	
Survey	Response
1	Coordination and integrate collection of data; use larger scales; need to coordinate provincial reports with work being done by local governments.
2	The turf wars must end and the data gathering and exchange must start soon.
4	As far as money and bodies are concerned, we don't have them and even if we could identify a land use inventory for the whole of B.C., very little of it would be of use--and it changes constantly. We should deal first with the land we already have identified in our LIS.
7	Develop standards and procedures for data collection and data management
8	Direct funding to those agencies that have not completed data capture efforts, but don't expect other agencies or their clients to fund those efforts.
11	Have two levels: a corporate level for all, and each interest area can have a more specific interest level.
13	GIS
14	Need standard scales for all agencies "Regional" =1:250,00 need to accept a common scale "Local" = 1:20,000 "Provincial"
16	RIC and CRII are on the right track to get at doing a better job on inventory.
20	Develop a province-wide, comprehensive Land Use inventory. More coordinated actions among agencies.
22	The province should push the implementation of the land information infrastructure, which would encourage and assist in better integration and synthesis of data across the province.
23	More coordinated approach/discussion between users/appreciation for other's needs, etc.

24	Direction and budget

Appendix E – Formal Data Model

SAIF Specifications of the Land Use Data Model

Table 11 in this report presents a tabular version of the land use inventory data model. The Land Use Task Force expects that the land use inventory will be implemented under the LIMF and LandData BC programs. These programs require a more formal representation of the data model for implementation under the Spatial Archive and Interchange Format (SAIF).

In SAIF, the GeographicObject class has attributes that include geometry and relationships. Therefore, all subclasses of GeographicObject have a geometry component that could be a set of points describing a polygon, line, or network. This information allows the geographic position and characteristics of any component in the inventory to be identified.

The SAIF format of the land use inventory data model is summarized as follows:

<Geographic Object		
subclass:	LandUseObject	
classAttributes:	name:	String
	scope	LandUseScope
	relevance	Duration
	scale	Integer
	representation	LandUseRepresentation
classAttributeDefaults:	scope:present	
	representation:area	
restricted:	relationship:nil	
comments:	"The Land Use Object inherits the geometry and metadata attributes and therefore can be associated with coordinate information. The name attribute is the land use category which is the land use attribute in common usage. Duration is a SAIF predefined domain which identifies a time range."	
<Enumeration		
subclass:	LandUseScope	
values:	present recent past historic future	
<Enumeration		
subclass:	LandUseRepresentation	
values:	area point line icon	
<LandUseObject		
subclass:	Activity	
restricted domain:	name:ActivityCategory	
<LandUseObject		

subclass:	LegalDesignation
restrictedDomain:	name:LegalCategory
<LandUseObject	
subclass:	Regulations
restrictedDomain:	name:RegulationCategory
<LandUseObject	
subclass:	DeclaredInterest
restricted domain:	name:ActivityCategory
<LandUseObject	
subclass:	Cover
restrictedDomain:	name:CoverClass
<Enumeration	
subclass:	ActivityCategory
values:	agriculture humanSettlement recreation wildlifeAndFisheries forestry hazardousWasteSite water resourceProtection energyAndHeatGeneration mineralAndPetroleumExtraction firstNations heritage
comments:	"This is the list of level I categories. The full list contains the more detailed categories which can be used for land use at all scales."
<Enumeration	
subclass:	LegalCategory
values:	tenure license lease (examples)
<Enumeration	
subclass:	RegulationCategory
values:	municipalZone protectedArea wildlifeManagementArea (examples)
<Enumeration	
subclass:	CoverClass
values:	forested wetlands upland alpine (examples)
comments:	"The CoverClass enumeration comes from the Terrestrial Ecosystems Inventory Task Force, Vegetation Inventory Working Group Subcommittee."

Appendix F – Metadata Requirements

Land Information Infrastructure Metadata

The following information was provided by the Ministry of Environment, Lands and Parks Surveys and Resource Mapping Branch.

LII Directory Data Definition Standard:

For each Participatory or Corporate data source, the following metadata must be provided (this data is more precisely defined in the LandData BC Data Definition Specification):

Data Entity	Description
Data Source	Any "logical" store of data. The data may be in digital form on computer (the data source may be based on one or more underlying physical databases), or it may comprise data in non-digital form such as a set of paper mapsheets. Typical attributes are: Name, Description, Data currency, LII Connection, LII Scope, Schema Level.
Category	A high level grouping of the data using a classification hierarchy which yields successively more restrictive descriptions of data. Typical attributes are: Name, Description, Super category, Group.
Custodian	Identifies the individual(s) within an organization who has/have varying degrees of responsibility for the data source. Typical attributes are: Name, Title, Phone Number, Fax Number, Mail Address, Responsibility.
Organization	Identifies the B.C. Government Ministry or Crown Corporation responsible for the data source. Typical attributes are: Name, Type, Branch, Program.
Georeference	Describes the geographic criteria which define the relationships between the data source and points on the earth's surface. Typical attributes are: Projection, Horizontal Reference, Vertical Reference, Base Map Scale.
Geographic Extent	Describes areas on the earth's surface which define the spatial limits or boundaries of data sources and associated products. Typical attributes are: Map Sheet Id, Map Series, Polygon Number, Latitude, Longitude.
Database System	The description of the physical environment in which the data source is stored, accessed and managed. Typical attributes are: Name, Description, Implementation Date, Documentation, Storage Type, Machine, Software, Physical Address, Network, Acronym.

3. LII Dictionary Data Definition Standard:

For each Corporate or Participatory data source, the following metadata must also be provided, when the data becomes accessible on-line, in addition to that described for the LII Directory Data Definition Standard and defined in the LandData BC Data Definition Specification:

Data Entity	**Description**
Data Type	Synonymous with entity. A named formal specification which determines the common, static and dynamic properties of all instances of that entity. Typical attributes are: Description, Integrity rules, Number of Instances, Last Update, security, Input Date, Super Type.
Attribute	This is a description of a uniquely identifiable item of data in terms of its physical characteristic and the rules governing its allowable values. Typical attributes are: Name, Description, Conceptual data Type, Storage Bytes, Editing Rules, Domain Rules, Accuracy, Optionality.
Enumeration	A set of discrete values which can be associated with any instance of an attribute. Typical attributes are: Value, Description.

Appendix G – Examples of Land Use Classifications

Examples of Land Use Classifications

Many land use classification systems were reviewed as part of the Land Use Task Force study. The following examples were examined by the workshop participants in developing recommended categories of land use activity for the corporate inventory.

The *Land Use Classification in British Columbia* (Sawicki 1986) uses the following hierarchy of land activities:

A000 - indicates agricultural activity but
A100 - specifies productive-land agricultural activities, and
A110 - is growing annual tillage crops while
A111 - is growing grain.

The BCLU's cover classes are less hierarchical. The classification also makes a distinction between uses that depend on the land (e.g., grazing) and those that are site-dependent (e.g., feed lots).

The BCLU recommends that each map polygon or coding sheet cell be classified using an 8-digit code: 4 for activity, 4 for cover. For instance, A121/V210 indicates cultivated forage activity with improved grass cover.

Table G-1 presents a comparison of the hierarchical characteristics of several major land use classifications used in British Columbia: the CLI Present Land Use, MOE's Land Use Classification, the British Columbia Assessment Authority database, and the Baseline Thematic Mapping (BTM) project of Ministry of Environment, Lands and Parks.

Table G-1 Hierarchies of Agricultural Land Use Categories

Scale	CLI--Present Land Use	BCLU	BCAA	BTM Vancouver Island
1:1M - 1:2M	Cropland	Agricultural activities	N/A	N/A
1:500K - 1:250K	Cropland	Productive agricultural activities	N/A	Agriculture
1:125K - 1:51K	Growing grain	Growing annual tillage crops	N/A	N/A
1:20K - 1:50K	Growing grain	Growing grain	N/A	N/A
1:5K - 1:1K	N/A	N/A	Farm	N/A
Parcel	N/A	N/A	Grain and forage	N/A

Land Use Category examples. The following land use categories are summaries of higher-level categories of some representative inventories. They are presented to stimulate discussion about the proferred land use categories for the corporate classification. In reviewing these categories, please consider how they might be used in a resource management or land allocation.

Canadian Land Classification (1:1,000,000 to 1:50,000)

1. Urban
   - A. Industrial
   - B. Commercial
   - C. Residential
   - D. Recreational
   - E. Associated non-agricultural
2. Tree fruits and horticulture
   - A. Horticulture
   - B. Vineyards
   - C. Orchards
   - D. Other
3. Cropland
   - A. Hay
   - B. Grain
   - C. Other (oilseeds, etc.)
   - D. Other (tobacco, etc.)
4. Pasture
   - A. Improved
   - B. Open grassland
   - C. Scrub grassland
5. Woodlands
   - A. Dense
   - B. Open
   - C. Scrub
   - D. Cut-over or burnt over
6. Water
   - A. Water
   - B. Swamps and marshes
7. Unproductive

Canada Land Inventory Present Land Use Classification (1:50,000)

1. Urban
   - A. Built-up areas
   - B. Mines, quarries, gravel pits
   - C. Outdoor recreation
2. Horticulture
3. Orchards and vineyards
4. Cropland
5. Improved pasture and forage crops

4-5. Cropland-pasture complex

6. Unimproved pasture and rangeland
   - A. Open grassland
   - B. Open woodland forest range
7. Woodland

- A. Mature productive woodland
- B. Immature productive woodland
- C. Non-productive woodland on a productive site
- D. Non-productive woodland on a non-productive site

8. Swamp, marsh, and bog
9. Unproductive land
   - A. Sandflats, dunes, and beaches
   - B. Rock and other unvegetated surfaces
10. Water surfaces

Ottawa Urban Fringe Area Land Use Classification (1:25,000)

1. Urban
   - A. Residential
   - B. Commercial
   - C. Extraction (gravel pits, quarries, topsoil removal)
   - D. Manufacturing
   - E. Municipal government use
   - F. Institutional
   - G. Utilities
   - H. Recreation
2. Agriculture
   - A. Intensive
     - a. Orchards
     - b. Market gardens
     - c. Sodfarms, nurseries, flowers
     - d. Garden plots
   - B. Extensive
     - a. Corn
     - b. Small grains
     - c. Soybeans
     - d. Summerfallow
     - e. Hay
     - f. Pasture
3. Non-agricultural uses
   - A. Abandoned land
4. Forest
5. Reforestation
6. Swamp, marsh, or bog
7. Water

Generalized Land Use Mapping, Ontario Economic Regions (1:250,000)

1. Residential
2. Seasonal residential
3. Industrial and commercial
4. Quarries and pits
5. Outdoor recreation
6. Forestry
7. Agriculture
8. Indian reserve
9. Airport
10. Railway
11. Major roads
12. Waterbodies

British Columbia Land Use Classificaiton (1:20,000)

Activity classes

1. Agricultural activities
   - A. Productive land
     - a. Annual tillage crops
     - b. Forage crops and grazing
     - c. Fruit, berry, and nut production
     - d. Ornamental trees and shrubs
     - e. Sod production
     - f. Agricultural research
     - g. Hop production
     - h. Specialty and perennial crops
     - i. Other
   - B. Site agricultural activities
     - a. Housing livestock
     - b. Outside animal feeding and holding
     - c. Housing poultry and fur-bearing animals
     - d. Greenhouses
     - e. Storing crops and agricultural equipment
     - f. Mushroom growing
     - g. Beekeeping
     - h. Other
2. Unused land
   - A. Former agriculture
   - B. Former forestry
   - C. Former extraction
   - D. Former recreation
   - E, F, etc. Former dwellings, transportation, manufacturing, commercial, institutional
3. Commercial activities
   - A. Wholesaling
   - B. Retailing

C. Commercial services

4. Dwelling activities
   A. Housekeeping
   B. Other
5. Extraction activities
   A. Surface extraction
   B. Underground extraction
   C. Extraction site activities
   D. Exploration activities
6. Forestry activities
   A. Productive land forestry
   B. Site forestry activities
7. Wildlife and fisheries related activities
   A. Productive land wildlife activities
   B. Wildlife and fisheries--related site activities
8. Transportation and communication activities
   A. Transporting activities
   B. Communicating activities
9. Institutional services
   A. Legislative, judicial, and legal services
   B. Protective and custodial
   C. Educational
   D. Health, medical, and care
   E. Religious and associated activities
   F. Assembly
10. Land in transition (future change likely to occur)
11. Manufacturing
   A. Electric energy and heat generation
   B. Raw material processing
   C. Processing processed goods
   D. Assembling products
   E. Storage activities
   F. Treating, disposal of wastes
   G. Undifferentiated manufacturing and storage
12. No perceived activity
13. Land for ecological research, conservation, flood control, and drainage
14. Aquaculture
   A. Productive activities
   B. Site aquaculture activities
15. Recreational activities
   A. Land-dependent activities
   B. Indoor and outdoor recreation and cultural site activities

Cover classes:

1. Grasses and other non-woody plants
   A. Annually cultivated crops
   B. Grasses, legumes, sedges, reeds

C. Mosses or lichens
D. Other non-woody plants

2. Woody vegetation
   A. Tall and mature trees
   B. Small and immature trees and shrubs
   C. Vines
3. Denuded (bare) surfaces
   A. Rock
   B. Unconsolidated material
4. Constructed cover
   A. Structures
   B. Surfaces
5. Water
   A. Salt water
   B. Streams, rivers, canals
   C. Ponds, lakes, reservoirs
6. Snow and ice

Baseline Thematic Mapping, Southern Vancouver Island
(1:250,00:1:20,000)

1. Agriculture
2. Alpine
3. Avalanche chutes
4. Barren surfaces
5. Recently burned
6. Estuaries
7. Ice
8. Mature forest
9. Immature forest
10. Logged areas
11. Urban
12. Wetlands

Part of Proposed Michigan Land Cover and Use Classification System
(1:250,000)

1. Urban
   A. Residential
      1. Multifamily, medium to high rise
      2. Multifamily, lowrise
      3. Single family and duplex
      4. Strip residential
      5. Mobile homes
      6. Group and transient quarters
   B. Commercial, services, and industrial
      1. Primary or central business district
      2. Shopping centre

3. Strip development
4. Secondary, neighbourhood business district
5. Other commercial and services
6. Other institutional
7. Indoor cultural, public assembly, and recreation

2. Agricultural land
   - A. Cropland, rotation, and permanent pasture
     1. Cultivated cropland
     2. Hay, rotation, and permanent pasture
   - B. Orchards, bush fruits, vineyards, and ornamental horticulture
     1. Tree fruits
     2. Bush fruits and vineyards
     3. Ornamental horticulture
   - C. Confined feeding operations
     1. Livestock
     2. Poultry
   - D. Inactive land
   - E. Other agricultural land
     1. Farmsteads
     2. Greenhouses and mushroom houses
     3. Racetracks
     4. Other
3. Rangeland
   - A. Herbaceous rangeland
     1. Upland herbaceous rangeland
     2. Lowland herbaceous rangeland
   - B. Shrub rangeland
4. Forest
   - A. Broadleaved forest
     1. Upland hardwoods
     2. Aspen, white birch, and associated species
     3. Lowland hardwoods
   - B. Coniferous forest
     1. Upland conifers
     2. Lowland conifers
     3. Mixed conifer-broadleaved forest
5. Water
   - A. Streams and waterways
   - B. Lakes
   - C. Reservoirs
   - D. Great Lakes
6. Wetlands
   - A. Forested wetlands
   - B. Non-forested wetlands
7. Barren
   - A. Salt flats

B. Beaches and riverbanks
C. Bare exposed rock
D. Transitional areas
E. Other

8. Tundra
9. Permanent snow and ice

Appendix H – Land Use Coding

To be added at a later date.

Appendix I – Land Use Task Force Members

The following people (listed in alphabetical order) were active members of the Land Use Task Force at the time that this report was prepared:

Randy Blaney, British Columbia Assessment Authority
Anthony Britneff, Ministry of Forests
Daryl Brown, Commission on Resources and the Environment
Barron Carswell, Ministry of Agriculture, Fisheries, and Food
Graham Dragushan, Ministry of Agriculture, Fisheries, and Food
Malcolm Gray, Ministry of Environment, Lands and Parks, Surveys and Resource Mapping
Lucky Luchin, Ministry of Municipal Affairs, Recreation, and Housing
Rob Menes, Ministry of Agriculture, Fisheries, and Food (Chair)
Kathleen Moore, Canadian Wildlife Service
Graham Weir, Ministry of Environment, Lands and Parks, Surveys and Resource Mapping
Brian Williams, Ministry of Environment, Lands and Parks, Surveyor General Branch

Appendix J – Preparers of the Report

This report was the product of the efforts of many people in the government and outside of government. The following people were primarily responsible for preparing the report on behalf of the Land Use Task Force:

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