

AN EVALUATION OF THE ECOLOGICAL RESERVE PROGRAM IN BRITISH COLUMBIA

by

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An Evaluation of the Ecological Reserve Program

in British Columbia

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ABSTRACT

British Columbia was the first province in Canada to establish an ecological reserve program. Ecological reserves are legally protected areas established specifically for scientific research and educational use. The objective of this program is to set aside examples of both representative and unique ecosystems throughout the province to serve as research and education areas, and repositories of genetic material. The Ecological Reserve Program (ERP) grew out of the International Biological Program and was formalized in the Ecological Reserve Act in 1971. This study evaluates the effectiveness of the Ecological Reserve Program in fulfilling its objectives.

Five evaluative criteria are used in assessing ERP: legislation and jurisdiction; institutional power; funding and staffing; planning and management capabilities; and achievement of objectives. Based on these evaluative dimensions and results from preliminary questionnaires, a telephone survey of interest groups and interviews with key actors were undertaken. These findings are supplemented with case studies of reserve management.

The Ecological Reserve Program has been successful in establishing and protecting a system of natural areas. There are, however, some weaknesses. The Ecological Reserve Act and regulations are partially effective but have some deficiencies. The program is limited through funding and in its power to influence decisions. These limitations, in turn, affect the planning and management capabilities of the program and its ability to meet ascribed objectives. Recent emphasis on planning and management, however, benefited the program and furthered attempts to meet its mandate. Research and educational use of the program are limited. Protection to ensure preservation is incomplete.

This evaluation leads to several policy recommendations. Legislative deficiencies related to acquisition, protection, and administration can be improved by policy changes aimed at securing private land and seeking expert advice. Increased funding and staffing can improve planning and management capabilities and, in turn, assist in the achievement of objectives.

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DEDICATION

To my grandmothers,
for their courage and inspiration.

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ACRONYMS

| | |
|----------|--|
| ABC PF | Association of B. C. Professional Foresters |
| ACER | Associate Committee on Ecological Reserves |
| CCEA | Canadian Council on Ecological Areas |
| CCICP-CT | The Conservation of Terrestrial Communities Subcommittee of Canadian Committee of the IBP |
| ERP | Ecological Reserve Program |
| FER | Friends of Ecological Reserves |
| IBP | International Biological Program |
| IBP-CT | The Conservation of Terrestrial Communities Subcommittee of the IBP |
| ICSU | International Council of Scientific Unions |
| IUBS | International Union for Biological Sciences |
| IUCN | International Union of Conservation of Nature and Natural Resources |
| MOE&P | B. C. Ministry of Environment and Parks |
| MOL,P&H | B. C. Ministry of Lands, Parks and Housing |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| WAC | Wilderness Advisory Committee |

CHAPTER 1

THE STUDY

1.1 Research Context

intro

Sound scientific knowledge is required for rational use and management of the earth's resources. Biological research on undisturbed ecosystems is an important source of such knowledge. Undisturbed ecosystems, however, are disappearing rapidly. British Columbia has attempted to protect such areas under the ecological reserve designation.

An ecological reserve is a legally protected natural area where human influence is kept to a minimum. In order to conserve representative and unique ecosystems and, consequently, to provide long-term research and educational opportunities, it is the most protective land use designation in British Columbia. It complements existing land uses by widening the range of opportunities for society to experience and learn from the natural world (fig. 1).

Figure 1: Range of Land Uses in British Columbia

| Purposes | Preservation | Protection | Multiple Use | Extractive Use |
|----------------------------|-------------------------------------|---|--|-----------------------------|
| General Management Classes | No significant land use disturbance | Allow various uses but maintain essential processes | Allow both renewable & nonrenewable resource use | Extraction is principle use |
| Institutional Arrangements | Ecological reserves | | Provincial forests | |
| | National parks | | | Mining reserves |
| | | | Provincial parks | |
| | | | Private lands | |

Ecological reserves serve a number of functions (Foster, 1975; McLaren and Peterson, 1975; Taschereau, 1985). They are living museums and genetic banks which conserve and preserve natural genetic diversity and ecological functions. Ecological reserves are outdoors laboratories for baseline research into the functioning of natural processes and the impact of human activities and environmental change. They are outdoor classrooms to complement classroom and laboratory research and to inspire an intellectual understanding and aesthetic appreciation of the natural world.

1.2 Study Purpose

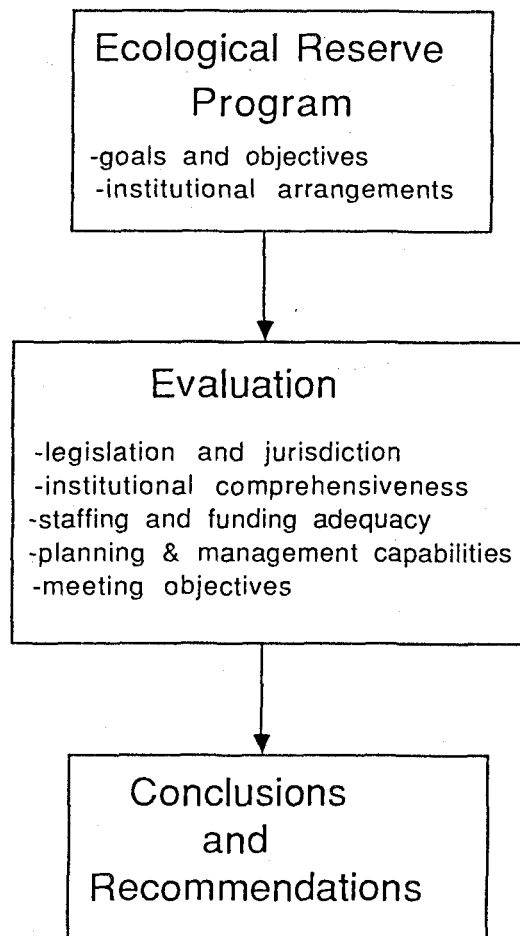
The purpose of this study is to evaluate the effectiveness of the Ecological Reserve Program (ERP) in British Columbia in protecting areas for scientific purposes. In this research, two key areas are addressed. First, the institutional arrangements of the program are discussed and second, the affect of these arrangements in achieving program objectives is evaluated. For this purpose, five criteria have been derived from studies by Grigoriev *et al.*, 1985 and Ouellet, 1969 (cited in Mitchell, 1975). These include: 1) the legislation which establishes the program and its jurisdiction; 2) the institutional power of the program; 3) the adequacy of funding and staffing; 4) planning and management capabilities for the implementation of the program; and 5) the extent to which the objectives of the program are achieved.

1.3 Study Organization

1.3.1 *Model*

The approach of this study is based on the model shown in figure 2. This model is adapted from the approach developed by Day *et al.* (1977, 173) and modified by Mattison (1983, 3) for evaluating resource policies, programs, and projects. There are three major components: purpose and objectives of the program; institutional arrangements; program evaluation; and recommendations for improvements to the program.

Figure 2: Evaluative Model



1.3.2 Organization

The organization of this study follows the model. In chapter 2, the Ecological Reserve Program goals and objectives are presented and the development and evolution of the program are discussed. In chapter 3 the evaluative criteria are presented. Chapter 4 documents the evaluation of the program according to these criteria and chapter 5 examines achievement of program objectives through case studies. Finally, recommendations based on the evaluation and alternative policies to increase ERP effectiveness are proposed in chapter 7.

1.3.3 Information Sources

This study is based on a variety of information sources. These include the literature, surveys, interviews, technical consultation, and existing documentation of ERP. The literature was reviewed for the history of the ecological reserve concept and the development of natural area programs. It also provided information for the development of criteria.

The bulk of the information used in the evaluation was derived from surveys and interviews (table 1). Two preliminary questionnaires and a telephone survey were conducted. Initially, 11 volunteer wardens were asked to identify program problems and issues. Then, a stratified random sample of 55 Greater Vancouver residents were questioned on their awareness of wilderness and environmental issues in British Columbia. With these results, a telephone survey was conducted to assess attitudes and perceptions of the program and its effectiveness. As only 6% of Greater Vancouver residents were aware of ERP, this survey is based on the actor theory which suggests that only groups that have knowledge of the topic should be approached (Keith *et al.*, 1976).

The telephone survey involved groups representing the range of actors associated with ERP such as preservation interests, industry, government agencies, and professional user groups. The respondents were asked to reply to 25 statements, indicating their degree of agreement with the statement using a five-point Likert scale. Interviewees were given the opportunity to decline from answering if they felt their knowledge or information on the topic was insufficient. In total, 22 telephone surveys were conducted. The questionnaire and detailed responses are presented in appendix A.

Table 1: Evaluation Groups

| | | Preliminary question | Telephone survey | Interviews |
|---------------------|---------------------------------------|----------------------|------------------|------------|
| PROVINCIAL AGENCIES | Ministry of Forests & Lands | | 2 | 2 |
| | Ministry of Energy | | 2 | 2 |
| | Ministry of Agriculture | | 1 | 1 |
| | Ministry of Environment & Parks | | | 4 |
| PRESERVATIONISTS | Volunteer Wardens | 11 | 4 | 4 |
| | Friends of Ecological Reserves | | 1 | 3 |
| | Federation of B. C. Naturalists | | 1 | 2 |
| | Nature Trust | | | 1 |
| PROFESSIONALS | University professors | | 2 | 4 |
| | Former ERP advisory committee members | | 2 | 4 |
| | Scientific researchers | | 1 | 1 |
| | Educators | | | 1 |
| INDUSTRY | ABCPF | | 1 | 1 |
| | Cattlemen's Association | | 1 | |
| | B. C. Mining Association | | 1 | 1 |
| | B. C. & Yukon Chamber of Mines | | 1 | 1 |
| | B. C. Forestry Association | | 1 | 1 |
| | B. C. Hydro | | 1 | |
| PUBLIC | | 55 | | |
| TOTAL | | 66 | 22 | 32 |

The findings of the perception and attitude surveys were supplemented using in-depth interviews. Individuals representing the different actor groups such as provincial agencies, preservationists, professionals, and industry were consulted about the concerns and perceptions of their group. These informal interviews were approximately one hour in length.

The Ecological Reserves Program staff in the Ministry of Environment and Parks was consulted regarding technical aspects of the program and to fill information deficiencies. Program documentation

was reviewed for information on policies and procedures, research, education, and management. ERP documents also serve as sources of information on the evolution of the program.

CHAPTER 2

SETTING THE STAGE

2.1 Evolution of the Ecological Reserves Concept

The ecological reserve concept stems from the conservation and preservation ethic. In Canada, preservation of natural areas can be traced as far back as the 17th century when naval reserves were established to protect timber supplies (Aird, 1976, 99). Since then, preservation motives have evolved with changes in cultural characteristics and political systems (Fosberg, 1981, 1). In 1948, a program to protect natural areas for scientific reasons was initiated by the United Nations Educational, Scientific and Cultural Organization (UNESCO). This program, the International Union for Conservation of Nature and Natural Resources (IUCN), was aimed at the preservation of species, and their genetic varieties, as well as their biotic communities and ecosystems.

The spread of human populations and the trend of increasing use of natural resources caused concern for the continued existence of natural areas. In response to the disappearance of, and the lack of knowledge about, many of the world's natural areas, the IUCN along with the International Council of Scientific Unions (ICSU) and the International Union for Biological Sciences (IUBS), established the International Biological Program (IBP) in 1964 (Curry-Lindahl, 1978). This program involved 10 years of international cooperative studies on the biological productivity of the earth and the biological basis of human adaptability and welfare. To provide scientific knowledge on the earth's ecosystems in order to rationally use and manage the earth's limited resources, a subcommittee for the Conservation of Terrestrial Communities (IBP-CT) was created (Taschereau, 1985, 1). It attempted to document the range and productivity of world ecosystems and preserve representative examples of these ecosystems for present and future biological research before they are irreversibly altered by man's activities.

Canada joined the IBP in 1965. The Conservation of Terrestrial Communities Subcommittee of the Canadian Committee of the IBP (CCIBP-CT) was established to identify and locate examples of major Canadian ecosystems. Between 1967 and 1974, over 900 areas in Canada were inventoried including 135 from British Columbia (Clapham, 1980, 152; Ontario, Provincial Parks Branch, 1978).

The IBP was the impetus for many protection initiatives around the globe. Under these programs, protected areas are known by different names such as ecological reserves, nature preserves, natural research areas, reference areas, and critical areas. However, according to Moir (1972, 397), such areas have a number of common characteristics. They are natural or near natural in character and relatively undisturbed by man. They are protected to ensure preservation and permanency. As well, they are selected based on ecological criteria such as habitats, communities, and floristic or faunistic associations and have features of scientific and educational value. In addition, they contain genetic stock which may be of value to society in areas such as agriculture, silviculture, mariculture, or medicine.

There is both provincial and national involvement in preserving and protecting natural areas in Canada. IBP work in identifying and describing ecosystems has encouraged many provincial governments to legally and permanently establish a program for natural area preservation. Prior to IBP, the protection of natural areas was achieved through the establishment of national and provincial parks and the private acquisition of lands by naturalists organizations. In 1971, British Columbia enacted the first Canadian ecological reserve legislation to establish an ecological systems program. By the following year it had created 54 reserves and presently has 117. Subsequently, Alberta, Quebec, New Brunswick, Newfoundland, Saskatchewan, Nova Scotia, and Manitoba adopted similar legislation. Only Ontario, Prince Edward Island, and the northern territories do not have specific ecological reserves legislation although the former two do use other acts to establish similarly protected areas.

National level activity has focussed on co-ordination of ecological reserve programs. The Associate Committee of Ecological Reserves (ACER) was established on an interim basis to continue the work on ecological reserves begun by the IBP-CT. In 1982, the Canadian Council of Ecological Areas (CCEA) was founded as an independent, nonprofit national forum to encourage and facilitate the selection, legal protection, and stewardship of a comprehensive system of ecological reserves in Canada. It is involved with promotion and public relations, advising government agencies and other interested organizations, and establishing guidelines for the selection, protection, and management of ecological reserves (CCEA, 1984).

2.2 British Columbia's Ecological Reserve Program

2.2.1 *Rationale*

In British Columbia, there are both federal and provincial programs which contribute to natural area protection (table 2). Provincial parks are the primary preservation areas serving both conservation and recreation needs. Since the program contributes significantly to recreation, research was normally secondary and hindered due the emphasis on recreation (Pojar, 1976; McLean, 1976; Franson, 1978, 8). As a result, the acquisition of highly scenic lands with recreation value has had priority over the systematic preservation of ecological zones. Facilities which alter natural ecosystems have been developed to support intensive public use (MOE&P, 1987). Consequently, there is a need for a specific research designation that represented all the varied ecological zones. Legislation was eventually pursued to provide such a program.

Table 2: **Protected Areas in British Columbia (1987)**

| Classification | Number | Total Area (hectares) | Percentage of Total Land Area |
|---------------------------|------------|--------------------------|-------------------------------------|
| FEDERAL | | | |
| National parks* | 5 | 372,000 | 0.39 |
| Wildlife/bird sanctuaries | 12 | 5,452 | 0.01 |
| PROVINCIAL | | | |
| Class A parks* | 291 | 3,190,745 | 3.36 |
| Class B parks* | 4 | 1,229,782 | 1.30 |
| Class C parks* | 40 | 1,146 | 0.001 |
| Recreation areas* | 30 | 410,408 | 0.43 |
| Wilderness conservancies* | 1 | 131,523 | 0.14 |
| Ecological reserves | 117 | 154,629 | 0.16 |
| TOTALS | 500 | 5,495,685 | 5.80 |

*As of 31 December, 1986

2.2.2 Evolution

The establishment of an ecological reserve program in British Columbia took many years of effort. The present program is largely the result of the efforts of Dr. V. J. Krajina, professor of plant ecology at University of British Columbia and Dr. A. F. Szczawinski, botanist of the provincial museum in Victoria (Franson, 1975, 51; Dooling, 1985, 33). Through informal discussions, these two men were able to interest the Social Credit Minister of Lands, Forest and Water Resources, Ray Williston, in a reserve program. In 1967, formal meetings were held with government officials and a governmental Interdepartmental Ecological Reserve Committee was established. In 1968, this committee met with members of CCIBP-CT to review potential sites. That summer, twenty-two sites were surveyed and recommended as reserves.

In February 1969, Williston informed the legislature that the government had embarked on a program to establish ecological reserves on crown land using the Land Act. Ten reserves were outlined ^{on?} of the Department of Lands maps and labelled as "reserved" on 6 March of that year. These were authorized in 1970 through a re-enactment of the Land Act (Franson, 1975, 52). To ensure the protection and preservation of such areas for future generations, the Ecological Reserves Act was passed unanimously on 2 April 1971 (appendix B). In 1975, regulations related to use and protection of reserves were enacted through order-in-council (appendix C).

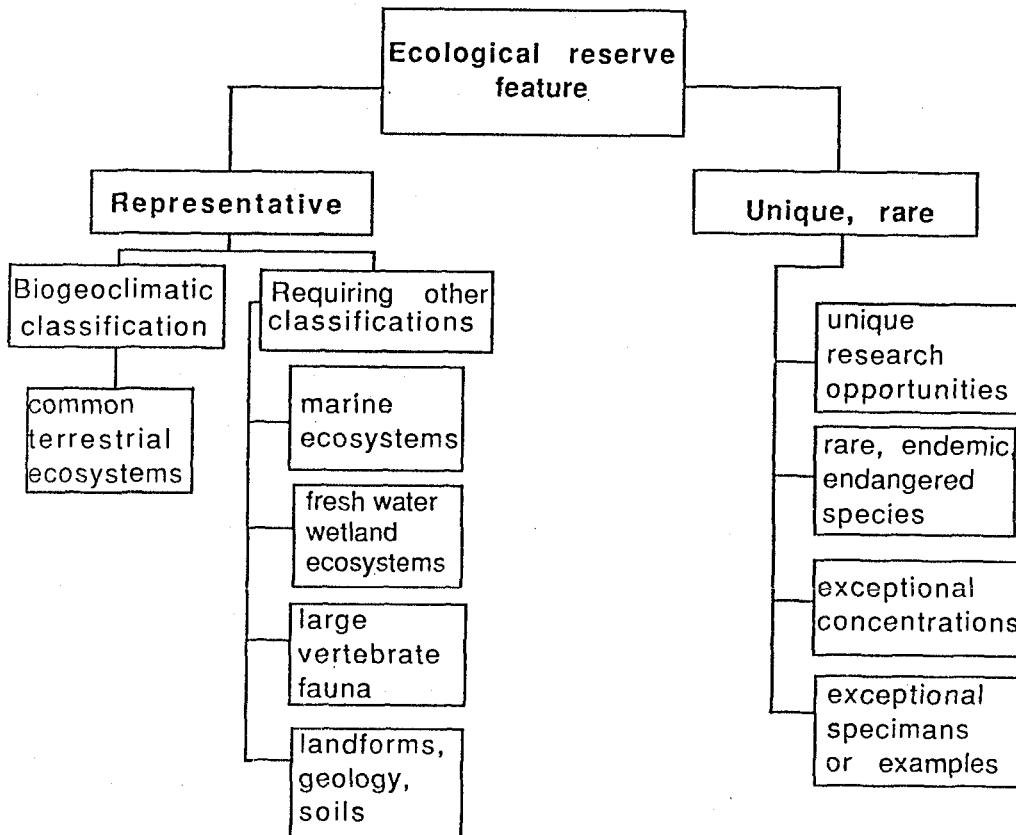
The purpose of the Ecological Reserves Act is to reserve crown land for ecological purposes. Areas suitable for scientific research and educational purposes associated with studies of productivity and other aspects of the natural environment are considered for reservation. Such areas are representative examples of natural ecosystems within British Columbia or, they protect rare or endangered native plants and animals in their natural habitat and geological phenomena. In addition, such areas can serve as examples of ecosystems that have been modified by man and thereby offer an opportunity to study the recovery of natural ecosystems.

2.2.3 Selection and Designation

The selection process for ecological reserves is based on two categories, representative and unique (fig. 3). The representative category has two components. First are those ecosystems that can be classified under the biogeoclimatic zone system and those which require other classification systems. The biogeoclimatic system, developed by Dr. V. J. Krajina and adapted by the Ministry of Forests and Lands, aids in the selection of common terrestrial systems. It divides British Columbia into 13 zones based on climatic, topographic, and vegetative interactions (appendix E). A goal of the program is to cover the entire range of biogeoclimatic zones and subzones (MOE&P, 1987; MOL,P&H, 1979). The second component other features such as freshwater and marine ecosystems, large vertebrate fauna, landforms, geology, and soils.

The unique category of reserves includes areas that have features which require the strict protection afforded by the Ecological Reserve Act. Areas are selected according to uniqueness and sensitivity to disturbance. Rare, endemic, and endangered species are preserved under this group. Also included are unique research opportunities, exceptional concentrations, and exceptional specimens.

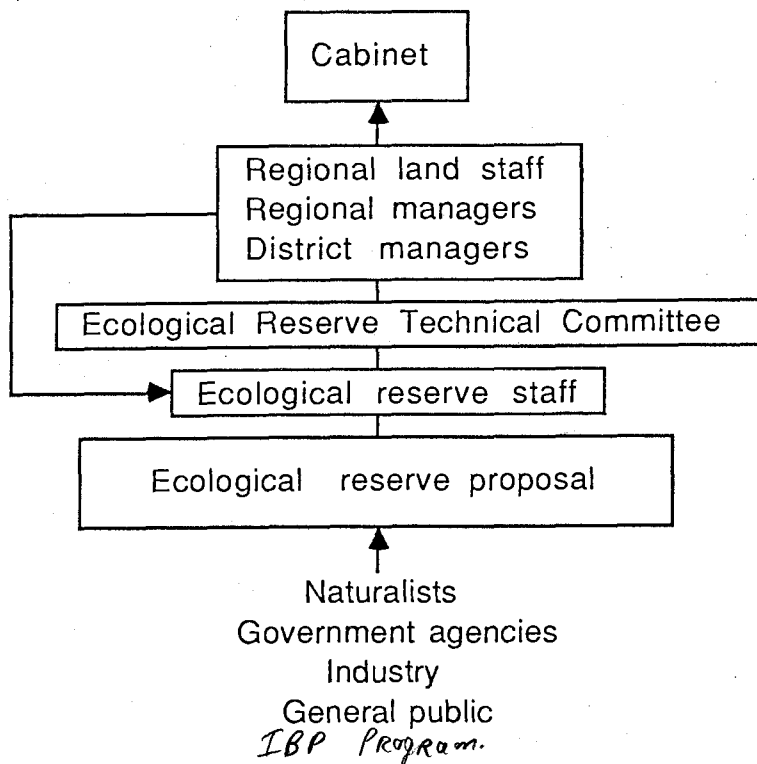
Figure 3: Selection of Ecological Reserves



The process for designating ecological reserve has been changing. Suggestions for new reserves originate from the IBP program as well as a variety of groups and individuals including scientists, industry, government agencies, naturalists groups, and the general public. These proposals are reviewed by the program staff who conduct additional research as required. Until 1984, acceptable proposals were passed through a provincial referral system which allowed provincial agencies to comment on land use proposals within the framework of provincial resource and land use planning (fig. 4). First, proposals were referred to the Ecological Reserve Technical Committee, and then to appropriate regional land administration staff. Regional land directors distributed proposals to district managers who referred them to all relevant resource agencies and individuals for review. Proposals were often modified to accommodate concerns of agencies or individuals. Unanimous approval was needed from all potentially affected parties and each resource agency had veto power over the creation of ecological reserves. Proposals that have been cleared through the resource agencies were passed on to the Executive Committee of the Ministry of Environment and Parks and then to cabinet for ministerial approval. At this level, proposals could receive reserve status by an order-in-council and by notification in the British Columbia Gazette.

In 1984, the land use referral process ceased to function. At that time, British Columbia economy was in recession and land use conflicts were increasing. As a consequence, many sites suggested for protection were being contested (Goulet, 1986). In 1985, the *ad hoc* Wilderness Advisory Committee (WAC) was appointed to study the problem of preserving wilderness in British Columbia and suggest solutions. Its recommendations attempted to resolve most of the conflicts. These included resolutions of specific land use conflicts and a recreation area category in the parks system to allow a limited time for mineral exploration. The ERP staff is currently working on the recommendations adopted by the government. In the wake of WAC, however, there is no structure for commenting on land use decisions. The future process for designating sites is not yet known (Goulet, 1987).

Figure 4: Ecological Reserves Decision Making Process



2.2.4 Administration, Management, and Protection

The Ecological Reserves Program has been placed under a number of administrative jurisdictions due to the changing needs of the program and changes in bureaucratic structures of government. The first reserves established in 1971 were administered by the Ecological Reserves Unit in the Department of Lands, Forests, and Water Resources, with assistance from a voluntary advisory board and a governmental technical committee. As the program developed, it became necessary to augment the efforts of volunteers with paid staff and to increase the financial support given to the program by government (Dooling, 1985, 33). Consequently, in 1974 the position of director was created to administer the program, and Dr. Bristol Foster was appointed. Two years later the unit was moved to the newly-created Ministry of the Environment. In 1978 it was moved to the Ministry of Lands, Parks, and Housing as a separate program in the Land Disposition and Reserves Section of Lands Program Branch. Due to fiscal restraint, the program was re-aligned in 1983 so it was no longer a separate entity. As a result, Dr. Foster resigned in 1984 and for 10 months the program was without a coordinator (Victoria Times-Colonist, 1984a). In April 1985 Dr. Louise Goulet was appointed coordinator. At that

~ same?

time, the program focus was changing from obtaining new reserves to managing the existing areas. As a result, it became part of the Planning and Research Section of the parks program under the same ministry. In 1986, the Ministry of Lands, Parks and Housing was abolished. The Parks and Outdoor Recreation Division, including the Ecological Reserve Program, was moved to the Ministry of the Environment and Parks.

The staff of the Ecological Reserve Program are responsible for administering the program subject to provisions of the Ecological Reserve Act and regulations. They are charged with identifying suitable ecological reserve areas, and reviewing and screening ecological reserve proposals. They also facilitate and negotiate the establishment of reserves, manage research programs, design management programs for each ecological reserve, and answer enquiries.

The Ecological Reserve Act is a powerful piece of legislation. It withdraws the reserves from disposition under any other acts or laws in force in British Columbia, thus protecting reserves from activities sanctioned under other legislation such as mining and logging. The regulations under the act indicate uses that would be in conflict with the purposes of a reserve and thus prohibited. These include prospecting for minerals, cutting timber, livestock grazing, camping, road or trail-building, trapping, hunting, use of motorized vehicles, removal of flora and fauna, introduction of plants or animals, or discharge of sewage, waste materials, or contaminants. These regulations also declare that research and educational use of a reserve requires authorization by permit.

The ERP staff is aided by a group of volunteer wardens. This program was implemented in 1980 to provide local monitoring of reserves. Currently, there are 55 to 60 volunteer wardens who were recruited from naturalists, conservation groups, and the general populace. The objectives of the wardens program are to enhance the management of ecological reserves through public participation, and to improve public understanding of ERP. They also provide ongoing liaison between the general public, local government, and the Ecological Reserve Program, and assist in the development of research programs within the reserves.

The primary responsibility of wardens is to inspect reserves and report damage, whether natural or caused by people entering an area, to the Ministry of Environment and Parks. The latter is to prevent destruction or alteration of reserves through illegal activities such as livestock grazing, trail bike riding,

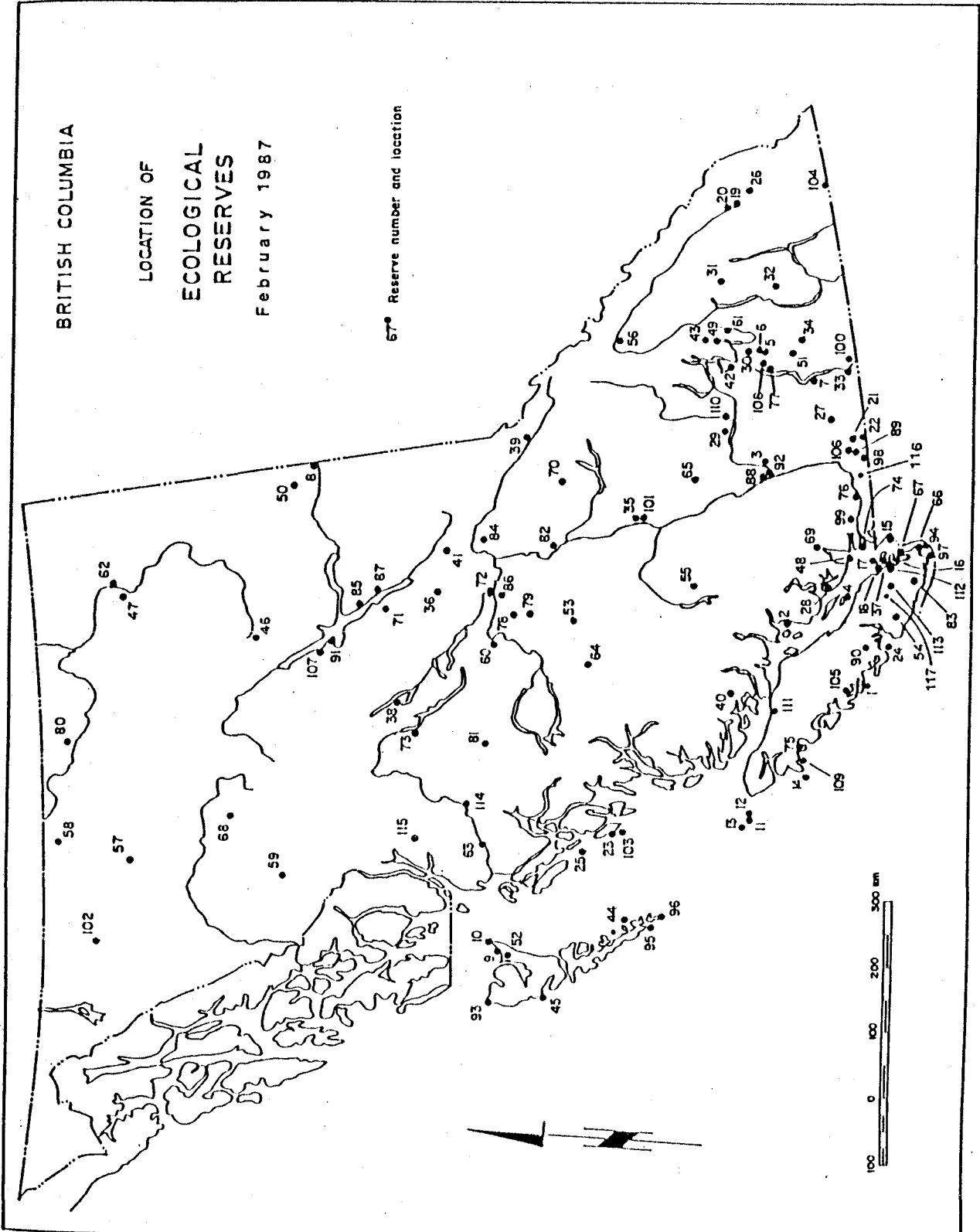
and tree cutting. Wardens are asked to report pollution, littering, and violations of the Fish and Wildlife Act to federal fisheries and environment agencies. They also play a role in public education by providing information and assisting with slide programs and more formal meetings (MOE&P, 1987). In addition, wardens often help with biological inventories and research projects on reserves.

Wardens are generally interested in ecological reserves, a specific reserve, or natural history. Individuals associated with naturalists organizations are preferred since they can share responsibilities and a replacement is normally available when wardens can no longer serve (Goulet, 1986). Local clubs are the sources of volunteer assistants; they have close access to the reserve and usually take a greater interest in a reserve which is in their community. In a few cases, schools are appointed as wardens and their reserve becomes a teaching tool.

2.2.5 Current Status

Since 1971, 117 sites totaling 154,629 hectares received protection under the Ecological Reserves Act (fig. 5); nearly one-third of this area consists of marine waters. Reserves are located in all regions of the province and contain representative samples of many ecological zones, subzones, and unique or special species and ecosystems. A list of the location, main features, and size of each reserve is shown in appendix D.

Figure 5: Ecological Reserves in British Columbia



Source: B.C. MOE&P, 1987

CHAPTER 3

EVALUATIVE CRITERIA

The criteria needed to evaluate the performance and effectiveness of the Ecological Reserve Program are defined and developed in this chapter. The five criteria discussed include legislation and jurisdiction, institutional power, funding and staffing, planning and management capabilities, and achieving objectives. Legislation provides for the institutional arrangements to establish and administer a program such as ERP. For effective implementation, institutional power, funding, and planning and management capabilities are needed. Together these requirements affect the degree to which objectives are achieved and thus, the program success.

3.1 Legislation and Jurisdiction

Appropriate ecological reserve legislation has been discussed in detail by Franson (1975, 1972). He suggests four elements of effective legislation. There should be a mechanism for acquisition of sites. Second, relatively permanent protection should be assured. Third, guidance to administrators should be provided for the implementation and management of the program. Finally, there should be some means for continuing input from reserve users concerning management plans, research, and educational uses.

3.1.1 *Acquisition*

Effective legislation should provide a mechanism to acquire and establish ecological reserves on both public and private property (Franson, 1975, 33). The power to establish reserves on crown land can easily be provided in legislation. Private property preservation can be achieved by allowing government to accept donations of private lands, to purchase or expropriate lands, or to allow for private lands to be registered as reserves. In the latter case, an owner may register land after accepting articles of dedication to ensure appropriate management. Under this system, these lands would be protected from expropriation as well as rights and powers granted under other legislation (Franson, 1975, 44). In addition to the mechanisms described above, the legislation should include a provision for emergency or provisional reserves to enable the minister to protect a proposed site while it is being

considered.

3.1.2 Protection

Protection of reserved land is one of the most important functions of ecological reserve legislation (Franson, 1975, 17). This ensures that these lands are maintained in a natural state for scientific purposes. Entry onto, and use of, reserves should be strictly controlled to adequately protect the resource and the research in progress. Legislation can make provisions to exclude or modify the operation of other acts and make entry subject to permit. Permits can also be used to approve and safeguard research projects.

3.1.3 Administration

Franson (1975) suggests the act should give administrative powers to a minister of the crown. These powers include the ability to acquire and formally designate sites and to make and enforce regulations concerning use. For effective administration, the act should expressly state that the minister may designate an official as responsible for the program, except for making regulations and acquiring land (Franson, 1975, 38). This official should have broad powers to formulate management plans, categorize and zone reserves, issue permits, and restrict or prohibit activities on reserves.

Administrative and management guidelines should be included in the act. This would be beneficial to the official responsible for the program and insure that the mandate is clear to the administrators (Franson, 1975, 12). It would also reduce misunderstanding concerning the purpose of the act, so demands are not made on the program that cannot be satisfied.

3.1.4 User Input

User input into the administration and management of a specialized program such as ERP is beneficial. Legislation should provide a formal framework for this communication through the provision of a scientific advisory committee (Franson, 1975, 17). Such a committee would have the expertise to provide specific scientific advice to the minister. It could recommend areas for designation, aid in the formulation of management plans, and provide a forum to discuss management problems. In addition, it could liaise with other groups having similar objectives and with related land use programs. Finally, it

could improve political accountability. This could be accomplished through a provision in the act which would require the advisory committee to be consulted before any lands are withdrawn from the program.

The composition of this committee is critical. Franson (1975, 40) suggests that the advisory committee should be composed of representatives from the main government land use departments and from user groups experienced in administration, industry, education, and sciences. For the committee to fulfill its obligations, it needs to be given certain powers. This includes the authority to obtain required technical and professional advice, to establish technical subcommittees drawing on expertise from public and private institutions, and to convene public hearings at the public's expense (Franson, 1975).

3.2 Institutional Power

Institutional power is the ability of the program to influence decision making. This ability will affect the extent to which a program can carry out its mandate and meet its objectives. For the purposes of this paper, this criterion is broken into five components. These include: 1) the comparative importance of the program in the hierarchical arrangement of the provincial government; 2) its relationship with the administering and other agencies; 3) political awareness of, and support for, the program; 4) public awareness and support; and 5) constituency groups and their affect on the program.

3.2.1 Hierarchical Integration

Sabatier and Mazmanian (1981, 12) suggest that the degree of hierarchical integration is determined by the number of points through which a decision must be cleared. These clearance points represent the occasions where the attainment of objectives may be impeded. As the hierarchy increases in size and complexity, the number of opportunities for obstruction also increases. Consequently, the power of a program to influence decisions is affected by the number of clearance points between it and the decision maker.

3.2.2 *Agency Relationships*

The power and success of a program is dependent on the agency it is in and its relationship with other government bodies. In any government, there are controls that allow an opportunity for agencies to comment on, and influence, the plans and action of others. As a consequence, cooperation which is based on an appreciation and understanding of objectives, is required for effective implementation of a program. The success of such a program, therefore, is determined by the perception and knowledge of it.

ERP should be within an agency experienced at land management (Franson, 1975). Taschereau (1985, 94) has discussed the merits of parks or lands administrations assuming responsibility of reserve management. Generally, a parks agency has more experience in managing natural areas than a lands agency. With the differences that exist in parks and reserves mandates, however, there is the potential that the public and civil servants might confuse them with recreational parks and permit damaging kinds of development to take place. Land department personnel, on the other hand, are often trained to think of resource exploitation and are influenced by lobbyists who work for lumbering and mining companies. As a consequence, an ecological reserve might not receive appropriate and effective protection under lands. Based on his experience, however, the effectiveness of reserve programs is tied to the degree that an agency accepts stewardship responsibilities and is committed to the achievement of objectives, rather than the type of agency.

3.2.3 *Political Awareness and Support*

Governments must commit themselves to both the spirit and the letter of the law in order for a program to be successful (Taschereau, 1985, 89). The establishment of a program is only one step in achieving statutory objectives. Both financial and political support by government are required. As a result, politicians need to be aware of the program and willing to implement it. Without such a commitment, the act establishing the program is merely 'window dressing'.

3.2.4 Public Awareness and Support

The public can affect decision making both through the choice of political representatives and through public opinion which influences the decisions of the politician. Consequently, public awareness and support for a program can affect the political will to implement a program. Public interest in an issue, however, declines over time (Sabatier and Mazmanian 1981, 18). As a result, there is a need for a public relations program to maintain awareness and support.

3.2.5 Constituency Groups

Constituency groups have a special interest in a particular area and decisions affecting that area. Industry often has large financial incentives as well as the resources and organization to effectively lobby decision makers (Sabatier and Mazmanian, 1981, 18). Employment opportunities for the public and taxation benefits to government can further increase their ability to influence decisions. In contrast, preservation does not offer immediate measurable gains obvious to the voter or the politician and supporters are often neither numerous nor organized (Franson, 1975, 18).

3.3 Funding and Staffing

Adequate funding is essential to the implementation of a statute and the associated program (Sabatier and Mazmanian, 1981, 11). The financial resources available will affect the number and quality of staff hired and thus, the extent to which duties can be fulfilled. The qualifications in terms of experience and education of the personnel will also affect how well the program is implemented. Taschereau (1985, 95) recommends that since the staff is responsible for a variety of tasks which include field work, management plans, and reporting to the advisory committee, careful consideration needs to be given to characteristics, abilities, and background of the candidates.

3.4 Planning and Management Capabilities

3.4.1 Planning

Planning and management capabilities influence the ability to implement a program and achieve objectives. Systematic planning is used to prepare recommendations for policies and courses of action to achieve accepted objectives (Sharpe *et al.*, 1983, 107). Management involves the implementation of these recommendations.

A systems plan is required to plan effectively for a program such as ERP. To do so, provincial and regional objectives must be established. This provides a structure and rationale for the selection of reserves needed to transfer these concepts to the protection of natural areas. Taschereau (1985), Franson (1975), and Peterken (1968) agree that such a program should be based on the biophysical habitat since habitat preservation and management are essential for the survival of any organism. The kinds of areas, their numbers, and sizes required are important elements in developing a systems plan. This detailed information will ease government apprehensions concerning the amount of land that will be alienated for the reserve program (Franson, 1975, 52).

3.4.2 Management

Management is required to maintain an area in a natural state and meet the objectives of the program. In the case of ecological reserves, management may be, in fact, no management (Stone, 1969, 200). Most reserves, however, are not self contained and are subject to impinging factors from within and without the area (Pyle, 1980, 321). Consequently, controlled interference may become necessary to achieve the goals established for a reserve.

The starting point for management is to determine goals for a particular reserve (Franson, 1975, 55). From these goals, an ecosystem management strategy can be developed. In the literature, there are a number of viable options for the management of ecological reserves (Geist, 1982 cited in Wittkugel, 1983, 23; Stone, 1969). These include the following: *laissez-faire* or "hands-off", where nature is allowed to take its course without interference by man; *status quo* where the reserve is kept in a wild but more or less static condition; maximum biological diversity; preservation of certain favored species; and preservation of successional stages. Depending on the option selected, substantial

management actions may be required.

Management is complex and demanding and can be simplified through a hierarchical development of management policies and plans. Both Franson (1975, 54) and Taschereau (1985, 96) agree that the first step in reserve management is to publish a general policy statement to give direction to the program and to establish guidelines. This should indicate administrative, vegetative, and wildlife management, research, education, visitor use, access, facility development, and resource protection and rehabilitation. In developing specific management policies, Franson (1975, 55) suggests several points that should be addressed. Firstly, features of special interest in the reserve should be determined in order to focus protective management measures. Secondly, an ecosystem management strategy should be established. This would include an investigation of the need for intervention and its type, frequency, and duration. Thirdly, the role of education should be examined. This step would define the degree of public access, the role of interpretative programs, and the kinds of research. Finally, the occurrence and management of fire and pests should be assessed.

Individual reserve management plans can be developed from specific policies. They are based on specialized local knowledge obtained from reserve inventories and baseline monitoring. In such a plan, the goals and objectives for the area that are consistent with its values should be stated. A program of inventory, monitoring, research, and education should be outlined and a policy for visitors established. Development guidelines and administrative and enforcement measures should also be included. An implementation strategy should be defined and provisions should be made for periodic review of plans. Franson (1975) suggests that recommendations of an advisory board and the public should be considered in formulating plans for ecological reserves.

Management plans can also designate specific areas in reserves. Zoning can be used as a management tool to allocate the most appropriate reserve uses. CCEA (1985) suggests four types of zones: strict, managed, buffer, and access. The strictly protected area has a high degree of natural integrity where natural processes prevail without man's intervention. In the managed zone, natural processes may be manipulated to maintain a particular feature or condition. These two areas make up the core. The third type, the buffer, is used to shield the core area from incompatible uses of adjacent and surrounding lands. Finally, access zones are confined areas, usually within the buffer, where

development and support facilities for access and research are located.

3.5 Achievement of Objectives

This criterion evaluates the implementation of a program to meet the stated objectives. The Ecological Reserve Act sets out four objectives including areas for research, education, preservation of ecosystems and species, and protection. The success of achieving these objectives can be measured a number of ways: the perceptions of key actors; the use of reserves for these purposes; and the planning and management capabilities.

Physical components are also important in achieving the objectives. The distance of a reserve from the major population base, the size of reserves, and the presence of buffer areas are considerations. These are discussed below.

The distance of a reserve from the population base is important as there are tradeoffs to establishing reserves in remote or accessible areas (Franklin and Trappe, 1968; Weetman and Cayford, 1972; Franson, 1975; Taschereau, 1985). Reserves that are removed from the population in the south of the province are not subject to the pressures of alternative uses. They are often easier to protect from human disturbances and, therefore, can be more readily used to conserve living material. Franklin and Trappe (1968) allege, however, that a remote area would have to be unique before scientists and students could justify visiting it. Sites close to large populations, on the other hand, are more readily available and accessible for scientific and educational use. Such areas have management problems in controlling or limiting public access. As well, there is a potential for major conflict between a reserve and its immediate surroundings. Activities such as land clearing, road building, and commercial development adjacent to a natural area can bring about changes that can alter the biota through drainage and introduction of pollutants (Taschereau, 1985, 6; Weetman and Cayford, 1972). As a result, accessible areas are less suited for maintaining genetic resources and for long-term research of relatively undisturbed ecosystems.

Another consideration is reserve size. Studies in island biogeography (Diamond, 1975; McMichael, 1975; Sullivan and Schaffer, 1975; Peterken, 1977) have begun to provide useful models in

the appropriate size and shape of reserves to adequately protect and maintain ecosystems. Pojar (1976) and Taschereau (1985, 93) believe that the preservation of whole watersheds is the best way of minimizing uncontrolled outside affects as it provides internal homeostasis and a buffer against external influences. This is often impossible, however, due to nonscientific considerations such as political pressures and competing resource uses.

Buffer areas can counterbalance the affect of small size and location close to a population base. By reducing the affect of surrounding land uses, buffers can protect core areas and small reserves. Certain activities not permitted in reserve areas, such as habitat manipulation and certain kinds of destructive research, could take place here (Taschereau, 1985, 93). Thus, buffers remove core ecosystems from the general public's attention and encroaching development, and provide areas for interpretative natural history studies and manipulative research.

CHAPTER 4

EVALUATION

The Ecological Reserve Program is evaluated in this chapter using the evaluation criteria developed above. This analysis is based on a telephone survey, interviews, and the literature. General survey findings are summarized briefly in this chapter; a more detailed account of responses is included in appendix A. Findings are presented in terms of percentages calculated from the number of those responding to a particular question which is indicated by the variable "n".

4.1 Legislation and Jurisdiction

British Columbia's ecological reserve legislation was the first of its kind in Canada. It is considered a landmark as it acknowledged the inadequacy of the existing legal framework to provide areas for specific and specialized uses such as scientific research. Franson (1975, 21) found that existing legislation enabled authorities to create reserves but it was inadequate for any long-term use. This is because it did not protect sites from activities permitted by other acts or provide guidelines for selection of sites or input from user groups.

Franson (1975, 30) describes the act as an excellent piece of legislation in terms of protection and management. It is, however, not without deficiencies. In the following section, the act is evaluated in terms of the legislative elements described in the preceding chapter. These include mechanisms for site acquisition, assurance of relatively permanent protection, guidance to administrators, and means of obtaining user input.

4.1.1 *Acquisition*

The Ecological Reserve Act authorizes the minister to establish reserves by order-in-council. This act, however, only mentions crown land and has no provision for accepting land donations for reserves or for the purchase or expropriation of land. As well, there are no provisions for emergency reserves. Consequently, the act does not provide the full range of mechanisms for site acquisition. In conjunction with other acts, however, the complete range is possible. For example, under the Lands

Act, donations for reserve purposes are accepted through a leasing arrangement and map reserves are established as a holding action for areas under investigation (Taschereau, 1985, 36). Recently, other acts have been used to disencumber previously alienated land to allow for ecological reserve designation (Goulet, 1987).

The primary means of obtaining noncrown lands is through leasing arrangements with nongovernmental organizations. The Nature Trust of Canada is such an organization; it acquires ecologically significant lands and leases them to crown or private agencies under a 99-year agreement (The Nature Trust, 1985). To date, two ecological reserves in British Columbia have been established through this process (Goulet, 1987).

There are other means for the government to protect ecosystems on private land in British Columbia that have not yet been employed. The Crown Land Fund could be used to purchase or lease privately held lands (Dooling, 1985; Brink, 1987). Expropriation powers of other acts could also be exercised (Franson, 1975, 43). This method, however, is politically unpalatable and expensive.

4.1.2 Permanent Protection

The Ecological Reserve Act adequately protects reserves (65%; n=17). It excludes and modifies statutes inimical to the reserves, as well as giving cabinet power to make regulations. Current regulations specify the activities that are prohibited and establish a permit procedure to control entry and use of reserves. For maximum protection, they allow the minister to close any reserve to entry or use.

These protective measures have received criticism. Criticisms include the use of orders-in-council to establish reserves and the lack of penalties in the act. An order-in-council is a decision made by cabinet which can be changed as easily as it is made. Brink (1987) suggests that orders-in-council are becoming too common and are removing decision making from the democratic process. Given political pressure, areas can be removed from reserve status without public consultation or support. Legislating land use is an alternative to establishing a reserve by an order-in-council. Governments are reluctant, however, to commit land to long-term protection under an act as stringent as the Ecological Reserve Act. Most likely, few areas would be established under such a system. Given

this constraint, designation by order-in-council is the preferred method. Franson (1975) suggests that it could be improved by stipulating in the act that changes to orders-in-council must be referred to the advisory committee for consideration. This would ensure that an adequate case would be made for the retention of a reserve before it is deleted.

The second criticism of the legislation is the absence of penalties in the act (Foster, 1986; Taschereau, 1985, 35). Once again, existing legislation could be used to redress this shortcoming. Offenders can be prosecuted under other acts such as the Parks Act or the Summary of Convictions Act. However, due to lack of political will, these acts have not yet been used to protect ecological reserves.

4.1.3 Administration and Management

The act addresses both institutional arrangements for administration and guidelines for administration and management. Reserve administration is the responsibility of the minister of environment, currently the minister of environment and parks. The minister, in conjunction with the rest of cabinet, has been given broad powers to make regulations for the management and protection of reserves. Under the regulations, the power of issuing permits and regulating research and education in reserves is delegated to the administrator. This administrator is not named in the act, a matter which has created debate on the validity of the regulations (Foster, 1986). The administrator, however, may be construed to represent the minister and thus to implement the regulations (Franson, 1986). The regulations also provide management guidelines with respect to research and prohibited activities but they do not contribute to ecosystem or visitor management.

4.1.4 User Input

Participation of knowledgeable people can benefit such a specialized program. An advisory committee can supply the minister with the expertise of the scientific community. In British Columbia legislation, the minister is not obliged to, but "may", appoint such a committee. The act does not state its composition and there is no provision for consultation before lands are withdrawn from reserve status. Other than this group, there is no other mechanism for input from scientists and other reserve users.

An advisory committee was appointed early in the development of the Ecological Reserve Program to provide expertise in establishing policy for the program. When staff was assigned to the program, many of the committee's duties were duplicated. Failure to rationalize and specify the role of the committee resulted in its disbandment in 1984 (Goulet, 1986). There are plans to reinstate this group; terms of reference are now being established and a list of candidates is being prepared (Goulet, 1986). Of those surveyed, 95% (n=17) indicated that the advisory committee played an important role and 93% (n=15) indicated that it is needed and should be re-established.

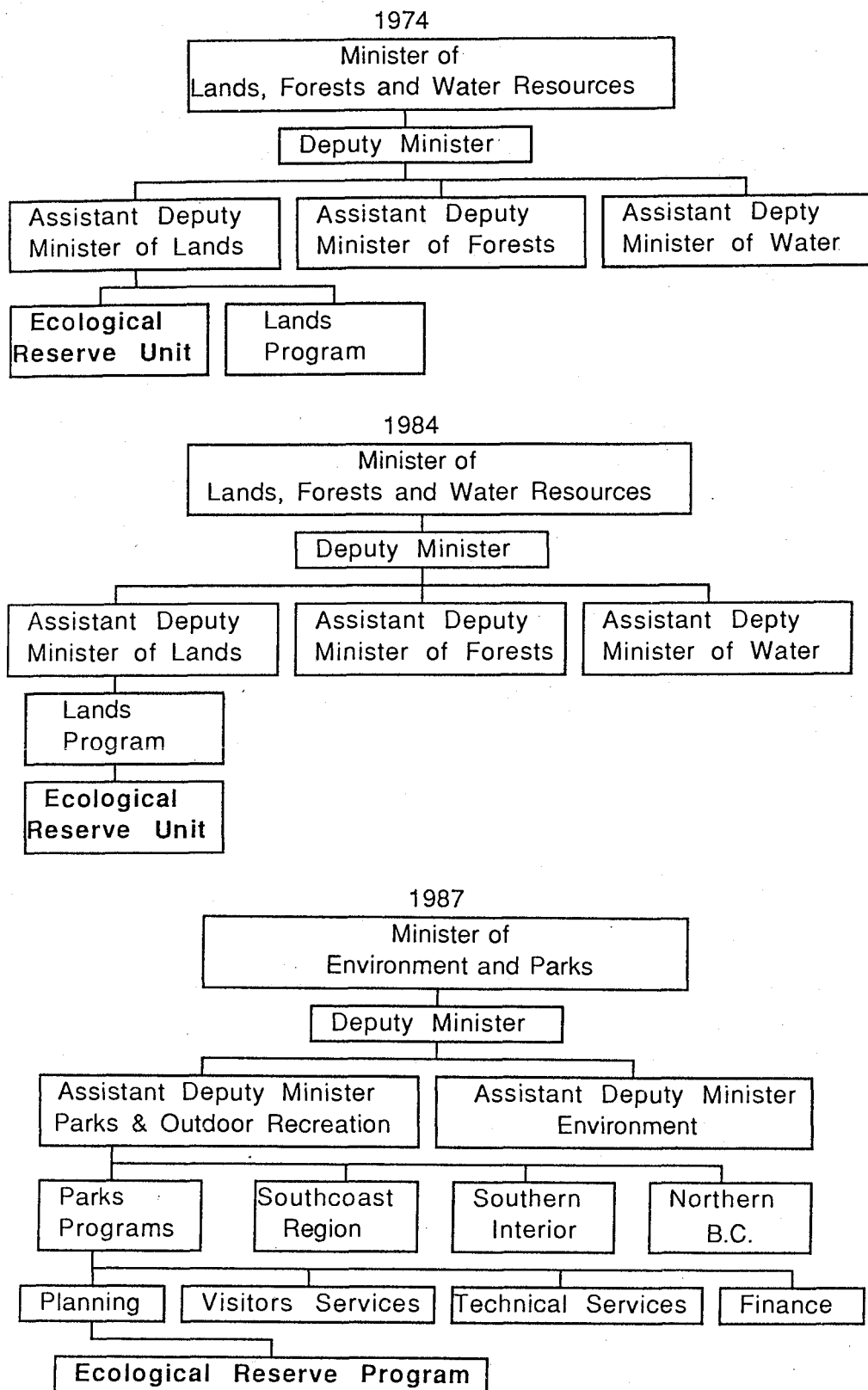
4.2 Institutional Power

The power and prestige of ERP in influencing decisions that affect the program is limited (59%; n=22). In this section the power of the program is described in terms of hierarchical integration, agency relationships, political awareness and support, public awareness and support, and constituency groups.

4.2.1 *Hierarchical Integration*

The position of ERP in the bureaucratic hierarchy has changed a number of times as indicated in chapter 2. Initially, the program existed as a separate entity responsible for establishing and allocating its budget, and reporting to the assistant deputy minister of Lands, Forests and Water Resources. In 1984, it was integrated into the Lands Branch and reported to the manager of Land Disposition and Reserves who was under the director of the Lands Branch, and to the minister of Lands, Parks and Housing. This integration increased the number of clearance points and removed control over the budget. Currently the program is included in the Parks Branch of the Ministry of Environment and Parks. Figure 6 depicts the change in hierarchical position from the inception of the program to 1987.

Figure 6: Change in Hierarchical Position of the Ecological Reserve Program



4.2.2 Agency Relationships

The relationship of ERP within the administrating agency has also been changing. The 1985 move of the Ecological Reserve Program from a lands to a parks agency has been an improvement. This is because the Parks Branch philosophy and mandate is more similar to that of the program than is the Lands Branch philosophy. Also, staff associated with parks can help to manage and police the reserves more effectively. The assignment of the program to the Lands Disposition Section of the Lands Branch made sense while reserves were being established. Now, planning and management of these areas are required. Thus the position of ERP in the Planning Section of the Parks Branch is advantageous.

Communication between agencies had been accomplished through a governmental referral system, described in chapter 2. Of those surveyed, 70% (n=20) feel that this system worked well ensuring all agency interests are represented. Through it, all agencies could comment on land use plans. However, there were some problems with this system including the economic basis to land use decisions, veto power, and the efficiency of the referral process. These are discussed below.

The economic basis of the decisions was the most significant problem in the referral system. Many values associated with ecological reserves escape quantification, yet the costs and benefits of resource use are readily calculated. Consequently, ERP receives lands of low economic potential rather than those of high preservation value (Dooling, 1985, 35).

The unanimous approval by all land use agencies which has been traditionally required to establish a reserve was a second problem. As a result, one agency could veto a proposal with little recourse for appeal and negotiation. Restrictions on hunting and mineral exploration and extraction resulted in many proposals being blocked by the Fish and Wildlife Branch of the Ministry of Environment and the Ministry of Energy, Mines and Petroleum Resources.

Finally, the process had become long, tedious, and inefficient. This was the result of the large number of proposals which have been referred and considered. Moreover, decentralization of the land agencies to the regions in the late 1970's increased the number of clearance points from seven to 49 (Foster, 1986). In total, over 300 proposals were referred, many of them in the first five years of the program. Obtaining approval from 49 sources proved to be difficult. As a result, proposals were

accumulating without final decisions.

Together with numerous land use conflicts, the referral process broke down. The Wilderness Advisory Committee made recommendations in 1986 in an attempt to resolve these issues. In total, 13 ecological reserves conflicts were addressed. Protective status was recommended for 12 reserves proposals, seven as ecological reserves and five as parts of recreation areas. Since these recommendations, there has been no formalized means for agencies to comment on reserve proposals. This lack of communication could lead to more land use conflicts.

An improved referral process is needed to reach decisions concerning proposed ecological reserves. Considerations other than economics such as intangible values, and political and social ramifications of proposals should be taken into account. Negotiations and decision by consensus of land use agencies should replace the current system which is based on unanimous agreement.

4.2.3 Political Awareness and Support

Politicians are not adequately aware of ERP and the importance of ^{the} program to preservation (73%; n=22). As a result, the power and prestige of the program suffers. At the inception of the program, politicians could afford to embrace the notion of preservation and reservation of natural areas. The faltering economy of the 1980's, however, placed pressures on politicians that make them reluctant to alienate lands under such stringent legislation. The de-emphasis of recreation and the prohibition of resource extraction by the Ecological Reserve Act makes these areas politically less attractive than other types of protected areas where recreation, hunting, and controlled resource extraction can take place (Taschereau, 1985, 81). An awareness program is required to increase the level of understanding of politicians and thus, program support.

4.2.4 Public Awareness and Support

Public awareness is important in influencing political decisions. The public, however, is not adequately aware of the program; only 6% of the public approached in the preliminary questionnaire were informed about ERP. This finding was supported by a telephone survey in which 68% (n=22) of the respondents indicated that the public is not aware of ecological reserves. If there is no public awareness and support, political support cannot be expected. This is especially true for a program that

conflicts with a number of uses that are economically significant and are supported by powerful constituencies.

Awareness of protected areas such as parks may parallel that of ecological reserves. Davidson (1979, 29) suggests that parks were riding the crest of a wave of popular enthusiasm for environmental quality in late 60's and early 70's. This enthusiasm appears to have waned due to current economic concerns. Davidson asserts that support for parks has diminished or is less visible, and nature conservation now commands far less public and political attention. Of those surveyed, 48% (n=21) agreed with this position. All the professionals, however, did not feel that there is a drop in public interest. A recent poll of Canadians' concerns indicated that environmental issues are the most important (*Globe and Mail*, 1987). Awareness of ERP may be affected by the specialized nature of the program that is not well understood by the public (Brink, 1987). Young (1987) and Dearden (1987) suggest that the public cannot distinguish reserves and their purposes from those of parks. Dooling (1985, 34) asserts that only the scientific community really understands the breadth of the ERP mandate. A public awareness campaign can improve the public's understanding and support for the program. It is difficult to inform people about the program without referring to individual reserves; but to do so would encourage visitors. Too many visitors, however, can potentially disturb a rare or unique feature. Consequently, as use increases, so must supervision, guided tours, signage, and enforcement all of which require funds and manpower that currently are not available.

There are two schools of thought concerning the amount of publicity that the Ecological Reserve Program should receive. The first maintains that reserves should keep a low profile to ensure their protection (37%; n=21). The second feels that reserves should have a high profile to maximize awareness and possibly establish a support group for their protection (48%; n=21). There is a distinct difference between the preservationist and government agency groups on this matter. The preservationists (66%) favor secrecy and the government agencies (75%) publicity.

4.2.5 Constituency Groups

Constituency groups lobby the government to influence decisions which may result in special benefits to them. The survey results indicate that the ecological reserve designation is recognized as a valid land use (100%; n=22) but within constraints. As pointed out by the Wilderness Advisory Committee (1986, 13), this is because resource development interests cannot sustain further reduction in the exploitable areas to which they currently have access. There are three important constituency groups that try to influence land use decisions with respect to ecological reserves: the forest industry, the mining industry, and the Friends of Ecological Reserves. Their roles are discussed below.

The Forest Industry: Forestry is the largest industry in British Columbia. Alienation of large areas of productive land now in provincial forest can affect the province's ability to maintain a viable economic base and to provide jobs for an expanding work force (B. C. Wilderness Advisory Committee, 1986, 13). The industry, however, also has a vested interest in maintaining forests for baseline studies and genetic stock for future generations. ERP presently protects forested ecosystems that have limited use for current industrial research (Swanson, 1979). Generally, the protected areas are old growth stands on marginal forest land; forest industry research, however, is directed at shorter rotations and plantations.

A policy to encourage regional foresters to propose worthy ecological reserve sites in their areas has been initiated by the Association of British Columbia Professional Foresters and adopted by the Ministry of Forests (Klinka, 1986; Baker, 1987). Under this new system, reserve proposals representative of regions will be selected by professionals who know the region. Consequently, they will be better suited to regional research needs and should have strong support for the creation of new reserves.

The Mining Industry: Mining is the third largest industry in British Columbia and its representatives are concerned about the affects of reserves on resource development. Through the alienation of large land units, potential reserves could block natural gas rights to an area (Stevenson, 1987). The industry's reluctance to approve reserve proposals are related to the characteristics of the industry: determination of deposits; technological developments; and variable market price as explained below (B. C. Wilderness Advisory Committee, 1985, 6). First, 'gold is where you find it'. Deposit discoveries cannot be planned; there are difficulties in determining the location and extent of mineral, oil, and gas deposits. Secondly, technological changes can make the mining of previously valueless minerals

economically viable though the development of new uses, alloys, and mining methods. Lastly, price changes can also make a previously uneconomic deposit profitable to mine. These uncertainties discourage the mining industry from approving other land use proposals where there is potential alienation of valuable geological deposits.

The mining industry is sympathetic to ERP as long as reserves are kept small and do not block access to other sites (Germain, 1987; Rotel, 1987). In 1984, the Minister of Mines and Petroleum Resources suggested to the Minister of Lands, Parks and Housing that there should be an amendment to the Ecological Reserve Act to allow industry to obtain petroleum and natural gas rights in reserves (Victoria Times-Colonist, 1984b). This is a possibility that could be explored. Through directional drilling, deposits below the surface of the reserve could be extracted without disruption to reserves. Precautions would need to be stipulated and observed to ensure that no environmental damage would occur to reserves if mining were to take place under a reserve.

The Friends of Ecological Reserves: FER is a citizen advocacy group established in 1983 to promote the interests of the Ecological Reserves Program in British Columbia. Created as an independent support group to lobby government and educate the public, it currently has 250 members (Husband, 1986). FER is committed to promoting the interests of the program in British Columbia and to support the program in public and private arenas. With its own resources, it sponsors projects that would not, or could not, be supported by government. It has been effective in raising issues with the government and educating the public through guided tours, slide shows, and the distribution of information.

4.3 Funding and Staffing

Inadequate funding has been a major constraint in the implementation and management of the Ecological Reserve Program (87%; n=15). Taschereau (1985, 33) points out that there is little money to encourage research or even to maintain fencing around some reserves. As indicated in chapter 2, the limited staff consisting of a coordinator and two assistants, does not allow administrative procedures and responsibilities and program functions to be fully carried out (72%; n=18). Employees, however, are adequately trained for their work (84%; n=16). Staff members have university degrees in the natural

sciences and biological field experience which is a good basis for such a program.

Contracts have been a solution to staffing problems. For the past two years, contracts in the areas of planning, policy analysis, and management have been let. This practise needs to be continued and broadened as there is little prospect for a larger increase in ERP staff given the current political philosophy. Long-term contracts are needed to further develop the systems plan and management plans. These are important to give the program direction; this work may take several years and should be reviewed periodically. Shorter contract of a year's duration are required to establish management categories, and to design and implement a public relations program.

4.4 Planning and Management Capabilities

4.4.1 Systems Plan

The systems plan for the Ecological Reserve Program is based on two selection categories as described in chapter 2. The representative category is grounded on the biogeoclimatic zone system. The rare and unique category, on the other hand, is not predetermined but is established as an area and its need for protection is identified. Of those surveyed, 47% (n=19) indicated that this selection system works well. Those who disagreed with the effectiveness of this system, more than half the sample, identified the lack of political will to support it rather than at the system itself as the problem.

Implementation of a systems plan is difficult. There are three problems concerning the systems plan: the biogeoclimatic classification; the rare and unique category; and the the lack of complete information. These are discussed below. The categories of the biogeoclimatic classification are broad and represent a wide range of conditions. This amplitude increases the difficulty of selecting an area to represent a category. A modification of this system has been proposed which would divide subzones into cells based on plant communities indicative of ecosystem types (Roemer, 1986).

The rare and unique category represents a second problem in implementation of a systems plan. Due to the nature of these areas, they cannot be predetermined and can only be established once they have been identified. Taschereau (1985, 100) suggests that the protection of representative areas take precedence over special sites, as preserving special sites delays the reserve system in reaching its full

potential. Representative sites can be more valuable because they better exemplify the natural ecological variation of provincial regions and thus function better as outdoor laboratories for long-term studies to monitor comparative changes. As landscapes become altered, all these reserves will be unique. Foster (1987) counters this argument by saying that special sites are the areas that need protection now as they are rapidly being lost forever.

A third problem is that a complete biological inventory of the province is lacking. This complicates preparing and implementing a systems plan. Baseline information on each region is uneven in terms of accuracy and detail. For example, the southwest coastal region is known and documented in more detail than the northern region (MOL,P&H, 1982a). Foster (1977) suggests that as more is learned about the province, more differences will be identified, thus providing justification for the establishment of additional reserves. An inventory and data collection system is required to bring together the knowledge from all the ministries and the interest groups. This would widen and deepen the knowledge base and provide for more informed decisions.

These three implementation problems have made the demands for land seem infinite. Opponents accuse the program of 'land grabbing' and establishing reserves for no apparent reason (Brink, 1987; Foster, 1986; Taschereau, 1985 97). This accusation is based on the factors described above as well as the following: the large number of proposals referred to the land use agencies; the apparent unsystematic nature of proposals; and the number of reserves established in the first five years. A large number of areas, close to 400, have been proposed as ecological reserves (Goulet, 1986). Generally, once these proposals are referred, they were not guided through the system by the ERP staff but remained waiting for comment from the agencies. Meanwhile, new proposals were introduced and accumulated in the system. The selection process, under Foster's direction, focussed on the rare and unique category which cannot be preplanned. At the same time, resource industries were concerned about continued access to the land base (Brink, 1987). Given that 75 reserves, almost three-quarters of the reserves, were established in the first five years of the program, the industry began to fear that large parts of the province were being 'locked up' or withdrawn from resource use. As a result, the program began to lose support within the government and with the resource industries.

Steps have been taken to improve implementation of the systems plan. Candidate areas are now given priority as proposals according to another set of criteria which would take into account biological, physical, and management considerations (Goulet, 1986). An area that would protect an ecosystem and species not yet represented in the system is given high priority. Such an area which has a history of baseline research and is located far from the population base is preferred. The objections of other agencies are also examined; proposals that are likely to be contested are given low priority and possible alternative sites are sought. The appropriateness of the ecological reserve designation is then compared to alternative forms of reservation for each area and its long-term implications for management are studied.

The fear that large land areas will be alienated is unfounded. Over 100 areas have been established but this number is not indicative of the amount of land that has been removed from resource use. In total, 154,629 hectares has been given protective status as ecological reserves. This represents only 0.16% of British Columbia's land mass. In total only 6% of the land base is protected as parks, sanctuaries, or ecological reserves (table 2).

There have been new initiatives to complete the range of representation protected in ecological reserves while not removing land from resource use. Parks will be looked to as a source for new reserves as they contain 50% of British Columbia's ecosystem types (Taschereau, 1985, 36; Thompson, 1987). Only when representative areas cannot be found in parks will outside sources be investigated. Privately owned lands will continue to be purchased by nongovernmental organizations to obtain unique areas that are not owned by the crown. Given the increasing cost of establishing reserves, and the hesitancy to commit lands to such legally entrenched uses, other approaches to natural area protection should be sought. Taschereau (1985, 101) suggests that all major land use categories in Canada, such as forestry and agriculture, incorporate a natural areas program that would be regulated through policy and individual master plans. Such a strategy would increase the probability of establishing a viable system of ecological reserve in the province.

4.4.2 Management

The program, 15 years old, is still in its infancy in terms of management. In the first 10 years, emphasis was on establishing a network of reserves; now the program has turned to management (Goulet, 1986). Generally management has been reactive to the problems encountered and man-made disruptions are controlled where possible (B. C. MOE&P, 1987). An overall *laissez-faire* or 'hands-off' ecosystem management strategy has been adopted. This is appropriate as natural change is a characteristic of all ecosystems and is of much interest to scientists. In some cases, more active approaches such as fencing and ditching are undertaken to protect reserves. Such actions, however, are limited by staffing and budgetary constraints. As management becomes a pressing concern, new strategies will be needed. The current state of management guidelines, policies, and plans are discussed below.

Fire and Insect-Control Guidelines: Each reserve has been analyzed to determine the historic significance of fires and insects. Recommendations have been made concerning the degree to which fire and insect infestations should be tolerated. In most cases, there are no plans to protect ecological reserves from natural intrusions such as tree disease, insect infestation, or fire (B. C. MOE&P, 1987).

Research Guidelines: The regulations passed pursuant to the act provide research guidelines. An application for a permit must include a description of the proposed use, the area to be affected, means of access, duration of use, ecological impact of activities, number and names of individuals to be under permit, and name of the individual directing the proposed research or educational program. If the proposed research or educational use is likely to cause any significant disruption to the reserve, the administrator must first consult the advisory committee. In each permit, the administrator can include conditions that are needed to protect the reserve and ongoing research from disruption. These include limitations to the number of entries, the number of people, and the activities. Upon completion of research, the permittee is required to file a report which includes a statement of methodology, inventory of any plants or animals identified during research, description of land forms and soil conditions in research areas, and a statement of results, conclusions, or recommendations. Under the act, the administrator has the power to cancel or modify a permit if there is a conflict between two users, if the activities have caused unanticipated damage to the reserve, if beneficial use is not being made of a

permit, or if the permit conditions have been violated.

Visitor Policy: The general policy for visitor use is one of tolerance. Only scientific and educational uses are actively encouraged. In sensitive reserves that have been closed, a permit is required for entry. In most reserves, however, casual nonconsumptive, nonmotorized uses such as hiking, nature observation, photography, and birdwatching are allowed without a permit. If visitors do seek permission, they are often directed to the volunteer warden to guide them or provide information (Goulet, 1986).

Management Plans: Each reserve should have a management plan (100%; n=22). In theory, this is a wise policy but it is impractical given current budgetary and inventory constraints. Priority in developing management plans has been given to areas that are important to the system or that have current or potential management problems. Management plans for groups of similar reserves, such as seabird colonies are being prepared. This integrated approach to management should be furthered developed. A categorization system could be used to provide management guidelines (91%; n=22). These categories could be based on distance from population centers, potential for outdoor education, ability to sustain visitor use, potential for research, and ecological sensitivity. Each category would have a set of guidelines dictating access and use.

To establish such a system, a statement of goals and objectives for each reserve is required. These have only been cursorily established at the time of meeting the selection criteria (56%; n=18). Although the purpose of each reserve is determined upon selection, the function of the reserves within the program is not. Consequently, each reserve should be examined closely as to its potential unique role within the provincial ecological reserve system.

4.4.3 Volunteer Warden Program

The volunteer warden program is an innovative and cost effective means of monitoring existing reserves and increasing public awareness and appreciation of ERP goals and objectives. It is meeting its objectives (69%; n=13). Of those respondents who disagree (23%), they believe that the warden program is beneficial but there is a limit to the quality and quantity of work that can be expected from volunteers.

The training wardens receive is minimal. New wardens are given a kit which contains information on their reserves, guidelines, sample management tables, and a copy of the act and regulations. Workshops aimed at providing more tools to wardens are held at the annual general meeting. Only half of the interviewees believe that the present level of training is adequate as wardens are already interested in natural history (50%; n=10) and 20% are neutral. The dissenting respondents (30%; n=10) indicated that training sessions in plant and bird identification, management tools, and research and inventory methodologies, and management tools are needed to better serve the program.

Communication and incentives are important for a volunteer program. Communication to ensure that wardens understand ERP objectives and can fulfill their duties is accomplished through newsletters and by telephone. Direct information exchange between ERP staff and the wardens is encouraged by granting wardens permission to use the government telephone system in regional parks offices. Periodic letters and newsletters provide information on the program and the reserves, and the annual general meeting allows wardens to discuss their problems.

Communication with regional government staff is also important in facilitating the management of reserves. This has been effective in only a few regions as a result of either volunteers or interested park staff who have taken the initiative (Goulet, 1986). Regular contact with regional and district parks staff would ensure that wardens receive the help and guidance they require and that the management needs have not extend beyond the capabilities of the warden system. In the past, there was little support from other resource agencies; even parks perceived ecological reserves as competing for the same resource (Milnes, 1986). Now that the ecological reserves program is part of the Parks and Outdoor Recreation Division, there has been more cooperation, although financial constraints within parks limit their abilities to aid enforcement and management.

The incentives program for volunteer wardens is limited. Wardens receive group insurance which covers them while they are actively fulfilling their functions in the field, and mileage expenses are paid for up to two visits a year to their reserve. The major incentive offered to the volunteers is the annual meeting. They are all entitled to attend the annual meeting at the government's expense. There is also an annual prize, a painting or carving, for the best research project or inventory. This, however, has had limited effect in encouraging research to date (Goulet, 1986). The incentives program puts the wardens

into a competitive situation which may not facilitate communication among them. Other incentives and rewards such as service pins and public recognition of their work are needed (Grass, 1986).

4.5 Achievement of Objectives

4.5.1 *Research and Education*

Interviewees believe that reserves have not been used fully for research (63%, n=19) nor education (50%; n=18). Until three years ago, the use of the reserves for these purposes had not been accurately documented. As permits are not required for educational uses, such use continues to be difficult to ascertain as permits are not required. In some cases, it is difficult to distinguish research to generate data and educational use to demonstrate a lesson. There has, however, been significant research and education activity on reserves and there is potential for much more. Records show that in 1985 there were 31 research projects conducted on 16 reserves and three proposed reserves, in 1986 there were 37 research projects on 17 reserves and three proposed reserves, and in 1987 there were 27 research project on 19 reserves and one proposed reserves (Goulet, 1987). This research was conducted by a variety of groups ranging from the federal Ministry of Forests to school groups. Both universities and government agencies are presently using reserves for long-term monitoring (MOE&P, 1987). Reserves close to research institutions have proven to be important for research purposes. These include: the UBC Endowment Lands (#73) close to the University of British Columbia; Ten Mile Point (#66), Satellite Channel (#67), and Oak Bay (#94) close to University of Victoria; Baeria Rocks (#24) close to Bamfield Marine Station; and Race Rock (#97) close to Lester Pearson College.

The Ecological Reserve Program has taken steps to encourage research and education in reserves. In 1986, information listing reports and publications which have taken place in reserves was distributed to 250 researchers, colleges, universities, and government agencies (Goulet, 1987). This was the first attempt at documenting research research carried out in reserves as well as introduce and encourage research opportunities. Currently, a guide to reserves is being produced to encourage work in reserves. This publication will describe the program and the reserves. Each year the program has provided limited funding to a couple of research projects (Goulet, 1987). In addition, ERP staff readily provides information to interested parties.

The Friends of Ecological Reserves encourages research programs through limited financial support which has been quite effective in generating research in proposed reserves and aiding students. It has served to educate the public to ERP through slide shows, talks, field trips, and informational material.

The lack of interest in monitoring and inventory studies is not the fault of the program. There is little federal support for field-oriented research (Brink, 1987) and currently it is not a popular research area (McTaggart Cowan, 1987). To increase awareness and interest, ERP and its advisory committee could produce research priorities and distribute these to university and colleges.

4.5.2 Preservation and Protection

A wide spectrum of natural features have been preserved (appendix G). Dooling (1986, 33) believes that the program is a good start at representing many biological and geographical systems and the highly varied flora and fauna of British Columbia. These include offshore seabird colonies, subtidal areas, estuaries, marshlands, forest stands, grasslands, and alpine areas. Reserves have been established in all 13 biogeoclimatic zones (appendix E) and in many subzones although some of these protect rare and unique species rather than representative species (MOE&P, 1987). Some reserves contain vegetation typical of two, or even, three zones.

Representation, however, is incomplete (50%; n=20); 70% of the preservationists and professionals strongly agree with this conclusion. Some zones are better represented than others, and examples of important productive ecosystems such as coastal forests, valley bottoms, and grasslands are missing. Many of these areas are privately held or previously encumbered and are, therefore, more difficult to obtain. In addition to the lack of complete representation, not all subzones and associated biota are duplicated to mitigate against natural disasters such as fire, landslides, and floods.

The protection of reserves is guaranteed by the existing program (68%; n=22). There is, however, insufficient policing of reserves (78%; n=18). This is due to the lack of enforcement of the regulations and lack of prosecution. Due to budgetary constraints, the program relies on field staff from parks and other ministries, volunteer wardens, or researchers. Wardens and researchers, however, have a limited role as they cannot charge the offender; they can only report violations of regulations to

authorities and attempt to explain the situation to the offender.

The physical elements of protection -- reserve location, size, and buffers -- have been used to differing extents. Most reserves are clustered in the heavily populated area of British Columbia on the southwest coast (fig. 5). Reserves were probably established in these areas because of the volume of information available about the area and the threat of disturbance. This location, however, may limit the ability of the reserve to maintain and protect the ecosystems it represents due to the impact of human activities.

Protection is limited by reserve size. They range from 0.6 to 48,560 hectares. Although the current average size is 1,327 hectares, 104 of 117 reserves are less than the average. Most are very small, which causes concern for their viability as ecosystems to survive affects of surrounding land use. For example, clearcutting adjacent forest may expose the Nitnat Lake Reserve (#54) to blowdown and residential development may lead to overuse and abuse of the Mount Tzuhalem Reserve (#112). In the latter case, fencing is being undertaken to reduce this possibility.

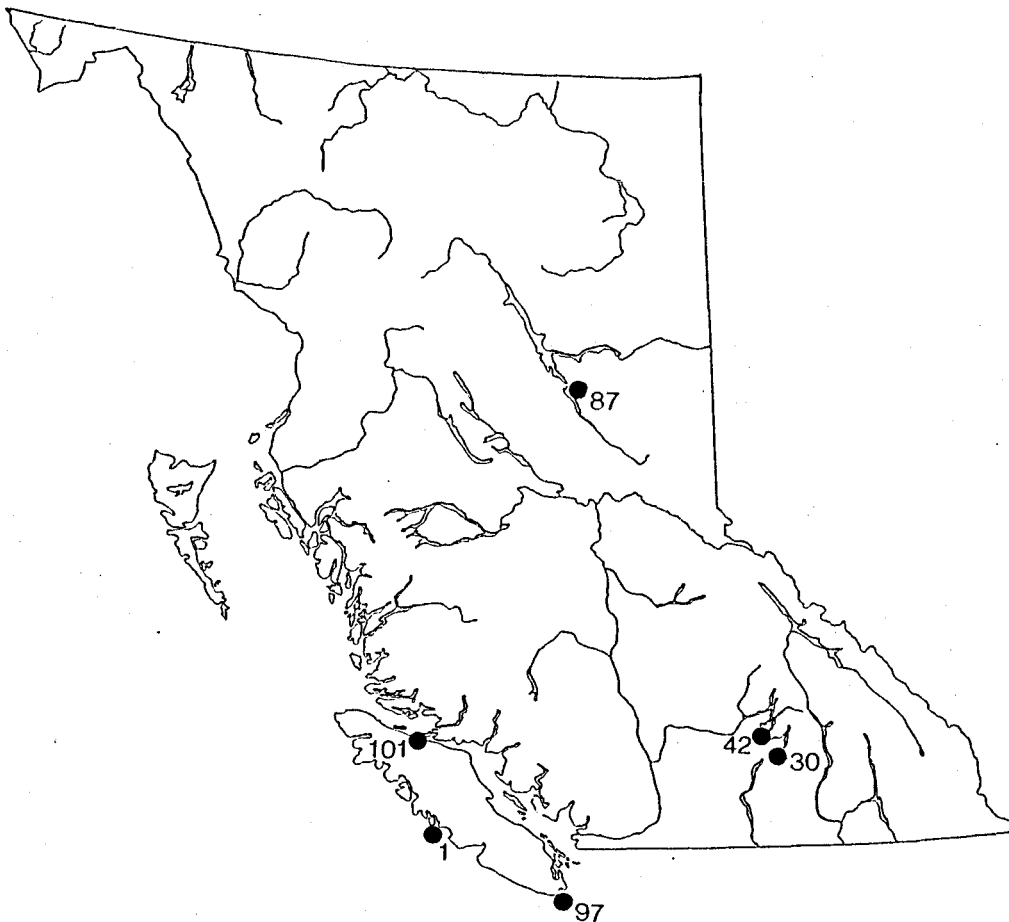
Buffers are not common to protect reserves although parks have been used for this purpose. One reserve (Gladys Lake #68) is in a provincial park and two other (Tow Hill #9, Rose Spit #10) are adjacent to a provincial park. In addition, one reserve (Pitt Polder #99) is in a provincial wildlife management unit. Given the location and size of the majority of reserves, buffers will be important to ensure protection.

CHAPTER 5

CASE STUDIES

This chapter investigates the adequacy of the institutional arrangements and the planning and management capabilities of the Ecological Reserve Program to achieve the program objectives. For the purposes of this study, six reserves are examined: Cleland Island (#1); Vance Creek (#30); Race Rocks (#97); Mara Meadows (#42); Heather Lake (#87); and Robson Bight (#101) (fig. 7). These reserves were chosen to depict the achievement of research, education, preservation, and protection objectives. To determine the success of the research objective, Cleland Island and Robson Bight were chosen. Vance Creek and Race Rocks were selected to represent the education objective, and Mara Meadows and Heather the preservation objective. The attainment of the protection objective is discussed in the case of each reserve.

Figure 7: Case Study Reserves



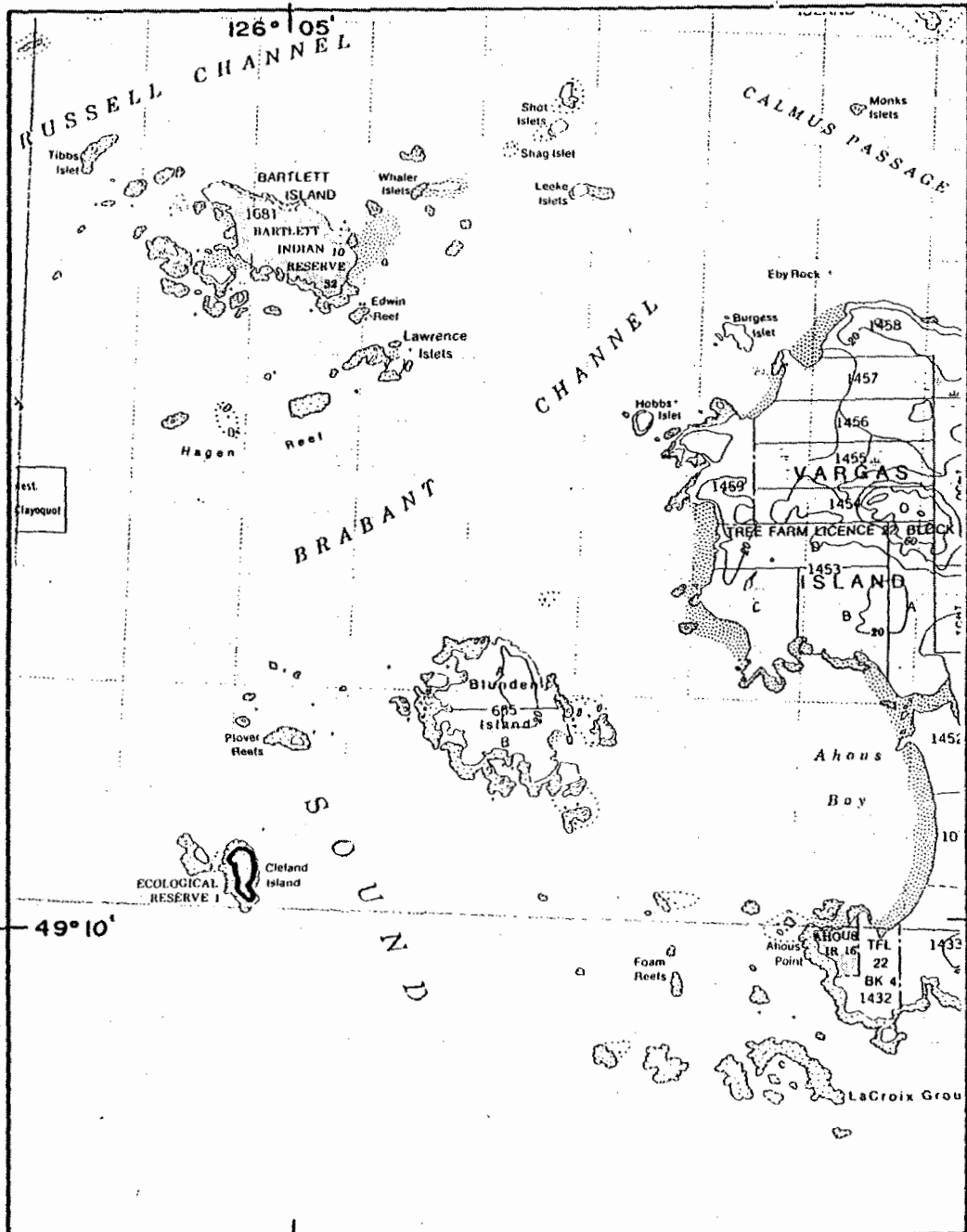
5.1 Cleland Island

The Cleland Island Reserve (#1) is located in Clayquot Sound, off the west coast of Vancouver Island (fig. 8 and fig. 9). It was the first reserve created at the initiation of the program in 1971 (Order-in-Council #1563; MOE, 1978). This 7.7-hectare site encompasses the whole island and protects a large and varied seabird population including murre, petrels, puffins, auklets, guillemots, and gulls. This abundance of seabirds makes Cleland a popular research base for scientists studying seabirds, reptiles, intertidal organisms, and plant ecology. It is an important educational reserve for students from the nearby Bamfield Marine Station, and for commercial nature tours operating on the west coast of Vancouver Island. Two Ph.D. dissertations on the black oystercatchers have resulted from research on this reserve, as well as publications and reports on oystercatchers, limpets, and rhinoceros auklets. In addition, the seabird population is monitored yearly by the Canadian Wildlife Service.

The seabird population on this small reserve is sensitive to human intrusion. As a result, the reserve was closed in 1977 through an order-in-council to relieve pressure on the bird population (Order-in-Council #1920). Now, all visitation requires a permit. Depending on the number of research permits given, commercial tours and student field trips are not always given permission to land. Attempts are made to ensure research projects are complementary, not competitive. Due to the policing limitations of the program, the researchers are primarily responsible for maintenance and policing of the reserve. Consequently, permit conditions are explicitly stated. These conditions include: reporting of any damage; taking every effort to minimize disturbance; removal of all garbage and human wastes; limitations of party size and length of visit; and camping and travel restrictions. The greatest factor contributing to the protection of this reserve is its location. Being an island, it is protected from vandalism.

Lessons: This reserve has effectively met the research objective of the program. High-quality research has been maintained by closing the reserve to entry and by limiting the number of research projects. Through issuing permits, ERP staff can attempt to minimize damage to the reserve.

Figure 8: Cleland Island Ecological Reserve



N.T.S. No. 92 E/1

Source: MOE&P, 1987.

Figure 9: **Gulls on Cleland Island Ecological Reserve**



5.2 Vance Creek

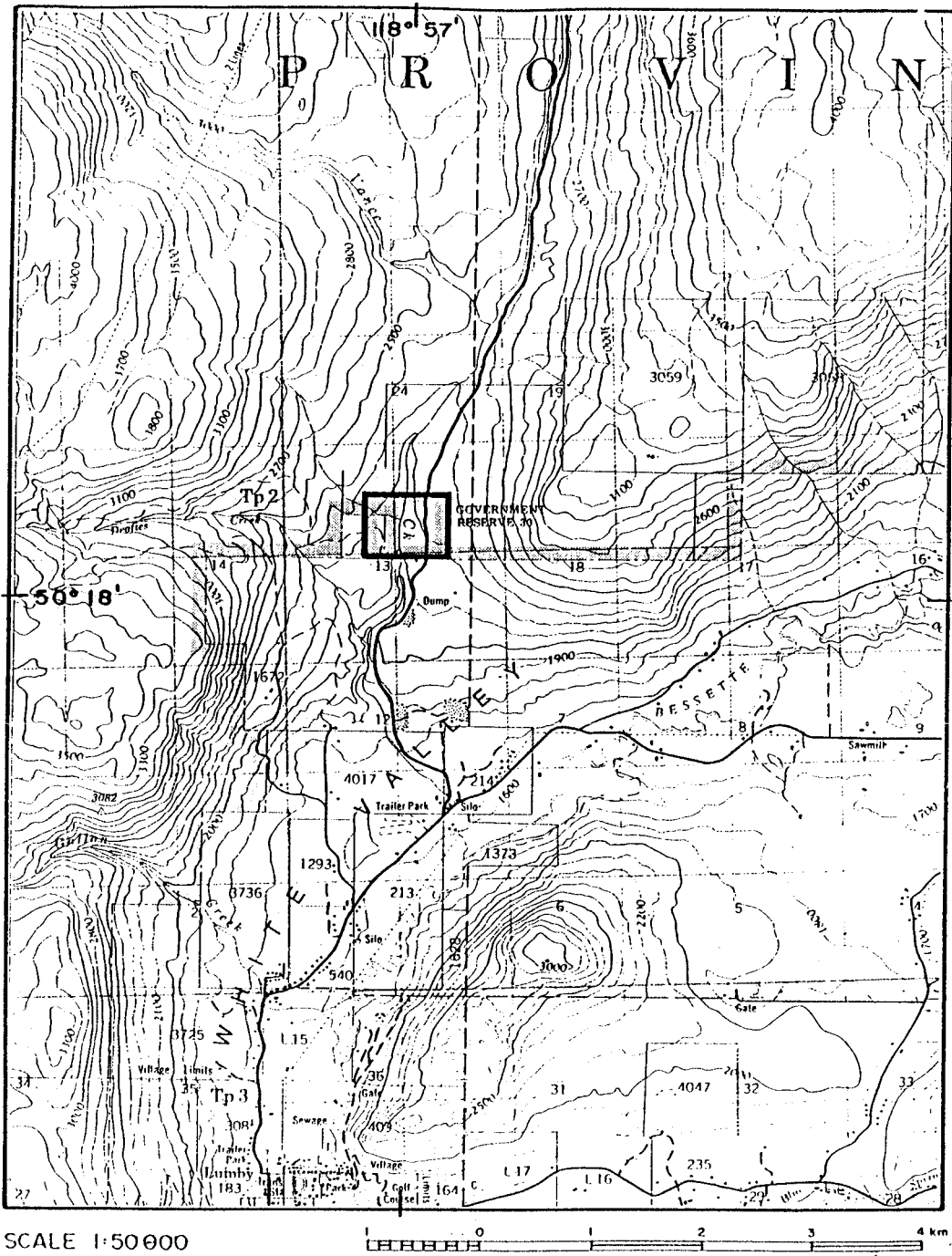
Vance Creek, 6-km north of Lumby in the Okanagan Valley, was established in 1972 (Order-in-Council #466; fig. 10 and fig. 11). It is a second growth forest that represents the transition between the interior Douglas fir and interior western hemlock zones and was established to provide a permanent site for teaching forest ecology (MOE, 1978; MOE&P, 1987). Between 1929 and the time it was designated as an ecological reserve, it was used by the Federal Department of Agriculture and the Canadian Forest Service for entomological field studies. From the early 1970's, it served as an outdoor laboratory for an elementary science program in the Vernon School District. To facilitate educational use of the area, the school district constructed toilets, tables, benches, and an open-sided shelter in 1972. The reserve was also used by secondary school students, professional foresters for workshops, and the adult education program in the Okanagan College for natural history courses. The outdoor education program in the Vernon School District was cancelled in 1984 due to restraint. Since then, there has been little use of the reserve.

Vance Creek is readily accessible as a public road runs through the reserve. This accessibility and its proximity to Lumby make it a good educational reserve but have also created management problems such as vandalism, woodcutting, and conflicts with private property and livestock. In 1974, the Department of Lands, Forest, and Water Resources attempted to solve the management problems of this reserve through suggestions to remove it from the reserve system. This, however, would set an undesirable precedent of cancelling a reserve every time management problems were encountered. Consequently, other solutions were sought. In the case of woodcutting and grazing, public education was used and steps were taken to advise the offenders that they could be liable for damages under the Trespassing Act. To discourage vandalism and trespassing, road access was blocked at the reserve border and the reserve was posted with signs indicating that it is an ecological reserve. As a further deterrent and since the reserve is not being used by the school district, the trails are not maintained.

Lessons: Vance Creek presents an excellent opportunity for educational uses due to its accessibility and facilities. Restraint budgets, however, limit the use on the reserve. Fortunately, this designation will ensure this opportunity will exist for future use. Public education has been effective in abating management and protection problems in this reserve and raising awareness of ecological

reserves.

Figure 10: Vance Creek Ecological Reserve



Source: MOE&P, 1987.

Figure 11: Trail in Vance Creek Ecological Reserve



5.3 Race Rocks

The Race Rocks Reserve is located in the Strait of Juan de Fuca, 17-km southwest of Victoria. It is comprised of 220 hectares of subtidal land down to a depth of 20 fathoms (36.6 meters) and includes seven or eight islets which are known as Race Rocks. The land above the high water mark of Great Race Rock is not included as it is a federal lighthouse installation. This reserve was established in 1980 to protect an outstanding high-current marine community (Order-in-Council #692). It contains a spectacular and diverse assemblage of organisms including a sea lion haul-out site, nesting marine birds, a high diversity of fish, some unique invertebrates, and rare and interesting algal communities (MOE, 1978).

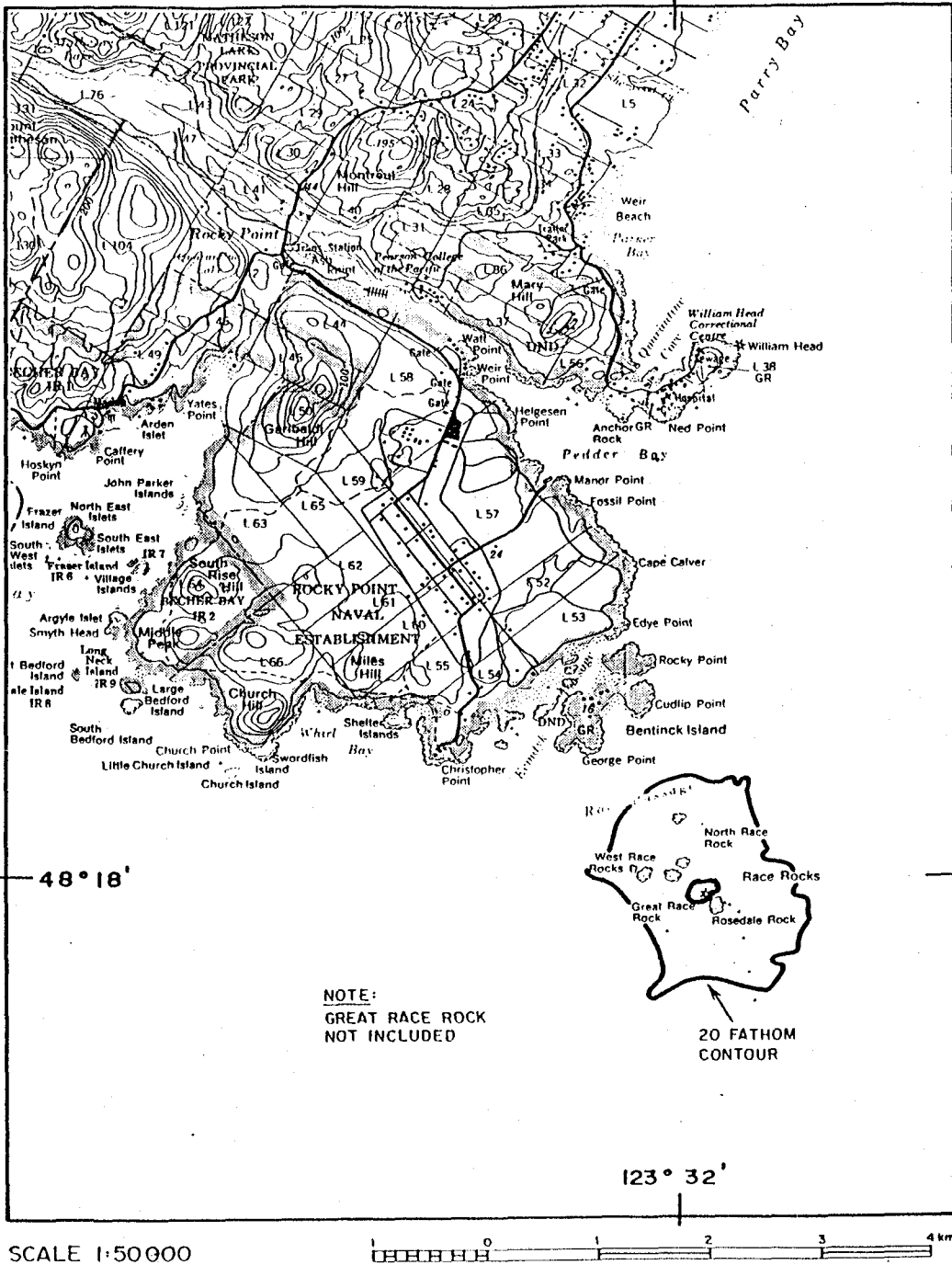
Its proximity to a population center has allowed it to be used extensively for educational and research purposes by the L. B. Pearson College in Victoria and the International Cetacean Watch Society. Volunteer wardens play a large role in protecting and monitoring this area. The Pearson College Diving Service serves as the warden and has conducted biological and oceanographic research since 1975. The Diving Service also monitors the area regularly while conducting intertidal and subtidal baseline monitoring programs (Fletcher, 1986). As a direct result of monitoring currents in this area, Race Rocks tables have been included in the *Tides and Currents* publication. The college uses this area for marine science and biological field trips, operates a marine education program for local elementary schools in the Sooke School District, and other groups such as Friends of Ecological Reserves, youth groups, students, and other diving clubs to the area.

Management problems due to vandalism are limited. This reserve is only accessible by boat and there is the constant presence of the lighthouse keepers. A pamphlet is being prepared to educate the public as a means to further protect the reserve. This pamphlet will emphasize the uniqueness and fragility of the area and provide guidelines for boaters and divers.

Lessons: This case demonstrates that scientific research on reserves can be more than an academic exercise and have applied uses. The importance of volunteer wardens in management and research is confirmed in this example. Management is also facilitated by the relative inaccessibility of this reserve; yet it is in a good location for research purposes. A pamphlet on this area will raise public

awareness of reserves as well as assist in management.

Figure 12: Race Rocks Ecological Reserve



Source: MOE&P, 1987.

Figure 13: **Sea Lions at Race Rocks Ecological Reserve**



5.4 Mara Meadows

Mara Meadows (#42) is in the unique category of reserves (fig. 14 and fig. 15). It protects a unique fen and several rare species of orchids (MOE&P, 1987). This 189-hectare reserve southwest of Mara Lake in the Larch Hills, was established in 1972 (Order-in-Council #3277). The volunteer wardens, the North Okanagan Naturalists Club, have been instrumental in proposing, describing, and protecting this reserve. They have assumed a management strategy for protecting the orchids and have taken several steps to maintain the meadows. These include the establishment of a buffer zone, manipulation of the waterflow, and closure with entry by permit as discussed below.

Protection of a sensitive area can be enhanced by a buffer area. This reserve can be seriously affected by surrounding agricultural and forestry land use through the alteration of the water regime. As a result, the original proposal called for a large buffer area to protect the bog. When the reserve was established, however, it contained only the bog areas. In 1984, a buffer zone of 100 acres of forest was added (Order-in-Council #1063) and private conservation organizations are attempting to purchase more land to further protect the area.

Past manipulation of the water regime has threatened the area. A farmer who had held this area under an agricultural lease in the 1960's, constructed a drainage ditch through the meadows. In the early 70's, the volunteer wardens initiated a sand bagging project to block the ditch to slow the drainage and to keep the water level high enough to arrest the change in the bog's character (Legg, 1986). In 1982, permanent wooden dams were installed by the North Okanagan Naturalists Club and plans are currently underway to fill the ditch with original marsh vegetation in an attempt to return the area to a near pristine condition (Legg, 1986).

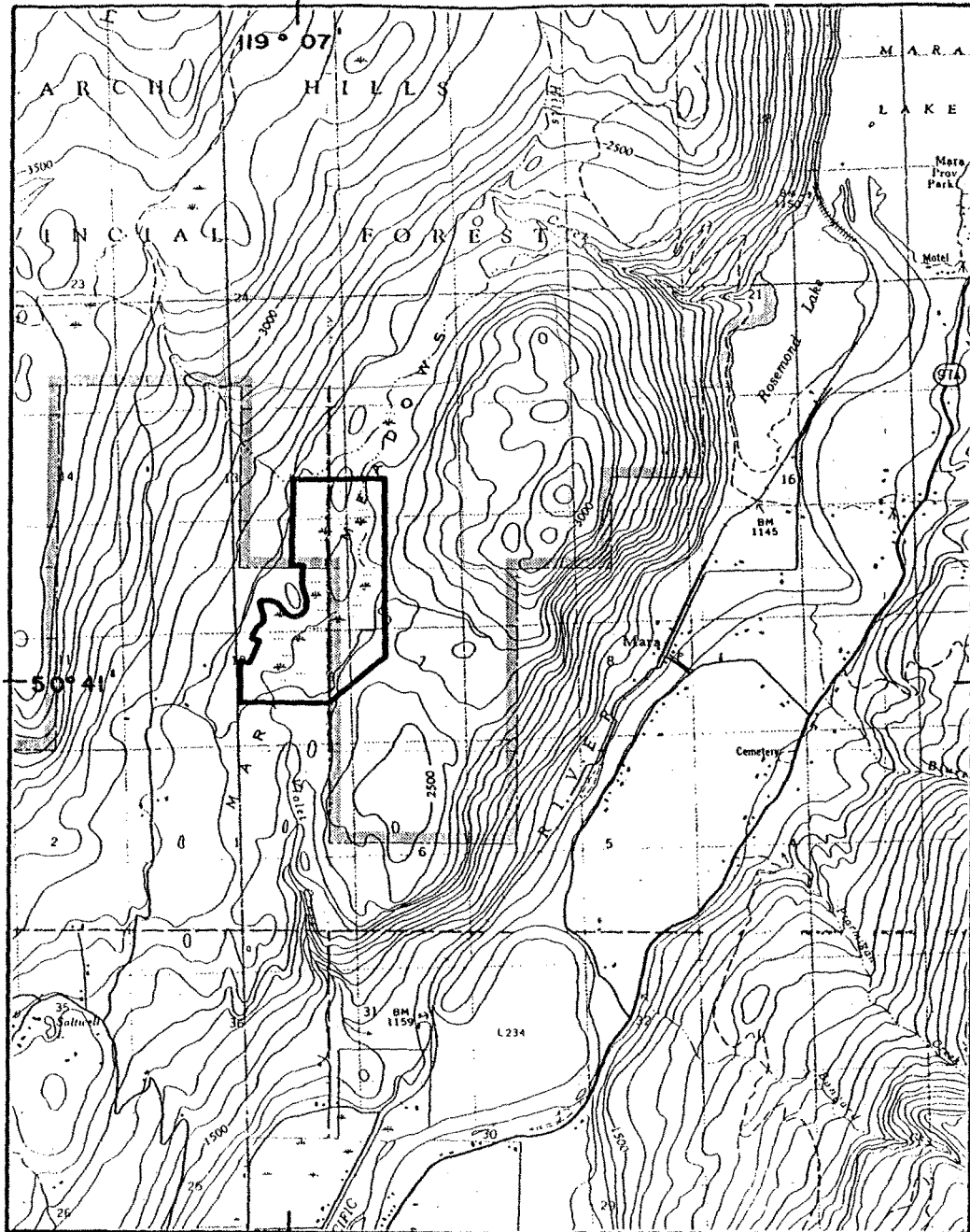
Legislative actions have also been used to protect this sensitive reserve. The orchids grow on brittle calcareous tufa deposits which are fragile and unique. Visitors who come to see and photograph the flowers pose a threat to the reserve. Consequently, it was closed to use except by permit in 1977 (Order-in-Council #1920). In addition to permits, the warden often acts as a guide to direct people to the appropriate areas and keep disturbance of the substrata to a minimum (Legg, 1986).

Other actions have been taken to protect the integrity of the area. These include the application for water rights and denial of access. A water reserve designation and establishment of a water license have been investigated to protect the water supply (Legg, 1986). Theoretically, Mara Meadows could be used for water storage purposes or its supply could be limited by upstream users. However, now that the area is an ecological reserve, such matters could be addressed through the governmental referral system.

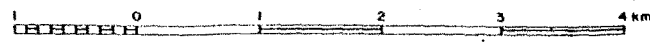
In 1986, there was a forestry right-of-way application that would run through the reserve. The forest company involved wanted to upgrade the road to remove the timber over a ten-year period. To protect the reserve, permission was refused. Temporary permission, however, was given to haul timber only until the Forest Service could provide an alternate route.

Lessons: This reserve has met the preservation objective and demonstrated the need for a management strategy to effectively preserve an unique reserve. Once again, wardens played an essential management role. This case also demonstrates that planning for a buffer zone is important to preserve the area. Closure is also shown to be an effective protection and preservation tool. Finally, this case demonstrates the importance of the referral system and the need for cooperation with other agencies to manage and protect reserves.

Figure 14: Mara Meadows Ecological Reserve



SCALE 1:50000



N.T.S. No. 82L/II

Source: MOE&P, 1987.

Figure 15: **Open Meadows of Mara Meadows Ecological Reserve**

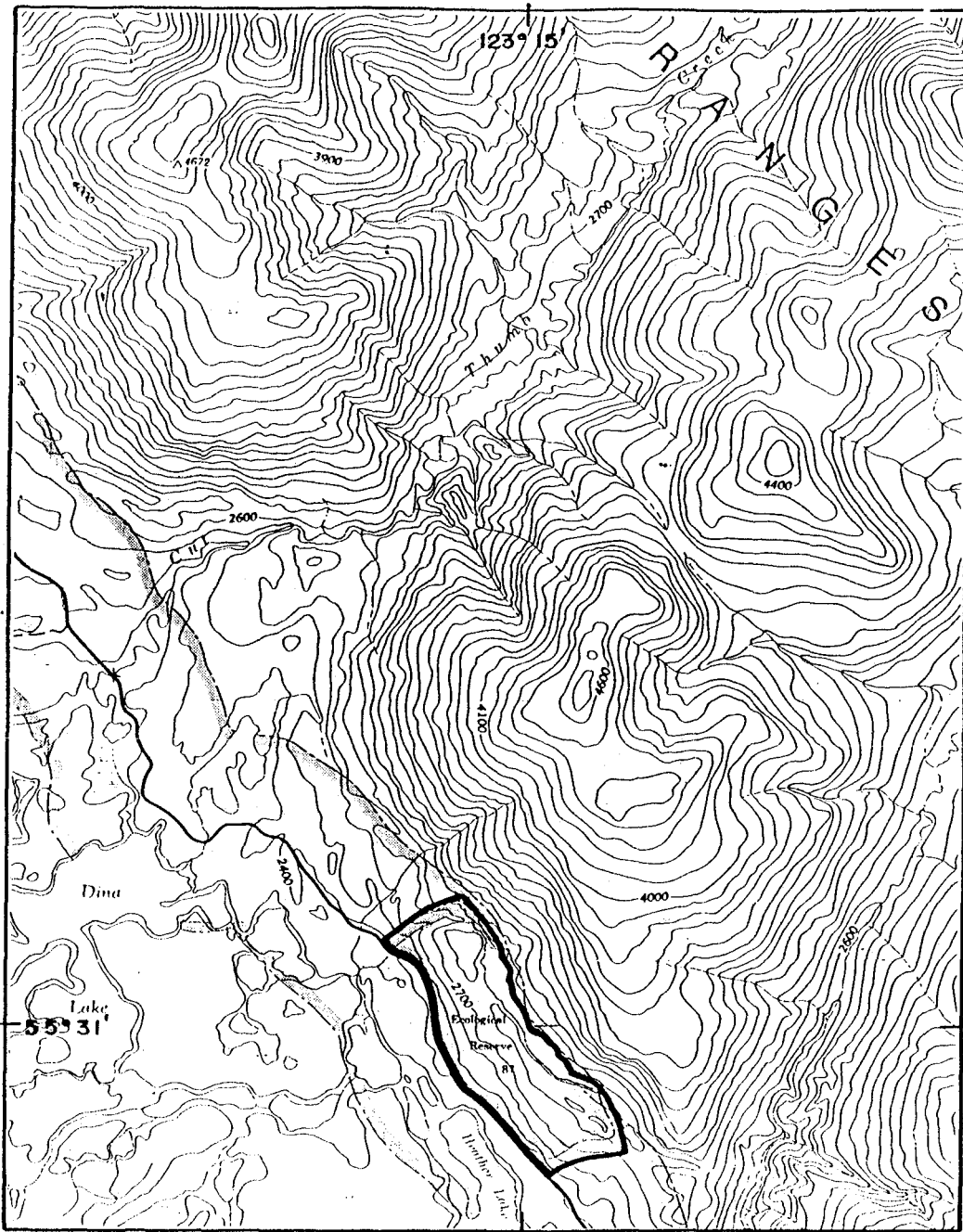


5.5 Heather Lake

Heather Lake (#87), created in 1978, is 23-km northwest of MacKenzie (fig. 16 and fig. 17). It is primarily a forest of trembling aspen that is similar to numerous other stands throughout the district but exhibits excellent growth on a productive site (MOE, 1978). It has no unique attraction for visitors and is far from the major population base. In addition, trees on this reserve are not in demand as a resource. It is, however, an excellent and accessible, although remote, site to study the flora and fauna of aspen-dominant ecosystems.

Lessons: This reserve is an example of a representative reserve. It demonstrates that the preservation and protection objective can be easily met due to its distance from the population base. An active management program is unnecessary. Due to its location, however, education and research opportunities are limited.

Figure 16: Heather Lake Ecological Reserve



SCALE 1:50000



N.T.S. No. 93 0/11

Source: MOE&P, 1987.

Figure 17: Tree Stand in Heather Lake Ecological Reserve



5.6 Robson Bight

Robson Bight is a small bay at the outlet of the Tsitika River, 10-km southeast of Telegraph Cove on the northeast coast of Vancouver Island, near the western end of the Johnstone Strait (fig. 18 and fig. 19). Its 1,248 hectares are entirely marine and serve to protect killer whales and a crucial part of their habitat (MOE&P, 1987). The bight was given ecological reserve status in 1982 (Order-in-Council #1134) because of the unusually large number of killer whales which use certain shallow, foreshore areas for rubbing themselves. This was an opportunity to protect key killer whale habitat and to maintain research and interpretative opportunities. As a symbol of its importance, it has been recommended as a National Site of Canadian Significance by Parks Canada (Canada, Parks Canada, 1982).

This area is particularly difficult to manage because of its popularity for human activity and overlapping federal and provincial jurisdiction. The Johnstone Strait area is a shipping channel and a commercial fishing area. Whale-oriented activities such as research, commercial photography, and whale-watching also occur here with great frequency. Its popularity is increased through easy accessibility by motor boat, sail boat, or kayak from Telegraph Cove, Port MacNeil, or Port Hardy.

One concern is the extent to which human activity interferes with the whales feeding, resting, reproduction, and social activity. Such interference could cause abandonment of the area by whales, reduce the survival of the population, or both (Darling, 1986). Problems occur when human activity disturbs or harasses the whales. Camping in the estuary, for example, disturbs the whales and keeps them from the rubbing beaches. This land, however, is privately held and the ecological reserve and park staff have no power to control camping. Volunteer wardens use 'friendly persuasion' in an attempt to keep the whales from being bothered (Borrowman, 1986).

Management solutions which were pursued include transferring management responsibilities to the Parks Branch, the possibility of land addition, and managing researchers and visitors. Management of the reserve was given to the Parks Branch in 1984, as the Parks Act allows for greater enforcement of the protective measures (Goulet, 1986). However, parks and ecological reserves statutes and regulations are limited because the reserve is established over navigable waters, which fall under federal jurisdiction. The Fisheries Act and British Columbia Fisheries Regulations administered by the federal

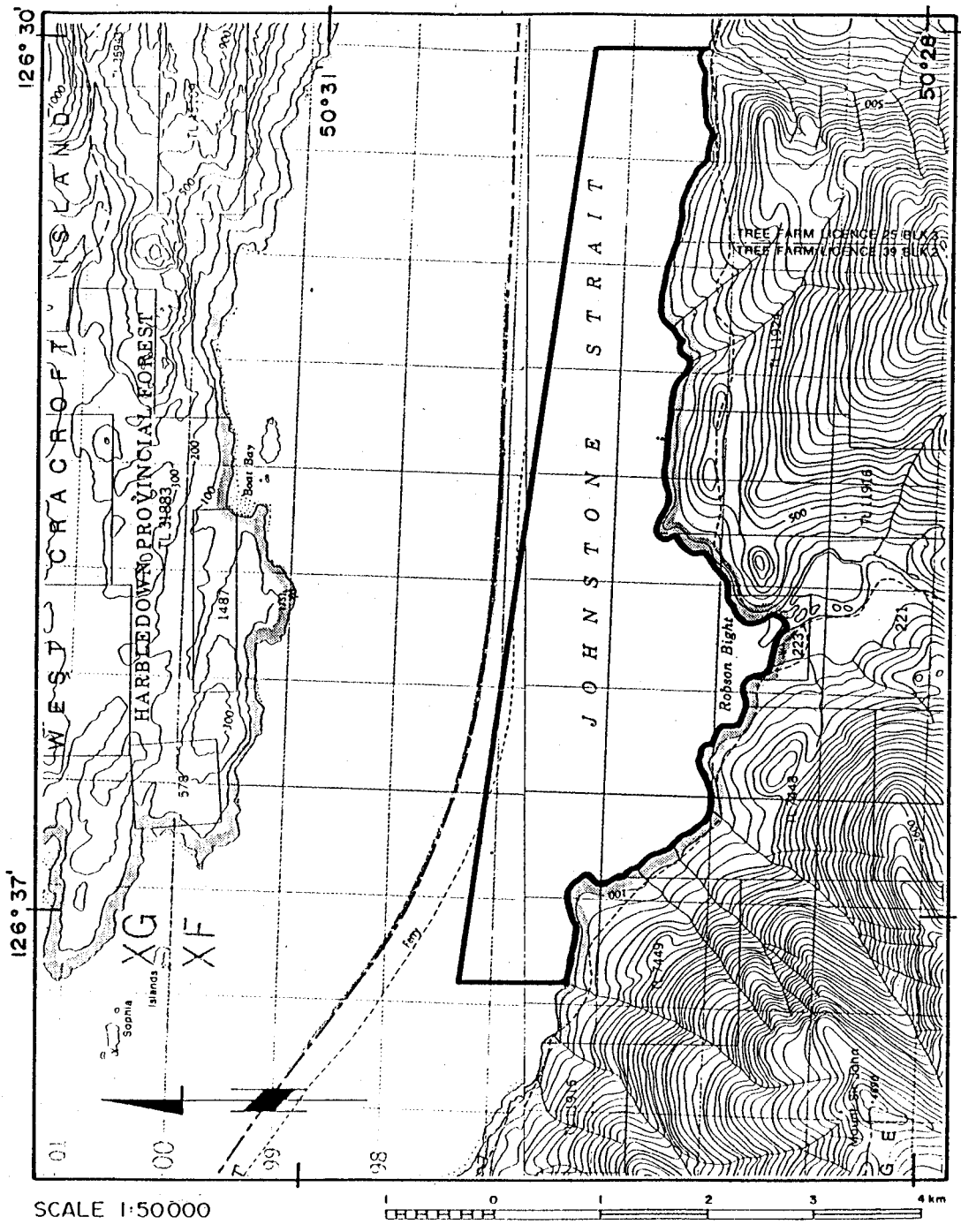
Ministry of Fisheries and Ocean, contain the necessary legislation to protect the whales from harassment. Provincial park staff, however, do not have the authority to enforce these regulations and there are no federal fisheries official permanently in the area.

More provincial control could be exercised by adding a land base. The Wilderness Advisory Committee recommended a 515-hectare upland addition to this reserve. Negotiations are underway between the province and the owner to purchase the land (Goulet, 1986). This addition would allow provincial officials to regulate camping and land traffic. It would also buffer the core whale habitat from the effects of logging activities.

Managing researchers and visitors could reduce the harassment problem. Research permits are issued on the condition that researchers attempt to minimize disturbance of the whales. This includes avoiding close approaches, avoiding diving and entering the water near the whales, and using remote control cameras for filming. In 1984, research was limited to alleviate pressures on the reserve. In 1985, a pamphlet describing the reserve and presenting guidelines for observing the whales was produced. These include: refrain from entering the reserve; if one happens to stray into the reserve, stay at least 300 meters from the whales; stay 100 meters away from the whales outside the reserve; keep noise levels down; avoid activities that would disturb or molest the whales; and approach whales slowly and from the side. This information is distributed to visitors by researchers, tourism counsellors, and boat charterers. Presently, a management plan is being prepared to address these harassment problems (Goulet, 1986). Measures such as closing the reserve to whale-watchers, limiting research permits, and developing an extensive education publicity program have been recommended (Darling, 1986). An information program in the reserve has been started. There are now three full time information officers from June to September who show slide presentations, distribute pamphlets, and contact every boat which enters the reserve (Goulet, 1987).

Lessons: Robson Bight represents an excellent opportunity for killer whale research and public education. The sheer volume of activity in this area and the lack of provincial jurisdiction, however, limit the ability of ERP to protect and management this area. A management plan, public education, and cooperation with federal fisheries will aid the situation.

Figure 18: Robson Bight Ecological Reserve



N.T.S.No. 92L/7,10

Source: MOE&P, 1987.

Figure 19: The Tsitika Estuary in Robson Bight Ecological Reserve



5.7 Summary

The Ecological Reserve Program objectives of research, education, protection, and preservation are being realized and may be further achieved in the future. In many reserves, management is essential. For the most part, such actions have been reactive to pressures and problems encountered on each reserve. The need for management is determined by the ecosystems protected as well as the pressures on, and the physical components of, that area. Management plans are being prepared for those reserves with acute management problems. Not all reserves, however, require such a plan. Permits and closure can reduce pressures on reserves and control research.

The volunteer wardens have been indispensable in the management of reserves and the realization of protection and education objectives. Public education has also been useful in the respect. Permits and closures have proven to be good management tools and cooperation with other government agencies is essential in management and thus protection and preservation of the reserve system.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The Ecological Reserve Program (ERP) in British Columbia which pioneered the concept of ecological reserves in Canada, has made significant contributions to the protection and preservation of the natural heritage of the province. Its most important accomplishment has been the reservation of natural areas to meet the needs of natural science research, education, and gene pool protection. If managed properly, these areas will continue to provide tangible and intangible benefits in perpetuity.

The effectiveness of ERP to protect areas for conservation, research, and educational purposes is evaluated in the study. This was accomplished using to five criteria: the legislation which establishes the program and its jurisdiction; the institutional power of the program; the adequacy of funding and staffing; planning and management capabilities for the implementation of the program; and the extent to which the objectives of the program are achieved. Generally it was found that ecological reserves are a beneficial and valid land use. A large number of areas have been established protecting both representative and unique features and providing opportunities for education and research. Specific findings are discussed below.

Legislation: British Columbia's ecological reserve legislation, although not perfect, is effective. The legislation recognizes the need for protection through designation and provides this through the politically expedient method of establishing areas through order-in-council. Although this method does not guarantee permanency, it has aided in establishing a number of reserves. The legislation also restricts the operation of other acts and allows for regulations to be made by cabinet. These regulations dictate entry to and use of reserves, primarily through a permit procedure which is effective in monitoring research.

The legislation also provides for the administration of reserves. Guidelines, however, are limited and primarily address the permitting procedure. The legislation is weak in soliciting user input and acquiring expert opinion. Such input is important to obtain specific scientific advice on selection,

management, and protection of reserves. The legislation is also weak in acquiring noncrown lands although such areas may be acquired under other legislation or through private organizations.

Institutional Power: The power of ERP to influence decisions is limited. This is primarily due to the economic criteria prevalent in land use decisions. The program competes with some land uses which have contributed significantly to the economy, principally forestry and mining. Agencies representing these uses have had a large influence over decisions and can veto any reserve proposal. As a result, areas of low economic potential rather than high preservation value are selected as ecological reserves. In addition, there is little political and public awareness and support for the program. The integration of the program into the Ministry of Environment and Parks in 1985 removed some of its power to influence decisions but has improved management and policing capabilities by tapping into a larger network of staff.

Funding and Staffing: Funding is one of the major problems faced by ERP. Without adequate resources and personnel, the program is unable to meet its responsibilities. Failure to have adequate funding reduces its credibility with other agencies and its institutional power. More manpower is needed in the areas of planning, policy analysis, management, and public relations to further the program in these areas.

* Planning and Management Capabilities: Traditionally, the program has been weak in these skills but progress is being achieved by an improved systems plan and application of priority criteria. These steps will give better direction to the program in the future and provide appropriate rationale for selection and creation of reserves. The focus of the program has shifted from acquiring areas to managing reserves. This will improve the program and give it credibility. Such a move, however, will be difficult given the number of areas to be managed and the limited budget and staff. Management in the past has been reactive; proactive plans for troublesome or potentially troublesome reserves are being addressed on a prioritized basis. Guidelines for fire and pest control and research have been established but not for visitation and education. Further experience in dealing with issues and development of general guidelines will continue to benefit the program.

The volunteer warden program is an innovative and cost effective means of monitoring existing reserve and increasing public awareness and appreciation. Such an approach is essential under

constraints of a restricted budget and limited political and public support. There is great potential for this program if certain measures are adopted. These include more training and an incentives program for wardens, and increased communication between wardens and regional land use agencies.

Achievement of Objectives: The research, education, preservation, and protection objectives of ERP have not been fully met. There are many research and education opportunities offered by the program, of which only some have been utilized. The preservation of representative ecosystems is not yet complete although a large number of areas has been established. Due to lack of enforcement of the regulations and lack of funds and staff, protection is not perfect. However, wardens and field staff of other agencies are helpful in monitoring use of reserves.

A number of deficiencies in legislation, institutional power, funding and staffing, planning and management, achievement of objectives have been identified in the evaluation. Recommendations for improvement are listed below according to the evaluative criteria used in this study.

6.2 Recommendations

6.2.1 *Legislation*

Include a provision for donations and registration of private lands. Change the legislation to allow for donations as well as for private parties to retain ownership and manage ecological reserves in accordance with the objectives of the program. This would increase the opportunities for preserving ecologically significant areas.

Include a requirement for an advisory committee in the legislation. Reinstated the advisory committee, clarify its role, and provide it access to the minister. This body can provide the necessary expertise to develop management plans and a permitting procedure to ensure that ecological requirements of reserves are met.

Legislate a review requirement to changes in orders-in-council. Refer intended changes to the advisory committee for comment prior to implementation. This will ensure debate over otherwise unilateral decisions.

Clarify the administrator's role. Provide the administrator with more management guidelines. This

would include management guidelines for particular categories of reserves.

Encourage lease arrangement. Continue to work with private organizations to establish reserves on private lands through leasing arrangements.

Provide interim protection. Continue to use map reserves as permitted under the Lands Act. This would protect natural areas under consideration for reserve status.

6.2.2 Institutional Power

Link reserves to other protective land categories. Encourage the policy of locating ecological reserves within national, provincial, and regional parks and within wildlife management areas. These areas can provide needed buffer areas for reserves. ERP could work with agencies to share management responsibilities and thus ensure cooperation of the supporting agency. P A

Reinstate a land use agency referral system. Provide a means for interagency communication on land use decisions. Recognition of intangible values of these areas is required to balance economic considerations. Land use agencies' veto over reserve proposals should be replaced with decisions based on negotiations and consensus.

Implement regional meetings. Arrange regional meetings between volunteers, park staff, and other resource agencies. Communications with district staff in parks, lands, and forests and meetings of these officials should also be encouraged. A more active role by ERP to establish communications can make up some of this deficiency.

Increase political awareness and appreciation of ecological reserves. Establish an awareness campaign directed at political representatives. Such an initiative is needed to promote an understanding of the program objectives and ease fears of alienating large tracts of land as ecological reserves. P A

Increase public awareness and appreciation of ecological reserves. Integrate the ecological reserves with school and other interpretative programs. Brochures, pamphlets, films, and public presentations would be useful in this respect. A basic low-key public information system should be P A

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developed for each reserve and made accessible to the public. As well, low-intensity programs and facilities could be developed in some reserves accessible to the public.

Explore the possibility of integrated resource use. Take into consideration concerns of the mining industry and of hunters. A category that would allow reserve proposals to be subject to drilling and hunting may open more opportunities for establishment of reserves although precautions need to be taken to minimize environmental impacts. Development interest would be secondary to conservation interests of the reserve. Such interests would carry the ultimate veto on development.

6.2.3 Funding and Staffing

Increase funding and staffing. Continue to provide funding for contractors to work on the areas of planning, management, policy analysis, and public relations. This is probably the most important recommendation for improving the effectiveness of ERP. Further development in these areas is required to take the program beyond its existing stage of development if it is to realize its potential in education and research and to ensure protection.

A
B

6.2.4 Planning and Management Capabilities

Complete the systems plan. Establish protection, research, and education objectives. Priorities should also be established for terrestrial, fresh water, and marine components.

B
C

Develop a classification system. Examine the objectives and goals of the reserves and establish categories for each. General management guidelines should be establish^{ed} for each category. For example, there could be educational reserves which can tolerate low intensity activity, and strict reserves in which access will be restricted. All reserves should be open to research under permitting controls which would regulate the type of research and ensure protection. An amendment to the act to include these categories would be useful as regulatory changes could dictate management guidelines for the categories.

C
D

Develop individual management plans. Include the goal, specific objectives, location, boundary descriptions, zoning, size, description of uses, access and development, specific management strategies, guidelines for volunteer wardens, and review provisions for each reserve on a prioritized basis. In the interim, management guidelines developed by the system above will provide direction for the

D
E

system.

Develop a inventory system. Collate the information that exists in the government ministries and with interest groups. This would allow for easy access and for better decision making for the existing reserve system.

Further develop the volunteer warden program. Create incentives and provide more training for the volunteer warden program. Wardens are essential and invaluable to ERP. Incentives such as certificates for one-year service and pins for 5-year service are needed. Workshops to give wardens further training should be continued, perhaps even more intensively than at present, at the annual general meetings. Regional workshops where techniques can be further developed could be implemented. A roving trainer could also be used to further the wardens' management skills.

6.2.5 Achievement of Objectives

Encourage research in reserves. Continue to distribute information on research to academics and research institutions. Develop communication with academics whose students would be interested in undertaking research. A registry of funding sources should also be assembled.

Promote educational activities in reserves. Encourage activities of educational value in appropriate reserves. Further promotion within the education system should be conducted as well. Provincial funding will need to be increased to provide the facilities and monitoring to meet this recommendation.

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APPENDIX A

Natural Resources Management Program

Simon Fraser University

Ecological Reserves

Perception and Attitude Survey

This survey is part of a project to evaluate the Ecological Reserve Program in British Columbia. I will be reading you a series of statements and you may respond to these statements in two ways. First, you can decline from responding if you do not have sufficient information or knowledge on the topic. Secondly, you can respond by indicating your degree of agreement with the statement by using this scale:

1. Strongly agree
2. Agree
3. Neutral/indifferent
4. Disagree
5. Strongly disagree

Please take a few moments now to jot down this scale for easy referral.

Please feel free to add comments you may have on the statements:

1. B. C. ecosystems are appropriately represented under the current Ecological Reserve Program.

| | | | | | |
|----------------------------|---|----|----|----|----|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 20)</i> | 1 | 6 | 3 | 6 | 4 |
| <i>Percentage</i> | 5 | 30 | 15 | 30 | 20 |

Comments:

- Some areas are over-represented but that is the nature of the areas available.
- Areas such as grasslands and valley bottoms are not represented.
- The representation has just began.
- The program does not have enough power to obtain more sites.
- The environmentalists would not agree but the present reserves cover a large number of areas which overlap and duplicate each other.

2. The protection of these reserves is guaranteed by the existing program.

| | | | | | |
|----------------------------|------|----|-----|------|------|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 20)</i> | 4 | 11 | 1 | 3 | 3 |
| <i>Percentage</i> | 18.2 | 50 | 4.5 | 13.6 | 13.6 |

Comments:

- Protection depends of the interests of forestry and mining industry.
- Some areas are never visited by wardens or enforcement officers.
- Establishment by order-in-council does not afford enough protection.
- The volunteer warden program important in ensuring protection of the reserves.
- These areas are sacrosanct.
- Management is a problem in protecting these areas.

3. The intended purpose of reserves for scientific research is being realized.

| | | | | | |
|----------------------------|------|------|-----|------|------|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 19)</i> | 2 | 4 | 1 | 8 | 4 |
| <i>Percentage</i> | 10.5 | 21.1 | 5.3 | 42.1 | 21.1 |

Comments:

- There is no budget for education and probably will not be.
- The potential of these areas are no where near to being reached.
- Only part of the spectrum of research is being conducted; more is needed.
- More inventory projects are needed.
- The lack of research is holding the program back.
- This type of inventory and long-term research is not popular in tenure track faculty.
- Government is only willing to fund research that is immediately applicable.
- There is some research ongoing but, more importantly, these areas are protected for future use.
- A baseline research program is needed.
- There needs to be more government funding.
- The reserves need to be used and perceived as used.
- A fair amount of baseline research is being done but not enough in depth work.

4. The intended educational function of the Ecological Reserve Program is being realized.

| | | | | | |
|----------------------------|---|------|------|------|----|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 18)</i> | 0 | 4 | 5 | 7 | 2 |
| <i>Percentage</i> | 0 | 22.2 | 27.8 | 38.9 | 11 |

Comments:

- There is no budget for the educational use of reserves and probably will not be.
- There is some use of reserves for this purpose but does not match its potential.
- The program staff is doing the best they can but need more government support.
- FER is helping to promote this purpose.
- There has been no effort and resources put into the promotion and encouragement of this use.
- In the future, these areas will be more valuable for this purpose.
- Is this really part of ERP's mandate?
- The program needs for instill a sense of stewardship into the public.
- The FER have been conducting tours of these areas but generally, public awareness is low.
- There is still more work to be done.
- Demand for this purpose will strengthen over time.

5. The Ecological Reserve Act and its regulations allows for proper protection and management of reserves.

| | | | | | |
|---------------------|------|------|------|------|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 17) | 2 | 9 | 3 | 3 | 0 |
| Percentage | 11.8 | 52.9 | 17.6 | 17.6 | 0 |

Comments:

- There is no financial support for protection; consequently only wardens provide a protection function.
- Enforcement is needed.
- Funding for enforcement is lacking.
- The act is strong but it lacks teeth.
- The act only allows for general management.
- The act is weak on the protection side.
- The act does not allow for proper management.
- The challenge is the enforcement.
- There are shortcomings in management.

6. The power and prestige of the Ecological Reserve Program within the provincial government is adequate to ensure that reserves receive appropriate and timely attention.

| | | | | | |
|---------------------|-----|------|------|------|------|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 22) | 1 | 4 | 4 | 8 | 5 |
| Percentage | 4.5 | 18.2 | 18.2 | 36.4 | 22.7 |

Comments:

- The power of the program depends on the political party in power.
- The problem is there are more reserves than envisaged and there is not enough money for them to reach their potential.
- The program has a good profile and is acknowledged as a valid land use.
- The program does not have a high enough profile.
- Parks and reserves must have a higher profile politically and publicly.

7. The current system of selection for new reserves works well.

| | | | | | |
|---------------------|-----|------|------|------|-----|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 19) | 1 | 8 | 5 | 4 | 1 |
| Percentage | 5.3 | 42.1 | 26.3 | 21.1 | 5.3 |

Comments:

- This system works well but there is no budget to look for new sites to complete the spectrum.

- It does not work because the government does whatever it pleases.
- Parks should be investigated for new reserves.
- There are many conflicts with forestry.
- This system is the best one under the circumstances; however, no one agrees with them.
- Without the advisory committee, there is very little public or scientific input into proposals.
- It does not work because the government thinks there's enough reserves created.
- It does not work because not many proposals are being approved.
- Too often an emotional basis is used for selecting areas rather than a scientific.
- Special species are protected under this system.

8. The current governmental referral system for the establishment of ecological reserves operates well in insuring all interests are fairly represented.

| | | | | | |
|----------------------------|----|----|----|----|----|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 20)</i> | 3 | 11 | 2 | 2 | 2 |
| <i>Percentage</i> | 15 | 55 | 10 | 10 | 10 |

Comments:

- Everyone gets asked but the decision is weighted in favor of resource agencies.
- There needs to be more public participation.
- Parks is not well represented in this process.
- Forestry and the mining industry have more economic clout and therefore, have more say in decisions.
- This process allows for comment but also for veto which bring the decision down to the lowest common denominator.
- There is a lack of commitment to make this work.
- This process needs public involvement.
- Allows other ministries to determine the economic costs of of different alternatives and takes into account unique environments.

9. The present funding level for the Ecological Reserves Program enables the purposes in the act to be fulfilled.

| | | | | | |
|----------------------------|---|-----|-----|------|----|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 15)</i> | 0 | 1 | 1 | 7 | 6 |
| <i>Percentage</i> | 0 | 6.7 | 6.7 | 46.7 | 40 |

Comments:

- The funding is far too low for the staff to be effective.
- The program is a low priority and thus cannot attract funding.
- This is the weakness in the program.
- For the large number of areas, there should be a larger budget.

10. The current number of full-time staff for the Ecological Reserve Program permits the program functions to be carried out.

| | | | | | |
|----------------------------|---|------|------|------|------|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 18)</i> | 0 | 3 | 2 | 5 | 8 |
| <i>Percentage</i> | 0 | 16.7 | 11.1 | 27.8 | 44.4 |

Comments:

- There should be two or three more staff members.
- Ideally there should be more staff members but the government cannot afford more.
- Given the current economic situation, there needs to more integration of responsibilities with other ministries.

- There is a reasonable number of staff, especially with the volunteer wardens program.
- Funding is a political decision.

11. The professional education of full-time ecological reserve staff is appropriate for the needs of the program.

| | | | | | |
|----------------------------|------|------|-----|---|---|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 16)</i> | 6 | 9 | 1 | 0 | 0 |
| <i>Percentage</i> | 37.5 | 56.3 | 6.3 | 0 | 0 |

Comments:

- There needs to be an education coordinator.

12. The public is adequately aware of the Ecological Reserve Program.

| | | | | | |
|----------------------------|---|------|------|----|------|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Percentage</i> | 0 | 13.6 | 18.2 | 50 | 18.2 |
| <i>Respondents (n= 22)</i> | 0 | 3 | 4 | 11 | 4 |

Comments:

- The program does not have much profile.
- The public does not care.
- Through interest groups, the public is kept informed.
- Information should be disseminated through the parks branch.

13. Public support for the Ecological Reserve Program has fallen off during the recent economic recession.

| | | | | | |
|----------------------------|------|------|-----|------|-----|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 21)</i> | 3 | 7 | 2 | 8 | 1 |
| <i>Percentage</i> | 14.3 | 33.3 | 9.5 | 38.1 | 4.8 |

Comments:

- There was not much public support to begin with and remained the same.
- There has been a resistance in the logging communities.
- There has not been much change but it did have a higher profile when it was a separate unit in government.
- The public is not aware.
- Government and industry views have changed.
- Support is strong in regions.
- The program has been low profile and remains so.
- The public has a limited understanding of the program and equates reserves with parks; education is needed.
- The program does not have a high profile and, therefore, does not have much support.
- The decline in the economy has resulted in a decline in support.

14. Politicians are aware of the importance of ecological reserves to the B. C. system of ecosystem preservation.

| | | | | | |
|----------------------------|-----|------|-----|------|------|
| <i>Answer</i> | 1 | 2 | 3 | 4 | 5 |
| <i>Respondents (n= 22)</i> | 1 | 3 | 2 | 13 | 3 |
| <i>Percentage</i> | 4.5 | 13.6 | 9.1 | 59.1 | 13.6 |

Comments:

- Many cabinet ministers do not hear the orders-in-council and, therefore, are not aware.
- The government does not care.
- The program is not a pressing issue so the ministers are not briefed and are aware only if they are personally interested.
- Politicians are often made aware through interest groups.

15. The former Ecological Reserves Advisory Committee has played an important role in planning, establishing, and managing reserves.

| | | | | | |
|---------------------|------|------|---|-----|------|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 17) | 4 | 12 | 0 | 1 | 0 |
| Percentage | 23.5 | 70.0 | 0 | 5.9 | 13.6 |

Comments:

- This committee was particularly important in advising.
- This committee was really a lobby group and became very political.
- It could have been more effective.
- It had a broad base of narrow vested interests.
- It had the expertise to advise the minister and was important in obtaining public input.

16. The Ecological Reserve Advisory Committee is needed and should be re-established.

| | | | | | |
|---------------------|------|------|-----|---|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 15) | 7 | 7 | 1 | 0 | 0 |
| Percentage | 46.7 | 46.7 | 6.7 | 0 | 0 |

Comments:

- Representation is needed from the Provincial Museum, forestry, wildlife, universities, public bodies, and private organizations.
- The committee should only review proposals, not initiate them.
- The committee is needed to ensure the program is meeting its objectives.
- The broad base expertise is needed to advise the minister.
- The committee requires terms of reference and should indicate that their function is primarily scientific.

17. There is proper policing of the ecological reserves.

| | | | | | |
|---------------------|-----|------|---|----|------|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 18) | 1 | 3 | 0 | 9 | 5 |
| Percentage | 5.6 | 16.7 | 0 | 50 | 27.8 |

Comments:

- The wardens play an important role.
- More funding is needed to meet this function.
- There is not much policing in the field.
- Some reserves are difficult to police due to their remoteness.
- There are problems with motorized vehicles on reserves.

18. The volunteer warden program is meeting its objectives.

| | | | | | |
|---------------------|-----|------|-----|------|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 13) | 1 | 8 | 1 | 3 | 0 |
| Percentage | 7.7 | 61.5 | 7.7 | 23.1 | 0 |

Comments:

- The volunteers have different skills and the reserves have different needs.
- It must be remember that this program is free labor and expectations must be scaled to this fact.
- It is difficult for a volunteer to meet such high objectives.
- They are a dedicated group of people.
- They are doing what they can but it is difficult when they cannot lay charges.
- They could be doing more.
- The wardens need more individual attention and help from biologists.
- They need to document information and monitoring.

19. The training wardens have enables them to fulfill their duties in accordance with the objectives of the volunteer warden program.

| | | | | | |
|---------------------|----|----|----|----|----|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 10) | 1 | 4 | 2 | 2 | 1 |
| Percentage | 10 | 40 | 20 | 20 | 10 |

Comments:

- The wardens are eclectic and the training they require depends on the reserve.
- There needs to be set training for the large turnover of wardens.
- The wardens need to be adequately qualified.
- The wardens get by but training is needed in certain areas.
- The wardens do not get much training but are committed.
- They have the background but not much formal training.
- The wardens are strongly motivated.

20. Public information of individual reserves should be limited to ensure their protection.

| | | | | | |
|---------------------|-----|------|------|------|------|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 21) | 2 | 6 | 3 | 6 | 4 |
| Percentage | 9.5 | 28.6 | 14.3 | 28.6 | 19.0 |

Comments:

- There is no point in informing the public.
- Publicity is needed for support.
- That is a tough question.
- Public information should be limited until there is greater protection in place.
- Damned if you do; damned if you don't.
- The program itself should have more publicity but the individual reserves should not.
- Education of the public is needed.
- This question is reserve-specific.
- Representative areas should be publicized and sensitive areas should be hidden.
- The public needs to be aware of the land use decision making process.
- Informing the public about reserves is self-defeating.
- There is a lack of respect for reserves.
- There are different levels of awareness.
- There are trade offs for support.

21. Objectives and goals for each reserve have been satisfactorily established.

| | | | | | |
|---------------------|-----|------|-----|----|-----|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 18) | 1 | 6 | 1 | 9 | 1 |
| Percentage | 5.6 | 33.3 | 5.6 | 50 | 5.6 |

Comments:

- Objectives and goals are established when reserves are created.
- They may be established but they may not be followed.
- It is hard to generalize.
- More precise goals need to be set; as yet only motherhood goals have been established.

22. Individual management plans are required for each reserve.

| | | | | | |
|---------------------|------|------|---|---|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 22) | 12 | 10 | 0 | 0 | 0 |
| Percentage | 54.5 | 45.5 | 0 | 0 | 0 |

Comments:

- Management plans are need for the majority of reserves but not every reserve.
- A policy statement would suffice for some reserves.

23. While management plans are being formulated, reserves should be protected by designations which regulate use and access.

| | | | | | |
|---------------------|------|------|-----|-----|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 22) | 8 | 12 | 1 | 1 | 0 |
| Percentage | 36.4 | 54.5 | 4.6 | 4.5 | 0 |

Comments:

- This is particularly needed for popular areas.
- Access should be limited.
- This should be accomplished under the act.
- Use is site-specific.

24. Overall, the Ecological Reserve Program is an important land use in B. C.

| | | | | | |
|---------------------|------|------|---|---|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 22) | 15 | 8 | 0 | 0 | 0 |
| Percentage | 68.2 | 31.8 | 0 | 0 | 0 |

25. The Ecological Reserve Program is a desirable expenditure of time and money for the people of B. C.

| | | | | | |
|---------------------|------|------|---|---|---|
| Answer | 1 | 2 | 3 | 4 | 5 |
| Respondents (n= 22) | 15 | 7 | 0 | 0 | 0 |
| Percentage | 68.2 | 31.8 | 0 | 0 | 0 |

APPENDIX B

1979

ECOLOGICAL RESERVE
[Consolidated January 20, 1984.]

RS CHAP. 101

ECOLOGICAL RESERVE ACT

CHAPTER 101

[Act administered by the Ministry of Lands, Parks and Housing]

Interpretation

1. In this Act

“disposition” means and includes every act of the Crown where Crown land, mines, minerals, coal, petroleum, natural gas, timber and water, or any right, title, interest or estate in them is granted, disposed of or affected, or by which the Crown divests itself of or creates a right, title, interest or estate in, or permits the use of land, mines, minerals, coal, petroleum, natural gas, timber and water;

“ecology” means the study of the interrelations between man, other animals, or plants and their environment;

“ecosystem” means a complete system composed of man, other animals and plants in a defined area, and with the soil and climate comprising their habitat in that area;

“environment” means all the external conditions or influences under which man, animals and plants live or are developed;

“habitat” means that kind of place or situation in which a man, animal or a plant lives;

“minister” means the Minister of Lands, Parks and Housing.

1971-16-1; 1977-75-3; 1979-20-14.

Purpose

2. The purpose of this Act is to reserve Crown land for ecological purposes, including areas

- (a) suitable for scientific research and educational purposes associated with studies in productivity and other aspects of the natural environment;
- (b) that are representative examples of natural ecosystems within the Province;
- (c) that serve as examples of ecosystems that have been modified by man and offer an opportunity to study the recovery of the natural ecosystem from modification;
- (d) where rare or endangered native plants and animals in their natural habitat may be preserved; and
- (e) that contain unique and rare examples of botanical, zoological or geological phenomena.

1971-16-2.

Lieutenant Governor to establish reserves

3. The Lieutenant Governor in Council may, by notice signed by the minister and published in the Gazette, establish ecological reserves of Crown land.

1971-16-3.

Lieutenant Governor may cancel or amend reserves

4. The Lieutenant Governor in Council may, by notice signed by the minister and published in the Gazette, add to, cancel in its entirety or delete any portion of an ecological reserve established under section 3.

Ecological reserves not available for disposition

5. After April 2, 1971, any area established as an ecological reserve under this Act shall be immediately withdrawn and reserved from any further disposition that might otherwise be granted under any Act or law in force in the Province including, without limiting the generality of the foregoing, dispositions under the *Land Act*, *Forest Act*, *Range Act*, *Water Act*, *Mineral Act*, *Mining (Placer) Act*, *Coal Act*, *Petroleum and Natural Gas Act*, *Mining Right of Way Act*.

1971-16-5; 1977-75-13; 1978-23-166; 1978-34-52; 1978-36-51.

Nature conservancy as ecological reserve

6. A nature conservancy or any portion of it, now or hereafter designated as such under the *Park Act* may, notwithstanding that Act, be established as an ecological reserve under this Act.

1971-16-6.

Regulations

7. The Lieutenant Governor in Council may make regulations and orders and, without limiting the generality of the foregoing, may make regulations

- (a) for the control, restriction or prohibition of any use, development or occupation of the land or any of the natural resources in an ecological reserve;
- (b) for the control, restriction or prohibition of exercise of powers granted by any other Act or regulation by a minister, ministry of the government, or agent of the Crown specified in the regulations;
- (c) for the control, restriction or prohibition of the dumping, deposit or emission within an ecological reserve of any substance; and
- (d) generally for any other matter or thing necessary or incidental to the protection of an ecological reserve.

1971-16-7; 1977-75-1.

Administration

8. Land established as an ecological reserve under this Act, subject to the regulations and orders made under this Act, shall be under the jurisdiction of and administered by the minister.

1971-16-8.

Advisers

9. The minister may appoint a person or persons to advise him on any matter relating to the establishment and administration of ecological reserves, and a person appointed under this section shall have the duties specified by the minister and shall be subject to the regulations made under this Act.

1971-16-9; 1983-10-21, effective October 26, 1983 (B.C. Reg. 393/83).

Other Acts

10. This Act, and any regulation or order made under this Act, applies to every ecological reserve, notwithstanding any other Act or regulation.

APPENDIX C

B.C. Reg. 335/75
O.C. 1456/75

Filed April 28, 1975

Ecological Reserve Act

ECOLOGICAL RESERVE REGULATIONS

[Consolidated January 31, 1985.]

1. No person shall enter upon an ecological reserve for a purpose inconsistent with the *Ecological Reserve Act*, and without limiting the generality of the foregoing, no person shall prospect for minerals, cut timber, allow domesticated animals to graze, camp, light fires, trap or molest animals, build roads or trails, use motorized vehicles within an ecological reserve, or remove plants, animals or material from an ecological reserve.

2. Research or educational use of an ecological reserve may be undertaken only when authorized by permit issued pursuant to these regulations.

3. The administrator of ecological reserves may, by permit, authorize the use of an ecological reserve for research or educational purposes. The administrator shall include in each permit issued under this section conditions that, in his opinion, are adequate to protect the reserve and any ongoing research from disruption; provided however that minimally disruptive procedures, such as collection of some plant and animal specimens, soil samples, and the like, may be specifically permitted.

4. The administrator may not issue a permit authorizing research or educational use of a reserve that is likely to cause any significant disruption within the reserve without first consulting the advisory committee. After he has consulted with the advisory committee, the administrator may issue a permit authorizing such research and containing such conditions as he deems advisable for the protection of the reserve and any ongoing research.

5. An application for a permit under sections 2 and 3 shall contain the following information:

- (a) a description of the proposed use;
- (b) a description of the areas of land to be affected, with an accompanying map;
- (c) a description of the means of access to be used;
- (d) the duration of the proposed use;
- (e) the ecological impact of any activities that will be undertaken within the reserve under the permit;
- (f) the number of individuals that will be entering the reserve under the permit and, where possible, their names;
- (g) the name of the individual who will direct the proposed research or educational programme.

6. Permits issued under sections 3 and 4 may be limited to one entry or may cover a specified period of time.

ECOLOGICAL RESERVE ACT
ECOLOGICAL RESERVE

7. The minister may, by order, close any reserve or portion thereof to any or all uses or entry for a specified period of time, and the minister may, by order, permit limited camping, hunting, fishing and use of motorized vehicles in any reserve or portion thereof, providing no significant disruption results to the reserve or to any research which may be in progress.

8. No person shall introduce into an ecological reserve any plant or animal species without the written permission of the administrator.

9. Subject to the terms of a permit, no person shall deposit, discharge or emit sewage, waste materials, contaminants or any other substance within the boundaries of an ecological reserve.

10. Upon completion of any research project authorized under section 3 or 4, the permittee shall, within 6 months, file a report with the administrator including, if applicable:

- (a) a statement of the methodology used in the research;
- (b) an inventory of any plants or animals identified during the research;
- (c) a description of land forms and soil conditions in the research area:
and
- (d) a statement of the results obtained and any conclusions or recommendations reached as a result of the research.

11. (1) The administrator may, by order, cancel or modify any permit where he considers such action advisable because

- (a) a conflict has arisen between users;
- (b) the activities authorized by the permit may cause, or have caused, unauthorized or unanticipated damage to the reserve;
- (c) a beneficial use is not being, or has not been, made of the permit;
- (d) the terms or conditions of the permit have been broken, or these regulations have been violated by the permittee or his agents.

(2) The administrator is not required to conduct a hearing before issuing an order under subsection (1).

(3) The permittee may appeal any order issued by the administrator under subsection (1) to the minister by notifying the minister and the administrator of his intention to appeal within 30 days of having received the administrator's order.

[Provisions of the *Ecological Reserve Act* relevant to the enactment of this regulation: section 7]

ECOLOGICAL RESERVE ACT

ORDER IN COUNCIL 1920, APPROVED AND ORDERED JUNE 16, 1977

Pursuant to the *Ecological Reserves Act*, and upon the recommendation of the undersigned, the Lieutenant-Governor, by and with the advice and consent of the Executive Council, orders that

Whereas certain ecological reserves were established pursuant to Orders in Council 1563/71, 1573/71, 1574/71, 1575/71, 1576/71, 1579/71, 1580/71, 1585/71, 3295/75, 1587/71, 3277/72, 1063/74, and 1826/73 under the *Ecological Reserves Act*:

And whereas these ecological reserves were subsequently respectively numbered 1, 11, 12, 13, 14, 17, 18, 23, 24, 25, 42, and 44:

And whereas these ecological reserves are recognized as being so sensitive that use of these areas can cause serious and long-term ecological damage:

And whereas actual damage to these reserves has been observed, the above-mentioned ecological reserves be closed to all uses or entry without the issuance of a permit.

For the purpose of this regulation, "permit" is a permit issued by the Coordinator, Ecological Reserves Unit, Land Management Branch, Ministry of the Environment, specifying terms and conditions for the use of Crown land.

J. A. NIELSEN

Minister of the Environment

W. R. BENNETT

Presiding Member of the Executive Council

jj5—570

APPENDIX D
List of Reserves

| ER# NAME | LOCATION | MAIN FEATURE(S) | AREA(ha) |
|-------------------------------------|---------------------------------|--|----------|
| 1 Cleland Island | Clayoquot Sound | Seabird Colony | 7.7 |
| 2 East Redonda Island | N end of Georgia Strait | Two biogeoclimatic zones with many habitats | 6,212 |
| 3 Soap Lake | S of Spences Bridge | Alkaline lake & Douglas fir forest | 884 |
| 4 Lasqueti Island | Georgia Strait | Shoreline forest with Rocky Mountain juniper & cactus | 201 |
| 5 Lily Pad Lake | S of Lumby | Undisturbed boggy lake on Interior Plateau | 101 |
| 6 Buck Hill Road | S of Lumby | Western larch stand | 16 |
| 7 Trout Creek | SSW of Summerland | Ponderosa pine parkland & several snake species | 75 |
| 8 Clayhurst | S of Clayhurst | Peace River parklands | 316 |
| 9 Tow Hill | Graham Island, Q.C.I. | Sandy beach, dunes, swamp & peat bogs | 514 |
| 10 Rose Spit | Graham Island, Q.C.I. | Sand dunes & shoreline meadows | 170 |
| 11 Sartine Island | One of Scott Islands | Seabird colony | 13 |
| 12 Beresford Island | One of Scott Islands | Seabird colony | 17.7 |
| 13 Anne Vallee (Triangle Island) | Outermost of Scott Islands | Largest seabird & sea lion colonies in province | 85 |
| 14 Solander Island | Off Cape Cook, Vancouver Island | Seabird colony | 7.7 |
| 15 Saturna Island | Strait of Georgia | Coastal Douglas fir forest | 131 |
| 16 Mount Tuam | Saltspring Island | Arbutus-Douglas fir forest | 254 |
| 17 Canoe Islets | Near Valdes Island | Seabird Colony | 0.6 |
| 18 Rose Islets | Trincomali Channel | Cormorant and gull colony | 0.8 |
| 19 Mount Sabine | N of Canal Flats | Montane spruce forest | 7.9 |
| 20 Columbia Lake | E side of Lake | Rare plants on limestone cliffs & along a calcareous stream | 32 |
| 21 Skagit River Forest | S of Hope | Douglas fir forest | 73 |
| 22 Ross Lake | S of Hope | Ponderosa pine in a semi-coastal environment | 61 |
| 23 Moore/McKenney/Whitemore Islands | Hecate Strait | Seabird colony & Sitka spruce forest | 73 |
| 24 Baeria Rocks | Barkley Sound | Gull colony & subtidal marine life | 53 |
| 25 Dewdney & Glide Islands | Hecate Strait | Variety of maritime bog, pond and scrub forest communities | 3,845 |
| 26 Ram Creek | East Kootenays | Hot springs & associated plants; burned forest | 121 |
| 27 Whipsaw Creek | SW Princeton | Interior Douglas fir & Ponderosa pine stands | 32 |
| 28 Ambrose Lake | Sechelt Peninsula | Coastal bog lake | 228 |
| 29 Tranquille | W of Kamloops | Sagebrush, Ponderosa pine, Douglas fir plant communities | 235 |
| 30 Vance Creek | N of Lumby | Forest stands transitional between Interior Douglas fir and Interior Western Hemlock | 49 |

| ER# NAME | LOCATION | MAIN FEATURE(S) | AREA(ha) |
|--|----------------------------------|---|----------|
| 31 Lew Creek | E of Upper Arrow Lake | A complete drainage basin including three biogeoclimatic zones | 815 |
| 32 Evans Lake | Valhalla Park, E of New Denver | Alpine forest, including disjunct stand of yellow cedar | 185 |
| 33 Field's Lease | W of Osoyoos Lake | Semi-arid shrub-grassland communities | 4.2 |
| 34 Big White Mountain | E of Kelowna | Subalpine & alpine plant communities | 951 |
| 35 Westwick Lake | S of Williams Lake | Aspen parkland vegetation in Cariboo area | 27 |
| 36 Mackinnon Esker | NW of Prince George | Long compound esker with lichen-woodland communities | 583 |
| 37 Mount Maxwell | Saltspring Island | Garry oak stand | 65 |
| 38 Takla Lake | E of Hazelton | Most northerly known occurrence of Douglas fir | 263 |
| 39 Sunbeam Creek | Near McBride | Alpine vegetation in Rockies | 511 |
| 40 Kingcome/Atalazi Rivers | Head of Kingcome Inlet | Rich alluvial swamps, bogs and forest | 414 |
| 41 Tacheeda Lakes | N of Prince George | Representative Suboreal spruce forest | 526 |
| 42 Mara Meadows | E of Salmon Arm | Unique calcareous fen; rare orchids | 189 |
| 43 Mount Griffin | E of Mabel Lake | Interior Cedar-Hemlock & subalpine forest over wide elevational range | 1,376 |
| 44 East Copper/Jeffrey/Rankine Islands | E coast of Moresby Island | Seabird colonies | 121 |
| 45 Vladimir J. Krajina (Port Channel) | W coast of Graham Island | Virgin littoral environment, lowland Sitka spruce forest, rare mosses, seabird colony, spawning salmon, endemic birds and mammals | 9,834 |
| 46 Sikanni Chief | NW of Hudson's Hope | Engelmann spruce at northern extremity of range. Alpine flora and fauna | 2,400 |
| 47 Parker Lake | W of Fort Nelson | Boreal bog habitat. Preservation of pitcher plant and other rare species | 259 |
| 48 Bowen Island | W of Apodaca Provincial Park | Forest of Douglas fir & red cedar. Dry subzone of Coastal Western Hemlock Zone | 397 |
| 49 Kingfisher Creek | Hunters Range ESE of Sicamous | Subalpine parkland vegetation in Monashee Mountains | 1,441 |
| 50 Cecil Lake | NE of Fort St. John | Fen, black spruce bog, and aspen communities | 129 |
| 51 Browne Lake | N of McCulloch | Meadow & forest rich in wild flowers | 124 |
| 52 Drizzle Lake | SE of Masset | Lake & bogland; unique species of stickleback; nesting loons | 837 |
| 53 Narcosli Lake | W of Quesnel | Waterfowl breeding grounds; well developed aquatic communities | 1,098 |
| 54 Nitinat Lake | Vancouver Island, SE of Bamfield | Population of Douglas fir in Coastal Western Hemlock Zone | 79 |
| 55 Cardiff Mountain | SW of Hanceville | Example of lava plateau, basalt columns & crater lake | 65 |
| 56 Goosegrass Creek | W of Mica Reservoir | An elevational sequence of 3 biogeoclimatic zones & a complete watershed | 2,185 |
| 57 Chickens Neck Mountain | N of Dease Lake | Climas stand of white spruce & subalpine fir | 680 |
| 58 Blue/Dease Rivers | W of Lower Post | Terrestrial & aquatic communities of the Boreal Black & White Spruce Zone | 777 |

| ER# NAME | LOCATION | MAIN FEATURES | AREA(ha) |
|------------------------------------|---|--|----------|
| 59 Ningunsaw River | SE of Bob Quinn Lake | Coastal Western Hemlock zone near its northern limit; Engelmann Spruce-Subalpine Fir & Alpine Tundra Zones | 2,046 |
| 60 Drywilliam Lake | S of Fraser Lake | An isolated oldgrowth stand of Douglas fir in the Sub-Boreal Spruce Zone | 95 |
| 61 Upper Shuswap River | E of Mabel Lake | Excellent alluvial stands of western red cedar | 70 |
| 62 Fort Nelson River | NE of Fort Nelson | White spruce developing within alluvial stands of balsam poplar | 121 |
| 63 Skeena River Islands | Near confluence of Exchamsiks River | Mature cottonwood stands on floodplain islands | 91 |
| 64 Ilgachuz Range | N of Anahim Lake | Isolated mountain mass with alpine-subalpine flora & fauna of biogeographic interest | 2,914 |
| 65 Chasm | N of Clinton | Ponderosa pine near its northern limits | 197 |
| 66 Ten Mile Point | Victoria | Inter- & subtidal marine life | 11 |
| 67 Satellite Channel | Between Saltspring Island & Saanich Peninsula | Rich subtidal marine life, particularly benthic infauna | 343 |
| 68 Gladys Lake | Spatsizi Wilderness Park | Stone sheep, mountain goats & their environment | 48,560 |
| 69 Baynes Island | Squamish River | Alluvial Black Cottonwood forest on undisturbed island | 71 |
| 70 Mount Tinsdale | ESE of Barkerville | Extensive transition between alpine & subalpine zones | 419 |
| 71 Blackwater Creek | NW of Mackenzie | Boreal forest & portion of extensive low moor area | 234 |
| 72 Nechako River | W of Prince George | Best stand of tamarack west of Rocky Mountains | 133 |
| 73 Torkelsen Lake | W of Babine Lake | Low moor wetlands with cloudberry & rich moss flora | 182 |
| 74 UBC Endowment Lands | Vancouver | Second-growth forest of Puget Sound Lowlands | 90 |
| 75 Clanninick Creek | Near Kyuquot | Alluvial Sitka spruce | 37 |
| 76 Fraser River Islands | W of Chilliwack | Alluvial cottonwood forest on islands | 76 |
| 77 Campbell-Brown (Kalamalka Lake) | W side of lake near Rattlesnake Point | Ponderosa pine-bunchgrass site; rattlesnake den | 107 |
| 78 Meridan Road (Vanderhoof) | S of Vanderhoof | Engelmann spruce-subalpine fir-lodgepole pine forest | 262 |
| 79 Chilako River | S of Vanderhoof; N of Batnuni Lake | Tamarack at southern limit in B. C.; swamp, fen, and bog mosaic | 64 |
| 80 Smith River | Near junction with Liard River | Complete drainage basin with boreal white & black spruce forest | 1,326 |
| 81 Morice River | SW of Houston | Burned sub-boreal spruce forest | 358 |
| 82 Cinema Bog | NNE of Quesnel | Lowland black spruce-sphagnum bog | 68 |
| 83 San Juan Ridge | E of Port Renfrew | Protection of rare white avalanche lily | 98 |
| 84 Aleza Lake | "Big Bend" of Fraser River | Sub-boreal spruce forest, lakes, wetland ecosystems | 242 |
| 85 Patsuk Creek | NW of Mackenzie | Paper birch & other seral forest species | 554 |
| 86 Bednesti Lake | W of Prince George | Kettle Lake wetland succession | 139 |
| 87 Heather Lake | NW of Mackenzie | Productive aspen forest | 235 |
| 88 Skwaha Lake | N of Lytton | Montane & sub-alpine forest with superb flower meadow | 850 |

| ER# NAME | LOCATION | MAIN FEATURE | AREA(ha) |
|---|--|--|----------|
| 89 Skagit River | Skagit River Valley | Excellent cottonwood stands | 69 |
| 90 Sutton Pass | W of Port Alberni | Rare Alder's-tongue fern | 3.4 |
| 91 Raspberry Harbour | W side of Williston Lake | Tall lodgepole pines on excellent growth site | 143 |
| 92 Skihist | NE of Lytton | Ungrazed Ponderosa pine-bunchgrass site | 36 |
| 93 Lepas Bay | Northern Graham Island, QCI | Storm-petrel colony on island | 3.6 |
| 94 Oak Bay Islands | E of Victoria | Spring flowers, rare plants, a seabird colony, and marine life | 170 |
| 95 Anthony Island | W of Moresby Island, QCI | Many small islets with nine species of nesting seabirds & rich marine life | 324 |
| 96 Kerouard Islands | S of Moresby Island, QCI | Major sea lion rookery, seabird colony & rich marine life | 130 |
| 97 Race Rocks | Metchosin, Vancouver Island | High current marine community; winter sea lion haul-out; nesting seabirds | 220 |
| 97 Chilliwack River | US border, SE of Chilliwack | Mature Alluvial forest with large western red cedars | 86 |
| 98 Pitt Polder | Near Maple Ridge | Two forested hills surrounded by swamp and bog | 88 |
| 100 Hayne's Lease | N end of Osoyoos Lake | Most arid ecosystem in Canada, including rare plants and animals | 101 |
| 101 Doc English Bluff | SW of Williams Lake | Limestone cliff with several species of rare flowers & ferns, colony of whitethroated swifts & golden eagle nest | 52 |
| 102 Charlie Cole Creek | S of Teslin; ESE of Altin | Cold-water springs used by ungulates as mineral licks | 162 |
| 103 Byers/Conroy/Harvey/Sinnett Islands | Hecate Strait | Eight species of nesting seabirds; tree-nesting peregrine falcons; extensive subtidal area | 12,205 |
| 104 Gilnockie Creek | E of Kingsgate in the East Kootenays | Mature western larch | 58 |
| 105 Megan River | NE of Estevan Point, W coast of Vancouver Island | Typical west coast alluvial forests | 50 |
| 106 Skagit River Rhododendrons | SE of Hope | Two stands of Pacific rhododendrons | 70 |
| 107 Chunamon Creek | NNE of Germansen Landing, Williston Lake | Two small drainages; Engelmann & white spruce forest on sites of varying productivity | 344 |
| 108 Cougar Canyon | S of Vernon, E side of Kalamalka Lake | Mosaic of dry forest communities; chain of small lakes with associated wetlands | 550 |
| 109 Checleset Bay | NW of Kyuquot, Vancouver Island | B.C.'s major sea otter population; extensive subtidal environments | 34,650 |
| 110 McQueen Creek | N of Kamloops | Native grassland with may wildflowers | 35 |
| 111 Robson Bight | Johnston Strait, SE of Telegraph Cove | Heavily used killer whale habitat; undisturbed estuary | 1,248 |
| 112 Mount Tzuhalem | Duncan | Garry oak, spring wildflower ecosystem | 18 |
| 113 Honeymoon Bay | Cowichan Lake | Outstanding population of pink fawnlily | 7.5 |
| 114 Williams Creek | SE of Terrace | Representative coastal western hemlock forest & outstanding terraced bogs | 700 |
| 115 Gingietl Creek | 30 km upstream of mouth of Nass River | Undisturbed watershed containing coastal western hemlock, mountain hemlock & alpine vegetation | 2,873 |

| ER# NAME | LOCATION | MAIN FEATURE | AREA(ha) |
|-------------------|-----------------|-------------------------|----------|
| 116 Katherine Tye | S of Chilliwack | Rare phantom orchid | 3.1 |
| 117 Haley Lake | SW of Nanaimo | Vancouver Island marmot | 93 |

APPENDIX E
Biogeoclimatic Zones

| Name of Zone (Abbreviation) | Climate | Location and Distribution | Major Tree Species |
|---|--|--|---|
| Alpine Tundra (AT) | Long, very cold winters and very short, cool growing seasons. Periglacial processes common. | All high elevations in the province, between unvegetated ice, snow and rock environments, and the subalpine forest or SWB Zone. Lower limits varying from 600 m on the outer NW coast to 1800 m in the Southern Rockies. | None |
| Spruce-Willow-Birch (SWB) | Cold, continental subalpine climate similar to the above; perma frost still possible on north slopes and in boggy depressions | Located above the boreal forest (BWBS Zone) and below the AT Zone; replacing the ESSF Zone as subalpine zone N of about 57° Lat. Elevation range in B.C. 900 - 1700 m. | Small stands in valleys, or clumps, of white spruce, black spruce, subalpine fir, lodgepole pine and aspen. |
| Boreal White and Black Spruce (BWBS) | Continental climate with very cold winters and short, moderately warm summers; still some perma frost in boggy depressions. Extensive forest fires common. | The boreal forest, occupying the lowest elevations in the northwestern quarter and the northeastern third of the Province. Largest zone in B.C. | White spruce, black spruce, lodgepole pine, aspen, subalpine fir, tamarack, balsam poplar, birch. |
| Sub-boreal Spruce (SBS) | Continental climate with cold, snowy winters and short, warm summers. Forest fires common. | Occupying the entire central interior area of the Province at low and middle elevations; below the ESSF Zone and generally N of the IDF, ICH and MS Zones. | Hybrid spruce (<i>Picea engelmannii</i> x <i>glauca</i>), white spruce, lodgepole pine, aspen, Engelmann spruce, subalpine fir, balsam poplar, Douglas-fir. |
| Mountain Hemlock (MH) | Maritime subalpine climate with short growing seasons and winters with very high snow accumulations which prevent severe freezing of the ground. | The subalpine zone west of the Cascade/Coast Mountains divide. Above 400 m in the north and along the outer coast, and 1000 m in the south; reaching 1700 m in the Cascades. | Mountain hemlock, yellow cedar, and; (in the south) Amabilis fir; subalpine fir and whitebark pine in the transitional areas only; shore pine on the outer coast. |
| Engelmann Spruce - Subalpine Fir (ESSF) | Continental subalpine climate with cold, snowy winters and short, moderately warm summers. | In all interior mountain ranges south of about 57° Lat. and on the east slope of the Coast/Cascade Mountains. | Engelmann spruce, subalpine fir, lodgepole pine, whitebark pine, alpine larch (in S), mountain hemlock only in Cariboo/Monashee and Selkirk Mountains. |

| Name of Zone (Abbreviation) | Climate | Location and Distribution | Major Tree Species |
|-------------------------------|---|--|---|
| Montane Spruce (MS) | Continental climate intermediate between that of ESSF and IDF Zones. Cold, dry winters and moderately warm periodically humid summers. | Interior zone which occurs between 1200 and 1700 m elevation, primarily on plateaus. It is located generally south of the SBS Zone, to which it has affinities. One of the four smallest zones. | Characterized by large seral stands of fire-induced lodgepole pine. Climax species are hybrid spruce, Engelmann spruce, subalpine fir, and (in the N) white spruce. Douglas-fir, western larch, western white pine locally common. |
| Ponderosa Pine (PP) | The driest, hottest of the interior forested zones. Winters dry and moderately cold. Forest fires common. | Low valleys of the Fraser-Thompson, Similkameen and Okanagan systems. Upper limits approximately 800 m. Smallest zone in the Province. | Ponderosa pine; in moist draws aspen, Douglas-fir, paper and western birch. Locally western larch; black cottonwood in alluvial sites. |
| Bunch Grass (BG) | Very dry, summer-warm, continental climate with dry, cold winters. | Within the range of the PP, IDF and southwestern SBS Zones, and there primarily on benches and plains with fine-textured soils. Small extent. | Ponderosa pine scattered; aspen, Douglas-fir, black cottonwood, birches and (in the N) white spruce in draws. |
| Interior Douglas-Fir (IDF) | Relatively warm, dry interior climate with moderately cold winters. | Southern third of Province anywhere east of the Cascade/Coast Mountains, including the Rocky Mountain Trench; commencing above the PP and ending below the MS Zone (300-1400 m). | Douglas-fir, lodgepole pine, aspen, hybrid spruce; locally western larch, ponderosa pine, western red cedar (moister sites), grand fir, white spruce. |
| Coastal Douglas-fir (CDF) | Mild coastal climate with rainy winters and dry summers, long growing season, but interrupted by summer draught. | In coastal rainshadow areas, surrounding the enclosed waters of Georgia Strait. Generally below 400 m elevation. Relatively small extent. | Douglas-fir, western red cedar, grand fir, broadleaf maple, arbutus; Garry oak only in the driest core of the zone. |
| Interior Cedar-Hemlock (ICH) | "Interior wet-belt" climate. Moderately cold, wet and snowy winters and hot, often humid summers. Wettest interior zone with long growing season. | At low and lower mid-elevations on the west slopes and in valleys of all interior mountain ranges from Cariboo/Monashee chain E to the Rockies. Disjunct portion in the middle Iskut, Nass and Skeena drainages. | Greatest diversity of trees in B.C. Always dominating are western hemlock and western red cedar. Local and seral in the south are Douglas-fir, western larch, grand fir, western white pine. White, Engelmann and hybrid spruce, subalpine fir and lodgepole pine throughout under suitable edaphic conditions. |
| Coastal Western Hemlock (CWH) | Mild, rainy coastal climate with relatively cool summers. Summer dry season less than in CDF and near-absent in the northwest. Long growing season. | All coastal low elevations, except around Georgia Strait. Upper limit 300 m in the north and 1000 m in the south, succeeded above by MH Zone. Also occurring above CDF Zone in the south. | Most common throughout are western hemlock and western red cedar. Sitka spruce and shore pine most common in the NW and amabilis fir, Douglas-fir in the SE of the zone. |

APPENDIX F
Ecological Reserves and Biogeoclimatic Zone Units

| BIOGEOCLIMATIC ZONE | ECOLOGICAL RESERVE NUMBER* |
|-------------------------------------|---|
| 1. Alpine tundra | 2**, 31, 32, 34, 39, 43**, 45**, 46, 49**, 56, 57**, 64, 68, 70, 114, 115 |
| 2. Spruce - willow - birch | 46, 57, 68, 80 |
| 3. Boreal white and black spruce | 8, 47***, 50, 57, 58, 62, 80, 102 |
| 4. Sub-boreal spruce | 35**, 36, 38, 41, 53, 55, 60, 71, 72, 73, 79, 81, 82**, 84, 85, 86, 87, 91, 107 |
| 5. Mountain hemlock | 2, 45, 83, 114, 115, 117 |
| 6. Engelmann spruce - subalpine fir | 31, 32, 34, 36***, 38***, 41, 43, 49, 56, 59, 64, 70, 78, 85, 88, 107 |
| 7. Montane spruce | 5, 6, 19, 26, 51, 88, 104 |
| 8. Ponderosa pine | 3, 7, 27***, 29, 77, 92, 110 |
| 9. Bunchgrass | 3***, 29***, 33, 100, 110 |
| 10. Interior Douglas fir | 3, 7***, 20, 21, 22, 26***, 27, 29, 30, 35, 51, 65, 77, 88, 89***, 101, 106, 108 |
| 11. Coastal Douglas fir | 2***, 4, 15, 16, 17**, 18**, 28***, 37, 48, 74, 94**, 97**, 112 |
| 12. Interior cedar - hemlock | 30***, 31, 42**, 43, 56, 61 |
| 13. Coastal western hemlock | 1**, 2, 9, 10, 11**, 12, 13**, 14**, 23, 24**, 25, 28, 40, 44, 45, 48, 52, 54, 59, 63, 69, 75, 76, 89, 90, 93, 95, 96**, 98, 99**, 103, 105, 106, 109, 113, 114, 115, 116 |

* Reserve consisting entirely of intertidal/subtidal environments (66, 67, 111) are excluded.

** Indicates that zonal vegetation of this category is only marginally represented.

*** Reserves occurring in zones defined by their forest vegetation but having non-forest cover over most of their land area such as bogs, fens, shrubland, maritime meadows, or bare rock.

Source: MOE&P, 1987.

APPENDIX G
Natural Features in Ecological Reserves

| NATURAL FEATURES | RESERVE NUMBERS |
|---------------------------------------|---|
| GEOLOGY AND LANDFORM | |
| Volcanic features | |
| ● basalt columns | 55 |
| ● lava landforms | 55, 64 |
| Glacial/alpine features | |
| ● prominent esker | 36 |
| ● minor eskers/drumlins/moraines | 36, 58, 68, 73 |
| ● alpine glacier(s) | 31, 46, 56, 68, 115 |
| ● solifluction lobes/patterned ground | 39, 46, 64, 68 |
| Caves/sinkholes | 68, 100, 101 |
| Fluvial features (major rivers) | |
| ● bar formation/channel shifting | 8, 62, 63, 76 |
| ● eroded banks | 8, 92 |
| ● island(s) in river | 63, 69, 76 |
| Coastal features | |
| ● extensive sand beach | 9, 10 |
| ● dunes | 9, 10, 45 |
| ● sea cliffs and stacks | 45, 109 |
| ● varied shoreline types | 23, 25, 45, 66, 94, 95, 109 |
| ● fjord | 45 |
| ● islands/islets | |
| -one only | 1, 2, 11, 12, 13, 14, 93 |
| -2 to 10 | 17, 18, 24, 25, 45, 96, 97 |
| -10+ | 23, 25, 94, 95, 103, 109 |
| Fossils | 68 |
| FRESHWATER FEATURES | |
| Complete watershed(s) | 28, 31, 45, 49, 56, 64, 68, 80, 88, 107, 108, 115 |
| Lakes | |
| ● alpine/subalpine tarns | 31, 56, 88 |
| ● bog lake(s) | 5, 25, 28, 45, 47, 52, 53, 58, 86 |
| ● alkaline lake(s) | 3, 35 |
| ● other lakes/ponds | 36, 41, 43, 45, 68, 84, 87, 108 |
| Mineral springs | |
| ● cold | 20, 42, 102 |
| ● hot | 26 |
| Rivers/streams | |
| ● enclosed reach of river | 61, 75, 89, 98, 105, 113 |
| ● meandering stream(s) | 9, 28, 36, 40, 41, 42, 43, 52, 53, 58, 78, 86 |
| ● mountain stream(s) | 21, 26, 30, 31, 43, 45, 46, 49, 56, 59, 64, 68, 80, 85, 88, 107, 114, 115 |

NATURAL FEATURES
RESERVE NUMBERS

VEGETATION

| | |
|--|---|
| Three elevational zones | 31, 56, 57, 59, 88, 114, 115 |
| Special non-forest habitats | |
| ● maritime shrub/meadow (islands) | 1, 11, 13, 14, 18, 23, 94, 96, 103 |
| ● marsh/fen/wet meadow | 25, 40, 42, 43, 47, 50, 51, 53, 58, 86, 100 |
| ● bog | |
| -coastal | 9, 25, 28, 40, 45, 52, 99, 114 |
| -interior | 47, 50, 58, 71, 72, 73, 82, 91 |
| ● estuary | 45, 111 |
| ● sand dune communities | 9, 10 |
| ● avalanche paths | 31, 32, 56, 59, 114, 115 |
| Special forest types | |
| ● alluvial deciduous forest | 8, 40, 59, 62, 63, 69, 76, 89, 113 |
| ● alluvial coniferous forest | 40, 45, 61, 75, 89, 98, 105 |
| ● western larch stands | 6, 104 |
| ● trembling aspen stands | 8, 50, 87 |
| ● paper birch stands | 85 |
| ● Garry oak stands | 37, 112 |
| ● arbutus stands | 16 |
| ● lichen woodland | 36 |
| ● subalpine parkland | 34, 43, 49, 70, 88 |
| Trees at edge of our outside usual range | |
| ● ponderosa pine | 22, 65 |
| ● yellow cedar | 32 |
| ● Douglas fir | 38, 41, 54, 60 |
| ● Engelmann spruce | 46, 59 |
| ● tamarack | 72, 79, 86 |
| ● Sitka spruce | 98 |
| ● black cottonwood | 115 |
| ● various | 21, 89 |
| Exceptional tree size/growth site | |
| ● white spruce | 107 |
| ● Rocky Mountain juniper | 4 |
| ● Sitka spruce | 45, 75, 105, 114 |
| ● Douglas fir | 48 |
| ● western red cedar | 61, 98, 105 |
| ● tamarack | 72 |
| ● lodgepole pine | 91 |
| ● western larch | 104 |
| Recent burns | 26, 81 |
| Rare vascular plants | |
| ● single species featured | |
| - <i>Cephalanthera austinae</i> | 116 |
| - <i>Erythronium montanum</i> | 83 |
| - <i>Ophioglossum vulgatum</i> | 90 |

NATURAL FEATURES
RESERVE NUMBERS

| | |
|--|---|
| - <i>Rhododendron macrophyllum</i> | 106 |
| - <i>Erythronium revolutum</i> | 113 |
| ● orchid diversity/rarity | 42, 51 |
| ● several species present | 4, 9, 10, 16, 20, 25, 28, 29, 33, 34, 37, 45, 47, 52, 68, 77, 94, 100, 101, 112 |
| Bryophyte/lichen features | |
| ● diversity/rarity | 23, 36, 45, 52 |
| Exceptional wildflower displays | |
| ● coastal | 37, 83, 94, 112, 113 |
| ● interior | 34, 39, 42, 51, 64, 88, 110 |
| Calcicolous vegetation | 20, 42, 101 |
| Marine algae | 24, 45, 66, 94, 95, 96, 97, 103, 109, 111 |
| FAUNA | |
| Birds | |
| ● seabird colonies | |
| -major | 1, 11, 13, 14, 23, 44, 45, 93, 94, 95, 96, 103 |
| -minor | 12, 17, 18, 24, 25, 97, 109 |
| ● nesting raptors | |
| -peregrine falcon | 11, 12, 13, 44, 45, 103 |
| -eagles | 12, 13, 44, 45, 68, 93, 95, 101, 103, 109 |
| ● sandhill crane nesting | 25, 42, 99? |
| ● important waterfowl habitat | 25, 35, 47, 52, 53, 86, 100 |
| ● peripheral species expected | 8, 33, 100 |
| ● endemic insular rares | 9, 10, 45, 52 |
| Mammals | |
| ● ungulates | |
| -important populations/uses | 46, 63, 64, 68, 88, 102 |
| -key winter ranges | 20, 29, 68, 81 |
| ● endemic insular race(s) | 9, 10, 11, 12, 13, 45, 52, 95, 117 |
| ● perihel species expected | 33, 74, 100 |
| ● marine mammals | |
| -sea otter | 109 |
| -sea lion rookery | 11, 12, 13 |
| -sea lion haulout | 14, 17, 45, 97, 109 |
| -key killer whale habitat | 111 |
| -whale migrations | 96, 97, 109, 111 |
| ● rare species | 117 |
| Herpetofauna | |
| ● rattlesnake den | 77 |
| ● reptile diversity/unusual species | 6, 7, 29, 33, 100, 108 |
| ● unusual amphibian occurrence | 1 |
| Insects | |
| ● types localities/first B. C. records | 35, 42, 100 |
| ● other insect features | 37, 52, 100 |
| Marine Invertebrates | |

NATURAL FEATURES**RESERVE NUMBERS**

| | |
|----------------------------|---|
| ● high species diversity | 24, 45, 66, 94, 95, 96, 97, 103, 109, 111 |
| ● high benthic production | 67 |
| ● accessible research area | 24, 66, 94, 97 |
| Fish | |
| ● unique taxa | 52 |
| ● spawning salmon | 45, 75, 105 |
| CULTURAL FEATURES | |
| Prehistoric use | 2, 13, 45, 92, 109 |
| Historical feature(s) | 13, 59 |

Source: MOE&P, 1987.