OCCASIONAL PAPER NO. 12

CANADIAN COUNCIL ON ECOLOGICAL AREAS FRAMEWORK FOR DEVELOPING A NATION WIDE SYSTEM OF ECOLOGICAL AREAS PART 1 A STRATEGY

D. GAUTHIER
EDITOR

JULY 1992

OCCASIONAL PAPER NO. 12

CANADIAN COUNCIL ON ECOLOGICAL AREAS FRAMEWORK FOR DEVELOPING A NATION-WIDE SYSTEM OF ECOLOGICAL AREAS

PART 1 - A STRATEGY

Prepared by: Canadian Council on Ecological Areas Systems Framework Task Force,
July, 1992

David Gauthier, Editor

CANADIAN COUNCIL ON ECOLOGICAL AREAS
FRAMEWORK FOR DEVELOPING A NATION-WIDE SYSTEM OF ECOLOGICAL AREAS
PART 1 - A STRATEGY

Prepared by the Canadian Council on Ecological Areas
Systems Framework Task Force
July 1992

Chair, Systems Framework Task Force:
Ross Thomasson (Manitoba Department of Natural Resources)
Members, Systems Framework Task Force:
Tom Beck (Calgary, Alberta)
Daniel Gagnon (Universite du Quebec a Montreal)
David Gauthier (University of Regina)
Arlin Hackman (World Wildlife Fund Canada)
Bob Halfyard (Newfoundland Department of Environment and Lands)
Peter Lee (Alberta Department of Forestry, Lands and Wildlife)
Leigh Warren (Canadian Wildlife Service, Ottawa)
Ed Wiken (State of the Environment Service, Ottawa)

Contributors:
John Anderson (State of the Environment Service, Ottawa)
Clayton Rubec (North American Wetlands Conservation Council, Canada)
Anthony Turner (State of the Environment Service, Ottawa)

ACKNOWLEDGMENTS

We express our deepest appreciation to the many members of CCEA and to the large number of expert readers who provided thoughtful and insightful comments on earlier drafts of this document. Members of this Task Force assume all editorial responsibility for the material presented in this document. The affiliations of the expert readers are as follows:

Agriculture Canada (Research Branch)
Alberta Recreation and Parks
British Columbia Conservation and Planning, Ministry of Lands and Parks
Canadian Environmental Advisory Council
Canadian Global Change Program
Canadian Heritage Task Force
Dalhousie University, School for Resource and Environmental Studies
Department of Indian and Northern Affairs
Nature Conservancy of Canada
Nova Scotia Museum Complex, Department of Education
Ontario Ministry of Natural Resources
Royal British Columbia Museum
Saskatchewan Ministry of the Environment and Public Safety
Simon Fraser University, Department of Geography
University of New Brunswick, Department of Forest Resources
University of Waterloo, Departments of Geography and Recreation and Leisure Studies

CHAIR'S PREFACE

The primary focus of the Canadian Council On Ecological Areas is to encourage establishment of a nationwide system of rigorously protected ecological areas. The Council believes that such a system is necessary to ensure maintenance of Canada's biodiversity and ecosystems.

It is in pursuit of its primary focus that the Council has published a number of Occasional Papers and has developed a National Registry of Ecological Areas. The Registry is a significant step towards development of a systematized approach to ecological area establishment and completion of the required system. It documents existing ecological areas which meet Council's criteria for protection and management thus laying a key part of the foundation for gap analyses of the current, all be it embryonic, system of ecological areas.

This paper, prepared over several years by key members of Council and reviewed by a number of eminent agencies, follows upon a recent paper that explored the issue of ecological representation. The paper establishes an overall strategy framework within which the Council, governments and private management agencies may develop additional guidelines to assist in selecting areas worthy of long term protection to make valuable additions to the required nationwide system. The framework itself is a valuable tool to facilitate co-ordination between governments and other agencies who choose to be responsible for establishing and managing ecological areas since it provides a common point from which discussions may emanate.

The paper is a "living" document and its concepts are "living" concepts. As such they are subject to change from time to time as new information, techniques and ideas develop. The proposed preparation of a companion paper to document case studies will, in likelihood, identify otherwise unknown causes for revisions. All revisions are intended to keep the framework's strategy current and appropriate to the needs of the Council, associated jurisdictions and agencies. The Council will continue to produce related documents as Occasional Papers. These will deal with associated issues such as ecosystem integrity.

On behalf of the Council, I commend this paper to your attention. I also encourage you to comment upon it and to provide your comments to Council so that you may participate in the revision process.

R.D. Thomasson
92-06-24

SUMMARY

1 CCEA believes our collective goal should be to achieve for Canada a nation-wide network of ecological areas developed on the basis of representation and integrity and managed to the highest standard of ecological protection. This Framework document promotes a comprehensive approach to establishing and conserving ecological areas that are representative of Canada's ecosystems, flora and fauna. With this systems Framework, CCEA is underscoring the fundamental mission of completing a representative network of ecological areas as an essential element of Canada's conservation agenda.

2 This Framework recognizes the mosaic of ecological areas systems plans in Canada already set in place by various responsible agencies. We call upon all jurisdictions[1] to develop and complete their own systems plans. CCEA stresses the need for a unified and integrated approach to encourage, support and emphasize coordination, collaboration and partnerships.

3 Given the magnitude of the task, system planning must now assume high priority across Canada. Jurisdictions must set dates for completion of their systems plans and measurable targets within those system plans.

4 CCEA calls for increased and adequate representation of Canada's territory in protected areas systems through a spectrum of mechanisms including legislated ecological areas.

5 CCEA urges all jurisdictions and interested groups to adopt a minimum acceptable short-term goal of the establishment of at least one representative ecological area in each ecoregion on a national scale. CCEA recognizes that, in some cases, there may be a pressing need to establish a number of ecological areas in a given region under severe development pressure. CCEA also recognizes that different jurisdictions may set different targets for the size of ecological areas to meet objectives for their area.

6 Given the small size of many ecological areas, CCEA believes that it is prudent to replicate representative areas. CCEA endorses the general rule that when in doubt about the adequacy of size for an ecological area, every effort should be made to adopt larger size areas.

7 CCEA supports the right of all jurisdictions to adopt the classification scheme most appropriate for their needs. CCEA has used the Terrestrial Ecoregions classification of Environment Canada as one example of a framework

---

[1] Jurisdictions are defined as federal, provincial or territorial governments with responsibility for public (crown) lands.

within which ecological areas could be established but regard it as the coarsest scale at which candidate ecological areas should be evaluated and established.

8 The fundamental basis on which ecological areas are established must be representation followed by maintenance of integrity.

9 Representation should be judged initially in relation to enduring features of the landscape, such as landforms and physiographic conditions that control regional ecosystem development and patterns. Landscape representation should be assessed initially on the basis of regional surveys rather than isolated site-specific surveys. Jurisdictions must develop landscape representation targets and corresponding site evaluation procedures which may be best facilitated, for example, through some form of gap analysis.

10 A management authority must prepare a management plan for the area(s) under its jurisdiction. A successful management strategy must define goals, define ecosystem boundaries and primary components, adopt a management strategy, and monitor effectiveness of the management strategy.

11 Effective management requires specific regulations within the legislative framework of either a provincial or federal statute with a mechanism to deter those who would damage a protected area. Monitoring and patrolling of ecological areas is essential to effective management and enforcement and require adequate budgets to ensure regular patrols and trained staff.

12 Management policies and regulations must be flexible yet ensure the physical protection of rare species and habitats and allow for scientific research and monitoring. The general public also must be part of the management strategy to secure a constituency of support.

13 Jurisdictions are urged to designate new ecological areas as quickly as possible bearing in mind the direction and guidance to be found in the Framework. CCEA stresses that an ecological area should be established in every ecoregion in Canada but that the first priority must be to designate pristine or virtually undisturbed sites in ecosystems that are not yet represented with ecological areas.

14 CCEA recognizes that achievement of the goals and objectives set out in this plan will require the combined efforts of governments (jurisdictions), private stewardship and aboriginal land authorities.

TABLE OF CONTENTS

List of Tables and Figures

Background

There have been fairly dramatic shifts in establishing protected areas[1] and ecological areas[2] in the past two or three decades in Canada. By the beginning of the 1960s, the number of protected areas (415) was more than double that which had been acquired from 1889 to 1950. By the end of the 1970s, that number more than doubled to 872 and almost doubled again to 1601 in 1980. By 1990, 2,945 protected areas were established. Ecological reserves have also shown a substantial increase in the past two decades, from 21 in 1970 to 179 in 1980 and 516 in 1990.

In recognition of the growing importance of these conservation initiatives, the Canadian Council on Ecological Areas (CCEA) was established in 1982. CCEA is an incorporated, non-profit, independent, national forum whose mandate is to encourage the selection, protection and stewardship of a comprehensive system of ecological areas in Canada. It draws its membership from federal, provincial and territorial governments, non-governmental organizations, universities and private citizens. The objectives of CCEA are:

1. To promote public understanding of and support for the establishment of a comprehensive Canadian system of ecological areas;
2. To facilitate the exchange of relevant information among governments and other interested organizations;
3. To advise and assist governments and others interested in the development and maintenance of a comprehensive Canadian system of ecological areas and in its integration with land use planning systems;
4. To prepare guidelines on the selection, establishment, protection and management of ecological areas, and on evaluation and upgrading of the relevant data base;
5. To evaluate and report on the selection, designation, protection, management and use of established and proposed Canadian ecological areas;
6. To establish useful relationships with international organizations and organizations in other countries having similar interests and concerns; and,
7. To do all such other things as are incidental or conducive to the attainment of the above objectives.

---

[1] All government owned properties (IUCN categories I-IV contained in the National Conservation Area Data Base maintained by the State of the Environment Reporting Branch of Environment Canada.

[2] All Ecological reserves as listed in the CCEA National Registry, plus national wildlife areas and national parks.

Since its inception, CCEA and its membership have attempted to strengthen, through various cooperative endeavours and partnerships, the means to build a more comprehensive system of ecological areas. Groups and individuals from provincial, federal and territorial governments, and from universities and private organizations have actively contributed to setting priorities, funding activities and carrying out tasks.

Initially, CCEA concentrated on promoting the value of an ongoing range of ecological area programs throughout Canada. This typically highlighted their environmental and socio-economic value in preserving biodiversity and gene pools, providing information on ecosystem health and life-sustaining processes, conserving vital environmental assets, and furnishing data for sustainable development planning. Most of CCEA's efforts were directed at information exchange involving the convening of yearly national meetings in various jurisdictions, the distribution of CCEA papers and newsletters, and the publishing of special task group reports. One of the most important contributions was the composition of a National Registry of Ecological Areas (Gray and Rubec 1989) in the late 80s. In addition, CCEA published Guidelines for the Selection of Protected Ecological Areas in 1989 which acted as a basis for work to develop a framework for a nation-wide system of ecological areas.

There have been a number of recent initiatives outside of CCEA regarding protecting ecological areas that have been important in developing concepts and actions on protected area systems:

* the publication by the Canadian Environmental Advisory Council of A Protected Areas Vision for Canada
* the Endangered Spaces campaign of the World Wildlife Fund of Canada
* the federal government Green Plan initiatives for protected areas
* the work of the Canadian Wilderness Task Force

These activities and others have greatly aided the CCEA in developing a strategy for a more comprehensive system of protected ecological areas. The pervading questions of whether Canada is protecting enough (i.e., in area, in location, in kind) and whether we are collectively following a strategy that will balance the diverse sets of interests held across the nation still continue. They have, however, steadily escalated in importance over the last decade.

INTRODUCTION

It is these foregoing questions that underpin this Framework for developing a nation-wide system of ecological areas. Objectives of the Framework are to assist in promoting and to stimulate thinking regarding a comprehensive approach to establishing and conserving ecological areas. The Framework, in effect, will be a broadly based accountability ledger for the nation. It must account for ongoing and sector-specific requirements but must also respond to new demands for more integrated and holistic needs. Many questions will demand answers. For example, how well are we as Canadians doing in conserving our range of environmental assets? Are the varied national interests of resource sectors (i.e., parks, wildlife, forestry, agriculture) and sciences (i.e., botany, zoology, entomology) being considered? What will Canadians use as a benchmark to measure success or progress? How do we evaluate representation? What are the elements that must be considered to ensure the integrity of ecological areas?

The Framework differs from a systems plan in that a systems plan details which areas are to be protected according to a time schedule. Those are tasks that must be met by individual jurisdictions. On a national basis, the need for systems plans has been advocated in texts such as Endangered Spaces (Hummel 1989) and On the Brink (Burnett et al. 1989). More globally, the World Conservation Strategy, the Brundtland Commission, and the IUCN report Caring for the Earth - A Strategy for Sustainable Living have called for worldwide action in taking a more purposeful strategy to establishing a network of ecological areas. This strategy has been advocated under the general principles of maintaining essential ecological processes, preserving genetic diversity, and sustaining the use of species and ecosystems.

Within Canada, we should continue to take advantage of the mosaic of systems plans that have already been set in place by various institutions and agencies. There is a need, however, for a unified and integrated approach to encourage, support and emphasize coordination, collaboration and partnerships. CCEA's initiative to develop a framework for developing systems plans is directed to these ends. Thus the sum of all these concerted efforts should result in the creation of a system of ecological areas representative of Canada's biodiversity and ecosystems[3]. *Our goal is to achieve for Canada a nation-wide system of ecological areas developed on the basis of representation and integrity and managed to the highest standard of ecological protection.*

---

[3] Jurisdictions are urged to note that in any plan development, the term "ecosystem" must be considered relative to hierarchical and spatial scales.

CCEA's Framework provides direction as to how this long term goal can be achieved. This will require establishing at least one ecological area in each ecoregion; thus, one ecological area per ecoregion is the immediate goal. Once this is accomplished the more complex question of adequate representation on an ecoregion basis can be addressed which, it is expected, will result in establishing more than one ecological area in some or even in all ecoregions. It is anticipated that the establishment of protected ecological areas will allow for protection of rare, threatened and endangered species and does not preclude specific efforts in those areas. The protection of rare, threatened and endangered species is already a primary thrust in many jurisdictions and in some it is a legislated criterion. Furthermore, while this document focuses on terrestrial ecological areas, CCEA has examined elsewhere issues related to marine reserves in some detail (Graham 1990). It is CCEA's opinion that the principles outlined in this Framework have application to marine areas.

This Framework for developing a nation-wide system of ecological areas is primarily directed to jurisdictions (governments) with responsibility for public (crown) lands. However, CCEA recognizes the important role in Canada of private land stewardship, for example, aboriginal lands, corporate and other private land holdings. We hope that those individuals and organizations involved in stewardship on private lands will find the document of interest and assistance and, above all, worthy of comment. CCEA also recognizes that without the commitment of private land owners throughout Canada a truly complete system of ecological areas cannot be achieved.

This document outlines the first part of an intended two-part volume. Part 1 outlines considerations fundamental to achieving the goal of a nation-wide system of ecological areas. We discuss the importance of an ecological classification framework within which to assess and select ecological areas for protection. Using one national ecological classification as an example, we examine the extent of protection for ecological areas across Canada based on selected classes of protected areas. We emphasize the concepts of representation and integrity and the need to frame a nation-wide system of ecological areas within a ecological classification based on enduring landscape features.

The second stage in developing this Framework will consist of examining the concepts outlined in Part 1 in relation to selected ecoregions across Canada through case studies that will provide direction on how the concepts outlined in Part 1 can be applied. Part 2 will also provide an evaluation of existing ecological classification schemes. CCEA will work in cooperation with all interested parties in developing case studies.

MEASURING THE EXTENT OF PROTECTED ECOLOGICAL AREAS IN CANADA

Before jurisdictions can specify in a system plan which ecological areas are in need of different degrees of protected status, they should know: (1) the extent and degree to which areas are already protected; (2) the criteria upon which areas will be granted protection; and (3) have an ecological classification system for their jurisdiction within which to select areas for protection. CCEA proposes in this Framework document that representation and integrity should be the primary criteria upon which areas will be granted protection. These key concepts are discussed more fully in later sections in this document.

A nation-wide system of ecological areas will rely on all jurisdictions having met the three requirements specified above. It would then be possible to produce a nation-wide map of currently protected ecological areas based on criteria of representation and integrity. That is not currently possible because a nation-wide database of protected ecological areas does not exist, nor have ecological areas been categorized according to criteria of representation or integrity. Furthermore, there is currently no consensus among jurisdictions on one acceptable classification system for ecological regions in Canada. No single approach to mapping of ecological areas would, therefore, be widely accepted. Recognition of that lack of consensus led World Wildlife Fund (Canada) to use ecological classification schemes adopted by provinces and territories and data on ecological areas provided by those jurisdictions to construct a separate map for each province and territory for its Endangered Spaces Campaign (WWF 1991). The Endangered Spaces campaign progress reports published annually by WWF (Canada) present the best available analyses based on each jurisdictions natural region classifications and representation targets. That approach is constructive and valuable. It does not, however, allow direct comparisons among jurisdictions because of different ecological classification schemes used by jurisdictions and because definitions of protected ecological areas differ among jurisdictions.

CCEA believes that there is value to constructing a nation-wide map of ecological areas based on one ecological classification with existing information as a starting point to further develop consensus among jurisdictions. A number of different maps are presented here using different categories of protected areas. Information from these maps is derived from the National Registry of Ecological Areas prepared and maintained by CCEA, and the Natural Areas Conservation Data Base (NACDB) housed in the State of the Environment Reporting (SOER) Branch (Environment Canada). Data from these sources is presented within the Terrestrial Ecoregions of Canada classification prepared by Environment Canada. The Registry documents ecological reserves for ready reference purposes. CCEA's National Registry of

Ecological Areas currently lists 516 properties identified as ecological areas (437), national wildlife areas (45) and national parks (34). The Natural Areas Conservation Data Base (NACDB) was created through the cooperation of the Canadian Parks Service, SOER, and CCEA, and contains information on 2,945 parks, ecological reserves and other categories of conserved or heritage areas. Information on ecological areas within this database are categorized according to the International Union for the Conservation of Nature (IUCN) categories of protected areas (see Appendix A). The NACDB is not complete for all jurisdictions. Environment Canada's Terrestrial Ecoregions framework encompasses 5,500 ecodistricts contained within 177 ecoregions which are, in turn, aggregated into 45 ecoprovinces. The Terrestrial Ecoregions, delineated using a consistent methodology, geographically represent Canada's landscapes in a fashion which lends itself to a systematic approach to creating a nation-wide system of ecological areas.

The maps presented in this Framework were prepared as a cooperative effort by a Task Force of knowledgeable CCEA members. Extensive analytical and Geographic Information System (GIS) support was provided by the Sustainable Development Branch of Environment Canada. The Framework is a 'living document' and as such the maps contained herein are subject to revision as circumstances dictate. Such circumstances include, but are not limited to, establishment of new ecological areas, revisions to ecoregion boundaries and the establishment of new ecoregions and/or ecoregion mapping systems.

DETAILS OF MAPS

The approach to preparation of maps was straightforward to the point of simplicity. All maps were plotted through Environment Canada's GIS which also contained the terrestrial ecoregions. This allowed for easy identification of ecoregions containing different numbers and area percentages of ecological areas. The boundaries of all 177 ecoregions from the Terrestrial Ecoregions classification system are shown on all maps. Figure 1 shows the boundaries of the 177 terrestrial ecoregions relative to national, provincial and territorial boundaries. Figure 2 shows the point locations of all protected ecological areas in Canada according to IUCN categories I through IV (see Appendix A).

Figure 3 shows the terrestrial ecoregions that do not have any protected ecological areas under IUCN categories I through IV. Figure 4 provides further details by depicting the number of protected ecological areas in each ecoregion according to six classes (see Table 1 below for tabular data) ranging from ecoregions with no protected ecological areas to those with greater than 10. That map and Table 1 indicate that fifty ecoregions occupying 20% of Canada have no protected areas within IUCN categories I through IV. A further 35% of Canada has from between one to three protected areas in each of 52 ecoregions. Twelve percent of Canada has between four to ten protected areas in each of 25 ecoregions. Fifty ecoregions

representing 33% of Canada's area have greater than 10 protected areas in each ecoregion. All ecoregions lacking at least one ecological area were, and are, deemed to be priority ecoregions from CCEA's perspective.

Table 1. Number of protected areas per ecoregions according to IUCN categories I-IV.

Number of Protected Areas	Number of Ecoregions	Area of Ecoregions as Percent of Canada
0	50	20.0
1	25	16.3
2	17	10.1
3	10	8.7
4 to 10	25	11.9
>10	50	33.0
TOTAL	*177*	*100*

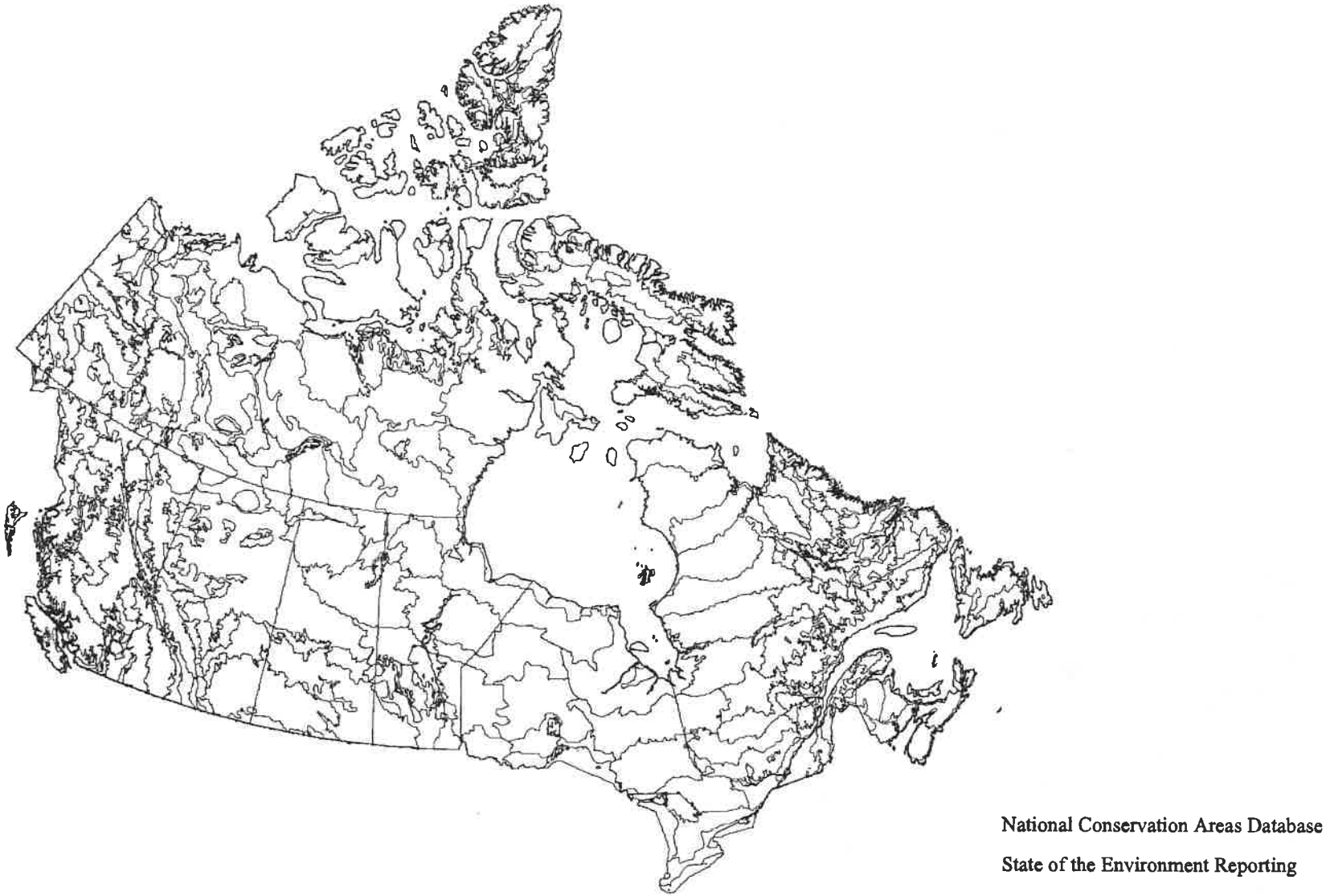


Figure 1. Terrestrial ecoregions of Canada.

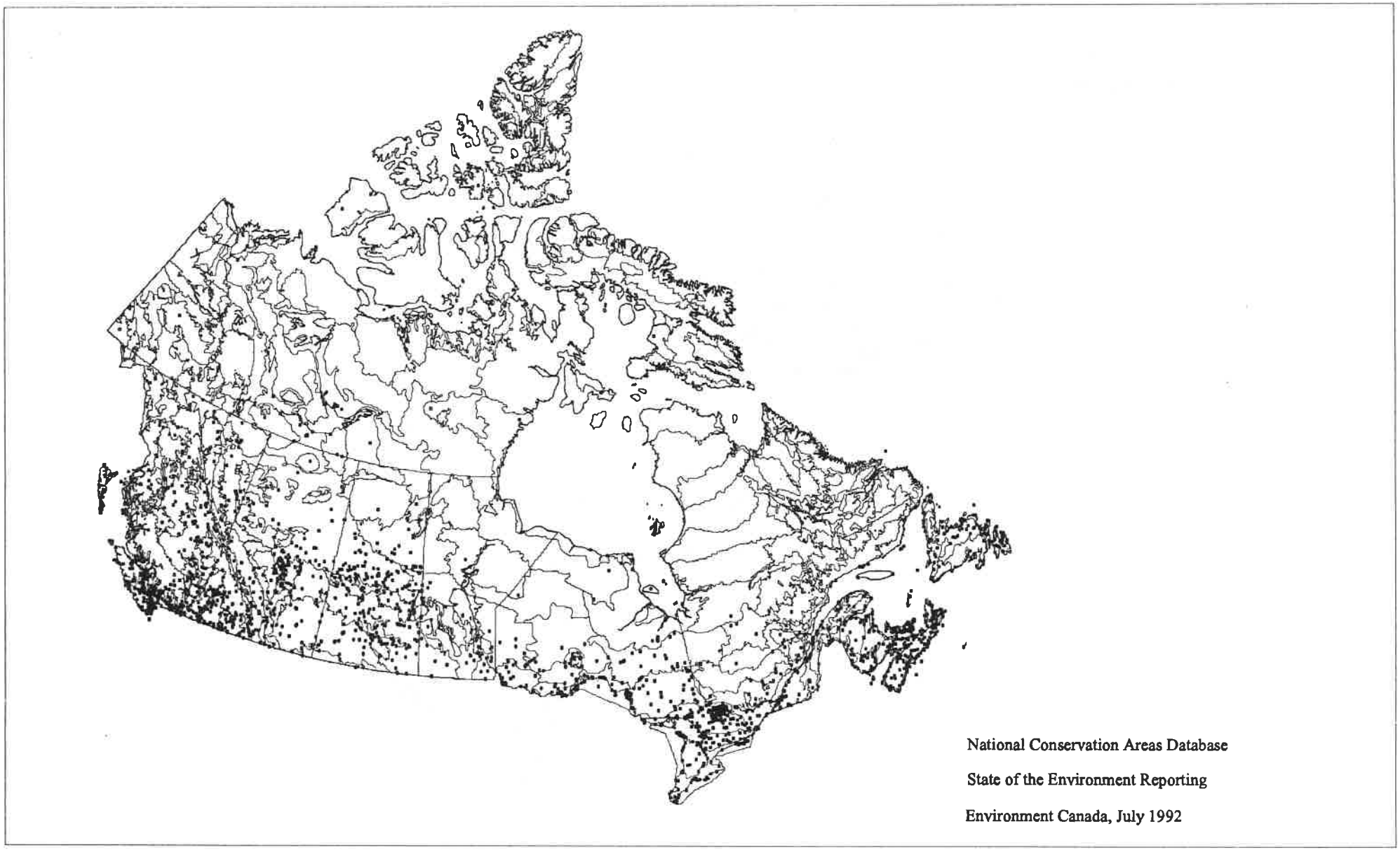


Figure 2. Location of protected ecological areas according to IUCN categories I-IV and in relation to the terrestrial ecoregions classification.

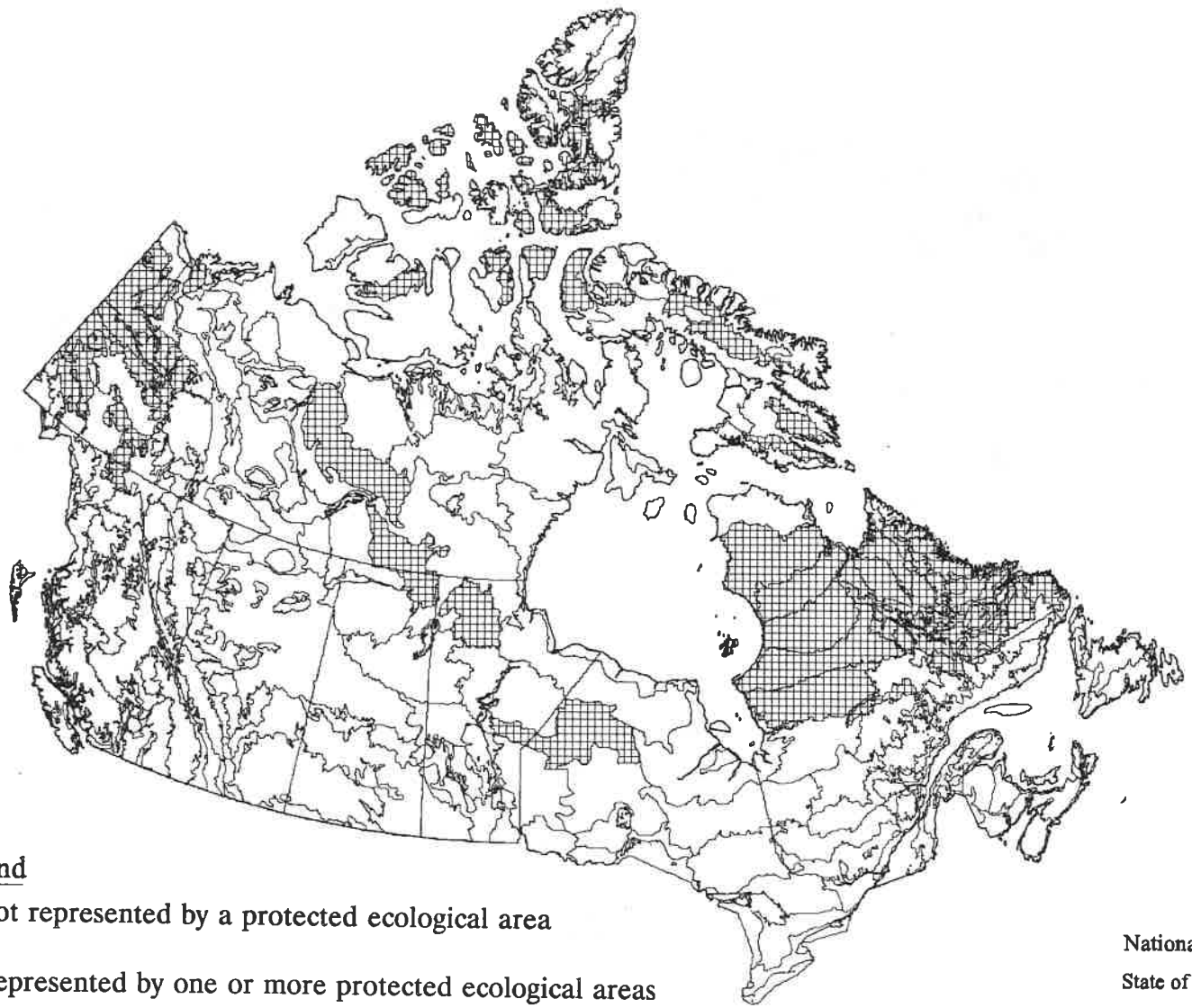


Figure 3. Terrestrial ecoregions not represented by one or more protected ecological areas.

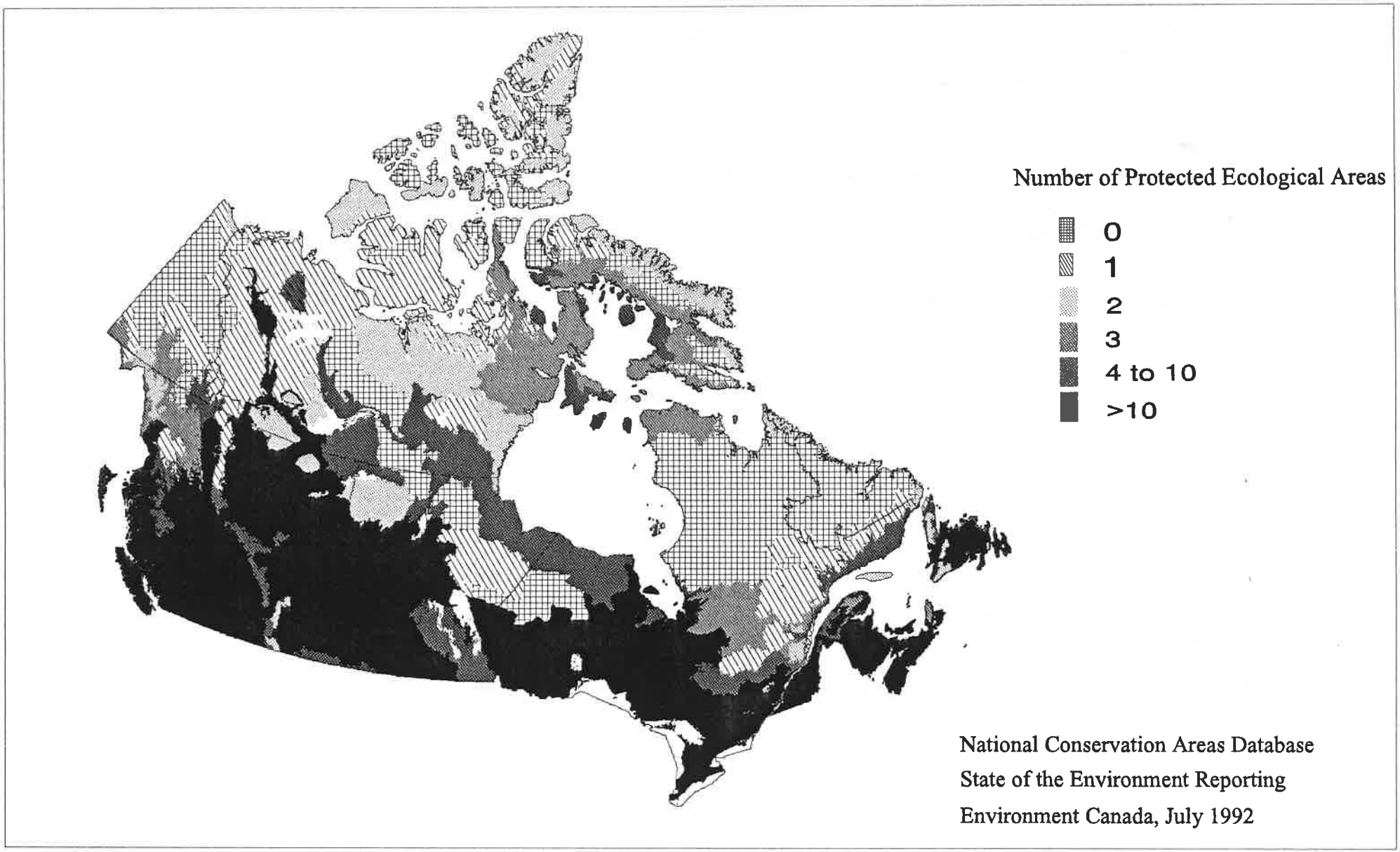


Figure 4. Number of protected ecological areas per ecoregion according to IUCN categories I to IV.

Considering only the number of protected areas per ecoregion is misleading, however. The amount of area that these protected ecological areas comprise is also important. Figure 5 shows the percent area of each ecoregion that is protected by ecological areas under IUCN categories I though IV (see Table 2 below for tabular data) according to six classes ranging from zero percent area protected to greater than 25% of the ecoregion protected. For example, 20% of Canada shows no areas protected. In 43 ecoregions occupying approximately 29% of Canada, greater than 0 to 1% of each of those ecoregions is protected. Twenty-six ecoregions occupying about 16% of Canada have slightly over 1% and up to 5% of their area protected. About 7% of Canada, represented by 18 ecoregions, has greater than 25% of its area protected. This map and table suggest that, at least according to IUCN categories, approximately 79% of Canada has 10% or less of its area in protected ecological areas, and that almost 50% of Canada has 1% or less of its area protected.

Table 2. Percent of area protected by ecoregion according to IUCN categories I-IV.

Percentage Protected	Number of Ecoregions	Area of Ecoregions as Percent of Canada
0	50	20.0
>0-1	43	28.6
>1-5	26	15.9
>5-10	18	14.8
>10-25	22	4.1
>25	18	6.6
TOTAL	*177*	*100*

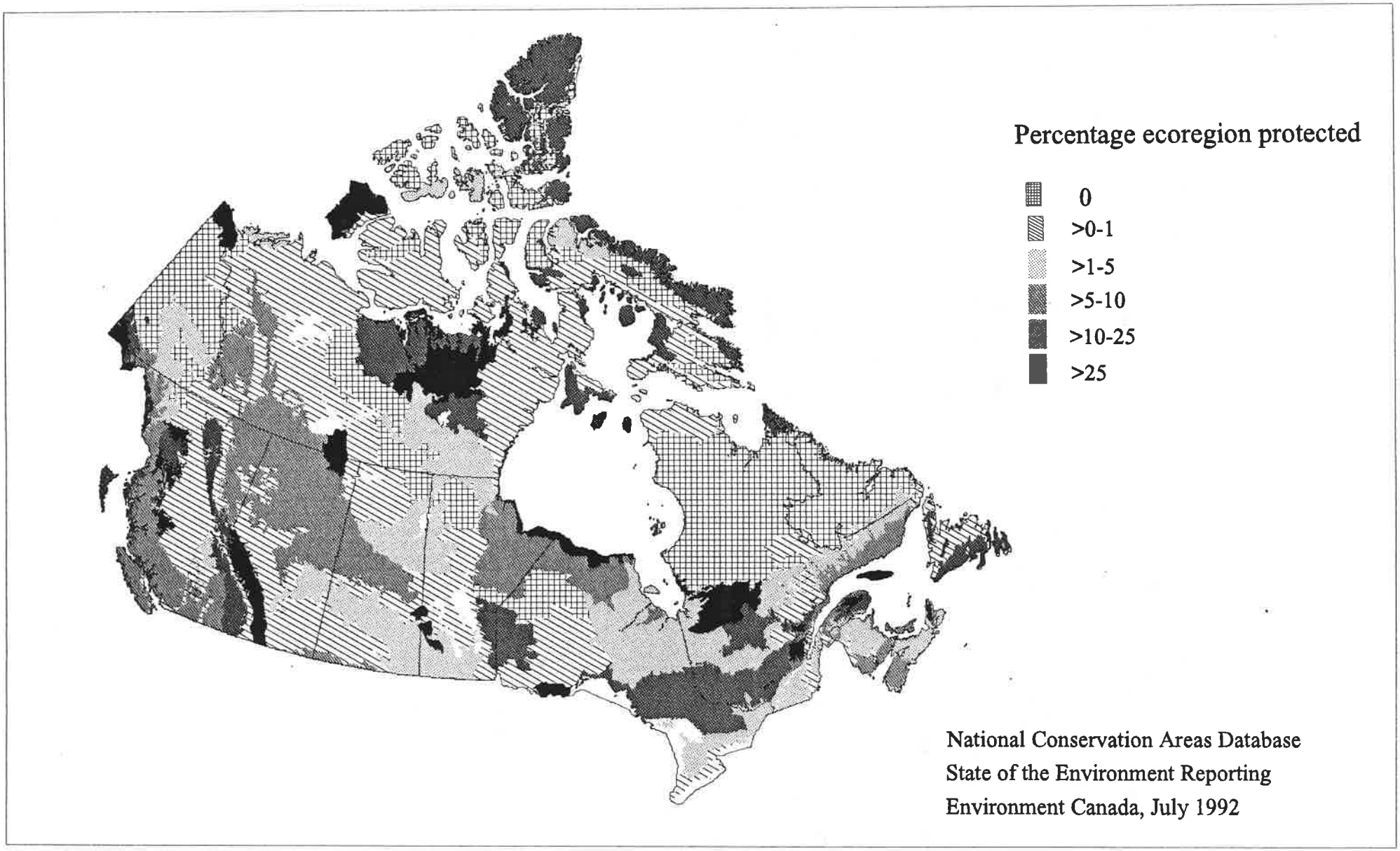


Figure 5. The percent area of each ecoregion protected by ecological areas under IUCN categories I to IV.

Viewing protected ecological areas within the Terrestrial Ecoregions framework according to IUCN categories provides one national perspective on the state of conservation protection in Canada. If protected area systems are viewed from a different set of categories of protection, however, then a somewhat different perspective results. The second perspective that we provide is based on the CCEA National Registry of Ecological Reserves and includes the Canadian National Parks, and National Wildlife Areas. Figure 6 shows the location of those three protected area types relative to the Terrestrial Ecoregions classification. Figures 7 and 8 display the number and percent area, respectively, of each ecoregion protected by ecological reserves, national parks and national wildlife areas (see Tables 3 and 4 below for tabular data).

Figure 7 and Table 3 show the degree of ecosystem protection in Canada based on the number of those three types of ecological areas. According to these categories, about 52% of Canada, represented by 90 ecoregions, shows no protected areas at all. That result contrasts quite strongly with only 20% of Canada (50 ecoregions) that show no protection when IUCN categories were used. According to the CCEA Registry categories, 80% percent of Canada's area (152 ecoregions) has three of less occurrences of those types of categories of ecological areas. When IUCN categories were used, 54% of Canada (102 ecoregions) had three or less occurrences of protected areas.

Table 3. Number of protected ecological areas per ecoregion according to CCEA National Registry data.

Number of Protected Areas	Number of Ecoregions	Area of Ecoregions as Percent of Canada
0	90	51.9
1	32	14.7
2	20	8.9
3	10	5
4 to 10	14	10.8
>10	11	8.7
TOTAL	*177*	*100*

National Conservation Areas Database
State of the Environment Reporting
Environment Canada, July 1992

Figure 6. Location of ecological reserves, national parks and national wildlife areas in Canada relative to the terrestrial ecoregions classification.

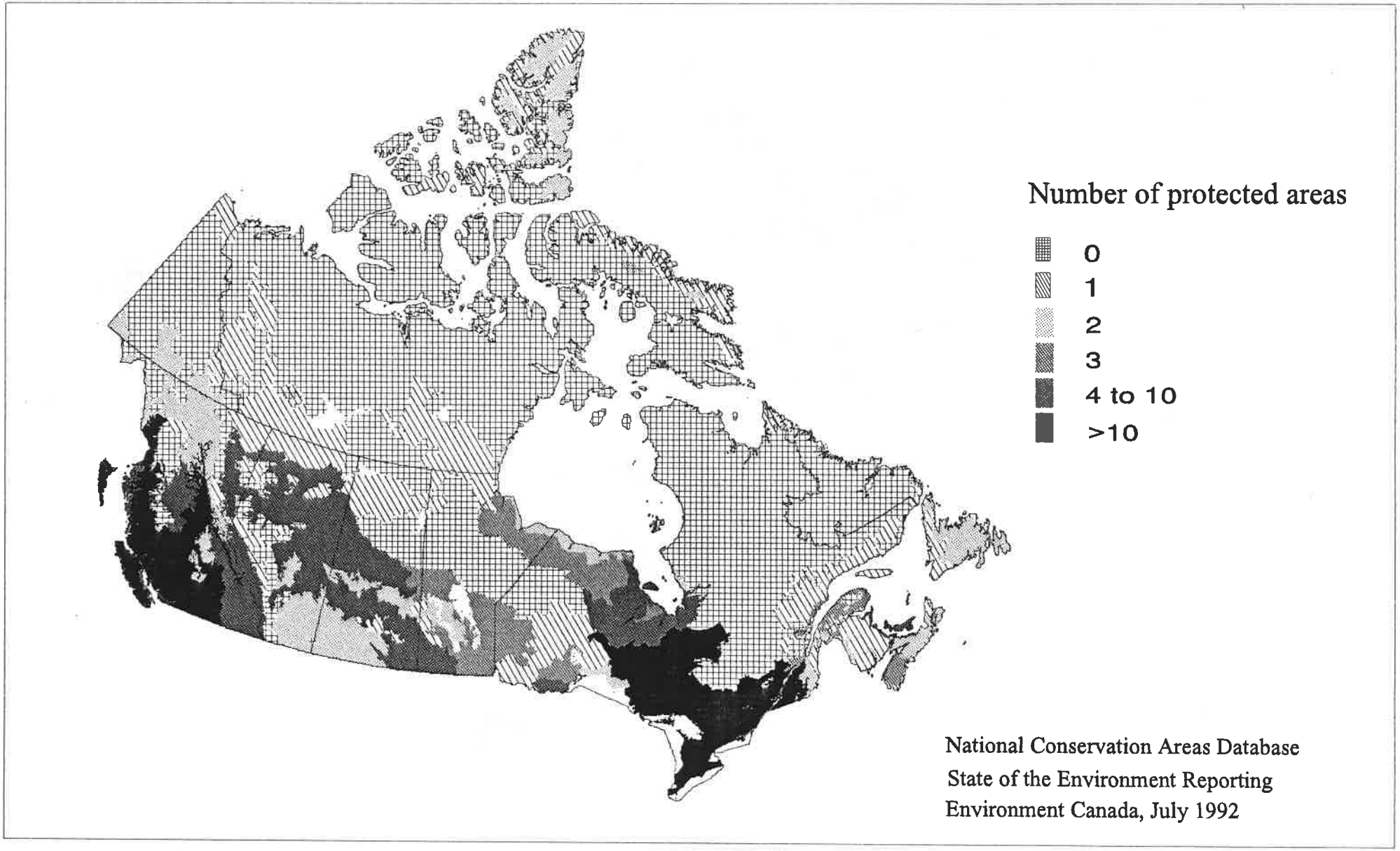


Figure 7. Number of ecological reserves, national parks and national wildlife areas per ecoregion.

Figure 8 and Table 4 show the *percent area* of each ecoregion protected by ecological reserves, national wildlife areas and/or national parks. Approximately 52% of Canada (90 ecoregions) is not represented by one or more of those three categories of any size. Again, that estimate compares with 20% of Canada (50 ecoregions) showing zero percent of areas protected when IUCN categories were used. According to the CCEA National Registry data, the remaining 83% of Canada (148 of the 177 ecoregions) has 1% or less of its area protected. When IUCN categories were used, 49% of Canada (93 ecoregions) had 1% or less of their areas protected.

TABLE 4. Percent of area protected by ecoregion according to CCEA National Registry data.

Number of Protected Areas	Number of Ecoregions	Area of Ecoregions as Percent of Canada
0	90	51.9
>0 to 1	58	30.9
>1 to 5	11	7.1
5 to 10	5	4.1
>10-25	7	4.4
>25	6	1.6
TOTAL	*177*	*100*

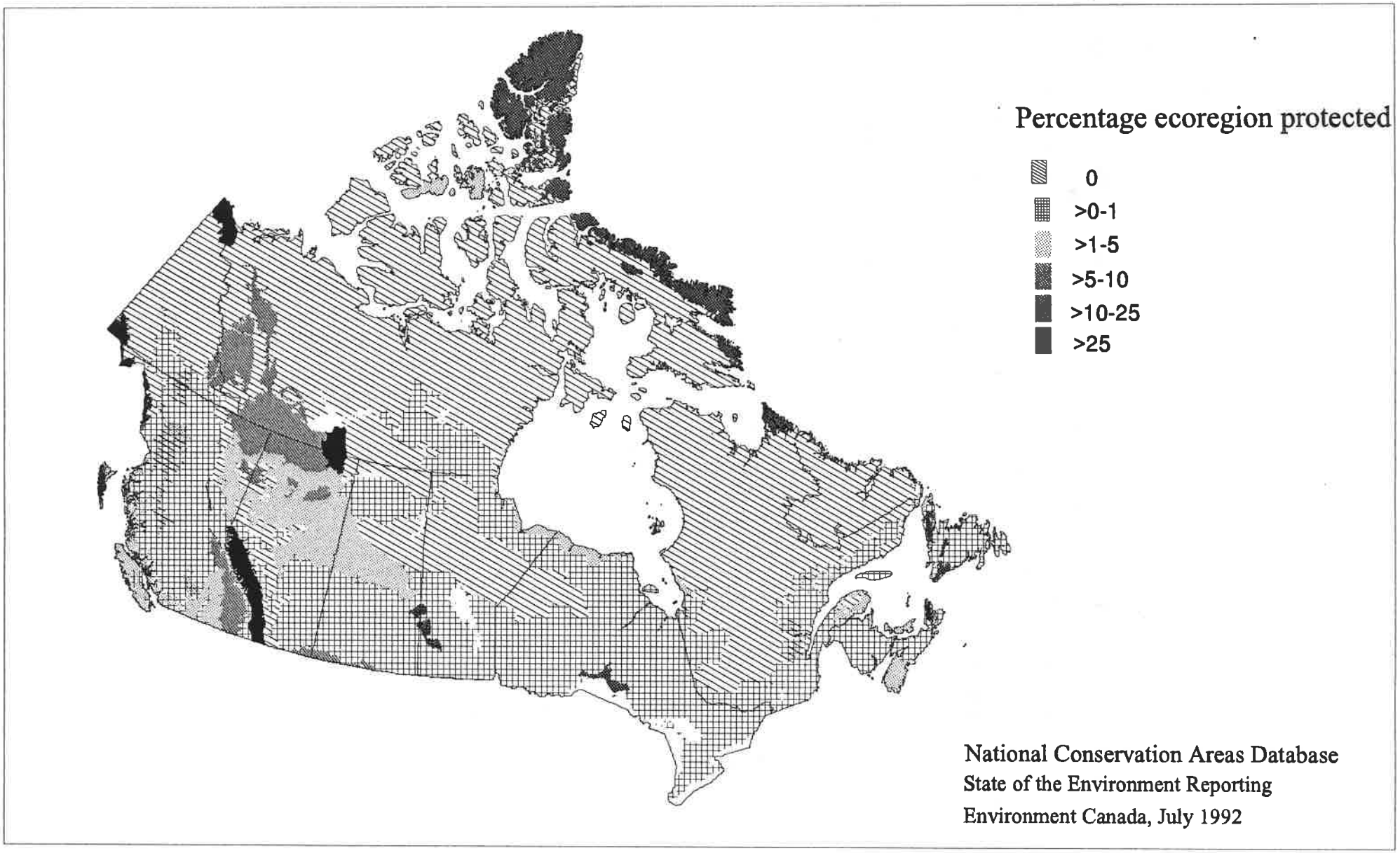


Figure 8. The percent area of each ecoregion protected by ecological reserves, national parks and national wildlife areas.

These maps and tables serve to illustrate the problem of differing categories being used to depict protected ecological areas. Different conclusions are reached depending upon the categories of protected ecological area that are used. There is a strong need for jurisdictions to adopt a common protocol of protected area categories for reporting at a national level.

However, even if full agreement was reached on a common system of categorizing sites for reporting at a national level, it is still difficult to talk about the number or area of sites that are *representative* of the ecoregions in which they occur. The maps show the presence or absence of protected areas or the percentage of areas. They are useful in depicting a nation-wide perspective on the extent and distribution of protected ecological areas according to the Terrestrial Ecoregions system of partitioning Canada based on ecological criteria. The notion of what should be considered in fully assessing representation is not shown in the maps but they were not designed to do so.

To accomplish that task requires further development of criteria to assess representation. Also, attribute characterization and methodology to survey and describe sites consistent with the ecoregion characterization is essential to assess representation. Currently, the criteria and information to allow that assessment is not available to provide a country-wide perspective. Furthermore, many jurisdictions employ different criteria for delineating ecoregions. It will be difficult to construct a national picture of representation across provincial and territorial boundaries that is acceptable to the jurisdictions unless they can agree on an acceptable ecoregion classification scheme.

The maps clearly reflect the need for further information to achieve the objective of showing how well ecological areas are representative of ecological diversity across Canada. CCEA will update and adjust the maps as new information becomes available and we call on jurisdictions to continue to provide information to NACDB expeditiously. The concepts of representation and integrity have been stressed in this document as fundamental pillars in the task of constructing a nation-wide system of protected ecological areas. In the following section we outline the basis for the importance of those concepts.

KEY CONCEPTS

REPRESENTATION

Site selection to complete the nation-wide system of protected ecological areas should be based initially on one underlying principle: representing the full diversity of Canada's natural history. In simple terms this involves classifying the terrestrial and aquatic ecosystems of Canada into distinct ecosystems and then protecting specific viable sites which exemplify each of those ecosystems. In practice, the size and diversity of Canada necessitates the subdivision of the country into natural regions containing characteristic assemblages of ecosystems, flora and fauna. The basis for the concept of representation outlined in this document is detailed in Peterson and Peterson (1991), a background paper commissioned by CCEA.

Many existing protected ecological areas were chosen for reasons other than the degree to which they represented an ecoregion, for example, their unique features, the provision of habitat for endangered species, aesthetic qualities and recreation opportunities. These are valid criteria for designating special conservation areas. However, with this systems Framework, CCEA is underscoring the fundamental importance of completing a representative network of ecological areas as a core component of Canada's conservation agenda.

This concept of representation is already embodied in a variety of protected area programs across Canada. For example, Section 2(b) of the Ecological Reserves Act in British Columbia states that an objective is to preserve "areas that are representative examples of natural ecosystems...". This objective has been interpreted to mean that representative natural features should be complete ecosystems (the biota and its physical environment in a defined geographic area) which are representative of ecosystems into which the province or territory is divided (Peterson, 1991, p.5).

The development of a system of ecological areas, based on the principle of representation, requires a planning process with two basic elements: 1) a classification and data base on ecosystems within a given jurisdiction, and 2) a procedure for identifying and evaluating the representation of existing and proposed ecological areas.

In Canada, the jurisdictions primarily responsible for protected area programs are the federal, ten provincial and two territorial governments. To date, all but two, Northwest Territories and New Brunswick, have developed natural region classifications for their ecological areas programs. World Wildlife Fund estimates that when all thirteen classifications are complete, there will be about 350 natural regions (both terrestrial and marine) that collectively define the natural history of Canada.

Though it is still evolving, and reflects some variation in approach from jurisdiction to jurisdiction, their classifications are already the basis for commitments to complete representative protected area systems in Ontario, Manitoba, Saskatchewan, Yukon and by the federal government.

In employing the Terrestrial Ecoregions classification, CCEA's system Framework is employing a coarser scale of analysis with 177 units. This approach has the benefit of applying consistent ecological classification parameters across Canada. However, CCEA recognizes the mandate of each jurisdiction to set its own system planning framework and fully endorses the finer scale targets which are being set and pursued by individual jurisdictions and the **Endangered Spaces** campaign. The ecoregions classification used in this Framework represents, in our view, an example of the coarsest scale of classification and target setting that should be employed in any jurisdiction for purposes of achieving representation.

Representation targets and corresponding site evaluation procedures are highly variable across the country at present, essentially the purview of agency professionals rather than prescribed by a planning "cookbook". Professional judgment, based on fieldwork, will always be needed. However, with representation as the overriding principle for protected area system development, some form of "gap analysis" should be employed. In CCEA's view, this approach is exemplified in the matrix approach described for Alberta by Morrison (1989). This matrix identifies the natural history themes, based on enduring landscape features, that are present in each natural region and assesses whether or not these themes are captured by existing ecological areas. Corresponding approaches for classifying, describing and analyzing communities are used in other provinces such as B.C., Nova Scotia, Ontario and Quebec.

As a principle, CCEA recommends that representation should be judged initially in relation to enduring features of the environment, such as landforms, not in relation to themes that are in high public profile at any given time, nor in relation to environmental features which can change rapidly, such as micro climate and populations of certain species that adjust to major natural and human-induced disturbances. Enduring features of the environment, which are recommended as the best basis for judging representation, refer to relatively stable landforms and seaforms and their accompanying plant and animal communities. CCEA recommends that physiographic landform units be the spatial units on which representation should be assessed. Physiographic characteristics, such as topography, slope, aspect and substrate conditions, in combination with regional climate, are primary determinants controlling ecosystem formation, function and productivity. Landforms are the stage upon which all processes take place. Such physiographic units, with their corresponding vegetation patterns, also provide dimensional aspects that can be readily identified. Representation should therefore be based on enduring features of the landscape relative to landform units. The term "representation" as used in this document refers to "landscape representation". It is recognized that the term

"representation" can be applied to other concepts, such as biodiversity and its many spatial, temporal and taxonomic subsets. For example, an ecological area can represent, to some degree, the many abiotic and biotic elements found within an ecoregion including paleontological information. We qualify our usage of "representation" to mean "landscape representation" at this initial stage leaving room for expansion of the concept to other thematic sets to which it can also apply. The landform approach is, therefore, a strategic one, based on the untested assumption that the result will be the representation of biodiversity. Full representation will be judged relative to all climatic, edaphic and biological site conditions characteristic of the ecoregion in the same or similar proportions as they would be found under natural conditions in the ecoregion. There will, therefore, need to be a hierarchy of classification schemes below the level of landforms that are of a less enduring nature than landscapes and that include biological factors such as plant communities. The strength of an ecoregion framework is that it provides several sub-regional tiers that are based upon increasingly finer levels of physiographic and ecological levels of characterization, i.e., ecodistricts, ecosites, ecoelements. Figure 9 provides a representative example of ecoregions based on a hierarchical ecological classification. As a final note, structural elements of the environment, regardless of their biological component, are also worthy of protection (for example, icefields, coastal cliffs, wave-cut platforms, drumlins, eskers) and dynamic landforms should be included when considering the elements of representation.

We emphasize a landscape approach in this document but recognize the complimentary need for species and diversity approaches. These different approaches encompass a spectrum of objectives. In the long-term, CCEA is emphasizing long-term maintenance of biodiversity, ecosystems and ecological processes. Short-term objectives focus on identifying and protecting present centres of species richness. In this latter context, the Nature Conservancy Conservation Data Centres have established databases that address representation at the biotic community level and identify of pockets of diversity and threats. Their approach provides a bottom-up complement to the top-down perspective brought by landscape and ecosystem-level approaches. CCEA recognizes that there can be high diversity within individual ecoregions in which case no one site may be representative of the total diversity within the ecoregion. A combination of the two approaches would be particularly complementary in assessing representation in such a case.

In many parts of the country the theoretical ideal of reserving one or a few large, intact natural ecosystems, to achieve representation, is no longer possible since human activity has altered and fragmented former wilderness areas. In these circumstances it is both possible and desirable to increase the chance of long-term representation of habitats in ecological areas that are normally much smaller than national parks (such as ecological reserves) by replicating the representation of natural communities and habitats. Replication will help to maximize representation, act as insurance against catastrophe and help to increase management options. In this

context, there is a need to include as wide a topographic diversity and altitudinal range as possible to ensure that they are adequate to maintain species diversity under likely future climatic changes. It is also imperative that ecological areas, particularly in badly fragmented regions, be linked by corridors of suitable habitat.

In all cases, representation should be assessed initially on the basis of regional surveys rather than isolated site-specific surveys. Once regional reconnaissance surveys have been used for initial selection of representative candidate areas, secondary criteria such as size of area, naturalness, diversity, rarity of species in the candidate sites, or threats to the candidate sites are considered in later stages of the selection and designation process (CCEA 1989). Selection should be regarded as a sieving process where representation is a dominant selection criterion and additional criteria are used at further levels in the hierarchy.

In implementing the foregoing principles and approach to improve the representation of Canada's ecological diversity in ecological areas systems, the following priorities should apply:

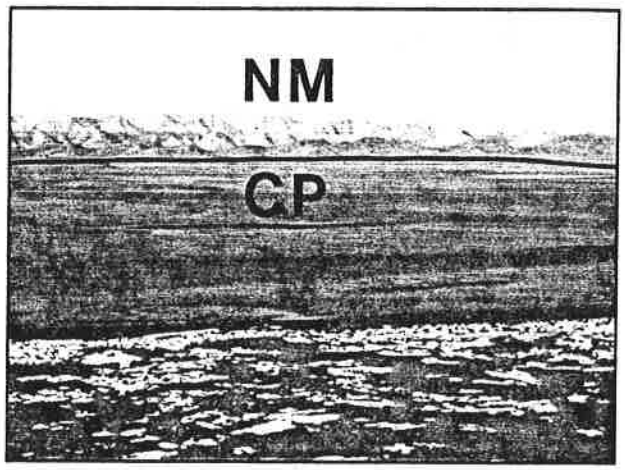
1. the first priority is to designate the least disturbed sites in ecosystems that are not yet represented within ecological areas;
2. the second priority is to protect representative sites in ecosystems which have been modified by human activity, but which can recover to conditions similar to those before disturbance. These sites should be managed to return to natural conditions. CCEA recognizes the growing importance of restoration ecology and active management approaches in this context and the importance of continued research in these areas.

Within each level of priority, candidate sites with the highest degree of risk should receive the greatest attention.

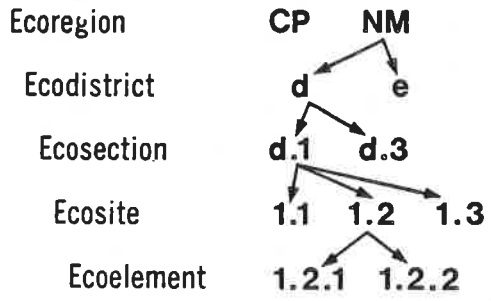
Figure 9. Example of ecoregion classification.

ECOREGION

REPRESENTATIVE OBLIQUE PHOTOGRAPHS

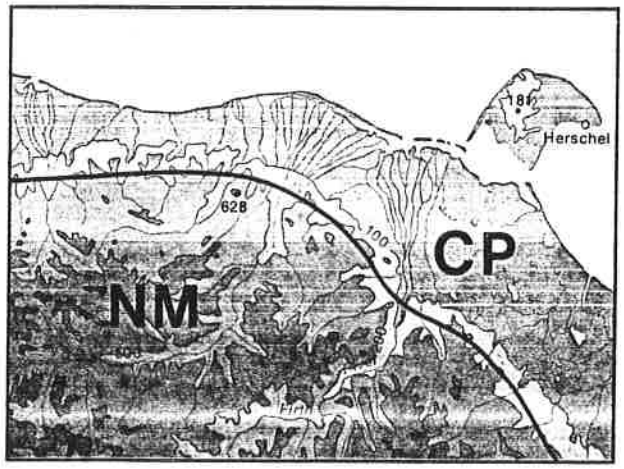


BRIEF DESCRIPTIVE TEXT



A small portion of two *ecoregions* is shown on the above oblique photograph. In the foreground, the Coastal Plain (CP) ecoregion, a gently inclined surface, extends along the coastal areas of Alaska, Yukon and Northwest Territories. Wet soils, tussocky and almost continuous sedge-trailing shrub communities, and a foggy and cool maritime climate prevail through much of this region. The Northern Mountains (NM) ecoregion is contrastingly sparsely vegetated, rugged and mantled by colluvial detritus. Below, the ecoregion boundary is portrayed on a 1:1,000,000 topographical map.

EXAMPLE BASE MAP FORMATS



INTEGRITY AND MANAGEMENT

While seeking adequate representation, CCEA accepts another important criterion that ecological areas should have the highest level of integrity. Integrity can be defined as the capability of a protected area to support and maintain assemblages of organisms (communities) that have a composition, form and functional organization comparable to that of similar ecosystem types of the region (Swanson *et al.* 1988). This view of integrity encompasses all landscape components that contribute to the support and maintenance of communities.

Integrity becomes more and more difficult to maintain as the environment surrounding the ecological area becomes less and less natural. This particular aspect of ecological areas is currently a major research topic in landscape ecology and conservation biology. Usually, the small size of an ecological area, the modification or absence of natural processes caused by the surrounding landscape, or the removal of one or several organisms will cause the conservation objectives for an ecological area to be threatened.

A large ecological area, encompassing great habitat diversity (elevation gradient, soil and bedrock type variations, soil moisture variations, micro-climate and meso-climate variations), and surrounded, or buffered, by a natural landscape much similar to the landscape within the ecological area, is the ideal situation to retain integrity. Within such an area, natural processes run their course. Furthermore, the potential for dramatic climate change in the future, or significant changes in surrounding land uses, support the need for the protection of large ecological areas containing a high degree of landscape diversity. Ideally, this would allow animals or plants to migrate within the area to suitable habitats, from previous habitats that have become unsuitable through such changes.

Forest fires create a mosaic of recently burnt areas, successional forests and mature forests. Insect epidemics reduce the population of certain species of trees, while others gain. Modern ecological theory considers that natural disturbances are a major source of habitat and landscape heterogeneity, leading to increased species diversity and genetic diversity. Where feasible, some protected ecological areas are managed to allow natural fires to burn, and even prescribed burns are used to maintain particular vegetation types.

Threats to the integrity of an ecological area might also come from the removal of one or several organisms. When such an organism is a "keystone species" (a predator in most cases), species composition and structure may change dramatically, and seriously alter the integrity of the natural area. For example, the removal of wolves may allow deer populations to expand, eliminating through browsing the

natural regeneration of trees. Also, the introduction of exotic species may cause similar problems. Feral goats destroy vegetation in some coastal islands in British Columbia. Similarly, Purple Loosestrife is an aggressive, introduced marsh species which may be displacing native plants. Conservation objectives are achieved only when minimum viable populations of the native species found within the ecological area are maintained.

To protect the integrity of an ecological area, a management plan must be adopted, based on the best ecological information available. Depending on the type of threats to the reserve's integrity, such a plan could vary from a hands-off policy to one of active intervention. Intervention management could include introduction or eradication programs, as well as the recreation of natural disturbance that simulate natural processes (i.e., prescribed burning). Thus, management strategies become the tools that will allow the maintenance of the integrity of an ecological area.

Any successful management strategy must contain four basic components to be effective. These include:

1. Define Goals
2. Define Ecosystem Boundaries and Primary Components
3. Adopt Management Strategy
4. Monitor Effectiveness of the Management Strategy

The definition of goals should be based on a clear and comprehensive understanding of the need for protecting natural systems and the will to do so. Ecosystem boundaries must be defined based on current scientific data to ensure significant features are not excluded and all primary components are identified. The strategy must be adopted, implemented and enforced. Finally, the strategy has to be monitored to ensure effectiveness and amended as time and situations dictate.

Effective management requires a strong base of biological and ecological knowledge. Within that base of knowledge, effective management further depends on the promulgation of specific regulations within the legislative framework of either a provincial or federal statute. There has to be a mechanism whereby managers can evoke the penalty of prosecution to deter those who would cause damage to a protected area. For further discussion of management issues, we encourage readers to examine CCEA's reports on management (CCEA 1984, Thomasson and Shay 1984).

BUILDING A NATION-WIDE SYSTEM OF ECOLOGICAL AREAS

The urgency of completing the nationwide system of ecological areas is such that progress must be made now and not be delayed until all or even a majority of the complexities are clarified. To this end, jurisdictions are encouraged to designate new ecological areas as quickly as possible drawing upon the direction and guidance to be found in this Framework. CCEA will update the Framework on a periodic basis to give more direction to jurisdictions and organizations interested in ecological areas.

ROLE OF THE CCEA

The CCEA promotes public understanding of and support for the establishment of a comprehensive Canadian system of ecological areas. As such, its role in plan implementation is to continue to foster public support and inter-agency communication particularly with respect to development of the comprehensive system of ecological areas. This will occur through distribution of this Framework, its review and periodic updating, maintenance of the Registry of Ecological Areas and CCEA's annual meetings. CCEA also recognizes the need to work with interested groups in exploring differences in terms and definitions and the need for a more consistent terminology. There are many additional roles for the CCEA:

* to refine the concept of representation
* to provide further guidance on describing, classifying, and monitoring representation at landscape, community and species levels
* to conduct or participate in case studies assessing representation of protected ecological areas
* to draw comparisons among different ecological classification schemes for protected areas
* to explore roles of protected ecological areas for conserving biodiversity
* to examine the role of protected ecological areas for rare, threatened and endangered species, old growth communities and other special features
* to develop standardized reporting and evaluation methods and processes for critical ecosystem types shared by many jurisdictions (e.g., prairies, wetlands)
* to offer expert opinion on the status of particular types of ecosystems at risk or endangered across Canada
* to examine the special needs posed by fragmented landscapes

Many of these tasks can be conducted in cooperation with government agencies, non-government organizations, industry or private interest groups. Many of these tasks will be addressed in the preparation of Part 2 of this Framework.

It is also a role of CCEA to encourage initiation, preparation, maintenance and implementation of regional systems plans, to comment upon these plans from the nationwide perspective and to incorporate them into updates of CCEA's Framework. CCEA has an additional responsibility to assist interested organizations in plan preparation through interpretation of this Framework. Further, CCEA has a responsibility to work with private land holders, be they individuals, groups or corporations, in both an advisory and a supportive capacity.

This Framework supports ongoing jurisdictional efforts by providing guidance and support to which they may relate their initiatives in a nationwide context. The Framework is therefore offered by CCEA to facilitate day-to-day communication between various organizations in the interest of informal coordination.

ROLE OF JURISDICTIONS

Responsibility for the establishment and stewardship of ecological areas rests with a variety of jurisdictions. Chief among these are the provincial, federal and territorial governments since, constitutionally, they are responsible for much of Canada's land, water and associated resource base. In developed parts of the country, regional governments (i.e., counties and municipalities) also share some responsibility. The rights and role of native peoples are recognized in this definition of jurisdictions. Private land holders are included as they have a role to play since land ownership conveys many stewardship responsibilities.

Numerous non-governmental organizations perform substantial, established roles in education and awareness, and advocacy. They contain useful expertise and some provide assistance in acquiring and securing areas.

It is the responsibility of each jurisdiction to prepare its own Systems Plan which should include measurable targets to be attained within specified time frames. Initially most planning areas will be bounded by provincial or territorial boundaries. In time, however, it is expected that these will give way to other boundaries of an ecosystematic nature.

Jurisdictions are also responsible for sculpting their activities to make the greatest possible contribution to the nationwide system of ecological areas. Cooperation with land holders, be they individuals, groups or corporations, is another major jurisdictional responsibility.

Establishment of ecological areas and creation of a system is not, in itself, sufficient since each area and the system must be maintained. To this end, jurisdictions must ensure that appropriate policies, regulations and guidelines are established and enforced to assure that the system effectively represents the

ecosystems found within the jurisdiction's boundaries and the maintenance of the integrity of each area.

CONCLUSIONS

There are many reasons for protecting ecological areas, ranging from utilitarian to aesthetic. One utilitarian value is scientific research. We are all dependent for our survival and standard of living upon the biological resources of our planet, and scientific research is necessary to ensure the sustainable use of these resources. Protected ecological areas provide undisturbed sites essential for this scientific research. Renewable resource management therefore benefits significantly from the existence of protected ecological areas. Only a very small subset of Canadian ecosystem types is currently protected within ecological areas, and remaining remnants of natural systems are being rapidly lost.

Our collective goal should be to achieve for Canada a nation-wide system of ecological areas developed on the basis of representation and integrity and managed to the highest standard of ecological protection. CCEA offers this document in the hope of furthering the establishment of a nation-wide system of ecological areas.

CCEA recognizes the variety of systems plans that have already been set in place by various institutions and agencies in Canada. We call upon remaining jurisdictions to develop and complete their own systems plans. Given the magnitude of the task before us, system planning must now be done within an atmosphere of urgency. Jurisdictions must set dates for completion of their systems plans and within those system plans jurisdictions must set measurable targets. While each jurisdiction must develop its own systems plan, we stress the need for a unified and integrated approach to encourage, support and emphasize coordination, collaboration and partnerships. CCEA's initiative to develop a Systems Framework for ecological areas is directed to these ends. This Framework promotes a comprehensive approach to establishing and conserving ecological areas that are representative of Canada's distinctive ecosystems, landscapes, flora and fauna.

To achieve effective representation, targets must be set. CCEA recommends a minimum acceptable short-term goal of one ecological area in each ecoregion on a national scale. The Terrestrial Ecoregions classification of Environment Canada has been used in this document as one example of a framework within which ecological areas could be established but it is the coarsest scale at which candidate ecological areas should be evaluated and established.

CCEA encourages all jurisdictions in Canada to adopt natural regions, landscape units and biotic communities as the main criteria by which representation is to be judged, with inter-jurisdictional coordination and standardization of classification at the

level of natural regions. Each province, territory and the growing number of aboriginal land-holding organizations are encouraged to determine the level of detail that is best for representation of landscape units and biotic communities.

CCEA supports the right of all jurisdictions to adopt the classification scheme most appropriate for their needs. Jurisdictions should support the continued refinement of ecosystem classification systems within each province and territory in Canada. This evolutionary process need not be a reason for postponing assessment of the degree to which Canada's ecological diversity is now represented in protected areas.

Regardless of jurisdiction or the classification framework, the fundamental basis on which ecological areas are established must be representation followed by maintenance of integrity. Furthermore, representation should initially be judged in relation to enduring features of the landscape, such as landforms, characteristic physiographic conditions and the assemblages of communities that they support. Representation should be assessed on the basis of regional surveys coupled with more intensive follow-up site-specific surveys. Jurisdictions must develop representation targets and corresponding site evaluation procedures which may be best facilitated, for example, through some form of gap analysis.

CCEA encourages the nation-wide use of the gap analysis approach. In this approach, each jurisdiction would define themes according to the level of classification detail they wish to use for definition of landscape units and biotic communities. Each theme or classification would then be assessed to determine how well it is represented in protected areas within each natural region of the jurisdiction. Many jurisdictions currently have evaluative tools to assess whether existing protected ecological areas are indeed good representations of the region. CCEA urges that these areas be assessed and reported on relative to the representation criterion. CCEA will pursue in Part 2 of its work the application of the concepts outlined in this document to one or more ecological regions for detailed analysis. We encourage jurisdictions to support that initiative.

Once regional reconnaissance surveys have been used for initial selection of candidate areas, then representation should be assessed as a separate step before criteria such as size of area, naturalness, diversity, rarity of species in the candidate sites, or threats to the candidate sites are considered in later stages of the selection and approvals process. Jurisdictions should support the concept that the kind of diversity that best serves the aims of nature conservation is a high regional diversity of **both** biotic communities and species. A community-level approach is preferred for assessment but insofar as any jurisdiction prefers to use species instead of communities for assessment, the emphasis should be on species composition rather than species richness. Given the small size of many ecological areas, we believe that it is prudent to replicate representative areas.

Legislation and flexible management arrangements are necessary to achieve the goal of maintaining the integrity of ecological areas. A management authority must prepare a management plan for the area(s) under its jurisdiction. A successful management strategy must define goals, define ecosystem boundaries and primary components, adopt an implementation strategy, and monitor effectiveness of the management strategy.

We recognize that management initiatives do not always develop through a federal, provincial or territorial legislated body, but that others, such as individuals, municipalities and industries are taking a more pro-active role. For example, an oil company played a pivotal role in the establishment of the Plateau Mountain Ecological Reserve in Alberta. That and other examples indicate the importance of incorporating external management, cooperation and support. Nonetheless, effective management requires specific regulations within the legislative framework of either a provincial or federal statute with a mechanism to deter and punish those who would damage a protected area. Monitoring and patrolling of ecological areas is essential to effective management and enforcement and require adequate budgets to ensure regular patrols and trained staff.

Management policies and regulations must be flexible yet ensure the protection of rare species and habitats and allow for scientific research and monitoring. The general public also must be part of the management strategy to secure a constituency of support.

CCEA envisages expanding its role to provide a forum for scientific and technical issues, for example, in refining the concepts of "representation" and "integrity" with reference to characteristic landscapes for each ecoregion, for more detailed refinements in terms of biotic features, and examining the role of protected areas in dealing with special features.

Jurisdictions should endorse the following priorities: (1) to designate the least disturbed sites in ecosystems that are not yet represented with ecological areas; and (2) to protect representative sites in ecosystems which have been modified by human activity but which can recover to conditions similar to those before disturbance. Furthermore, jurisdictions should view representation of major biophysical features as an underlying principle or goal which the selection process aims to satisfy, instead of using representation as just one of several different criteria by which nominated ecological areas are selected.

The urgency of building the nation-wide system of ecological areas is such that progress must be made now and not be delayed until all complexities are clarified. To this end, jurisdictions are urged to designate new ecological areas as quickly as possible bearing in mind the direction and guidance to be found in the Framework. We stress that at least one representative ecological area should be established in

every ecoregion in Canada. However, the first priority of Canadians must be to designate pristine or virtually undisturbed sites in ecosystems that are not yet represented with ecological areas, as well as in highly developed regions experiencing accelerating losses of natural areas.

REFERENCES

Burnett, J.A., C.T. Dauphine Jr., S.H. McCrindle, and T. Mosquin. 1989. On the Brink: Endangered Species in Canada. Western Producer Prairie Books, Saskatoon, Saskatchewan.

Canadian Council on Ecological Areaş. 1984. Guidelines on Management and Research in Ecological Areas. CCEA Occasional Paper No. 1.

Canadian Council on Ecological Areas. 1989. Guidelines for the Selection of Protected Ecological Areas. Management and Administration Committee. CCEA Occasional Paper No. 5.

Canadian Environmental Advisory Council. 1991. A Protected Areas Vision for Canada. Environment Canada, Ottawa.

Eidsvik, H. (Chairman). 1990. A Framework for the Classification of Terrestrial and Marine Protected Areas - Objectives, Criteria and Categories of Protected Areas. A report based on the work of the Commission on National Parks and Protected Areas (CNPPA) submitted to the CNPPA meeting in Perth, Australia November 1990. International Union for the Conservation of Nature (IUCN), Gland, Switzerland.

[4]Graham, R. (editor). 1990. Marine Ecological Areas in Canada. Perspectives of the Canadian Council on Ecological Areas Task Force on Marine Protected Areas. CCEA Occasional Paper No. 9.

Gray, P. and C. Rubec. 1989. National Registry of Ecological Areas in Canada. Secretariat, Canada Council on Ecological Areas, Environment Canada, Ottawa, Ontario K1A 0H3

Hummel, M. (editor). 1989. Endangered Spaces: The Future for Canada's Wilderness. Key Porter Books, Toronto, Ontario.

IUCN/UNEP/WWF. 1991. Caring for the Earth. A Strategy for Sustainable Living. Gland, Switzerland.

Morrison, K. 1989. Alberta Recreation and Park's conservation - outdoor recreation system: an evaluation of the protection program objective - biophysical resources component. Alberta Recreation and Parks, Edmonton, Alberta.

---

[4] This report, commissioned by CCEA, is an associated document to "Framework for Developing a Nation-Wide System of Ecological Areas".

[5]Peterson, E.B., and N.M. Peterson. 1991. A first approximation of principles and criteria to make Canada's protected areas systems representative of the nation's ecological diversity. Western Ecological Services Ltd., # 2-2563 Penrhyn Street, Victoria, B.C. V8N 1G2. Report prepared for the Canadian Council on Ecological Areas.

Swanson, F.J., J.K. Kratz, N. Caine, and R.G. Woodmansee. 1988. Landform effects on ecosystem patterns and processes. BioScience 38:92-98.

Thomasson, R.D., and J.M. Shay. 1984. Ecological Area Decision - Making Processes and Case Studies. CCEA Occasional Paper No. 2.

Wiken, E.B., C.D.A. Rubec, and G.R. Ironside. (in preparation). Terrestrial Ecoregions of Canada. Provisional Map. Ecological Land Classification Series. Environment Canada, Ottawa.

World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press, Oxford and New York.

---

[5] This report, commissioned by CCEA, is an associated document to "Framework for Developing a Nation-Wide System of Ecological Areas".

GLOSSARY

Biodiversity: Used in the context of "preserving biodiversity", which is the preservation of the diversity of species of living organisms in a given area (i.e., ecological reserve, province or planet). Living organisms include plants, animals (vertebrates and invertebrates), fungi and microbes. The genetic diversity expressed by each organism (species) is also included in biodiversity.

Ecological Areas: regulated ecological reserves and other areas established to preserve in perpetuity, examples of species, habitats, landscape features, biotic communities and ecological processes within ecosystems for the retention of natural diversity, environmental monitoring, appreciation, study and education. Such areas have: (1) a legal status; (2) a designated management authority charged with implementing a plan to preserve the ecological integrity of the area, and; (3) a legal prohibition on all activities which could jeopardize the ecological integrity of the area.

Ecoregion: A unit of the earth's surface characterized by a distinctive assemblage of biophysical characteristics which are reflective of regional ecological responses to physiography, climate and hydrology.

Integrity: Defined as the capability of an ecological area of supporting and maintaining processes and assemblages of organisms (communities) that have a composition and functional organization comparable to that of similar landscape units of the region. Synonyms include biological integrity; ecological integrity; dictionary synonyms include completeness, wholeness, entirety, soundness.

Management Plan: A plan based on the best ecological information available which prescribes management strategies appropriate for the maintenance of the integrity of an ecological area.

Prohibited Activities: Activities that interfere with the natural features and processes of an ecological area or disturb (or potentially disturb) its integrity.

Represent, Representative, Representation: "a fair sample of", "something characteristic of or serving to exemplify". Relative to ecological areas, representative areas would contain the majority of all climatic, edaphic and biological site conditions for one or more characteristic landscape units of an ecoregion and contain these in the same or similar proportions as they would be found under natural conditions in the ecoregion.

Systems Plan: A plan to achieve a nation-wide system of ecological areas representative of the landscape diversity of Canada.

APPENDIX A
INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE (IUCN) CATEGORIES I-IV OF PROTECTED AREAS[6]

I. **Strict Nature Reserve.** To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state.

II. **National Park.** To protect outstanding natural and scenic areas of national or international significance for scientific, educational, and recreational use. These are relatively large natural areas not materially altered by human activity where extractive resource uses are not allowed.

III. **Natural Monument/Natural Landmark.** To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focused on protection of specific features.

IV. **Managed Nature Reserve/Wildlife Sanctuary.** To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these may require specific human manipulation for their perpetuation. Controlled harvesting of some resources can be permitted.

---

[6] Source: IUCN/UNEP/WWF. (1991). *Caring for the Earth. A Strategy for Sustainable Living*. Gland, Switzerland. As of the writing of this document, revisions to these categories were under review but not yet approved by the IUCN. The proposed revised categories are: Category I - Scientific Reserves and Wilderness Areas; Category II - National Parks and Equivalent Reserves; Category III - Natural Monuments; Category IV: Habitat and Wildlife Management Areas; Category V - Protected Land/Sea Scapes (Ecosystem Conservation Areas). Detailed descriptions of these proposed categories are found in Eidsvik (1990). As revisions to the categories are adopted, the categories in the NACDB and CCEA Registry will be amended.

LIST OF CANADIAN COUNCIL ON ECOLOGICAL AREAS PUBLICATIONS *

National Registry of Ecological Areas. P.A. Gray, and C.D.A. Rubec, 1989. CCEA. 300 p.

The Status of Ecological Reserves in Canada. P.M. Tachereau, April 1985. CCEA. 120 p.

Jurisdictional Reports to CCEA. For the Period April 1, 1989 to March 31, 1990. T. J. Beechey, coordinator, September 1990. CCEA.

OCCASIONAL PAPERS

Occasional Paper #1. **Guidelines on Management and Research in Ecological Areas.** Management Committee, 1984. CCEA. 12 p.

Occasional Paper #2 **Ecological Area Decision-Making Process and Case Studies.** R. D. Thomasson and J.M. Shay, 1984. CCEA. 12 p.

Occasional Paper #3 **Guidelines for Annual Jurisdictional Reports to Council.** First Edition. T. J. Beechey, 1989. CCEA. 12p.

Occasional Paper #4 **Sustainable Development, Scientific Research and Ecological Areas.** First Edition. P. A. Keddy, 1989. CCEA. 15 p.

Occasional Paper #5 **Guidelines for the Selection of Protected Ecological Areas.** T.J. Beechey, coordinator, 1989. CCEA. 14 p.

Occasional Paper #6 **Neglecting the Protected.** Yorke Edwards, 1991. CCEA. 8 p.

Occasional Paper #7 **Valuing Public and Scientific Involvement with Ecological Areas.** George Francis, 1989. CCEA. 6 p.

Occasional Paper #8 N/A

Occasional Paper #9 **Marine Ecological Areas in Canada.** Robert Graham, editor, 1990. CCEA. 194 p.

Occasional Paper #10 **CCEA Annual Meeting Ottawa 1990.** Selected Papers and Workshop Results. J.R. Reid, editor, 1990. 107 p.

Occasional Paper #11 **A First Approximation of Principles and Criteria to Make Canada's Protected Area Systems Representative of the Nation's Ecological Diversity.** Everett B. Peterson *et al*, 1991. 72 p.

NEWS LETTERS AND BIENNIUM REPORTS

1) **Report of the Biennium 1982-84.** CCEA.
2) **Report of the Biennium 1985-87.** CCEA. 8 p.
3) **Report of the Biennium 1988-90.** CCEA. 8 p.
4) **News Letter No. 1.** February 1987. CCEA. 10 p.
5) **News Letter No. 2.** December 1987. CCEA. 12 p.
6) **News Letter No. 3.** June 1988. CCEA. 10 p.
7) **News Letter No. 4.** Dec 1988. CCEA. (out of print)
8) **News Letter No. 5.** April 1990. CCEA. 9 p.
9) **News Letter No. 6.** July 1990. CCEA. 8 p.
10) **News Letter No. 7.** Dec. 1991. CCEA. 8 p.

* Publications are available in the language submitted by the author.

PUBLICATIONS ARE AVAILABLE FROM:

CCEA Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, Ontario
K1A 0H3