

Protected Areas Strategy for New Brunswick – a science-based approach

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Abstract

The protected areas management strategy developed for the province of New Brunswick is a multiple-analysis GIS model designed to integrate enduring ecosystem structural and functional characteristics across a spatial landscape. The process involves understanding regional landscapes as ecological functional systems and using this knowledge to quantify and qualify the percentage of biological representation across the landscape.

One of the primary aims of the new protected watershed areas will be to provide habitat blocks in which ecological functions are representative of the eco-regions of the Acadian Forest. In order to compensate for the known and predicated effects of edge and isolation effects, the designated protected areas will vary in size from 20,000 to 25, 000 hectares and be representative of the major eco-region within the eco-district.

The management goal of the Protected Areas Strategy for the Province of New Brunswick is not to maximize populations of any individual species. It is to create protected areas that will ensure that the dynamic ecological processes to which mature forest species are adapted, can continue to evolve in collaboration with the forest management regimes within the Acadian Forest. The goals of the protected areas strategy will reflect the evolving natural conditions that have evolved across the landscape as a result of human and natural evolution rather than be representative samples of exact, static recreation of pre-settlement conditions.

I Protected areas

I.1 Introduction

Protected areas have been part of societies' choices about land use

since early human civilization. Natural areas were set aside in Sri Lanka for religious reasons as early as 200 BC. The first national park was declared in Yellowstone in 1872, followed in Canada by Banff National

Park in 1885. Today, virtually every country and jurisdiction in the world has protected areas. Protected areas are best known as national and provincial parks, but they also include a number of other categories such as scientific reserves and managed landscapes. Because the idea of protected areas has such a universal appeal and application, they have been called the most common human response to environmental concerns.

1.2 Defining protected areas

Protected areas are lands set aside to protect the province's diverse natural and cultural heritage. They are dedicated to present and future generations for a spectrum of compatible uses: as scientific benchmarks, as nature preserves, as places for education, appreciation and inspiration, and as places to enjoy certain recreational activities.

The Protected Areas Strategy will respect the treaty rights and Aboriginal rights and interests that exist in New Brunswick for land and resource use. Sustainance use by Aboriginal peoples will be permitted in protected areas, subject to conservation objectives.

1.3 Protected areas: a multiplicity of values

Protected areas are established for many reasons. They serve to conserve biodiversity, which simply refers to genes, species, populations and ecological processes. The world

is currently losing biodiversity from human activity at unprecedented rates. Protected areas are part of a larger strategy to stop these losses. Protected areas are part of a strategy that uses a pre-cautionary principle of biodiversity conservation. They are a safeguard given our lack of understanding of the effects of resource extraction on the environment.

In addition to acting as ecological reserves for biodiversity, protected areas have many other important values. They provide ecological services such as clean fresh water to drink and a supply of oxygen to breathe. They provide refuge for flora and fauna and for species to be perpetuated. They serve as ecological benchmarks from which to monitor change and to evaluate the long-term environmental implications of resource management initiatives.

Protected areas can have an important socio-economic role by serving as places for people to get away from the hectic pace of modern life, a place to be surrounded by wilderness and experience and appreciate human connections with nature. Protected areas can serve as places to hike and watch wildlife.

From a very practical viewpoint, protected areas can have an extremely positive economic value. They are focal points for tourism, often bringing in more revenue per unit of land than other extractive activities. A 1995 study in British Columbia showed that for every dollar spent on parks, there were 9 dollars in visitor expenditures. Provincial parks contribute 400 million dollars to the provincial economy each year

and provide 9300 direct and indirect jobs.

Worldwide, protected areas typically comprise less than 6.9% of the land-base of a country. This means that protected areas do not cover the majority of area and can not be expected to fulfil a mandate of protection by themselves. They must be part of a more comprehensive land use strategy. In the last two decades there has been a considerable amount of research on the role and value of all protected areas. There have been studies done on park size, what their shape should be, and how close they should be to each other. While some of these questions are still under debate and study, many issues have become clear.

Research has demonstrated that protected areas will be successful only when they are:

1. of minimum sufficient size and:
2. are integrated into the surrounding landscape and:
3. connected at a regional level to allow some movement of individuals (and thus genes) between the protected areas.

It is certain that protected areas must be of a minimum critical size to be effective. To be successful, a protected area must be able to protect whole populations (called a minimum viable population) as well accommodate ecological processes (such as fire or flooding). It is also certain that each protected area must not be managed like an island of wilderness in a sea of intensive land-use. Regardless of the size of a protected area, there are always border zone issues. Large-home-range animals

like bears cross-park boundaries, as do rivers and air-borne pollutants.

From a regional perspective, it is important that there is gene flow between populations so that inbreeding does not occur. This requires land use planning at an interregional level that allows movement of species across the landscape.

1.4 The vision for a system of protected areas within New Brunswick

Protected areas are a major component of New Brunswick's commitment to protecting and restoring the quality and integrity of the environment, and to securing a sound and prosperous economy for present and future generations. New Brunswick will designate and manage a system of protected areas to protect a diversity of biological, natural and cultural heritage resources.

By the year 2005, New Brunswick will have a comprehensive network of protected areas dedicated to present and future generations. As places where natural processes are allowed to occur with minimal human interference, these protected areas will form the cornerstone of a sustainable environment for New Brunswick. The existing inventory of protected areas will be expanded through a cooperative effort from all levels of government, non-government organizations, the private sector and individual citizens of the province.

The protected areas system will include selected areas that represent

the ecological diversity of the province's seven ecoregions, as well as highlight the natural, cultural and recreational features that are rare, special or outstanding. It will provide a diverse range of, research and heritage appreciation opportunities, all of which are compatible with natural and cultural values. As well, the system will include places where Aboriginal peoples can continue their traditional relationship with the land.

Use and management decisions will be guided by the principle that the protection of ecological viability and integrity is primary importance within a land management strategy.

1.5 Benefits of protected areas

Parks and protected areas offer a wide variety of benefits, ranging from the environmental and educational to the social and economic. Here are just a few:

- Protected areas maintain essential ecological processes and preserve the genetic diversity of species.
- They provide “environmental services” such as producing oxygen, creating and protecting soils, absorbing and breaking down pollutants, and improving local and global climates.
- They act as natural laboratories in which to gather and assess information about how ecosystems work and how they respond to change.
- They serve as benchmarks against which to measure changes caused by humans and nature.

- They build public support for habitat protection.
- They can help to diversify local and regional economies through nature tourism and sustainable use of parks and wilderness areas.
- They preserve biodiversity for potential future development of economic products such as plants for medicinal uses.
- They provide places of spiritual renewal and inspiration.

1.6 Defining how much to protect

The provincial government is committed to developing a protected areas network that will protect a representative sample of our biodiversity. However, in order to gain a proper understanding of the New Brunswick's protected area strategy it must be evaluated within the context of the Acadian Bioregion

Some ecoregions within the province may end up with differing level of representivity of their biodiversity, due to over-riding provincial objectives or existing land use commitments. In some areas, for example, the opportunity still exists to protect large areas with low fragmentation. In other areas, achieving satisfactory representation within areas of low fragmentation may not be possible. Flexibility and integration with surrounding political jurisdictions is therefore necessary in the development and application of a protected areas strategy.

2 The Current Status of Resource Conservation Initiatives in NB

2.1 Overview of the land resources in NB

New Brunswick is 7,108,309 hectares in size. 3,191,827 ha of this amount is Crown Land while 3,916,482 ha is privately owned.

This land base supports a variety of uses, the principal ones being agriculture, forestry, mining, residential, industrial, institutional, etc. A

growing proportion of New Brunswick is also subject to numerous conservation related management programs and initiatives. The total protected area of NB is 755,894 ha (Table 1). Some of the major protection initiatives which are presently integrated within New Brunswick's conservation initiatives are presented in the chapters 2.2-2.16.

2.2 Wetlands

Wetlands are critical habitat for a variety of aquatic plants and animals and especially for migratory birds. By definition, wetlands include fea-

Table 1. Existing New Brunswick Protected Areas by IUCN Classification¹ (number and area in hectares for each class).

IUCN CLASS	PUBLIC (HA)	PRIVATE	TOTAL NB
1A	1 210 (0.04)	0 (0)	1 210 (0.02)
1B	7 907 (0.2)	0	7 909 (0.1)
2	68 263 (2.1)	272 (.007)	68 535 (1.0)
3	18 379 (0.6)	44 (.001)	18 423 (0.3)
4	633 356 (19.8)	16 254 (0.4)	649 610 (9.1)
5	1 052 (0.03)	142 (0.004)	1 194 (0.02)
6	9 105 (0.3)	0	9 105 (0.1)
Total	739 272 ha	16 712 ha	755 984 ha
CLASS 1-3	95 761 (3.0)	316 (0.008)	96 077 (1.4)

¹ see http://www.unep.wcmc.org/protected_areas/categories

The average size of provincial parks and ecological reserves is less than 100 ha (1 km²).

Only classes 1-3 are primarily concerned with conservation. Class 4-7 IUCN sites address conservation as a secondary objective.

tures such as ponds, lakes, swamps, bogs, coastal marshes, inland marshes, floodplains and other related aquatic environments.

While a great many wetlands of varying descriptions exist throughout NB, numerous initiatives have been undertaken over the years to conserve, enhance and restore important wetlands as part of multi-jurisdictional long range waterfowl and shorebird management plans. As of 1997, 20,622 ha of wetland were being managed as habitats for a variety of species. Approximately 7,747 ha of this amount involves Crown Land while 12,875 ha are located on freehold.

The Canadian Wildlife Service, Ducks Unlimited Canada, DNRE, and Eastern Habitat Joint Venture are a few agencies involved with the conservation of wetlands. These and other wetland enhancement initiatives are expected to continue, as opportunities become available.

2.3 Ecological Reserves

Ecological reserves are created to protect rare and or endangered species and ecosystems; critical floral and faunal habitats of limited extent; outstanding assemblages of flora and fauna; representative examples of natural ecosystems; distinctive natural features of scientific or educational value; and, modified sites which would meet the aforementioned criteria through restoration. Public access to ecological reserves is generally not encouraged and all sites are subject to a range of specific land use restrictions so as to

preserve their natural integrity in perpetuity.

Fifteen ecological reserves encompassing 1212 ha existed in NB as of 1997. These average in size from 50 to 200 ha (although a few are larger) and include such features as a red oak stand, a peat bog, a coastal dune system, a steep coastal forested ravine, waterfalls, a remnant hardwood stand, a series of shallow lakes, a great blue heron nesting area and an osprey nesting area. Other candidate sites are being investigated on an ongoing basis.

2.4 Conservation Areas

Conservation Areas are similar to ecological reserves and are limited to Crown Land. These areas are subject to the same land use restrictions which apply to ecological reserves but allow for some traditional recreation activities, subject to site specific management plans (e.g. hunting and fishing, etc.), which are not permitted in ecological reserves. Five conservation areas totaling 7909 ha were proclaimed in 1996. It is anticipated that other sites will be established in the coming years.

2.5 Deer Wintering Areas

Deer Wintering Areas are forested landscapes used by deer during periods of deep snow. Deer generally use the same locations annually when snow depths necessitate yarding. With that, Crown Land and some industrial freehold wildlife management practices designate yarding

sites as deer wintering areas. This designation ensures that disturbances within these locations (e.g. forest harvesting, mining, etc.) are minimized. As of 1997, 268, 500 ha of Crown Land in over 900 sites were being managed as deer wintering areas. Although an acreage figure is not available at this time, some deer wintering areas located on industrial freehold are subject to limited harvesting.

2.6 Mature Coniferous Forest Habitat

Crown Land wildlife management practices call for mature coniferous-forested blocks to be set aside on a long-term rotational basis as habitat for a variety of birds and mammals. This initiative is being undertaken in recognition that certain wildlife requires this type of vegetative cover and to ensure that NB continues to have healthy populations of native wildlife. As of 1997, approximately 274,000 ha on Crown Land were being managed for this purpose.

New mature coniferous stands are continuously being evaluated and “set aside” as forest stands age.

2.7 Watercourse Buffer Zones

Watercourse buffers are vegetative strips (trees, bushes, etc.) maintained along watercourses to protect their environmental integrity. This applies to brooks, streams, rivers, lakes, ponds, etc. and is a requirement of the Province’s Clean Water Act.

Watercourse buffers are necessary in that many land use activities (e.g. farming, forestry, construction, etc.), have the potential to adversely affect many aquatic ecosystems. As of 1997, approximately 247,800 ha of Crown Land were being managed for this purpose. Freehold land subject to watercourse buffers is estimated at 36,700 ha.

Much wider watercourse buffers are usually maintained on Crown Land than is required by legislation since these areas also serve as important riparian zones.

2.8 Wildlife Reserves

Wildlife reserves are essentially game refuges. Hunting and other disturbances to wildlife are prohibited on these sites (approximately 12,636 ha). The majority of New Brunswick’s eight reserves are managed such that disturbances to ecological processes are minimized.

Given the array of other initiatives being undertaken to protect wildlife in New Brunswick, no plans exist at this point to establish additional wildlife reserves.

2.9 Migratory Bird Sanctuaries

New Brunswick is located along the eastern North American flyway and is an important staging/resting area for a variety of waterfowl and shorebirds during their annual migrations. Among the many initiatives undertaken to provide and protect habitat for migratory birds passing

through NB has been the establishment of three sanctuaries. Totalling 275 ha, these are managed by the Canadian Wildlife Service. Hunting is prohibited within these areas and access is limited. Migratory bird sanctuaries are established under the Migratory Birds Convention Act.

2.10 Ramsar Sites

Ramsar sites are designations given to wetlands of international importance in accordance with the provisions of the Ramsar Convention. This designation is designed to promote the conservation of such areas.

Wherein Ramsar sites contain exceptional habitat for migratory shorebird populations, management guidelines call for the ecological character of these areas to be preserved and maintained.

Three such sites, which total over 17,484 ha, have been designated in New Brunswick.

2.11 Nature Preserves

Eight nature preserves totaling 317 ha are located throughout the Province and are managed by the Nature Trust of New Brunswick. These sites are of unique ecological/bio-physical value and are protected in perpetuity. Natural features found at these sites include a fen and bog which support a variety of rare orchids; a Furbish lousewort colony; several Bay of Fundy islands; a sea bird sanctuary; a marsh - lowland forest complex; a Gray Tree Frog colony;

a coastal salt marsh and a Saint John River floodplain island.

It is anticipated that additional nature preserves will be established in the future.

2.12 Provincial Parks

Provincial Parks are unique landscapes which are managed for a variety of purposes including the protection of natural areas recognized as having significant outdoor recreation potential; the conservation of distinctive and unique natural landscapes and viewsheds; and the provision of a diversity of outdoor recreational experiences to New Brunswickers. As of 1997, the Provincial Parks system encompassed about 23,000 ha.

2.13 National Parks

National Parks are landscapes established for public recreation, resource conservation and education and are usually characterized by natural features of national and regional significance (e.g. landforms, flora, fauna, etc.). The two national parks located within N.B. total over 45,500 ha in size. National parks allow for a range of activities that compliment the natural resources for which they were intended to protect.

2.14 Stewardship Agreements

Stewardship Agreements are partnerships entered into between a private/corporate landowner and a conser-

vation organization (government and or non-Government) regarding the protection of a unique / endangered natural resources (e.g. wildlife populations and habitat / rare and endangered species and habitat, etc.). The main objective of these agreements is to ensure that the environmental integrity of each site is protected and or enhanced.

Resources managed under these agreements include two coastal salt marsh complexes, endangered species habitat, and a migratory bird staging area. As of 1997, approximately 900 ha of land were subject to such agreements.

2.15 Canadian Heritage Rivers

The Canadian Heritage Rivers Program is administered by Parks Canada and was created to conserve the natural, historical and recreational values of truly outstanding Canadian rivers. Approximately 185 km of the St. Croix River was designated under this program in 1991 and a 55 km section of the Upper Restigouche River has been nominated. A section of the Miramichi River is presently being considered for nomination.

2.16 Other Protected Areas

Numerous other sites over and above those previously described are also being managed with specific conservation objectives in mind.

Several of these are managed by Municipalities while some are owned

and or managed by NGO conservation agencies (e.g. Nature Conservancy of Canada) and industrial freehold interests. The possibilities of establishing other special management areas are presently being identified at the industrial freehold level.

3 Process for Identifying and Evaluating Potential Candidate Sites

3.1 Guiding principles

The major objective of the Protected Areas Strategy was to preserve relatively large undeveloped areas that are typical of the seven- (7) ecoregions found in New Brunswick. To achieve the goal of protecting representative examples of the province's seven ecoregions, the following guiding principles were developed:

- The strategy should be based on the best available scientific information, so that protected areas will firstly contribute to protecting New Brunswick's native plants and animals and the habitats which they need to survive.
- The strategy should have input from New Brunswickers, in its development and implementation.
- A system of protected areas should enable us to understand the ecological interactions within each ecoregion in New Brunswick.

- Within the need for nature conservation, a system of protected areas should contribute to the economic well being of present and future generations of New Brunswickers.
- The borders of New Brunswick are political and not ecological. Thus some types of conservation planning must occur in concert with our neighbors.

3.2 A three scaled approach

3.2.1 Definition of scales

Ecosystems are composed of many interacting scales. For example, climate patterns are global, large watersheds are regional, and the home range of a Pileated Woodpecker is local. Disturbance patterns that form the ecosystems are also variable in scale. It is generally believed that the enduring features and the scale of disturbances, their intensity, and frequency in an area, will create a landscape in which the plants and animals are adapted to, and dependent upon. The landscape is a mosaic of different conditions in which some species are generalists and can live in a wide variety of areas; others are specialized to unique areas, and as such, are found only in a few places. Thus, considerations of protected areas must recognize the inherent multi-scaled nature of ecosystems.

Representativity is an important criterion for selection of protected area, because climate, topographic relief, and soils, the components of representativity, are important determinants of the size and composition

of vegetation patches, and at certain small-to-medium scales, of wildlife habitat as well. Therefore, representativity in a system of protected area ensures the protection of broad classes of ecosystems and the genetic diversity of common species. However, representative areas cannot be expected to capture important features occurring at very fine or very coarse scales. For example, sites of outstanding value containing rare species or features can exist outside representative areas, but still must be addressed in any comprehensive program of conservation. At the opposite extreme of scale, planning within a regional framework ensures that landscape connectivity for wide-ranging species is maintained, and that minimum representation is achieved for all ecoregions.

Because of these scale issues, we have adopted three-scaled approach to a protected area strategy.

3.2.2 The coarse scale - large representative protected areas

We propose that a system of relatively large protected areas (20-25000 hectares) be established to be representative of each of the ecoregions found in New Brunswick. Ecoregions are defined by a combination of the National Ecological Framework for Canada (Minister of Supply and Services, 1996), the Ecological Units of the Eastern United States (USDA Forest Service 1995) and the Draft New Brunswick Ecoregions Framework. Using these data sources, there are 7 ecoregions occurring in New Brunswick of which 6 are shared in part with Nova

Scotia, Quebec and Maine. The goal of these large representative protected areas is that they be protected to IUCN Class 2 standards as provincial parks.

3.2.3 The fine scale – unique features and species

Large representative areas can never protect all the diversity of species and landforms found within a given ecoregion. However, in order to have a comprehensive protected areas strategy, we are proposing that a fine scale approach be developed to compliment the large representative areas. This would involve a detailed analysis of the species, plant communities and landforms found within the seven ecoregions.

Comparisons can then be made of how well each of these features is protected within the large representative area. Such an analysis is often called a “gap analysis”, simply because it will identify gaps in the conservation program. We propose that such a gap analysis be conducted for each region and a resulting set of finer scale conservation priorities be established. The conservation priorities can then be addressed by a range of public and private programs, such as the New Brunswick Nature Trust, the Nature Conservancy of Canada, and the New Brunswick Ecological Reserves Program. The fine filter assessment of each ecoregion was not included in this initial review. Instead, we propose to develop guidelines for the gap analysis and identify a time frame for its completion.

3.2.4 The large scale - interregional planning for populations and species movements

Within the Atlantic Maritime Ecozone (NB Ecozones are composed of many ecoregions. The Acadian Ecozone is composed of the provinces of New Brunswick, Nova Scotia and Prince Edward Island, Gaspé region of Québec, and the State of Maine. Each of these jurisdictions has separate conservation programs. The working group proposes that there are many opportunities and efficiencies for these jurisdictions to work together. We propose to approach these jurisdictions to explore the opportunities to work in collaboration. Initially we see several opportunities.

First, there is the opportunity to maximize the level of representativity within ecoregions. This can be done when siting large representative protected areas as well as by cooperating on fine-scale gap analysis, where ecoregions cross provincial boundaries. Perhaps more importantly, at this large scale, is the opportunity to plan for interregional movement of species and genes (by individuals dispersing) on the landscape. For example, the Isthmus of Chignecto connects New Brunswick and Nova Scotia. There is a real possibility that gene flow could be cut off across this geographic constriction. By proper regional land use planning, the role of this area as a functional wildlife corridor can be maintained into the future. Such regional corridors are not parks. Rather they are areas where people live and work. Proper planning for protected

areas must allow individual parks to be functionally linked which simply means allowing some movement of individuals. Animals like lynx and black bear will easily move several hundred kilometers in a single season if the landscape is suitable. The working group does not propose to plan for these regional connections, but rather to establish a set of principles and templates for inter-jurisdictional co-operation.

In addition to the 3 pronged approach described above, we are proposing that the following elements should be developed as part of a comprehensive Protected Areas Strategy for New Brunswick.

- Review of existing legislation and development of new legislation to support the protected areas strategy;
- The development of a land use management strategy that would be integrated to concept of protected areas;
- The development of an adaptive management strategy;

3.3 How Were Large Protected Areas Selected?

3.3.1 Selection process

We adopted the following process for the selection for large representative areas:

- 1) The initial goal was to have at least one large protected area (20-2500 ha in size) to be representative of each of the 7 ecoregions of New Brunswick. Some of these ecoregions are already partially represented by existing large

parks. We assessed the degree of representation of each ecoregion that was possible in 20,000 to 25,000 contiguous blocks of land. Degree of representation were determined by assessing the diversity of landscape relief classes, and the diversity of geological/soil types relative to the total diversity of these features found in the ecoregion. This was a GIS exercise where representation was assessed across the entire ecoregion in a systematic process without regard for land ownership patterns or disturbance history. A ranked list of areas of high representivity was generated for each ecoregion.

- 2) Road density (km of roads per forested square km) is a convenient index of landscape disturbance in forested areas. We assessed road density for the province for each 1:12,500 scale forest mapsheet. It was deemed desirable, but not essential, for area in representative protected areas to be relatively undisturbed by clear-cutting.
- 3) Representativity data and disturbance data were merged, and a number of potential representative protected area blocks were identified for each ecoregion. After selection of the potential large blocks, we searched for blocks that had relatively low densities of plantations, recent harvest, abandoned mines, etc.
- 4) Blocks of land that remain screened in after step three were then subjected to a conflict analysis, looking at such things as a lease

conflicts (sugar bush, camps), existing forestry operations, etc.

- 5) Other considerations were also evaluated for each proposed site, these included the maturity of forests, recreational or tourism opportunities, and outstanding scenic beauty.

3.3.2 Representativity

A system of protected areas designed at an ecoregion scale can not be large enough to represent all of the variation of ecodistricts within it. As many ecodistricts should be represented by the protected area as is feasible.

Protected areas will never be large enough to encompass the full range of ecological processes. However, integration of the protected area into the surrounding landscape will increase the functional role of protected areas connections between the protected area and natural areas outside will foster movement of species and processes, increase available habitat, and promote co-operation between stakeholders.

3.3.3 Road Density

The density of roads is a good indicator of the extent of resource use in an area. A high density of roads is associated with changes in the landscape and wildlife through increased amounts of forest management, hunting, trapping and fishing, and the expansion of invasive species. By contrast, roadless areas are associated with concepts of wilderness.

3.3.4 Land in Plantation

The intensity of forest management activities varies across the landscape. Plantations typically are artificial

environments with lower species diversity, often on areas that would have had produced a different forest community. Areas without plantations are a partial indicator of more natural conditions.

3.3.5 Forest Maturity

All forests of the province have been influenced by forestry or agricultural activities. However, some areas of the province are more recently impacted and others retain an older forest community. New protected areas do not have to be “pristine” and areas can be restored. Maturity is a partial indicator that could be used to select between similar candidate sites.

3.3.6 Size of Protected Areas

There are several ways to determine the size of a protected area. The size of a protected can be based on the scale of the ecological processes that have shaped the landscape. For example, in a fire-prone landscape, the area of the park should allow some level of wildfire disturbance without the whole park burning at once. Such an area is termed the minimum disturbance area. A review in New Brunswick suggested that protected areas be a minimum of 16,000 ha in some parts of the province where small fires are frequent (Methven and Forbes 1995). A second way to determine park size is to calculate the area required to conserve a viable population of large area-demanding species. The size of areas needed to conserve a heavily trapped population of Fisher may be over 50,000 ha, over 13,000 ha for Marten, and over 20,000 ha for Pileated Wood-

pecker (Methven and Forbes 1995). A third method of determining park size is to use species-area curves. Simply put the larger the area the more species it will contain. However, there are some logical break points. Gurd, Nudds and Rivard (1966 in press) have calculated the minimum area required to contain all mammal species in Atlantic Canada. The absolute minimum area, defined by the lower confidence interval of the species area curve, is 25000 ha. We have put these figures together to recommend a minimum size of large representative areas of 20-25000 ha.

4 Methodology used in identifying candidate sites

4.1 Introduction

A number of biological and historical factors, have influenced the present-day pattern of distribution of plants and animals over the landscape of New Brunswick. Ecosystem character, including climate, topography, and soil type, plays a strong role in determining the distribution of plants and animals. Human influences on the distribution of plants and animals in our region have been strong since the arrival of European colonists.

In general, patterns of diversity of flora and fauna in New Brunswick are related to (1) the pattern of re-advance of plants and animals into

our area following the retreat of glaciers 10,000 years ago (2) habitat variation, defined as climate, landform, and soil variation, and (3) land conversions from natural vegetation cover due to human activities in recent (<200 years BP) time. This report does not address historical factors related to number 1 above. Patterns of diversity related to post-glacial history must be addressed through a *fine-filter* assessment of the type done by The Nature Conservancy and natural history museums, for example. This report addresses climate, landform, and soil variation, with an eye on disturbance, as surrogates for large portions of ecosystem and species diversity.

The *Premier's Round Table on Environment and Economy* recommended the establishment of a system of protected areas "representing the important natural features of all of the province's bio-geographic regions". The reason is to protect biodiversity and ecosystem processes in the regions, and to ultimately better understand human effects on biodiversity and the environment.

In our analysis, we identify candidate-protected areas in the range of approximately 20,000 to 25,000 hectares for the ecoregions of New Brunswick. Candidate areas were rated according to their climatic, landform, and soil variation, and to their degree of disturbance, while taking into account the contribution of the three existing large New Brunswick protected areas.

4.2 Objective

To identify the most suitable sites in each ecoregion of New Brunswick for consideration as representative protected areas from the standpoint of ecoregion representivity and wilderness value.

4.3 Methods

We have performed an initial assessment of the entire land area of New Brunswick to identify areas within the ecoregions of NB that capture maximum landform and soil diversity (representivity) in areas of low disturbance (wilderness value). We have attempted to identify areas within which final boundaries of roughly 25,000-hectare protected areas can be outlined.

4.4 Sampling Protocol

New Brunswick's geographic information data on the forests, topography, and soils is organized into roughly 1800 - 4200 hectare data packets or "mapsheets" arranged in a map grid. This data structure provided flexibility to organize the data into multiple configurations of roughly configured potential protected areas by grouping the small maps together into "sampling quadrats".

The sampling quadrat used was composed of a maximum of 12 mapsheets together comprising nearly 50,000 hectares, configured 3 mapsheet columns by 4 rows. Each mapsheet theoretically forms the

upper-left corner of a potential quadrat that is accepted for further evaluation if its extent inside the ecoregion was at least 15,000 hectares; otherwise it was rejected. In total, 2015 quadrats were evaluated in all ecoregions.

4.5 Representativity

While landforms were not identified in strict accordance with standard CCEA methodology (i.e. the **landscape matrix** *sensu* Iacobelli *et al.* (undated)) a number of variables were generated from topographic and soils data that when considered together will approximate landform diversity in a manner similar to the standard CCEA methodology.

4.6 Soils

Soils data are derived from "The Forest Soils of New Brunswick" by Colpitts *et al.* (1996). While significant areas of deep ablation tills, drumlins, and glaciofluvial deposits exist in the province, the great majority of area is covered by fairly thin (<2m) veneer of basal till. For the most part, the shape of the underlying bedrock controls surface expression, and lithological composition of soils reflects underlying bedrock. Soil lithology is correlated with important ecological factors like pH and texture, both known to effect species composition of vegetation in NB. Lithology is therefore a prominent variable in the soil classification of Colpitts *et al.* (1996), and forms the basis for classification of soils for

this assessment, apart from interval, tidally influenced, and organic soils.

4.7 Ecosites

Ecosites are fine-scale ecological land classification units based on soil and topographic data that approximate landforms. Ecosite maps have been developed for each of New Brunswick's 34 ecodistricts. Ecosites were computer-generated on the basis of studies of the relationship between landform interpreted from soil, slope, and elevation, and vegetation inferred from the province's photointerpreted forest inventory. For more detail on the development of ecosites see Zelazny *et al.* (1997).

4.8 Topography

A detailed topographic surface was computer-generated, and the area in each of 20 elevation classes and in 7 slope classes was summarized for each map sheet.

4.9 Disturbance

On each map sheet the non-urban areas were assessed for road density in kilometers per square kilometer. The extent of road networks is highly correlated with the extent of forest harvesting, plantation establishment, agriculture, and human settlement. Absence of roads is a defining characteristic of wilderness area.

A weakness in the road density data is that some areas are updated with higher frequency than others,

causing bias in the data are. In particular, some private woodlot areas and some parcels of industrial freehold land have not been updated since the mid-1980s, while Crown land and other industrial freehold lands are regularly updated. Recommended areas that have been infrequently updated should be checked for the discrepancy between actual and estimated degree of disturbance and the effect this may have on site priority.

4.10 Ranking Candidate Quadrats

All quadrats in an ecoregion were ranked based on the number of classes found in the quadrat in each of the soil, ecosite, and topographic categories. The mean of these ranks was used to give an overall representivity ranking. Areas of highest diversity of slope classes, elevation classes, soil classes, and ecosites received the highest mean ranks.

Quadrats were also given disturbance rankings, with the highest ranks going to the quadrats with the lowest road density.

Overall quadrat ranks were derived in three ways that varied according to the weight given to representivity and disturbance rankings in deriving the overall rank. One overall ranking scheme gave 80% weight to the disturbance ranking in calculating overall rank; the second method gave 80% weight to the representivity ranking, and the third was based simply on the mean disturbance and representivity rankings (*i.e.* gave 50% weight to each).

4.1.1 Description and analysis of the proposed candidate sites

As a result of our analysis we identified thirteen (12) potential candidate sites within the seven ecoregions which could form the core of a Protected Areas Strategy for New Brunswick. We are presenting a general description and analysis of each proposed site. The final selection of the site within each ecoregion should be determined following a comprehensive Province wide public review of the proposed strategy.

The following sites were identified as offering the highest potential for the protection of biodiversity within each ecoregion. They are:

- Jacquet River Gorge
- Grand Lake Meadows
- Kennedy Lakes
- Long Lake
- New Brunswick Central Highlands and Mount Carleton Park
- Nerepsis Hills
- Restigouche River
- Upsalquitch Forks
- Loch Elva
- Cannan Bog
- Armstrong Lake
- Caledonia Gorge

5 Development and Implementation of a Strategic Action Framework

5.1 The elements of the framework

Prior to proceeding with the development of a Protected Areas Strategy for New Brunswick a Strategic Action Framework should be developed which will guide the sequential implementation of the strategy. The framework should include the following elements

1. A public review of the Proposed Strategy through a formal Province wide consultation process.
2. The development a public information strategy on the protected areas initiative.
3. The development management guidelines for candidate protected areas.
4. Review and revise the present regulations for protected areas under the Crown Lands Act.
5. Preparation of protected area designation action plan with specific milestones.
6. Develop a research strategy for the Protected Areas Network.
7. Develop a partnership strategy to involve all New Brunswickers in the development and management of a Protected Area Strategy.
8. Develop a funding strategy to support the development of a research strategy for the protected areas strategy

5.2 Planning and Management Guidelines for the Protected Areas

Planning and management guidelines will be developed which will define the roles of the various categories of protected areas (nature reserves, wilderness areas, and provincial parks) and to outline corresponding land management and resource use policies within and around the protected areas.

Management plans should be prepared for each candidate-protected areas according to priorities based on:

- the significance or sensitivity of the candidate area;
- the extent of threats or stresses on the ecological integrity of the candidate area;
- the extent of public interest, particularly at the local level, in initiating a management planning process; and,
- the availability of resources to undertake the management initiatives.

Following are some consideration of management options that could be integrated with each protected area.

5.3 Basic Management Principles

1. The maintenance of ecological integrity, natural ecological processes, and biodiversity is the first priority for the management and use of protected areas.
2. Public use and enjoyment - including such activities as wilder-

ness recreation, nature tourism, outdoor education, and scientific research - will be encouraged as long as these activities are ecologically sustainable and respect the interim management guidelines.

3. Existing land tenure and land use rights (e.g., existing mineral rights and campsite leases) will be honored. However, the activities must respect the protection-oriented values of the area.
4. A wide variety of partnership options will be encouraged in the planning and management of protected areas. Potential partners include, but are limited to:
 - local community organizations;
 - conservation organizations;
 - aboriginal groups;
 - nature tourism interests or wilderness user groups;
 - owners of private holdings or adjoining private properties;
 - holders of existing leases or licenses;

5.4 Potential Recreational uses within the Protected Areas

1. Facilities (such as hiking trails, portages, and tenting sites) developed to accommodate wilderness activities will be kept to a minimum and sited to minimize environmental impacts and to maximize the quality of the wilderness experience.
2. Traditional, long-established patterns of hunting, sport fishing, and trapping will be permitted within the candidate-protected

areas, however, specific guidelines regarding the nature and extent of these activities will be established for individual areas.

3. Travel within candidate protected areas for the purpose of hunting, sport fishing, and trapping will be by non-motorized means.
4. Snowmobiling within candidate protected areas will be permitted only on established trails that are essential links with more extensive trail networks and where environmental impacts are minimal.
5. The recreational use of all-terrain vehicles and motorboats will not be permitted within candidate protected areas.
6. Notwithstanding the preceding statements, in exceptional cases, permits may be authorized by the department to allow motorized travel within candidate protected areas on approved routes and under specific conditions.
7. Signs will be posted at access points to advise visitors that they are entering a candidate-protected area, and to inform them about appropriate codes of ethics (e.g. "Pack it in, pack it out") and regulations.

5.5 Resource Development and Extraction within the Protected Areas

1. Commercial forestry activities will not be permitted within candidate protected areas.
2. New exploration licenses will not be issued within candidate protected areas. However existing

mineral rights will be recognized and honored while they remain in good standing.

3. The termination of existing mineral rights will be negotiated with mineral rights holders who have indicated an interest in entering into negotiations.
4. Mineral exploration will be permitted on existing claims and will be carried out in such a way as to minimize impacts on protection-oriented values. Specific conditions will be determined by the Department of Natural Resources through review of proposed work plans.
5. Mineral rights holders will be given the necessary security of mineral tenure in that they will have the right to develop a mine on current holdings within candidate protected areas, subject to conditions relating to minimizing potential impacts on protection-oriented values and to the outcome of review processes under the Environmental Assessment Act.
6. Any new mineral development proposals will be subject to review under the Environmental Assessment Act. Proponents will be required to register any such mineral development proposals with the Department of the Environment.
7. New roads and utility corridors will not be permitted.
8. Notwithstanding the preceding statement, if a mine is proposed, the proponent will be required to enter into an agreement with the Province of New Brunswick to establish easements for any re-

- quired transportation or power access in a manner so as to maintain consistency with the goals and objectives of the candidate protected area(s) and to minimize potential environmental impacts.
9. Energy resource developments, including hydro developments and associated impoundment, will not be permitted within the candidate-protected areas.

5.6 Adaptive Management Strategies

1. Ecosystems will be managed with minimal interference to natural processes. Active management intervention in natural processes, however, may be considered where the structure and function of an ecosystem has been significantly altered by human activities and where manipulation is the only means to restore ecological integrity. As well, management intervention will be considered to protect rare and endangered species.
2. Where manipulation is necessary, specific management actions will be based on scientific principles. Techniques used will simulate natural processes and results will be carefully monitored.
3. Efforts will be made to prevent the introduction of exotic plant and animal species into candidate protected areas, and to eliminate or limit the proliferation of such species where they already exist.
4. Forest fires will be suppressed in the candidate protected areas. This is due to the potential for

- adverse affects on neighboring lands and resources, the current lack of scientific information on the ecological role of natural fire in New Brunswick, and indications that the majority of forest fires in New Brunswick are caused by humans.
5. Insect infestations and diseases will be suppressed within the protected areas.

5.7 Crown Land Use Permits, Licenses and Leases

1. New land use permits, leases, and licenses will not be issued for Crown lands within the candidate protected areas, except those as may be expressly required to fulfill the management objectives of these areas.
2. Existing campsite leases that are maintained in good standing will be honored.
3. Campsite leaseholders will be encouraged to play a stewardship role in the candidate protected areas where they hold leases.

5.8 Integration of Protected Areas within the Surrounding Landscape

1. Crown lands within the surrounding “working landscape” will be planned and managed with due consideration to the management objectives of candidate protected areas.

2. The owners of adjoining private lands will also be encouraged to recognize protected area management objectives and to consider complementary management practices wherever desirable and practical.

5.9 Scientific Research Strategy for the Protected Areas

All management requires feedback so it can adapt its actions and become more successful. The proposed core protected areas are to be integrated with surrounding managed lands. We propose making research, monitoring, and adaptive management part of the protected areas strategy. Using the core protected areas as benchmarks, New Brunswick has the opportunity to be a world leader in research in forestry and biodiversity. Using an adaptive approach, the working group sees these areas as ideal experimental designs for forestry and biodiversity management. The information for the protected areas and surrounding adaptive zones can be used by universities, forest managers, and governments.

6 Implementation

6.1 Resource Inventory and Data Base Management

The implementation of a Protected Areas Strategy will require the implementation of a comprehensive management strategy which would

effectively integrate all of the conservation and biodiversity data within the Acadian Bioregion. Within the limits of available resources, efforts should be undertaken to systematically integrate existing inventory and document significant gaps. The resource inventory should be designed to support protected areas planning, to provide input to integrated resource management planning, and, where possible, to encourage and facilitate private land stewardship initiatives. There is opportunity for co-operative programs with Conservation data centers, industry, universities and existing national monitoring efforts like EMAN. CDCs maintain databases on rare, threatened or endangered species and communities, which are at risk of extinction or extirpation through present threat or natural rarity, and thus require conservation effort.

The addition of GIS capability greatly enhances the CDC's ability to provide data on an area-specific basis, such as application to Protected Areas. Within the GIS, CDC data and PAS sites can be arrayed as digital map objects in thematic layers:

6.2 Scientific Advisory Group

The Minister of Natural Resources and Energy will consider the appointment of a scientific advisory committee to the Protected Areas Strategy. The membership will include representation from Universities, Government Agencies and other scientific organisations.

The Scientific Advisory group will act as an advisory group to DNR&E on issues related to protected areas. They will identify relevant research topics and develop a research agenda for the protected areas.

6.3 Development of a Strategic Partnerships Strategy

Public participation is essential to the effective planning and management of protected areas. Partnerships will be actively encouraged for a wide range of planning and management responsibilities. Areas of emphasis include, but are not limited to:

- owners of private holdings and parties holding leases or licences on lands within candidate protected areas;
- owners of adjacent private lands;
- community development interests;
- aboriginal groups;
- conservation-minded organisations;
- nature tourism and outdoor recreation groups; and,
- the scientific and educational community.

6.4 Liaison with Local Communities and Stakeholder Groups

The Department of Natural Resources and Energy will endeavour to communicate and meet with representatives of affected communities,

stakeholder groups, and interested individuals in order to:

- convey information on the status and implications of the Protected Areas Strategy;
- identify areas of interest or concern for future planning and consultation processes;
- seek advice regarding future consultation processes for protected areas planning and management; and,
- identify potential partners for planning, development, and management activities.

6.5 The Role of Private Landowners

Almost 30 % of New Brunswick is owned privately. The role of the individual landowner in preserving our natural areas is extremely important. That's why landowners will be actively encouraged to protect significant natural values on their properties.

6.6 Encouraging Community Development

New Brunswickers, of course, are not the only ones to appreciate our natural environment. Each year, more and more people from around the world choose our province for their "ecotourism" destination.

As a result, our system of protected natural areas can be important in the development of communities and nature tourism. It demonstrates that we are serious about striking a balance between the environment

and the economy; and it boosts New Brunswick's image as a clean, green, and healthy place in which to live, work, visit, invest, and do business.

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Development of an Action Strategy

An action plan should be developed which will translate the broad strategy into clearly defined tasks and priorities and to provide strategic direction for the implementation of the **Protected Areas Strategy**.

Adoption of the Protected Areas Strategy

The adoption of the Protected Areas Strategy by the provincial government is the initial step in the implementation process. Following a pub-

lic review of the proposed strategy, the government should proceed with the establishment of a comprehensive system of protected areas in New Brunswick **with a clearly defined implementation time table**.

Development of Interim Management Guidelines

Interim guidelines should be developed for the management of the candidate-protected areas included in New Brunswick's Protected Areas Strategy. They should remain in effect until legislation is in place and management planning and consultation processes have been completed.

During this interim period, traditional recreational uses will continue. In all cases, activities and developments within candidate protected areas must be ecologically sustainable and respect underlying protection objectives.

Protected Areas Legislation

Protected areas legislation should be reviewed and updated as needed to provide for the formal designation of the network of protected areas.