Towards a Model Policy for Implementing Ecoregional Conservation in the Northern Appalachian/Acadian Forest Ecoregion

John Nick Sanders

A Thesis in the Department of Geography, Planning and Environment

Presented in Partial Fulfillment of the Requirements
for the Degree of Master of Public Policy and Political Administration
(Geography Option)
at Concordia University
Montréal, Québec, Canada

April 2005

Your file Votre référence
ISBN: 0-494-13245-0
Our file Notre référence
ISBN: 0-494-13245-0

Abstract

Towards a Model Policy for Implementing Ecoregional Conservation in the Northern Appalachian/Acadian Forest Ecoregion

John Nick Sanders, M.P.P.P.A.
Concordia University, 2005

Using the conceptual framework of ecoregional conservation, this thesis provides an assessment of the current conservation frameworks operating within the Northern Appalachian/Acadian Forest ecoregion. The ecoregion, which covers three provinces, four states and two countries, stretches from the Adirondack Plateau in New York, through northern New England, the Eastern Townships and the Gaspé Peninsula of Québec, and includes all of New Brunswick and Nova Scotia. Much of the ecoregion was severely deforested and exploited in the first 400 years of European settlement and has now reached another crossroads in its evolution as the landscape is subjected to a further surge of human-induced stressors and habitat destruction. The impacts range from urban and rural sprawl, unsustainable resource extraction, and habitat fragmentation related to road construction and development. A policy analysis, combined with interviews with conservation practitioners, is used to identify strengths and weaknesses within the existing policy regime and to develop an alternative model policy for ecoregional conservation. This Model Policy addresses the impacts of land use conversion, unsustainable resource extraction, and facilitates cooperation across borders by defining the baseline biodiversity conditions of the ecoregion, regulating land use and development, assessing cumulative impacts, and designating a connected network of protected areas.

Table of Contents

List of maps, tables and figures

List of Abbreviations

APA	Adirondack Park Agency
BAPE	Bureau d'audiences publiques sur l'environnement
CBD	Convention on Biological Diversity
CEC	Commission for Environmental Cooperation
CCME	Canadian Council of Ministers of the Environment
CCNB	Conservation Council of New Brunswick
CEQ	White House Council on Environmental Quality
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CPAWS	Canadian Parks and Wilderness Society
COSEWIC	Committee on the Status of Endangered Wildlife In Canada
CWCS	Comprehensive Wildlife Conservation Strategy
DSM	Decision Support Network
EIA	Environmental Impact Assessment
ESA	US Endangered Species Act
EFE	Exceptional Forest Ecosystem (Québec)
HCP	Habitat Conservation Plans
IJC	International Joint Commission
IUCN	International Union for the Conservation of Nature and Natural Resources
LURC	Land Use Regulation Commission (Maine)
MFS	Maine Forest Service
NBDNR	New Brunswick Department of Natural Resources
NCEAS	National Center for Ecological Analysis and Synthesis
NEGEP	Conference of New England Governors and Eastern Canadian Premiers
NEPA	National Environmental Policy Act (US)
NFMA	Nation Forest Management Act (US)
NGO	Non-governmental organization
NRAC	Nature Reserves Advisory Committee (Nova Scotia)
NSDEL	Nova Scotia Department of Environment and Labour
NSDNR	Nova Scotia Department of Natural Resources
NSPLC	Nova Scotia Public Lands Committee
NSSA	Nova Scotia Salmon Association
NYDEC	New York Department of Environmental Conservation
POGG	Peace, Order and Good Government provision of the Constitution Act of 1982 (s. 91)
SARA	Species at Risk Act (Canada)
SARWG	Species at Risk Working Group
SQAP	Québec Protected Areas Strategy
TC	Trilateral Commission for Wildlife and Ecosystem Conservation and Management
TE&R	Threatened, endangered and rare species
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
VBP	Vermont Biodiversity Project
VLT	Vermont Land Trust

CHAPTER 1: INTRODUCTION

1.1 Conceptual Framework

The world is currently facing a biodiversity crisis due to misguided development objectives, unsustainable natural resource extraction and, especially in North America, an expanding per capita human environmental impact (Diamond, 2005). Wildlands are being transformed into clear cuts and monoculture tree plantations, roads being cut through these wildlands allow for the establishment of urban and rural sprawl, and agencies charged with regulation are being reduced to facilitators through agency capture. Currently, government efforts to address these problems are not strong enough, do not reach across political jurisdictions, and are not willing to expend political capital to rein in industries reaping short-term profits from their environmental destruction.

Current regimes of resource and land management place little value on ecosystem services and biodiversity. This utilitarian perspective tends to value landscapes based on the wealth that can be extracted, not the ecosystem services provided (clean water, flood regulation, pollination) or biodiversity's inherent non-economic value (Karkkainen, 1997). This failure of our economic system requires the intervention of responsible governments and the regulation of activities on public and private land (Goble, 2002). In addition, to ensure government action and effective ecosystem protection, stakeholder cooperation must be cultivated within the governmental planning and decision-making stages of the management process. Biodiversity, not the short-term economic gain brought by the liquidation of natural capital, must be the priority within land use, resource extraction and conservation programs.

One means of addressing these shortfalls is ecoregional conservation. Ecoregional conservation provides a coordinated, cooperative and regional approach to

conservation that allows biodiversity to be sustained or enhanced. This approach focuses on the conservation of biodiversity at multiple scales and requires cross-border (both intra and international) cooperation for its implementation. Central to the approach is the establishment of a representative system of protected areas connected by corridors and buffered to reduce impacts from external human-induced disturbances based upon an ecoregional framework founded on an inventory of biodiversity.

The key to effective ecoregional conservation is to manage human activities to reduce their impact, to protect and establish a network of representative protected areas, and, when necessary, or where possible and desirable, to restore extirpated species, while providing economic security through the implementation of sustainable development initiatives. The network of protected areas should be developed based on an integrative approach using ecological, biological, and abiotic considerations (Anderson et al, 1998). Areas that are both functional[1] and representative of the greater ecosystem should be set aside within protected areas, and effective connectivity ensured between these areas with buffer zones created to insulate and reduce the effect of external impacts. The approach should be administered on multiple scales – ecoregional, ecosystemic, and landscape – and should designate land use based on the ecological functionality of each landscape, the level of representativity, and its ecological value; these determinations are assessed within a biodiversity assessment. In other words, areas of high ecological value should be free from industrial, high intensity development, while areas of less ecological value can be designated for development (Trombulak, 2003). Thus, by setting restrictive

[1] Functionality "refers to the capacity of an area to maintain healthy viable targets and to sustain key ecological processes within their natural ranges of variability over the long term. Assessing the functional status of an area is critical in formulating appropriate conservation, management, and restoration strategies and in evaluating current and potential human uses in that area" (Poiani and Richter, 1999:8).

preservation controls over a representative subset of the ecoregion, sustainable resource extraction and development can be permitted in the remaining areas. By assessing the status of biodiversity within an ecoregion and setting a subset of that landscape aside, the shortfalls of current conservation regimes can be overcome.

In many cases, existing conservation frameworks provide elements of protection by restricting development or by protecting threatened or endangered species habitat, but these legislative elements were developed based on conceptual paradigms that do not consider ecoregional components of connectivity, buffer areas, representativity, or external stressors like invasive species or road construction. Conservation approaches in the past have generally focused on preserving sites, managing the impact of natural resource extraction, or protecting individual species or species assemblages. Policies addressing these issues reflected various concepts underpinning these paradigms, from the Canadian and US National Parks Acts, to policies for public land management and the endangered species acts found at the state, provincial and federal levels. These acts have been partially effective, but also limited by their lack of reach, coordination and disparate approach (Locke, 2000; Soulé and Noss, 1998; Kohm et al, 2000). The frameworks also suffer from a lack of foresight resulting from funding shortfalls, bureaucratic impediments (Johnson, 1999), an over-reliance on, and agency capture by, resource extraction industries (Parson, 2001), and, most significantly, a lack of policy mechanisms to work across the border (Pedynowksi, 2003).

Ecoregional conservation has arisen from both the successes and failures of these measures, and represents an integration of the theories of conservation biology with those of sustainable development (Soulé and Noss, 1998). An integrative ecoregional approach

must assess these following policy themes holistically by instituting policy approaches that encompass:

- Protected area establishment and management;
- Protected area connectivity, representivity and functionality;
- Threatened, endangered, and rare species protection;
- Public lands and natural resource management;
- Land use and planning regulations;
- Public participation;
- Biodiversity assessments.

By assessing the status of biodiversity within an ecoregion and setting a subset of that landscape aside, the shortfalls of current conservation regimes can be overcome. Agency capture can be reduced through a science-based designation process and increased public participation and access to outcomes of land use management decisions. Cross-border cooperation will be increased by working at an ecoregional scale due to the establishment of connectivity between core protected areas across provinces, states and international borders.

Methodologies to institute an ecoregional vision have been developed by Anderson et al (1998 and 1999), Noss (1992), the Millennium Ecosystem Assessment (MEA, 2003) and NatureServe (2003) in cooperation with many of the Natural Heritage Programs, but these methodologies limit themselves to classifying and mapping landscapes and proposing wilderness area designs, not proposing policies to apply this paradigm. The purpose of this thesis is not to reinvent these methodologies, but to develop the policy recommendations necessary to apply ecoregional conservation.

The ecoregional map itself is a relatively new vision; NGOs have peered across the US-Canadian border and initiated cross-border programs, but government agencies

have attempted to institute a cross-border ecoregional approach in only a few regions. This evolution of conservation programs has followed the evolution of the natural resource markets that have long been internationalized. As a means to remain effective, the conservation programs managing these resources must also be internationalized.

This thesis develops a model policy that will apply an ecoregional framework to the Northern Appalachian/Acadian Forest ecoregion that encompasses the aforementioned themes in an integrative and multi-scalar approach in order to address the current failures that have resulted from a lack of inter-jurisdictional cooperation, agency capture, and the shortcomings of existing conservation frameworks. The implementation of such an approach is not without precedent. It has been at least partially successful in the mountainous Yellowstone to Yukon ecoregion within the Crown of the Continent Ecosystem (see Pedynowski, 2003), a region that is less acceptable of both land use planning and conservation as a whole, and a similar program aimed at increased connectivity between Algonquin Park in Ontario and Adirondack Park in New York.[2] In addition, other cross-border conservation programs provide a policy precedent. For instance, the Maine-New Brunswick International Riverway Commission on the St. Croix River demonstrates that these types of programs are both achievable and practicable.

1.2 An introduction to the Northern Appalachian/Acadian Forest Ecoregion

The focus of this research is the Northern Appalachian/Acadian Forest[3] ecoregion, a stretch of eroded mountains, mountain streams, salmon rivers, and forests

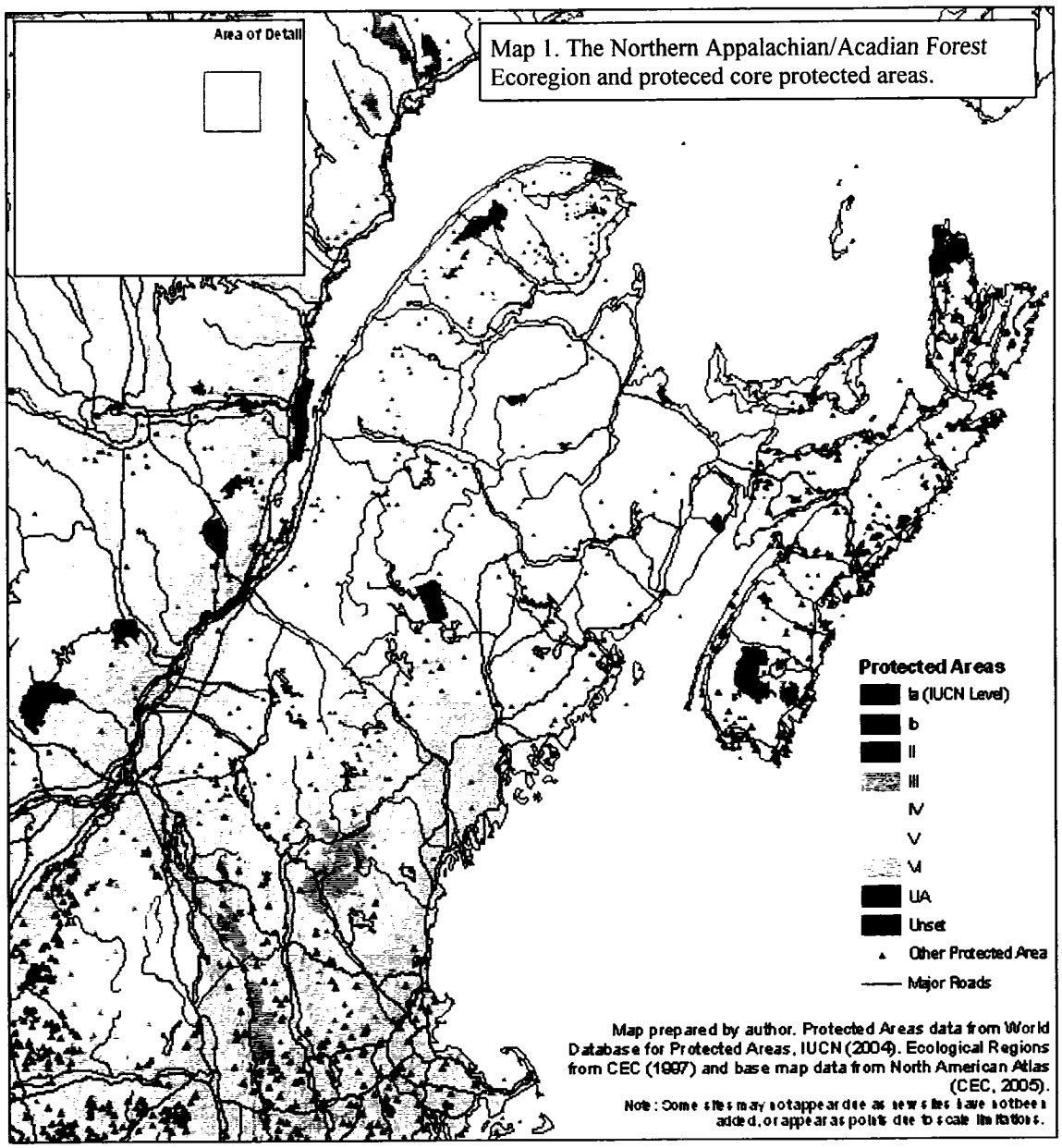
[2] It is important to note that the wider Y2Y initiative is an NGO-driven initiative, but the cross-border Crown of the Continent program was instituted between the 17 agencies with jurisdiction in the region.
[3] The ecoregion will be referred to as the Northern Appalachians hereinafter.

that extends from the highlands of northern New England and the Adirondack Plateau of New York, to the Eastern Townships of Québec and into the Atlantic, Gulf of Maine, the Bay of Fundy and Gulf of St. Lawrence off the rocky coasts of Down East Maine, Gaspé, Québec, New Brunswick and Nova Scotia (see Map 1). The ecoregion forms the northern reach of the Appalachian Mountains, surrounded by the Acadian forests to the east and the Adirondack Plateau to the west. The boundaries of the region are defined by a common geology, geomorphological history (e.g. glaciation), elevation, forest and vegetation type, and species assemblages. Rickets et al (1999) describe the ecoregion as follows:

> [The ecoregion is] hilly to mountainous with the highest elevations occurring in the White Mountains of New Hampshire. The mountains of this region contain a number of forest types; northern hardwoods/spruce forests predominate, and comprise roughly half of the forested landscape... This ecoregion can be described as a transition zone between the boreal spruce-fir forest to the north and the deciduous forest to the south, with the Atlantic Ocean strongly influencing vegetation dynamics of the ecoregion, especially in coastal areas... The forests are a moderately rich example of temperate broadleaf and mixed forests. The mosaic of forest types and habitats support 225 bird species, making these forests the second-richest ecoregion within the temperate broadleaf and mixed forests, and among the 20 richest ecoregions in the continental United States and Canada. For example, mature northern hardwood stands in New England commonly contain softwoods–usually red spruce, eastern hemlock, or white pine–and as a result they also contain bird species associated with coniferous forests, such as red-breasted nuthatches (*Sitta canadensis*), golden-crowned kinglets (*Regulus satrapa*), and northern parula warblers (*Parula americana*) (Niering, 1992). [The] forests contain 14 species of conifers, more than any other ecoregion within this major habitat type save for the Appalachian/Blue Ridge Forests and the Southeastern Mixed Forests. This ecoregion contains several rare ecological or evolutionary phenomena including major areas of serpentine rocks and associated rare vegetation, raised peat bogs, ribbed fens, and coastal raised peatlands There are numerous Atlantic coastal plain plant species at their northern limits and the northeastern limits of several deciduous tree species and forest communities with southern affinity can also be found within the ecoregion. Typical of the transitional nature of this ecoregion, the southernmost outliers of arctic vegetation in eastern North America also occur here. The ecoregion has many fast-flowing, cold water rocky rivers with highly fluctuating water levels that give rise to interesting floral and faunal communities.

The Northern Appalachian ecoregion, covers over 80 million acres (2C1Forest, 2004), and provides habitat for Canada lynx, American black bears, moose, loons, fisher, coyote, American marten, and Atlantic salmon (Ray, 2000). The region represents the transition zone between the northern boreal forests and the temperate forests to the south. Within this transition zone the composition of the forest biodiversity reflects this area of species intermixing (interview with Emily Bateson).

For centuries, the Iroquois and Algonquin Nations created their economic and democratic traditions from the natural resources of the region. This is also where the first European settlers created communities, relying on the same landscape as the First Nations for sustenance and, subsequently, to build economies based on the export of natural resources (2C1F, 2004). By 1850, 75% of arable land in the ecoregion had been converted to agriculture, but as the western frontiers 'opened up' farmers abandoned the region for the more fertile fields of the Midwest (Degraaf and Yamasaki, 2001). As these areas were abandoned, forests crept back and were reestablished, although with a different composition (Foster, 2002; Foster and Motzkin 1998; Degraaf and Yamasaki, 2001). The ecoregion remains densely populated relative to other parts of North America (50 million people live within one days drive), but the populations have become concentrated and urbanized, allowing for the reestablishment or perseverance of large tracts of unbroken wilderness – Baxter State Park in Maine, Kejimikujik National Park in Nova Scotia, and Parc-de-la-Gaspésie in Québec, for example.



Map 1. The Northern Appalachian/Acadian Forest Ecoregion and proteced core protected areas.

My research focused on this region due to its personal connection as the landscape where I grew up, learned to fish and have hiked and traveled across. In addition, there is an increasing concern within the conservation community over the perseverance of wildlands and biodiversity within the region. As a means to address this concern, and in order to preserve the biodiversity and wilderness values and the cultural landscapes of the region, a coalition of conservation organizations established the 2

Countries, 1 Forest (2C1Forest) initiative in 2003. The goals of the organization are to ensure the existence and establishment of:

- Protected, connected wild areas that clean air and water, provide homes for species large and small, safeguard older forests, and offer recreational opportunities and wilderness respite;
- Farms and forests that provide communities vibrant economies and stable livelihoods while also respecting the natural environment;
- Policymakers and land use planners that understand the scientific principles of conservation and pursue strategies to bring about an intact ecological landscape; and
- A diverse, effective network of people that care enough to protect and restore a shared, irreplaceable natural heritage that transcends borders. (2C1F, 2004:1)

In addition to the 2C1Forest initiative, Ray et al (2002) described the need for an ecoregional approach in the Northern Appalachians:

> Canada lynx is an important flagship species and furbearer for the Northern Appalachian region straddling the border of the United States and Canada. The Northern Appalachian region is a natural conservation planning unit, and coordination of research and conservation activities in the region is critical for the large-scale ecosystem and landscape approach required for the successful conservation of wide ranging species such as the lynx. Such coordination faces many obstacles, however, including monetary and personnel constraints of small jurisdictions and a lack of common regulations among states/provinces and between the USA and Canada (Ray et al, 2002:4).

As a means to fill this policy void, this thesis will provide the 2C1Forest initiative with an understanding of the diverse conservation policies, the policy gaps existing within the region, and a Model Policy that will enable the application of ecoregional conservation within the Northern Appalachian ecoregion.

1.3 Threats to the Northern Appalachian ecoregion

The Northern Appalachian ecoregion provides a prime example of the lack of reach of the current conservation approaches in both Canada and the United States, and between the two countries. The threats facing the Northern Appalachian ecoregion vary across the landscape, from poor forestry practices to rural sprawl. An ecoregional approach can

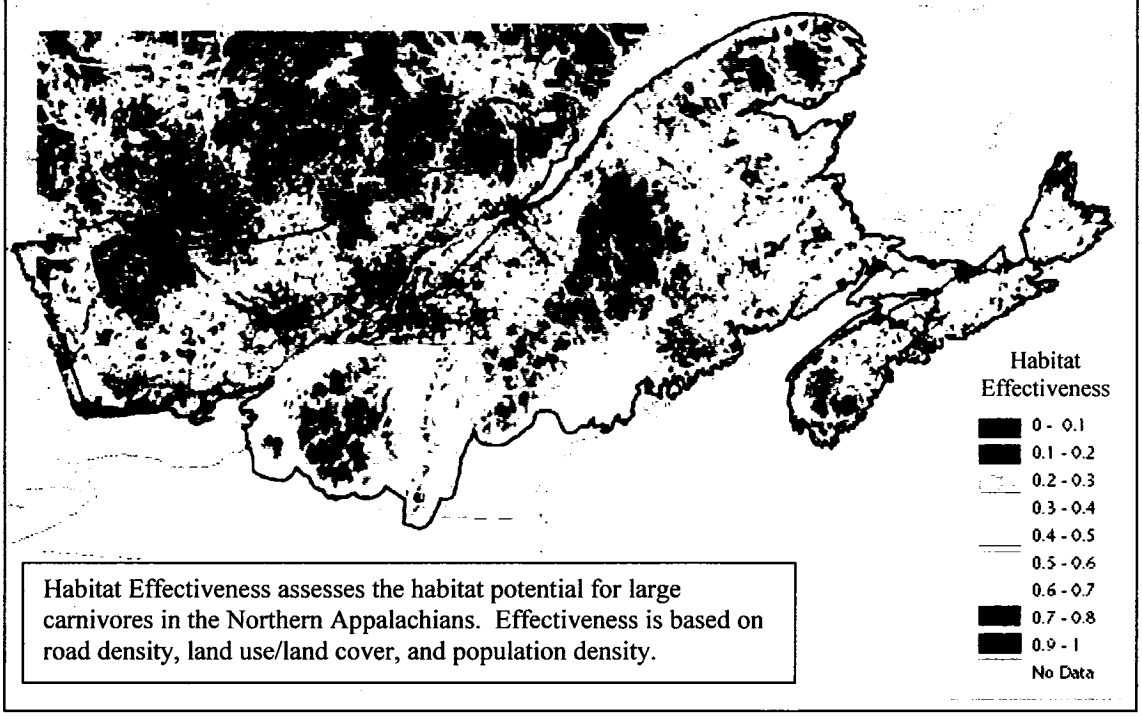
reduce the impacts of poor development and resource extraction policies, provide a remedial policy solution to these issues, and stimulate cross-border conservation efforts.

Poor forestry practices, including the conversion of mixed stands to monoculture plantations, and unsustainable natural resource extraction has fragmented and degraded habitats across the region (Ray, 2000). The historical context painted by Foster and Motzkin (1998) provides a view of the cultural landscapes in the Northern Appalachian ecoregion and their evolution over the past 200 years, from an area deforested by agriculture and forestry, to a region that has witnessed remarkable forest regeneration. However, the regeneration of these forests has not relieved the pressure industrial forestry continues to place upon the ecoregion, as timber corporations demand an increasing yield on the public and private lands they manage and have reduced tree biodiversity through clear cutting and the conversion of forests to monoculture tree plantations (see NBDNR, 2004; Flatebo et al, 1999). In Nova Scotia, over one-sixth of the province was clear cut between 1975 and 1999 (NSPLC, 2004), while in New Brunswick, each year 30% of the areas subjected to forestry are converted to black spruce or jack pine plantations for use in the pulp and paper industry (CCNB, 2004). The conversion of forest stands to monocultures degrades forest habitat and reduces the ecological functionality of the site, reducing its ability to preserve biodiversity. In addition, the forest roads constructed to remove timber reduce forest biodiversity, provide pathways for invasive species, and degrade habitat along the pathway of the road (USFS, 2000). The stands of old growth forest are also disappearing. Between 1993 and 1999, the percentage of the New Brunswick landscape covered by old growth stands decreased, depending on stand composition, between 5% and 9%. The Fundy Model Forest biodiversity indicators

continue to suggest that this decline will continue without changes in management regimes (Fundy Model Forest, 2004). In general, across the region, the forests are younger and more fragmented (interview with Emily Bateson; MFS, 2001).

In terms of habitat potential and human impacts, Map 2 highlights the road and population density within the ecoregion; the red areas represent areas of poor habitat

Map 2 Habitat Effectiveness for large carnivores in the Northern Appalachian ecoregion and Eastern Ontario based on road and population density (from Carroll, 2003:17).



Habitat Effectiveness assesses the habitat potential for large carnivores in the Northern Appalachians. Effectiveness is based on road density, land use/land cover, and population density.

effectiveness for large carnivores. The map also highlights the core areas of the ecoregion located in Adirondack Park, northern Maine, the Gaspé Peninsula, and southern Nova Scotia, and the need to ensure effective connectivity between these areas.

As forestry's importance and economic viability in certain parts of the region is reduced, as is the case with Maine (interview with Diano Circo), the large private landholdings in the region are being sold off, subdivided and converted into residential developments, mostly for second homes (MFS, 2001; 2005). This trend is termed rural

sprawl and refers to the low-density housing developments that rely on a heavily roaded infrastructure that creates significant habitat fragmentation and degradation. Thorne and Sundquist (2001) found that the growing population, projected to grow to 1.6 million in 2020, in the southern region of New Hampshire has created pressure on the forested landscapes, leading to land use conversion and 'terminal harvesting' (i.e. clearing land for development). Each year terminal, or liquidation, harvesting removes about 0.46% of the state's forested areas; 42% of "pine lands have been converted to development and other non-forest uses" (Thorne and Sundquist, 2001:11). In Maine, the Maine Forest Service (MFS) estimates that 16,000-64,000 acres are liquidated through terminal harvesting each year (MFS, 2001:2). Rural sprawl is having a significant impact in Northern New England due to the high percentage of private lands and accessibility to the population centers of Montreal, New York, and Boston (Thome and Sundquist, 2001). Rural sprawl also affects the areas surrounding protected areas, as these areas act as a magnet for residential development and service delivery (Searle, 2000).

Large core protected areas exist in the ecoregion, but they are too few in number and have minimal connectivity (see Map 1). Carroll (2003:15) estimates that approximately 6-7.5% of the ecoregion is currently protected at IUCN Level I or II management requirements, but the region needs additional large core protected areas, like the aforementioned sites, to provide a foundation for the ecoregional conservation framework (Anderson et al, 1999). Estimates for the amount of core protected areas necessary vary from 12% in the *Convention on Biological Diversity* (CBD, 1996; 2004) to 20-30% (Shaffer et al, 2001). In addition, many of the sites are not buffered from land use conversion and intensive resource use surrounding the protected areas. The isolation

of these core areas reduces their conservation efficacy and reduces the intermixing of wide-roaming species (Groves et al, 2000).

Connectivity is another significant shortfall of the current conservation portfolios within the ecoregion. The interviews I conducted with agency personnel and NGO representatives suggest that the management priorities fall short of the connectivity necessary to sustain the local biodiversity. The Adirondack Plateau is not connected with the rest of the ecoregion, while connectivity is threatened within the lower elevations of New Hampshire and Vermont. In addition, government-initiated ecological classification programs have found many of the ecological features underrepresented in protected areas (Ministère de l'environnement, 2003; Nature Serve, 2003; NSPLC, 2003), but many of these areas remain unprotected.

Lastly, the species assemblages are incomplete in the ecoregion; in particular, the extirpated wolf population has not been reintroduced. The wolf regulates prey populations and prey vegetation consumption; without wolves as the primary carnivore, ungulate populations are unregulated and significantly alter the vegetative structure and composition (Carroll, 2003; Soulé et al, 2002; Miller et al, 2001). Hunting is practiced throughout the region, but hunting in itself is not enough to regulate ungulate behavior and impact on native floral biodiversity, as was demonstrated by the wolf's reintroduction into the Greater Yellowstone Ecosystem (McNamee, 1997).

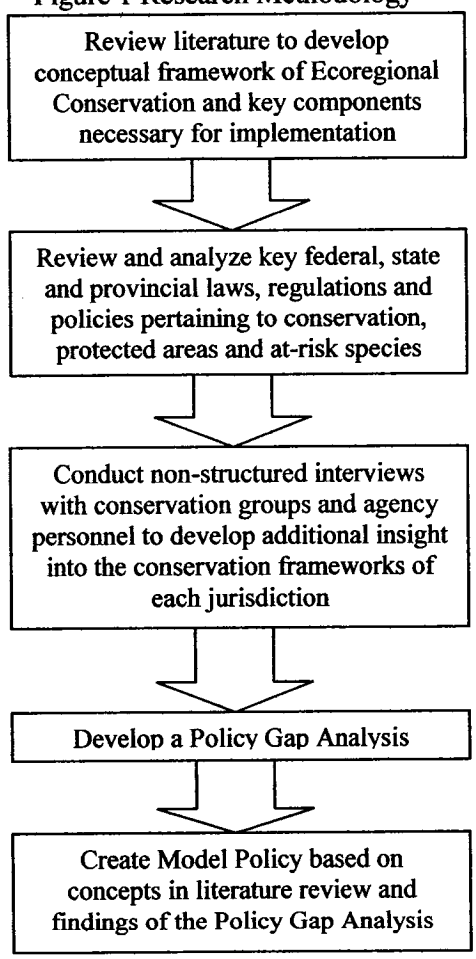
The threats facing the Northern Appalachian ecoregion cannot be addressed solely within an intra-jurisdictional basis, nor with the application of only site-based or species-based conservation efforts. The threats to biodiversity in the Northern Appalachian ecoregion must be addressed with an integrative approach that can effectively work

across borders, hence the application of ecoregional conservation. The answer is to develop large, connected networks of protected and managed areas that are functional and, as much as possible, contain all trophic levels (plants, herbivores, and predators) (Soulé and Noss, 1998). Ecoregional conservation provides a framework for addressing multiple threats, assessing the ecological value of landscapes, coordinating the creation of an effective protected areas network, and creating conditions for the species assemblages and communities to be sustained.

1.4 Methodology

In order to identify and define the themes to be addressed by the Model Policy, my research used a two-pronged approach; 1) an assessment of the conservation frameworks; and 2) interviews with practitioners of conservation in the ecoregion. My methodology is modeled after Pedynowski's (2003) approach for investigating cross-border conservation efforts on the Montana-British Columbia-Alberta border. First, I analyzed the conservation frameworks and programs promoting biodiversity at state, provincial, and federal levels.[4] For example, within Québec, this

Figure 1 Research Methodology



[4] The research for these sections was aided by three databases, CEC's 'Summary of Environmental Law in North America' cec.org/pubs_info_resources/law_treat_agree/summary_enviro_law/publication/index.cfm?varlan=english, Cornell University Law School's Legal Information Institute, www.law.cornell.edu, and the Canadian Legal Informational Institute, www.canlii.org/index_en.html.

entailed reviewing the *Parks Act*, the *Endangered Species Act*, the *Natural Heritage Conservation Act*, the *Land Use Act*, the *Forest Act*, and the *Québec Environmental Quality Act*. In addition, policies related to conservation were reviewed, including the Québec Protected Areas Strategy and the Exceptional Forest Ecosystem program. A similar review was completed for each jurisdiction.

This policy review provided an initial analysis which was then complemented by the semi-structured interviews conducted with agency personnel and experts affiliated with conservation organizations in all jurisdictions. Appendix 1 lists the persons interviewed, their position, affiliation, date of the interview, and how the interview was conducted (email, phone, etc.). Initial interviewees were selected through personal contacts with conservation organizations in the region, websites of groups or agencies, and authors of literature that was reviewed. Subsequent contacts were identified through recommendations from the initial group of interviewees. Each state or province was represented by at least two interviewees, with at least one from a conservation agency and one from a conservation NGO, with the exception of Québec, where no agency representatives were available for interview. Most of the interviews were conducted via email and telephone, although I was able to interview participants of the 2C1Forest initiative in person, with follow up interviews via phone and email.[5] At the outset of each interview, I informed the interviewee of who I was, my affiliation with Concordia University, the purpose and scope of my research, and asked whether or not they wanted to be quoted or included in the research. At the end of the interview I reconfirmed the interviewee's permission for inclusion in my research.

[5] The interviewees from groups involved with the 2C1Forest initiative are Conrad Reining, Emily Bateson, John O'Driscoll, Jean Francois Gagnon, Roberta Clowater, Nadia Stensor, and Kathy Daley.

The main insight I expected from the interviewees was an understanding of the disparity between program claims and the actual implementation of these programs. The interviews were unstructured and open ended and included discussion of the following:

- Conservation frameworks within the jurisdiction, including their strengths and weaknesses;
- Experience to date with implementation of biodiversity action plans and protected areas strategies;
- Incentives and disincentives for conservation;
- Existence and implementation of programs implementing ecoregional conservation or cross-border (international or national) programs and initiatives.

I described my research and asked a few probing questions based on the person's expertise, (i.e. what policies exist for protecting endangered species habitat or what policies exist to designate protected areas) and allowed the person to elaborate on gaps, strengths or major concerns within the conservation framework of their jurisdiction. During the interviews, many of the participants directed me to websites for additional information, publications, maps or legislative information. Where these additional resources were consulted as part of my research they are cited within the text. Lastly, I was able to conduct some limited field studies of forestry practices in Gaspé, eastern Maine, and the Mount Washington Valley of New Hampshire.

The findings of my interviews are documented in the Policy Gap Analysis chapter, which provides the foundation for the Model Policy and implementation measures, the centerpiece of this thesis. The Model Policy was developed based on the insights gained from the Policy Gap Analysis and the conceptual basis of ecoregional conservation reviewed in chapter 2. The Model Policy works to fill areas not addressed by the current conservation frameworks and provide a means to apply an ecoregional framework to the entire ecoregion.

1.5 Organization of the thesis

This thesis is divided into 5 chapters. Chapter 2 reviews the relevant literature to provide an understanding of the theoretical and conceptual context and how these theories are applied within conservation policies. Chapter 3 focuses on the Policy Gap Analysis; it assesses the strengths, gaps, and best practices existing within the current conservation frameworks in the ecoregion. Chapter 4 uses the Policy Gap Analysis to develop a Model Ecoregional Conservation Policy. Finally, the thesis concludes with a discussion of the implications of the Model Policy.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews existing literature on the concepts of ecoregional conservation, endangered species preservation, and the use of indicator, focal and umbrella species. In addition, literature concerning the impact of land use and sprawl on biodiversity and open space preservation is also reviewed, along with the policy applications of these concepts within the US and Canada.

To begin, numerous volumes cover US-Canadian environmental relations and the basic frameworks of environmental policy established in the two countries (see Kirton, 1997). These works provide a basic understanding of how divergent federal structures have led to the creation of two entirely different systems of environmental governance. In addition, there is a wealth of knowledge concerning protected areas in the works of Noss and Cooperrider (1994), Thomas and Middleton (2003), IUCN (1999) and Davey (1998). Due to the expansive literature within the conservation milieu, the present literature review focuses only on that literature directly relevant to ecoregional conservation, conservation area designs, cumulative impacts assessment, adaptive management, and land use and sprawl.

2.1 Conservation Biology

Carroll and Meffe (1997), in *Principles of Conservation Biology*, describe conservation biology as "a new, synthetic field that applies the principles of ecology, biogeography, population genetics, economics, sociology, anthropology, philosophy, and other theoretically based disciplines to the maintenance of biological diversity throughout the world" (quoted in Carr et al, 2002:14). Conservation of biodiversity relies on the concept of 'rewilding' through the preservation of critical habitats, the designation of large,

functional, representative protected areas, and management foci that assesses and preserves ecological integrity at multiple scales of ecological classification (Noss, 1992; Noss and Cooperrider, 1994; Soulé and Terbogh, 1999). In order to achieve this vision, public and private lands need to be managed in a manner that allows for the establishment of core protected areas that are inter-connected and buffered by zones of low impact resource extraction or recreation (Locke, 2000; Trombulak, 2003).

Carr et al (2002:14) delineate the scientific basis used for the designation of the protected areas network: it should provide the size to insulate and buffer external stressors and impacts, maintain ecological processes, and allow the continuance of evolutionary processes. The insight this knowledge provides facilitates the management of human activities in order to slow the rate of biodiversity loss (Carroll and Meffe, 1997).

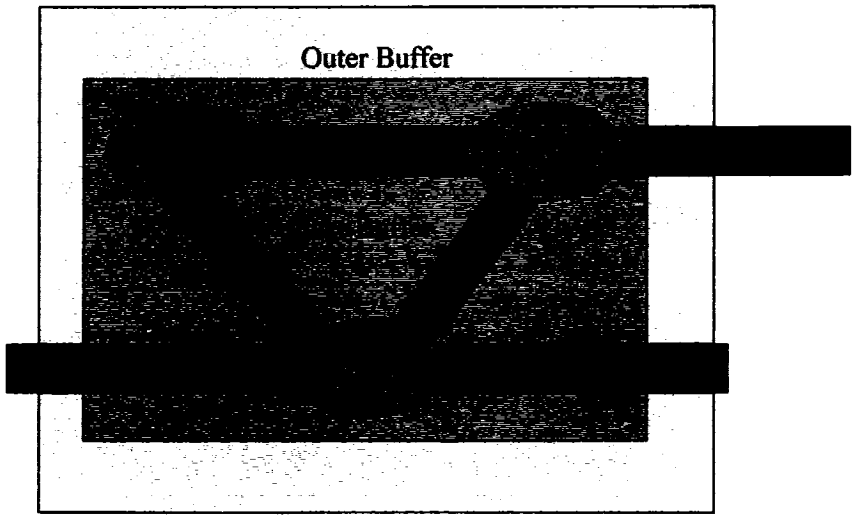
2.2 Ecoregional conservation

The goal of ecoregional conservation is to conserve functional landscapes and to connect these landscapes to form a network of blocks that create a matrix of functioning, intact ecosystems, which form an agglomerated protected areas network over an entire ecoregion (Poiani and Richter, 1999). Ecoregional conservation is applied in a phased, cyclical approach and based on the establishment of a network of cores, corridors and buffer areas (Anderson et al, 1998). Core protected areas serve as the foundation, while corridors provide connectivity and buffers reduce the impact of external or peripheral activities (Soulé and Terborgh, 2000). This increases the effectiveness of the system as the establishment of an interconnected network of "large functionally connected landscapes [is] more likely to protect viable populations of native species, functioning

ecological processes, and evolutionary forces" (Carr et al, 2002:18). The key to conserving large landscapes is the implementation of the cores, corridors, and buffer concept (Poiani and Richter, 1999). Such implementation necessitates an integrative approach that works on multiple scales and crosses political borders (Locke, 2000).

The initial phase of implementing an ecoregional conservation program is the inventory of the biodiversity and ecological components of the ecoregion and the delineation of the landscape into subgroups representing ecosystem and ecotypes (see Table 5 in Appendix 2 for definitions of these components). The inventory classifies the level of protection afforded to each subgroup (representativity), how well the areas are interconnected (connectivity), and the gaps within the protected areas network. The ecological gaps in the protected areas network are then filled using a conservation area design (Noss, 2003). The conservation area design uses the inventory data to select areas of high ecological importance and a high level of 'functionality'. Next, focal or indicator species are selected to measure and monitor ecosystem health and to evaluate the site or network functionality (Lawler et al, 2003). The conservation area design development is usually assisted by geographic information systems (GIS) modeling, that allows the practitioner to integrate the multitude of data sets onto a spatial grid of the ecoregion. Based on the inventory data, each spatially assigned grid is attributed with a value corresponding to the area's ecological value; areas with a high ecological value are then prioritized for protection (Carr, 2002; Anderson et al, 1998). Finally, an adaptive management regime is implemented to continually assess the efficacy of the conservation program.

Figure 1. Conservation Area Design Matrix, Adapted from Noss, 1992



a) Conservation Area Design

Protected areas are the starting blocks for a complete conservation system; this section details the knowledge base concerning expanding the protected areas system to cover all representative ecosystems and the models and policies currently employed to achieve this goal. The ultimate goal, as illustrated by Noss (2003:1217), is 'rewilding' by realizing the "concept of a continental-scale network of core reserves connected by broad habitat linkages". Ecoregional and ecosystem conservation concepts are central to developing systems of protected areas, as protecting whole ecosystems and "managing all public and private land in a region for conservation value is impractical for social and economic reasons; so the problem of reserve design has focused on selecting small portions of a region for conservation" (Fischer mad Church, 2003:556). This is where the conservation area design component finds its importance. The conservation area design

must find the ecologically important landscapes, establish a level of protection for these sites, and then provide for connectivity (Noss, 1992; Fischer and Church, 2003).[6]

With this in mind, Trombulak (2003) takes this concept a step further by designating specific land uses across a region. According to Trombulak (2003), lands should be classified within three basic categories: 'Stewardship lands' would be managed for forestry and agriculture utilizing best practices; 'ecological lands' would be set aside with the goal of preserving 'wild nature'; and 'intensive use lands' would provide the land base necessary to meet "those needs of society that cannot be met on stewardship lands, especially high-density occupancy, industry, and most if not all extractive activities that cannot be carried out sustainably" (Trombulak, 2003:12). The categorization of ecological lands necessitates in depth scientific analysis and documentation of the importance of these landscapes to the preservation of biodiversity in order to justify this designation and "should not be based solely on acquiring lands that merely have high recreational value (e.g., classic "rock and ice" ecological reserves), are inexpensive, or are not controversial" (Trombulak, 2003:13).

In order to measure the ecological importance of landscapes, Margules and Pressey (2000) use two measures for defining conservation networks: representativity and persistence. Representativity assesses how well the system covers each ecosystem; persistence focuses on managing ecological integrity within the protected areas, buffer zones, and managed areas. As a further means of ensuring an integrative and all encompassing approach, Noss (2003) has developed a 'checklist' to assist the development of conservation networks which encompasses the concepts discussed by

[6] A political consideration within the protected areas designation is inevitable and any conservation are design must integrate these considerations into the decision process.

Margules and Pressey (2000). The checklist addresses the expertise required for developing a conservation area design, goals and research hypotheses, conservation targets, surrogate or proxy indicators of biodiversity, and the type of planning unit (hexagonal grid, ecoregions, ecozones, watersheds, etc) (Noss, 2003:1272). The checklist also takes account of focal, indicator, and at-risk species populations, landscape, abiotic and biotic communities, areas of critical concern (migratory stopovers/corridors, seasonal or breeding areas), and human threats/stresses, while complying with transparency and the scientific review standards and principles of adaptive management (Noss, 2003).

Another conservation area design system used is the '5-S framework' described by Poiani and Ritcher (1999). The '5-S Framework' a) assesses conservation areas for the protection of *systems*, b) identifies *stresses* and c) the *source* of the stress, d) develops conservation *strategies*, and e) creates *success* measures. This system is applied both on a site basis and also within an ecoregional context as a means to measure the conservation status of an ecoregion and the connectivity of the functional sites protected within a region (Poiani and Ritcher, 1999; Low, 2003).

b) Developing Conservation Plans

Conservation biology has provided the theoretical basis for developing large networks of protected areas, and the development of integrative and representative systems have become central to the preservation of biodiversity and 'wildlands' (Soulé and Noss, 1998; McShane, 2003; Kohm et al, 2000; Fischer and Church, 2003). Low (2003) delineates both the concepts and the steps needed to develop a regional conservation plan in the North American context. First, data must be gathered concerning the ecological systems and communities encompassing the at-risk, special

concern, and focal species ranges and habitat needs; spatial groupings of species; and areas of species aggregation. Second, natural resources within the area and development stresses and threats should also be catalogued, after the integration of these data; areas can be selected based on their biodiversity attributes (Low, 2003). Lastly, in order to build public support, best management practices (especially for sustainable utilization and development) should be implemented as a means to demonstrate plan feasibility (Low, 2003). Margules and Pressey (2000) use a similar method: the current conservation portfolio within the region is assessed (see GAP Analysis in Section 3.4) and, where possible, areas are expanded or other sites are selected.

Most conservation network designs attempt to involve the local public at each stage of plan development, employ a variation of the methodology that assesses conditions within the selected region (biological, abiotic), develop conservation targets, use an iterative method for selecting areas with high conservation value and connectivity, and finally, restrict use or prioritize biodiversity within these lands (Margules and Pressey, 2000; Low, 2003; Noss, 2003; Fischer and Church, 2003; Poiani and Richter, 1999; Soulé et al, 2002).

c) Cores, corridors and buffers

This section investigates the literature pertaining to cores, corridors and buffer areas, specifically how these concepts have been applied and the efficacy of these applications. These three concepts, when applied, provide the foundation for ecoregional conservation, and this section will provide additional insight into the science behind this paradigm.

The development of core protected areas should focus on four key elements, 1) the ecological functionality of the site; 2) the size and 3) shape of the core area; and 4)

the species assemblage (Soulé and Noss 1998; Low, 2003; Poiani and Richter, 1999). The literature concerning protected areas is extensive, and these concepts are central to establishing and managing a protected area that allows the biodiversity within to flourish (Noss and Cooperrider, 1994; Thomas and Middleton, 2003).

In theory, corridors allow wide-ranging species to migrate between core areas, facilitate intermixing of separate species meta-populations and reduce habitat fragmentation; but the application of this concept has had mixed success (Wenger, 1999). In general, the effectiveness of corridors increases as the corridor is widened and the distance between core areas is lessened (Beier and Noss, 1998). It is not only the size that is important, but the site selection of the corridor can also predict its utility; poor site selection can limit the effectiveness of the corridor (Thompson, 2004). In the context of the Northern Appalachians, the use of corridors in Maine "function on a local scale, providing movement among adjacent habitats, as well as on a regional scale that offers opportunities for species to expand their range" (Flatebo, 1999:114).

The effectiveness of corridors is also limited by incomplete scientific information concerning target species or a lack of complimentarity between the target species and other species inhabiting the same ecosystem (Flatebo, 1999; Simberloff et al, 1992). The concerns of Simberloff et al (1992), however, center on the cost/benefit of targeted corridor purchases, where the priority is land disposal and not ecological corridors, reinforcing the need for proper site selection. A review by Beier and Noss (1998:1249) of 32 studies across North America concluded "corridors and connecting patches function on a local scale, providing movement among adjacent habitats, as well as on a regional scale that offers opportunities for species to expand their range". Beier and Noss (1998)

also cautioned that corridors must be designed properly, or as Simberloff et al (1992) concur, the corridor will not allow for species movement.

Buffer zones are utilized to reduce the impact of external stressors and reduce the edge effect fragmentation creates (Noss, 1992). 'Edge effect' refers to habitat degradation that occurs in the zone of interface between wilderness and other land uses (Martino, 2001). The size and design of buffer zones depends on the context (Carroll and Meffe, 1997). In addition, Anderson et al (1999:44) found buffer zones of 'light-use' protected core areas from human-induced disturbances created in areas of high-intensity use. In addition to using these 'light-use' areas as a buffer, landscapes that have been severely degraded, but are in the process of recovery, can also be used to buffer core areas (Ewing and Kostyack, 2005).

Buffer zones surrounding water bodies are directly related to the health of the aquatic biodiversity, and facilitate both the movement of animals and plant dispersal (Wenger, 1999). Buffer zones surrounding rivers or lakes have dramatically reduced the amount of sediment, nutrients and contaminated runoff that reaches the watercourses (USEPA, 1999). The US Environmental Protection Agency (1999) found a direct correlation between the decreased pollutant levels in streams and larger buffer zones. Flatebo et al (1999) discuss a similar finding from their study conducted in Maine, where they recommend forestry projects be managed to ensure a buffer zone is established by considering the slope and stream order. Wenger's (1999) review of riparian buffer zones across the Eastern US discussed the importance of the buffer zone covering the entire length of the stream and its tributaries with a minimum buffer of nine meters in an area of minimal slope. The nine meters was in reference to water quality, while longer term

research demonstrated a "need for riparian corridors at least 100 m (328 ft) wide, and even wider corridors when possible" to address species dispersal and protection of fish habitat (Wenger, 1999:37). Flatebo et al (1999) include a similar 100 meter width recommendation along rivers, and a 200 meter buffer surrounding larger lakes in their sustainable forestry guidelines in Maine.

In sum, buffer zones have effectively insulated core areas from external impacts, particularly in areas surrounding water bodies, while providing, in some instances, a means for low-intensity resource use (selective logging, non-timber forest product extraction, for example).

d) Using Indicator/Umbrella Species as proxies for Conservation

The use of indicator species as a proxy measure for conservation site-selection and preservation-oriented management regimes has been implemented widely with mixed results. The use of indicator species is employed where there is a lack of species range, critical habitat and behavioral data – in other words, where there is a wealth of information for a small subset of species and a lack of data for the rest (Lawler et al, 2003; Groves et al, 2002; Raven and Wilson, 1992). There are different types of indicator species including keystone, focal, indicator and umbrella. A keystone species may be vital to the health of that ecosystem and the continued presence of that species is relied upon by other parts of that biological community to persist; its disappearance would be a harbinger of community collapse (Soulé et al, 2003). The protection of the target or focal species, by default, provides a level of protection for the remainder of the community from human-caused perturbation or development. This is also referred to as an umbrella species, as the species provides an 'umbrella' of protection for other species as well.

The theory behind this methodology posits that "sites selected to include members of an indicator group have the potential to cover a large percentage of organisms outside the group if the distributions of the members of the group are representative of a larger set of organisms" (Lawler et al, 2002:867). In addition, these species may perform specific functions (wolves regulating the population of elk in Yellowstone, for example) or be endemic to a specific area (Carroll, 2003). The Nature Conservancy uses this strategy when targeting conservation towards a specific endangered species and the establishment of critical habitat for endemic species and the preservation of their restricted habitats. Focal species that are "resource-limited, dispersal limited, area-limited, or limited by ecological process", and keystone species which have an "impact on a community or ecosystem that is disproportionately large relative to their abundance" can be utilized to develop management prescriptions over a large area (Grove et al, 2002:503-4; Power et al, 1996).

A study, conducted in West Virginia, Virginia and Pennsylvania, found the use of indicator species to be partially effective (Lawler et al, 2002). Species within the same taxa were good predictors of species presence, but as the terrestrial and aquatic variables are added to the equation the predictive relationship decreased (Lawler et al, 2002). The study used at-risk taxa as a proxy indicator and when using full coverage[7] "between 61% and 82% of all [at risk] other species" were found within the selected site (Lawler et al, 2002:878). Not surprisingly, the use of terrestrial indicators to protect aquatic species was found to be the least effective means to employ this strategy, as the predictive habitat relationship between the two was minimal (Lawler et al, 2002).

[7] Full coverage consists of "selecting the smallest sets of sites that included each species in the indicator group at least one time" (Lawler et al, 2002:877)

e) Adaptive Management

Conservation programs generally focus on integrating adaptive management in order to address the dynamic nature of landscapes, new developments in science concerning species or ecological integrity, integrating monitoring information, and changes within political or regulatory frameworks. Adaptive management approaches embrace scientific uncertainty and continually integrate new science due to the limitations managers face concerning funding and human resources (Kay and Schneider, 1994). In addition, monitoring indicators used to measure the success of a conservation program allow programmatic changes and adjustments to increase the efficacy of the management regime (Salafsky et al, 2001; Saterson et al, 1999). The flexible nature of this approach "views management not only as a way to achieve objectives, but also as a process for probing to learn more about the resource or system being managed" (Johnson, 1999: Section 1).

Most descriptions (Pollock et al, 2003; Kay and Schneider, 1994; Salafsky et al, 1999) include the following components of this circular management approach common to most adaptive management programs:

- Establish clear goals and purposes
- Design a model of the local systems involved
- Create a suite of monitoring programs, implemented within the local community if possible
- Analyze results and assess program efficacy
- Modify program according to program assessment
- Repeat

The monitoring aspect of adaptive management is central to its effective implementation. Saterson et al (1999) sees monitoring as necessary to

> determining whether the project is meeting its conservation goals and whether it is achieving a positive conservation impact; deciding how project staff should adapt and modify their efforts through time to ensure that the project continues to achieve positive impacts; [and] ensuring that all participants in the project,

> from international nongovernmental organizations (NGOs) to local communities, learn from the experience and can improve their implementation of future conservation interventions (Saterson et al, 1999:3).

Continual monitoring programs provide opportunities to involve local communities in conservation projects (Pollock et al, 2003).

In addition to monitoring programs, high quality data is imperative for planning an adaptive program and integrating new information in order to adjust management techniques (Pollock et al, 1999). The continual integration of new and better information allow for improved management decisions (CEAA, 2002). In addition, Gunderson (1999) considers this continual program renewal process as a response to the boom and bust, cyclical responses to resource crisis. As new information is integrated in a more efficient and faster fashion, management prescriptions can be adjusted before resource levels reach calamitous levels (Johnson, 1999).

Johnson (1999) discusses how adaptive management has been implemented within resource management agencies, specifically within the US Forest Service, and the impediments, both institutional and regulatory, that hinder adoption. Agencies in the US and Canada have adopted adaptive management approaches to remedy management problems of large systems where traditional approaches have fallen short (Johnson, 1999). Implementation of adaptive management

> is usually more expensive than traditional approaches, but may result in more effective management in the long run. Increased effectiveness may be achieved through more efficient short-term management or, perhaps more importantly, by avoiding costly catastrophes, repeated management failures, and management by litigation. Incorporating adaptive management into agency operations will require some changes in management philosophy. Most importantly, both managers and resource users will need to acknowledge uncertainty in management and try to determine the costs and benefits of reducing that uncertainty (Johnson, 1999:conclusion).

Adaptive management is generally accepted as one of the integral components of ecoregional conservation and it continues to be implemented to address gaps in knowledge and increase "understanding of systems as a whole through active participation and learning, evolving experimentation, reviewing and responding" (Bennet and Lawrence, 2002:24). However, the major impediments to its implementation have been both financial (Johnson, 1999) and regulatory restraints (Pollock, 2003).

2.3 Cumulative Impact Assessment

Cumulative impact assessment (CIA) analyzes the effects multiple stressors have within a temporally and spatially defined area. "Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis" (USEPA, 1999:2). Odum (1982) provides a useful discussion of cumulative impacts affecting San Francisco Bay, where hundreds of individual environmental decisions from multiple agencies created widespread impacts upon the Bay. This impact accumulation was termed a "tyranny of small decisions" (Odum, 1982:728) and Odum called for an integrative approach that forces each decision-maker to include impacts from other sources in their analysis.

Canada implements a similar approach. Hegmann et al (1999) developed the process for Canada, and they integrated the following components to:

- Assess effects over a larger (i.e., "regional") area that may cross jurisdictional boundaries; [Includes effects due to natural perturbations affecting environmental components and human actions.]
- Assess effects during a longer period of time into the past and future;
- Consider effects on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the effects of the single action under review;

- Include other past, existing and future (e.g., reasonably foreseeable) actions; and
- Evaluate significance [of impacts] in consideration of other than just local, direct effects. (Hegmann et al, 1999)

Defining the impacts along a temporal and spatial scale is the first step; the second is to create a means of utilizing these data. In this respect, Herdendorf and Crist (in USGS, 2004) use a CIA methodology that spatially designates impacts through the registration of individual impact assessments. The database can be utilized to provide a means of deciding where a project should be executed. Cumulative impacts assessments have also influenced the sustainable forestry guidelines developed by Flatebo et al (1999) in Maine. The guidelines recommend an increase of habitat corridors and connective parcels for forest stands subjected to numerous forestry operations (Flatebo, 1999). Lastly, the Maine Land Use Regulation Commission uses cumulative impact assessments to assess the implication of new large-scale developments (MLURC, 1999).

2.4 Gap Analysis Programs

Numerous state, federal and provincial initiatives have been instituted that aim at identifying ecological 'gaps' within each jurisdictional conservation portfolio. The provinces have also implemented or are debating whether to initiate similar programs within their biodiversity action plans; these plans act or will act as the national implementation program for the Convention on the Conservation of Biological Diversity (CBD) in Canada. This section will briefly discuss the methodologies and outcomes of these programs.

The GAP analysis project of the United States Geological Survey (USGS) developed state assessments concerning the current conservation portfolio of the lands under their jurisdiction, and studied the extent to which these portfolios represent the

ecological communities on the ground, and identified opportunities to close the 'gaps' in the state/regional protected areas network (Jennings and Scott, 1997). The data sets produced are standardized in order to facilitate ecoregional planning across state borders. The basic process uses satellite imagery to develop a set of land use/land cover (LULC) maps; land ownership and current conservation status is then integrated along with native vertebrates and endangered species ranges (Jennings and Scott, 1997). The analytical outcomes provide "a measure of the relative protection afforded to plant communities and terrestrial vertebrates, thereby providing descriptive information on 'gaps' in the protective network" (Prior-Magee et al, 1998:211). The Canadian programs are less extensive, but follow a similar methodology (Ministère de L'environnement, 2004; NSPLC, 2004).

A global gap analysis was completed by Rodrigues et al (2003:31) and assessed the level of protection for "threatened birds, all mammals and all amphibians". The analysis used the lowest species viability requirement (one population located within a protected area) and a coarse scale grid (again a methodology similar to the US and Canadian, but with a smaller scale and lower protection thresholds) with two scenarios. Scenario A considers a population 'covered' if the population range intersects a protected area and that all protected areas provide equal protection. Scenario B allows 'partial coverage' for range/protected area intersections and only considers protected areas greater than 100 hectares (Rodrigues et al, 2003:32-33). The results of the global analysis found that 12% of species were not covered in scenario A and 17% were not covered in scenario B (Rodrigues et al, 2003:42-43).

The basic structure of GAP programs use land use and species range data to provide an assessment of the location of endangered species, to identify areas with a high potential for conservation, and to improve conservation and development/natural resource use planning (USGS, 2004).

2.5 Habitat conservation plans

Habitat Conservation Plans (HCPs) allow for the taking of endangered species, but provide overall ecosystem protections and assurances of habitat protections for the remaining undeveloped areas. HCPs are a component of the US ESA. Beatley (2000) discusses the role of HCPs as having the "potential to generate significant financial and political support for securing and managing substantial blocks of habitat and protected land, often in close proximity to metropolitan areas" (Beatley, 2000:9). HCPs, according to the USFWS, provide assurance to private property holders that unintentional destruction of habitats will not be punished if the landholder agrees to develop a conservation plan within the property (USFWS, 1999). The HCP can cover multiple listed *and* candidate species and "benefit the permittee by ensuring that the terms of an HCP will not change over time with subsequent species lists"; this aspect is referred to as 'No Surprises' (USFWS, 1999:13).

The application and implementation of HCPs has been criticized, specifically in regards to the efficacy of the mitigation measures, the uncertainty pertaining to endangered species population sizes, how multiple plans could deleteriously affect the endangered species, and a lack of scientific standards (Watchman et al, 2001; NCEAS, 1999). Many conservation organizations have questioned the implementation of HCPs,

as HCPs have been viewed as an allowance for extractive industries and developers to destroy habitat, with no complimentary protections (ALA, 2003).

The National Center for Ecological Analysis and Synthesis (NCEAS, 1999) reviewed 208 HCPs, analyzed the data used to develop the HCPs, and also assessed how new information was incorporated. The NCEAS assessment found a concentration of plans in Texas, California and Florida, but HCPs are currently in place in 13 states (NCEAS, 1999:2). The study found that although 74% of species listed under the HCP had declining population levels due to habitat destruction, the plans were allowed to proceed and destroy critical habitats; in 56% of these cases the permit-holder failed to effectively quantify population levels and the number of affected individuals (NCEAS, 1999:2-3). Additionally, the monitoring and adaptive management components of all but seven plans (of a subgroup of 43) were considered acceptable (NCEAS, 1999).

A similar study conducted by Ostermeier et al (2000) assessed 31 HCPs and found that both public participation and the type of development covered significantly changed the composition of the HCP. This lack of continuity was a result of a shortage of management prescriptions, or 'how to's' and an antagonistic political environment (Ostermeier et al, 2000). In this context, neutral facilitators were viewed favorably in the development of an HCP in Nevada as a possible solution to increase stakeholder input, improve decision making and reduce the 4-6 year HCP planning timescale (Ostermeier et al, 2000).

The theoretical concept of HCPs appears to be sound, but the numerous reviews of the application of these instruments point to gaps in knowledge and limited resources for enforcement (ALA, 2003; Beatley, 2000; NCEAS, 1999).

2.6 Impacts of urban and exurban development

Habitat destruction has been the most significant factor causing species decline in both the Northern Appalachians and the continent in general (Noss and Peters, 1995; Main et al 1999). A significant contributor to habitat loss is poorly planned urban, suburban and exurban development (McKinney, 2002; Beatley, 2000, Theobald, 2003). This low density urban development, concentrated along major thoroughfares, has been termed 'sprawl' and numerous studies have reviewed its impacts on biodiversity. Sprawl usually affects agricultural and forest lands and contributes to further habitat destruction and fragmentation (Theobald, 2003).

a) Land use planning

As a means of assessing the impact of urbanization on biodiversity, McKinney (2002) identified an urban-rural biodiversity gradient. At one end of the scale were natural areas that had the highest levels of biodiversity. The least native diversity was found in 'built habitat' which included "buildings and sealed surfaces such as roads", while "residential, commercial, and regularly maintained green spaces" followed with slightly more native biodiversity, but not generally suitable as habitats (McKinney, 2002:884). Over time, "areas of active development tend to have low biodiversity because of the devastating impact on native species of most residential and commercial development" and the disturbed landscapes facilitate the colonization of non-native species (McKinney, 2002:886). Similar findings were reported when assessing the impact of urban development on specific taxonomic groups; Blair and Launer (2000) found decreases in butterfly diversity, while Dickman (1987) found decreases in vertebrate populations within developed areas. Lastly, Rupasingha and Goetz (2001) see

the concern with poor, low-density land use as a long term problem, due to the permanence of land conversion to an urban form.

In outlining the results of a multi-stakeholder land use planning workshop, Cohn and Lerner (2003) propose that land use plans should have a conservation component included and be implemented on a local and regional scale. In addition, and of importance to the Northern Appalachians, the authors conclude that private lands must be considered within these plans allowing inclusion of the entire landscape and the utilization of the numerous private land conservation measures available (Cohn and Lerner, 2003). These plans, they posit, must be developed within the local political system, using legitimate mechanisms and incorporating adaptive management principles. The implementation of "[c]onservation planning should become the primary means used to protect biodiversity, and to be successful must achieve more than what has become the standard, piecemeal approach to conservation. Conservation plans should connect the importance of biodiversity, habitat and natural resource conservation to a community's quality of life" (Cohn and Lerner, 2003:23).

The development of rural areas, in particular the areas surrounding lands of high biological value, also requires management prescriptions that minimize edge effects and human impacts within these areas (Theobald, 2003). Theobald (2003) developed a methodology to identify lands with both high conservation value and low protection status, by incorporating socio-economic factors, like urbanization, resource use and high intensity agriculture. This process allows the user to expand on the data provided by the GAP Analysis Project of the USGS and extend it to identify development threats and

create incentives to draw development away from important landscapes and habitat corridors (Theobold, 2003).

Incentives for conservation and disincentives for sprawl and habitat destruction must be formalized and enforced (Defenders of Wildlife, 2002; ODA, 2003). Current property tax regimes favor land conversion and urban and rural sprawl leading to habitat destruction and fragmentation over much of the Northern Appalachians. Thorne and Sundquist's (2001) study of forest fragmentation in New Hampshire connects forest conversion directly to property tax regimes that encourage development and demonstrates how disincentives to conserve impede measures to slow development and sprawl. Thorne and Sundquist (2001) cite the recommendations of the New Hampshire Governor's Advisory Committee on Growth Management that direct local and regional planning processes to adopt measures that promote large forest blocks through improved zoning and taxation schemes or ordinances and provide a more conservation-oriented regulatory environment. Rupasingha and Goetz's (2001) review of land use research catalogs numerous incentives for sprawl including depressed mortgage rates, the relocation of retail, commercial and industrial complexes to the periphery, subsidized highway construction, and the attraction of single family dwellings.

b) Smart growth

Smart growth pertains to policies that restrict urban development to predetermined areas, while reducing human impacts upon functional habitats and reducing the conversion of open space (parks, agricultural areas) to urban or suburban land uses (Hollis and Fulton, 2002). These plans can be regional, such as the Massachusetts BioMap or the Florida Ecological Network, or based around a single metropolitan area, for example the Baltimore Greenways project and the Minnesota

Metro Greenways (Cohn and Lerner, 2003). These strategies dovetail with the above mentioned land use programs to afford increased protection from urban and exurban development. Hollis and Fulton (2002:1) detail the support in the US for local and state initiatives for open space preservation, including the passage of "86 of 115" referenda and the apportionment of $1.2 billion to open space preservation and land acquisition.

Benedict and McMahon (2000) envision smart growth as a function of *green infrastructure*, a system of "hubs and links" similar to the network concept discussed above. In addition, green infrastructure provides services to urban areas, "such as flood control, storm water management and the filtration of pollutants. The loss of natural systems increases the risk of flooding and natural disasters ... [and] costs communities billions in mitigation efforts and in disaster relief" (Benedict and McMahon, 2000:12).

Personal choice is also factored as a determinant within the context of low-density development; rational choice towards migration to low density development at the level of the individual may make sense, but the combined impact of the same choice upon society ends up creating a negative result (Rupasingha and Goetz, 2001). Reinvestment in city centers has been offered as a solution to the habitat consumption of suburban sprawl (Rusk, 1998), but others do not foresee smart growth as an economically viable solution to the problem of sprawl (Gordon and Richardson, 1997; O'Tolle, 1999). The concern and efficacy of smart growth, as well as the limitations of private property, are still in doubt, but what is clear is the need to limit the expansion of suburban and exurban centers in order to reduce the threat to and stress upon peripheral habitats (Theobald, 2003).

c) *Easement and Private Land Conservation*

Private land development represents a serious issue within the Northern Appalachians Ecoregion in terms of habitat destruction. Numerous mechanisms have been introduced to both ensure the continuance of private property rights and conserve open space parcels. HCPs, discussed above, are one mechanism; resource conservation agreements, conservation easements, and land trusts provide another set of policy tools.

Hollis and Fulton (2002:3) identify four categories of private land conservation; specifically the purchase of a property, the purchase of the development rights within a parcel, property tax reductions, and direct regulation or prohibition of certain activities on private property. In terms of direct purchase in the US, the Land and Water Conservation Fund, derived from off shore energy development royalties, is a significant purchaser of lands, procuring about "4.7 million acres, but much of the funds have been oriented toward recreation rather than preservation of pristine landscapes" (Hollis and Fulton, 2002:13-14).

Main et al (1999:1) propose developing resource conservation agreements (RCAs) as "an incentive-based alternative that provides private landowners compensation for the agricultural and nonagricultural development potential of their land in exchange for conserving and managing wildlife habitat." This compensation provides an incentive to offset the numerous disincentives for conservation, in particular property tax statutes which favor developed lands (Main et al, 1999). Between 1974 and 1995, two RCA programs, the Environmentally Endangered Lands and the Conservation and Recreation Land Programs in Florida, protected 360,000 ha of biologically significant lands at a cost of $1.15 billion (Main et al, 1999:1270).

2.7 Developing Suitable Political Climates for Implementation

Conservation is a political process that manages human interaction and the use of landscapes and natural resources. As such, stakeholders must be involved in the planning process. Management focuses on human activities and measures to improve or reduce impacts induced by these activities. The CBD sees

> ecosystem management [as] a social process. There are many interested communities, which must be involved through the development of efficient and effective structures and processes for decision-making and management. The approach is an overall methodological framework for supporting decisions in policy-making and planning, within which those implementing the Convention can develop more specific approaches appropriate to their particular circumstances. The ecosystem approach is a tool that contributes to the implementation of various issues addressed under the Convention, including the work on, *inter alia*, protected areas and ecological networks. (CBD, 2003:7)

Table 1 Parameters for a suitable political climate (Krup et al, 2002:13)

- Institutional and legal framework
- Planning system
- Knowledge and information
- Political commitment (provided it reflects what society really wants)
- Participation
- Technical capacity
- Awareness
- Mainstreaming in sectors
- Ensuring livelihoods (tenure, certainty, long term perspective)
- Communication and co-operation (in particular scientists-managers)
- National Biodiversity Strategy and Action Plans (NBSAPs)
- Monitoring system
- Regional co-operation
- Economical and social incentives (improved markets as benefits)

The implementation of any conservation or preservation program must assess and cultivate a socio-political climate that is willing to accept the costs and understand the benefits of a comprehensive approach to conservation. Krup *et al* (2002) delineate the necessary contextual conditions that need to be cultivated to provide an acceptable conservation foundation (see Table 1). Their framework, developed from a range of ecosystem approach case studies, suggests changing the political climate by developing a capacity for action, both within the regulatory framework and within the conservation community. The regulatory framework includes mechanisms for

participatory site selection/land use planning, implementation, and monitoring. The capacity within 'civil society' needs to provide a strong communicative ability to convey conservation benefits, assurances of continued economic viability, the provision of examples of successful 'on the ground' examples, and creating strong partnerships with local communities (Krup et al, 2002). Beatley (2000) describes the necessity of a collaborative, informed approach to conservation in order to avoid the vitriolic, combative impediments employed by extractive industries.

The increasing politicization of conservation science and the political nature of conservation decisions continue to neglect the necessary reforms needed to improve ecosystem health and reestablish ecosystem communities and interrelationships.[8] Miller et al (2001) describe this impediment to science based management which allows anti-conservation governments to produce science that fits political and economic goals, but these poorly developed "conservation strategies for large carnivores have been compromised by trying to move incrementally ... While this may prevent taxonomic extinction (in the short-term) it does little to mend ecosystems" (208). Additionally, politics has played a major role in the implementation of conservation policy. The Center for Biological Diversity, a US conservation NGO, has studied the implementation of the *Endangered Species Act* (ESA), and the lack of political impetus in taking direct action to protect endangered species. Suckling et al (2004) reviewed species listings and the relation between listing delays and species extinction or extirpation. The results concluded that "[l]ong delays – often for more than a decade, sometimes for more than twenty years – contributed to the extinction of both unlisted and listed species. Seventy-

[8] The political context of environmental decision-making generally leads to politically-charged science due to the large financial stakes involved, in particular from extractive industries and developers.

seven percent of extinctions involved significant delays in the listing process. In every instance where agency discretion permitted delay, delay occurred" (Suckling et al, 2004:8). The most egregious example cited was the delay in listing the Curtus's pearlymussel in the Tombigbee River in Alabama; listing was delayed, although the Department of Interior had identified it as imperiled, in order for dam construction to continue. After the dam was constructed, the species was listed, but disappeared due to the irreparable impacts caused by habitat destruction (Suckling et al, 2004:6).

Conservation programs must find a balance between ecological efficacy, political expediency and local acceptance. Building on ecologically focused reforms of local regulatory regimes, state, provincial and federal authorities must improve coordination and harmonization of their powers, policy enforcement and mechanisms, and institutions. Wilkinson (1999) conceived a devolved mechanism of state enforcement, similar to the provincial regimes, due to the local implementation of land use, master planning and economic development. The "local planning and zoning laws, which affect development patterns, are structured to meet state enabling acts" ... and "many national environmental laws, such as the Clean Water Act, are implemented through state programs and regulations" (Wilkinson, 1999:73). Conservation programs must have political support and public participation in order to succeed, and the implementation of these programs must follow the principles of legitimacy and transparency, and they must also benefit the at least a segment of the local population, or the policies will be reviled, or ignored (McShane, 2003).

2.8 Conclusion

The current knowledge base concerning the components of ecoregional conservation is deep and provides the foundational basis for the application of ecoregional conservation. The concepts cover conservation area design and the components of ecoregional conservation, the application of land use and smart growth strategies and the development of methodologies for cumulative impacts assessment. This review allows us to proceed with a more informed idea of what ecoregional conservation entails. The next step is to determine the gaps in the existing regulatory framework, enabling the design of an effective Model Policy.

CHAPTER 3: POLICY GAP ANALYSIS

In order to apply an ecoregional conservation program to the Northern Appalachian ecoregion, we need to understand the conservation context of the region, the policies in place, and the status of the implementation of these policies. This chapter assesses international, federal, state and provincial conservation measures, focusing on the state and provincial measures due to their increased relevance within the Northern Appalachian ecoregion.

3.1 International Institutions

Numerous cross-border commissions concerning environmental management currently exist; these include the International Joint Commission (IJC), the Commission for Environmental Cooperation (CEC), and the Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TC). These commissions are restricted to monitoring and assessment of the relevant obligations of the parties, and enforcement provisions within these institutions are strictly contained due to the potential impact upon national sovereignty and political and economic resistance to supranational environmental institutions. The potential for enforcement, limited to arbitration and recommendations, has reduced the reach and efficacy of these institutions, but each demonstrates a potential for coordinating conservation programs at this scale.

Historical environmental cooperation between the US and Canada dates back to the Boundary Waters Treaty of 1909 (the foundation of the IJC) and the Migratory Bird Convention of 1916, and has included monitoring and managing international fisheries, caribou populations on the Yukon/Alaska border, air pollution, and cross border transfers

of hazardous waste (see Table 6 in Appendix 2).[9] The most recent treaty, the North American Agreement for Environmental Cooperation (NAAEC) provides the foundation for the CEC and covers all aspects of environmental sustainability within the context of North American trade; biodiversity is one of the central concerns assessed within this framework (Kirton, 1997). The existence of these precedents and other examples of cross-border cooperative agreements indicate the potential for a cross-border ecoregional conservation regime.

a) International Joint Commission

The IJC, established by the Boundary Waters Treaty of 1909, reports on cross-border water quality and management, monitors the *Great Lakes Water Quality Agreement*, and, if requested by either country, can investigate air or water pollution (IJC, 2005). The management of cross-border watersheds is a key element of ecoregional management; policies to protect watershed quality need to be enforceable equally across political borders, while management plans must respect local jurisdiction and national sovereignty. An example of the IJC's effectiveness is the management of the St. Croix River, which forms a segment of the Maine/New Brunswick border and is cooperatively managed by the two jurisdictions. The IJC led the initial development of a cross-border river board in 1986, and in 2000 both countries signed a mandate superseding the previous agreements covering the watershed, centering on the establishment of the ecosystem approach to watershed management (IJC, 2000a).[10] The combined watershed board is responsible for monitoring water use and quality, ecosystem health, and development within the watershed, while ensuring compliance by both parties to the

[9] Note treaties signed prior to 1933 were between the US and Great Britain.
[10] Cross-border management boards exist for the Great Lakes, 10 other watersheds, and the International Air Quality Advisory Board.

agreement (in this case the governments of Maine and New Brunswick) (IJC, 2000a:21-2). The enabling legislation, the *St. Croix International Waterway Commission Act* S.N.B. c. S-14.1 (New Brunswick) and *St. Croix International Waterway Commission* Title 38, Chapter 8 (Maine), requires the board to develop a cross-border management plan to both protect the ecosystem and provide for economic development, but no enforcement provisions are included; the enforcement mechanisms remain within the control of the provincial/state agencies.

b) The Commission for Environmental Cooperation

The NAFTA-based CEC has provided a facilitative forum for the protection of species across borders by initiating cooperative programs for both species-based management (North American Conservation Action Plans) and complimentary programs working at the landscape and ecoregional level found in the *Strategic Plan for North American Cooperation in the Conservation of Biodiversity* (Strategic Plan for Biodiversity). Accordingly, the CEC acts as a cooperative body, attempting to align stakeholders towards management actions that are agreeable to all parties.[11] The approach borders on impossible, as a result of the reliance on the national and regional governments for implementation and a lack of serious action by these actors, but there has been limited success (Markell and Knox, 2003). The CEC is also not a means of supra-national enforcement, as it relies on the existing conservation frameworks for environmental protection. In 2004, a pilot program for the first continental species management plans was established for the humpback whale, leatherback turtle, and the pink-footed shearwater (Trio, 2004). In addition, the CEC has delineated a version of the

[11] The goal of the CEC was not necessarily protection of the environment, but more so the marketization of the environment (personal communication with Axel Huelsemeyer, Huelsemeyer, 2004)

ecoregions of North America and used these maps to identify priority conservation areas and a list of common species of conservation concern (author's experience with the CEC[12]; CEC, 2003).

The CEC is also involved in developing ecoregional management frameworks, specifically within the CEC's *Strategic Plan for Biodiversity.* The strategy calls for biodiversity gap analysis, threat identification and biodiversity monitoring, protecting species of common conservation concern, identification of priority areas for conservation (i.e. biodiversity hotspots), sustainable utilization of resources, alignment of management regimes, and cooperative cross-border action in order to promote both sustainable development and reduce or halt biodiversity loss (CEC, 2003). The effect of these and subsequent action plans remains to be seen, as budgetary and enforcement restraints may lead to poor or no implementation; a result common for the CEC (see Markell and Knox, 2003).

c) *Trilateral Committee for Wildlife and Ecosystem Conservation and Management*

The TC was established in 1996 through the signing of the *Memorandum of Understanding Establishing the Canada/Mexico/United States Trilateral Committee for Wildlife and Ecosystem Management*, with the intention to facilitate cooperative management and coordinate species recovery and ecosystem management programs across borders (TC, 1996). The MOU formalizes cross-border activities, including enforcement of international treaties, specifically CITES. The TC's areas of work include CITES enforcement, protected areas and shared species management, law enforcement and biodiversity information sharing (TC, 2004). The North American

[12] I worked with the CEC periodically as a consultant managing environmental informatics from 2003-2005.

Wildlife Enforcement Group (NAWEG), a joint Trilateral Committee and CEC body, is responsible for the law enforcement coordination within the TC. The NAWEG provides a precedent for cross-border cooperation focusing on law enforcement for the implementation of a cross-border ecoregional conservation model.

On a positive note, these three commissions provide valuable examples of coordinated cross-border management, in situations where the parties are willing participants and willing to follow a common means of reducing human induced environmental impacts; however, these boards do not have any enforcement powers, thus reducing their efficacy when one of the parties is unwilling to regulate itself.

3.2 Federal Conservation Frameworks[13]

The federal responsibilities and jurisdictions of the US and Canada are distinctly different and this difference has resulted in the divergent paths taken towards the conservation of biodiversity. The strong federal structure of the US allows for federal regulations to supercede state laws and grants federal jurisdiction over federal lands. The weak federal system of Canada bestows more power to the provinces, especially with respect to the management of natural resources on Crown Lands. This structural divergence is the basis for the 'command and control' framework of the US and the cooperative 'guideline' framework in Canada.

[13] The research for these sections was aided by three databases, CEC's 'Summary of Environmental Law in North America' cec.org/pubs_info_resources/law_treat_agree/summary_enviro_law/publication/index.cfm?varlan=english, Cornell University Law School's Legal Information Institute, www.law.cornell.edu, and the Canadian Legal Informational Institute, www.canlii.org/index_en.html.

However, the use of the US federal framework has been less effective in the Northern Appalachian ecoregion due to the large concentration of private lands and the relative paucity of federal lands. The framework does have several strong components, in particular the citizen suit provisions found within the *National Environmental Policy Act* of 1969 (NEPA), the *Endangered Species Act* of 1973 (ESA), the *Wilderness Act* of 1964, and the *National Forest Management Act* of (NFMA) 1976 which allow for meaningful public participation, i.e. where citizens can affect outcomes and compel government action.[14] The ESA also provides a mechanism for protecting endangered species habitats on state and private lands within the region. The Canada lynx and Atlantic salmon are two imperiled species that are protected under the ESA (USFWS, 2000).

The Canadian federal conservation framework was developed piecemeal in order to respond to myriad threats to biodiversity (Parsons, 2001). The framework affords protection of species and habitats on federal lands and provides the government the authority to designate National Parks, protect fisheries and endangered species, and assess the impact of proposed projects, policies and programs. The basic division of authority in the *Constitution Act of 1982* allows provincial ownership and management of public lands and natural resources (excluding uranium) (Section. 92a); while giving the federal government control over fisheries, coasts, trade and the negotiation of international treaties (Section. 91). In addition cross-boundary (provincial and international) issues (e.g. migratory wildlife) are regulated by the federal government. The federal government also has the potential to establish national directives using the

[14] The Citizen Submission component of the Wilderness Act has been temporarily suspended by the Bush Administration in order to halt citizen led wilderness designations. The provision may be re-instituted with future, more conservation oriented administrations.

residual Peace, Order and Good Government (POGG) provision, but has been unwilling to invoke this constitutional clause in respect to environmental issues (Parsons, 2001).

On the whole, the application of both sets of federal measures is minimal in the Northern Appalachian ecoregion, raising the importance of the role of the states and provinces. In the US, the lack of federal lands, with the exception of the National Forests of New Hampshire and Vermont, reduces the role of the *Wilderness Act*, NMFA and the reach of NEPA, although the federal ESA still applies and provides a restrictive measure for protecting threatened or endangered species on private and state land. In Canada, the division of constitutional authority limits the role of the federal government to the provisioning of environmental management guidelines and species listing under SARA. As a result, the remainder of this Policy Gap Analysis focuses on the powers of the states and provinces within the ecoregion and their potential to apply an ecoregional conservation program.

3.3 State and Provincial Conservation Frameworks – Gaps, strengths, and the center of action

The provincial frameworks are key to conservation in Canada, and the devolution of powers to the states carried out by the Reagan and both Bush administrations has also increased the importance of state-level conservation regimes in the US. The devolution in the US has also increased the flexibility of state policies, creating 'labs' to experiment with novel paradigms in regulation (Wilkerson, 1999).[15] This section will review the conservation measures employed at the state and provincial level that focus on 1) establishing and managing protected areas, 2) protecting threatened, endangered or rare

[15] This also takes into account the anti-environmental policies carried out by these administrations.

(TER) species, 3) managing natural resource extraction, 4) developing land use plans and 5) enforcing environmental assessment measures. I focus on the main gaps, strengths, and best practices in the context of the each state or province.

In order to reduce repetition, I will start the analysis by discussing two strengths common among all of the jurisdictions: the implementation of ecological land classification programs and the ability to institute conservation easements on private property.

As discussed in Section 3.2, ecoregional conservation programs must be founded on an in-depth ecological classification, that delineates the varying ecosystems and landscapes that form the ecoregion, along with species range and presence information. All jurisdictions have completed an ecological classification (see NatureServe, 2003) and are in the process of developing an inventory of biodiversity information within their jurisdiction. The completion of this initial stage is an important step in the process of instituting an ecoregional conservation program. The second strength is that all jurisdictions have programs allowing for the establishment of conservation easements on private property (see Section 2.6a for more information concerning easements). These easements allow property owners to cede development rights in return for reduced taxation.

a) Québec

The Northern Appalachian ecoregion in Québec covers the Gaspé Peninsula and stretches west and south along the St. Lawrence River before moving inland into the Eastern Townships and connecting to the Green Mountains of Vermont and the White Mountains of New Hampshire and Maine. In terms of protected areas, Québec has officially protected the least amount of land (as a percentage of total area) of any

Canadian province or US state, 2.65%[16] (NTREE, 2003:29). Crown lands management is directed almost exclusively to resource development (Aux Arbres Citoyens, 2005), although the proposed components concerning natural resource management within the new sustainable development law appear to be promising, nothing has been formalized or presented before the National Assembly, so it is too early to comment on this potential new direction.

The threats facing Québec change as one travels west to east within the ecoregion. The Eastern Townships region is mostly private land and faces increasing development pressure resulting in rural sprawl, while the Gaspé region continues to exhibit the impacts of poorly planned resource extraction, such as forestry in the reserve faunique of the Chic Chocs or the devastating scar left by the abandoned mining operations in Murdochville (author's field study).

The relevant regulations assessed in this section include the *Parks Act*, the *Act Respecting Threatened or Vulnerable Species*, the *Forest Act*, the *Québec Environmental Quality Act*, the Québec Protected Areas Strategy (SQAP, in French), and a suite of land use regulations.

Protected Areas Establishment and Management

As a means to 'catch up' to the surrounding provinces in terms of lands protected, Québec developed the SQAP (Québec Protected Areas Strategy) in 2000. It is the centerpiece of the province's program to protect biodiversity and implement the CBD.

[16] This refers to protected areas where logging, mining and energy extraction is prohibited and does not include any sites protected after 2004.

The goals of the SQAP are to protect 8% of each ecosystem found in Québec by 2005,[17] to develop an extensive protected areas network focusing "on the preservation of representative sampling of [Québec's] biodiversity," and to "preserve sensitive areas or exceptional settings as well as the habitat of threatened or vulnerable species" (Québec Minister of the Environment, 2003). The strength of the plan is the integration of both representativity and connectivity within the design of the conservation network. The incorporation of these concepts demonstrates the potential of this plan, but the plan's implementation has been limited. In 2002, the government designated 13,000 km^2 in the Québec boreal forest; unfortunately, however, no areas were protected within the Gaspé or Eastern Townships (i.e. within the Northern Appalachian ecoregion).

Within the SQAP, the Minister of the Environment has three policy options for designating protected areas: the *Parks Act* of 1977, the *Ecological Reserve Act* of 1974, and the *Natural Heritage Conservation Act* of 2002. The Québec *Parks Act* and the *Ecological Reserves Act* give the provincial Minister of the Environment the authority to designate protected areas on Crown lands and to regulate the management of the area. The acts specifically prohibit all extractive activities, including hunting and trapping within these designated sites. These sites are managed under IUCN Category I or II (see Table 4 in Appendix 2 for a description of the IUCN categories). The Québec Park designation should not be confused with Québec's reserve faunique sites, which permit all of the above mentioned industrial activities and are considered managed lands, not protected areas (NRTEE, 2003). Additionally, the *Natural Heritage Conservation Act* provides the Minister of the Environment with the power to halt an activity that is

[17] Note the level required by the CBD is 12%, so this level remains quite low, especially in comparison with jurisdictions with similar size and population density, for example BC has protected 11% and Alaska has over 30% protected.

demonstrably degrading an important component of the 'natural environment' and allows for the development of management plans within areas that have been designated as a conservation area, but have not been established by an act from the National Assembly. These acts allow the Minister of the Environment to designate de facto protected areas, without parliamentary action.

In addition to the lack of protected areas designated within the Northern Appalachian ecoregion, the Québec government has recently subverted the *Parks Act* by allowing illegal development and by illegally transferring lands within two parks, Parc d'Oka and Parc Mont-Orford[18] (interview with John O'Driscoll, Jean-Francois Gagnon). Section 7 of the Québec *Parks Act* forbids the construction of any new pipelines within a park boundary, but the Charest government is permitting the expansion of a pipeline through the middle of Parc d'Oka. Within Parc-Mont-Orford, an illegal land exchange (Section 4) is removing valuable lands from the park for ski area expansion, in exchange for lands with a lower biological value.[19] The public's only recourse in such situations is the Bureau d'audiences publiques sur l'environnement (BAPE) process or expensive legal actions; the lack of public access to this process represents a significant gap within Québec's framework.

The Exceptional Forest Ecosystems (EFE) program protects sites at the stand scale that are either rare, old growth or forest ecosystems that are home to endangered, rare or threatened species under regulations similar to the *Parks Act*, the *Ecological Reserves Act*, and the *Natural Heritage Conservation Act*. The Minister of Natural

[18] Note Park D'Oka is not located in the Northern Appalachian ecoregion, but it provides a good example of the mismanagement of designated parks in Quebec. Park Mont-Orford is located in the Eastern Townships.

[19] For more information see the BAPE website, Parc Mont-Orford www.bape.gouv.qc.ca/sections/mandats/mont-orford/index.htm and for Parc d'Oka www.bape.gouv.qc.ca/sections/mandats/oleoduc_oka/index.htm

Resources manages these sites, generally no larger than 5 square kilometers, and usually less than 1 km^2. This program could be used to connect stretches of protected private land in the Eastern Townships, providing corridors of shelter, old growth or rare forest stands and linkages across borders.

Threatened, Endangered & Rare species protection

The *Act Respecting Threatened or Vulnerable Species* of 1989 provides protection for endangered species and their habitats. The listing process and designation of critical habitat is determined entirely by the Minister of the Environment, with input from other ministries. The Act allows the minister to lease or acquire the habitat of listed species and provides funds for the study of endangered species. In addition, the Act also requires persons or companies to be financially responsible for damage realized on any area of critical habitat. The critical habitat is demarcated by the Minister of the Environment and these areas are protected on private land as long as the owner has been consulted. The Act does contain some strong component including the critical habitat provisions, but the process is dominated by the Minister and there are no means to compel the government to act to either develop a management plan or protect critical habitat. The political nature of this act is its weakness, as was demonstrated in the case of the copper redhorse, a species of fish indigenous to Québec that was listed under the provincial act. As the government was considering the construction of a dam on the Richelieu River, it found the dam would create significant impacts for the already degraded critical habitat of the copper redhorse in the only river where the fish has been able to reproduce (Hout, 1999), and would likely lead to extirpation or extinction (Branchaud and Gendron, 2000). Regardless of these

findings, the dam was constructed and the species has continued to decline (Branchaud and Gendron, 2000).

Public Lands Management and Natural Resource Management

The Charest government recently announced the results of a review of all forestry activities on Crown lands. The review does not focus entirely on conservation issues, but includes an overall assessment of the impacts of forestry on the environment, economy, government subsidies, and societal indicators. The review, completed by the Coulombe Commission, found Québec's forests were being severely degraded due to both high grading, that is the removal of the best trees, and current forest management regimes that are removing forest 'capital' instead of forest 'interest' (Coulombe Commission, 2004). The disturbing trends uncovered by the commission need to be addressed in order to ensure the conservation of biodiversity and the sustainability of the forestry sector. As noted by Andre Bouchard, a member of the commission, "in light of our consultations and analyses, we are convinced that Québec must definitely lean toward ecosystem-based management... not only because it will protect the environment and better balance management priorities, but also because it will ensure the long-term viability of wood processing companies" (Coulombe Commission, 2004b). The shift to an ecosystem approach for forest management will improve the quality of forests and provide a sustainable approach for forest management, while creating less of an impact upon the areas surrounding protected and core areas. The implementation of the recommendations of the Coulombe Commission would also increase Québec's conservation portfolio and

facilitate the implementation of an ecoregional conservation vision, but questions remain about political commitment for conservation in Québec[20] (Boyd, 2003).

The Québec *Forests Act* of 1986 allots 25-year forestry leases to wood processing or mill owners for the provision of annual harvests that meet the needs of the lessee. The contracts also deduct any improvements on Crown land performed by the timber company, including costs incurred from complying with the Québec standards for forest management (MRNFPa, 2003). This regulation acts as a subsidy for access to timber resources and is a disincentive for conservation. Each allocation is reviewed every five years to measure compliance with provincial forestry standards, but the Coulombe Commission (2004) found compliance and monitoring was weak and insufficient to ensure long-term timber extraction.

Importantly, the *Forest Act* also contains a measure allowing the Minister of Natural Resources to change the management regime of an area to designate a protected area or to change the management regime of an area to protect a species or ecosystem (MRNFPa, 2003). Any change in the forestry lease may require a change in other management plans or remuneration by the province to the lessee, but this component provides the opportunity to designate at least de facto protected areas within areas of high ecological value, and can delay extraction or development until the National Assembly can act to legislatively protect the area. In addition, the *Forest Act* requires a buffer zone to be created along all significant rivers. The buffer zones act as a *de facto* protected area; they are generally required to extend 20m from either side of major rivers and 5-10m along first through third order streams, but compliance with the minimum

[20] The Coulombe Commission's investigation was initiated within a greater government-wide effort to employ sustainable economic development programs, in particular within the natural resources sector.

requirements of this measure is limited (author's field study). In the Gaspé region, many of the buffer zones along streams were no wider than 10m, even in the protected zones along the York River.[21]

Land Use Regulations

The *Land Use Planning and Development Act* requires all municipalities and regions to develop a land use plan that covers development (roads/infrastructure, construction, etc.) and the protection of agricultural and ecological areas. Specifically, Section 5 of the act allows land use restrictions to be put into place for reasons of public hazard and ecological or agricultural significance, and permits areas to be attributed with a preference for development within the land use plans (Section 5, *Land Use Planning and Development Act*). Section 62 allows municipalities to restrict development outside urban perimeters and to coordinate development with other municipalities. This section essentially allows for multiple municipalities to develop a coordinated ecoregional conservation plan, ensuring that connectivity exists between core areas, and enables the regional planning board to restrict specific land uses (Section 62). Finally, the Act allows for bequeathment and expropriation of lands for the establishment of parks or protected areas (Section 117).

Within the land use planning regulations, the Québec government requires land use plans to delineate agricultural zones "to secure a lasting territorial basis for the practice of agriculture, and to promote, in keeping with the concept of sustainable development, the preservation and development of agricultural activities and enterprises in the agricultural zones established by the regime" (*Preservation of Agricultural Lands and Agricultural Activities Act*, Chapter P-41.1). The regulation restricts any

[21] Personal observations

development on agricultural land, unless no other land is available. Again, a similar zoning protection can be implemented for ecoregional conservation.

Environmental Assessments

The *Québec Environmental Quality Act* of 1972 requires agencies "to prepare plans and programs for the conservation, protection, and management of the environment and emergency plans to fight any form of contamination or destruction of the environment" (Division II, Article 2). This includes execution of environmental impact assessments and environmental planning. A key component of the *Québec Environmental Quality Act* is the BAPE, mentioned above. The BAPE allows and facilitates public participation in the development of environmental policy and specific projects through public meetings and the initiation of expert panels to advise on project-specific environmental impacts. The BAPE then makes a decision on whether or not to execute a project. Unfortunately, the BAPE findings are not binding and can be overruled by the minister responsible for the project, another gap in the Québec framework.[22]

The Québec framework contains numerous components that can be utilized to implement an ecoregional conservation program, especially within the SQAP, but the actual application of this framework has been limited. The existence of the large tracts of Crown land in the Gaspé also provides an opportunity to establish protected areas through the legislation detailed in the *Protected Areas* section. The land use acts can be used to effectively protect habitat on private lands, while concentrating development within 'urbanized perimeters', and the *Parks Act* and the *Natural Heritage Conservation*

[22]Refer to these sites for findings from the BAPE where the government disregarded the BAPE findings http://www.bape.gouv.qc.ca/sections/mandats/becancour/index.htm, http://www.bape.gouv.qc.ca/sections/archives/suroit/

Act can protect areas that have been found to have high ecological value. As noted by the Coulombe Commission, the SQAP needs to be fully implemented and expanded to cover closer to 20-30% of the ecoregion, as Québec continues to have the lowest percentage of protected areas in either country, and most of the protected areas are found outside the Northern Appalachian ecoregion. The two other primary weaknesses are the political nature of the at-risk species legislation and the poor application and adherence to the *Parks Act*, both of which are threatening the efficacy of conservation programs in Québec.

b) Nova Scotia

The entire province of Nova Scotia is covered by the Northern Appalachian ecoregion, from the key connection to New Brunswick at the Isthmus of Chignecto, to the Fundy and Atlantic coasts, and the highlands of the Tobeatic and Kejimikujik parks on the mainland, and the highlands of Cape Breton respectively. Nova Scotia has a progressive conservation framework, but the enforcement and management dictated in these acts is severely limited (Boyd, 2003). Relevant acts to be discussed in this section are: the *Wilderness Protection Act*, the *Nature Reserves Act*, the *Forestry Act*, the *Endangered Species Act*, along with public participation measures.

Protected Areas Establishment and Management

Recent additions to the Nova Scotia Protected Areas portfolio have extended the implementation of Nova Scotia's biodiversity plan, but could also act as an obstacle to further conservation efforts. While these additions have been significant, they have fallen significantly short of government commitments (NSPLC, 2004). The Nova Scotia Public Lands Committee (NSPLC), a conservation coalition, has developed an inventory of biological hotspots and is currently campaigning to generate public and political support

towards protection of these areas (NSPLC, 2004b). In addition to the protection of public lands, conserving corridors and core areas on private lands is exceedingly vital, as only 30% of the province is public land, the lowest of the three Canadian provinces discussed (NSPLC, 2004a).

Nova Scotia has three types of protected areas: Wilderness Areas, Nature Reserves, and Heritage Rivers. Each of these has corresponding legislation and regulations that provide the government with the power to designate additional areas: Wilderness Areas are governed by the *Wilderness Areas Protection Act*; Nature Reserves by the *Special Places Protection Act*; and Heritage Rivers are part of the Canadian Heritage Rivers System, a provincial-federal partnership to protect Heritage Rivers.

Most significantly, the *Wilderness Areas Protection Act* of 1998 designated 30 Wilderness Areas on Crown lands, while creating the framework for establishing additional Wilderness Areas. The Wilderness Areas are managed under the Nova Scotia Department of Environment and Labour (NSDEL) and are managed within IUCN Level I restrictions (see Table 4 in Appendix 2). The act provides wilderness protection for areas of Crown lands, but there is no mechanism that allows citizen participation in the establishment of new protected areas; participation is restricted to the post-designation process.

The *Special Places Protection Act* of 1981, administered by the Department of Environment and Labor (NSDEL), provides "for the identification, acquisition, designation, protection, maintenance, restoration, regulation, study, educational use and environmental appreciation of nature reserves" (NSDEL, 2003). The Act also established the Nature Reserves Advisory Committee (NRAC). The appointed members of the

NRAC were directed to develop management plans for protected areas and to determine potential protected areas in the province. The NRAC is restricted to an advisory role and the Minister may overrule the committee. The passing of the act was a significant conservation milestone, but the government sees this act and the accompanying designations as the 'completion' of the network, although numerous ecoregions remain without protection (interview with David Miller).

Threatened, Endangered and Rare Species Protection

As with Québec, the *Endangered Species Act* of 1998 provides basic core habitat protection and individual protection. The act requires the development of recovery plans one year after listing of an endangered species and two years after the listing of a threatened species. After listing, the Minister appoints a recovery team to prepare the recovery plan. The Minister may only declare core habitat on private lands if the habitat on Crown lands is not sufficient. The provision allows the Minister to restrict any use of parts or the entire designated critical habitat. The private lands provision (16.1) allows the Minister to develop agreements with landowners of critical habitat.

The Species-at-Risk Conservation Fund was established in 2003 to support this role. The fund allows the government to acquire or receive private lands in order to preserve critical habitat. The funds may also be directed towards the development of recovery plans and status reports. As with Québec, the act is highly political and there are no means to compel government action (Boyd, 2003).

Public lands Management and Natural Resource Management

The management of public land, not yet within a conservation portfolio, is controlled through the Integrated Resource Management Plan developed by the Nova

Scotia Department of Natural Resources (NSDNR) and released for public comment in 2000 (NSSA, 2005). The management plan divides public land parcels into three categories: Category 1 allows unrestricted development and use; Category 2 restricts certain uses (e.g. protecting moose habitat by restricting mining activities); and Category 3 provides for protection, restricts development and allows for future protected areas designation (NSDNR, 2004). Interestingly, the planning process excluded public comment until after the lands had been categorized; conservation groups, the tourism industry and much of the local media criticized the plan as favoring industry and mechanized recreation, while reducing the importance of conservation and preservation of critical public lands hotspots[23] (interview with Raymond Plourde). The total area of land added to the protected areas system within this planning framework was less than one percent of all Crown land (NSSA, 2005). Within this management framework, the opportunity exists to establish an ecoregional approach, but the NSDNR refuses to do so (interview with Raymond Plourde).

Within the context of public lands management, the *Forestry Act* is exceedingly vague in terms of management prescriptions and sustainability measures. The act has little consideration of biodiversity and appears to favor the establishment of plantations (see Sections 9c-9h and 11.1-11.4). The act also provides subsidies to promote wood products and silviculture research through the Sustainable Forestry Fund. Reform of this act is needed to ensure the establishment of protected areas, buffers and corridors within heavily managed Crown Lands.

[23] See NSPLC compilation of public comments http://publicland.ca/publiclands/irmpublicreaction.html

Land Use Regulations

Land use regulations in Nova Scotia are developed at the municipal level and there is no province-wide standard for land use planning (see *Municipal Government Act*, Planning Commission Orders), although specific land use regulations have been passed for areas of ecological or cultural value. The lack of provincial directives to guide and coordinate land use planning has the potential to create significant gaps within an ecoregional conservation plan.

As mentioned above, the protected areas legislation is impressive, but enforcement, designation components and pro-active measures are significantly lacking (interviews with Raymond Plourde, see Boyd, 2003). The NSDNR has become a significant barrier to the protection of public land hotspots, generally favoring mining and mechanized recreation over the designations to protect and sustain biodiversity (interview with Raymond Plourde). Agency capture (by the mining and mechanized recreation interests), especially within a framework with limited public participation, reduces the efficacy of a strong framework and demonstrates the need for effective, meaningful participation in the form of citizen suit provisions that allow citizens or public interest groups to compel government action or have a role in the outcomes of agency actions.

c) New Brunswick

New Brunswick is at the center of the Canadian portion of the Northern Appalachian ecoregion. It has an extensive border with Québec and Maine, and maintains a vital connection with Nova Scotia through the Chignecto Isthmus. New Brunswick is struggling to incorporate conservation measures within their Crown lands management framework; protected areas programs are in the process of being established and the forest management regime on Crown lands is also evolving due to a recent

assessment of Crown lands management (NBDNR, 2000). Interviews with conservation groups, including CPAWS NB, the Conservation Council of New Brunswick, and the Crown Lands Network, highlighted the growing divergence between policy language and agency implementation.

Protected Areas Establishment and Management

In terms of protected areas, the *Protected Natural Areas Act*, passed in February 2003, designated 10 new sites and permanently protected previously designated sites. In addition, it sanctions the formation of local, provincial and scientific advisory boards, the development of management plans, and it regulates the use and access of protected areas, while founding a protected areas trust fund to support conservation work related to the protected areas system (Natural Resources NB, 2003). The public advisory boards exist on two levels, locally around the protected sites; and provincially directed to develop scientifically based management programs. This public participation measure, although newly introduced, is a significant step towards local involvement and management of public lands (interview with Roberta Clowater). Unfortunately, according to David Coon of the CCNB, the passage of this act has expended the current "political appetite" for conservation, and new protected areas are unlikely to be designated if a drop in annual allowable timber harvest is a result. The a commitment to add another 5000 hectares to the protected areas system on Crown land by 2007, through a "fine filter" prioritization process, has been characterized as the 'completion' of the New Brunswick protected areas system even though the existence of core areas and connectivity remains minimal.

Threatened, Endangered and Rare Species Protection

The *New Brunswick Endangered Species Act*, similar to SARA and other provincial legislation, prohibits the harassment, injury, hazing, trade and taking of individual life forms of a protected species and protects critical habitat; however, similar to Québec and Nova Scotia, numerous criticisms of this act have arisen due to the political nature of the listing process (Boyd, 2002; Clowater and Coon, 1996).

Public lands Management and Natural Resource Management

The future management of Crown land forests has been directed by the Select Committee on Wood Supply, the report on *New Brunswick Crown Forests: Assessment of Stewardship and Management* (the Jaakko Pöyry Report), and public reaction to this report.[24] The Jaakko Pöyry Report proposed to increase yields on Crown lands by converting a higher proportion of Crown timber leases into softwood timber plantations and allowing more timber harvests in special management areas (stream buffers, specially designated old forest habitat, for example). This would effectively reduce the biodiversity of forest types on Crown lands and reduce the effectiveness of an ecoregional approach, as intensive harvesting would likely occur within potential corridors between core protected areas, further increasing habitat fragmentation. The hostile public reaction (NBDNR, 2004), in particular from conservation groups, led the provincial government to create the Select Committee on Wood Supply, with a mandate to gather public input regarding the future of NB's Crown forest management. Public comments during the hearings led the Select Committee to recommend the government minimize plantations, maintain Acadian forests, and diversify the forest industry to reflect the Acadian forest structure.

[24] See http://www.gnb.ca/0078/reports/jpmc.asp for the report and the NBDNR comments.

The *Crown Lands and Forests Act* is the legislative framework for managing forestry (and other extractive activities) on Crown land. The act requires forestry companies to develop and implement five-year forest management plans and the plans must address and adhere to the Department of Natural Resources' forestry standards. The development of this management regime created a significant conservation gap on Crown lands. The first iteration of the act consolidated all timber leases on Crown lands (~43% of the province) and divided the leases into 10 licenses (interview with Marc Spence). The private woodlot owners and small contractors on private lands were given primary source-of-supply rights for specific mills in the region (interview with Marc Spence). It is important to note that this provision was removed in the second iteration of this act, passed in 1992, which facilitated the consolidation of the leases. Currently, ten licenses exist for all of the Crown forests and are held by 5-6[25] companies (interview with David Coon, Beth McLaughlin and Marc Spence). These companies also control all of the mills that process the timber. The extensive centralization of the timber holdings on public lands was cited by conservation groups as an impediment to both conservation objectives and public participation in Crown forest management (interviews with Roberta Clowater; David Coon). These licenses comprise over 80% of the Crown forests in the province (interview with Marc Spence).

Disincentives for sustainable forest management in New Brunswick are also creating barriers to instituting a connective, systematic planning program for protected areas. First, the centralization of the timber holdings in the hands of a few multinational companies has allowed these companies to control timber supply and mill allocations, creating an incentive to clear cut without regard to long-term sustainability and habitat

[25] One of the current permit holders is currently in bankruptcy proceedings

condition. Secondly, an avoidance of FSC certified timber by these companies has resulted in fewer Forest Stewardship Council (FSC) certifications[26] (interview with Marc Spence). Lastly, a 50% capital gains tax is applied when land is transferred inter-generationally or sold (interview with Marc Spence). A woodlot with an inventoried value of $100,000-200,000 would need to harvest a significant portion of their holding in order to pay the capital gains tax, unless they had another means of income. Removing or reducing this tax burden would likely facilitate conservation and promote the creation of important wildlife corridors on private lands (interview with Marc Spence).

Land Use Regulations

The *Community Planning Act* of 1973 regulates the development of regional and municipal land use plans, and, similar to Québec, contains a provision for designating a development boundary (Section 23.5.2-3). The land use plan is required to delineate areas of natural resource conservation, "conservation of the physical environment" and watershed and water resource protection (23.5.5, 6, 9).

New Brunswick is the Canadian heart of the ecoregion, as it connects Nova Scotia over the Chignecto Isthmus and has an extensive border with Maine. Developing an ecoregional approach to conservation and connecting the current protected areas across the border could provide significant connective habitats. In this respect, Roberta Clowater, of CPAWS New Brunswick, sees an opportunity for New Brunswick's biodiversity and conservation programs to be viewed in a regional context, within which it plays a key role. Unfortunately, there are few cross border programs currently being implemented and conservation initiatives are developed without consideration of the

[26] The FSC Maritime standard is the regional FSC standard and is more conservation oriented than the SFI standard

greater ecoregional context. The management of Crown lands is directed almost entirely to industrial forestry and connectivity is not a high priority within the protected areas planning process in New Brunswick, another considerable gap in the conservation portfolio. In short, the protected areas framework exists, as well as the power to regulate land use to provide environmental services or protect the environment; these regulations can be used to designate vital corridors in New Brunswick.

d) Maine

Maine constitutes the core of the Northern Appalachians on the US side of the border; connecting its protected areas with New Brunswick is a key tactic within the implementation of an ecoregional conservation strategy. Maine's small percentage of public lands is unique in the region and creates the need to assess the conservation framework with an approach that focuses almost entirely on how to preserve or acquire private forest land. The concentration of private lands leads the scope of the assessment to concentrate on the comprehensive rural land use planning program, programs that fund habitat acquisition programs and major land exchanges between private entities. The amount of lands acquired by NGOs in Maine in the past 10 years is unprecedented in the region and thus deserves specific analysis. The regulations concerning park management and forestry will follow the discussion of private land conservation.

Private Land Conservation Initiatives

A continuing trend in Maine is the large percentage of private forest holdings changing hands, from private industrial forestry companies to either private conservation groups or the state (Irland, 1998). Conservation proponents in Maine have focused their efforts on private lands; Table 2 lists the largest private land deals completed within the last decade (interview with Conrad Reining, Ralph Knoll) and highlights the need for

measures that promote and facilitate private land conservation and transfers across the entire ecoregion.

Table 2 Recent land purchases in Maine (interview with Conrad Reining)

Area Conserved	Size (acres)
Pingree Forest Easement	762,192
Debsconeag Lakes/Katahdin Forest	200,000
St. John River	221,000
Machias River	31,000
Nicatous Lake	20,268
West Branch of the Penobscot River	329,000

Large sales of forest lands provide the opportunity for the creation of large core protected areas and areas which, although in need of rehabilitation, can be used to connect the key areas across the ecoregion. As Thorne and Sundquist (2001) discuss, the subdivision of these lands leads to extensive rural development and creates forest fragmentation and degradation. As a means to address this concern, the purchase of the development rights in Pingree Forest Easement by the New England Forestry Foundation provides an example of how to reduce the threats related to rural sprawl. Development rights were removed and the area will be sustainably logged, providing long-term economic stability and no threat of rural sprawl (NEFF, 2005).

The Katahdin-Debsconeag land purchase is an interesting private-private land exchange between the Nature Conservancy and Great Northern Paper, a large employer in Northern Maine. The Nature Conservancy acquired $50 million of Great Northern's debt and retired $14 million in other loans in exchange for a conservation easement over 200,000 acres surrounding Mt. Katahdin. This easement will restrict future development, while acquiring a 41,000 acre stretch of wilderness near the Debsconeag Lakes – a parcel which connects Baxter State Park, the Allagash Wilderness Waterway, and other private land reserves (interview with Conrad Reining). The private land exchange protected and

connected a swath of the North Woods, while sustaining economic activity in the North Woods of Maine.

Unfortunately, however, habitat fragmentation has been exacerbated by another facet of rural sprawl that has spread into northern Maine. Developers are clear cutting large stretches of subdivided properties and converting these parcels to residential land use (interview with William Suggs, Diano Circo; MFS, 2005). This process, referred to as liquidation or terminal harvesting, not only removes productive forests and the opportunity for sustainable forestry and provision of buffer zones, but the added infrastructure fragments and degrades the surrounding habitat and water quality. The government of Maine has attempted to address this problem by instituting new land transfer and harvest standards (Maine Forest Service Rule – Chapter 23, *Harvesting Standards to substantially eliminate Liquidation Harvesting*). As these new regulations only came into effect in January, 2005, an assessment of their efficacy could not be included in the present discussion.

Protected Areas Establishment and Management

The above mentioned land purchases are conducted between private entities with little public involvement, but state agencies have also instituted acquisition programs, namely within the Land for Maine's Future (LMF) program and the Bureau of Parks and Lands. In 1999, the LMF program received $50 million after a bond was passed by state referendum, with $40 million dedicated to open space protection and boating access. The monies have been used and the legislature is considering bringing a similar referendum to the public in the fall of 2005 (interview with Ralph Knoll). This was the third direct

financial allocation given by voters for land acquisition in Maine and represents both strong public support for conservation and effective public participation.

Threatened, Endangered and Rare Species Protection

The Maine *Endangered Species Act* does not require recovery plans or the designation of critical habitat, but fortunately the federal ESA has been implemented to protect habitat for Atlantic salmon and Canada lynx (interview with Conrad Reining; USFWS, 2000; Ray, 2000). The designation of critical habitat for these two species will protect habitat surrounding salmon rivers (USFWS, 2000) and the unfragmented forest habitats in northern Maine (Ray, 2000). This application demonstrates a potential strength for providing protection for species and landscapes inhabiting the listed species' critical habitat.

Public Lands Management and Natural Resource Management

The management of state lands in Maine is regulated through the *Integrated Resource Policy* (IRP), initially adopted in 1985. Lands with a conservation potential are either managed as parks, administered by the Maine Bureau of Parks and Land (MBPL), reserved lands or nonreserved lands (MDC, 2000). The reserved and nonreserved lands are managed under the principle of multiple use and the management plans must include measures for timber harvesting, other resource extraction, and mechanized recreation (MDC, 2000). The parks designation provides a management regime comparable to IUCN Level I, II or III, depending on the management designation[27]. The major

[27] IRP classification scheme: Special Protection Areas – includes natural areas, historic/cultural areas, and ecological reserves; Backcountry recreation areas – includes non-mechanized and motorized recreation areas; Wildlife dominant areas – includes essential habitat, significant habitat, and specialized habitat areas and features; Remote recreation areas – includes trail corridors, shorelines, and remote ponds; Visual

conservation impediment within this management regime is the artificial cap on protected areas (interview with Conrad Reining). The IRP process has limited the percentage of public lands that can be designated as ecological reserves (IUCN Level I) at 15% of the lands managed by the MBPL or 100,000 acres, whichever is less, and can only cover 6% of areas with forestry potential (MDC, 2000:24). The artificial cap places an even higher importance on the need for proper management of private conservation lands in the state.

Land Use Regulations

The Land Use Regulation Commission (LURC) for the unorganized townships governs planning and land use throughout the northern and eastern sections of Maine. It regulates about 10.4 million acres, of which 95% is privately owned and sparsely populated (~11,000 residents) (MLURC, 1997). The road network within the region was established during the last 30 years, mainly for mining or the extraction of timber, not development (MLURC, 1997:15). The areas follow the northern Maine/Canadian border and the current land use planning framework could provide significant protection if the management focus was shifted towards biodiversity protection. The LURC also provides a precedent for private land use regulation outside of municipal boundaries. The LURC defines development goals and principles across the land use spectrum, from resource extraction to residential development, and finally conservation and the provision of habitats within areas facing a high rate of development. The regulations, however, are sufficiently vague, requiring interpretation from the commissioners on the board (interview with Diano Circo). A similar provision expanded across the ecoregion would

---

consideration areas – includes areas with visual or aesthetic value; Developed recreation areas – includes developed class i and developed class ii areas; Timber management areas – includes areas dedicated to forestry (from MDC, 2000:12)

be effective at limiting rural sprawl, while providing for the creation of areas for sustainable resource use and wilderness preserves.

Conservation of private lands in Maine posits different challenges from those of the Canadian provinces, which have large stretches of Crown lands. The major threat to biodiversity in Maine is the resale and subdivision of forest holdings and subsequent rural sprawl. Remedial policies have been introduced, private lands have been purchased by land trusts and been acquired by government, and rural land use policies exist to promote conservation, but concerns remain about whether these programs are strong enough and whether they effectively prioritize biodiversity. These large tracts of land need to receive some level of protection and the management prescriptions within these areas must be viewed from an ecoregional perspective (Carroll, 2003). Possible ecological connections must be assessed and protected instead of facilitating subdivisions and rural sprawl. The subdivision of these lands presents a long-term threat to the conservation and designation of large protected areas in the region.

e) Vermont and New Hampshire

Vermont and New Hampshire are currently experiencing population growth and subsequent urban sprawl within key connective areas, but both of these jurisdictions have developed incentive programs to protect private landholdings – the Current Use policy – and are developing Comprehensive Wildlife Conservation Strategies (CWCS), part of a state-federal partnership to manage non-game wildlife and develop protected areas. In addition, the Green and White Mountain National Forests provide the opportunity to connect federal and state lands to core wilderness areas within the ecoregion. The Current Use policies, land use planning policies, private land conservation, and the Vermont Biodiversity Project are analyzed in this section for their strengths and gaps.

Protected Areas Establishment and Management

The Vermont Biodiversity Project (VBP) is a best practice biodiversity assessment in the policy gap analysis, as it has taken the USGS GAP program and used it to assess biodiversity conditions within the state and provide an ecological framework to develop a proposed connected system of protected areas. The VBP has completed the baseline information needed for the implementation of an ecoregional conservation program. This is an encouraging development that provides the scientific foundation for the conservation network design (see Thompson, 2002 for the VBP report).

The New Hampshire Living Legacy Program (NHLLP) is a similar project that developed an inventory and assessment of the status of biodiversity in the state and produced a 'blueprint' for biodiversity conservation in the state (Fleming, 2003). The NHLLP is a partnership composed of experts from state agencies, the University of New Hampshire, and locally-based conservation NGOs. Its initial goal in 1996 was to develop a complete ecological gap analysis of the conservation network in the state (Fleming, 2003). Currently, the NHLLP is developing "a statewide Comprehensive Conservation Plan that includes compilation and analysis of current knowledge and data sets, creation of dynamic and up-to-date databases, and assessment and mapping of the state's most ecologically significant areas" (Fleming, 2003:13). Both of these programs, the VBP and the NHLLP, represent strengths within the conservation frameworks of the two states, political support for developing ecoregional conservation plans, and the foundation for the creation of connected landscapes.

Threatened, Endangered and Rare Species Protection

In another example of the devolution of federal powers to the states, the USFWS has created a grant program through which funds can be obtained by state agencies that are developing comprehensive wildlife conservation strategies (CWCS). The goal of the CWCS program is to coordinate the management of non-game species between states and between states and the federal government. This policy prioritizes protection for habitats with high biological value and works to identify habitat stressors and links between habitats and indicator, focal or keystone species (NHFGD, 2004). For example, New Hampshire has identified both areas of high biological concern and key habitats for rare and threatened species, specifically connections between Sandplain/Pitch Pine habitats and the Karner Blue Butterfly, an endangered species (NHFGD, 2004). In Vermont, the VBP facilitated the formation of their Comprehensive Wildlife Conservation Plans. These plans provide a means of generating rigorous scientific information that will facilitate the linkage of landscapes and important habitats. Additionally, the development of CWCSs provides for government and NGO cooperation through cooperative inventory programs concerning the gathering of species and ecological data. The final plans will not be approved until October 2005, but the guiding principles and plan frameworks provide a key measure to connect key habitats.

Public Lands Management and Natural Resource Management

The Green and White National Forests cover a large swath of the two states; land use within the National Forests is regulated by the *National Forest Management Act* of (1976) , the *National Environmental Policy Act* of 1976, and, where wilderness has been designated, the *Wilderness Act* of 1964. The remaining public lands in the two states are

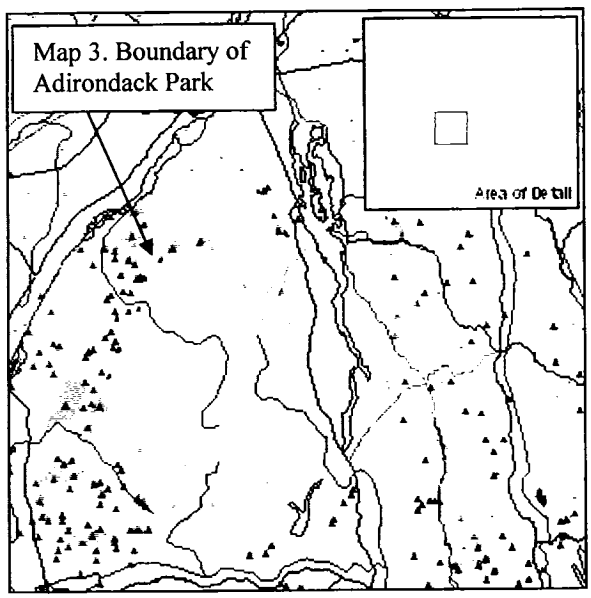
managed by state statutes similar to the federal management regulations (interview with Conrad Reining).

Land Use Regulations

Vermont's *Land Use and Development Law* (Title 10, c. 151), passed in 2003, is an attempt to combat sprawl at the state level by forcing developers to perform environmental impact assessments of any subdivision, development, resource extraction, or construction above 2500 feet (VEB, 2003). Unfortunately, the application of the act has been limited and the mitigation measures required in the environmental assessments are not enough to preserve biodiversity (interview with Conrad Reining). Both states also employ a Current Use program that allows for reductions on property taxes in exchange for the landholder's accession of development rights.

Both Vermont and New Hampshire face the threat of rural sprawl and increasing population pressure, but have only implemented limited measures to promote biodiversity. The large stretches of state and federal forests provide an opportunity to change management regimes on public land and provide protection for critical habitats, while the CWCS program has provided for the development of multi-species conservation plans focusing on connecting and buffering habitat. Finally, both states have instituted extensive biodiversity assessment programs that provide the baseline data needed to develop an ecoregional conservation plan, but the application of these plans remains limited (Thorne and Sundquist (2001).

f) New York



The Northern Appalachian ecoregion's New York section is almost entirely located within the boundaries of Adirondack Park. For this reason, this section will focus only on the management of Adirondack Park, a best practice for regulating land use. The park, covering over 6 million acres, and comprised of a mix of protected areas, private conservation easements, forestry lands and large private landholdings, is managed by the Adirondack Park Agency (APA) and the New York Department of Environmental Conservation (NYDEC).

The state lands within the park are governed under the 'forever wild' clause of the New York State Constitution (Article IV, Section 1)[28], affording a high level of protection for these lands classified as Wilderness and Forest Preserves (generally managed at IUCN Level I and II) (WDPA, 2004). The Agency also develops a master plan for the management of Adirondack Park lands and restricts development across the region in areas the agency and NYDEC deem unable to withstand development. The agency, within the master plan, clusters new development and classifies all private lands by the land use (interview with Keith McKeever). Any change to the land use plan is

[28] From the New York State Constitution, Article IV, Section 1 "The lands of the state, owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands/ They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed."

subject to a public hearing and may be rejected if the change will negatively impact the characteristics of the park.

Adirondack Park provides a best practice measure for land use planning as the entire 6 million acres, including private lands, are regulated under the master plan. This large-scale program sets a precedent that allows government agencies to restrict destructive economic activity on private lands with the intention to preserve biodiversity, wildlands, and sustainable utilization of natural resources. The land use regulations provide protection to undeveloped lands by imposing growth boundaries around municipalities, similar to the recommendations of Reid and Kostyack (2005). The APA and NYDEC developed an inventory of ecologically valuable landscapes within the boundaries of the parks and created zoning classifications for private lands that restricted development in areas of critical habitat, slopes, and wetlands (interview with Keith McKeever; APA, 2003). This classification was used to create the Adirondack Park State Land Master Plan, which channels and concentrates development within the municipal boundaries and 'rings the hamlets with moderate and low zones' (interview with Keith McKeever).

The strict regulation of land use and land use conversion has allowed Adirondack Park to retain its wilderness character even in the face of intense pressure to develop; it is located within a day's drive of 30% of the North American population (RCPA, 2003). The attribution of land use in the park, as recommended by Trombulak (2003), proffers protection in the region and provides an example of how to successfully regulate private lands.

3.4 Conclusion

The conservation frameworks of the Northern Appalachian ecoregion have the potential to promote an ecoregional conservation approach, but the current implementation of the frameworks leaves many gaps in the safety net of conservation (see Table 3).

The current land use programs set a precedent for the regulation of private lands, but the management focus needs to shift towards the protection of biodiversity, and not the facilitation of development (Locke, 2000). Protected areas frameworks exist, but the laws are not being abided by and the parks are suffering from development within and outside the boundaries (see discussion of Park Mont-Orford for example; Searle, 2000; Suckling et al, 2004). Furthermore, no mechanisms exist to automatically set aside core areas, and managing agencies do not prioritize connectivity and buffer zones (Boyd, 2003). Public lands management continues to focus on the removal of natural resource wealth, generally subsidized, instead of preserving the region's natural heritage. Threatened, endangered and rare species legislation exists, but, again, political interference dominates the Canadian frameworks, particularly in the area of listing procedures and critical habitat designation. In contrast, the US ESA provides legally binding protections and the public has a major role in both the listing process and compelling government agencies to protect species in peril (Melious and Thornton, 1999).

Public participation, throughout much of the ecoregion, is limited to a post-decision role, generally through public comments. The US citizen suit provision provides a best practice of public involvement; citizens or conservation groups can both, as mentioned above, compel government action while proactively working to define core protected areas under the *Wilderness Act*.

Table 3 Summary Table for the Policy Gap Analysis

Theme	Québec	Nova Scotia	New Brunswick	Maine	NH/VT	New York
Protected Areas Establishment and Management	Strong legislative framework, poor implementation, little representativity in the Northern Appalachians	Recently established additional protected areas, but system still incomplete and NSDNR unwilling to designate additional areas	Recently established new set of areas, in process of completing limited additional designation of 5,000 ha	Mostly completed through private-private land exchanges, although $50 million bonds for land acquisition have passed three times; artificial cap put on protected areas designations on state lands.	Large areas of wilderness designated on federal lands, but lower elevations severely underrepresented	Adirondack Park Agency restricts development outside municipal boundaries, wilderness areas classified within the boundaries (state) constitutionally protected
Programs for protected area connectivity	SQAP has provision for connectivity, but again the program is poorly implemented	System remains unconnected and unrepresentative, although hotspots have been identified by NGOs	Connectivity not considered in protected areas design	NGOs purchasing large areas to provide for connectivity within cores, providing for buffer areas	CWCS provides multi-species plans, along with connectivity and buffers	APA provides connectivity within park management
TE&R species protection	Political listing process impedes protection of critical habitat	Good provisions for habitat protection, but political listing process impedes effectiveness	Provisions exist for critical habitat protection, but political process impedes effectiveness	State law weak, but federal protection for Atlantic salmon, Canada lynx will some provide habitat/umbrella protection	Weak state laws, but are covered under US ESA	US ESA provides some protection
Public Lands Management & Natural Resource Management	Non-protected areas dedicated to resource extraction. Coulombe Commission found poor extractive practices, compliance with regulations	DNR management favors industrial extraction, mechanized recreation. IRM policy has not designated enough protected areas	Strong public support for conservation shown with response to Jaako Poyry report	Artificial cap on IUCN Level I areas, limited amount of public lands	Federal lands managed by NFMA, multiple use regulations	All state lands in the region restricted from development, allows limited resource extraction in resources zones

Theme	Québec	Nova Scotia	New Brunswick	Maine	NH/VT	New York
Land use regulations	Provisions exist for growth boundaries and establishment of conservation areas	Controlled by local municipalities, although provincial regulations have targeted specific high value areas	Provisions exist to provide protection for conservation areas, watersheds and growth boundaries	LURC regulates private land in north of state, along border and provisions exist to restrict develop	Current Use programs reduce taxes on conservation lands, but it is too easy to remove lands from program	Strict land use regulations, based on ecological values, slowed rural sprawl. Precedent for regulating private lands
Public Participation	BAPE findings are not binding	Limited to post-decision process, specifically in IRM	New protected areas advisory commissions are best practice for local management surrounding protected areas	3 referendums have passed, 4th is likely to fund habitat acquisition, w/i land management participation is limited to post-decision process	Mostly limited, but federal statutes have citizen suit provision	Local land use commissions regulate development
Biodiversity Assessments	Ecological classification completed	Ecological classification completed	Ecological classification complete, fine filter process assessing smaller sites for protected	Ecological classification complete	VBP and NHLLP provide best practice examples of fully completed biodiversity assessments	Completed biodiversity assessment in order to develop initial land use plan

CHAPTER 4: MODEL POLICY

> *"A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." (Aldo Leopold, in Trombulak 2003:4)*

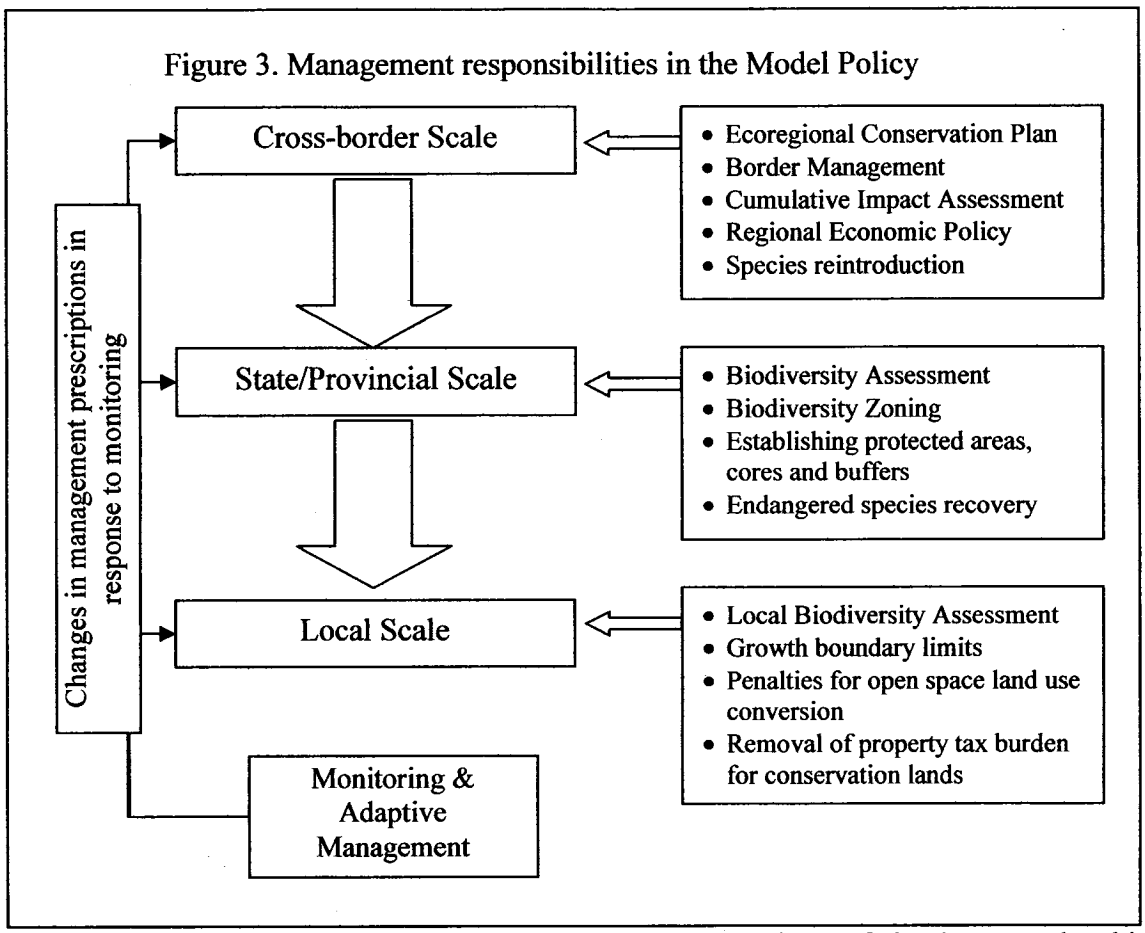
The best means of protecting biodiversity is through the creation of large protected areas (Level I IUCN) that form a representative network of reserves connected by wildlife corridors that allow intermixing of populations (Locke, 2000; Groves et al, 2000; Kohm et al, 2000). Buffer zones of limited, sustainable resource extraction should surround these areas to limit the impacts from external stressors (Noss, 1992). The following Model Policy implements this vision, through a multi-scalar approach that provides incentives for conservation, redirects management foci to sustaining biodiversity, and fosters a cooperative, integrated, nested approach to ecoregional conservation.

Ecoregional conservation is multi-scalar,[29] thus a Model Policy must provide measures to implement this policy on multiple levels of government and along a time-scale that ranges from the present to 100-200 years into the future (see Figure 3). Under this Model Policy regime, the local scale would address landscape scale issues of property tax, land use planning and sprawl, while the regional scale – covering state, provincial and interstate and inter-provincial activities – would address connectivity, protected areas establishment, protection and recovery of rare and at-risk species, communities and habitats, and resource extraction. The cross-border scale manages the ecoregion in its entirety by promoting a regional planning process, species reintroduction, and the assessment of the cumulative impacts of human-induced perturbations. A scaled approach provides the flexibility needed to manage human activities within an ecoregion,

[29] Local refers to county/municipal government; regional refers to the state/provincial government; cross-border refers to measures between countries.

while ensuring the cumulative impacts do not threaten the maintenance of biodiversity at the ecoregional scale. Each of these scales will be analyzed in turn. In addition, issues of constitutionality will be covered in the discussion section in Chapter 5.

Figure 3. Management responsibilities in the Model Policy



The lessons gathered from the distinct Canadian and U.S. federal approaches hint at the benefits that can be gained from combining these approaches: a strong regulatory approach (the US) with cooperative measures (Canada) that facilitate cooperation between state, province and local governments. An ecoregional approach would require both carrots and sticks; the 'stick' would regulate land use within areas of key habitat, and the 'carrot' would develop significant incentives for conservation on private lands and for sustainable resource management.

4.1 Guiding Principles

The underlying principles of this Model Policy are inspired by the guiding principles of the ecosystem approach, as defined in Agenda 21 and the CBD (CBD, 1996). These include: equitable access to resources; equitable application of regulations; efficiency and effectiveness in implementation and management; and an adaptive approach to designing programs that includes the incorporation of a continual monitoring program (CBD, 1996; 2003). These goals allow for flexibility in terms of adaptive management, while providing a stringent and enforceable regulatory structure.

4.2 Local

Developing sustainable measures for local governance of land use, development and resource use, and extraction provides the small scale foundation for the Model Policy.[30] The local aspect of this policy addresses two key areas: first, it reduces land use conversion based on a revised land use planning system; and secondly, it reduces the property tax burden on privately held conservation lands. This component addresses the municipal and county levels of government and provides the 'fine'[31] scale of analysis and proactive environmental management necessary for effective implementation.

a) Fine Scale Assessment

The regional (in Québec), county or municipal governments (depending on the population and development density) will initiate a fine scale biodiversity assessment and prepare an inventory of protected areas, endangered species habitat, and resource use to

[30] The policy at this scale takes into consideration the difficulty of organizing the numerous government actors at the local scale, but if directed from the state/provincial level the components at the local scale can be implemented effectively (see Massachusetts BioMap and Oregon Biodiversity Project in Cohn and Lerner, 2003)

[31] Fine scale assessment refers to an assessment carried out over small area (county) with a scale greater than 1:20,000

enable the development of a local biodiversity management plan. The plan will address local connectivity between protected areas, habitat fragmentation, and species protection and recovery within the locality and between neighboring areas. In addition, the regulation of resource extraction will mirror the biodiversity assessment, and human-induced disturbances will be planned in areas with a relatively low ecological value. This fine scale assessment will serve as the ecological rationale for the zoning, land use planning and taxation reforms discussed in the following sections.

b) Zoning and Land use planning: Disincentives for Sprawl

Land use conversion, as described by Beatley (2003), Benedict and MacMahon (2000), and Broberg (2003), is a significant cause of habitat destruction, along with the accompanying infrastructure and access that opens previously inaccessible areas to development. The associated impacts then create a positive feedback cycle of development and habitat destruction. Land use planning exists as a tool to manage development, but within the Model Policy its application would shift to embrace the conservation of biodiversity by concentrating development within a 'growth boundary'.

The institution of 'smart growth' boundaries has successfully regulated and, at a minimum, slowed urban sprawl in many urban areas in the US (see Cohn and Lerner, 2003) and each state or province, with the exception of Nova Scotia, already has provisions to institute this component. Smart growth boundaries focus development within a prescribed area and require new construction to occur within that boundary, sparing the surrounding open space and conservation areas from land use conversion. Concentrating development within the growth boundary also reduces rural sprawl, an increasingly imminent threat as former forestry lands become available for the construction of second homes (Ewing and Kostyack, 2005). Low-density but heavily-

roaded development increases local infrastructure and maintenance costs that may not be recouped by increases in property taxes, as discussed by Hollis and Fulton, (2002) and the VLT (2000). By concentrating development within a defined area, infrastructure costs tend to be reduced.

The smart growth boundaries in the rural areas of the Northern Appalachian ecoregion should be centered along the main thoroughfares and highways, and within established town centers. The municipality will employ the fine scale assessment data to delineate the growth boundary based on differentiations between the land use categorizations delineated by Trombulak (2003).[32] The Model Policy introduces a monitoring program to assess the impacts of the boundary, assessing regional habitat fragmentation, wildlife passage and percentage of lands developed.

The Model Policy also introduces a substantial fee to be applied to any land use conversion from open space to a built environment. This fee would apply to any building, road or extraction permits, above the initial royalty or permit fee. Applying this type of a fee generates a disincentive for open space development and an incentive for development in previously disturbed or built environments (ODA, 2003; Defenders of Wildlife, 2003). This fee would then be conferred to the municipal government and dedicated for open space acquisition. By dedicating these funds, lands allowed to be converted would be 'replaced' within the local area. The fee could also be scheduled to reflect the importance of an area in terms of biological significance, representativity, connectivity or buffering.

The construction of new roads would also be subject to this fee. Roads fragment habitats and degrade habitats along the edges created (USFS, 2000). Through this

[32] Ecological lands, stewardship lands and intensive use lands, these categories are defined in Chapter 2.

measure, the Model Policy would increase the cost of road construction, creating another disincentive to road construction and the development that follows increased accessibility.

*c) **Property tax reform***

Conservation lands provide environmental services (water filtration, flood prevention, etc.) that are not calculated into land valuation or property tax assessments (Benedict and McMahon, 2000). These lands are often assessed as agricultural or forestry lands, with a level of taxation based on economic potential, disregarding the environmental services and biodiversity values provided (Main et al, 1999). Under the Model Policy, local property tax structures would be reformed to reflect the inherent value of the lands and the services provided. The Vermont and New Hampshire Current Use programs discussed in the Policy Gap Analysis provide a precedent by providing reduced taxation on agricultural and forest land due to the non-economic values open space parcels provide.

The tax burden placed on privately conserved lands would be reduced to 5-10% of developed lands within the municipality. The reduced tax burden would then allow owners to use these funds to invest in the maintenance of the properties or expand conservation property holdings and enter into new conservation easements. The investments in the property would provide for habitat improvements, prescribed burning or the inducement of natural disturbances, as well as coordination for monitoring of habitat conditions across networks of private conservation lands. Landholders would receive the reduced tax burden after agreeing to forgo development rights, and the municipality would be permitted to inspect and monitor the conserved lands to ensure no development occurred on those lands.

Penalties for violating this covenant would be prohibitive. The weakness in the Vermont and New Hampshire Current Use policies is the ease with which landowners can remove themselves from the agreement. The penalty should equal three or four times the sum of the avoided taxes and administrative costs.

With this in mind, it is important to consider the impacts extensive conservation holdings with minimal taxation may have upon these communities. The extensive implementation of conservation easements can create local fiscal shortfalls due to reductions in property tax revenues. Property taxes provide counties and municipalities with the funding needed for the basics of local governance, including education, fire, police and emergency services, as well as funds to maintain local road, water and sewage infrastructure. Admittedly, the expansion of conservation easements and the removal of these development rights would create an undue burden on these municipalities. Removing these funding sources would lead to significant local opposition, with the likelihood of impoverishing these areas and furthering the economic hardships many of these communities already face. The Model Policy provides for the replacement of those funding resources that would be removed once the municipality reaches a predetermined threshold of lands conserved.

Both the US and Canada have habitat stewardship and conservation land acquisition programs; the lost local revenues would be replaced by funds from these programs. The US Land and Water Conservation Fund uses royalties from offshore oil and gas extraction as a means of reparation for the environmental harm caused by these activities. The US Forest Service also administers the Forest Legacy Program that provides funding for the conservation of private forest lands. Additionally, all three

states have dedicated conservation funds; these funds could also be directed in part to funding local private land conservation.

The Habitat Stewardship Program in Canada is small, but could be directed to assist local municipalities and regions protecting local private lands. Provincial royalties from energy development or mineral extraction could also be directed to replacing lost local property tax revenues. Lastly, as discussed in the Policy Gap Analysis, mining and forestry are both subsidized, in particular on public lands, and benefit from replanting, road building and maintenance, and state-sponsored research. As a means to direct economic development down a sustainable path, portions of these funds could also be used to replace the reduced property tax revenues.

The property tax refunds in both the US and Canada would be paid directly to the local government from one of the above mentioned sources, thereby providing a strong incentive for the promotion of private land conservation. Cash-starved municipal governments would welcome new revenue sources, and depending on the aesthetic and ecological attributes of an area, some are likely to hold the potential to become magnets for tourism. The replacement of lost revenue removes the local incentive to develop as much land as possible as a means of increasing the local tax base. Poorly planned development has led to significant issues of rural sprawl and habitat fragmentation (Thorne and Sundquist, 2001; Beatley, 2000). Local remuneration of lost property tax revenues would remedy this situation and provide a local incentive for private land conservation.

The protection of private lands, in particular in the US part of the ecoregion, is a vital means of connecting core protected areas, extending protected areas and buffering

habitats from external impacts. Increasing the financial viability of land owners would ensure that conservation on private lands is practiced.

4.3 State/provincial

The state and provincial (interstate/interprovincial) policy focuses on connecting cores, establishing new protected areas, providing for sustainable resource use, and managing land use on a regional scale. Before the network can be established, ecological conditions within the ecoregion need to be assessed. This should include:1) the spatial variation of ecotypes within the ecoregion; 2) the prevalence of special concern, at-risk or rare species; 3) the level of protection and representivity of protected areas; and 4) land use and demographics in the ecoregion.

a) Ecoregional Biodiversity Assessment

The initial stage of the policy involves a biological assessment across the entire ecoregion. Maine, New Hampshire, New York and Vermont have completed assessments, while each of the other three jurisdictions has defined their ecoregions, ecozones and ecosystems. The completed biodiversity inventories provide a foundation for the Model Policy biodiversity assessments; however this component encompasses the entire ecoregion and is implemented cooperatively. The biodiversity assessment should involve local stakeholders, conservation groups, hunting, fishing and trapping groups and resource managers to comment and, more importantly, provide or complete biological surveys for the inventory. As discussed in the previous chapter, the Nature Conservancy

and Wildlands Project[33] have developed their own conservation assessments, while the VBP and NHLLP constitute best practices in public-NGO cooperation.

The assessment would include each of the following:

- Defining vegetation types and species assemblages, including:
  - Forest types, wetlands, etc.
  - Keystone species, endangered, threatened and rare species
  - Invasive species presence
- Defining abiotic environments, including:
  - Geology, soil types and elevation
- Inventorying focal, indicator and endangered species range and critical habitats.
  - Percentage of extant native species
- Assessing level of protection afforded to each biotic community using the IUCN categorization
- Determining connectivity between core protected areas.
- Identifying local, regional and external threats and stresses.
- Inventorying land use, road density, human uses
- Inventorying and mapping environmental impact assessments conducted and how the areas have been affected.
- Determining land ownership, including:
  - Percentage that is public/private
  - Percentage within conservation easements
  - Potential for acquisition

The policy and funding infrastructure already exists to implement such an assessment; it simply extends the current GAP analysis programs in the US and the ecological classifications and biodiversity action plans carried out within the Canadian provinces. After developing the inventory, the assessment then categorizes landscapes and ecosystems based on:

- Biological importance
  - Number of species, species assemblages and communities present
  - Importance to specific taxonomic group
- Scarcity of landscape type
- Level of protection afforded to each ecosystem
  - Based on percentage conserved, IUCN level of protection

[33] The Nature Conservancy and the Wildlands Project are conservation NGOs that have both developed conservation area designs based on connecting core protected areas and establishing buffers on both private and public lands.

- Connectivity potential
- Potential for core protected area, buffer or corridor designation

After the assessment is completed, the Model Policy provides for the production of an atlas and report to be released and made freely available to the public.

The biodiversity assessment provides the baseline data for an ecoregional conservation plan to be enacted, but specific policy mechanisms and triggers are necessary to ensure implementation. The following sections discuss those specific policies.

b) Biodiversity Zoning

The local scale of the policy focuses on fine scale land use and zoning measures to protect and connect local conservation sites. Zoning at the regional scale provides for protection and the establishment of core areas and corridors, and facilitates the management of sustainable resource extraction. This zoning process, a term I have coined 'biodiversity zoning,' minimizes impacts accumulating from multiple disturbances on a regional basis.

The concept of biodiversity zoning is an expansion and improvement on HCPs. HCPs have a sound theoretical basis, as discussed by Beatley (2000) and NCEAS (2003), but they have been poorly implemented, in many cases without a sound scientific basis. Species' ranges and habitat needs must be incorporated into the plans and monitored for effectiveness (see ALA, 2003; NCEAS, 2003, Ostermeier et al, 2000; Watchman et al, 2001). Biodiversity zoning covers public and private lands, and uses the biodiversity assessment results to find areas of high biodiversity and restrict development within these areas. It overlays the critical habitats of listed species, categorizes areas by their value to

threatened or endangered species, and sets restrictions within these areas, similar to the US ESA. Development outside of these areas is permitted (including forestry, recreation, etc.). Monitoring is included to ensure compliance with these plans and to ensure that management prescriptions are successfully protecting the targeted species. For example, the key areas of snowshoe hare habitat will be subjected to these restrictions, in order to allow for the recovery of Canada lynx populations (Ray, 2000; Carroll, 2004). Resource extraction within the legally defined habitat boundaries is prohibited, while a monitoring program assesses the condition of the species assemblage. Biodiversity zoning establishes a definitive use across the landscape and upon each parcel. The definitive use, as described by Trombulak (2003), provides for both economic and recreational values and stringent protections for areas of high ecological value.

Biodiversity zoning improves regulatory efficiency by allowing multiple species to be managed within a single plan, while bestowing certainty upon landholders within areas subject to these conservation regulations. The major criticism of endangered species regulations has been the uncertainty landholders face due to potential restrictions on economic activities (Goble, 2004; Inden, 1996). Biodiversity zoning regulates areas of high ecological importance, while permitting forestry, recreation, non-timber forest product extraction, etc., on lands with less importance, as long as the activity is executed within the guidelines of the biodiversity zoning program and the ecoregional management plan discussed in the cross-border section.

The literature review included discussion of the use of indicator and focal species as proxy measures for ecological health (see Poiani and Richter, 1999; Nature Conservancy, 2001; 2003; Lawler et al, 2003). The use of indicator species increases the

efficiency of conservation programs. Biodiversity zoning facilitates management regimes that cover multiple species with similar habitat needs. Plans can be enacted for moose in Nova Scotia, where it is a provincially endangered species or snowshoe hare and Canada lynx in Maine, to ensure critical habitat is both protected and connected (Snaith and Beazley, 2002; Ray et al, 2002).

Biodiversity zoning may require remuneration (or compensation) of certain landholders at the outset, but after the initial implementation, landholders and state management agencies will have an increased measure of certainty in terms of economic activities that will be allowed. The biodiversity management plan will be reviewed and amended at 5-10 year intervals; this review will assess the efficacy of the plan and implement any adaptations necessary.

*c) **Establishing new protected areas, cores, corridors and buffers***

The Policy Gap Analysis found that the current regulatory structure overseeing the designation of protected area networks is severely limited, in particular with regard to public involvement in the designation process and automatic designation of protected areas. Strategies exist (see the SQAP and the Nova Scotia Biodiversity Strategy) to designate protected areas on public lands, but the public must rely on agencies to designate these areas. New Brunswick and Nova Scotia exemplify the limitations of these agencies, which have been captured by corporate interests and have limited protected areas designations (interviews with Roberta Clowater, Raymond Plourde), even though conservation groups have identified areas of high biological value on public lands (Beazley et al, 2003; NSPLC, 2004).

The automatic designation mechanism for protected areas establishment has two avenues. First, public lands found within the assessment to be of high biological value

(for reasons of connectivity, buffering, or core protection) will be immediately managed at IUCN level I management prescriptions (i.e. wilderness). Second, it allows for public interest involvement by allowing citizens to submit proposals for protected areas on public lands. This component is similar to the provision in the US *Wilderness Act* which provides that any person or group can petition the government to place temporary protection over a specific area while the government studies the legitimacy of the petition. Private lands can be included in the petition in order to improve the likelihood of approval, if permission is given by the landholder. The government of the province or state will allow for public input on the proposal and will render a decision based on the merits of the proposal and public comments, and protect all, a portion, or none of the proposed area.[34]

d) Protection for endangered and threatened species

The major flaw inherent in the state and provincial at-risk or endangered species legislation discovered in the Policy Gap Analysis is the political nature of the listing process, and the costly process of designating critical habitat for each species. The biodiversity assessment addresses this problem by developing a baseline measurement of endangered species populations and habitat status across the ecoregion. The biodiversity assessment develops a scientifically-based assessment of the condition of species, habitat, and species assemblages necessary for their continued existence in order that species recovery programs can be designed with this baseline survey serving as the scientific foundation. The policy removes political interference from the listing process and creates legally binding restrictions on how critical habitats within these landscapes are managed

[34] Each jurisdiction has a regulatory structure for land acquisition and bequeathments so this policy does not address those areas, as there were no significant gaps.

and ensures the scientific integrity of the habitat conservation plans (Ostermeier et al, 2000).

4.4 Cross-border

Cooperative environmental programs, such as the NEGECP Climate Change Action Plan and the St. Croix International Waterway Commission, have been administered successfully within the region. Agreements necessary to start an ecoregional conservation program can 'piggyback' on these previous achievements. Cross-border ecoregional management at this scale focuses on: cooperative action along the borders - or border management; the creation of ecoregional conservation boards, similar to the St. Croix Commission, to coordinate management activities and the development of an ecoregional management plan; and, similar to the CEC and IJC, a monitoring body to ensure compliance with the local and state/provincial sections of this policy.

This policy is not meant to address economic development within the region, but it does realize the importance and inter-linkage of sustainable economic development and environmental protection. For this reason, three additional policy components are included: 1) incentives for increasing certified sustainable forestry; 2) the inclusion of a highest and best use policy for timber extracted from public lands within the ecoregion, and; 3) the implementation of measures to develop a regional Northern Appalachian identity.

a) Ecoregional Conservation Board

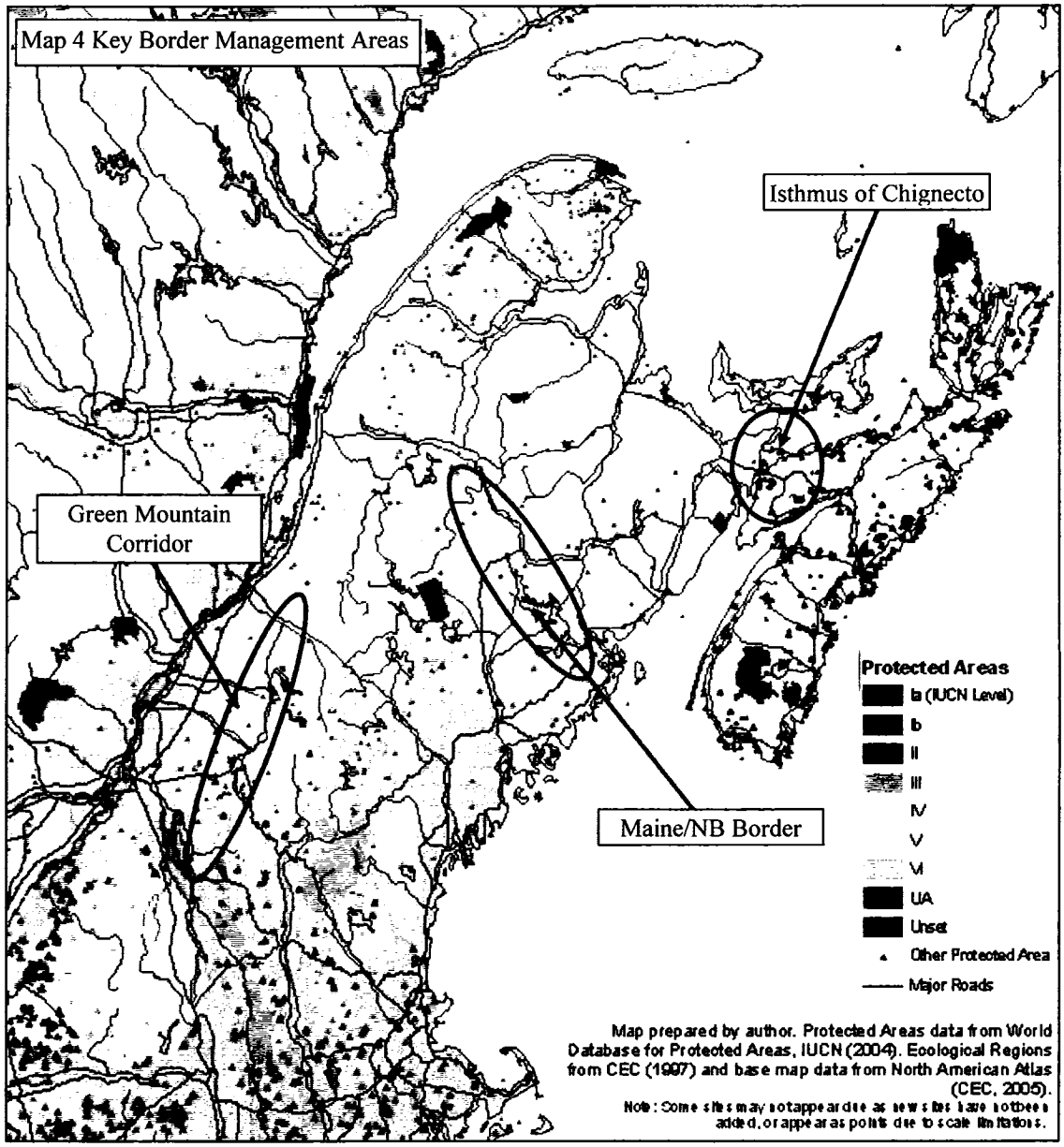
The Model Policy provides for the creation of a new cooperative management board, the Ecoregional Conservation Board (ECB), with representatives from state, provincial and federal agencies, the CEC, conservation NGOs in the region, and economic stakeholders.

The ECB's mandate would be to develop an ecoregional management plan, to meet on a biannual basis to monitor the implementation of the management plan, to develop adaptive measures within the management plan to remedy gaps or shortcomings within the plan, to plan species reintroduction programs, and to institute a cumulative impact assessment program. The establishment of the ECB would require memorandums of understanding (MoU) between each jurisdiction that shares a border. Similar legislation was passed in Maine and New Brunswick in order to establish the St. Croix International Waterway Commission.

b) Border Management

Measures available to establish connective corridors across borders (either national or international) are severely lacking in the region and appear to be implemented by land trusts and conservation groups. In order to maintain connectivity between key border corridors an approach that manages land use within border areas will be necessary. Map 3 illustrates a few of the key areas, with none more important than the Isthmus of Chignecto, the land bridge that keeps Nova Scotia connected (see Map 4).

The Model Policy requires specific management plans for public and private lands to be developed in coordination as a means to ensure intact connective landscapes across these areas. The Y2Y network has effectively spurred the designation of connective areas within the Mountain West (Y2Y, 1998), but, within the Northern Appalachian landscape, government agencies need to play an increased role.



c) Species Reintroduction Mechanism

Ecosystems, no matter the level of protection, will not function if major, keystone species are missing. Carroll (2003), Soulé and Noss (1998) demonstrated the importance of species, like the wolf, which act as a regulator of trophic cycles. The reintroduction of key species may be needed to restore ecological functions and, as Soulé and Noss (1998) posit, to 'rewild' these ecosystems. The reintroduction of the wolf in the western US has

reinstituted a natural regulatory regime on ungulate populations; a similar affect could be seen in the Northern Appalachians. The wolf is just one example of a candidate species for reintroduction in the region. The reintroduction of species would take place after an initial environmental impact assessment and a public comment and review period. The plan for reintroduction would be developed by the ECB, although much of the baseline habitat studies have already been completed by NGO groups (see Carroll, 2003).

d) Cumulative impact assessment

A regional approach to cumulative impact assessments (CIA) will be enacted within the policy to ensure resource extraction is not overly concentrated and does not overly impact upon a specific ecozone or ecotype within the ecoregion. Regulations have been developed for the employment of CIAs in Canada and the US. For example, the CEQ's guidelines (CEQ, 1997) integrate spatial, temporal, and quantity of action indicators. This approach uses a spatially defined border, i.e. the ecoregion, and uses a quantitative method to assess internal and external stressors and impacts occurring within subsections of the ecoregion.

The CIA provision has three main functions. First, for each parcel that is converted from an open space land use, an equivalent parcel within the same ecosystem will be protected through the removal of development rights or land acquisition. This policy ensures that any area facing development pressure will have a certain percentage protected. This component could prove useful within the lower elevation areas of Vermont and New Hampshire, which are facing increasing development pressure (Thompson, 2002). This component compliments the biodiversity zoning program by providing a base level of ecosystem representativity within the ecoregion.

The second function is to monitor external stressors, specifically air and water pollution, and acid rain. The impacts of these external stressors are monitored, and

Figure 4. Cumulative Impact Assessments DSM

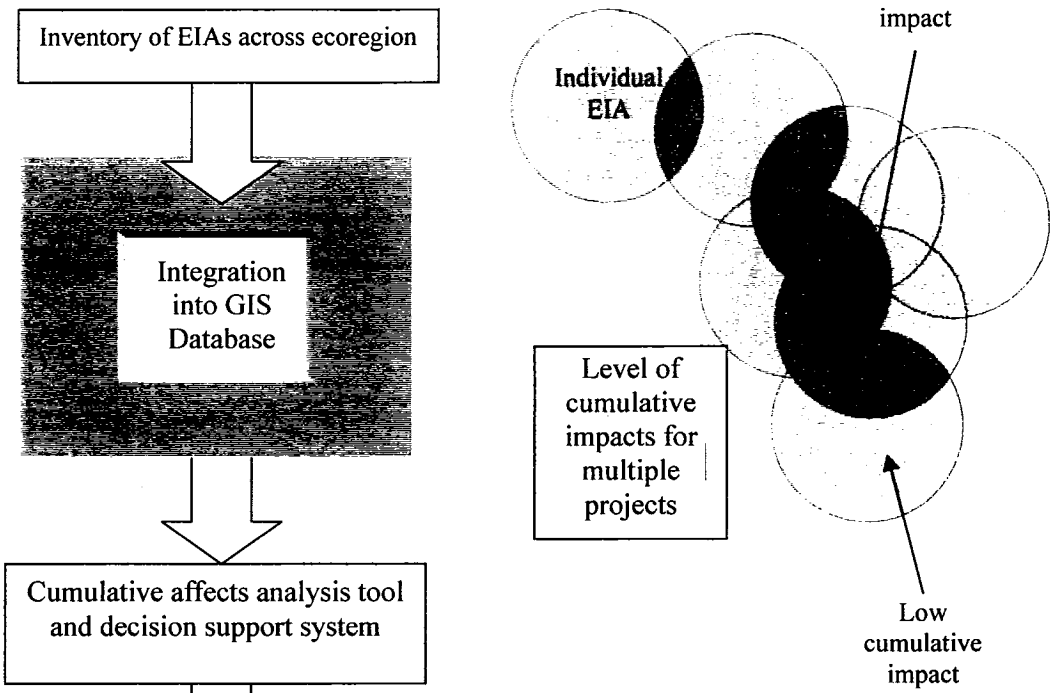


Figure 3. The cumulative impact assessment tool will inventory the impacts from all EIAs conducted within the ecoregion, develop a spatial grid of these impacts, and design a decision support mechanism to guide development and resource extraction in order to minimize, concentrate, or distribute cumulative environmental impacts.

recommendations can be developed within the federal structures of either country to reduce these impacts. For example, acid rain resulting from highly polluting generating stations in the US Midwest and southern Ontario is directly related to acid rain and air pollution in the region; this has led to declining forest health, acidification of lakes and other impacts. This provision in the Model Policy would only develop evidence through monitoring, as other legislation, the Clean Air Act for example, allows for states to take further remedial action.

Lastly, the third function employs and expands upon the CEQ's use of a basic overlay model to measure the affect of multiple impacts upon a geographically defined area (see Figure 4). The initial biodiversity assessment is used as the baseline study for the entire ecoregion along with an inventory of all EIAs conducted within the region. The inventory allows for the development of an ecoregional data set that spatially assigns a value for predicted or realized impacts across a grid of the ecoregion. This gridded impact assessment data set provides the data for a decision support mechanism (DSM). The DSM is employed to facilitate environmental planning by directing development projects, resource extraction, etc. to the most appropriate areas. Odum (1982) and Noss (1990) recognized the danger of ignoring cumulative impacts; the DSM provides a basis for calculating these impacts on a spatial and temporal scale. In addition, based on the types of impacts created, the DSM will assess whether the impacts should be spread over a larger area (forestry), minimized (mining, mechanized recreation), or concentrated (development, land use conversion). The DSM also integrates watershed protection with a similar gridded impact attribution to ensure protection from cumulative impacts.

e) Ecoregional Economic Development

The focus of this thesis is conservation, but sustainable development must accompany a conservation initiative to ensure programmatic success. Within this context there are a few additional measures that should be incorporated into an ecoregional management plan to increase local natural wealth retention. First, instituting a highest and best use policy for timber management will allow timber extracting areas to add wealth to the timber that is removed. Interviews across the region highlighted how extracted timber was not being used to its fullest potential, partially due to the subsidization of silviculture. For example, maple was being processed for pulp in New

Brunswick (interview with Roberta Clowater), and much of the region has shifted to a pulp dominated economy, instead of lumber, which generally increased local revenues. The value-added product increases local wealth and demonstrates that conservationists are not just dedicated to preserving wildlife, but to developing local economic stability. Additionally, tax incentives should be introduced to foster incorporation and adoption of sustainable forestry practices within the region.

Lastly, a regional branding program can develop a Northern Appalachian identity that corresponds to tourism and the products developed in the region. The Y2Y initiative has been successful with the marketing of their landscape (see Y2Y, 1998) and a similar initiative to brand the cultural and wilderness values of the Northern Appalachian could be used to develop local products and tourism. The ECB will be responsible for the development of these programs.

4.5 Conclusion

In summary, the Model Policy uses a multi-scale approach to: 1) inventory biodiversity information and map areas of high biological diversity; 2) provide protection for these areas; 3) develop incentives for conservation and disincentives for development; and 4) assess impacts and provide for adaptive management. The local scale concentrates growth by minimizing sprawl through a municipal growth boundary and disincentives for land use conversion, while encouraging local land use preservation by replacing revenues lost from the removal of private conservation land property taxes. The 'middle', or state/regional scale, inventories biodiversity information, develops triggers for protected areas establishment, and uses biodiversity zoning to provide multiple layers of protection for threatened, endangered or rare species and species assemblages. Lastly, the bi-

national scale establishes an ecoregional management board which manages the connective areas at jurisdictional borders, provides a forum for species reintroduction, and develops a means to institute ecoregional cumulative impact assessments.

There is no doubt that the implementation of this policy will encounter resistance from certain economic stakeholders and, as a means to build support, the benefits of ecoregional conservation must be communicated along with the potential costs. The implementation of the policy will necessitate certain legislative changes (like a science-based species listing process in Canada and protected areas designations across the ecoregion), but, as the Policy Gap Analysis demonstrated, most of the conservation frameworks exist and merely require measures to strengthen or to refocus management priorities to facilitate the establishment of a more effective, coordinated approach to biodiversity conservation in the region.

The biodiversity assessments will also provide a means of mapping and defining areas of ecological value, while the zoning measures at both the local and state/provincial scale, will provide planners and land managers with an extensive management tool upon which to base management prescriptions. By allowing public involvement throughout the process, the problem of agency capture can be reduced, and finally through the development of the ECB, a forum will be established for the implementation of cross-border conservation management plans and initiatives.

CHAPTER 5: DISCUSSION AND CONCLUSION

The implications of the Model Policy concerning land management and the measures necessary to implement this strategy are outlined in this chapter. The constitutionality of the Model Policy and existing precedents that allow for the regulation of private lands is considered first.

5.1 Precedents in the Regulation of Private Property

Property rights are one of the founding pillars of both Canadian and US constitutions and economic systems, but governments have retained the right to regulate activities on private property when activities upon these parcels affect other property holders, or the commons as a whole (Gardner, 1997; Goble, 2002, 2004; Inden, 1996). Within any environmental regulation there is generally a restriction on property rights, but these restrictions are considered politically and economically acceptable when compared to the societal benefits they deliver. Within the context of ecoregional conservation, private property covers many of the key connective corridors, as well as parcels of unfragmented or restored landscapes (especially in the context of timber holdings). In order to maintain biological diversity and the provision of ecological services, segments of private land must be regulated, by local zoning or state-level conservation programs, and development (i.e. use) of the land must be minimal.

If private land holdings are to be regulated and activities restricted, concern arises regarding the constitutional basis for these restrictions. The US Constitution states "No person shall... be deprived of life, liberty, or property without due process of law; nor shall property be taken for public use, without just compensation" (5th Amendment, as quoted in Inden, 1996:123). This 'deprivation' is termed 'takings' (US) or

'expropriation' (Canada) and originally referred only to direct seizure by government of property, but conservative court rulings have extended 'takings' to any regulation that creates a "physical invasion of his [or her] property" or "if a regulation completely denies an owner of all economically beneficial or productive use of his [or her] land" (Inden, 1996:124). This right to use of property, though, is also a 'social contract', with an entrenched responsibility to not create undue harm to neighboring landholders and "that the rights that accompany a given parcel of land are fluid, rather than fixed. Having been given by the community, they can likewise be taken away if it is in the best interest of the community to do so" (Inden, 1996:128). The preservation of biodiversity necessitates strong government action through the regulation of land use and resource extraction (Locke, 2000).

Sustaining biodiversity and ecosystem services provided by intact, protected landscapes, central to endangered species acts (both the US federal and certain state/provincial acts), is a societal benefit that, in general, outweighs the cost borne by the property owner; and the responsibility to protect critical habitats is engendered within the owner's societal responsibility. Thus, individual landholders must be required to manage their parcels in order to minimize impacts to biodiversity, in particular, within areas of high biological and ecological value. If individual property owners are allowed to be driven by rational choice (i.e. maximizing the value to their holding without interest to their neighbors or common resources), valuable areas will face 'death by 1,000 cuts' (Goble, 2002). As each individual is allowed to develop all resources or convert landscapes, the impacts to the biological commons would be excessively deleterious and irreversible. This problem of "cumulative impacts has two dimensions: remedial action

and cost allocation. The first involves determining what measures are necessary to reduce and reverse adverse environmental impacts. The second relates to whether the individual property owner, or the general public, should bear the burdens of those measures" (Gardner, 1997:552). Within an ecoregional context, the allocation aspect is more equitable, as a coordinated, adaptive approach as detailed in the Model Policy, assigns protection values based on ecological value; the costs borne by these land holders would be both predictable and recognized. On the state and provincial scale, the cost allocation would be similarly predictable and, through the coordination of the ECB, each jurisdiction would be responsible for protecting the areas within their borders that have been identified as ecologically valuable by the biodiversity assessments. By assessing costs during the implementation of a conservation area design, basic takings or expropriation claims can be settled at the outset, reducing the conflict inherent in programs that regulate land use.

The Adirondack Park land use regulations provide an important precedent. The Model Policy proposes a similar regulatory approach to restricting land use on private lands, but instead of only within the park, the Model Policy extends this concept across the entire ecoregion and adds measures to inventory and assess biodiversity, develop local land use plans, and designate a connected system of protected areas. The APA regulations have withstood constitutional takings challenges[35] and, although restrictive, these regulations have allowed for both certainty of land use status and the preservation of wilderness (interview with Keith McKeever). Each of these cases challenged the government's right to regulate private property with the explicit goal of preserving

[35] see Ton-Da-Lay, Ltd. v. State of New York, 1979; Loon Lake Estates Inc. v. the Adirondack Park Agency, 1975, Horizon Adirondack Corp. v. State of New York, 1976 and Bucci v. the State of New York, 2004.

biodiversity, and the government won each case. The US ESA also restricts private property with the goal of preserving endangered species habitat, and the US ESA has never been judged unconstitutional (Melious and Thornton, 1999).

To ensure compliance with the Model Policy and the strict land use policies there within, the responsibility to conserve biodiversity should not rest only on private landholders, but should be scaled and applied to each level of governance. Each state or province should be responsible for protecting the biodiversity within its boundaries through the ecoregional conservation plan, and equivalent commitments should be developed at the county or region level, as well as the bi-national level, as it is part of the social contract between nations to protect each national contribution to the global commons.

5.2 Application of the Model Policy

As mentioned in Section 1.1, ecoregional conservation plans have been developed for the Yellowstone to Yukon ecoregion, among others, and NGO-led initiatives are developing the baseline scientific data for the Northern Appalachians. Unfortunately, as demonstrated in the Policy Gap Analysis, the components of ecoregional conservation remain in a nascent state in the Northern Appalachian ecoregion; too few protected areas exist; connectivity is not a priority; and the role of governments and agencies remains a facilitator of development and resource extraction, not the conservation of biodiversity.

The Model Policy uses the conceptual components of ecoregional conservation to institute this ecoregional vision and remedy the shortcomings inherent in the disparate approaches practiced today that do not coordinate across borders (both intra and international), are subject to agency and governmental intransigence or do not value

environmental services, connectivity, representivity, and functionality. In addition to the components of the Model Policy, measures must be instituted to create incentives to induce state and provincial participation and to avoid the potential of free-riding; these incentives could include increased tourism or jobs within sustainable resource extractive industries (some of which were mentioned Section 4.4e).

5.3 Conclusion

The preservation of the wildlands of the Northern Appalachian/Acadian Forest ecoregion will necessitate that government agencies and land use planners managing these landscapes understand the reach and impact of their actions. As the gap analysis points out, weaknesses exist in the current conservation framework, but these issues can be addressed. Policies need to be instituted that establish core protected areas and that apply the concept of connectivity and that buffer core protected areas from external stressors. Endangered species programs must be allowed to protect critical habitat without political interference, and public lands management policies must direct their vision to something greater than the removal of the natural resource wealth of the region. Lastly, land use decisions must be informed by the devastating impact that sprawl has upon biodiversity. With this in mind, we must remember that development and resource extraction can be planned and concentrated; a system of cores, corridors and buffer areas can be developed to allow biodiversity to be sustained; and governments at each level of governance can base their actions on an integrated approach to environmental management.

The Model Policy provides a remedial and novel solution to halt the loss of biodiversity and allow the forests of the Northern Appalachian/Acadian Forest ecoregion that have regenerated over the past 100 years to continue to flourish. The policy

concentrates growth within town squares as a means to reduce infrastructure costs and spare the surrounding habitats from destruction. Resource extraction will continue under this policy, but sustainable practices will reduce its impact on the region, and through the biodiversity assessments, the system of core protected areas, corridors and buffer zones can be planned according to ecological value and ecological functionality. The Model Policy provides for the application of the ecoregional conservation concept and, hopefully, will provide a means of protecting the Northern Appalachian/Acadian Forest ecoregion from any further loss of biodiversity.

> *"Wilderness is not a luxury, but a necessity of the human spirit. The idea of wilderness needs no defense, it only needs defenders." Edward Abbey.*

Appendix 1 – Interviews

Non-structured interviews were conducted with the following people. The interviews were crucial in the development of the Policy Gap Analysis, as these contributors highlighted strengths and gaps that were not revealed by simply analyzing the provincial, state and federal laws, regulation and polices.

1. Ralph Knoll Deputy Director, Maine Bureau of Parks and Lands, conducted via phone January 10, 2005.
2. Diano Circo, North Woods Policy Advocate and Outreach Coordinator, Natural Resources Council of Maine, conducted via phone February 1, 2005.
3. William Suggs, Executive Director, Maine Environmental Policy Institute conducted via phone, February 2, 2005.
4. Lee Sochasky (NB/ME) St-Croix International River Commission conducted via phone, December 10, 2004.
5. Roberta Clowater, Executive Director CPAWS, New Brunswick Chapter conducted in person May 3, 2004, with follow up conversations via phone.
6. David Coon, Conservation Council of New Brunswick, conducted via phone December, 10, 2004
7. Marc Spence, Forester, New Brunswick, conducted via phone January 10, 2005.
8. Vince Zelazny Ecologist, New Brunswick Department of Natural Resources, Policy and Planning Branch, conducted via phone February 15, 2005.
9. Beth McLaughlin, Coordinator Crown Lands Network, New Brunswick conducted via phone January 10, 2005.
10. Keith McKeever, Public Information Officer, Adirondack Park Agency, New York, conducted February 16, 2005
11. Duncan Bayne, Land Securement Coordinator, Nova Scotia Land Trust, conducted via phone January 12, 2005.
12. Raymond Plourde, Ecology Action Center, Nova Scotia, conducted via phone January 11, 2005
13. David Miller, Nova Scotia Environmental Network, conducted via phone October 2004.
14. John O'Drisoll, President Canadian Parks and Wilderness Society, Montreal Chapter, conducted in person, May 5, 2004, follow up interviews conducted in person and via email.
15. Jean-Francois Gagnon, Executive Director CPAWS, Montreal Chapter, conducted in person, May 5, 2004, follow up interviews conducted in person and via email.
16. Conrad Reining, Wildlands Project, Vermont, conducted in person May 10, 2004, with follow up interviews via phone, email and in person.
17. Richard Langdon, Aquatic Biologist, Vermont Dept of Environment and Conservation, conducted via phone, January 12, 2005
18. Penny Hannigan, Vermont Land Trust conducted via phone, January 12, 2005
19. Kathy Daley, formerly of Hubbard Brook Research Foundation, New Hampshire conducted in person May 10, 2004, with follow up interviews via email and in person.
20. Nadia Stensor, Crosspatch Conservation Consulting, New Hampshire, conducted in person May 10, 2004, with follow up interviews via email and in person.
21. Emily Bateson, formerly of 2 Countries, 1 Forest and A Northeastern Wilderness (ANEW), New England, conducted in person May 10, 2004, with follow up interviews via phone, email and in person.
22. Cynthia Fleming, Staff Ecologist, The Wilderness Society, New England, conducted in person May 10, 2004, follow up via email.

Appendix 2 – Reference Tables

Table 4. IUCN Protected Areas Classification
(from WDPA, 2005 (http://sea.unep-wcmc.org/wdbpa/)

CATEGORY Ia:	Strict Nature Reserve: protected area managed mainly for science
Definition	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
CATEGORY Ib	Wilderness Area: protected area managed mainly for wilderness protection
Definition	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
CATEGORY II	National Park: protected area managed mainly for ecosystem protection and recreation
Definition	Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
CATEGORY III	Natural Monument: protected area managed mainly for conservation of specific natural features
Definition	Area containing one, or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
CATEGORY IV	Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
Definition	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.
CATEGORY V	Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation
Definition	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
CATEGORY VI	Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems
Definition	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Table 5. Definitions of Ecoregional Conservation Components

Cores – The protected areas that serve as the focal points for the conservation of biodiversity, generally managed at IUCN Level I or II. Three main factors should be considered, size, functionality and ecological importance.

Corridors – Areas connecting core sites.

Buffer zones – Areas of low-impact resource utilization used to protect cores and corridors from external stressors.

Protected areas network – Connected system of established core areas

Conservation area design – Method of applying ecoregional conservation across an ecoregion. The conservation area design is used to connect the protected areas network and establish corridors and buffer zones.

Connectivity – Indicator used to assess effectiveness of protected areas network to allow for intermixing of species assemblages and communities. Roads, rural sprawl, and poor resource extractive techniques can lower connectivity.

Representativity – Indicator used to assess protection levels for each ecosystem within an ecoregion; areas of low representativity need to be protected.

Ecological classification – Inventory of different ecosystems, ecotypes and ecoregions, generally administered on a jurisdictional basis that provides a basis for assessing representativity and connectivity, and establishing a protected areas network.

Ecozone – Large scale land classification.

Ecoregion – Regional scale of ecological classification.

Ecosystem – Subregion unit within an ecoregion, larger than an ecotype

Ecotype – Site-based/landscape level of ecological classification.

Ecological Gap Analysis – Inventory that assesses level of protection, connectivity, and representativity for ecosystems, species biodiversity, abiotic components, biodiversity stressors and threats.

Indicator species – Species that can be used as a proxy indicator of ecosystem health.

Keystone species – Species who's existence is relied upon by multiple species within an assemblage; the removal of this species could result in a reordering or collapse of a species community (Beier and Noss, 1998).

Umbrella species – Species that is afforded protection which provides de facto protection for species within the same habitat; wolves and bears, due to their wide ranging nature and protection under the US Endangered Species Act, are examples.

Focal species – Focal species can be categorized within any of the above species groups, and management regimes are developed with these species as a focus.

Table 6. US/Canadian Cross-border environmental treaties (UNEP, 2000)

Treaty	Date of adoption
Boundary Waters Treaty	1909
Migratory Bird Convention	1916
Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere	1940
Treaty Concerning the Diversion of the Niagara River	1950
The Great Lakes Water Quality Agreement	1972/78/87
Convention on Future Multilateral Cooperation in the North-West Atlantic Fisheries	1978
The Canada-US Agreement on the Transboundary Movement of Hazardous Waste	1986
Agreement on the Cooperative Management of the Porcupine Caribou Herd	1987
Canada-US Agreement on Arctic Cooperation	1988
The Canada-US Air Quality Accord	1991
Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean	1992
North American Agreement on Environmental Cooperation (NAAEC)	1993

Literature Cited

2 Countries, 1 Forest (2C1F). 2004. Website Draft, June 14, 2004. Documents obtained from Conrad Reining, Wildlands Project and Emily Bateson, 2C1F.

Adirondack Park Agency (APA). 2001. *Adirondack Park State Land Master Plan.* Adirondack Park Agency and the Department of Environmental Conservation, State of New York.

Adirondack Park Agency. 2003. *Adirondack Park Agency Rules and Regulations.* Adirondack Park Agency, State of New York.

American Lands Alliance (ALA). 2003. 'Endangered Species Act: Habitat Conservation Plans' [online] http://www.americanlands.org/issues.php?subsubNo=1086834263&article=1090411118 [January 6, 2005].

American Wildlands. 2005. 'What is a Roadless Area?' [online] http://www.wildlands.org/publands/road_whatis.html [February 2, 2005].

Anderson, Mark, Frank Biasi, and Steven Buttick. 1998. 'Conservation Site Selection: Ecoregional Planning for Biodiversity'. *Proceedings of the Environmental Systems Research Institute User Conference*, San Diego, CA, July 27-31.

Anderson, Mark, Pat Comer, Dennis Grossman, Craig Groves, Karen Poiani, Marion Reid, Rick Schneider, Barbara Vickery and Alan Weakley. 1999. *Guidelines for Representing Ecological Communities in Ecoregional Conservation Plans.* Washington, D.C : The Nature Conservancy.

Audubon, National Society. 2000. 'Endangered Species' [online] http://www.audubon.org/campaign/esa/ [January 26, 2005].

Baxter State Park Authority. 2005. 'About Baxter State Park' [online] www.baxterstateparkauthority.com/aboutus [March 1, 2005].

Beatley, Timothy. 2000. 'Preserving Biodiversity', *Journal of the American Planning Association*; 66(1):5-20.

Beazley, K., L. Smandych, T. Snaith, P. Austin-Smith, Jr., and P. Duinker. 2003. 'Biodiversity considerations in conservation system planning: a map-based approach for Nova Scotia, Canada', *Ecological Applications.*

Beier, Paul and Reed F. Noss. 1998. 'Do Habitat Corridors Provide Connectivity', *Conservation Biology*, 12(6):1241-52.

Benedict, Mark A. and Edward T. McMahon. 2000. *Green Infrastructure: Smart Conservation for the 21st Century*, Sprawl Watch Clearinghouse Monograph Series, Sprawl Watch Clearinghouse, Washington, D.C.

Bennet, John and Paul Lawrence. 2002. 'Adaptive Management Framework for Catchment and Coastal Management and Decision Making'. *Proceedings of Coast to Coast 2002, Australia's National Coastal Conference* [online] http://www.coastal.crc.org.au/coast2coast2002/index.html [January 6, 2005].

Blair R.B. and A.E. Launer. 1997. 'Butterfly diversity and human land use: Species assemblages along an urban gradient', *Biological Conservation*, 80:113-125.

Boyd, David. 2002. *Wild by Law: A Report Card on Laws Governing Canada's Parks and Protected Areas, and a Blueprint for Making these Laws more Effective.* Victoria, BC: The POLIC Project on Ecological Governance, University of Victoria.

Branchaud, A. et A. Gendron. 2000. 'Le pouvoir de ne rien faire', *Le Devoir*, September 1:A9.

Broberg, Len. 2003. 'Conserving Ecosystems Locally: A Role for Ecologists in Land-Use Planning', *BioScience* 53(7):670-673.

Canadian Council of Ministers of the Environment (CCME). 2005. 'About CCME' [online] http://www.ccme.ca/about/ [February 22, 2005].

Canadian Environmental Assessment Agency (CEAA). 2002. 'Regional Cumulative Effects Management Framework for Cold Lake, Alberta' [online] http://www.ceaa-acee.gc.ca/015/0002/0017/index_e.htm [January 6, 2005].

Canadian Nature Federation (CNF). 2001. '2001 Report Card on the Implementation of the National Accord for the Protection of Species at Risk' [online] http://www.cnf.ca/species/report01/index.html [May 12, 2004].

Canadian Wildlife Service. 1997. 'Conserving Borderline Species: A Partnership between the United States and Canada', Species at Risk Program' [online] www.speciesatrisk.gc.ca/publications/cbs/more_e.cfm#anchor60690 [November 8, 2004].

Carr, Margaret H., Thomas D. Hoctor, Crystal Goodison, Paul D. Zwick, Jessica Green, Patricia Hernandez, Christine McCain, Jason Teisinger, Karen Whitney. 2002. *Final Report: Southeastern Ecological Framework*, Planning and Analysis Branch, U.S. Environmental Protection Agency, Region 4, Atlanta, GA.

Carroll, Carlos. 2003. 'Impacts of Landscape Change on Wolf Viability in the Northeastern U.S. and Southeastern Canada: Implications for Wolf Recovery', Special Paper No. 5, *The Wildlands Project*, Richmond, VT.

Clowater, Roberta and David Coon. 1996. *The Nature of New Brunswick: A Biodiversity Primer*, Conservation Council of New Brunswick, Fredericton, NB.

Cohn, Jeffrey P., and Jeffrey A. Lerner. 2003. *Integrating Land Use Planning & Biodiversity.* Defenders of Wildlife, Washington D.C.

Convention on Biological Diversity. 1996. *An Ecosystem Approach to the Management of Northern Coniferous Forests*, Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) Second Meeting Montreal, September 2, 1996.

Convention on Biological Diversity. 2003. *Ecosystem Approach: Further elaboration, guidelines for implementation and relationship with sustainable forest management.* SBSTTA Ninth Meeting, November 10, 2003.

COSEWIC. 2003. 'COSEWIC Home' [online] www.cosewic.gc.ca/eng/sct5/index_e.cfm. [12/1/03].

Coulumbe, Commisison. 2004. 'Rapport: Commission d'etude sure la gestion de la forst publique quebecois' [online] http://www.commission-foret.qc.ca/rapportfinal.htm [January 31, 2005].

Coulumbe, Commission. 2004a. 'Press Release: The main priorities for improving the management of Quebec's public forests, December 14, 2004' [online] http://www.commission-foret.qc.ca/centre_14_dec_04-1a.htm [January 31, 2005].

Coulumbe, Commission. 2004b. 'Press Release: A focus on ecosystem-based management and the completion of the protected areas network. December 14, 2004' [online] http://www.commission-foret.qc.ca/centre_14_dec_04-3a.htm [January 31, 2005].

Coulumbe, Commission. 2004c. 'Press Release: Toward Forest Management that is integrated, decentralized and transparent. December 14, 2004' [online] http://www.commission-foret.qc.ca/centre_14_dec_04-7a.htm [January 31, 2005].

Council on Environmental Quality (CEQ). 1997. *Considering Cumulative Effects Under the National Environmental Policy Act*, CEQ, Executive Office of the White House, Washington, DC.

Davey, Adrian G. 1998. *National System Planning for Protected Areas.* Island Press, Washington, D.C.

Defenders of Wildlife. 2002. *Conservation in America: State Government Incentives for Habitat Conservation.* Defenders of Wildlife, Washington, D.C.

Degraaf, R.M. and Yamasaki. 2001. *New England wildlife, Habitats, natural history and distribution*, University Press of New England, Hanover, NH.

Diamond, Jared. 2005. *Collapse.* Viking Press, Published by the Penguin Group: New York, NY.

Dickman, C. R. 1987. 'Habitat fragmentation and vertebrate species richness in an urban environment,' *Journal of Applied Ecology* 24:337-351.

Drumbl, Mark A. 2002. 'Environmental Supra-Nationalism,' *Washington & Lee Law Review*, 59(1):289-298.

Dwivedi, O.P., Patrick Kyba,Peter J. Stoett, and Rebecca Tiessen. 2000. *Sustainable Development and Canada: National and International Perspectives.* Broadview Press, Peterborough, ON.

Environment Canada. 2003. 'Species at Risk Act: A Guide.' [online] www.speciesatrisk.gc.ca [October 1, 2003].

Ewing, Reid and John Kostyack. 2005. *Endangered by Sprawl: How Runaway Development Threatens America's Wildlife.* National Wildlife Federation, Smart Growth America, and NatureServe. Washington, D.C..

Fischer, Douglas T. and Richard L. Church. 2003. 'Clustering and Compactness in Reserve Site Selection: An Extension of the Biodiversity Management Area Selection Model.' *Forest Science* 49(4):555-565.

Flatebo, Gro, Carol R. Foss, and Steven K. Pelletier. 1999. 'Biodiversity in the Forests of Maine: Guidelines for Management.' University of Maine Cooperative Extension.

Fleming, Cynthia. 2003. *Landscape-level initiatives in the Northern Forest*, The Wilderness Society, Washington, DC.

Foster, David R. 2002. 'Thoreau's country: a historical-ecological perspective on conservation in the New England landscape,' *Journal of Biogeography* 29:1537-1555.

Foster, David R. and Glenn Motzkin. 1998. 'Ecology and conservation in the cultural landscape of New England: Lessons from Nature's History,' *Northeastern Naturalist* 5(2):111-126.

Fundy Model Forest (2004). *Report on the status of Local Level Indicators of Sustainable Forest Management.* Saint Johns, NB.

Gardner, Royal C. 1997. 'Taking the Principle of Just Compensation Abroad: Private Property Rights, National Sovereignty, and the Cost of Environmental Protection.' *University of Cincinnati Law Review*, 65:539.

Goble, Dale D. 2002. 'The Problem of Unraveling: Biodiversity and Private Property in Land.' *Idaho Law Review* 38:291.

Goble, Dale D. 2004. 'Constitutional Conflicts on Public Lands: The Property Clause: As if Biodiversity Mattered.' *University of Colorado Law Review* 75:1195.

Gonzales, Emily K., Peter Arcese, Rueben Schulz, and Fred L. Bunnel. 2003. 'Strategic reserve design in the central coast of British Columbia: integrating ecological and industrial goals.' *Canadian Journal of Forest Research* 33(11):2129-2140.

Groves, Craig R., Deborah B. Jensen, Laura L. Valutis, Kent H. Redford, Mark L. Shaffer, J. Michael Scott, Jeffrey V. Baumgartner, Jonathan V. Higgins, Michael W. Beck and Mark G. Anderson. 2000. 'Planning for Biodiversity Conservation: Putting Conservation Science into Practice.' *Bioscience* 52(6):499-512.

Gunderson, L. 1999. 'Resilient management: comments on "Ecological and social dynamics in simple models of ecosystem management" by S. R. Carpenter, W. A. Brock, and P. Hanson.' *Conservation Ecology* 3(2):7.

Hegman, G., C. Cocklin, R. Creasey, S. Dupuis, . Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 1999. *Cumulative Effects Assessment Practitioners Guide.* Prepared for the Canadian Environmental Assessment Agency by the Cumulative Effects Assessment Working Group and AXYS Environmental Consulting. [online] http://www.ceaa-acee.gc.ca/013/0001/0004/index_e.htm [March 2, 2005].

Hollis, Linda and William Fulton. 2002. *Open Space Protection: Conservation Meets Growth Management.* A discussion paper prepared for The Brookings institution Center on Urban and Metropolitan Policy, Washington, D.C.

Huelsemeyer, Axel. 2004. Globalization and Institutional Adjustment: Federalism as an Obstacle? Ashgate, Aldershot, UK.

Huot, Michel. 1999. 'The Copper Redhorse: To the Rescue of a Threatened Species in Quebec.' *St. Lawrence Vision Newsletter*, 10:3. [online] http://www.slv2000.qc.ca/bibliotheque/lefleuve/vol10no3/volume10_3_accueil_a.htm [March 9, 2005]

Inden, William L. 1996. 'Compensation Legislation: Private Property Rights vs. Public Benefits.' *Dickinson Journal of Environmental Law & Policy* 5:119.

Interior Columbia Basin Ecosystem Management Project (ICBEMP). 2003. 'The Interior Columbia Basin Strategy: A Strategy for Applying the Knowledge Gained by the Interior Columbia Ecosystem Management Project to the Revisions of Forest and Resource Management Plan and Project Implementation.' [online] http://www.icbemp.gov/ [February 1, 2005].

International Joint Commission (IJC). 2000. *Transboundary Watersheds: First report to the governments of Canada and the United States under the Reference of November 19, 1998 with respect to international watershed boards.* International Join Commission, December, 2000.

IJC. 2000a. 'Directive to the International St. Croix River Board.' International Joint Commission, International St. Croix River Board. [online] http://www.ijc.org/conseil_board/st_croix_river/en/stcroix_mandate_mandat.htm [January 17, 2005].

IJC. 2004. 'IJC' [online] http://www.ijc.org/en/home/main_accueil.htm January 12, 2005.

International Union for the Conservation of Nature and Natural Resources (IUCN). 1999. *Parks for Biodiversity: Policy Guidance based on experience in ACP countries.* Island Press, Washington, DC.

Irland, L. C. 1996. 'Land, timber, and recreation in Maine's Northwoods.' *Maine Agricultural and Forest Experiment Station, Misc. Pub. 730*, Orono, ME: University of Maine.

Karkkainen, Bradley C. 1997. 'Biodiversity and Land.' *Cornell Law Review* 83:1.

Kay, J.J. and E. Schneider. 1994. 'Embracing complexity: The Challenge of the Ecosystem Approach.' *Alternatives* 20(3).

Kirton, J. 1997. 'The Commission for Environmental Cooperation and Canada-U.S. Environmental Governance', *The American Review of Canadian Studies* - Red, White and Green: Canada-U.S. Environmental Relations 27(3).

Kohm, Kathryn, P. Dee Boersma, Gary K. Meffe, Reed Noss. 2000. 'Putting the Science into Practice and the Practice into Science.' *Conservation Biology* 14(3):593-594.

Korn, Horst, Rainer Schliep and Jutta Stadler. 2002. Report of the International Workshop on the "Further Development of the Ecosystem Approach". Federal Agency for Nature Conservation: Federal Ministry of Environment, Nature Conservation and Nuclear Safety, Germany.

Jennings, Michael and Michael Scott. 1997. 'Official Description of the National Gap Analysis Program.' Biological Resources Division, United States Geological Society GAP Analysis Program, Moscow, ID. [online] http://www.gap.uidaho.edu/About/Overview/GapDescription/default.htm [January 10, 2005].

Johnson, B. L. 1999. 'The role of adaptive management as an operational approach for resource management agencies.' *Conservation Ecology* 3(2): 8. [online] http://www.consecol.org/vol3/iss2/art8/ [January 6, 2005].

Lawler, Joshua J., Denis White, Jean C. Sinfneos, and Lawrence Master. 2003. 'Rare Species and the Use of Indicator Groups for Conservation Planning.' *Conservation Biology* 17(3):875-882.

Lindgren, (2000). 'The Species at Risk Act: An Overview.' Canadian Environmental Law Association, Toronto, ON.

Low, Greg. 2003. 'Landscape-scale Conservation. A Practitioner's Guide. The Nature Conservancy, Washington, D.C.

Main, Martin B., Fritz M. Roka, and Reed Noss. 1999. 'Evaluating the Costs of Conservation.' *Conservation Biology* 13(6):1262-1272.

Maine Department of Conservation (MDC). 2000. 'Integrated Resource Policy for Public Reserved and Nonreserved Lands, State Parks and State Historic Sites.' Maine Bureau of Parks and Land, Department of Conservation.

Maine Forest Service (MFS). 2001. *The 2001 Biennial Report on the State of the Forest and Progress Report on Forest Sustainability Standards.* Report to the Joint Standing Committee of the 120th Legistlature on Agriculture, Conservation and Forestry, October 11, 2001.

MFS. 2005. 'MFS Rule – Chapter 23: Timber harvesting Standards to Substantially Eliminate Liquidation Harvesting. Maine Department of Conservation.' Effective Date January 2, 2005.

Maine Land Use Regulation Commission (MLURC). 1997. 'Comprehensive Land Use Plan: For Areas within the Jurisdiction of the Maine Land Use Regulation Commission.' Maine Department of Conservation.

Martino, Diego. 2001. 'Buffer Zones Around Protected Areas: A Brief Literature Review.' *Electronic Green Journal,* Issue 15.

McKenney, Dan. 2002. 'Cross-border species distribution modeling: An invitation for partners from the United States.' *Gap Analysis Program Bulletin* 11 [online] http://www.gap.uidaho.edu/Bulletins/11/crossborder.htm [January 12, 2005].

McKinney, Michael L. 2002. 'Urbanization, Biodiversity and Conservation.' *BioScience* 52(10):883-890.

McNamee, T. (1997), *The Return of the Wolf to Yellowstone,* Henry Holt, New York.

McShane, Thomas O. 2003. 'The Devil in the Detail of Biodiversity Conservation.' *Conservation Biology* 17(1):1-3.

Meffe, G and C. Carroll. 1997. 'Principles of Conservation Biology,' 2nd Edition. Sinauer Associates, Sunderland, MA.

Melious, Jean O. and Robert D. Thornton. 1999. 'Contractual Ecosystem Management Under the Endangered Species Act: Can Federal Agencies Make Enforceable Commitments.' *Ecology Law Quarterly* 26:489.

Millennium Ecosystem Assessment. MEA, 2003. 'Ecosystems and Human Well-being: A Framework for Assessment. World Resources Institute.' Island Press: Washington, D.C.

Miller, Brian, Barb Dugelby, Dave Foreman, Carlos Martinez del Rio, Mike Phillips, Rich Reading, Michael E. Soulé, John Terborgh, and Louisa Wilcox. 2001. ' The Importance of Large Carnivores to Healthy Ecosystems.' *Endangered Species Update* 18(5):202-210.

Ministère de L'environnement. 2003. 'Protected areas in Québec : a pledge for the future.' [online] www.menv.gouv.qc.ca/biodiversite/aires_protegees/orientation-en/index [May 1, 2004].

Ministère de L'environnement. 2004. 'Biodiversity Strategy and Action Plan: A Summary.' Quebec Minister of the Environment [online] http://www.menv.gouv.qc.ca/biodiversite/2004-2007/enbref-en.htm [January 10, 2005].

Ministère des Ressources naturelles, de la Faune et des Parcs (MNRFP). 2003). 'The Forest Act.' [online] www.mrnfp.gouv.qc.ca/english/forest/quebec/quebec-system-management-act.jsp [May 2, 2004].

Mitchell, Lisa. 2000. *The New Brunswick Environmental Law Handbook.* Conservation Council of New Brunswick, Fredericton, NB.

National Center for Ecological Analysis and Synthesis (NCEAS). 1999. 'Using science in habitat conservation plans.' National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara.

Nature Conservancy. 2001. *Conservation by design: A Framework for Mission Success.* The Nature Conservancy, Arlington, VA.

Nature Conservancy. 2003. *The Five S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success.* The Nature Conservancy, Arlington, VA.

NatureServe. 2003. *A Working Classification of Terrestrial Ecological Systems in the Coterminous United States. International Terrestrial Ecological Systems Classification.* NatureServe, Arlington, VA.

New Brunswick Department of Natural Resources (NBDNR). 2000. 'A Vision for New Brunswick Forests: Goals and Objectives for Crown Land Management.'

NBDNR. 2003. New Brunswick Protected Areas. [online] http://www.gnb.ca/0399/index-e.asp [September 15, 2004].

NBDNR. 2004. *Staff Review of the Jaakko Poyry Report: New Brunswick Crown Forests: Assessment of Stewardship and Management.*

New England Forestry Foundation (NEFF). 2005. 'Pingree Forest Partnership: Conserving over 750,000 acres in Maine.' [online] http://www.newenglandforestry.org/projects/pingree.asp [March 7, 2005].

New Hampshire Fish and Game Department. 2005. 'Critical Habitats and Associated Species in New Hampshire.' [online] http://www.wildlife.state.nh.us/Wildlife/Wildlife_Plan/critical_habitats_species.htm [January 11, 2005]

North American Wildlife Enforcement Group (NAWEG) 2000. 'NAWEG at Work.' [online] http://www.cec.org/programs_projects/law_policy/regional_enforce_forum/naweg/work.cfm?varlan=english [January 21, 2005].

Noss, Reed. 2003. 'A Checklist for Wildlands Network Designs.' *Conservation Biology* 17(5):1270-1275.

Noss, Reed. 1992. 'The Wildlands Project Land Conservation Strategy.' *Wild Earth* (Special Issue):10-25.

Noss, Reed. 1990. 'Indicators for monitoring biodiversity: A hierarchical approach.' *Conservation Biology* 4:355-364.

Noss, Reed and A. Cooperrider. 1993. 'Gap Analysis as Applied Conservation Biology.' *Gap Analysis Bulletin* 3:3-5.

Noss, R. F., and A. Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity.* Washington, D.C.; Covelo, CA: Island Press.

Noss, R., E. LaRoe, M. Scott. 1995. *Endangered Ecosystems of the United States: A preliminary Assessment of loss and degradation.* Washington, D.C. National Biological Service.

Noss, R. F. and R. L. Peters. 1995. *Endangered Ecosystems: A status report on America's Vanishing Habitat & Wildlife.* Defenders of Wildlife, Washington D.C.

Nova Scotia Department of Environment and Labour. 2003. *A Summary of Nova Scotia's Wilderness Areas Protection Act.* Nova Scotia Department of Environment and Labour, Halifax.

Nova Scotia Department of Natural Resources (NSDNR). 2004. 'Introduction [to the IRM process].' [online] http://www.gov.ns.ca/natr/irm/introduction.html [May 18, 2004].

Nova Scotia Public Lands Coalition (NSPLC). 2004. 'Home' [online] http://publicland.ca/home/index.html, [May 19, 2004].

NSPLC. 2004a). 'Filling the Gaps. Nova Scotia Public Lands Committee, Ecology Action Centre.' [online] http://www.publicland.ca/issues/fillinginthegaps.html [May 20, 2004].

NSPLC. 2004b. 'Nova Scotia's Endangered Wilderness Hotspots.' [online] http://www.publicland.ca/endangeredspaces.html [May 20, 2004].

Nova Scotia Salmon Association (NSSA). 2005. 'News and Issues : IRM.' [online] http://www.novascotiasalmon.ns.ca/newsandissues/irm.htm [February 4, 2005].

Odum, W.E. 1990. 'Environmental degradation and the tyranny of small decisions.' *BioScience* 33:728-9.

Olson, David M., Eric Dinerstein, George V. N. Powell, Eric D. Wikramanayake. 2002. 'Conservation Biology for the Biodiversity Crisis: Editorial.' *Conservation Biology* 16(1):1-3.

Oregon Department of Agriculture (ODA). 2003. *Conservation Incentives Work Group: Report to the Seventy-Second Legislative Assembly.* Presented by the Oregon Department of Agriculture and the Oregon Department of Forestry.

Ostermeier, David, David Bidwell, and Susan Schexnayder. 2000. 'Habitat Conservation Planning: Current Processes and Tomorrow's Challenges.' *Environmental Practice*, 2(2):166-175.

Parsons, Edward A. (ed.). 2001. *Governing the Environment: Persistent Challenges, Uncertain Innovations.* University of Toronto Press: Toronto.

Parks Canada, 2000. 'Ecological Integrity in National Parks.' [online] http://www.pc.gc.ca/progs/np-pn/eco_integ/index_E.asp [October 12, 2003]

Pedynowski, D. 2003. 'Prospects for Ecosystem Management in the Crown of the Continent Ecosystem, Canada-United States: Survey and Recommendations.' *Conservation Biology* 17(5):1261-1269.

Plamondon, André. 2002. 'Quebec's 20m Buffer Between Clear Cuts and the Hydrologic Network: Scientific Background.' *Symposium on Small Stream Channels and their Riparian Zone.* February, 2003, Vancouver, BC.

Poiani, Karen and Brian Richter. 1999. 'Functional Landscapes and the Conservation of Biodiversity.' *Working Papers in Conservation Science*, No. 1. Conservation Science Division, The Nature Conservancy.

Pollock, Rebecca M., Graham S. Whitelaw and David K. Atkinson. 2003. *Linking Community Based Ecosystem Monitoring to Local Decision Making and Policy Development on Sustainability.* Voluntary Sector Initiative Project, Canadian Nature Federation and the Ecological Monitoring and Assessment Network Coordinating Office, Environment Canada. [online] http://www.ccmn.ca/english/library/vsi/ [September 12, 2004]

Power M.E., D. Tilman, J.A. Estes, B.A. Menge, W.J. Bond, L.S. Mills, G. Daily, J.C. Castilla, J. Lubchenco, R.T. Paine. 1996. 'Challenges in the quest for keystones.' *BioScience* 46:609-620.

Prior-Magee, Julie S., Bruce C. Thompson and David Daniel. 1998. 'Evaluating Consistency of Categorizing Biodiversity Management Status Relative to Land Stewardship in the Gap Analysis Program.' *Journal of Environmental Planning and Management* 41(2):209-216.

Ray, Justina C. 2000. 'Mesocarnivores of Northeastern North America: Status and conservation issues.' *Wildlife Conservation Society Working Papers* 15:1-84.

Ray, Justina C., John F. Organ and Michael S. O'Brien. 2002. *Canada Lynx (Lynx canadensis) in the Northern Appalachians: Current Knowledge, Research Priorities, and a Call for Regional Cooperation and Action.* Report of a meeting held in Portland Maine, April 2002.

Residents Committee to Protect the Adirondacks (RCPA) 2003. 'Adirondack Park Issues.' [online] http://www.adirondackresidents.org/. [3 Nov 2003].

Rickets, Taylor H., Eric Dinerstein, Karen Carney, Rabin A. Abell, and Steven Walters. 1999. *Terrestrial Ecoregions of North America. A Conservation Assessment.* Island Press, Washington, D.C.

Rodrigues, A.S.L., Andelman, S.J., Bakarr, M.I., Boitani, L., Brooks, T.M., Cowling, R.M., Fishpool, L.D.C., Fonseca, G.A.B., Gaston, K.J., Hoffman, M., Long, J., Marquet, P.A., Pilgrim, J.D., Pressey, R.L., Schipper, J., Sechrest, W., Stuart, S.N., Underhill, L.G., Waller, R.W., Watts, M.E.J., Xie Y. 2003. 'Global Gap Analysis: towards a representative network of protected areas.' *Advances in Applied Biodiversity Science* 5.

Rupasingha, Anil and Stephan J. Goetz. 2001. *Land Use Research: Scientific Publications from 1986 to the Present. Rural Development Paper No. 8*, Northeast Regional Center for Rural Development, Pennsylvania State University, University Park, Pennsylvania.

Salafsky, Nick, Richard Margoluis, Kent Redford. 2001. *Adaptive Management: A Tool for Conservation Practitioners.* Biodiversity Support Program, Washington, D.C. [online] http://www.worldwildlife.org/bsp/publications/aam/112/titlepage.htm [November 10, 2004]

Saterson, K., R. Margoluis, and N. Salafsky. 1999. *Measuring conservation impact: An interdisciplinary approach to project monitoring and evaluation.* Biodiversity Support Program, Washington, D.C.

Searle, Rick. 2000. *Phantom Parks: the Disappearance of Canada's National Parks.* Key Porter Books: Toronto, ON.

Sierra Legal Defence Fund (SLDF) 2002. *The Lost Decade: Canada's conservation track record since signing the Rio Convention on Biological Diversity.* Sierra Legal Defence Fund, Vancouver, BC.

Simberloff, D.J., A. Farr, J. Cox, and D.W. Mehlman. 1992. 'Movement corridors: Conservation bargains or poor investments?' *Conservation Biology* 6(4):493-504.

Smallwood, Kate 2003. *A Guide to Canada's Species at Risk Act.* Sierra Legal Defence Fund, Toronto, ON.

Snaith, T. and K. Beazley. 2002. 'Moose (*Alces alces americana* Peterson) as a focal species for reserve design in Nova Scotia, Canada.' *Natural Areas Journal* 22: 235-240.

Soulé, Michael, James A. Estes, Joel Berger, and Carlos Martinez del Rios. (2003). 'Ecological Effectiveness: Conservation Goals for Interative Species.' *Conservation Biology*, 17(5):1238-1250.

Soulé, Michael and Reed Noss. 1998. 'Rewilding and Biodiversity: Complementary Goals for Continental Conservation.' *Wild Earth* Fall: 19-28.

Soulé, Michael and John Terborgh. 2000. 'Conserving nature at regional and continental scales: a scientific program for North America.' *Recovery: An Endangered Species Newsletter* 17.

Suckling, Kieran, Rhiwena Slack, and Brian Nowicki. 2004. *Extinction and the Endangered Species Act.* Center for Biological Diversity, Tucson, AZ.

Theobald, David M. 2003. 'Targeting Conservation Action through Assessment of Protection and Exurban Threats.' *Conservation Biology* 17(6):1624-1637.

Thomas, Lee and Julie Middleton. 2003. *Guidelines for Management Planning of Protected Areas.* Island Press, Washington, DC.

Thompson, Elizabeth H. 2002. *Vermont's Natural Heritage: Conserving Biodiversity in the Green Mountain State.* Vermont Biodiversity Project, Burlington, VT.

Thompson, Mark. 2004. 'Comment: Keeping the Door Open: Protecting Biological Corridors with Existing Federal Statutes.' *Environmental Law* 34:703-742.

Thorne, Sarah and Dan Sundquist. 2001. *New Hampshire's Vanishing Forests: Conversion, fragmentation and parcelization of forests in the Granite State.* Report of the New Hampshire Forest Land Base Study. Society for the Protection of New Hampshire Forests, Concord, New Hampshire.

Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TC). 1996. 'Memorandum of Understanding Establishing the Canada/Mexico/United States Trilateral Committee for Wildlife and Ecosystem Management.' [online] http://www.trilat.org/general_pages/mou_eng.htm [January 21, 2005].

TC. 2004. 'Working Tables.' [online] http://www.trilat.org/working_tables_eng.htm [January 15, 2005]

Trombulak, Stephen C. 2003. 'An Integrative Model of Landscape-scale Conservation in the 21st Century.' *In* Reconstructing Conservation: History, Values and Practice. Ed. Ben A. Minteer and Robert E. Manning. Island Press.

UN Environment Program (UNEP). 2000. *Global Environment Outlook 2000.* United Nations Environment Program [online] http://www1.unep.org/geo-text/index.htm [January 12, 2005].

United States Environmental Protection Agency (USEPA). 1999. *Consideration of Cumulative Impacts in EPA Review of NEPA Documents.* EPA 315-R-99-002.

United States Fish and Wildlife Service (USFWS). 1999. 'Habitat Conservation Plans.' *Endangered Species Bulletin* XXIV(6):12-14.

USFWS. 2000. 'Final endangered status for a distinct population segment of anadromous Atlantic salmon (Salmo salar) in the Gulf of Maine.' *Federal Register* 65(223): 69459-69483.

United States Forest Service (USFS). 2000. *Forest Roads: A Synthesis of Scientific Information.* United States Department of Agriculture, Washington, DC.

United States Geological Survey. (USGS). 2004. *The Best of Gap: A compilation of the Best of the GAP Analysis Bulletin.* United States Geological Survey, US Department of the Interior, Moscow ID.

Vermont Environmental Board (VEB). 2003. 'Act 250' [online] http://www.state.vt.us/envboard/publications/jurisdiction_categories.pdf [March 8, 2005].

Vermont Land Trust (VLT). 2000. 'Property Tax Impacts of Land Conservation.' [online] http://www.vlt.org/proptax.html [February 10, 2005].

Watchman, Laura, Martha Groom, and John D. Perrine. 2001. 'Science and Uncertainty in Habitat Conservation Plans.' *American Scientist* 89(4):351-360.

Wear, David N, Monica G. Turner and Richard O. Flamm. 1996. 'Ecosystem Management with Multiple Owners: Landscape Dynamics in a Southern Appalachian Watershed.' *Ecological Applications*, 6(4):1173-1188.

Wenger, Seth. 1999. *A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation.* Office of Public Service & Outreach, Institute of Ecology, University of Georgia.

Wild Rockies. 2005. 'The Cove/Mallard Coalition. History of Roadless Areas' [online] http://www.wildrockies.org/cove/roadless!/history.html [February 2, 2005].

Wilderness Society, The. 2004. *The Wilderness Act Handbook: 40th Anniversary Edition.* The Wilderness Society, Washington DC.

Wilkinson, Jessica Bennet. 1999. 'The state role in biodiversity conservation.' *Issues in Science and Technology*, 15(3):71-77.

Y2Y. 1998. *A Sense of Place: Issues, Attitudes And Resources In The Yellowstone To Yukon Ecoregion.* Yellowstone to Yukon Conservation Initiative, Canmore, Alberta.