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# Implementing Ecosystem-based Management Approaches in Canada's Forests

A SCIENCE-POLICY DIALOGUE



Edited by  
Brenda McAfee and  
Christian Malouin

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Edited by  
**Brenda McAfee and  
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# Contents



**Contributors** 5

**Introduction** 7

## **Conceptual Thinking**

Achieving Sustainable Development: Organizing to Focus on Systems 13  
Ken Harris

The Ecosystem Approach: International Dimensions 17  
Ole Hendrickson

Ecosystem-based Approaches to Species at Risk 23  
Tom J. Fowler

Integrated Landscape Management: Applying Sustainable Development to Land Use 26  
Tony Andrews

## **Tools for Developing Ecosystem-based Approaches**

NatureServe Vista: A Decision-Support System for Land-Use Planning and Resource Management 33  
Andy Cutko, Patrick Crist, and Steve Curtis

An Integrated Risk Analysis Framework in Support of Sustainable Forest Management in Canada:  
Project Overview 38  
Brian J. Hearn, Joan E. Luther, and David R. Gray

Socioeconomic Approaches to Integrated Land Management Decisions in the Foothills Model  
Forest and Beyond 42  
Mike N. Patriquin and W.L. (Vic) Adamowicz

## **Recent Efforts, Experiments, and Lessons Learned**

Sustainable Resource and Environmental Management in Alberta 49  
Morris Seiferling

Ecosystem-based Management in the Central and North Coast Areas of British Columbia 53  
Andy MacKinnon

Stand Level Adaptive Management (SLAM) Mixedwood Project 57  
James A. Rice and Rongzhou Man

New Brunswick's Systems Approach to Natural Resources Management Planning	63
Steve Gordon	
<b>Implementing Ecosystem-based Integrated Resource Management in Nova Scotia</b>	71
Bruce Stewart and Peter Neily	
A National Ecosystem Approach and Integrated Management at Fisheries and Oceans Canada	78
Jake Rice	
<b>Conclusions</b>	87
Brenda McAfee and Christian Malouin	
<b>Appendices</b>	
Appendix 1. Workshop Agenda and Participants	95
Appendix 2. Canadian Case Studies Illustrating the Convention on Biological Diversity's Ecosystem Approach Principles	101

# Implementing Ecosystem-based Integrated Resource Management in Nova Scotia

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## INTRODUCTION

Development of a systematic approach to ecosystem-based integrated resource management has been ongoing in Nova Scotia since the early 1990s, supported by the National Forest Strategy (CCFM 1992) and the Canadian Biodiversity Strategy (Environment Canada 1995). The planning system has evolved over this period with the development of ecological planning tools, forest modeling capability, policy guidance, and regulations. Many of the components are well established, some are in use at draft stages, while others are still concepts requiring further development.

Nova Scotia has a land area of 5.3 million ha of which 28% is provincially owned (NSDNR 1999a). The Department of Natural Resources (DNR) has broad responsibilities for a wide range of Crown resources, including timber and forests, wildlife, wildlife reserves, endangered species, fire and pest protection, provincial parks, beaches, and mineral resources. The province is 80% forested, and forestry activities dominate most of the land base (NSDNR 1999a). As a result, many planning tools and systems have a strong forestry focus. Integrated resource management planning promotes synergy between the management of multiple values and encourages the modification of forestry practices for use as efficient tools to meet other management objectives (for example, conservation, habitat). This has increased management options, reduced conflict, and lessened the mitigation required to sustain sensitive values.

The following describes Nova Scotia's progress in implementing ecosystem-based management. A hierarchical ecological planning framework is provided

by Nova Scotia's ecological land classification (Neily et. al. 2003). The province's forest ecosystem classification guidebooks provide the stand level extension for management prescriptions (Keys et. al. 2003). A forest modeling system capable of tracking multiple values at various spatial and temporal scales was developed to support planning, and the assessment of forest management strategies. The overall planning system relies on a hierarchical integrated resource management approach that consists of strategic, tactical, and operational levels (NSDNR 2003). Resource planning is governed by a range of acts, regulations, and policies.

The Department of Natural Resources recently began developing new strategies for forests, minerals, parks, and biodiversity (NSDNR 2007b) with extensive public consultation led by a Voluntary Planning Project Committee (NSDNR 2007a). The process will culminate in 2010 with new strategies that will affect the planning system currently conceived and described in this paper.

## ECOSYSTEM CLASSIFICATION FRAMEWORK

The ecological framework consists of several classifications and interpretations:

- The **ecological land classification (ELC) for Nova Scotia** was designed to support a broad range of ecosystem management planning issues and scales (Table 1) (Neily et al. 2003). It has five nested hierarchical levels each defined by a set of enduring features that increase in number and precision from the continental scale to the local scale.

- **Natural disturbance regime and potential climax forest interpretations** were developed to provide knowledge of pre-European conditions and processes (Neily et al. 2007). These interpretations are attached to the ecosection level of the ELC, making them easily mapped, readily adaptable to new information, and explicitly linked to enduring ecological features. They will inform planning at both landscape and stand scales respecting forest composition, age structure, patch size, successional development, and harvesting systems.
- A **forest ecosystem classification (FEC)** provides site level descriptions of ecotypes, vegetation types, and soil types (Keys et. al. 2003). Three interim guidebooks have been produced that provide fairly complete coverage of the province. The full system, with guidebooks for each ecoregion, is scheduled for completion in 2010. The FEC system is the stand level extension of the ELC and will be incorporated into operational prescriptions affecting vegetation development and soil conservation.
- A hierarchical **vegetation classification** is evolving to integrate existing forest and non-forest classifications and inventories. It will include vegetation types, successional stage and pathways interpretations, natural disturbance processes, growth projections, and ecosystem associations.

## INTEGRATED RESOURCE MANAGEMENT PLANNING SYSTEM

An integrated resource management (IRM) process was developed to coordinate planning among resource sectors to optimize multiple benefits and minimize conflicts (NSDNR 2003). This consists of a strategic, tactical, and operational planning system led by Department of Natural Resources IRM teams composed of professional and technical experts from minerals, forests, recreation, wildlife, and parks.

### Strategic

Public and stakeholder consultations were completed in 2002 to identify issues and inventory values on Crown land. Over 1500 submissions were received and results were compiled to produce two planning products designed to inform tactical and operational planning:

1. Spatial classification of all Crown land to identify primary values and areas with overlapping and potentially conflicting values (NSDNR 2003)

C1 General Resource Use (507 000 ha, source IRM data 2007).

C2 Multiple and Adaptive Resource Use consisting of specific resource value categories (671 000 ha)

C3 Protected and Limited Use (303 000 ha). Most is administered by the Department of Environment and Labour under the Wilderness Areas Program

2. A statement of 24 provincial objectives, with associated strategies and indicators, representing management priorities for seven sectors: water, land, multiresource, conservation and recreation, minerals and energy, wildlife, and forestry.

### Tactical

Development of long-range management frameworks involves a two-step process that begins with

**Table 1.** Management applications for the ecological land classification for Nova Scotia.

EcoUnit	Management application
Ecozone	The province is entirely contained within the Acadian forest ecozone, a continental unit used for developing and coordinating strategic policies at regional, national, and international levels.
Ecoregion	Nine provincial climatic regions support distinctive vegetation communities and physiographic patterns. Ecoregions will be used to roll up landscape plans produced for ecodistricts into "master" landscapes to address coarse-scale issues related to habitat conditions, timber flow, etc.
Ecodistrict	Thirty-nine ecodistricts are characterized by distinctive patterns of vegetation, landform, and ecological processes. These provide the landscape units used for tactical planning.
Ecosection	Consistent physical conditions support repeating vegetation communities and successional responses. The pattern of repetition across ecodistricts imparts character and shapes landscape processes. Ecosections provide the fundamental unit for describing landscape structure and analyzing functions. This level of classification includes natural disturbance regime and potential climax forest interpretations, as well as non-forest communities.
Ecosite	Ecosites have not yet been mapped and are expected to be similar to the ecotypes described in the forest ecosystem classification guidebooks. These units will support operational planning and fine-scale conservation.

an ecological landscape analysis (Stewart and Neily 2006) and is followed by landscape design. Planning is assisted by the Crown Lands Forest Model decision-support system and the ecological emphasis classification zoning system.

### Ecological landscape analysis

Multidisciplinary teams from the Department of Natural Resources conduct an ecological landscape analysis for the entire land base in each of the province's 39 forested ecodistricts (Stewart and Neily 2006). These analyses provide a foundation for ecosystem-based planning on Crown land and will be made publicly available as a resource for private land planners seeking a common ecological framework. The analysis closely follows the procedures outlined by Diaz and Apostol (1992) with modifications to fit the Nova Scotia condition as follows:

- **The landscape as an ecological system:** landscape structure in terms of matrix, patch, and corridor ecosystems is defined, and the relationship of landscape flows and functions to the ecological structure is explored.
- **Connectivity and fragmentation:** the nature of connectivity within the landscape is characterized.
- **Special features:** rare, uncommon, and threatened species; sites, habitats, and other sublandscape scale features are identified.
- **Ecological representation:** the distribution of ecological units (ELC) and communities within reserve systems is quantified.
- **Road ecology:** a road index tool is used to quantify and map the relative ecological influence of the transportation network, and identify potential intersections with ecological systems.
- **Landscape composition:** the landbase classification from the forest model is used to summarize the current distribution of vegetation communities, age classes, and successional stages.
- **Ecological emphasis classification:** the current distribution of ecological emphasis classes is mapped using geographic information system (GIS) inventory and previous treatment records. An ecological emphasis index is summarized at various ecological levels to quantify relative land-use intensity.

### Landscape design

Landscape design provides a best fit of preferred ecosystem management direction that will need to integrate ecology, forest management, mineral, park, and biodiversity objectives to achieve a balance of social, economic, and environmental values within ecodistricts and ecoregions. Opportunities and constraints are highlighted and options for action defined. Landscape design products include spatial representation of current and future land uses along with management directives and activity schedules. A broad range of stakeholder interests are intimately involved in this process. Currently, the landscape design procedures are being developed while the landscape analysis proceeds.

### Crown lands forest model

The Crown Lands Forest Model provides decision support for landscape-level ecosystem-based planning, and facilitates the design of the forest management component of IRM (that is, preservation/harvest systems/silviculture investment). The model's structure is based on the representation of values and objectives in the form of quantitative indicators. These indicators are an expression of forest condition in spatial and temporal context. The modeling environment allows teams to evaluate management scenarios in the process of selecting or recommending preferred management direction.

Development of the Crown Lands Forest Model is driven by the scope of IRM values. The process of quantifying IRM values within the modeling framework has resulted in:

- A provincial Strategic Forest Modeling Values document that details a suite of standard values, objectives, and indicators that are reflective of current resource management strategies and policies (O'Keefe 2007). The indicators are quantifiable, predictable, and measurable representations of forest conditions relevant for modeling multiple values and objectives.
- A provincial landbase classification process that merges and standardizes the representation of all spatial and attribute databases relevant to IRM values. This provides a consistent representation of existing information for decision makers as well as the initialization necessary for forest projections.
- A forest modeling environment developed on the Remsoft Spatial Planning Systems technology. This



modeling environment is the analytical framework that allows the forecasting of forest modeling indicators. A key design functionality is the ability to investigate long-term trends among multiple and often competing forest values and alternative management strategies in developing forest management direction.

### Ecological emphasis classification and index

The ecological emphasis classification (EEC) is a planning tool for assessing and assigning classes of land-use intensity (Stewart and Neily 2006). It was incorporated into the growth functions of the Crown Lands Forest Model for evaluating zoning scenarios. An associated ecological emphasis index provides a numerical indicator and monitoring function. Four ecological emphasis classes are defined based on the degree to which management practices emphasize the conservation of natural conditions (Table 2). Two of the classes, intensive and extensive, involve active forest management. The Code of Forest Practice (NSDNR 2004) will provide ecosystem-specific interpretations (based on the FEC) that will specify operational criteria for each ecological emphasis class. Full implementation of the code will not occur until the department's strategy development process is completed in 2010.

**Table 2.** Ecological emphasis classification (EEC) and index definition (Stewart and Neily 2006).

EEC	Description	Index weight
Reserve	Preservation of natural conditions using laws and policies to restrict management (for example, wilderness, parks, conservation easement, Old Forest Policy).	1
Extensive management	Management of multiple values using ecosystem-based techniques that sustain or restore natural conditions and processes.	0.75
Intensive management	Management to optimize resource production and site productivity on sites maintained in a native state (for example, forested).	0.25
Converted industrial	Conversion to an unnatural state, or significant degradation of site productivity (for example, agriculture, urban, roads, Christmas trees, seed orchards).	0

During the ecological landscape analysis, the condition of all lands is assessed to determine their existing ecological emphasis class reflective of previous use. An ecological emphasis index is then summarized to provide an overall indicator of current land-use intensity.

During the landscape design phase, the EEC is assigned to land units as a zoning tool to guide future activities. Management prescriptions are then governed by the EEC specific requirements contained within the Code of Forest Practice. This has broad application for directing management to meet landscape and local scale objectives (for example, timber, restoration, connectivity).

### Operational

Landscape designs are to be implemented through short-range plans and prescriptions that represent the tactical level activity schedules of the different resource sectors. Plans from the forestry sector integrate multiple values, are ecosystem based at the ecosection and ecosite levels, and are subject to review and approval by IRM teams. They may be developed by tenure or rights holders assigned management responsibility for Crown land or resources. Forestry plans will need to conform to Code of Forest Practice guidelines and include site descriptions, treatment prescriptions, and spatial layouts. These procedures are currently being developed and are awaiting completion of the Code of Forest Practice. The following represents the most recent draft:

- Pre-treatment assessment using the FEC.
- Handbooks to determine ecotype, vegetation type, and soil type.
- Harvesting and silviculture prescriptions incorporating FEC specific interpretations and response projections.
- Harvesting and silviculture prescriptions compliant with the EEC zoning requirements and Code of Forest Practice guidelines.
- Harvesting and silviculture prescriptions consistent with the landscape design objectives for forest composition, as reflected in the activity schedules of the Crown Lands Forest Model.

## REGULATORY AND POLICY FRAMEWORK

Nova Scotia's resource planning system is supported and guided by a wide array of acts, regulations, and policies. Some of the more recent developments follow.

The *Crown Lands Act*, amended in 1989, provides for the use of Crown lands by governing forest management and harvesting, leasing and licensing, integration of wildlife and recreation in forest management planning, and administration and management of all Crown lands (Nova Scotia 1989).

The *Forests Act* was amended in 1998 to allow for new regulations supporting the 1997 forest strategy (NSDNR 1997, 2007c). A significant component of the strategy was the provision of a Code of Forest Practice, which specifies requirements for management of Crown lands. The code consists of three parts:

- Code Principles provide guidance for strategic planning in the areas of forest ecosystems, forest products, wildlife habitat, and integrated forest use. These principles were released in 2004 (NSDNR 2004).
- Code Guidelines specify management requirements for ecosystems, forest products, wildlife, and integrated use. The code guidebooks are scheduled to be released in draft for public comment in 2008 through the voluntary planning strategy consultation process.
- Technical References developed through research and practice provide tools and options for management applicable to Nova Scotia forest conditions. This includes a broad suite of existing and developing management and decision-support tools.

The *Environmental Goals and Sustainable Prosperity Act*, 2007, recently established several specific initiatives and objectives affecting management of provincial lands (Nova Scotia 2007). The IRM process will need to reflect these objectives:

- commit to legally protect 12% of the provincial land mass by 2015,
- develop a policy preventing loss of wetlands by 2009,
- adopt a natural resources strategy for forests, mines, parks, and biodiversity by 2010.

The Interim Old Forest Policy, 1999, established an objective to identify and protect the best remaining old forests and old-forest restoration opportunities on a minimum 8% of Crown land in each of the 39 ecodistricts (NSDNR 1999b). Most of this objective has now been met.

The Environmental Certification Programs, particularly the Forest Stewardship Council, the Canadian Standards Association, and the Sustainable Forestry Initiative, have a growing influence on forest management direction on private land, which makes up over 70% of the provincial land base. Many of the tools and planning processes developed for Crown IRM support these certification programs which are encouraging better landscape level coordination across tenures. Large areas of Nova Scotia Crown land have already been certified under one or more of these programs.

## SUMMARY

Integrated resource management was introduced in the early 1990s as a three-tiered strategic, tactical, and operational planning system. Development of this ecosystem-based approach is evolving as the required planning tools and processes are introduced. This has presented challenges to maintain momentum, integrate planning tools, and provide training and communication in the face of change. Yet the policy has encouraged overall integration of values, better communication among resource sectors, and improved decision-making within the NSDNR.

Currently, the ecological framework and many of the ecosystem planning tools are completed or sufficiently advanced to be in use. The strategic planning phase was completed in February 2002 following public consultation. This produced a spatial land-use classification and a statement of 24 objectives, strategies, and indicators to guide integrated planning across seven sectors. IRM teams currently rely on these products to assess proposals and plan operations while the other planning levels are developed. The tactical level phase was divided into two stages of landscape level planning. An ecological landscape analysis of the province's 39 ecodistricts began in 2007. This will be followed by a landscape design and decision stage for which procedures are currently being finalized. Revision of the operational planning system will follow. Monitoring procedures for tracking

progress will use elements from the planning system, including the strategic plan indicators, indexes from the tactical plan, quantifiable values from the forest model, and state of the forest reporting.

Continued progress in implementing the full system relies on policy direction from the Code of Forest Practice which will undergo public consultation as part of the resource strategy initiative. Effective resource management policies in Nova Scotia require sharing and coordination among the three major ownerships, Crown, large private, and small private, each of which make up significant portions of the province. Multistakeholder involvement and coordinated research and planning are other critical components. Progress is occurring with the sharing of ecological tools and classifications and the growing influence of environmental certification programs. This was further enhanced by the emergence of partnership organizations such as the Nova Forest Alliance (Canadian Model Forest Network and Forest Communities Program) in central Nova Scotia; Mersey Tobeatic Research Institute and associated Southwest Nova Biosphere Reserve Association in western Nova Scotia; and the Collaborative Environmental Planning Protection Initiative in eastern Nova Scotia. Many other community partnerships have also developed and will play an important role in the future development of integrated resource management.

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