

IMPLEMENTING ECOSYSTEM BASED INTEGRATED RESOURCE MANAGEMENT IN NOVA SCOTIA

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Development of a systematic approach to ecosystem based, integrated resource management has been ongoing in Nova Scotia since the early 1990's, supported by the National Forest Strategy and Canadian Biodiversity Strategy (CCFM, 1992, Anon, 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 hectares, of which 28% is Provincial ownership (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 (IRM) 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 (e.g. 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 has been developed to support planning, and the assessment of forest management strategies. The overall planning system relies on a hierarchal 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 development of new strategies for forests, minerals, parks and biodiversity (NSDNR, 2007a). This process is now underway with extensive public consultation led by a Voluntary Planning project committee (Anon, 2007). It will culminate in 2010 with new strategies that will affect the planning system currently conceived and herein described.

ECOSYSTEM CLASSIFICATION FRAMEWORK

The ecological framework consists of several classifications and interpretations:

- The **Ecological Land Classification for Nova Scotia (ELC)** 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, which 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, 2006). 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 which provide fairly complete coverage of the province. The full system, with guidebooks for each ecoregion, is scheduled for completion in 2010. The forest ecosystem classification 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.

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 (FEC). These units will support operational planning and fine scale conservation.
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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, multi-resource, conservation & recreation, minerals & energy, wildlife, and forestry.

Tactical

Development of Long Range Management Frameworks (LRMF) involves a two step process that begins with 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

Multi-disciplinary teams from the Department of Natural Resources conduct an ecological landscape analysis (ELA) for the entire landbase in each of the Province's 39 forested ecodistricts (Stewart and Neily, 2006). These 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 Apostle (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 sub-landscape 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 historical 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 under development 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 (i.e. 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 enables 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 the development of 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 has been 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 Forest Code of Practice (NSDNR, 2004) will provide ecosystem specific interpretations (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.

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

During the landscape design phase the ecological emphasis classification 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 Forest Code of Practice. This has broad application for directing management to meet landscape and local scale objectives (e.g. timber, restoration, connectivity).

Table 2. Ecological Emphasis Classification and Index definition (Stewart and Neily, 2006).

Ecological Emphasis Class	Description	Index Weight
Reserve	- Preservation of natural conditions using laws and policies to restrict management. (e.g. 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 (e.g. forested)	0.25
Converted-Industrial	- Conversion to an unnatural state, or significant degradation of site productivity (E.g. agriculture, urban, roads, Christmas trees, seed orchards)	0

Operational

Landscape Designs are to be implemented through short range plans and prescriptions which 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 Forest Practice Code guidelines and include site descriptions, treatment prescriptions, and spatial layouts. These procedures are currently being developed and are awaiting completion of the Forest Code of Practice. The following represents the most recent draft:

- Pre-treatment assessment using the Forest Ecosystem Classification (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 Ecological Emphasis Classification zoning requirements and Forest Code of 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 include:

Crown Lands Act, amended in 1989, provides for the utilization 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).

Forests Act, was amended in 1998 to allow for new regulations supporting the 1997 Forest Strategy (NSDNR, 1997 & 2007b). A significant component of the Strategy was the provision of a Forest Code of Practice, which is to specify requirements for management of Crown lands. The Code consists of 3 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.

Environmental Goals and Sustainable Prosperity Act 2007, recently established a number of specific initiatives and objectives affecting management of the provincial lands (NS, 2007). The IRM process will need to reflect these objectives:

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

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 percent of Crown land in each of the 39 Ecodistricts (NSDNR, 1999b). Most of this objective has now been met.

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

SUMMARY

Integrated Resource Management was introduced in the early 1990's as a 3-tiered strategic, tactical and operational level 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

Department of Natural Resources.

Presently 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 has been 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 upon 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 3 major ownerships, Crown, large private, and small private, each of which make up significant portions of the province. Multi-stakeholder involvement and coordinated research and planning is another critical component. Progress on these fronts is occurring with the sharing of ecological tools and classifications, and the growing influence of environmental certification programs. This has been further enhanced by the emergence of partnership organizations, such as the Nova Forest Alliance (Canadian Model Forest Network & Forest Communities Program) in central Nova Scotia; Mersey Tobeatic Research Institute and associated Southwest Nova Biosphere Research Association in western Nova Scotia; and the Collaborative Environmental 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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Abstract

The following describes Nova Scotia's approach and progress in implementing ecosystem based management. Planning occurs within an integrated resource management system that consists of strategic, tactical, and operational levels. Nova Scotia's Ecological Land Classification (ELC) provides the hierarchical ecological framework for planning, while the province's Forest Ecosystem Classification (FEC) guidebooks provide the stand level extension for management prescriptions. A forest growth model capable of tracking multiple values has been developed to provide strategic and tactical decision support.

The strategic planning phase used extensive public consultation to produce a spatial zoning of management priorities, and a comprehensive list of values and objectives from multiple sectors. These products provide direction to the tactical process which is unfolding in two stages; analysis, and design. Ecological analyses are currently underway in each of the 39 landscapes defined at the ecodistrict level of the Ecological Land Classification. These will guide planning on Crown land, and will be provided as a resource for private land managers. The design phase for Crown land will employ multi-stakeholder consultation to work with Department of Natural Resources integrated management planning teams. Plans at the tactical level will use a "conservation emphasis class" zoning to indicate the intensity and type of management activities desired for Crown land. Operational planning will employ the province's forest ecosystem classification to develop ecologically based prescriptions that are compatible with the conservation emphasis class zoning.