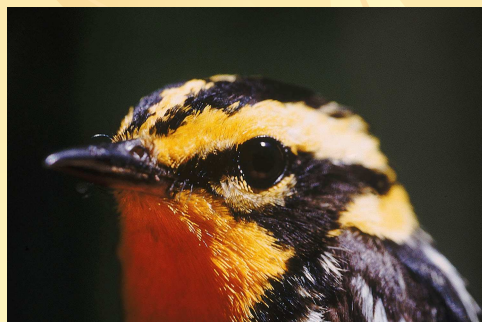# Our Acadian Forest in Danger

The State of Forest Diversity and Wildlife Habitat in New Brunswick

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Executive Summary

The purpose of this study was to determine whether forest management in New Brunswick is sustaining our Acadian forest ecosystems. The Department of Natural Resources (DNR) requires licensees to manage forests on Crown lands to maintain the diversity of forest ecosystems and their associated ecological values and to provide habitat necessary to support populations of native wildlife species across their natural ranges. DNR prescribes the objectives and standards the licensees must meet to achieve these goals.

This study examined three questions:

1. **Is the current classification system for forest diversity and wildlife habitat on Crown land sufficient for maintaining the diversity of the Acadian forest?**

2. **Are the current target levels (or areas) for forest diversity and wildlife habitat being maintained at required levels on Crown lands?**

3. **Are the current target levels (or areas) for forest diversity and wildlife habitat sufficient to maintain the diversity of the Acadian Forest?**

Maintaining the forest diversity on Crown lands is essential to conducting sustainable forest management. If forest diversity is lost or reduced in New Brunswick, then forest management is not sustainable.

New Brunswick's forest area is part of the Acadian forest region. This forest is unique to the Maritime Provinces and limited parts of northern New England and southern Quebec. The Acadian forest is an incredibly diverse ecosystem and this diversity is essential to the proper functioning of this forest. This forest was historically composed of long-lived tree species (200 – 400 years) that largely existed in forest stands that contained a mixture of hardwoods and softwoods. This forest was not subject to frequent, large scale disturbances. Under natural conditions small groups or individual trees would have died and been replaced by younger trees in the understory. Forest stands would have persisted in this state for centuries (Lorimer, 1977; Loo and Ives, 2003; Mosseler et al., 2003).

The past three hundred years of European settlement and industrialization of forest management has caused many changes in the Acadian forest. As a result of forest removal from agriculture, past forest management and current clearcutting practices, the species composition has shifted towards shorter-lived, shade intolerant species such as white birch, poplar and white spruce understory (Lorimer, 1977; Loo and Ives, 2003; Mosseler et al., 2003). The area of mature forest (average tree age equal to 80 years) has been reduced by almost 35 percent from its historic levels (DNR 2004 Forest Inventory). Old growth forest (average dominant tree age equal to 150 years) has been reduced from 50 percent of the forest landbase to less than 5 percent of the current forest landbase (Mosseler et al., 2003). The Acadian forest has been listed as one of North America's most endangered forests by the World Wildlife Fund (Davis et al., 2005).

In contrast, many proponents of New Brunswick's forest industry often state that New Brunswick has the best managed forests in the world. A new report was released in 2002 by the Jaakko Pöyry consultant group, commissioned by the New Brunswick Forest Products Association. The report concluded that the wood supply on New Brunswick's Crown lands could be doubled without negatively affecting biodiversity in New Brunswick's forests (Jaakko Pöyry Consultants, 2002).

Strongly diverging opinions such as this made it necessary to take a more in-depth look at New Brunswick's Crown land goals and objectives for biodiversity and determine if our current goals and objectives are sufficient to maintain New Brunswick's forest diversity and wildlife populations.

The Conservation Council of New Brunswick conducted a study of the forest diversity and wildlife habitat goals for Crown Land. Over 1,000,000 hectares (ha) of Crown Land in the northern part of New Brunswick was analyzed using DNR's forest inventory and the Geographic Information System (GIS) ArcView 3.0 mapping tool to determine whether or not the Licensees managing Crown Land were meeting their goals for forest diversity and wildlife habitat.

Our findings were as follows:

1. **The classification system used by the Department of Natural Resources to define both the forest diversity and the habitat types in New Brunswick are not adequate to protect key features of the Acadian forest.**

2. **Current vegetation communities and habitat type targets are not being met. Thus forest diversity and wildlife habitat are currently not being maintained on Crown lands.**

3. **The targets that have been set for forest diversity and wildlife habitat by the Department of Natural Resources are often too low to properly maintain key components of the Acadian forest.**

These findings show that forest management in New Brunswick is currently not sustainable in terms of maintaining the diversity of New Brunswick's Acadian forest. One immediate consequence of this could be local wildlife extinctions for species that rely on mature Acadian forest.

The forest needs to be reclassified to better reflect the character of the Acadian forest ecosystem. Wildlife habitat goals and objectives need to be re-examined to ensure we continue to maintain all species that live in New Brunswick's forests. Immediate action needs to be taken to meet forest diversity and wildlife habitat targets where they are currently not being met.

Lowering annual allowable harvests, dramatically reducing the amount of clearcutting that occurs on Crown lands, and reducing the area of plantation forestry are all actions that should be taken immediately to help achieve these goals. Acadian forest must be maintained in New Brunswick if we are to call our forestry sustainable.

1 Introduction

1.1 Why was this study needed?

The purpose of this study was to determine whether forest management in New Brunswick is sustaining our Acadian forest ecosystems. The Department of Natural Resources (DNR) requires licensees to manage forests on Crown lands to maintain the diversity of forest ecosystems and their associated ecological values and to provide habitat necessary to support populations of native wildlife species across their natural ranges. DNR prescribes the objectives and standards the licensees must meet to achieve these goals.

This study examined three questions:

1. Is the current classification system for forest diversity and wildlife habitat on Crown land sufficient for maintaining the diversity of the Acadian forest?
2. Are the current target levels (or areas) for forest diversity and wildlife habitat being maintained at required levels on Crown lands?
3. Are the current target levels (or areas) for forest diversity and wildlife habitat sufficient to maintain the diversity of the Acadian Forest?

In this report, we examine what the Acadian forest is, and why it is important. We look at DNR's goals and objectives for maintaining forest diversity and wildlife habitat on Crown land. We compare the character of the Acadian forest, as previously defined by Loucks (1962) and Loo and Ives (2003), to the DNR's current classification system for forest diversity.

The Conservation Council has conducted an analysis of the diversity and wildlife habitat on the northern third of New Brunswick's Crown lands, encompassing over 1,000,000 hectares (ha). Our analysis was carried out with data contained in DNR's forest inventory using a Geographic Information System (GIS) (ArcView 3) mapping program.

This report concludes with a list of recommendations for how forest diversity and wildlife habitat could be better maintained on New Brunswick's Crown lands to maintain the character of the Acadian forest.

1.2 What is Acadian Forest?

The forest region encompassing the Maritime Provinces and parts of New England is called the Acadian Forest. Its unique and diverse mixtures of trees are found nowhere else on the planet. It is a meeting place, where the northern Boreal forest blends with southern hardwood forests creating a remarkable variety of forest ecosystems and opportunity. Many forest stands in the Acadian forest consist of a mix of softwood and hardwood tree species. Among the main tree species of the Acadian forest are red spruce, yellow birch, sugar maple, beech, eastern hemlock, white pine and balsam fir.

The Acadian Forest is ancient. It has been developing for over 10,000 years since the retreat of the last glacier in this region. Slowly the Maritime region changed from tundra-like conditions that developed as the glaciers receded, to boreal forest as the climate gradually warmed. As temperatures continued to increase, more southern tree species were able to move into the region and establish roots, creating the mixed Acadian forest communities.

Many of our trees (including white pines, red spruce, sugar maples, yellow birch, beech, eastern white cedar and eastern hemlock) naturally reach ages ranging from 200 to more than 400 years old. Eastern hemlock is capable of achieving ages of 800 years. Individual stands[1] in the Acadian Forest are typically made up of trees of all ages, with young trees in position to replace older trees when they die.

The World Wildlife Fund counts the Acadian Forest among the most endangered in North America (Davis et al., 2005). After 300 years of commercial use, first by the British Navy, then by the timber barons and now by the corporate forestry industry, the Acadian Forest has been altered from a forest of long-lived species to a forest of shorter lived species such as white birch, poplar, white spruce and balsam fir (Loo and Ives, 2003).

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[1]Forest Stand: A group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes.
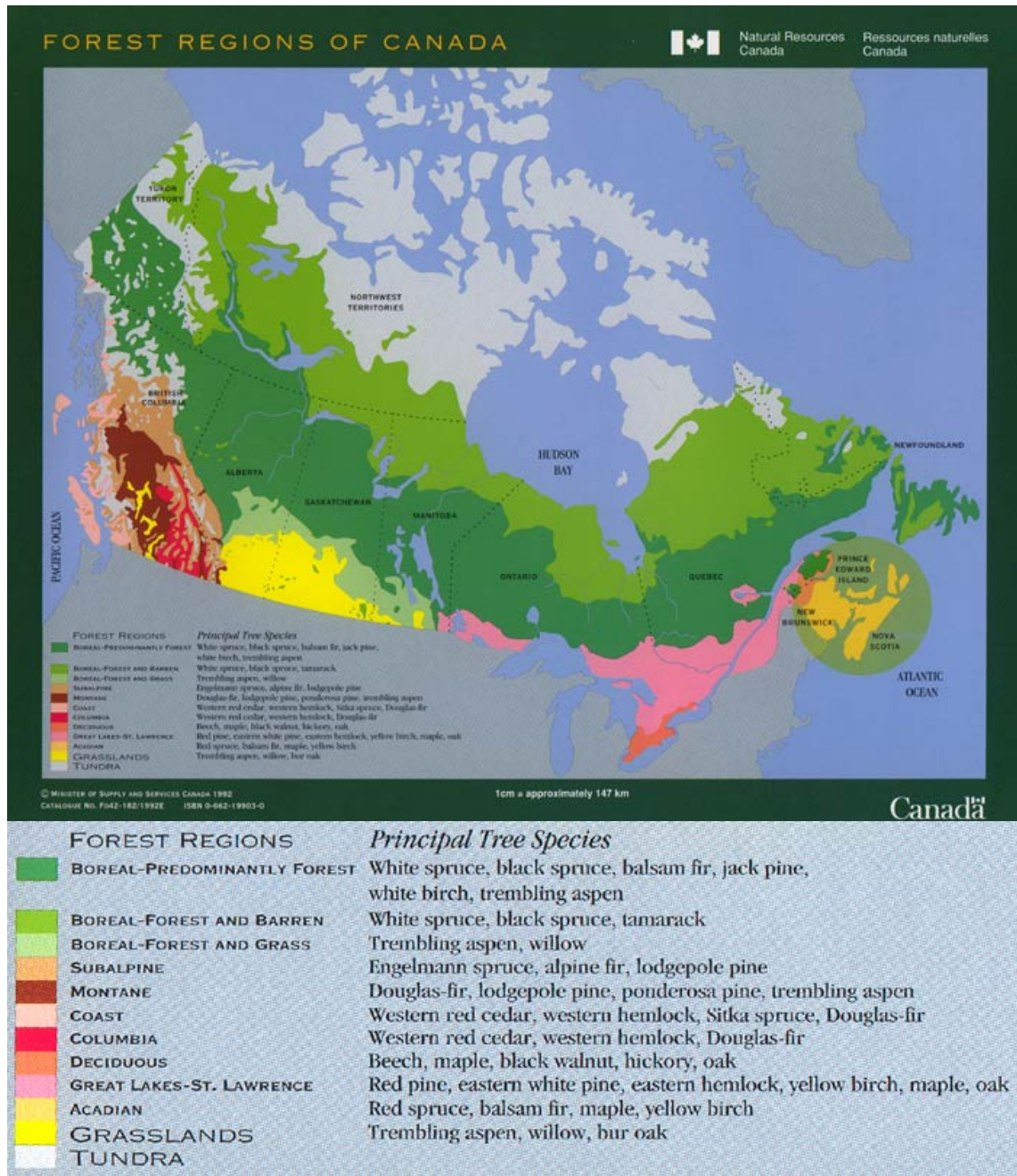
Figure 1.1 The Forest Regions of Canada. There are ten different forest regions in Canada. The Acadian forest is the region that encompasses most of the forest in the Maritime Provinces. This forest is a transition zone between the hardwood dominated forests to the South, and the boreal softwood forests to the North (Natural Resources Canada).

Acadian Forest in NB

Adapted from Loucks (1962) *

Loucks Forest Regions Index

- Boreal
- Acadian
- Acadian/boreal coastal

NB Ecoregions Index

1 : Highlands
2 : Northern Uplands
3 : Central Uplands
4 : Fundy Coastal
5 : Valley Lowlands
6 : Eastern Lowlands
7 : Grand Lake

* An initial forest regions map was produced by Loucks in 1962 and adapted by Mosseler, Lynds and Major in 2003. This map illustrates approximate Acadian and Boreal forest region boundaries as defined by Loucks, reflecting the current Ecological Land Classification system.

Figure 1.2 Map of the Acadian Forest Region in New Brunswick based on Loucks (1962). This map shows the historical and natural distribution of Acadian forest in New Brunswick. Two of the highest regions in the Province are defined as Boreal regions, and are classified as the Highlands Ecoregion 1. The rest of the province is classified as Acadian forest.

1.3 The Importance of Mature Forest in the Acadian Forest

Before the arrival of Europeans in New Brunswick, over 50 percent of the forest would have been considered old growth forest – with the average dominant tree age of 150 years (Mosseler et al., 2003). Over 80 percent of the forest would have likely been mature forest -- with an average tree age of more than 80 years old (Lorimer, 1977; Mosseler et al., 2003). By 2004, the amount of mature forest across New Brunswick's Crown lands had declined to 45 percent of the forest landscape (DNR Forest Inventory).

Mature forest is a vital component of healthy Acadian forest ecosystems. Its presence ensures the forest can provide the full suite of ecosystem services we require, from soil building to flood control, and supply the habitat necessary to support the full diversity of wildlife native to the Acadian forest.

Mature trees produce millions of seeds that produce the next generation of trees. Many of these seeds don't make it to become a new tree, but provide food for the insects, birds and mammals that live in the forest. When a mature tree dies, it can sometimes remain standing in the canopy for many years and is called a snag. Insects invade the snags and break down the wood inside. Woodpeckers feed on these insects and also drill holes in the soft wood, creating nesting areas. These nests are then used by a variety of other species including flying squirrels, many species of duck, and owls.

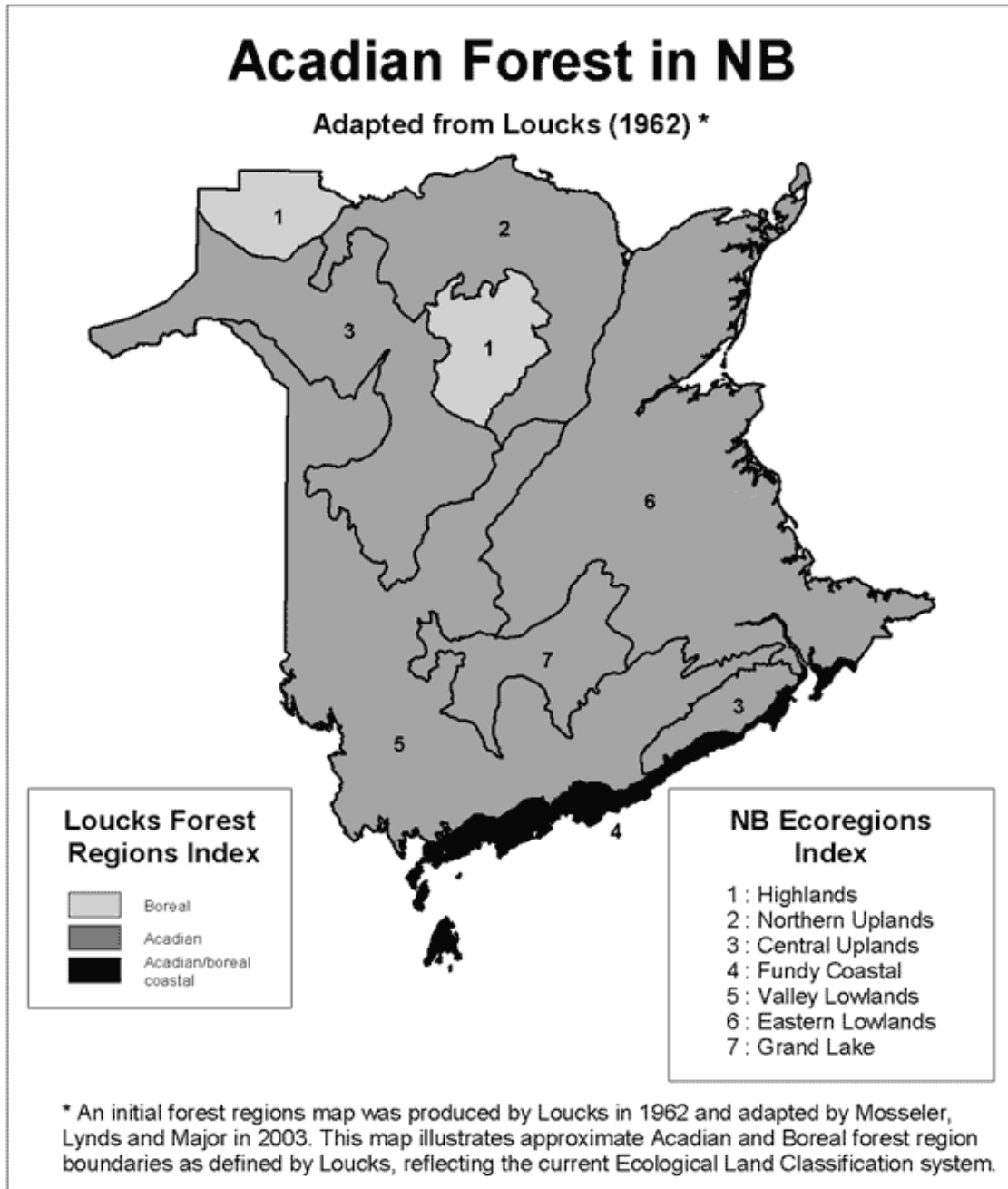When a dead tree finally falls to the ground it becomes deadwood, also called coarse woody debris. At this stage moss, fungus and insects work together to break down the wood of the tree. The nutrients from the wood are released back into the soil and create the rich organic layer of the forest floor. This becomes the seed bed for new plant life, including tree seedlings.

Clearcutting is currently the main source of mature forest loss in New Brunswick. Clearcutting is typically conducted in **70 – 80 percent** of forest management operations on Crown lands (DNR Forest Inventory). Once clearcut, it is unlikely that mature Acadian forest will be allowed to develop on that site again.

After clearcutting an Acadian forest stand, it is reduced at first to a forest stand of one age – seedlings. Pioneer species such as white birch, trembling aspen (poplar), red maple, and pin cherry are generally the first species to grow back on the site. Balsam fir will also do well after a clearcut if its seeds or seedlings were present before clearcutting. These species are better adapted to the sunny environment of a clearcut than most typical Acadian forest species (sugar maple, red spruce, yellow birch, etc.).

Large-scale clearcutting in New Brunswick has led to a major shift in the forest species composition across the entire province from long-lived shade tolerant species to shorter lived, shade intolerant species (Betts and Loo, 2002; Loo and Ives, 2003; Mosseler et al., 2003). In a sense, our Acadian forest is being converted to a more boreal-like forest.

Mature forest is an essential part of the Acadian forest ecosystem. In order to properly manage our forest all the features of the Acadian forest must be maintained. This includes maintaining mature forest stands throughout the province, composed of trees of mixed ages, and species.

1.4 The Importance of Diversity in the Acadian Forest

There are thirty tree species that make up the Acadian forest. Historically, the most common species of the Acadian forest included red spruce, sugar maple, yellow birch, American beech, white ash, white pine, cedar, balsam fir and eastern hemlock. These species combine themselves into a number of different forest communities which often include both softwood and hardwood species (Loo and Ives, 2003). This diversity within the forest stands also plays an integral role in how our forest functions.

The diversity of softwood and hardwood tree species in a forest community helps maintain stable forest ecosystems. Hardwood forests are less likely to burn in forest fires. Forest fires in the Acadian forest would have occurred every 300 to 800 years at most in the Acadian forest, depending on the forest type (Lorimer, 1977; Wein and Moore, 1977).

Insect outbreaks are also greatly reduced when tree species occur in mixedwood stands. Studies have shown that spruce budworm attacks are much less intense in mixedwood forest. When softwood species are bordered by hardwood trees, it is less likely they will be attacked then if they are in a stand of pure softwoods (Su et al., 1996). Most species of insects tend to have specific likes for a particular type of tree, at a particular stage of development. When trees are located in diverse forest stands it is more likely insect populations will remain at low levels as their food source is limited and harder to find in a diverse forest system.

Healthy Acadian forest ecosystems contain a full complement of the predators and parasites that provide pest control services. They also create soil, produce fresh water, and regulate the flow of our rivers and streams.

1.5 Forest Communities of the Acadian Forest

The following Acadian forest communities were derived from work by Judy Loo and Nadine Ives (2003) on the historical condition of the Acadian forest. Their work was based on Loucks' classification system for Acadian forest conducted in 1962 as well as Rowe, 1959; Simmens, 1984 and their own personal observations. Loucks' work in 1962 to characterize the Acadian forest was developed to assist forest management in the Maritimes. This classification system also takes into account what was the historical condition of the Acadian forest. Common names were developed for the forest types by the Conservation Council of New Brunswick.

Appalachian Hardwood Forests
These rich tolerant hardwood forests are found on uplands and consist of sugar maple, beech, yellow birch, white ash, ironwood all of which may be associated with hemlock and in western New Brunswick can also include basswood and butternut. The understory includes wild leek, bloodroot and Dutchman's breeches. These forests are found in Western New Brunswick.

Floodplain Forests
These rich tolerant hardwood forests are found on floodplains and consist of silver maple, red maple, American elm, bur oak, red and black ash and sometimes balsam poplar. The understory includes ostrich fern and nodding trillium. These forests are found in the St. John River watershed.

Ridgetop Forests
These tolerant hardwood forests occupy ridge tops and upper slopes. They consist of beech, sugar maple, yellow birch, white ash and ironwood, but may include some balsam fir, red spruce, hemlock, white spruce and white pine. The understory includes red trillium, rose twisted stalk, trout lily, and Indian cucumber root. These forests are found in the uplands of northwestern and central New Brunswick and in the Fundy highlands of Albert County.

Mixedwood Forests
These upland mixed wood forests commonly consist of sugar maple, yellow birch, red spruce and beech with some balsam fir. At lower elevations they include white pine and eastern hemlock. Where soils are rich in calcium carbonate, eastern white cedar may be present. White spruce and red maple may also be found in the mix in some areas. The understory includes clintonia, star flower, bunchberry and violet. These forests once dominated southwestern and northern New Brunswick.

Fire Forests
These mixed wood forests consist of jack pine, poplar and black spruce commonly mixed with red maple, white birch and grey birch; or of white pine, red oak and red pine where soils are well-drained. These forests regenerate in response to fire. Their understory includes bracken fern, lambkill, velvet-leaf blueberry and bunchberry. They are found throughout the province but dominate the eastern New Brunswick lowlands.

Orchid Forests
These mixed wood forests contain cedar, black ash, red maple and sometimes black spruce. Several orchid species are found in these forests, including the calypso orchid, yellow lady's slipper orchid, showy lady's slipper orchid and the blunt-leaf rein orchid. The understory also commonly includes marsh fern, royal fern and wood anemone. These forests are found throughout New Brunswick in scattered patches where the soil is alkaline and poorly drained.

Bog Forests
These are boreal-type forests consisting of black spruce and tamarack with some red maple and balsam fir. The understory includes various sphagnum moss species, Labrador tea, lambkill and rhodora. Bog forests are found around peat bogs, but are most common in the lowlands of eastern New Brunswick.

Fog Forests
New Brunswick's coastal forests are boreal-like consisting of white spruce and balsam fir along with some white birch and red maple. Occasionally black spruce or white pine may be present, and along the Fundy Coast red spruce is common. The understory includes Shreber's moss, bunchberry, starflower, and twinflower. These forests stretch along the thousands of kilometers of New Brunswick's mainland and island coasts.

Snowforests
These boreal-type forests consist of balsam fir, black spruce, white spruce and a scattering of white birch. The understory includes Shreber's moss, bunchberry, twinflower, wild-lily-of the-valley and wood fern. These snowforests are found in New Brunswick's Appalachian Mountains in north central New Brunswick, and experience the province's highest levels of precipitation - much of it as snow.

Shade Forests
These long-lived, perpetually dark coniferous forests consist of red spruce, white pine and eastern hemlock with balsam fir and a small amount of sugar maple, beech and yellow birch. They also may contain some minor amounts of black and white spruce, tamarack and cedar. The understory includes Schreber's moss, partridge berry, creeping snowberry, pink pyrola, twinflower and moccasin flower. Shade forests are most common in eastern New Brunswick.

2 Provincial Policies on Ecosystem Diversity and Wildlife Habitat

2.1 Overview of Crown Land Management in New Brunswick

Crown land represents 50 percent of New Brunswick's land base, approximately 3.4 million hectares. DNR divides it into ten distinct licenses, with some companies holding multiple licenses.

As of 2005, the responsibility for managing the forests on Crown lands has been licensed to five multinational forest companies. J.D.Irving, UPM-Kymmene, Fraser Papers, Bowater and Weyerhauser hold the licenses to log and manage Crown Lands in New Brunswick. Wood allocations are tied to the operation of the companies' mills.

DNR is responsible for setting the goals and objectives for how our Crown lands are managed. These goals are presented in "A Vision for New Brunswick's Forests…Goals and Objectives for Crown Land Management" (DNRE, 2000), commonly known as "The Vision Document".

The License holders develop five-year management plans based on these goals and objectives. The management plans are checked and approved by DNR, and the companies are then required to carry out the management plan. DNR has the additional responsibility to monitor the companies' operations on Crown land. The Vision document is reviewed and revised every five years in time for the licensees to prepare their next management plans – 2000, 2005, 2010, etc. It takes two years to develop new management plans, so the Vision document must be revised well ahead of time.

Presented below are the goals and objectives for maintaining forest ecosystem diversity and wildlife habitat, the two values being examined for this study. These goals and objectives were originally developed and presented in the Vision Document in 2000 (DNR, 2000).

2.2 Conserving the Diversity of Forest Ecosystems[2]

Goal: To maintain the diversity of forest ecosystems and their associated ecological values.
Strategies/Actions
- Direct forest management activities to ensure that the full range of naturally occurring forest types and successional stages are maintained.
- Identify and protect unique sites and their associated values.
- Use harvest practices that favour natural regeneration.

Objective
To ensure 12 percent of the area of nine different forest ecosystem types exists as mature forest.

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[2] Goals, strategies and Actions are found in "A Vision for New Brunswick's Forests…Goals and Objectives for Crown Land Management" (DNRE, 2000).

2.3 DNR's Forest Ecosystem Types

DNR requires licensees to ensure a minimum of 12 percent of the total area of nine different forest ecosystems is in a mature state. These targets were developed for each of the province's seven different ecological regions and then distributed among the 10 license areas. When a target is not met, a long-term plan for meeting the objective is supposed to be proposed.

Table 2.1 Species Composition Criteria for Forest Ecosystem Types (Vegetation Communities)

Vegetation Community	Compositional Criteria
Tolerant Hardwood Pure (THP) (e.g. sugar maple, beech, yellow birch)	Softwood less than 50%, Tolerant hardwood[1] equal or more than 20%, Tolerant hardwood and red maple equal or greater than 75%.
Tolerant Hardwood - Softwood (THSW) (e.g. sugar maple, beech, red spruce, balsam fir)	Softwood less than 50%, Tolerant hardwood equal or greater than 20%, Tolerant hardwood and red maple greater than 35% but less than 75%.
Intolerant Hardwood – Softwood (IHSW) (e.g. poplar, grey birch, white spruce, balsam fir)	Softwood less than 50%, Tolerant hardwood less than 20% or Tolerant hardwood and red maple less than 35%.
Pine (PI) *(red and white pine)*	Softwood greater than or equal to 50%, Pine (red or white) greater than 35%.
Jack Pine (JP)	Softwood greater than or equal to 50%, Jack Pine greater than or equal to 35%.
Cedar (CE)	Softwood greater than or equal to 50%, Cedar greater than or equal to 35%.
Black Spruce (BS)	Softwood greater than or equal to 50%, Black Spruce greater than or equal to 35%.
Spruce (SP) [2] *(red and white spruce)*	Softwood greater than or equal to 50%, Spruce (red or white) greater than or equal to 35%.
Balsam Fir (BF)[3]	Softwood greater than or equal to 50%, Balsam fir greater than or equal to 35%.

[1] Tolerant hardwood primarily sugar maple, yellow birch and American beech.
[2] Includes those stands with greater than 75 percent spruce and fir and greater than 35 percent spruce.
[3] Includes those stands with greater than 75 percent spruce and fir and greater than 35 percent fir.

Table 2.2 Approximate Minimum Age of the Old and Large Successional Stages

Vegetation Community	Approximate Minimum Age	
	Old	Large
Tolerant Hardwood Pure (THP)	90/120 years	90/120 years
Tolerant Hardwood – Softwood (THSW)	90/120 years	90/120 years
Intolerant Hardwood – Softwood (IHSW)	70 years	90 years
Pine (PI)	90 years	90 years
Jack Pine (JP)	70 years	--[1]
Cedar (CE)	80 years	--
Black Spruce (BS)	80 years	--
Spruce (SP)	90 years	110 years
Balsam fir	60 years	--

[1] Stands with vegetation communities of JP, CE, BS or BF do not regularly produce trees of 45 cm or greater in diameter; hence they do not achieve a successional stage of LARGE.

2.4 Conserving Wildlife Habitat[3]

Goal: To provide habitat necessary to support populations of native wildlife species at desired levels across their natural ranges.

Strategies/Actions

- Develop quantitative habitat objectives for selected wildlife species or species groups for inclusion in forest management.
- Ensure forest management activities provide the amount, quality and distribution of identified habitats to meet population objectives for all native vertebrate species.
- Protect the habitat of endangered species.

Objectives
The habitat requirements for forest-dwelling birds, mammals, reptiles and amphibians that use mature Acadian forest have been identified by DNR using the limited state of knowledge available from the scientific literature. As a result, targets have been set to maintain minimum areas of five distinct mature forest habitat types: Hardwood, Tolerant Hardwood, Spruce-fir, Pine and Mixedwood. Those wildlife species thought to be dependent on these habitat types were chosen as indicators (Table 2.3).

In 2003, habitat needs were determined for each species and these habitat needs were matched with measurable stand characteristics such as the number of large trees in a stand, dead wood in a stand and canopy closure. Estimates were established regarding how many individual animals were needed to maintain a **minimum viable population – the fewest individuals needed to sustain a population of the species in question**. Area requirements were determined for a nest or breeding pair for each indicator species. The amount of area required for nest or breeding pair was multiplied by the number of individuals needed to maintain the minimum viable populations (MVP) for each indicator species. This determined the habitat objectives needed to maintain each indicator species (DNR, Forest Habitat Program, 2003).

Targets were developed for each ecoregion, and distributed among the Crown License areas. In the event that the habitat target for a specific license/ecoregion cannot be met, a strategy for meeting that target over the longer term is supposed to be proposed (DNRE, 2000).

The size of the habitat patches range from 10 ha to 60 ha for all habitat types except Old Spruce-Fir. Old Spruce-Fir habitat patches must have be composed of a minimum of 150 ha. Only Old Spruce-Fir habitat must be identified on forest maps by the companies holding Crown land licenses.

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[3] Goals, strategies and Actions are found in "A Vision for New Brunswick's Forests…Goals and Objectives for Crown Land Management" (DNRE, 2000).

Table 2.3 Wildlife Habitat Types with associated Vertebrate Species, Habitat Characteristics and Vegetation Communities

Habitat Type	Old Tolerant Hardwood	Old Hardwood Habitat	Old Spruce-Fir Habitat	Old Pine Habitat	Old Mixedwood Habitat	Large Mixedwood Habitat	Old Forest Habitat
Associated Indicator Species	Barred owl	Northern goshawk	American marten	Pine warbler	Northern flying squirrel	Fisher	Big brown bat
	Pileated woodpecker	Hairy woodpecker	Black-backed woodpecker		Swainson's Thrush		Porcupine
	Eastern wood pewee	Northern flicker	Red-breasted nuthatch				Raccoon
	White-breasted nuthatch	Ovenbird (warbler)	Evening grosbeak				Red-tailed hawk
			Olive-sided flycatcher				Chimney swift
			Boreal chickadee				Common raven
			Ruby-crowned kinglet				Brown creeper
			Bay-breasted warbler				Northern parula warbler
			Pine siskin				Black-throated green warbler
Habitat Characteristics	50% hardwood, 35% tolerant hardwood Volume: greater than 70 m³/ha	Less than 20 tolerant hardwood, at least 50% hardwoods with white birch and poplar dominating Volume: greater than 70 m³/ha	At least 50% softwood, at least 35% balsam fir, red spruce, white spruce, black spruce and eastern cedar Volume: greater than 70 m³/ha	50% softwood and at least 35% white and red pine Volume: greater than 70 m³/ha	25% to 75% hardwood and meet criteria for one of OSFH, OPH, OTH. Or OHH Volume: greater than 70 m³/ha	25% to 75% hardwood and meet criteria for one of OSFH, OTH. Volume: greater than 70 m³/ha	General term for old forest of any type. Volume: greater than 70 m³/ha
Vegetation Communities	THP, THSW (Old)	IHSW, THP, THSW (Old or Large)	SP, BF, BS, EC (Old or Large)	PINE (Old)	Any community; softwood content ≥ 25% and < 75% (Old or Large)	Any community; softwood content ≥ 25% and < 75% (Large)	

3   Evaluating Sustainability of Forest Diversity and Wildlife Habitat on Crown Lands

The Conservation Council of New Brunswick carried out its own analysis on the state of forest diversity and wildlife habitat on Crown Land. The goal of our analysis was to answer the questions:

1. Is the current classification system for forest diversity and wildlife habitat on Crown land sufficient for maintaining the diversity of the Acadian forest?
2. Are the current target levels (or areas) for forest diversity and wildlife habitat being maintained at required levels on Crown lands?
3. Are the current target levels (or areas) for forest diversity and wildlife habitat sufficient to maintain the diversity of the Acadian Forest?

The latest available forest inventory from 1990 and the 25 year forest management plans were used to examine vegetation communities and wildlife habitat levels on the 1.1 million hectare study area of Crown lands in Northern New Brunswick that was used for this analysis (Figure 3.1). It encompasses the entire Restigouche River Watershed, and portions of the St. John River, Miramichi River, Nepisiguit River, and Chaleur Bay Composite Watersheds (Table 3.1).
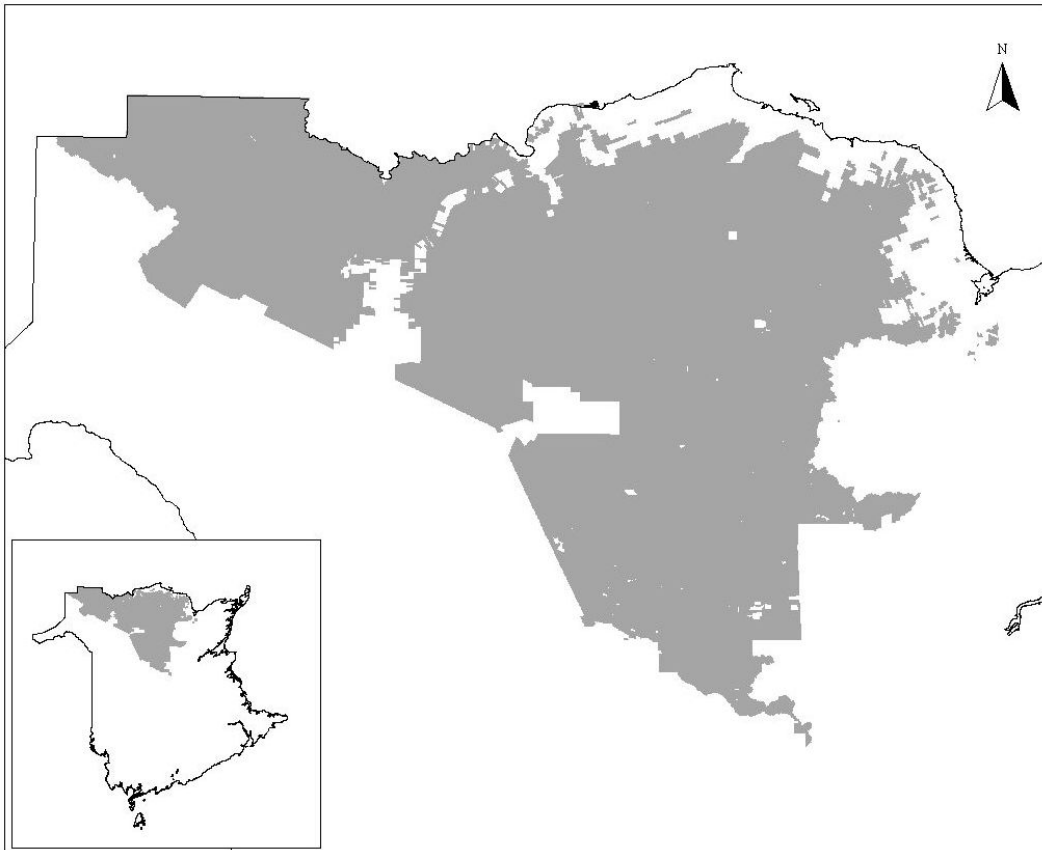

Figure 3.1 Northern New Brunswick Crown Lands Study Area

Table 3.1 Area of watersheds included in study area

Watershed Name	Basin ID	AREA (ha)	AREA (%)
St.John River	1	86 208,64	8%
Miramichi River	2	185 490,66	17%
Restigouche River	3	501 349,94	46%
Nepisiguit River	5	191 234,17	17%
Chaleur Bay Composite	10	133 799,74	12%
Study Area		**1 098 083,16**	**100%**

All stand types in the forest inventory were assessed to determine the area of stands in each vegetation community and habitat type. Forest management plans were then used to determine how much of these areas had been harvested since 1990. The amount of area harvested since 1990 was subtracted from the total area of each vegetation community and habitat type. The result was the amount of area that remains on the forest landbase in each vegetation community and habitat type.

DNR produced target levels of how much area to maintain in the vegetation community and habitat types for every ecoregion throughout the province. Licensees are responsible for maintaining these target levels based on what proportion of the ecoregions occurred on their Crown license. Our study area in northern New Brunswick did not incorporate all of the Licensees crown land holdings. It was therefore necessary to adjust the targets for vegetation communities and habitat types based on the percentage of the license and ecoregions that was included in our study area.

The results obtained from our analysis for the 1.1 million hectare Crown land study area were compared with the targets set by DNR for each of the licenses by each of their ecoregions, to determine which targets were met.

4 What are the Problems Facing Forest Diversity?

4.1 How has diversity changed in New Brunswick's Acadian Forest?

Historically, much of New Brunswick's forest would have been classified as mature with 50 percent of New Brunswick's forest classified as Old Growth forest (average dominant trees over 150 years old) (Mosseler et al., 2003). Stands in the Acadian forest would have been largely composed of shade tolerant and long-lived trees when Europeans first arrived in the 1600's (Loo and Ives, 2003; Lorimer, 1977).

Mixedwood forests would have historically made up many forest stands in the Acadian forest (Lorimer, 1977). For the last 300 years, however, softwood species were mostly selected for harvesting, leaving behind hardwood forests and balsam fir – the only softwood which was not heavily used.

Tall, straight white pines (as large as 160 feet tall and five feet in diameter) were the first tree to be extensively commercially harvested in New Brunswick beginning in the early 1700's (Loo and Ives, 2003). The supply of pine had decreased dramatically by the 1830's due to harvesting. Spruce and tamarack were the next species to be used for ship building. Hemlock was harvested for railway sleepers and for the tannin found in the bark. Cedar was used for fence posts and shingles. Black spruce, white spruce and jack pine were used for the production of pulp when this industry emerged in New Brunswick in the early 1900's (Loo and Ives, 2003).

The current high rate of clearcutting has dramatically accelerated the decline of New Brunswick's Acadian forest ecosystem (Figure 4.1).

The Acadian forest in New Brunswick today is generally composed of younger forest stands that contain shade intolerant species that are fast growing and typically short-lived, such as poplar, white birch, white spruce and balsam fir. Species that grow well in the shade and are longer-lived have declined dramatically in New Brunswick's forest, including sugar maple, yellow birch, hemlock, white ash and red spruce (Figure 4.2) (Betts and Loo, 2002; Loo and Ives, 2003; Mosseler et al., 2003). As a result, our mixedwood, hardwood and cedar forests are in serious decline. These include our Shade Forests, Orchid Forests, Mixedwood Forests, Ridgetop Forests and Appalachian Hardwood Forests.

4.2 How has forest diversity policy changed in New Brunswick?

DNR's 2000 Vision Document laid out the first plan for maintaining forest ecosystem diversity on Crown lands. A system was developed for forest managers to determine what type of forest should naturally occur throughout New Brunswick based on the bedrock, climate and soil types of the province. This is called ecological land classification, and represented a significant step forward for planning to manage for ecosystem diversity in the province of New Brunswick.
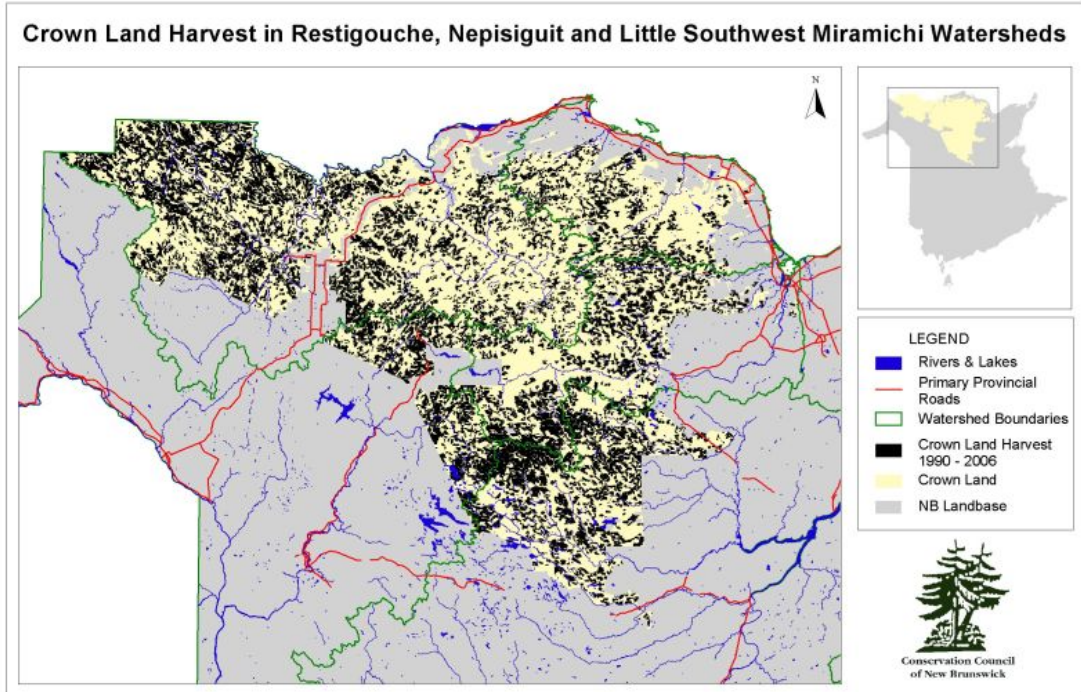
Figure 4.1 Distribution of Crown Land Harvest in the Study Area (1990 – 2006). Clearcut harvesting that has taken place or will take place between 1990 and 2006 in the study area can be seen as the black patches on the map.
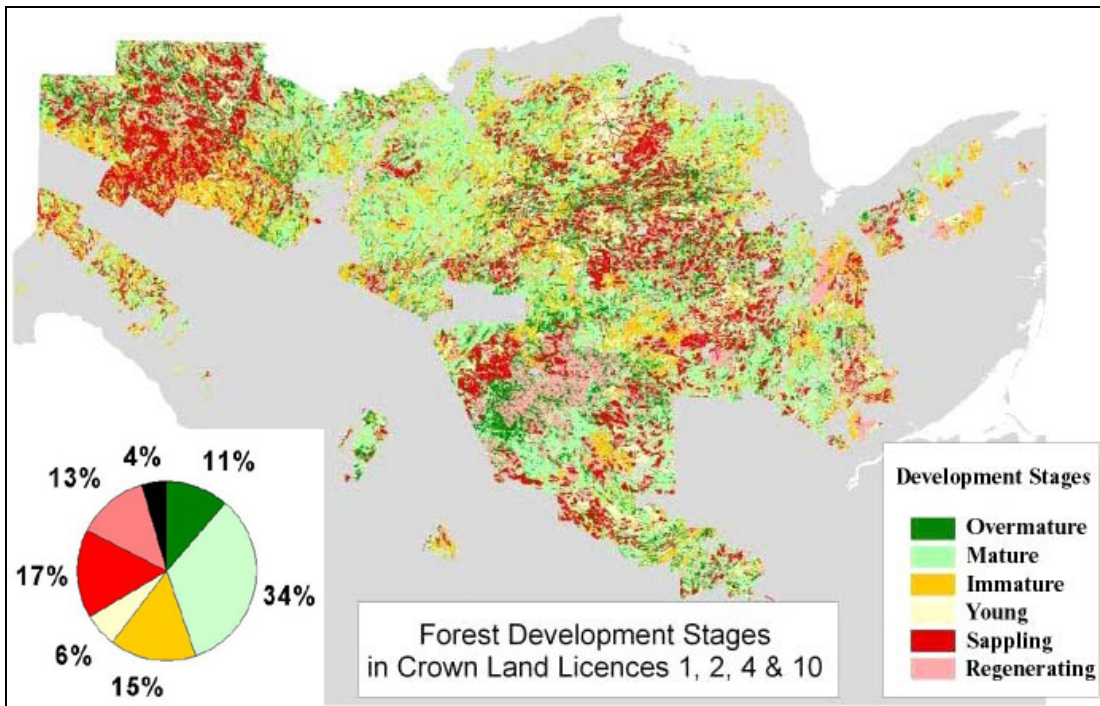

Figure 4.2 Forest age class distributions in the study area. Currently mature and overmature forest make up 45 percent of the forest landbase. Regenerating, sapling and young forest make up a 33 percent of the forest landbase. This young forest is the result of clearcutting and is different in structure and species composition to natural Acadian forest.

4.3 Are DNR's goals and objectives sufficient to maintain forest diversity in the Acadian Forest?

4.3.1 Question #1: Is the current classification system for forest diversity on Crown land sufficient for maintaining the diversity of the Acadian forest?

The stated goal of the Vision Document for the management of forest ecosystems is *"To maintain the diversity of forest ecosystems and their associated ecological values."* One of the strategies employed to meet that goal is to *"Direct forest management activities to ensure that the full range of naturally occurring forest types and successional stages are maintained"*.

In order to ensure that this goal is achieved, it is of key importance to ensure that the forest ecosystems are correctly classified and reflect the natural species composition and successional stages of the Acadian forest, and in the case of limited areas in New Brunswick, the boreal forest. The vegetation communities presented in Section 2 are the communities used to represent the forest diversity of New Brunswick's forest.

Making a good classification system to represent forest diversity is by no means a simple task, but is fundamental to maintaining the full range of wildlife habitat and forest structures that wildlife species depend upon, and the ecological relationships that keep our forest functioning in a healthy manner. There are a number of different ways to classify New Brunswick's forest. Below we have compared DNR's system (DNRE, 2000, presented in Section 2.0) to Loo and Ives' (2003) system for classifying the Acadian forest (presented in Section 1.5). These two systems are quite different from one another. For example:

i)   DNRE's system is based on the 1982 forest inventory of New Brunswick's forest and is adjusted for human disturbance. This system was designed to aid forest management activities. Loo and Ives based their classification system on the historical condition of the Acadian forest before the arrival of Europeans. This system was intended to describe the historical condition of the forest to help forest managers make silvicultural[4] decisions.

ii)   The DNRE (2000) vegetation communities are based heavily on softwood communities, with less emphasis on hardwood and mixedwood communities. Loo and Ives' classification system places more emphasis on mixedwood communities, with more emphasis on the hardwood component of vegetation communities.

iii) The DNRE system incorporates the entire province of New Brunswick. There are two small areas in the northern part of New Brunswick that are part of the Boreal Forest and consist naturally of a higher percentage of softwood. Loo

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[4] **Silviculture** - the art and science of growing forest trees.
    Silvics - The life history and general characteristics of forest trees and stands, with particular reference to environmental factors.

and Ives' system looks at the entire province and classifies the boreal sections of the province as the fir-pine-birch zone (labeled as the Snowforest in Section 1.5).

Answer: No. There are problems with DNR's Forest Diversity Classification System

DNR vegetation communities do not reflect the full range of forest types that occur in the Acadian Forest. The Department of Natural Resources system for classifying the forest does not reflect the full range of forest types that make up the Acadian forest when compared to Loucks' classification system (1962) and Loo and Ives' (2003) work. DNRE's (2000) classification system needs to be updated in order to meet their goal to maintain the full range of naturally occurring forest types.

i) Mixedwood Underestimated

The current vegetation communities used by DNRE (2000) do not include a softwood dominated mixedwood community. This exclusion allows softwood dominated mixedwood communities with less than a 50 percent hardwood component to be replaced by softwood communities or plantations, without the current classification system registering a change. This needs to change for at least three reasons:

a) Mixedwood forest is one of the fundamental forest communities of the Acadian forest. Having no category for this forest community could further alter the character of the Acadian forest.

b) In the past few years hardwoods have been increasing in economic value. Maintaining the diverse range of Acadian forest species is fundamental to maintaining a diverse and healthy forest economy that can respond to a rapidly changing global market.

c) Foresters and ecologists have been learning more about the importance of mixedwood communities in the Acadian forest. Mixedwood communities provide essential habitat for a number of important forest species including the flying squirrel, Swainson's thrush and fisher. Mixedwood stands have proven to be the most resistant stand type to spruce budworm outbreak, the hardwood component of the stand providing protection to the softwood trees in mixedwood stands (Su et al., 1996).

ii) Spruce Vegetation Community – Identity Crisis

The Spruce vegetation community includes both red spruce and white spruce, yet the silvics (the study of the life history, requirements and general characteristics of forest trees and stands in relation to the environment and the practice of Silviculture) of these two species are completely different. Red Spruce is a long lived, shade tolerant species which often occurs in shade tolerant mixedwood stands, or as a major component of old growth forests along the coast line of the Bay of Fundy. White Spruce is a shade intolerant species that is much shorter lived than red spruce and typically becomes the dominant species on agricultural land that has been left to develop. These two species

should generally be managed using very different methods (selection harvesting for red spruce communities versus even-aged management for white spruce communities). Combining them into the same community doesn't make sense from a forest management or ecological perspective.

iii) Too Much Emphasis on Softwood Communities

Out of the nine forest type communities used for DNR's classification system, six are softwood dominated with each community representing one or two species. This system over-emphasizes the softwood species in the Acadian forest, and decreases the focus on the hardwood species. This could result in an overall decline in the abundance of hardwood trees across New Brunswick.

DNR vegetation communities do not reflect the full range of species that grow in New Brunswick's forests. Some ecologically important species are overlooked by the DNRE (2000) classification system. Hemlock, white ash, and red oak for example, are all characteristic species of the Acadian forest but are not specifically identified by any of the vegetation communities. It is possible for forest management to greatly reduce the populations of these species while still maintaining the target levels for all the current vegetation communities. The vegetation communities must reflect the full range of species that naturally occur in the Acadian forest in order to ensure these species are maintained and DNR's forest diversity goals are reached.

4.3.2 Question #2: Are the license holders meeting their targets for forest diversity?

Both the Conservation Council's analysis and an analysis carried out by DNR for all license areas found targets set for forest diversity are not being met in many cases.

Answer: No. The area of many vegetation communities are currently below their target levels.

In DNR's own target analysis (which included all of their licenses and ecoregions on New Brunswick's Crown Land) the tolerant hardwood softwood community was below its target level on 22 of 30 areas where targets were set. Spruce, and tolerant hardwood communities were each found below target levels on one of these areas. Jack Pine was found below target levels on two of the thirty areas where targets were set (Appendix 6).

Eight different vegetation communities did not meet their targets in at least one or more licenses or ecoregions of northern New Brunswick examined in our study. The only vegetation community that consistently met its target amount of habitat was intolerant hardwood softwood. This community type is generally over-abundant in New Brunswick's forest relative to historical levels due to past forest harvesting practices. This likely explains its high abundance relative to its target levels.

The Spruce vegetation community was below the set target levels in the majority of areas examined (9 of the 14 areas studied). Tolerant hardwood softwood was below its target

level on 6 of the 14 areas examined. Balsam fir and Pine were both below target in 5 out of 14 areas studied. Eastern Cedar was under target levels in 4 of the 14 areas studied. Jack Pine was under target levels in 3 of the 14 areas. Black Spruce and Tolerant hardwood pure were both below target levels in 2 of the 14 areas (Table 4.1, Appendices 1 to 4).

Table 4.1 Summary of Vegetation Communities that do not meet DNR Objectives

Ecoregion	Upsalquitch	Nepisiguit	Upper-Miramichi	Restigouche-Tobique
Highlands	**Tolerant Hardwood-Softwood** *, Balsam Fir	**Jack Pine**	**Jack Pine**	Tolerant Hardwood-Softwood, Balsam Fir, Spruce
Northern Uplands	Tolerant Hardwood-Softwood, Pine, Balsam Fir, Spruce	Tolerant Hardwood-Softwood, Eastern Cedar	Not in License	Tolerant Hardwood Pure, Tolerant Hardwood-Softwood, Spruce
Southern Uplands	Tolerant Hardwood Pure, Eastern Cedar, Balsam Fir, Spruce	Eastern Cedar, Black Spruce, **Jack Pine**, **Spruce**,	Pine, Spruce	Spruce
Continental Lowlands	Not in License	Not in License	**Pine**	Not in License
Eastern Lowlands	No target	Tolerant Hardwood-Softwood, **Pine**, Eastern Cedar, **Black Spruce**, Balsam Fir, **Jack Pine**, Spruce	**Pine**, **Black Spruce**, **Spruce**,	Not in License

* Vegetation Communities shown in **bold** have a current area below 15 percent of their target area

What does it mean if the targets set by DNR are not being met?
Having vegetation communities below their target levels is cause for concern. This means that DNR is currently not maintaining forest diversity on Crown lands. Where targets are not met, there is less than 12 percent of that vegetation community left in its mature successional stage. Certain species that require 12 percent or more mature forest to meet their habitat requirements could experience local extinctions in these areas. Eight of the nine vegetation communities are already well below the 12 percent mature forest target on some ecoregions across each license. This has two serious implications:

  i. Forest ecosystem diversity as defined by DNR is not being maintained on the ground under the current management regime, so the provincial policy goal is not being achieved.
  ii. A direct consequence of not meeting these targets is species loss and thus diversity loss of vegetation communities.

4.3.3 Question # 3: Are the current targets appropriate for maintaining forest diversity of the Acadian Forest?

Answer: No. DNR vegetation communities do not maintain appropriate levels for maintaining the diversity of the Acadian Forest.

Currently, the Department of Natural Resources has set a minimum limit for Large and Old forest (mature forest) in each vegetation community category at a level of 12 percent.

It is of key importance now to ensure that as forest researchers learn more about the needs of species in relation to the forest landscape, that the Department of Natural Resources always maintains the power to improve ecosystem diversity objectives on Crown land. The 12 percent mature forest minimum standard was based on an early concept of acceptable levels of habitat (Brundtland, 1987; Woodley et al., 1997). Currently scientists are finding the minimum level of habitat for many species that depend on mature forest is much closer to 40 percent and higher in the case of certain species (Andrén, 1994; With and King, 2001; With and King, 1999; Vos et al., 2001).

Considering that 80 percent of New Brunswick's forest landbase would have been historically (pre-European settlement) composed of mature forest, it is possible that New Brunswick's forests are changing at a faster rate than many wildlife species can adapt (Betts and Loo, 2002). Based on current research on species habitat thresholds – amount of habitat required to maintain populations in a given landscape, reducing mature Acadian forest to 12 to 15 percent of the forest landbase could lead to species loss.

Based on the currently low target of 12 percent mature forest being set for New Brunswick's forests, two trends are particularly troubling when looking at the vegetation community results for our study area:

i.   **Vegetation Communities Near their Target Levels**
     The remaining area of some vegetation communities is currently very close to their set targets. These vegetation communities should now only be harvested at a rate of old/large forest replacement as areas of younger stands of the same vegetation community move into the old/large age class to maintain the target level.

     Increasing the target levels of these vegetation communities to 40 percent mature forest as opposed to 12 percent is only a possibility for the long-term as the younger forest of these vegetation communities grows into the old and large forest stage categories. This would necessitate a change in forest practices to ensure such a long-term target could be achieved.

ii. **Vegetation Communities Which Have Small Target Areas Relative to their Current Areas**
     The area targets for some vegetation communities are set at a much lower amount of area than they currently cover (Table 4.2, Appendices 1 to 4). This

means that huge areas of these types of forest ecosystems can be clearcut until the target is reached. For vegetation communities that are characteristic of Acadian forest, this is often an inappropriate goal for maintaining forest diversity.

Table 4.2 Summary of Vegetation Communities with low DNR targets (all lower than 50 percent, some under 10 percent) in comparison to the current levels.

Ecoregion	Upsalquitch	Nepisiguit	Upper-Miramichi	Restigouche-Tobique
Highlands	Tolerant Hardwood Pure	Tolerant Hardwood Pure, Tolerant Hardwood-Softwood, Black Spruce, Balsam Fir, Spruce	Black Spruce, Spruce	
Northern Uplands	Tolerant Hardwood Pure	Tolerant Hardwood Pure, Black Spruce	Not in License	Balsam Fir
Southern Uplands	Tolerant Hardwood Pure	Tolerant Hardwood Pure, Tolerant Hardwood-Softwood	Tolerant Hardwood Pure, Tolerant Hardwood-Softwood	
Continental Lowlands	Not in License	Not in License	**Tolerant Hardwood Pure***, **Tolerant Hardwood-Softwood,** Eastern Cedar, **Black Spruce, Balsam Fir, Spruce**	Not in License
Eastern Lowlands	No target	Eastern Cedar	Tolerant Hardwood Pure, Tolerant Hardwood-Softwood, Eastern Cedar, Black Spruce, Balsam Fir, Spruce	Not in License

*Vegetation Communities shown in **bold** have a target area below 10 percent of their current area

Low Target Not Appropriate for Vegetation Community:

Pure Tolerant Hardwood and Tolerant Hardwood/Softwood – These vegetation communities had low targets set relative to their current areas, on many ecoregions and licenses. This trend is very troubling. These vegetation communities do not undergo large natural disturbances (like fire, major insect or wind disturbances) for centuries (Lorimer, 1977). The tree species that make up these vegetation communities are long lived and shade tolerant. There is no reason that, based on the natural disturbance regime[5] of this forest, the amount of Pure Tolerant Hardwood or Tolerant Hardwood/Softwood should decline much (if at all) from its current level.

These two vegetation communities are two of the most representative forest types of the Acadian forest. To reduce the percentage of these vegetation communities by 50 percent

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[5] **Natural Disturbance Regime:** A natural disturbance (eg fire, insect outbreak, flood) with a characteristic frequency, intensity, size, and type that has influence on an ecosystem over evolutionary time.

or more, as currently permitted, would seriously alter the natural composition of the Acadian forest.   The target set for Pure Tolerant Hardwood and Tolerant Hardwood/Softwood will not maintain the forest diversity of the Acadian forest. Levels of these vegetation communities should at least remain the same as currently present on the ground.

Eastern Cedar – This vegetation community focuses on Eastern white cedar.   This vegetation community doesn't occupy large areas across the study area. Eastern cedar has been reduced by almost half of its original population over the past 300 years as a result of forest harvesting (Betts and Loo, 2002). The targets for this species are set below 50 percent of its current level on two ecoregions in the Upper Miramichi license and one ecoregion in the Nepisiquit License.

Eastern Cedar is one of the characteristic species of the Acadian forest. It is shade tolerant and can live for up to 400 years. Under natural conditions, eastern cedar communities are likely to be quite stable and not subject to large scale disturbances. A more appropriate target for eastern cedar communities would be to maintain what populations are left of this community by replacing clearcutting in these areas with selection cutting. Setting the target at 50 percent or less of the current amount of habitat is an inappropriate goal for this community type and is not an appropriate goal for maintaining the character of the Acadian Forest.

Hard to Evaluate Target Based on Current Classification System:

Spruce - The Spruce vegetation community has low targets set in two ecoregions on the Nepisiquit license, and three ecoregions on the Upper Miramichi License. The spruce vegetation community can include white spruce – a shorter-lived, shade intolerant species, and red spruce – a long-lived shade tolerant species. If much of these spruce communities are composed of red spruce, then these low target levels are not appropriate. Red spruce is a defining species of the Acadian forest which has adapted to mature forest conditions. Reducing the amount of area this species occupies by at least 50 percent would further degrade the character of the Acadian forest.

Low Target May be an Appropriate for Vegetation Community:

Black Spruce and Balsam Fir – These two communities both have low targets set on certain ecoregions in certain licenses. It is likely that past and current forest management practices have increased the amount of these vegetation communities that would naturally occur in the Acadian forest. Steep declines in these communities may not be cause for concern. Low targets relative to the high abundance of habitat could be a reflection that these species are currently more abundant than they would be under natural forest conditions.

5   What are the Problems Facing Wildlife Habitat?

5.1 How has the diversity of Wildlife Habitat and Wildlife changed in New Brunswick?

The forest landscape and consequently the wildlife habitat in New Brunswick have gone through major changes over the last three hundred years. The major harvesting of White Pine from 1700 – 1830's, sawlog harvests from the 1800's to 1900's and the arrival of the pulp industry in the early 1900's has significantly reduced the size of trees in our forest and changed the tree species composition (Loo and Ives, 2003).

Overhunting led to the removal of wolves in the early 1900's (Squires, 1946). Loss of forest habitat through land clearing and forest harvesting, hunting and brain worm introduced by white tail deer caused the extirpation of woodland caribou from the Acadian forest by 1930 (Loo and Ives, 2003).
.
Today, hunting and trapping is not the major threat to forest wildlife populations in New Brunswick. The major impact currently impacting forest wildlife is habitat loss (Pimm, 1995). Clearcutting is the forest management practice that is prescribed for at least 70 percent of operations on the Crown land forest landbase (DNR Forest Inventory). After an area is clearcut, the forest is reduced to an even-aged forest stand that will require 80 or more years to regain its mature forest characteristics. This has led to a major decline in mature forest habitat, from 80 percent historically (Lorimer, 1977; Mosseler et al., 2003), to 45 percent of New Brunswick's Crown Land currently existing in the mature or overmature forest age class categories (DNR Forest Inventory).

Starting in 1982, forest management in New Brunswick followed an "oldest first" harvesting policy. Old and mature forest was considered to be slower growing and less productive than younger forest. Therefore in order to maximize the productivity of the forest lands for volume (or fiber) growth, the oldest forests were cut first so they could be replaced by younger, faster growing naturally regenerating forests or by softwood plantations.

Forest Managers and wildlife biologists at the Department of Natural Resources recognized in the 1990's that mature forest was valuable for many species of wildlife, and was needed to maintain long lived and shade tolerant tree species in the forest landscape. They also recognized that under the forest management system that was in place at the time, there were no provisions to maintain mature forest on Crown lands.

In 1997, the Department of Natural Resources established guidelines to protect some large patches of Mature Coniferous Habitat, as well as Deer Wintering Areas. Both classifications of mature habitat were designed to conserve mature softwood stands, as these stands had been greatly reduced and were in need of protection. The establishment of these objectives into the forest management plans caused a reduction in what the companies could harvest by 19 percent of the licenses Annual Allowable Harvest.

It then became clear that other old forest habitat types needed to be conserved to protect the populations dependent on them. In the Vision document of 2000, requirements for five other old forest habitat types were established.

Thirty wildlife species were identified that required mature forest to meet their habitat needs. One or more species were chosen to represent the different habitat types. These species are used as mature forest indicators, and their presence is used to indicate that levels of mature forest are adequate (DNRE, 2000).

5.2 Are DNR's goals and objectives for conserving wildlife habitat sufficient in the Acadian Forest?

5.2.1 Question #1: Is the current habitat type system used on Crown land sufficient for maintaining the diversity of the Acadian forest?

It is important to start this section by acknowledging that many important steps have been taken to include more wildlife habitat goals into the Crown land management plans over the past 10 years. Before 1997 there were no provisions in place to maintain mature forest habitat. Putting mature forest objectives in place in the 2000 Vision Document, and identifying wildlife species that depend on mature forest in 2003 were very important steps forward in the forest management planning process for Crown lands.

That being said, forest harvesting is occurring at a higher rate today than at any point in New Brunswick's history (DNR Annual Reports, 1945–2004). Mature forest is approaching the habitat threshold some forest researchers believe could cause population crashes. It is a crucial time for New Brunswick to evaluate the current habitat types and set targets to ensure they are adequate to meet established Goals and Objectives.

Answer: No. There are problems with the Minimum Viable Population system that has been used to develop habitat targets for wildlife species on Crown Lands.

i. There is a lack of sufficient data for most wildlife species.
DNR's habitat targets have been developed for 30 vertebrate species, 24 of these species are birds, and six of the species are mammals. These targets account for 0.1 percent of the total number of wildlife species that are found in New Brunswick.

Currently there are no wildlife goals established for many other types of animals including amphibians, reptiles, invertebrate species (insects, spiders, etc), forest plants, and bryophytes (mosses and lichens). This is clearly a monumental task, but already researchers are discovering that reduced diversity of forest stands is reducing the diversity of amphibians (Waldick et al.,1999), birds (Freedman et al., 1994), herbaceous plants (Ramovs and Roberts, 2003) and bryophytes (Ross-Davis and Frego, 2002) in New Brunswick.

It is likely that the wildlife goals developed by DNR for the 2000 Vision Document, and 2003 Habitat Objectives are not adequate to ensure that all wildlife population in New

Brunswick will be protected across their natural ranges under the current management regime.

ii. Knowledge of habitat characteristics is not sufficient to properly develop minimum viable populations.

Research conducted by several researchers (Bourque and Villard, 2001; Buford and Capen, 1999; Guenette, 2003) has found that for some of the forest bird indicator species, the stand characteristics outlined by DNR's Habitat Definitions for Vertebrate Forest Wildlife in New Brunswick (Beaudette and Makepeace, 2003) may not meet their habitat needs.

Ovenbird, for example, according to DNR's Habitat Definitions (2003) calls for 40 percent Crown Closure for a stand to qualify as wildlife habitat. Research has found that Ovenbirds are more likely to be present in a stand if Crown Closure is over 50 percent (Guenette and Villard, 2005). Differences such as this lead to an overestimation of Ovenbird habitat according to DNR's models, and thus overestimate ovenbird populations. Ovenbird populations are likely lower than DNR is predicting.

Another study has found DNR's requirements for numbers of large trees in a stand (5 to 27 large trees per hectare over 30 cm) are below what really needs to be maintained for the nineteen species of songbirds associated with mature forest - 80 large trees per hectare (Guenette, 2003).

Further, old forest habitats provided for in the forest management plans are not actually evaluated in the field, but by using aerial photographs, photo interpretation and Geographical Information Systems. It is possible to misinterpret stand information from aerial photos (i.e. it is difficult to distinguish immature and mature age classes from one another). This could therefore lead to overestimating the amount of wildlife habitat on the ground.

Planning for minimum viable populations when managers 1) do not completely understand the habitat needs of the indicator species and 2) can not provide totally accurate estimates of the amount of habitat, could lead to species loss in New Brunswick. Overestimating the amount of habitat available to a species can quite possibly lead to population crashes before one realizes habitat is insufficient.

5.2.2 Question #2 - Are the License Holders Meeting their Wildlife Habitat Targets?

Answer: No. Certain habitat types are below target levels in northern New Brunswick

The areas of four of the seven habitat types are below the minimum area prescribed by DNR targets in northern New Brunswick. Old Spruce-Fir, Old Mixedwood, Large Mixedwood and Old Tolerant Hardwood have not met habitat targets on at least three of the 14 study units analyzed by the Conservation Council.

Old Spruce-Fir habitat did not meet its habitat targets in 9 of the 14 study units analyzed. Old Mixedwood did not meet its habitat target on 6 of the 14 study units. Large Mixedwood did not meet its habitat target on 3 of the 14 study units. Old Tolerant Hardwood did not meet its habitat target on 3 of the 14 study units analyzed (Table 5.1, Appendices 1 to 4).

This means there is currently not enough habitat to sustain wildlife populations in those areas. This could already be causing local population crashes for the 16 different indicator species that rely on these habitat types (Appendix 5). No comprehensive population monitoring is carried out to check whether or not New Brunswick is currently experiencing population crashes for these species.

Table 5.1 Summary of Habitat Types that do not meet DNR Objectives

Ecoregion	Upsalquitch	Nepisiguit	Upper-Miramichi	Restigouche-Tobique
Highlands	Old Spruce-Fir, Old Mixedwood	Old Spruce Fir		Old Spruce-Fir, Old Mixedwood
Northern Uplands	Old Spruce Fir		Not in License	Old Spruce-Fir
Southern Uplands	Old Spruce Fir, Old Mixedwood	**Old Mixedwood** [*], Large Mixedwood, Old Tolerant Hardwood	Old Spruce-Fir, LMWH	Old Spruce Fir, Old Mixedwood
Continental Lowlands	Not in License	Not in License		Not in License
Eastern Lowlands	No target	Old Tolerant Hardwood	Old Spruce Fir, Old Mixedwood, Large Mixedwood, Old Tolerant Hardwood	Not in License

[*] Habitat Types shown in bold have a current area below 15 percent of their target area

The Problem with Failing to Meet Habitat Targets
Let's for a moment examine exactly what it means for wildlife in New Brunswick when the availability of suitable habitat falls below target levels by using two examples.

Pine Marten

The American pine marten needs large forest patches to accommodate their habitat needs. The area an animal requires for carrying out all of its life history needs (feeding, breeding, raising young) is called its home range. Martens are carnivorous and solitary. Females need to maintain a large home range in order to have enough food to raise her young, and will defend this territory against other females. Males have even larger home ranges in order to have more than one female within his range, and will defend his territory against other males. Martens require at least some downed trees in their home

ranges to provide sites for denning during the winter months, and for nesting in the spring.

DNR has estimated that 375 ha of Old Spruce-Fir habitat will accommodate two families of pine marten (Beaudette and Makepeace, 2003). The target area for Old Spruce-Fir in License 1/Ecoregion 1 is 1775 ha in our study area, which would support approximately 9 families of pine marten. DNR estimates that 9 families of marten are sufficient to maintain their population in this area. However, currently there is only enough Old Spruce-Fir habitat to accommodate 8 families. This indicates that there is not enough habitat available to support a healthy population of martens. Local extinction could be the result.

For example, when one family is missing, there is a loss of one litter of young every year. That litter is needed to replace animals that die or move to other locations. Losing a female from a population means that there is one less female now for males to breed with and thus genetic diversity will begin to decrease in this population. If individuals try to pack into an area (family doesn't move to a new area where habitat is suitable), competition will likely become too intense for food resources and this could threaten the survival of the remaining individuals. Individuals may start encountering one another more often, with violent confrontations resulting from the limited resource of food and mates.

The Red-Breasted Nuthatch

The red-breasted nuthatch is a small bird that nests in small holes, called nesting cavities, made in trees by woodpeckers. Woodpeckers typically require dying or dead trees that are fairly large in order to make a good nesting cavity. After raising their young for one season, the woodpeckers will move on from that tree, leaving the cavity vacant for a number of other species, like the red-breasted nuthatch, to use for their own nesting needs. Old and large trees are therefore an integral part of the red-breasted nuthatches habitat.

The red-breasted nuthatch home ranges are much smaller than the martens'. As an insect eater, these little birds have access to plenty of food in a small area.

DNR has estimated that 30 ha of Old Spruce-Fir habitat will accommodate 10 nests for these songbirds. The target area for Old Spruce-Fir habitat in License1/Ecoregion 1 is 1775 ha, which would support 591 nesting pairs of red-breasted nuthatches. However the available habitat falls 225 ha short of the target.

This eliminates critical habitat that would support 75 breeding pairs of red-breasted nuthatches, lowering the remaining population of this species in this area to 516 breeding pairs. This number of birds is estimated to be too low for this area to support a healthy population of red-breasted nuthatches.

Birds typically mate with more than one individual during the season. This helps to increase the genetic diversity of the population. Eliminating 75 pairs of red-breasted nuthatches from a region could significantly reduce the genetic diversity of the red-breasted nuthatches in that area. It also greatly reduces the number of young that are born each year to replace birds that do not survive from year to year. These are some of the factors that could cause local extinctions of these animals where their habitat targets are not met.

Table 5.2 Target area compared to actual amount of habitat on the ground for two Habitat types that are presently below their targets in Ecoregion 1/License 1.

Habitat Type	Target Area	Actual Area	Difference	# of Indicator Species Affected
Old Spruce-Fir	1775 ha	1550 ha	-225 ha	American pine marten Black-backed woodpecker Red-breasted nuthatch Evening grosbeak Olive-sided flycatcher Boreal chickadee Ruby-crowned kinglet Bay-breasted warbler Pine siskin
Old Mixedwood	1725 ha	975 ha	-750 ha	Northern flying squirrel Swainson's thrush

Table 5.3 Number of home ranges that have been eliminated by not meeting DNR's established targets for three example indicator species on Ecoregion 1/License 1.

Habitat Type	Example Indicator Species	Minimum Viable Population (MVP)	Actual Area Available Would Support a Maximum Of:	# of Home Ranges (breeding pairs) short of maintaining MVP
Old Spruce-Fir	American Marten	9 families	8 families	1 family
	Red-Breasted Nut Hatch	591 pairs	516 pairs	75 pairs
Old Mixedwood	Flying Squirrel	287 families	162 families	125 families

5.2.3 Question #3: Are the current targets appropriate for maintaining wildlife habitat in the Acadian forest?

Answer: No. Current habitat targets are not appropriate for maintaining wildlife habitat in the Acadian Forest.

Certain Habitat type targets have low target levels set relative to their current areas (less than 50 percent of their current areas) (Table 5.4, Appendices 1 to 4). Allowing habitat areas to decline by this much in New Brunswick could result in future population crashes, particularly for wildlife species that rely on habitat that would not change much under natural disturbance regimes. The rate of habitat decline will depend on the rate of forest harvesting, particularly clearcutting methods.

This is the case for the following habitat types:

Old Tolerant Hardwood – This habitat type has a low target set in ecoregions 1, 2 and 3 on the Upsalquitch and the Nepisiquit license. This habitat type is characteristic of the Acadian forest. It would generally not be subject to large scale or frequent natural disturbances. There would be no natural reason for this habitat type to decline to 50 percent of its present level. A more appropriate target would be to maintain the current levels of this habitat type through selection cutting instead of cleacutting.

Large Mixedwood Habitat – This habitat type is often high in abundance but has low targets set for it in almost all ecoregions of all the licenses. This habitat type includes any stand with a mixture of at least 25 percent softwood and less than 75 percent hardwood with adequate stand characteristics. Tolerant hardwood/softwood communities and intolerant hardwood/softwood communities both qualify as large mixedwood habitat though the silvics of these two vegetation communities are quite different. However mixedwood forest is one of the key components of the Acadian forest (Loo and Ives, 2003). To reduce this habitat type by 50 percent of its current level will likely have negative impacts on the many species that rely on this habitat type.

Old Hardwood Habitat – This habitat type is high in abundance but has low targets set for it on almost all ecoregions in all Licenses. Old Hardwood Habitat encompasses both old tolerant hardwood habitat and intolerant hardwood communities. Reducing this habitat type to 50 percent of its current level will further change the natural composition of the plants and animals that have adapted to the characteristics of the Acadian forest.

Table 5.4 Summary of Habitat Types with low DNR targets (all lower than 50 percent, some under 10 percent) in comparison to the current levels.

Ecoregion	Upsalquitch	Nepisiguit	Upper-Miramichi	Restigouche-Tobique
Highlands	Old Hardwood, Large Mixedwood, Old Tolerant Hardwood	Old Hardwood, Large Mixedwood, Old Tolerant Hardwood	**Large Mixedwood** [*]	**Old Hardwood, Large Mixedwood**
Northern Uplands		Old Hardwood, Large Mixedwood, Old Tolerant Hardwood	Not in License	Old Hardwood, Large Mixedwood
Southern Uplands	Old Hardwood, Large Mixedwood, Old Tolerant Hardwood	Old Hardwood, Large Mixedwood, Old Tolerant Hardwood	**Old Hardwood**, Large Mixedwood	**Old Hardwood**, Large Mixedwood
Continental Lowlands	Not in License	Not in License	**Old Hardwood, Old Spruce-Fir, Old Mixedwood, Large Mixedwood, Old Tolerant Hardwood**	Not in License
Eastern Lowlands	No target	**Old Hardwood**	Old Hardwood	Not in License

6   Saving the Acadian Forest – What Needs to Be Done?

6.1 Conserving the Diversity of Forest Ecosystems

Existing DNR Goal: To maintain the diversity of forest ecosystems and their associated ecological values.

Suggested New Goal – To maintain and restore the diversity and function of the Acadian forest ecosystem.

Strategies/Actions
*   Design a classification system that reflects the characteristics of the Acadian forest. This system needs to:

    1.   Reflect the historical condition (pre-European) of the Acadian forest to give managers an idea of what should be on the ground in relation to what is currently present.
    2.   Reflect the full range of species that make up the Acadian forest and relative proportions of these species.
    3.   Have age class categories reflect the biological maturity, as opposed to the economic maturity of tree species.

*   Maintain a minimum of 40 percent of the forest landbase on Crown lands in the mature age class category.
*   Conduct forest management operations that match the silvics as well as the natural disturbance regime of the stand being managed.

Recommendations for Vegetation Communities Classification

The current classification system for vegetation communities is not adequate to maintain the forest diversity of the Acadian forest. The classification system should reflect more closely the species diversity and community types of the Acadian forest.

1.   **Vegetation communities should represent the major community groups of the Acadian forest and identify the species that are part of these communities.** For example, there should be a softwood dominated mixedwood community that would account for the hardwood component of softwood dominated stands. This community should at least be divided into two groups, one recognizing shade intolerant species and the other – shade tolerant species and the different silvics of these two different categories.

     More emphasis needs to be placed on hardwood communities and less on softwood communities. The current classification system includes six softwood communities; each based on one or two softwood species, and does not reflect the characteristics of the Acadian forest. This system can lead to stand conversion and needs to be immediately addressed.

The classification system presented in Loo and Ives (2003) would be a more appropriate system to use as it identifies the species that would normally be present in the forest types of the Acadian forest. This includes species currently not recognized by DNR's system such as hemlock, red oak and white ash. This system builds on the work of Loucks (1962) which was meant to be used for forest management, while providing insight into the historical condition of the forest.

2. **The spruce community needs to be divided into red spruce and white spruce.** These two species have completely different silvics and should not be categorized together. Immediate action needs to be taken to reclassify red spruce into a more appropriate category to ensure this species is maintained at adequate levels. This species is a key component of the Acadian forest.

Recommendations on Meeting Targets

1. **Increase target levels for mature vegetation communities from 12 percent to 40 percent.** Selection harvesting techniques could be used in many vegetation communities to still harvest volume, while maintaining the character of the forest stand. This will have the additional benefit of ensuring there is enough mature forest habitat to protect wildlife populations that rely on mature forest. It will also help promote higher value products to be grown in the forests of New Brunswick.

    This recommendation is particularly important for vegetation communities that are representative of the Acadian forest that currently have low set targets relative to the amount of forest left in that community. Immediate action needs to be taken to ensure levels of Pure Tolerant Hardwood, Tolerant Hardwood/Softwood, and Eastern Cedar are not reduced to their current target levels as these communities would naturally persist for many centuries.

2. **Many vegetation communities are already threatened and below their set targets within the area we studied. It is recommended that DNR reassess their annual allowable harvest and take immediate measures to ensure more vegetation communities do not fall below these levels and restore those vegetation communities below their current targets.** Vegetation communities below these levels must now be given time and area (from younger stands of the same community) with which to restore themselves before more forest harvesting occurs.

Recommended Forest Management Changes

1. **Clearcutting should be eliminated in forest stands that are not subject to frequent large scale natural disturbances.** Under the current management regime this would include tolerant hardwood, tolerant hardwood/softwood, eastern cedar, and possibly pine and red spruce. Individual tree selection methods

should be used when harvesting these vegetation communities in order to maintain the important stand composition components.

2. **Plantation levels need to be reassessed based on a newly defined classification system to ensure that the current rate of plantations do not cause stand conversions from one species to another.** It is important that species planted reflect what should be present on the ground with regards to the historical condition of the Acadian forest and the ecological land classification data.

Species and stand conversions can currently take place under the existing classification system. For example, converting a red spruce stand to a white spruce stand is very possible today but does not reflect the natural disturbance regime of the Acadian forest. It is also possible today to convert a mixedwood stands that have a hardwood component (less than 50 percent) to a softwood plantation without technically changing a vegetation community. The percentage of the land base scheduled to be converted to plantations should be re-examined based on a new classification system that would end the possibility of stand conversion.

6.2 Conserving Wildlife Habitat

Existing DNR Goal: To provide habitat necessary to support populations of native wildlife species at desired levels across their natural ranges.

Suggested New Goal: Maintain and restore healthy populations of New Brunswick's forest dependant wildlife species across their natural ranges.

Strategies/Actions
- Take immediate steps to end clearcutting and restore habitat types that have currently fallen below their target levels.

- Maintain the habitat characteristics of the Acadian forest to which the wildlife have adapted over 10,000 years. More focus need to be placed on the natural disturbance regime. This should be achieved through vegetation community objectives. Ensure that forest management techniques are used that maintain the characteristics of the indicator species habitat type characteristics.

- Update the current indicator species program based on the latest research for the indicator species. Develop a monitoring program to track both habitat type levels and the populations of some select species both through mapping inventories and on the ground sampling.

Recommendations for Maintaining Wildlife Habitat

1. **A number of habitat types are already in short supply. For habitat types that are currently below their targets – Old Spruce Fir, Old Mixedwood, Large Mixedwood and Old Tolerant Hardwood – immediate action needs to be taken to raise the level of these habitat types to avoid the possibility of local extinctions.** These habitat types should be spatially referenced in forest management plans and the cutting of any relevant blocks should be suspended until target thresholds are achieved.

   Silviculture techniques that would improve the levels of these four habitat types could also be employed to increase the amount of these habitat types. Management regimes that focus on returning the species composition of the Acadian forest towards long-lived, shade tolerant species would help create forest stands that could persist for centuries without stand break-up. These stands could then be selection harvested over time to provide a source of timber, and could still provide habitat.

2. **Take immediate steps to improve the habitat definitions.** Patch-size targets and stand characteristics are currently based on estimates of what the minimum amount of area would be required to maintain a population. This approach leaves

no room for error, (i.e. missing targets, establishing targets that are too low, incorrectly defining habitat for a species) as this, by definition, could lead to population crashes and local extinctions.

Habitat definitions need to be reexamined based on the latest research available to evaluate the appropriateness of the original targets and definitions. Adjustments should be made to the target levels to ensure the indicator species do indeed have enough habitat to maintain healthy populations – not just minimum viable populations. Habitat type stand characteristics need to be redefined based on new research on species habitat requirements. Target levels will again need to be re-evaluated to determine how habitat type objectives are performing on the ground and whether the targets are being met.

3. **Monitor the habitat type levels on the ground to ensure that there is enough habitat on the ground to meet wildlife goals.** Monitoring the populations of the indicator species that are representing these habitat types would further help determine whether the goals and objectives to maintain wildlife populations were indeed being met.

Rate of habitat decline needs to be carefully examined to ensure populations do not risk local extinctions. If a particular population experiences a decline by 50 percent or more over a ten year period of time, or over three generations, it can be considered vulnerable if the cause of its population decline is known and could have been prevented (planned habitat reduction) - (**IUCN, 2004).**

All species that have habitat targets set at less than 50 percent of their current area of habitat could be at risk if this habitat area is rapidly clearcut.

7 Conclusion

Our study found that the forest diversity and wildlife habitat in New Brunswick's Acadian forest is not being properly maintained under the current management regime. The three major findings of this study include:

1. **The classification system used by the Department of Natural Resources to define both the forest diversity and the habitat types in New Brunswick are not adequate to protect key features of the Acadian forest.**

2. **Current vegetation communities and habitat type targets are not being met. Thus forest diversity and wildlife habitat are currently not being maintained on Crown lands.**

3. **Targets that have been set for forest diversity and wildlife habitat by the Department of Natural Resources are often too low to properly maintain key components of the Acadian forest.**

The current classification system that identifies vegetation communities to represent forest diversity in New Brunswick's forests does not adequately represent the characteristics of the Acadian forest. Under the current classification system, it is possible for stand conversion to take place through clearcutting and plantation forestry. Tolerant hardwood species, tolerant mixedwood communities, and red spruce are currently at risk under our present classification system. Also at risk are less common species that are still characteristic of the Acadian forest such as eastern hemlock, red oak and white ash. These species have no representation at all under the current vegetation communities.

Perhaps of even more pressing importance is the fact that under this classification system, many of the vegetation community targets for maintaining forest diversity and habitat type targets for maintaining wildlife habitat are not being met. Our study indicates that current forest management practices are not sustainable for maintaining forest diversity and wildlife habitat. The consequence of this is possible local extinctions of species that rely on mature forest habitat.

Compounding this problem is the fact that many of these targets have been set too low to begin with. Currently, only 12 percent of Crown land needs to be maintained as mature forest, to meet the vegetation community target, when Acadian forest would have historically been composed of at least 80 percent mature forest. This value is much lower than many scientists are predicting is needed to maintain healthy populations of wildlife that require mature forest habitat. Many targets have been set at values lower than 50 percent of their current area. This is inappropriate for many vegetation communities that would generally not be subject to large scale disturbances, such as tolerant hardwood, mixedwood and softwood communities.

Based on these findings we suggest a number of recommendations to improve forest management in New Brunswick:

- A new classification system that reflects the characteristics of the Acadian forest must be introduced for the next Vision Document. This classification system should reflect the silvicultural characteristics of the Acadian forest communities.
- Clearcutting must be eliminated in vegetation communities that are not subject to frequent large scale disturbances. Selection harvesting should replace clearcutting in these vegetation communities.
- The area of plantations should be re-evaluated based on the new classification system.
- Immediate action needs to be taken in vegetation communities and habitat types that are currently below their targets on Crown land to ensure their levels are increased over time. This will likely involve identifying these areas on ground, and ensuring that forest harvesting does not further reduce these communities.
- New targets for habitat types need to be established in order to maintain healthy populations for wildlife that depend on mature forest. More area needs to be maintained for mature Acadian forest.
- A monitoring program should be in place for indicator species, to ensure that the populations of these species are maintained over time.

Forest management in New Brunswick needs to address these major problems immediately to avoid losing more forest diversity or wildlife habitat. These values are not just "extras" for the enjoyment of the people. These values are fundamental to the proper functioning of New Brunswick's forests and integral to maintaining the ecosystem services they provide, including forest productivity itself.

If we are to avoid further erosion of the character of the Acadian forest and head-off the possibility of local extinctions, we must begin to manage our forests based on their natural diversity and silvics. It is time to recognize that the current system of timber management is not achieving the established forest diversity and wildlife habitat goals, and address the problem. Until this occurs, forest management in New Brunswick can not be considered sustainable.

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Appendices

Appendix 1

Vegetation Community and Habitat Type Constraining Objectives
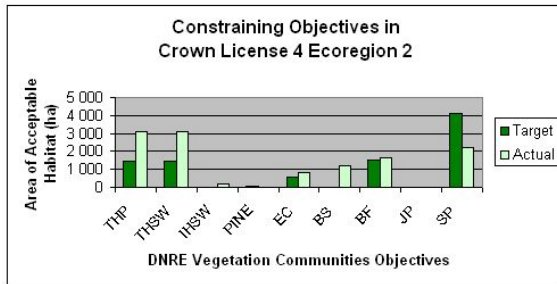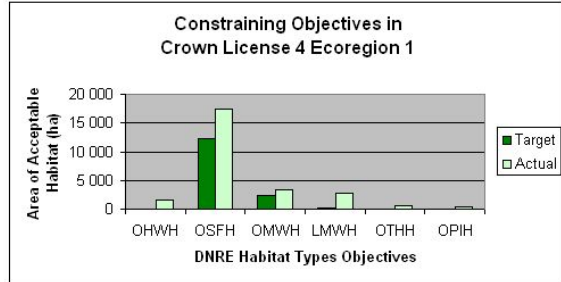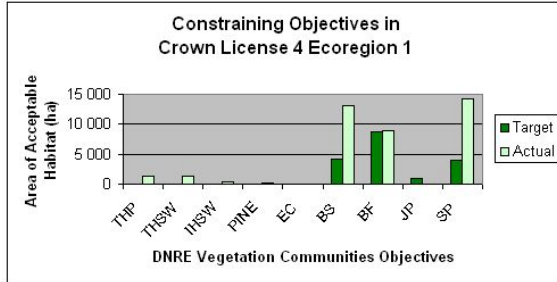## on Crown Licence 1 (in Study Area)
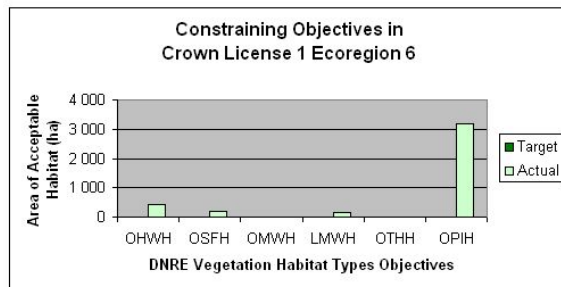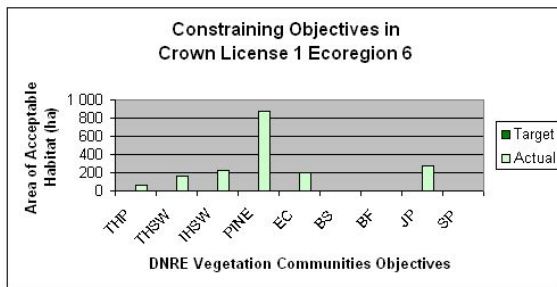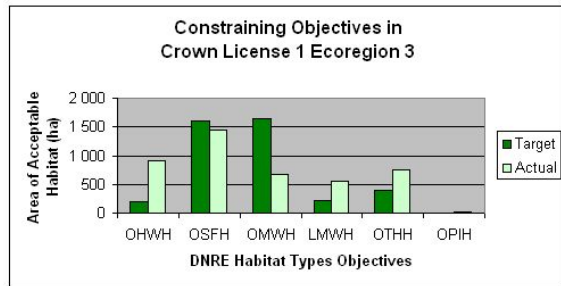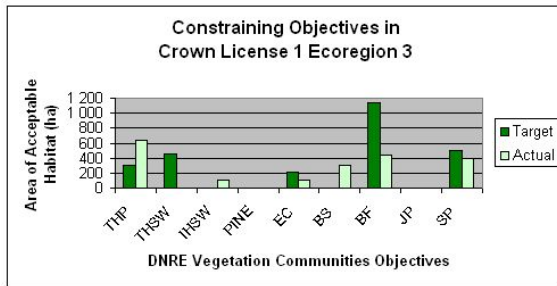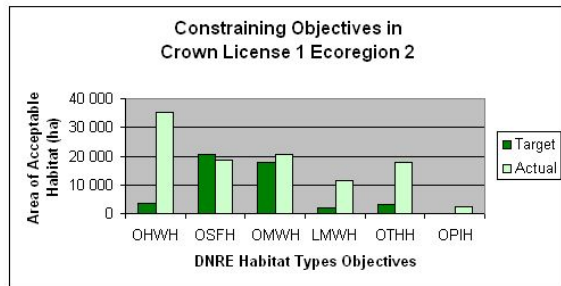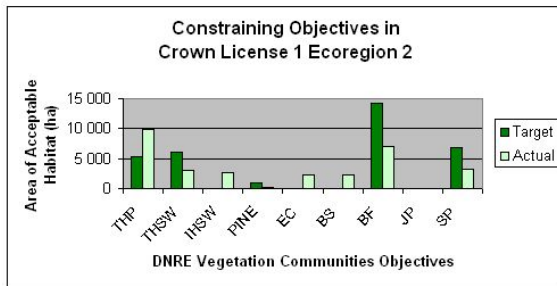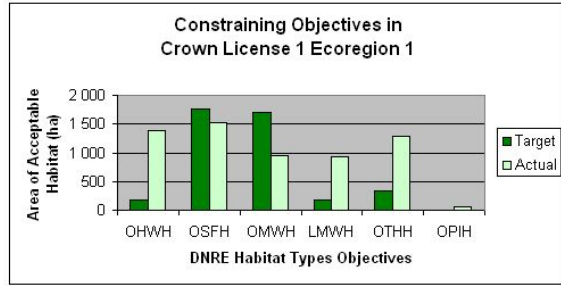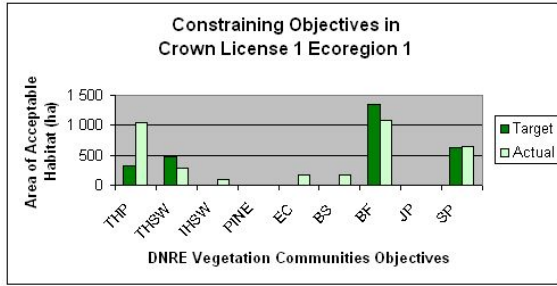
Appendix 2

Vegetation Community and Habitat Type Constraining Objectives
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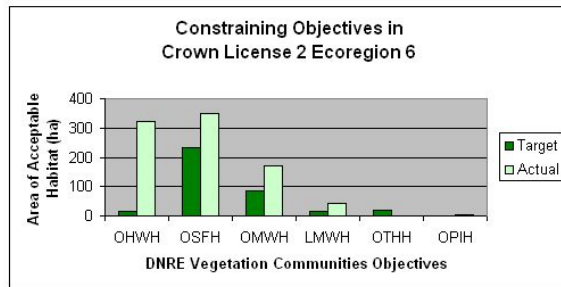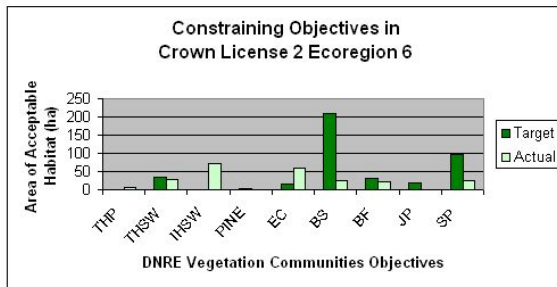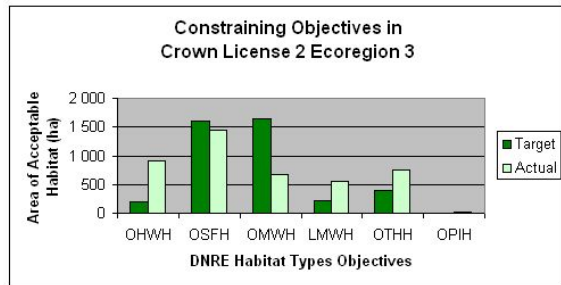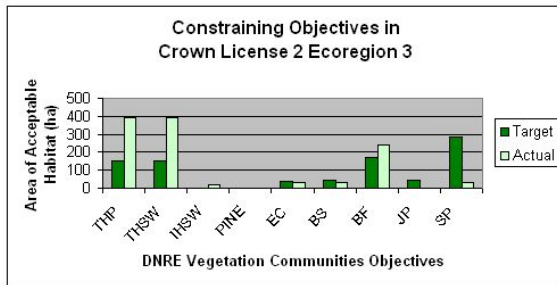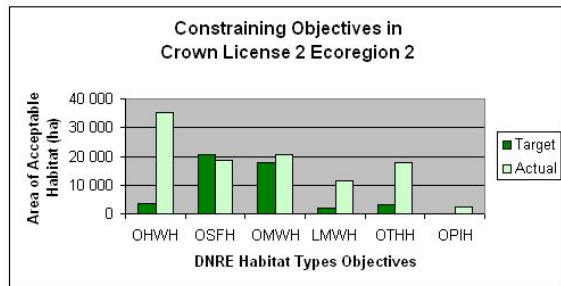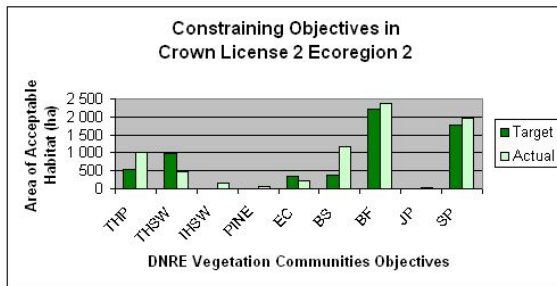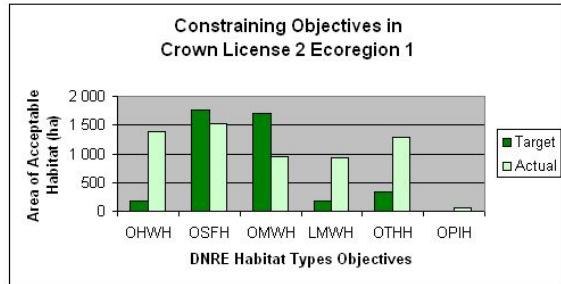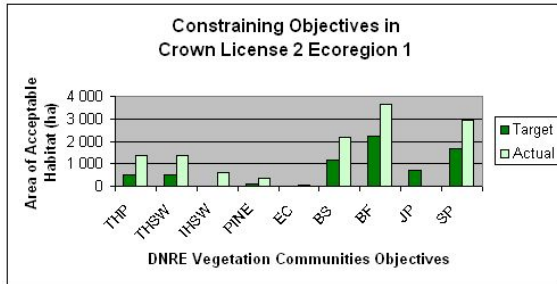
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Vegetation Community and Habitat Type Constraining Objectives
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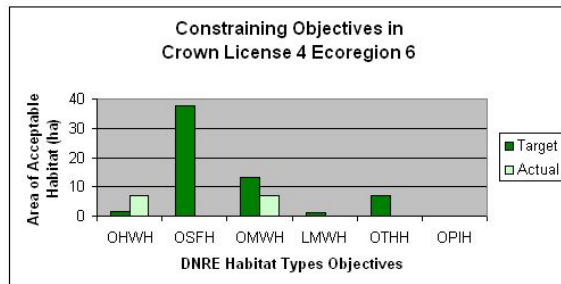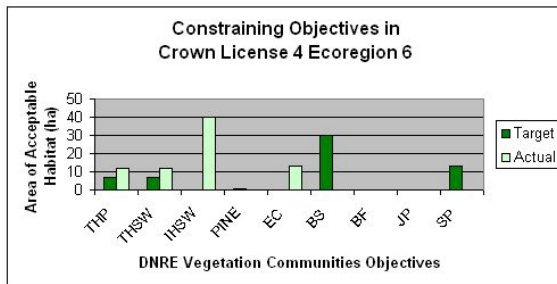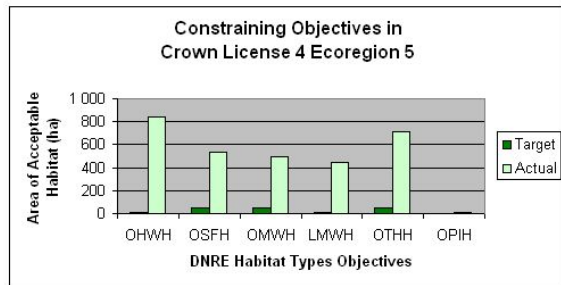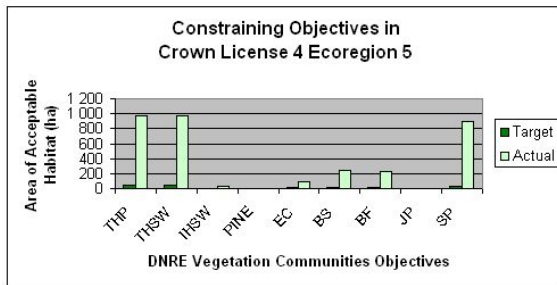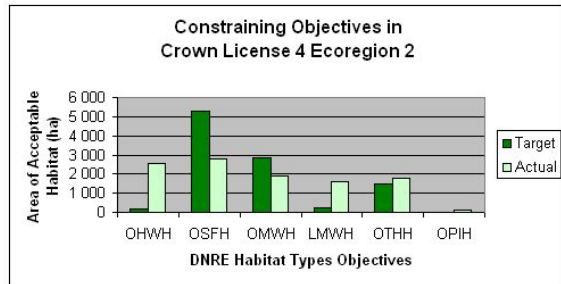
Appendix 4

Vegetation Community and Habitat Type Constraining Objectives on Crown Licence 10 (in Study Area)
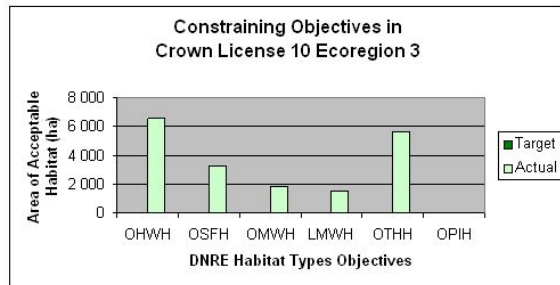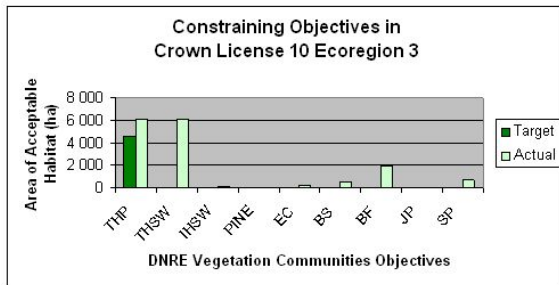
Appendix 5

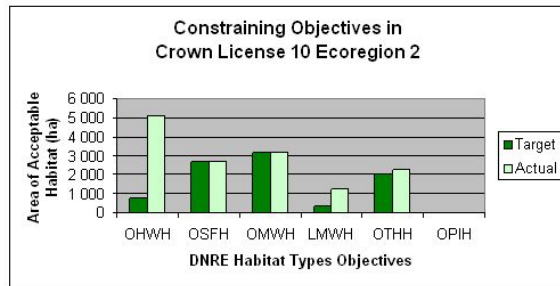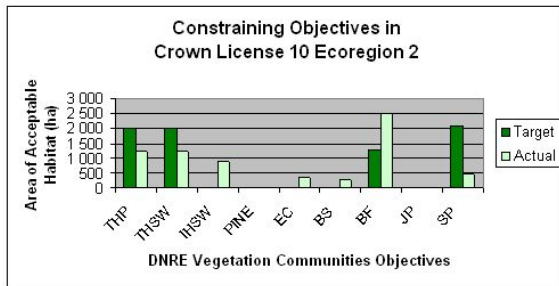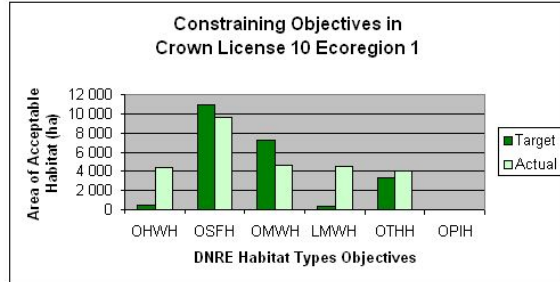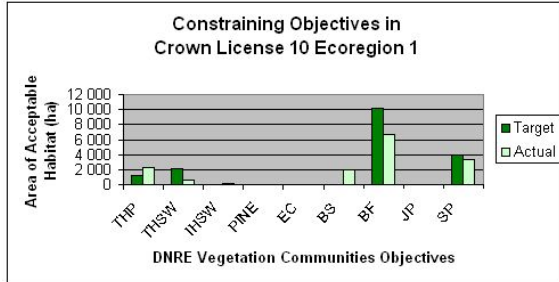**Species Associated with Habitat Types that are at Risk**

Old Tolerant Harwood Habitat (OTHH)

Barred Owl
Downy Woodpecker
Pileated Woodpecker
Eastern Wood Pewee
White-Breasted Nuthatch
Black-Throated Blue Warbler

Old Spruce-Fire Habitat (OSFH)

American Marten
White-Tailed Deer
Black-Backed Woodpecker
Red-Breasted Nuthatch
Red Crossbill
Evening Grosbeak
Olive-Sided Flycatcher
Boreal Chickadee
Winter Wren
Golden-Crowned Kinglet
Ruby-Crowned Kinglet
Blue-Headed Vireo
Cape May Warbler
Bay-Breasted Warbler
Pine Siskin

Old Mixedwood Habitat (OMWH)

Northern Flying Squirrel
Swainson's Thrush

Large Mixedwood Habitat (LMWH)

Fisher

Appendix 6

Vegetation Communities and Habitat Types in short supply according to DNR internal documents obtained under the Right to Information Act

VEGETATION COMMUNITIES in short supply

License	Ecoregion	Vegetation Community	Objective	Current Level	P1 Clearcut Area	Post-CC Area	CURRENTLY BELOW OBJECTIVE - NO CLEARCUT	P1 CC WILL BRING BELOW OBJECTIVE
1	1	THSW	470	413	32	382	X	
1	2	THSW	6090	4591	46	4545	X	
1	3	THSW	460	415	1	413	X	
1	3	SP	500	382	3	379	X	
2	1	THSW	480	289	5	283	X	
2	2	THSW	1730	1487	212	1274	X	
2	3	THSW	130	135	39	96		X
2	6	THSW	720	755	47	708		X
2	6	JP	430	140	54	86	X	
4	6	THSW	800	885	153	732		X
5	6	THSW	1080	873	45	828	X	
5	6	JP	350	137	12	125	X	
6	4	THSW	280	74	12	62	X	
6	6	THSW	2610	4153	505	3648		X[1]
6	7	THSW	610	818	28	789		X[1]
7	4	THSW	450	41	2	39	X	
7	5	THSW	1830	1556	67	1489	X	
7	6	THSW	1740	2308	296	2012		X[1]
7	7	THSW	1350	724	65	659	X	
8	5	THP	1970	2022	98	1924		X
8	5	THSW	2930	2565	279	2286	X	
8	7	THSW	320	116	1	116	X	
9	5	THSW	950	1015	78	936		X
10	1	THSW	2640	1706	96	1610	X	
10	2	THSW	1370	493	83	410	X	
10	3	THSW	3050	1177	50	1126	X	

[1] Vegetation Community objectives for THSW on License 7/ Ecoregion 6 (7/6/THSW), 6/6/THSW and 6/7/THSW have been included in the list even though the analysis indicated they are not in short supply. However, ancillary data analysis and field inspection have indicated that community levels will be below objective levels after scheduled Period 1 clearcut. The error stems mostly from the inclusion in "Current Level" of area that has received partial harvest, area in stands less than 2 ha in size, and area where rM and wB were erroneously typed as TH.

HABITATS in short supply

License	Ecoregion	Habitat Type	Objective	Current Level	P1 Clearcut Area	Post-CC Area	CURRENTLY BELOW OBJECTIVE - NO CLEARCUT	P1 CC WILL BRING BELOW OBJECTIVE
7	4	OTHH					X	
9	5	OTHH					X	