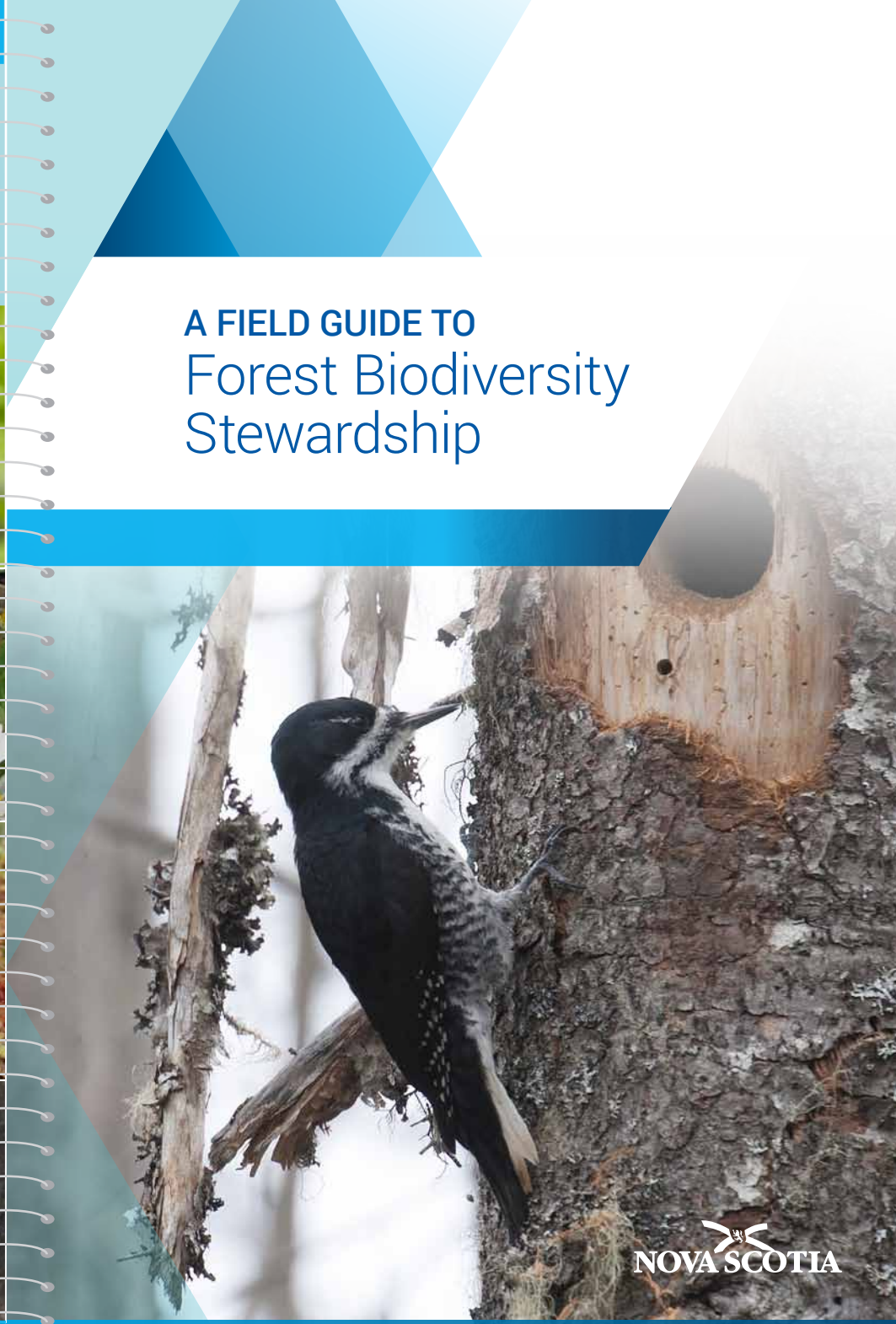
NOVA SCOTIA

A FIELD GUIDE TO

Forest Biodiversity Stewardship



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REPORT FOR 2017–1

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Prepared by the Nova Scotia Department of Natural Resources

Compiled by: Peter Neily and Glen J. Parsons
Nova Scotia Department of Natural Resources,
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Photo credits

Cover Photo: Black-backed woodpecker at cavity tree (Mark Elderkin)

Back Cover Photos: Background and cavity tree (CNS, Len Wagg); Vernal pool in winter, bloodroot, mushroom (DNR, Peter Neily); Great blue herons (Andrew Kennedy); Red fox (Mark Elderkin); Wood turtle (Alain Belliveau, AC CDC).

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Report FOR 2017-1

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A Field Guide to Forest Biodiversity Stewardship

Introduction

Nova Scotia has over 4.2 million hectares of forested lands—that represents about three quarters of the province's total area. Our forests are life giving—they filter the air we breathe, provide clean water and food, help prevent soil erosion and flooding, provide the wood we use to build and maintain our communities, and support biodiversity by providing places to live for countless species…including ourselves.

Nearly 60 per cent of forested land in Nova Scotia is privately owned by businesses, families, and individual landowners. Every day, people from all over our province make decisions that impact our forests and biodiversity. Making these decisions is a shared responsibility. Governments, Mi'kmaq, industry, woodland owners and users, interested groups, and individuals all have roles and responsibilities in the shared stewardship of our forest and biodiversity resources. This shared approach is critical to effective forest biodiversity stewardship.

This field guide is designed as a stewardship tool primarily for forest harvesters, woodland managers, and private woodland owners. However, it also provides valuable information for anyone with an interest in Nova Scotia's forests and their biodiversity. It describes important biodiversity features, and presents practical information on the responsible use and conservation of our forest and the biodiversity it supports. Whether you are preparing for a commercial timber harvest, cutting firewood for your own use, or planning a trail or road through woodland, the information in this guide will help you to recognize and take actions to protect the important forest biodiversity features you may encounter along the way.

For further information on forest biodiversity stewardship in Nova Scotia visit the on-line Woodlots and Wildlife Module of the Nova Scotia Woodlot Management Home Study Program. (woodlot.novascotia.ca)

What is Biodiversity?

*The Path We Share – A Natural Resources Strategy for Nova Scotia (2011–2020)** describes biodiversity as, "The variety and inter-connectedness of all life, including all plants, animals, and other organisms, the genes they contain, and the systems and processes that link them."

Nova Scotia's biodiversity and forest health are tightly connected. A healthy forest is composed of many living and non-living things, and the processes that link these together. Any alteration or disturbance of forest biodiversity and/or the non-living components of a forest can influence the ways in which the overall forest ecosystem functions—potentially impacting forest health.

How to Use this Field Guide

Through research and knowledge sharing, our overall understanding of forest biodiversity stewardship is constantly improving. This guide brings together current information from several sources including government policies and programs, and both printed and on-line publications and articles. It also draws on the experience and first-hand expertise of many people who deal with the day-to-day challenges and rewards of forest biodiversity stewardship.

It is important to recognize that forest stands are parts of a larger landscape and that ecosystems on the landscape are interconnected. This guide aims to provide easy to use information, primarily at a forest stand level, about many of the important features of forest biodiversity stewardship, where forest structure and wildlife habitat can be influenced by a range of options. For many sections, the content is specific and technical, and in others it is more broad and general—depending in part on the overall knowledge and information available.

This field guide provides the reader with several stewardship actions that support forest biodiversity conservation. Application of stewardship actions in a single stand can influence habitats on a larger scale, and these habitats may also be influenced by activities beyond property boundaries. Providing a range of forest structure and composition over time helps to maintain viable populations of wild species.

** Downloadable PDF is available at novascotia.ca/natr/strategy/*

As knowledge of forest biodiversity stewardship increases, it is hoped that broad application of these actions will contribute to the continued improvement of biodiversity and forest health throughout Nova Scotia.

The guide is divided into five main sections:

Stand Features: There are many forest stand features that are significant to biodiversity. This guide provides general information to help you identify these features and include them in your planning.

Special Habitats: Many species spend all or part of their life cycles in special forest habitat. Many of these habitats are fragile and easily altered unintentionally. This guide provides general information to help you identify these habitats and include them in forest planning.

Watercourses and Wet Forests: Watercourses and riparian areas are well known biodiversity hotspots that require special consideration in forest planning. This guide provides general information to help you identify ways to maintain and enhance these important areas.

Soils and Soil Communities: Soils are the fundamental drivers of biodiversity and productivity in forest ecosystems. They support a mix of flora, fauna and related ecosystem processes that greatly influence plant species composition, growth, decomposition and nutrient cycling. This guide provides general information to help you identify ways to maintain and enhance soil health.

Species at Risk: Dozens of species at risk live in our forests. Designated species at risk are protected by law, and recovery plans are in place for many of these species. This guide provides general information about many of the species at risk in Nova Scotia's forest, and identifies ways to minimize risk and enhance the recovery of these species.

Stewardship Actions

The forest biodiversity stewardship actions outlined in this guide fall under three general headings: **Best Management Practices, Crown Forest Policy**, and **Legal Requirements**. These categories convey specific conditions for the application of forest biodiversity stewardship practices on both Crown and private woodlands throughout Nova Scotia.

Best Management Practices (BMPs)

Voluntary practices that support forest biodiversity conservation. BMPs outline actions based on experience and professional judgement of strategies that will help support the specific biodiversity features described. People are encouraged to use these BMPs, and/or other effective strategies appropriate to the biodiversity features present.

Crown Forest Policy

Mandatory direction for forest management operations on Crown forests. This includes biodiversity Special Management Practices approved by the Department of Natural Resources and other Crown policies (e.g., **Old Forest Policy**).

These practices are voluntary and encouraged on private woodlands.

Legal Requirements

Laws and regulations that govern the management and conservation of all Nova Scotia's forests and biodiversity (e.g., **Wildlife Act**, **Endangered Species Act**, **Wildlife Habitat and Watercourses Protection Regulations**).

This guide highlights many of the forest biodiversity stewardship actions of existing policies, laws and regulations. However, the information in this guide does not replace or supersede any conditions or requirements under existing government policies, laws and regulations.

Eco Notes

The Eco Notes located throughout the guide describe some of the many fascinating wildlife species and amazing habitats found in Nova Scotia's forests.

Links

Websites to the on-line information sources used in the development of this guide are highlighted throughout. These links are also meant to help the reader access up-to-date and more detailed information on each topic, its stewardship and applicable regulations on-line.

Forest Ecosystem Classification

The Nova Scotia Forest Ecosystem Classification (NS FEC) is a classification that supports an ecosystem-based approach to the planning and management of Nova Scotia forests. The NS FEC is available on-line at: novascotia.ca/natr/forestry/veg-types

Stand Features

Cavity Trees

Main Photo: CNS (Len Wagg); Inset: DNR (Eugene Quigley)

Description

Live-standing trees with a cavity, usually created by limb or crown breakage. Large hardwood trees with dense wood (such as sugar maple and yellow birch) provide the best living cavity trees, for reasons of longevity and size.

Importance to Biodiversity

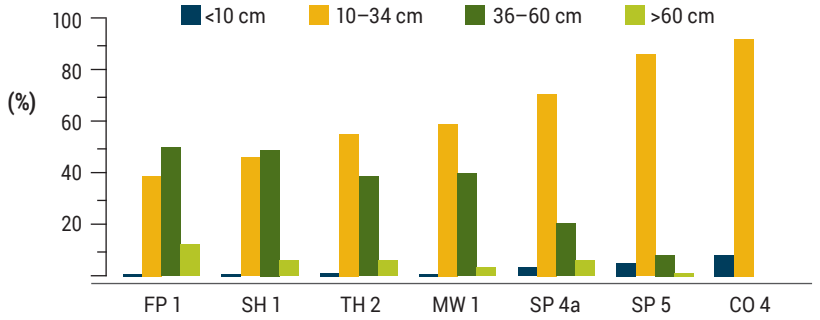
Cavity-nesting species such as woodpeckers and owls depend on cavity trees. The excavation of cavities in living trees creates more stable, long-lived habitat than cavities in dead wood. Large diameter trees may provide den habitat for mammals as large as coyotes. Hollow trees may be used by several species of bats (some endangered), or by chimney swift (also endangered).

Alain Belliveau, AC CDC

Stewardship Actions

Leaving cavity trees in the centres of legacy clumps will promote the conservation of these trees and may reduce safety concerns. In conifer stands, large hemlock may already be used by wildlife, and retaining these trees as individuals or in clumps can be beneficial. Hemlock decays more slowly than spruce and fir in many situations, and has particular value as coarse woody debris logs. Mature and uneven-aged tolerant hardwood forests often contain abundant quality snags and cavity trees suitable for retention.

Percentage of trees in each diameter class, by Vegetation Type (VT)



Note: Full names of the above Vegetation Types are found in Appendix C

VTs with a larger percentage of late successional species such as red spruce, hemlock, white pine and shade tolerant hardwood have the potential to have a higher percentage of larger diameter trees that could eventually be used as cavity trees. Data source: Forest Ecosystem Classification for Nova Scotia (2010)

Best Management Practices –

- Where practical and safe during harvesting, maintain existing cavity trees. If cavity trees must be felled for safety reasons, they should be left in place as coarse woody debris *(See pg 16)*.
- Where possible include the cavity trees within the legacy clumps *(See pg 19)* required under the **Wildlife Habitat and Watercourses Protection Regulations** *(See "LINKS")*. This provides security for wildlife using the trees as habitat, and reduces the chance of windthrow.
- If available, leave at least one large (> 50 cm diameter) and three medium (> 30 cm diameter) living hardwood trees per hectare in clearcuts. In the absence of hardwoods, conifers may be substituted.

LINKS

For detailed and up-to-date information

www.novascotia.ca/just/regulations and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Eco Notes

The Northern saw-whet is the smallest owl in Nova Scotia, measuring approximately 20 cm in length. This forest owl nests in tree cavities—sometimes in old woodpecker nests. Although small in size, these owls have a distinctively loud and continuous "*too-too-too-too-too…*" call.

Photo: Mark Elderkin

Coarse Woody Debris

Photo: DNR (Eugene Quigley)

Description

Woody material that has accumulated on the forest floor through natural disturbance or harvesting activity is called coarse woody debris. It can exist in all stages of decomposition, and includes logs, branches, roots and stumps.

Importance to Biodiversity

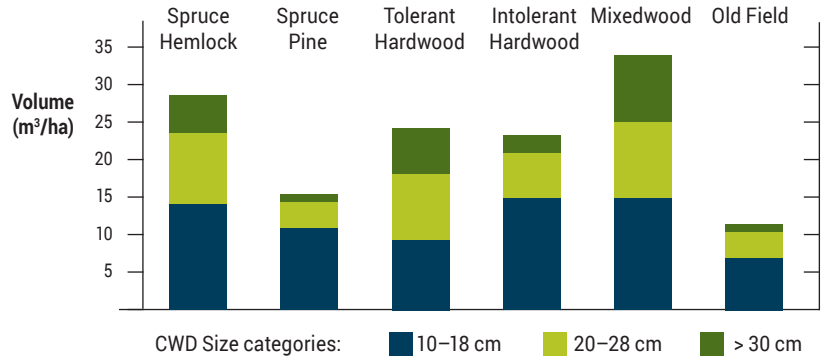
Coarse woody debris (CWD) contributes to the long-term sustainability of forest ecosystems by acting as a storage sink for the slow release of water and nutrients. It is also a site for regeneration of seedlings, mosses, lichens, fungi and micro-organisms, and provides habitat for many species of insects, birds, amphibians and mammals requiring a moist, shaded environment.

Logs that are supported off the forest floor by limbs are often used by mammals and birds for breeding displays, lookouts, and runways. Male ruffed grouse use large logs for drumming and display, while red efts (stage of Eastern newt) and several species of salamander find shade and food beneath them. Earthworm and insect activity is often abundant in the cool, moist environments of large hollow logs, which also have the potential to be used as den sites by several species of small mammals.

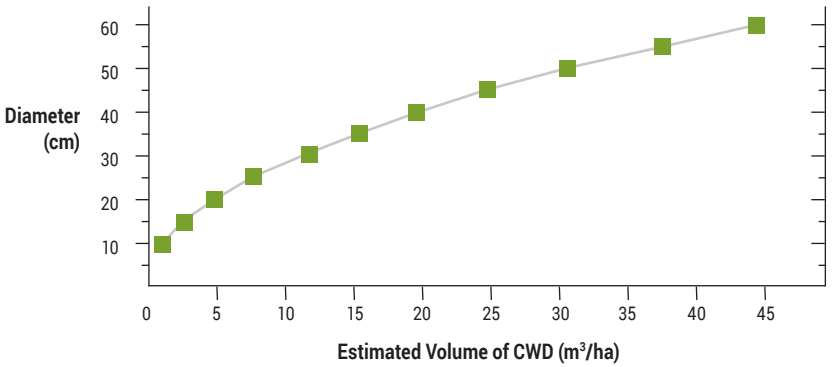
Photo: DNR (Peter Neily)

Stewardship Actions

Larger logs provide more options as habitat than smaller logs and limbs because of their persistence in the landscape and slower rate of decay. Hardwood logs decay more rapidly than conifer logs of a similar size, therefore conifer stands are more likely to accumulate coarse woody debris. The value of coarse woody debris logs for habitat generally increases with diameter. Logs > 40 cm in diameter provide habitat for a wide range of species.



Average values for downed coarse woody debris in mature stands by Forest Group
Data source: Forest Ecosystem Classification for Nova Scotia (2010)



This graph can be used for estimating the volume per hectare for each piece of CWD crossed by a 100 m sampling transect. Source: McCurdy, D. & B. Stewart. 2005. NSDNR Research Report No.76

Best Management Practices –

- Where it is practical, large coarse woody debris (> 40 cm diameter) should be avoided by machinery to reduce damage during harvest activities. If hollow stumps or logs are present, they should be regarded as valuable wildlife habitat.
- Woody material that is not marketable should be left distributed across the site, keeping in mind that larger diameter (> 40 cm), long (> 2 m) tree boles are more important as wildlife habitat. Where tree butts are hollow, try to leave them intact.
- Plan for future coarse woody debris by leaving a few larger live trees that will become coarse woody debris in the future.

Legal Requirements –

- The **Wildlife Habitat and Watercourses Protection Regulations** *(See "LINKS")* require forestry operators to ensure that levels of coarse woody debris on all harvested sites are similar to natural patterns to the fullest extent possible *(For average conditions refer to Forest Ecosystem Classification for Nova Scotia, pg 11)*.

LINKS *For detailed and up-to-date information*

www.novascotia.ca/just/regulations and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Photo: Mark Elderkin

Eco Notes

Ruffed grouse are common game birds found in mixed and coniferous forest throughout Nova Scotia where they feed on a variety of seeds and insects. In the spring, male ruffed grouse often seek out rocks, stumps and fallen logs to display their talent for drumming—maneuvering their wings in a way to create a low thumping beat whose sound can travel deep in the forest.

Legacy Trees and Features

Main Photo: CNS (Len Wagg); Inset: DNR (Peter Neily)

Description

Mature trees that survive stand-replacing natural disturbance events (fire, wind, insects) or that are left during timber harvesting, often retain ecological legacies of the former stand. These living legacy trees may also include understory flora, lichens and invertebrates. Legacy trees are a seed source for stand regeneration, and can serve as sites for re-colonization by wildlife and as refugia for wildlife moving within unfavourable habitat.

Importance to Biodiversity

Legacy trees contribute to the species composition, structure and diversity of a regenerating stand. With time, legacy trees may also become habitat features such as snags or cavity trees, or provide habitat for mosses and lichens. By conserving key elements of a harvested stand, these biodiversity features will more likely be carried forward into the succeeding stand. Choice of tree species is important, as species like hemlock, white pine, sugar maple or yellow birch have relatively long lives and superior retention qualities.

Photo: DNR (Sean Basquill)

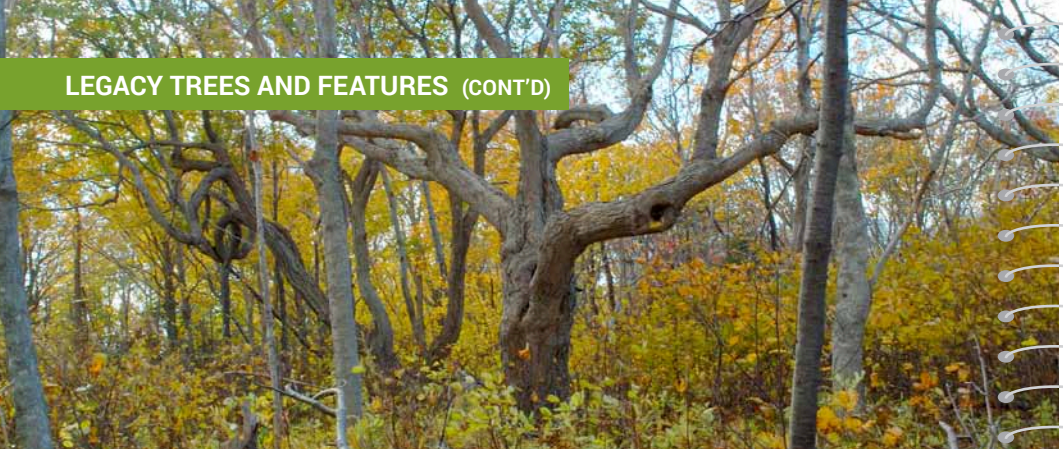


Photo: DNR (Sean Basquill)

Stewardship Actions

Stand harvesting methods can mimic natural disturbance events, by leaving legacy trees, patches and other features within harvested areas. These features provide a refuge for species with limited dispersal ability or close association to micro habitats. Retaining legacy features such as ground vegetation, large trees, large pieces of coarse woody debris, and patches of representative forest can maintain elements of biodiversity within a young stand.

Best Management Practices –

- Choose **clumps** for retention based on the availability of:
  - large diameter (> 50 cm) snags and logs
  - medium diameter (> 30 cm) shade-tolerant tree species (excluding balsam fir)
  - presence of old growth features (e.g., late-successional species, large coarse woody debris)
  - cavity trees or presence of large stick nests
  - uncommon shrub or herbaceous species
  - conifer inclusions in hardwood stands, and hardwood inclusions in conifer stands
  - vernal pools, seeps and springs, and other unique or sensitive habitat features
- Choose **individual trees** for retention based on:
  - uncommon species or specimens such as mature beech with smooth bark
  - oak or beech for mast production
  - large (> 50 cm) snags, cavity trees and shade-tolerant tree species (excluding balsam fir)

Legacy clumps conforming to the Wildlife Habitat and Watercourses Protection Regulations

Legal Requirements –

- On any harvest site (clearcuts, shelterwood harvests and selection management) larger than 3 hectares, leave intact clumps of habitat consistent with the **Wildlife Habitat and Watercourses Protection Regulations** *(See "LINKS").*

LINKS *For detailed and up-to-date information*

www.novascotia.ca/just/regulations and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Eco Notes

Nova Scotia has two species of flying squirrels. The northern flying squirrel is found throughout the province. It is larger than the southern flying squirrel that usually occurs just in the southern half of the province.

Both species are active at night. They prefer mature stands where they glide—not fly—throughout the forest. Sometimes both species den together in small groups in tree cavities. They play an important role in the dispersal of mycorrhizal fungi.

Photo: Peter Hope

Mast

Photo: DNR (Eugene Quigley)

Description

Mast is the fruit of woody plants that provides food for wildlife. Mast can be either hard or soft. Hard mast includes nuts and seeds of both hardwood and conifer trees. Soft mast refers to fruit and berries with fleshy pulp.

Importance to Biodiversity

Mast provides wildlife with high levels of fat and protein for over-wintering, hibernation or migration. Wildlife that are active during the winter consume mast that remains on trees or shrubs, or beneath snow and leaves. Some birds and mammals will cache mast for use during the winter.

Red oak provides one of the most nutrient-rich foods available to wildlife, contributing to energy stores of white-tailed deer, black bear, red fox, red squirrel, Eastern chipmunk, ruffed grouse and blue jay. Beech nuts can also be an important food source for black bears, white-tailed deer and small mammals.

The seeds of maples, birches, ash, ironwood, beaked hazelnut and conifers provide important overwintering food sources for many birds and mammals.

Although not as rich in fats and proteins as hard mast, soft mast is an important source of energy. Large quantities are produced annually by pin cherry, choke cherry, mountain-ash, serviceberry, wild raisin, elderberry, wild apple, raspberry and blackberry.

Probability of Red Oak			Probability of Beech		
Low	Probable	High	Low	Probable	High
IH6	IH3	IH1	IH2	MW1	TH1
SH1	IH6A	IH2	IH3	MW3	TH2
SH3	MW2A	SP9	IH7	TH4	TH3
SH4A	SH2	TH6	MW2	TH6	TH5
SP8	SP3		SH2	TH7	
	SP4		SP9	TH8	
	SP6				

Note: Full names of the above Vegetation Types are found in Appendix C

The potential of Vegetation Types to develop mast-producing red oak or beech in the overstory. Data source: Forest Ecosystem Classification for Nova Scotia (2010)

Stewardship Actions

Despite the competitive nature of species like pin cherry and raspberry on regenerating harvest sites, these species have high value as food for wildlife. Disease free beech in particular may have greater value if left uncut for wildlife than if harvested for timber. Beech trees must remain healthy until age 50 to produce quantities of nuts every 2 to 8 years.

Best Management Practices –

- Where practical, encourage oak and healthy beech mast sources. The crowns of young oak taller than 9 m can be expanded by releasing them on two or three sides from surrounding trees during partial harvesting and tending operations.
- During years of heavy mast production in oaks and beech, consider delaying a harvest of these trees until after the nuts have matured (i.e., Sept or Oct).
- Retaining wild apple trees during timber harvests on old farm properties will protect these sources of soft mast.

Eco Notes

Red squirrel are common throughout Nova Scotia in mature softwood and mixed forest where they feed heavily on seeds found in the cones of softwood trees. They also eat a variety of other forest foods including mushrooms, berries, nuts, insects, mice, bird eggs and the sweet sap from sugar maples.

Photo: DNR (Peter Neily)

Snags

Photo: DNR (Peter Neily)

Description

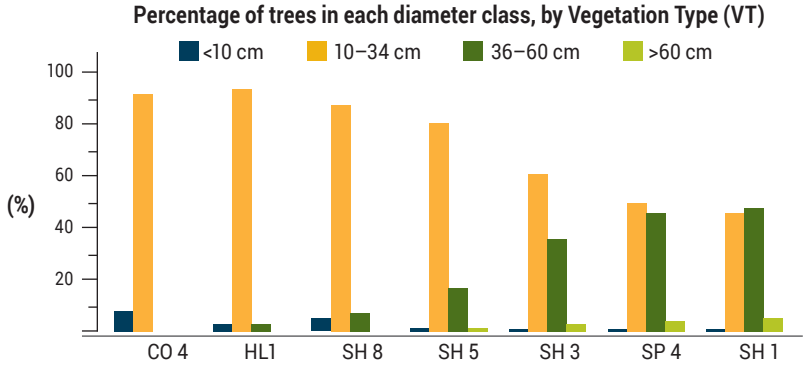
Snags are standing dead and dying trees, which serve as habitat for many wildlife species if left upright. Dead wood results from a variety of disturbances (e.g., windthrow, fire and disease), as well as natural aging.

Importance to Biodiversity

Snags provide important opportunities for birds that use them for nesting, perching, resting, feeding and mating. Bats may seek shelter beneath the loose bark. Broad-winged hawks may perch and nest on the remaining branches. Olive-sided flycatchers may prey on the increasing number of insects that are found in and around the dead tree. Insects, like the spruce bark beetle and carpenter ant, can also cause tree mortality. The beetle feeds on sapwood beneath the conifer bark; the ants cultivate fungi on dead wood for food; and birds like woodpeckers feed on these insects and further excavate the tree.

Stewardship Actions

Hardwood snags tend to be more valuable to cavity nesters and may last longer, but all species will be used. Larger diameter trees have more value as habitat than small diameter trees. Snags that are < 10 cm in diameter have limited use as habitat, and primary cavity-nesting species rarely use them.



Note: Full names of the above Vegetation Types are found in Appendix C

Vegetation Types with red spruce, white pine and hemlock have the potential to have a higher percentage of larger diameter trees that could eventually become snags. Data source: Forest Ecosystem Classification for Nova Scotia (2010)

Best Management Practices –

- Where practical and safe during harvesting, maintain existing snags. If snags must be felled for safety reasons, they should be left in place as coarse woody debris *(See pg 16)*.
- Where possible include the snags within the legacy clumps *(See pg 19)* required under the **Wildlife Habitat and Watercourses Protection Regulations** *(See "LINKS")*.
- During selection management the goal is usually to harvest the poor quality trees first, including dead and dying trees. Where practical, retain 10 or more snags per hectare, with at least one large (> 50 cm diameter) and three medium (> 30 cm diameter) snags per hectare.

LINKS

For detailed and up-to-date information

www.novascotia.ca/just/regulations
and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Eco Notes

Of the six species of woodpecker in Nova Scotia, the pileated is the largest and has the greatest ability to excavate a snag while the sapwood is still firm.

Photo: Mark Elderkin

Super Canopy Trees

Photo: CNS (Len Wagg)

Description

Super canopy trees project above the canopy of dominant and co-dominant trees. They are usually the largest trees on the landscape in height and in some cases diameter. Heavy branches, twisted and seamed boles, and multi-stem tops characterize super canopy trees.

Importance to Biodiversity

Super canopy trees increase the complexity of the upper canopy, providing habitat for species that require tall trees free from surrounding obstructions. For example, they provide habitat for raptors that need large open spaces for aerial maneuvering when chasing prey or during mating rituals. Large raptors such as ospreys, bald eagles, and red-tailed hawks often build stick nests near the top of super canopy trees.

Stewardship Actions

White pine, red spruce and white spruce are the most common species associated with a super canopy. These trees are often the remnants of a previous harvest, and may possess characteristics that make them unsuitable for forest products.

Photo: CNS (Len Wagg)

Probability of White Pine

Low	Probable	High
IH2	OW2	OW4
OW1	SH1	SH2
SH6	SH3	SH4
SP7	SH5	SH9
SP8	SP1a	SP3
	SP2	SP4
	SP6	SP5
		SP9

The potential of Vegetation Types to develop a super canopy of white pine sometime during the successional pathway.

Data source: Forest Ecosystem Classification for Nova Scotia (2010)

Note: Full names of the above Vegetation Types are found in Appendix C

In many instances these trees are too large in diameter for harvest machines to process. Identify super canopy trees when stands are being assessed for harvesting.

Best Management Practices –

- Super canopy trees may be examples of residual old-growth trees in a younger stand. If they can be retained over several harvesting cycles, their value as habitat will increase.
- Where possible, super canopy trees should be maintained at the centre of legacy clumps *(See pg 19)*.
- If active stick nests are present on these trees, avoid forestry activity in the area.
- If there are large raptors in the vicinity and a stick nest cannot be found, use caution during harvest layout to avoid disturbing the birds. Watch for cavity trees if stick nests cannot be found *(See pg 14)*.

Eco Notes

Bald eagles often choose to nest in large white pine with a dead top. *(See Raptor Nests, pg 54)*

Photo: Mark Elderkin

Vertical Stand Structure

Photo: CNS (Len Wagg)

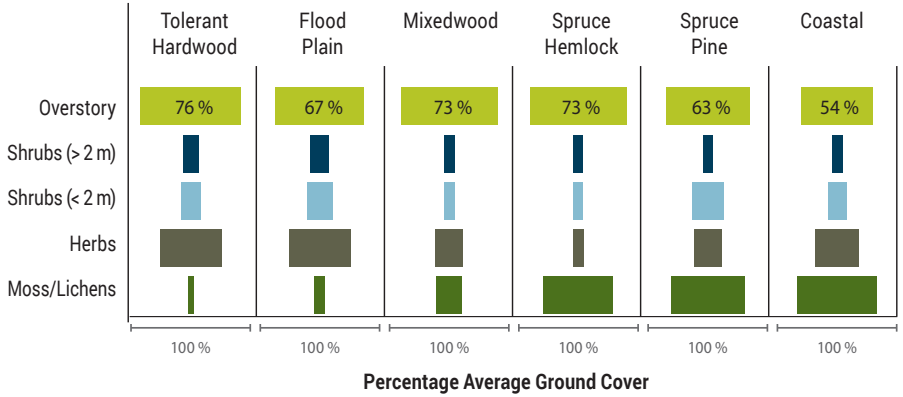
Description

Vertical stand structure refers to the extent in which plants occur in layers within a stand. It is determined by local site and soil factors, species composition (trees, shrubs, herbs, mosses and lichens), and the history of stand disturbances. The amount of crown closure also influences how much layering can occur. Increased vertical structure is directly related to increased habitat diversity and complexity—which in turn enhances potential for biodiversity. Habitat conditions are influenced and changed as gradients of temperature, humidity, light and wind occur at different heights in a stand.

Importance to Biodiversity

While all forest successional stages have some degree of vertical complexity, the types of structures and the representation in a stand tend to increase over time. In general, this means that early successional, even-aged forests tend to have less structural complexity than mature, uneven-aged forests.

The vertical arrangement of forest vegetation has direct impacts on the availability of food and shelter for wildlife. The presence of foliage, seeds and flowers at various heights above the forest floor allows for their use by many different species. In addition, sites are available for perching, resting, shelter, nesting and searching for food.



This chart depicts average percentage ground cover of five layers in a selection of Forest Groups. Note: Tree regeneration and suppressed trees are included in the shrub layers. Data source: Forest Ecosystem Classification for Nova Scotia (2010)

The upper canopies of forests are more productive than any other part of the vertical strata. Here, flowers, fruit and leaves receive maximum sunlight and moisture, attracting particular insects which serve as food for some birds and bats. At lower levels other species of birds and bats, red squirrels, flying squirrels and chipmunks, utilize other food sources and insect species.

Several species of mosses and lichens take advantage of habitat throughout the range of vertical complexity depending on the suitability of sites for attachment and their exposure to sunlight and moisture.

Stewardship Actions

Two dominant forest harvesting systems are used in Nova Scotia: even-aged and uneven-aged. Each has unique effects on stand structure. Complex vertical structure is easier to achieve in stands that contain shade-tolerant long-lived tree species that can occupy multiple canopy layers. The Forest Ecosystem Classification for Nova Scotia (NS FEC) can be used to identify forest communities (stand Vegetation Types) that are best suited to the above harvesting systems.

Best Management Practices –

- For **even-aged** stand management, use shelterwood harvesting where appropriate to maintain and enhance vertical structure.
- For **uneven-aged** stand management use individual tree or group selection harvesting to maintain and develop vertical structure.
- During partial harvesting, maintain tree species composition consistent with site conditions, Vegetation Type, and successional stages of stands *(Refer to NS FEC for guidance, pg 11)*.
- Maintain mature vertical structure during thinning and shelterwood operations by leaving trees that will increase variability in tree height and species diversity.
- Promote a range of vertical structures by retaining some areas as closed-canopy forest with sparse understory, and other areas with open canopies and dense understory.

Eco Notes

An example of a stand with a relatively simple vertical structure is mature red pine forest.

Photo: DNR (Peter Neily)

Tree Composition

Photo: CNS (Len Wagg)

Description

The composition of trees in forest stands strongly influences stand structure and ecological processes. Trees in the overstory shape the distribution and abundance of other forest dwelling species by regulating available light and nutrients, and by shaping microclimatic conditions. When the composition or density of the overstory changes after natural disturbance or tree harvesting, the relationship between trees and other species is strongly altered in the lower layers of the forest.

Importance to Biodiversity

As the largest plants in our forests, trees play a strong role in shaping the structure, composition, and function of forest ecosystems in Nova Scotia. In addition, maintaining natural composition levels in stands has the potential to reduce susceptibility to natural catastrophes, and to facilitate adaptation to climate change. The life cycles of many wildlife species are also influenced by tree composition. Plant life beneath the canopy is influenced by the size and shape of tree structures, and by whether those trees are hardwood or conifer. Tree species composition affects the quality and quantity of litter that is present on the forest floor, and has an important role in soil processes such as nutrient availability and cycling of organic materials.

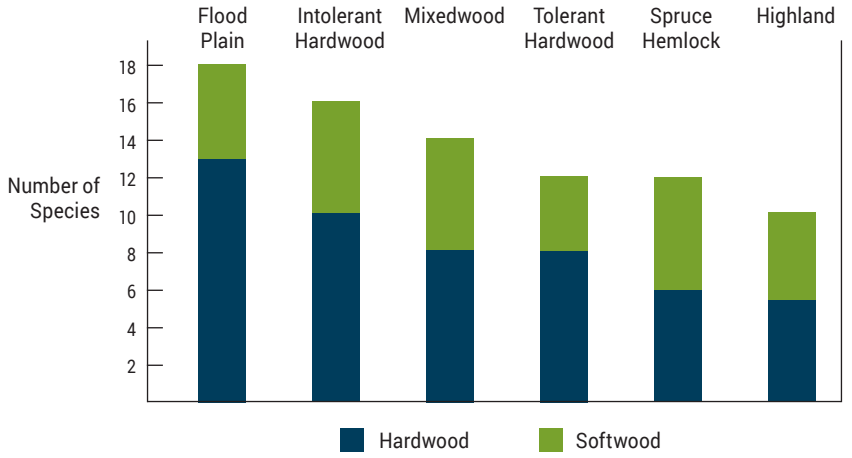
Stewardship Actions

Where small patches of hardwood trees occur in conifer forests, and conifers in hardwood forests, important habitat conditions and associated wildlife species may occur that are not found elsewhere in the stand. These small patches likely reflect changes in site conditions or may originate from past disturbances. The Forest Ecosystem Classification for Nova Scotia (NS FEC) provides guidance on typical species composition among Vegetation Types (stand types).

Best Management Practices –

- Maintain tree and large woody shrub species consistent with natural site conditions, Vegetation Type, and successional stages of stands *(Refer to NS FEC for guidance, pg 11)*.
- Where practical, conserve uncommon native tree species in stands, and remnants of older stands, by leaving them within legacy patches *(See Legacy Trees & Features, pg 19).* This maintains their presence and encourages their regeneration.
- Maintaining hardwood inclusions in conifer stands, and conifer inclusions in hardwood stands is most effective where they result from permanent site factors.
- During selection harvests, maintain species mixtures that are reflective of natural conditions, and protect advanced regeneration.
- Promote diversity in early successional stands by protecting regeneration of late successional species like sugar maple, yellow birch, red spruce, and eastern hemlock.

Photo: CNS (Len Wagg)



The diversity of tree species is influenced by many factors including site, disturbance and climate. The above illustrates the tree species composition of several Forest Groups. Data source: Forest Ecosystem Classification for Nova Scotia (2010)

Eco Notes

Yellow-bellied sapsuckers drill holes in the bark of trees to extract sap as a food source. Wasps and other insects are attracted to these holes, and sapsuckers will feed on those that get trapped in the sap. Other birds (including woodpeckers, hummingbirds, and nuthatches) also use these holes for feeding.

Birches and maples are the preferred food source for sapsuckers, but white spruce and balsam fir are used in the early spring before the hardwoods have leafed out.

Photo: DNR (Eugene Quigley)

Old Growth

Photo: DNR (Peter Neily)

Description

Old growth forests are structurally diverse stands of older, usually late-successional trees. Typical characteristics include a patchy, multi-layered canopy made up of trees of several age classes and species dominated by large overstory trees. Senescence or disturbances creates on-going gaps in the canopy, which younger trees then grow to fill. The forest also includes occasional dead-topped trees or snags and abundant coarse woody debris. Old growth forest can exist as hardwood, conifer or mixed stands in various topographic positions, and can occur in all ecoregions in the province.

Importance to Biodiversity

Old growth stands are significant due to their advanced age class, large tree size, presence of snags and fallen woody debris, and their ecological processes. These unique structures and long developmental processes provide distinct habitat and interconnections that are not found in other forest types. For example, some species of lichen are found only in old growth stands.

Stewardship Actions

The Old Forest Policy defines old growth as a forest stand where 30 per cent or more of the basal area is in trees 125 years or older, at least half the basal area is composed of climax species, and total crown closure is a minimum of 30 per cent.

	Species	Height (m)	Diameter (cm) *	Age (years) *
Softwood	Hemlock	26.6	102.0	287
	Red spruce	27.8	70.0	194
	White pine	31.2	100.0	174
Hardwood	Sugar maple	28.7	90.0	215
	Yellow birch	24.2	98.0	260
	Beech	24.5	66.0	175

** Diameter and Age measured at the 1.3 m height*

Maximum tree height, diameter and age of late successional Acadian Forest species from NSDNR Forest Ecosystem Classification sample plots (2000–2015)

It is important to ensure that adequate old growth exists on the landscape to maintain the elements of biodiversity that old growth contributes.

Crown Forest Policy –

- Evaluate potential old growth stands using the Old Forest Scoresheet, and consider for conservation *(See "LINKS")*.
- Make use of mature cover adjacent to old growth stands to sustain interior forest conditions and reduce edge effect impacts.
- Movement of wildlife associated with old growth can be supported by maintaining elements of mature forests in surrounding stands.
- Where restoration is desired, promote old growth forest development by conserving stands composed of mature late-successional tree species.

LINKS *For detailed and up-to-date information*

For further guidance on scoring and selecting old growth, see NSDNR **Old Forest Policy**: novascotia.ca/natr/forestry/programs/ecosystems/oldgrowth.asp

Eco Notes

One of the oldest trees measured in Nova Scotia is a 435-year-old hemlock from Lunenburg County. Hemlock varnish shelf fungus is often found in old growth on decaying hemlock. These mushrooms (also known as Reishi) are considered to have strong medicinal properties and are often powdered and used in teas.

Photo: DNR (Peter Neily)

NOTES

Special Habitats

Caves

Photo: DNR (Sean Basquill)

Description

A cave is a naturally created hollow extending underground, usually formed by the weathering of rock. Cave can also refer to openings in rock faces caused by erosion or by mining.

Importance to Biodiversity

Providing dark, stable, internal environments, caves lend important attributes to the biodiversity of a landscape. They provide shelter from weather and predators, and may support species that live their entire lifespan within caves. The presence of water in caves increases the diversity of wildlife species using them, from aquatic organisms like amphipods (freshwater shrimp), to insect populations such as mole crickets. Other species that utilize caves include black bears, bobcats, raccoons and porcupines.

Photo: Sean Blaney, AC CDC

Bats are perhaps the most notable species group associated with caves, although snakes also use them as overwintering sites.
A fungal disease called white-nose syndrome has recently decimated bat populations in Nova Scotia and throughout much of north-eastern North America, infecting them during hibernation.

Stewardship Actions

Where limestone, gypsum or dolomite sinkholes are present, there is a possible safety hazard if heavy equipment is traversing the area. Subterranean voids are possible in these locations (caused by the easily eroded bedrock).

Best Management Practices –

- Caves can be unstable and hazardous. To minimize disturbance to biodiversity, and for your own safety, never go inside a cave
- The location of potential geohazards, such as abandoned mine openings, karst areas, and underground coal workings, can be viewed on-line *(See "LINKS")*. Please report any additional geohazards found on Crown lands to your nearest Department of Natural Resources office *(See Appendix D)*.
- Caves, if discovered, should be protected to the greatest extent possible, since their presence indicates a significant and unique contribution to biodiversity.
- Overwintering bats are easily disturbed by direct human disturbance, noise and vibration. Avoid forest harvesting between November 1 and April 30 within 100 m of caves that are known bat overwintering sites.

Legal Requirements –

It is a violation of the **NS Endangered Species Act** to destroy or disturb the hibernaculum or den of an endangered or threatened species at risk *(e.g., See Bats, page 87)*.

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/meb/hazard-assessment/abandoned-mines.asp

Eco Notes

Waking true hibernators such as bats has huge "energy" costs for the animal—each awakening burns irreplaceable fat reserves, which it needs as fuel to stay in hibernation until spring.

Little brown myotis (Myotis lucifugus)

Photo: Dr. Hugh Broders

Deer Wintering Areas

Photo: DNR (Terry Power)

Description

Deer wintering areas, also called deer yards, refer to forested locations where white-tailed deer congregate in winter. Once snow depth exceeds 20 cm, deer may begin to congregate in conifer stands which provide thermal cover, shallower snow and access to food. Deer yards often occur in fertile riparian areas or on south-facing slopes which provide shelter from wind and maximum exposure to the sun. Yards are generally irregularly-shaped, mature softwood or mixed stands which offer cover, as well as access to acceptable browse. The number of deer utilizing wintering areas is extremely variable, and patterns of use may vary from year to year.

Importance to Biodiversity

Congregating in winter is one means of dealing with harsh winter conditions and enhancing survival. The movement of deer into wintering areas in response to snow depth is thought to maximize browse availability, evade predators, lessen energetic costs associated with moving through deep snow, and help conserve body heat in low temperatures.

Stewardship Actions

Forest managers should be mindful that timber harvesting in deer wintering habitat during the period when snow restricts deer movements may negatively impact their health and survival. Hemlock appears to be the most favoured thermal cover, followed by spruce and fir. Dimensions of wintering areas are difficult to predict, however the size should be large enough that in winters with deep snow (> 50 cm), deer can establish trail networks and avenues of escape.

Crown Forest Policy –

The following are selected from the **Special Management Practices** for deer wintering areas. Complete guidelines are available on-line *(See "LINKS")*.

- Sites currently used by overwintering deer should be identified on the working landscape, and provision made to retain areas of dense mature conifers and adjacent feeding areas (e.g., cutovers with regenerating hardwood) for winter habitat. If available, retain hemlock as thermal cover.
- Where winters are usually severe, at least 50 per cent of conifer cover should be retained as uncut shelter patches (i.e., each patch a minimum of 10 ha; conifers at least 10 m in height; and crown closure of 60 to 80 per cent).
- Where winters are usually not severe, at least 30 per cent of conifer cover should be retained as uncut shelter patches (i.e., each patch a minimum of 5 ha; conifers at least 10 m in height; and crown closure of at least 30 per cent).
- Avoid creating openings greater than 10 ha in wintering areas.
- Selection harvesting and patch cutting should be used where appropriate to encourage regeneration of browse species.
- Where shelter and forage areas are separated, mature softwood corridors for travel should be provided.
- To reduce predation on deer in wintering areas, a minimum of 10 ha of conifer cover is suggested.

LINKS *For detailed and up-to-date information*

Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Eco Notes

During early spring, deer often move to south-facing hardwood stands during the day to bed in the sun's warmth and to browse for beechnuts and acorns exposed by sun and wind.

Photo: DNR

Dens

Main photo: DNR (Eugene Quigley); Inset : CNS (Len Wagg)

Description

Dens are generally described as a place of shelter or lair used by some animals as protection from predators and outside environmental conditions like extreme temperatures or precipitation. As special habitat within ecosystems, den sites are widely variable. They include cavities in trees, uprooted trees, built vegetated lodges (e.g., beaver and muskrat dens), caves, excavations in the soil (e.g., holes, tunnels, burrows) and natural openings in rock fissures and rock piles.

Importance to Biodiversity

Many mammal species use dens for shelter, including red fox, Eastern coyote, black bear and bobcat. American marten and fisher are among the arboreal mammals that use tree cavities as dens. Mammals that den in the upper layers (< 1 m) of forest soil and among tree roots include black bears and woodchucks. Bears may also scoop out dens in shallow depressions in which to hibernate.

Photo: Mark Elderkin

Stewardship Actions

Many species (including marten and fisher) require large areas of mature conifer forest with suitable large-diameter trees for dens. Conserving representative areas of mature conifers across the landscape, and ensuring the existence of large trees, provides needed habitat for these animals and other denning species.

Best Management Practices –

- Where permanent dens are present, forest stewardship planning should account for the conservation of these habitats. Leaving undisturbed buffers around den sites will provide continued use of the sites.
- A single disturbance to a den site at the wrong time can cause an animal to permanently abandon the den site. Avoid disturbing existing dens—especially in the springtime and early summer if the den is being used to raise offspring.
- Avoid damaging hollow logs and stumps during harvesting, and when possible leave large woody material distributed throughout the harvest site.
- Incorporate dens into legacy clumps where possible *(See pg 19).*

Legal Requirements –

- It is a violation of the **NS Wildlife Act** to destroy, disturb or damage the den of a fur-bearing animal. It is a violation of the **NS Endangered Species Act** to destroy or disturb the den of an endangered or threatened species. *(See SAR section, pg 82)*

Eco Notes

Large tree cavities that open to the forest floor and fallen hollow logs provide shelter for many ground-dwelling forest animals.

In the summer garter snakes often den beneath boulders and in rock crevices in the forest—to avoid predators and hot temperatures. Before the arrival of winter, garter snakes can travel several kilometres to large underground communal den sites to escape frigid temperatures.

Photo: DNR (Peter Neily)

Great Blue Heron Colonies

Photo: CNS (Len Wagg)

Description

Nesting colonies of great blue heron are frequently located in areas that are both isolated from human disturbance and adjacent to water (e.g., swamps, marshes, beaver ponds, and woodlots). In Nova Scotia 70 per cent of all heronries, especially the larger and more viable ones, are on islands isolated from human and mammal contact. The mainland colonies tend to be smaller and more transitory.

Importance to Biodiversity

Herons are especially vulnerable to disturbance and habitat alteration during the breeding season (March to August) when large numbers of birds are concentrated in a colony. Herons tend to desert nests, and even entire colonies, if disturbed during periods of pair forming (late March), nest construction (early April), or early egg laying (mid to late April). Herons continue to be sensitive to disturbance following hatch (June) until the young fledge (early August).

Photo: Andrew Kennedy

Stewardship Actions

Herons are extremely sensitive to disturbance when nesting. If planning any forest harvest or silviculture within 1 km of an active heron colony, contact a Department of Natural Resources office *(See Appendix D)* for help in planning your forest operation and reducing disturbance.

Photo: CNS (Len Wagg)

Crown Forest Policy –

The following are selected from the **Special Management Practices** for heron colonies. Complete guidelines are available on-line *(See "LINKS")*.

- A primary zone, with no timber harvest or removal or alteration of trees and ground vegetation at any time of the year, extends at least 150 m out from the nests on the edge of small colonies (< 30 nests) to a minimum of 300 m for larger colonies.
- A secondary zone extends up to 1 km from the peripheral nests of the colony, and activities such as road construction, forest harvesting, and major construction should be avoided during the nesting season.
- For heronries located on islands, all efforts should be made to leave the islands undisturbed.
- Abandoned heronries may be re-occupied and should not be damaged.

Legal Requirements –

- It is a violation of the **NS Wildlife Act** to disturb the Great Blue Heron nests. Great Blue Herons are also protected under federal laws including the **Migratory Bird Convention Act.**

LINKS *For detailed and up-to-date information*

Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Eco Notes

Great blue herons are the largest heron species in North America. In the spring and summer, these migratory birds are found throughout Nova Scotia. They are often seen wading in the shallow wetlands where they feed on small fish, amphibians, reptiles and small mammals.

Hibernacula

Photo: Dr. Hugh Broders

Description

Hibernacula are places of shelter for wildlife species that are unable to migrate or remain active during the coldest winter months. In these shelters wildlife pass the winter in a sleeping or inactive state called hibernation. Hibernacula come in many types depending upon the species using them. They include abandoned mines, caves, hollow trees, stumps and small woodland ponds.

Importance to Biodiversity

Black bears, raccoons and skunks are light hibernators and are easily woken. Chipmunks, woodchucks and bats are true hibernators and enter a period of inactivity and depressed metabolism. While some insects and invertebrates are capable of avoiding freezing by lowering the freezing point of body fluids, vertebrates must spend their dormancy in a refuge that allows them to maintain core body temperatures above a minimum threshold. Some reptiles and amphibians, such as turtles and frogs, use small forest pools, ponds and brooks for overwintering.

Photo: DNR (Peter Neily)

Stewardship Actions

Forestry operations (including road construction, tree harvesting and silviculture) can disturb hibernating mammals if cavity trees are cut or trees are uprooted. Bats can be roused if activity disturbs them during dormancy, often with fatal consequences. Large brush piles are sometimes used by overwintering bears. Where this is suspected, forest operations should be avoided.

Best Management Practices –

- Reducing winter activity around known hibernation sites will allow hibernating mammals to conserve crucial energy stores.
- Consider leaving large cavity trees and legacy trees for future use by wildlife species.
- Avoid operations close to woodland pools and ponds, if siltation may result.
- Never enter caves or abandoned mines, and avoid harvesting disturbances nearby during winter when they may be used as hiberacula.

  The location of potential geohazards, such as abandoned mine openings, karst areas, and underground coal workings, can be viewed on-line. *(See "LINKS")*. Please report any additional geo-hazards found on Crown lands to your nearest Natural Resources office *(See Appendix D)*.

Legal Requirements –

- It is a violation of the **NS Endangered Species Act** to destroy or disturb the hibernaculum of an endangered or threatened species. *(See SAR section, pg 82)*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/meb/hazard-assessment/abandoned-mines.asp

Eco Notes

Some animals, including black bears and raccoons, do not enter true hibernation; they reduce their body temperature by only a few degrees.

Photo: DNR (Mike Boudreau)

Karst

Photo: Reg Newell

Description

Karst is a rugged and irregular kind of topography with diverse surface expression including cliffs, caves, fissures, talus, pinnacles, sinkholes and/or underground streams—all created by the dissolving of soluble rock such as limestone and gypsum. In Nova Scotia most karst forms when the overlying soil is less than 1 m thick, although in some areas it may be up to 5 m thick. Exposed gypsum outcrops and sinkholes are the best indicators of karst.

Importance to Biodiversity

The calcererous soils associated with karst topography support the greatest diversity of snails in the province. Rare plants such as ram's head lady's slipper and bulblet bladder fern are found exclusively on karst. Other rare plants associated with karst include yellow lady's slipper, leatherwood, shepherdia, and hyssop-leaved fleabane. Where caves and fissures are created in karst, habitat for bats, porcupines and other mammals is present.

Photos: DNR (Peter Neily)

Stewardship Actions

Photo: DNR (Peter Neily)

Yellow lady's slipper (Cypripedium parviflorum)

Karst will form more readily the closer easily-erodible rocks (like gypsum and limestone) are to the surface.

Karst features can be structurally fragile and can pose a safety risk to human accessibility. Forestry operations in and around these features should exercise caution, particularly with heavy equipment.

Best Management Practices –

- Karst topography is ecologically fragile. Harvesting on karst sites should be avoided or carefully planned to minimize damage, especially where rare plants and caves are known.
  (See Caves, page 38)

Eco Notes

Gypsum karst forests are rare in the temperate region of Canada, with most examples found in Nova Scotia.

Photo: DNR (Eugene Quigley)

Open Woodlands

Inset: Mountain laurel Photos: DNR (Eugene Quigley)

Description

Sites that support tree growth but have less than 30 per cent crown closure, because of limiting site and soil conditions, belong to the Open Woodland Forest Group. Woody shrubs (primarily ericaceous species) and reindeer lichen are common. Open woodland can also be found on sites with exposed bedrock, excessive surface stoniness, sandy soil, talus slopes, and on sites with frequent wildfires. Often open woodlands are embedded as smaller ecosystems within a larger forested condition.

Importance to Biodiversity

Open woodland ecosystems can support biodiversity elements not found in other Forest Groups. Plants such as cow-wheat, three-toothed cinquefoil, rice grass, black crowberry, and broom crowberry may grow among extensive patches of reindeer lichen. On talus, rock vole or Gaspé shrew may use rock outcrops and ledges for sunning. Vesper sparrow may perch among wild raisin and huckleberry shrubs in open woodland.

(far left) Grey reindeer lichen (Cladina rangiferina)

(left) Broom and Black crowberry (Corema conradii and Empetrum nigrum)

Photos: DNR (Peter Neily)

Photo: DNR (Peter Neily)

Stewardship Actions

Most open woodlands have little pressure from forestry, as they occur in conditions that do not normally support operable wood volumes. Productivity, tree age, canopy height and old growth potential are all low. Windthrow and fire are the main disturbance agents.

Best Management Practices –

- Forest access roads should be sited to avoid open woodlands.
- Hiking trails should be carefully sited. Efforts should be made to minimize off-trail use, which can degrade sensitive vegetation.
- All Vegetation Types of the Open Woodland Forest Group (identified in NS FEC), should be avoided during forest management activities.
- Consider maintaining adjacent wooded conditions to help protect the ecology of these special areas.

Eco Notes

The Vegetation Type "Red pine-White pine / Broom crowberry / Grey reindeer lichen (OW4)," is uncommon in Nova Scotia—and not found anywhere else in the world. Many species of high conservation concern are associated with this vegetation type including rockrose, pine barren golden heather and Dixie reindeer lichen.

Photo: Sean Blaney, AC CDC

Persistent Stand Openings

Photo: DNR (Peter Neily)

Description

Open areas within forest stands that have been created by disturbance, or that result from localized soil limitations, may persist for many years, maintaining small ecosystems distinct from the surrounding forest. These gaps are often densely vegetated with grasses, ferns, other herbaceous plants and are sometimes called “glades.” Somewhat similar in black spruce—pine forests are small openings covered with ericaceous shrubs and reindeer lichen.

Importance to Biodiversity

Maintaining portions of managed woodlands as small openings can be important—from a habitat and biodiversity perspective. Many species of wildlife use small sheltered openings for feeding, resting, breeding and nesting. Species such as woodcock require openings for courtship displays and nesting, while common nighthawks (a threatened species) nest on the ground in open habitats with sparse vegetation. White-tailed deer and snowshoe hare feed and rest in openings. Ruffed grouse, woodcock and common nighthawk prefer these smaller habitats over the larger openings typically associated with larger scale forest harvesting.

Photo: DNR (Eugene Quigley)

Hay-scented fern (Dennstaedtia punctilobula)

Stewardship Actions

Where woodland access roads and landings have been constructed, road features can serve as habitat openings for decades once grasses and forbs become established.

Best Management Practices –

- Openings can be maintained by removing encroaching trees.
- Soils in natural openings should not be significantly disturbed during forest harvesting.

Eco Notes

Inactive agricultural land may provide openings for several decades following abandonment. On these sites, apple trees are sometimes present, which enhances habitat values. Old apple trees can be retained, and released from surrounding competing vegetation such as white spruce.

Openings in tolerant hardwood stands may be colonized by hay-scented fern, which can be very invasive and spread aggressively, restricting tree regeneration and other herbs and shrubs.

Voles, shrews and other rodents move freely in the thicket of ferns and feed on seeds of competing plants before they can germinate. The ferns protect the small mammals from owls, foxes and other predators.

Red-backed Vole (Myodes gapperi)

Photo: Mark Elderkin

Raptor Nests

Inset: Red-tailed hawk Photos: DNR (Banner: Eugene Quigley, Inset: Peter Neily)

Description

Forest raptors are predatory birds, including eagles, hawks, falcons and owls. Their habitat in Nova Scotia varies widely—from mature interior forest to wetlands, cutovers and fields. There are several species that build stick nests in trees or use old nests of other species. Nest size ranges from 50 cm in diameter for broad-winged hawk to more than a metre for bald eagle, osprey and Northern goshawk.

Importance to Biodiversity

Raptors are generally top predators in ecosystems and an important indicator of ecosystem health. Their breeding sites are rich in biodiversity—having an abundance and diversity of birds, insects and tree species. Raptor breeding sites can be used to find forests of high biodiversity value. Most hawks build their own stick nests, which when later abandoned are used by other species including owls, merlins and squirrels.

Stewardship Actions

White pine is the preferred site for some of the largest nesters, including bald eagle, red-tailed hawk and osprey. Northern goshawk prefer large hardwood trees (with strong triple-branch main forks) in closed-canopy stands, or large white pine trees. Other raptors (such as barred owl and great horned owl) will build stick nests or occupy tree cavities. Some species, including Northern goshawk, cannot tolerate disturbance: caution is required to prevent these large raptors from abandoning nests during critical nesting periods.

Crown Forest Policy –

Bald Eagles

The following are selected from the **Special Management Practices** for bald eagle nests. Complete guidelines are available on-line *(See "LINKS")*.

- Within 200 m of an active nest no clearcutting, land clearing or road construction is permitted.
- In a zone 100–200 m from the active nest non-clearcut forest harvesting and silviculture my be conducted outside of the breeding season (February 1 to July 31).
- Similar guidelines apply to inactive nests between February 1 and March 31. If the site remains inactive non-clearcut forest harvesting and silviculture can proceed beginning April 1 in a zone 20 m from the inactive nest.

Other Raptors

- No harvesting or road construction within 200 m of an active goshawk nest at all times of the year.
- For all other raptors no harvesting or road construction within 100 m during the nesting period March 1 to August 15. When harvesting near a nest outside of the restricted period, leave a clump of trees large enough to conceal the nest and to provide perching sites.

Legal Requirements –

- It is a violation of the **Nova Scotia Wildlife Act** to disturb raptor nests.

LINKS *For detailed and up-to-date information*

Forest Raptors and Their Nests in Central Ontario (1998)
www.ontariowoodlot.com/publications/owa-publications/landowner-guides/forest-raptors-and-their-nests-in-central-ontario

Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Eco Notes

Barred owls usually nest high off the ground in the cavities of large trees of old forest or in abandoned large stick built nests of other birds. These non-migratory nocturnal predators feed on a variety of small mammals including voles and mice, and spend most of the days resting in the protective cover of thick coniferous trees.

Photo: DNR (Peter Neily)

Talus, Cliffs, Banks & Rocky Outcrops

Photo: CNS (Len Wagg)

Description

Talus is a type of deposit created when falling rock fragments form a continuous slope or basal cone at the bottom of a cliff or steep slope. Cliffs are exposed rock outcrops with a near-vertical face. Sometimes cliffs are exposed for several kilometres forming a linear landscape feature called an escarpment. Outcrops and ledges are other examples of exposed rock. Banks are cliffs or steep slopes composed of materials such as soil or gravel. They are formed by gravity or processes associated with watercourses.

Importance to Biodiversity

Variation in talus rock fragment size, shape and stability can result in diverse types of talus habitat. South and west-facing talus may be more desirable for snakes and small mammals to use for sunning. Mosses, lichens and plants eventually establish on older talus.

The diversity of microhabitats on cliffs increases their potential for protecting wildlife from weather conditions and predators, especially during nesting. Cliff height, rock type and geographical location influence habitat quality. Thermal movement of air upward across cliff faces increases their suitability as perches, roosts and nesting sites for raptors and corvids. The updrafts provide aerodynamic lift for eagles, hawks, falcons and ravens. Vertical and horizontal cracks in cliff faces may be utilized by bats, small mammals and bank (cliff) swallows. Nests and dens are protected from terrestrial predators by their inaccessible locations.

Photo: Alain Belliveau, AC CDC

Ledges, rocky outcrops and stable banks can be significant habitat features with value as lookouts and sunning areas for mammals and nesting sites for birds. Red fox and Eastern coyote use these sites as territory boundaries, marking them with urine or scat. Where escarpments are stable, they may be used by bank swallows.

Stewardship Actions

For the most part, these biodiversity features do not support operable forest stands or stands of commercial value. Due to their sensitivity, these sites should be avoided when harvesting nearby.

Best Management Practices –

- Shallow soils, stoniness and low productivity indicate that caution should be exercised when working near or on outcrops.
- Protect soil and gravel escarpments from increased erosion by leaving buffers of standing trees and vegetation.

Eco Notes

Talus slopes and rocky outcrops may seem devoid of wildlife, but these sparsely vegetated areas are home to rock voles, Gaspé shrews and long-tailed shrews (the latter two are species at risk). Predators, including hawks, owls, snakes and small carnivorous mammals, also use these areas to hunt.

Photo: CNS (Len Wagg)

NOTES

Watercourses and Wet Forests

Beaver Ponds

Photo: Rob Fraser, Ducks Unlimited Canada

Description

A flooded ecosystem created by the construction of a dam(s) by beaver. The dams regulate water flow, keeping constant water levels during times of little precipitation and providing winter water depths which will not freeze to the bottom. During the winter beaver sustain themselves on the bark of cached branches and logs, usually submerged in holding areas close to lodges and dens. As a result of slow water movement from the damming, sediments accumulate on the bottom of flowages, enriching the soil beneath. Because they feed on tree bark, beaver tend to construct dams in areas of aspen, birch and alder.

Importance to Biodiversity

By increasing aquatic productivity, beaver ponds significantly contribute to ecosystem richness and biodiversity. The resulting flooded forest greatly changes the ecosystem dynamics of the site providing:

- Dead standing trees that are used as snags and cavity trees. These may be excavated by woodpeckers and used later by cavity nesters such as wood ducks.
- Increased habitat diversity including new habitat for wetland wildlife including muskrat, mink, otter and fish.
- Good foraging habitat for insect eaters such as bats and fly-catchers, which feed in the open spaces above beaver ponds.
- Osprey nesting sites near ponds where fish are present.
- Feeding areas for wading birds such as great blue heron, which prey on reptiles, fish and amphibians.
- Shelter and food sources for amphibians and reptiles, including Nova Scotia's four freshwater turtle species (Blanding's, Eastern painted, snapping, and wood turtles).

Stewardship Actions

For some woodland owners, the presence of beaver and their activities are a nuisance. Beaver can plug culverts with branches and mud, flood access roads, damage timber, and use roads as bases for new dams. For nuisance beaver problems, refer to Nuisance Fact Sheets *(See "LINKS")*.

Best Management Practices –

- Maintain biodiversity features created by beaver ponds and adjacent meadows.
- Design and locate new roads and crossings to minimize potential for attracting beavers. Reduce crossings and avoid small or multiple culverts in favour of a single, large culvert.
- Install appropriate water-control systems where flooding is anticipated to limit damage to access roads and standing timber.

Legal Requirements –

- Except under permit, it is a violation of the **NS Wildlife Act** to disturb or damage the den or dam of a beaver. Consult the **Wildlife Habitat and Watercourses Protection Regulations** to ensure that appropriate Special Management Zones have been assigned to watercourses *(See "LINKS")*.

LINKS *For detailed and up-to-date information*

Nuisance Fact Sheets novascotia.ca/natr/wildlife/living-with-wildlife/

www.novascotia.ca/just/regulations/ and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Eco Notes

Beaver are herbivores and can eat a variety of plants, but prefer the soft inner bark of deciduous trees like aspen, birch, maple and willow. A beaver's front teeth are chisel sharp. They grow continuously so don't get worn down from chewing the trees they use for dams and lodges, and for food.

Photo: Alain Belliveau, AC CDC

Floodplains

Photo: DNR (Peter Neily)

Description

Floodplains are areas along rivers and large streams that are periodically flooded, typically in spring after snowmelt and after large rain events. They include a variety of habitats such as marshes, meadows, beaches and forests. Floodplain forests today are mainly mixed hardwood forests of red maple, sugar maple and white ash, often with scattered white spruce. Historically, elm, black cherry and black ash were more common. The understory is characterized by a species-rich herb layer with few mosses.

Importance to Biodiversity

Floodplains contain the highest species diversity of any Forest Group in Nova Scotia. Periodic flooding creates ephemeral channels and levees which, although relatively small, can remain active for a time after a flooding event. Inactive channels may form ox-bow topography with rich soils, with associated herbs such as bloodroot, ostrich fern and meadow rue. The richness promotes growth of some of our rarest herbs (e.g., Canada lily, blue cohosh, wild leek). The richness of riparian forest is also reflected in the number of wildlife species that spend at least part of their lives in these areas. They are important nesting areas for reptiles such as wood turtles and many warbler species, and feeding areas for kingfishers, great blue herons, woodpeckers and otters, among a host of other wildlife. Vernal pools may also be present, attracting a host of amphibian species like wood frogs, red efts and blue-spotted salamanders. During and after flood events, floodplains can be temporary habitat for fish.

Stewardship Actions

The sediments that get washed into these areas with each periodic flood make floodplains our most fertile forest and prime lands for agriculture. Few large floodplain forests remain for this reason. Forestry activities in floodplain/riparian areas have the potential to affect many species due to their high species diversity. It is important that sufficient planning is completed before undertaking harvesting work in or near these areas.

Best Management Practices –

- Because of the diversity and richness of floodplain/riparian sites, extensive disturbance should be avoided.
- If harvesting is to be scheduled, consider using an uneven-aged approach, consistent with **forest management guides**. *(See Glossary, pg 116)*
- Harvesting when the ground is frozen or during the driest part of the year will minimize or eliminate rutting.
- Consider forest restoration on abandoned agricultural land located on floodplains.

Legal Requirements –

- Consult the **Wildlife Habitat and Watercourses Protection Regulations** to ensure that appropriate Special Management Zones have been assigned to watercourses *(See "LINKS")*.

LINKS *For detailed and up-to-date information*

www.novascotia.ca/just/regulations/ and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Forest Management Guides
novascotia.ca/natr/forestry/programs/timberman/pta.asp

Eco Notes

Bloodroot is typically found on floodplains and blooms before the foliage opens in the spring. Bloodroot seeds are spread by ants which eat the fleshy part before discarding the seeds in their nest debris. The showy flowers disappoint various bees and flies as they produce pollen but no nectar. A break in the plant, especially the roots, produces a sap that can be used as a red dye.

Photo: DNR (Peter Neily)

Seeps and Springs

Photo: DNR (Peter Neily)

Description

Seeps and springs are places where groundwater escapes through the forest floor and saturates or floods the soil for part of the growing season. Seeps typically originate near breaks in the slope, and often return underground further down slope. Springs often originate as small pools that remain above ground year-round and may spill out as small, intermittent streams downslope from the pool. Both seeps and springs can remain unfrozen for long periods during the winter because of the warming effect of groundwater, which stays above freezing all year. Rich hardwood seepages occur on upland slopes where nutrient rich groundwater escapes through the forest floor. The nearby presence of rich-site plants (including white ash, ironwood and sugar maple) differentiates this seepage from other less fertile seeps where sphagnum moss and softwood trees are usually abundant.

Importance to Biodiversity

Seeps and springs create micro-habitat for many species of wildlife. Both are a reliable source of fresh water, and seeps are often hibernation sites for amphibians that overwinter in the unfrozen ground. In the spring these areas are often epicentres for wildlife activity. An abundance of insects and earthworms provide food for woodcock and other migratory birds early in the season. Springs are used as breeding sites for frogs and salamanders. The early green herbaceous vegetation around seeps and springs provides an important food source for black bear emerging from hibernation. Small mammals such as star-nosed moles and voles, which are drawn to these oasis-like features, are preyed upon by sharp-shinned hawks, foxes and other predators.

(l to r) Sensitive fern; Red baneberry; Woodland Horsetail – plants associated with rich hardwood seepages

Photos: DNR (Eugene Quigley) (sensitive fern and horsetail), Alain Belliveau, AC CDC (red baneberry)

Stewardship Actions

Seepages discovered during pre-treatment assessment (PTA) should be marked and identified on harvest plans. Lay out roads and wood extraction trails during times of the year when seeps and springs are most visible.

Best Management Practices –

- Avoid operating heavy equipment where ground disturbance could lead to rutting, soil compaction or soil runoff near identified springs and seeps.
- Utilize properly sized culverts and portable crossings where groundwater flow cannot be avoided, and place them downstream of springs, if possible.
- Avoid disturbing the ground upslope of seeps and springs.
- Where legacy clumps *(See Legacy Trees & Features, pg 19)* are to be left, the areas around seeps and springs can be chosen to enhance the habitat values of the clumps.
- Maintain adjacent forest cover to help protect the ecology of these special areas. Where consistent with forest management guides, favour the selection harvesting method when working close to seeps and springs.

Eco Notes

American woodcock are small stocky migratory "shorebirds" that breed in old fields and young forest. These birds move slowly along the forest floor, probing their long bills into the soil seeking worms—their favorite food. Although difficult to see, in late April to mid-May male woodcock can easily be heard giving their loud "*peent*" call just after sunset.

Photo: Mark Elderkin

Treed Wetlands

Inset: Round-leaved sundew Photos: DNR (Peter Neily)

Description

Treed wetlands occur in forests where the water table is close to the surface and mineral or organic soils are saturated for much of the growing season. Typically, wetlands on mineral soils are called swamps and those on deep organic soils are peatlands. Softwood sites are usually nutrient poor and acidic. Typical treed peatland and softwood swamp species include black spruce, tamarack and balsam fir. Hardwood swamps are typically dominated by red maple, white ash or trembling aspen. The forest floor tends to be dominated by sphagnum mosses (in peatlands) and ferns (in swamps).

Importance to Biodiversity

Treed wetlands often occur in headwater areas, and have intermittent streams flowing through them. As a result they are often important for maintaining baseflow in streams, flood and erosion control, retention of particulates/contaminants, and carbon storage. Treed wetlands provide a great diversity of wildlife habitat, including vernal pools that support wood frogs, spring peepers, and blue and yellow-spotted salamanders, as well as rich invertebrate life that is adapted to temporary pools. Intermittent streams provide migration routes for turtles, while wood ducks and other waterfowl nest in tree holes that are also used by other cavity nesters such as owls, flying squirrels, and brown bats. Many mammals, such as moose, deer, bear and bobcat use swamps for a variety of reasons, such as a migration corridor between adjacent upland forest patches. Endangered black ash *(See pg 106)* and eastern cedar *(See page 108)* may be found in wetland sites.

Stewardship Actions

Shallow rooting on wet sites increases the vulnerability of trees to windthrow. Wind also creates frequent small gap disturbances on these sites, resulting in hummocks where uprooted trees have decomposed. These mounds often yield better drainage than surrounding microsites, and may offer improved conditions for germination and establishment of regeneration.

Best Management Practices –

- Treed wetlands are sensitive sites that may be easily damaged during forest operations. It is important to plan sufficiently before starting harvesting work or access road construction close to these areas.
- Using temporary roads and minimizing road width will reduce impact. Proper use of culverts, drains, and road design will maintain flow through wetlands and improve road durability.
- Harvesting when ground is frozen or during the driest part of the year will minimize rutting and compaction. If roads must cross watercourses or wetlands, bridges and culverts should be installed only after constructing a sediment barrier. Crossings should be perpendicular to the watercourse, and located on low banks with solid footings.

LINKS *For detailed and up-to-date information*

The **Nova Scotia Wetland Conservation Policy (2011)** is downloadable at novascotia.ca/nse/wetland/conservation.policy.asp

fpinnovations.ca/ResearchProgram/forest-operations/resource-roads/Pages/guide-for-planning-construction-and-maintenance.aspx

Photo courtesy of the Nova Scotia Museum

Eco Notes

The northern spring peeper leaves its woodland hibernation sites as early as March in southwestern NS. These thumbnail-sized tree frogs perch on grasses and sedges at the edge of wetlands. The males call mates with a shrill "*peep-peep-peep.*" After eggs are laid on twigs and leaf litter at the pond bottom, the adults head back to the woods for the rest of the year. These frogs are difficult to see due to their small size and camouflage colouring of brown or gray with a dark stripe on the sides of the head and dark markings on the back.

Vernal Pools

Photo: CNS (Len Wagg)

Description

Vernal pools are small, shallow wetlands without permanent inlet or outlet streams. They are critical habitat for amphibians and other wildlife species. Usually well shaded by overstory vegetation, vernal pools are characterized by a seasonal cycle of flooding and drying. They are deepest in the spring and often reflood in the fall after drying out most summers. Viable vernal pools usually retain water for at least two months.

Importance to Biodiversity

Several species depend entirely on the existence of vernal pools. The elimination of this habitat from the landscape would severely impact some populations of amphibians, reptiles and invertebrates (e.g., spotted salamanders, wood frogs and fairy shrimp). Insects provide food for amphibians, while larvae, eggs, as well as adult amphibians, are in turn consumed by turtles and other animals attracted to the abundance of food in and around vernal pools. To sustain healthy populations, some species of salamander and frog need to travel overland to other vernal pools for breeding to maintain optimal levels of genetic diversity.

Dry vernal pool

Photo: DNR (Peter Neily)

Stewardship Actions

The surrounding forest is a primary contributor to the vitality and viability of vernal pools. Trees and shrubs help keep water cool, contribute to the food web, and regulate the hydrology of pools. Sphagnum mosses, sedges, and ostrich and cinnamon ferns are often found around the margins of vernal pools. By maintaining lower water temperatures in vernal pools, trees slow evaporation and moderate aquatic plant growth. Autumn leaf fall provides organic material for food. Trees also intercept runoff and help prevent the erosion of soil adjacent to the pool.

Best Management Practices –

- Where consistent with **forest management guides**, *(See Glossary, pg 116)* favour the selection harvesting method when working close to vernal pools.
- Maintain shaded conditions around pools by leaving buffers of undisturbed trees and vegetation.
- Keep logging slash and woody debris away from pool edges.
- It is best to identify the boundaries of vernal pools in the spring when they are in a fully flooded state. Mark the perimeter to ensure identification during times of the year when they are more difficult to detect.

Eco Notes

Vernal pools lack fish, which are predators. Their absence allows other wildlife species, such as salamanders, to survive and feed on the multitude of other organisms that inhabit vernal pools.

Eastern red-backed salamander (Plethodon cinereus)

Photo courtesy of the Nova Scotia Museum

Watercourse Management Zones

Photo: Alain Belliveau, AC CDC

Description

The riparian zone (the area along a watercourse) is one of the most important and fragile wildlife habitats. Watercourses are defined as "the bed and shore of a river, stream, lake, creek, pond, marsh, estuary or salt-water body that contains water for at least part of each year."

On January 14, 2002 Nova Scotia enacted the **Wildlife Habitat and Watercourses Protection Regulations** to protect water quality and riparian wildlife habitat. The regulations are mandatory on all private, industrial and Crown lands. The regulations require the establishment of **Special Management Zones**—an area of forest adjacent to a watercourse that protects the watercourse and bordering wildlife habitat from the effects of forestry operations.

Importance to Biodiversity

The riparian zone provides water, food and cover for many species of wildlife including amphibians, waterfowl and semi-aquatic mammals, and is preferred by many larger wildlife species as a travel corridor. The presence of water, often in combination with fertile soil, increases diversity by providing habitat for plants not found elsewhere.

Trees and other rooted vegetation along a watercourse stabilize the soil, minimizing erosion and the resulting siltation which smothers the gravel beds needed for trout and salmon spawning habitat. Trees and shrubs shade the stream, helping to prevent overheating of the water which can be fatal to fish. Insects, organic matter and other nutrients falling from vegetation are important additions to the food cycles of aquatic ecosystems. Undercut tree roots and overhanging or fallen logs provide cover for fish. Large organic debris, in the form of fallen logs or branches, stabilizes the streambed and is important in pool formation.

Stewardship Actions

Regulations are applied to watercourses based on average stream width. This average width is calculated by measuring the width of the bed at 10 approximately equidistant locations along the entire portion of the watercourse that is within or adjacent to the forest land where a forestry operation is being planned.

Legal Requirements –

The following is summarized from provincial regulations. For the complete regulations, see "LINKS" at the end of this section.

Streams greater than 50 cm average width:

- A **Special Management Zone** must be established with a minimum 20 m width on each side of the watercourse.
- Where the land on which a Special Management Zone is established has an average slope within 20 m of a watercourse boundary of greater than 20%, the forestry operator shall increase the width of the Special Management Zone by 1 m for each additional 2% of slope to a maximum of 60 m in width.
- The use or operation of a vehicle for forestry operations within 7 m of the watercourse is not permitted.
- A partial harvest is permitted in a **Special Management Zone** as long as the basal area of living trees is not reduced to less than 20 m^2 per hectare. (No opening can be created in the dominant tree canopy larger than 15 m at its greatest dimension.)

Photo: DNR (Eugene Quigley)

Photo: Alain Belliveau, AC CDC

Streams less than 50 cm average width:

- Tree harvesting is permitted. However, the use or operation of a vehicle for forestry operations within 5 m of the watercourse is not permitted, except for the purpose of watercourse crossings approved by Nova Scotia Environment.

General Guidelines

- A forestry operator shall ensure that understory vegetation and non-commercial trees within 20 m of the edge of any watercourse are retained to the fullest extent possible.
- No forestry operator shall conduct any activity that would result in sediment being deposited in the watercourse.

Crown Forest Policy –

- Bogs and meadows are not included in these regulations, although these wetlands are required to have **Special Management Zones** if they occur on Crown lands.

Best Management Practices –

- Trees and large branches that are accidentally felled into watercourses should be left, as removal may cause more damage.

Snapping turtles Photo: DNR (Terry Power)

Eco Notes

Snapping turtles are the largest freshwater turtles in Nova Scotia. They spend most of their life in vegetated shallow ponds and waterways, and only come out of the water in June and July to build their nest and lay eggs.

Photo: DNR (Terry Power)

LINKS

For detailed and up-to-date information

This guide provides basic information on watercourse management zones. Consult the **Wildlife Habitat and Watercourses Protection Regulations** to ensure that appropriate Special Management Zones have been assigned to watercourses. *(See link, below)*

www.novascotia.ca/just/regulations/ and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

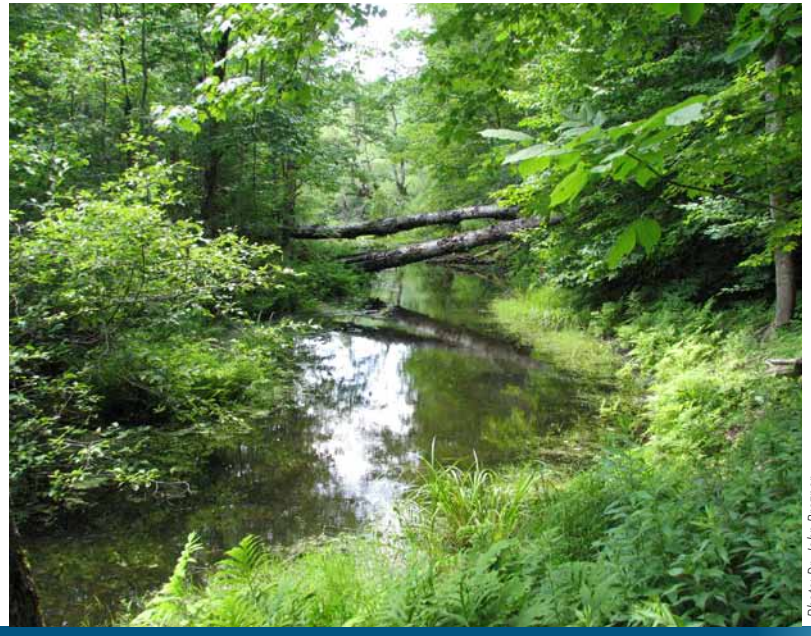


Photo: Dr. John Brazner

NOTES

Soils and Soil Communities

Soil Communities

Photo: DNR

Description

Soil is the unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of plants. Soils are a fundamental driver of biodiversity and productivity in forest ecosystems. They are home to a myriad of flora and fauna and support ecosystem processes influencing plant species composition, growth, decomposition and nutrient cycling. The variety, number and activity of organisms found in forest soils are generally much greater than that found in agricultural soils, and the majority of this diversity and activity is found in surface organic horizons (also called the forest floor or duff layer) and around plant roots (rhizosphere). Indeed, the presence and relative abundance of soil organisms give rise to characteristic forest floor types (mor, moder and mull) that can be generally related to potential site productivity.

(header photo)
A typical well drained forest soil in Nova Scotia showing a leached (greyish-white) A-horizon "broken" by historic windthrow events and a highly oxidized, iron-enriched B-horizon below

(left) A "mottled" soil (orange iron concentrations and grey iron depletions) indicating poor drainage conditions

Photo: DNR (Eugene Quigley)

Importance to Biodiversity

Soil flora fall into three main categories: bacteria, fungi and algae. Bacteria are abundant in soils and are involved in such processes as organic matter decomposition, nitrification, and nitrogen fixation. The relative abundance of bacteria versus fungi is generally greater in more fertile soils. Fungi are responsible for most of the organic matter decomposition in acidic forest soils and their thread-like filaments (hyphae) are readily visible in many forest floor horizons. Some fungi also form symbiotic associations (called mycorrhizae) with plant roots, which greatly enhances nutrient and water uptake by these plants (including trees). These mycorrhizae associations often form complex webs between trees and are a critical component of forest ecosystem health and productivity. Algae are less common than bacteria and fungi, especially in acidic soils. Some types of algae form symbiotic relationships with fungi (forming lichens) that colonize exposed rock and mineral soil, while others are involved with nitrogen fixation.

Soil fauna are divided into three size classes. Microfauna (< 0.1 mm) are mainly involved with organic matter decomposition and predation of microbial populations (e.g., Protists). Mesofauna (0.1–2 mm) are mainly involved with organic matter decomposition, predation of microbial populations, and physical breakdown of organic matter (e.g., nematodes, mites and springtails). Macrofauna (> 2 mm) are mainly involved with physical breakdown of organic matter and soil mixing (e.g., insects and worms).

Diversity, abundance and activity of soil organisms can be affected by both natural and human disturbance. Short and long term impacts are related to changes in soil moisture, temperature, aeration, pH, and organic matter quality and quantity.

Photo: DNR (Eugene Quigley)

Pulling back a matted forest floor to reveal a leached (grey) A-horizon

High stone content taken from a shallow to bedrock, rapidly drained soil

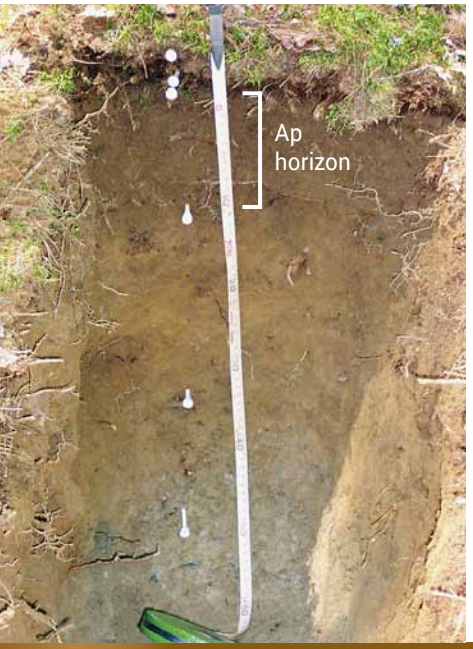
Photo: DNR

Within limits imposed by nutrient and moisture availability, soil and plant communities co-develop and react to various site disturbances, including forest management activities.

While there is a fair amount of functional redundancy in soils (i.e., when one community is negatively impacted by disturbance another takes advantage of the opportunity, thereby maintaining ecosystem function), long-term forest management impacts on soil ecology are generally not well understood. In the absence of this knowledge, mimicking natural disturbance patterns and/or avoiding damage during management treatments are the best options for maintaining forest soil health.

Stewardship Actions

The two main sources of disturbance damage are loss of organic matter and loss of aeration porosity. Loss of organic matter mainly comes from loss of coarse woody debris (CWD), forest floor material and/or topsoil through harvesting, displacement or erosion. Loss of aeration porosity is mainly caused by soil compaction and/or puddling associated with machine traffic. Rutting is also considered damaging when it exposes less fertile subsoil or negatively impacts hydrology and soil moisture regime.



It is a given that forest management activities will almost always result in some level of soil disturbance on some percentage of the area being treated. However, it is also understood that disturbance does not necessarily equal permanent damage and disturbance area can be limited and/or made less damaging if operations are planned and carried out with prior knowledge of inherent hazards and site limitations.

An old field forest soil showing a brown, organically enriched upper soil horizon caused by tillage

Photo: DNR

Best Management Practices –

- Become familiar with the soil types found in your management area and their potential limitations and opportunities. *(Refer to the Nova Scotia Forest Ecosystem Classification (2010), pg 11)*
- Match available equipment, trail layout, trail design, and treatment scheduling to minimize potential soil damage based on specific hazards associated with each soil type.
- On soils that are susceptible to compaction and rutting, minimize potential damage by concentrating machine traffic to a few well-constructed trails—understand that damage can occur with as few as one or two machine passes on high hazard sites.
- Whenever possible, use harvest slash on trails to reduce machine ground pressure.
- As a general rule, try to conserve forest floor horizons and avoid mineral soil exposure.
- Favour retention of some hardwoods when conducting thinning operations in softwood or mixedwood stands, since deep-rooted hardwoods contribute soil organic matter, promote soil structure, and provide annual litter inputs for nutrient cycling.
- Minimize disturbance to existing CWD and ensure there are adequate CWD volumes left after harvest (either current or potential CWD) based on forest ecosystem type and site-specific need *(See pg 16).*

Photo: DNR

A thick layer of partially decomposed peat moss (Sphagnum spp.) over a depleted mineral soil associated with poor drainage conditions

Crown Forest Policy –

- Avoid full-tree harvesting on sites that cannot accommodate this type of treatment due to recognized soil/site limitations.
- Conduct a pre-treatment assessment (PTA) before any management treatment to document current site conditions and potential hazards. Use information collected from the PTA, including information on soil type hazards and CWD distribution, to inform final management prescriptions.

Eco Notes

There are thousands of species of mycorrhizal fungi in North American forests, but these can be grouped into two main types:

ECTOmycorrhizae (EC-to-myco-RIZ-a) have hyphae that penetrate the spaces between root cells and form (usually) a compact fungal mantle around these roots.

ENDOmycorrhizae (EN-do-myco-RIZ-a) have hyphae that actually penetrate root cells, but do not form a fungal mantle.

Ectomycorrhizae are associated with all native conifer species in Nova Scotia, as well as some deciduous species (birch, oak, beech, ironwood). Endomycorrhizae are associated with maple, ash, elm, and black cherry. Aspen, poplar, and willow species can be associated with either type of fungi.

Photo: DNR (Peter Neily)

Black Chanterelles (Craterellus spp.)

Species at Risk

Species at Risk

Photo: Alain Belliveau, AC CDC

Introduction

Species at risk include any plant, animal, or other organism that is seriously at risk of extinction. There are at least 60 species at risk in Nova Scotia, including many that occur in our forests. Species at risk in Nova Scotia are protected under the **Nova Scotia Endangered Species Act** and/or the federal **Species at Risk Act**, and many have plans in place to support their recovery and management.

Provincial Protection

Under the **Nova Scotia Endangered Species Act**, species at risk are separated into five status categories: endangered, threatened, vulnerable, extirpated and extinct.

Status Category	Definition
Endangered *	a species facing imminent extirpation or extinction
Threatened *	a species likely to become endangered if limiting factors are not reversed
Vulnerable	a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events
Extirpated	a species that no longer exists in the wild in the Province but exists in the wild outside the Province
Extinct	a species that no longer exists

** It is a violation of the **Nova Scotia Endangered Species Act** to kill or disturb any Endangered or Threatened plant or animal, or to disturb or destroy the nest, den, or hibernaculum of an Endangered or Threatened animal.*

Under the **Nova Scotia Wildlife Act**, it is a violation to destroy, disturb or damage the den of a fur-bearer or the nest of a bird.

Federal Protection

Many of the plants and animals in this guide are also protected under federal laws, including the **Species at Risk Act** and **Migratory Bird Convention Act**.

LINKS *For detailed and up-to-date information*

Species at Risk
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Nova Scotia Endangered Species Act
novascotia.ca/natr/wildlife/biodiversity/legislation_nsesa.asp

Federal Species at Risk Act / Species at Risk Public Registry
www.sararegistry.gc.ca/

Nova Scotia Wildlife Act
nslegislature.ca/legc/statutes/wildlife.pdf (downloadable PDF)

Migratory Bird Convention Act
laws.justice.gc.ca/eng/acts/M-7.01/

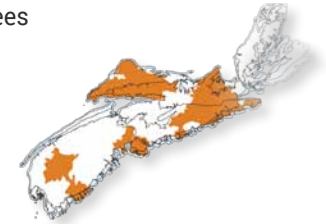
Important Note *— Consult the table on page 85 for a list of species found in this guide, their protected status, and applicable laws. Since a species' status and/or protection laws can change over time, readers are asked to check on-line (See "LINKS" above, and on each species page) for more detailed and up-to-date information.*

About Species at Risk in this guide

This guide provides general information about 35 species at risk that live in Nova Scotia's forests. It identifies ways to reduce threats to these species, and provides general recommendations to support their recovery. Further information on these species and other species at risk in Nova Scotia can be found in the Mersey Tobeatic Research Institute's Guide shown below.

The species at risk are divided into the following categories: Mammals, Birds, Reptiles, Lichens, Plants & Trees

Distribution maps show where each species is known or expected to occur in the province. Ecoregion boundaries are shown on the map. *(See Appendix E)*



If you have concerns about species at risk or are planning any forest harvest, silviculture, or road construction in an area where they are expected to occur, contact a regional Department of Natural Resources office *(See Appendix D)* for help in planning your forest operation to avoid and/or reduce disturbance.

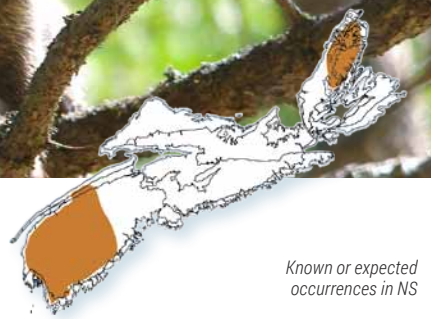
Mersey Tobeatic Research Institute Species at Risk Guide, 2nd Edition available on-line:
www.speciesatrisk.ca/SARGuide/

Species	Provincial Status	Special Management Practices	Protection under the following provincial laws: NS Endangered Species Act	NS Wildlife Act	Protection under federal laws, including: Species at Risk Act	Migratory Bird Convention Act
MAMMALS						
American Marten	Endangered	X	X	X	–	–
Little Brown Myotis, Northern Myotis, Tri-Colored Bat	Endangered	–	X	X	X	–
Canada Lynx	Endangered	X	X	X	–	–
Moose (Mainland)	Endangered	X	X	X	–	–
BIRDS						
Bicknell's Thrush	Endangered	–	X	X	X	X
Canada Warbler	Endangered	–	X	X	X	X
Chimney Swift	Endangered	–	X	X	X	X
Common Nighthawk	Threatened	–	X	X	X	X
Eastern Whip-poor-will	Threatened	–	X	X	X	X
Olive-sided Flycatcher	Threatened	–	X	X	X	X
Rusty Blackbird	Endangered	–	X	X	X	–
REPTILES						
Blanding's Turtle	Endangered	–	X	X	X	–
Eastern Ribbonsnake	Threatened	–	X	X	X	–
Wood Turtle	Threatened	X	X	X	X	–
LICHENS						
Boreal Felt (and Vole Ears)	Endangered	X	X	–	X	–
PLANTS & TREES						
Atlantic Coastal Plain Flora *	Endangered/ Threatened	–	X	–	X	–
Black Ash	Threatened	–	X	–	–	–
Eastern White Cedar	Vulnerable	–	X	–	–	–
Ram's Head Lady's Slipper	Endangered	–	X	–	–	–
Rockrose	Endangered	–	X	–	–	–

** The ACPF species listed in this guide are protected under federal laws including the Species at Risk Act.*

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Endangered



Known or expected occurrences in NS

Description

The American marten (*Martes americana*)—also known as the pine marten—can grow to 80 cm long. It has a slender brown body with a light orange patch under its neck and belly, and a bushy tail. Historically, marten were found throughout Nova Scotia but are now found in only two locations—a small native population on Cape Breton Island and a re-introduced population in southwestern Nova Scotia. Marten are usually found in mature older conifer-dominated forests or mixed-woods where small prey and wild berries are abundant *(see Dens, pg 42)*.

Stewardship Actions

Crown Forest Policy — American marten **Special Management Practices** (SMPs) for forest operations are available on-line *(See "LINKS")*.

These SMPs apply to a defined Marten Habitat Management Zone in Cape Breton and highlight several actions to protect American marten and their habitat, including:

- Leaving live mature trees, evenly spaced throughout the harvest site—these are in addition to all other requirements under the **Wildlife Habitat and Watercourses Protection Regulations**.
- Large yellow birch trees should be left standing where possible.

Legal Requirements — America marten and their dens are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

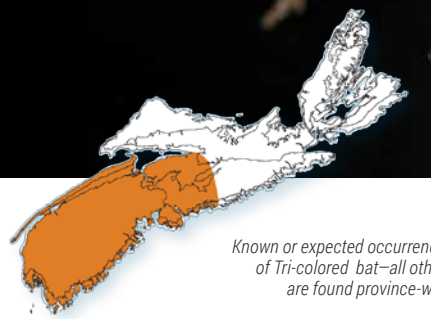
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.speciesatrisk.ca/martenandlynx/

Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Photo: DNR (Peter Austin-Smith)

Endangered



Known or expected occurrences of Tri-colored bat—all others are found province-wide

Description

Little Brown Myotis, Northern Myotis, Tri-Colored Bat

These three species of bats (*Myotis lucifugus, Myotis septentrionalis, Perimyotis subflavus*) are all dark and small—growing up to 10 cm long with a wingspan no greater than 27 cm. Each has become a species at risk in Nova Scotia and throughout much of north-eastern North America due to the spread of White-nose Syndrome—a deadly condition caused by the spread of a fungus which interrupts bats during their critical hibernation period, causing mass deaths in most colonies.

Overwintering bats in Nova Scotia hibernate in deep caves and abandoned mines–away from the freezing outside temperatures. In warmer months bats use tree hollows and openings beneath loose tree bark, and other natural and man-made hide-away sites (e.g. old barns and attics) as roost and nursery areas. Some bats are also known to roost in old man's beard lichen. Bats feed on flying insects, and are often seen feeding over waterways, forest edges and fields. *(See Caves, pg 38; Hibernacula, pg 46)*

Stewardship Actions

Where possible, leave large, dead and dying trees standing in forest harvest areas, and maintain existing old growth forest habitat. Practicing uneven-age management and maintaining healthy riparian areas along watercourses will also benefit bats. Overwintering bats are easily disturbed by direct human disturbance, noise and vibration. Avoid forest harvesting between November 1 and April 30 within 100 m of caves that are known bat overwintering sites.

Legal Requirements — These three listed species and their hibernacula are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.batconservation.ca

Photo: Northern myotis (Dr. Hugh Broders)

Canada Lynx

Endangered

Known or expected occurrences in NS

Description

The Canada lynx (*Lynx canadensis*) is a wild cat that can grow to 90 cm long. It is greyish-brown, and has large paws, distinct facial side-burn hairs, a short black-tipped tail, and long black-tipped ear hair tufts. In Nova Scotia, lynx are currently only found in the Cape Breton highland—where deep snow exists for longer in the year than in lowland areas. They use a variety of habitats, but normally live in coniferous forest that have snowshoe hare—their favorite food.

Stewardship Actions

In general, Canada lynx benefit from a variety of forest stand ages, distributed throughout the landscape. Retaining old growth forest, maintaining healthy riparian areas along watercourses, and providing wildlife travel corridors all benefit lynx.

Crown Forest Policy – Canada lynx **Special Management Practices** (SMPs) for forest operations are available on-line *(See "LINKS").*

These SMPs include forest operation practices that can influence lynx prey (e.g., snowshoe hare, red squirrel) habitat and access by other large competing predators (e.g., Eastern coyote).

Legal Requirements – Canada lynx and their dens are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.speciesatrisk.ca/martenandlynx/

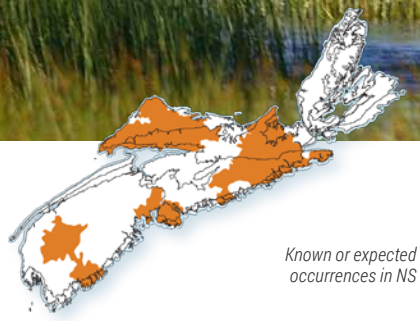
Special Management Practices

novascotia.ca/natr/wildlife/habitats/terrestrial/

Header Photo: DNR (Peter Austin-Smith)

Moose (Mainland)

Endangered



Known or expected occurrences in NS

Description

Nova Scotia's mainland population of moose (*Alces alces americana*) is native to our province and is genetically distinct from Cape Breton Island moose that were introduced from Alberta in the 1940s. The current estimated population of mainland moose is less than 1000—with small concentrations occupying five areas throughout the province.

Mainland moose can weigh in excess of 450 kg, and adult males have very large palmate antlers.

In the warmer months these moose usually inhabit mixed-wood forest and wetlands where food from aquatic vegetation, young deciduous trees and shrubs are abundant. Dense conifer forest are also important to moose in summer as places to cool down during hot days. During the cold winter months they often inhabit mature conifer or mixed-wood forest to seek shelter and protection from predators and weather.

Stewardship Actions

Crown Forest Policy – Mainland moose **Special Management Practices** (SMPs) for Crown lands in the five significant Mainland Moose Population Concentration Areas *(See distribution map, top left)* are available on-line *(See "LINKS").* These SMPs include forest habitat objectives for Moose Shelter Patches, Moose Retention Patches, Moose Buffers, Roads and Access Points, and Coarse Woody Debris.

The following is a summary of the **Special Management Practices**:

Moose Shelter Patches – a portion of the harvested area must be retained as closed canopy coniferous stands, if available, for moose cover and security requirements.

Photo: Reg Newell

MAMMALS

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Moose Retention Patches — smaller coniferous patches (< 0.5 ha), if available, must also be retained within each harvest area to provide temporary shelter and concealment for moose moving within and among areas of travel or foraging habitat. These patches should be distributed so that moose will be no more than 100 m from cover at any time.

Moose Buffers — forested buffers should be retained around and or near open wetlands, watercourses, and waterbodies. Buffers need to be equal to or greater than 20 m wide and located in such a way (i.e., on higher ground, or between a road and the water) that they conceal moose in open wetland and aquatic habitats.

Legal Requirements — Mainland moose are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

novascotia.ca/natr/wildlife/biodiversity/species-recovery.asp#moose

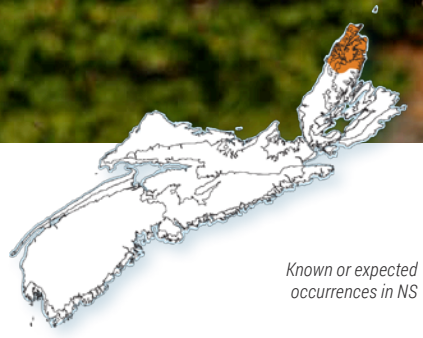
Special Management Practices

novascotia.ca/natr/wildlife/habitats/terrestrial/

Photo: DNR (Peter Neily)

Bicknell's Thrush

Endangered



Known or expected occurrences in NS

Description

Bicknell's thrush (*Catharus bicknelli*) can grow up to 18 cm long from beak to tail. They have a light buff chest with dark spots, light underparts and olive-brown back, and a slender pointed yellow bill with a faded black tip.

In Nova Scotia, this small songbird is known only to occur in the damp cool spruce-fir forest of the Cape Breton highlands and a few offshore coastal islands. It prefers to nest in dense second growth woods with many young conifers. Bicknell's thrush is one of the most endangered song-birds in North America.

Photo: Kevin Fraser

Stewardship Actions

Bicknell's thrush are sensitive to human activity and are quick to abandon their nest if disturbed by forest harvesting. To reduce distur-bance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs of birds between June 1 and July 31.

Pre-commercial thinning limits nesting habitat so untreated areas should be provided in locations where the thrush is present.

Legal Requirements — Bicknell's thrush and their nests are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.birdscanada.org/research/speciesatrisk/

Songs and calls can be heard on-line at www.bicknellsthrush.org

Canada Warbler

Known or expected occurrences in NS

Description

The Canada warbler (*Cardellina canadensis*) can grow up to 14 cm long from beak to tail. It is most easily recognized by the short black breast stripes that stand out against its bright yellow underparts (more striking in males), slate blue back, and yellow eye-rings that look like rimmed spectacles.

They build their nests out of leaves, grasses, fine tree rootlets and moss sporangia, in tree stumps, roots of upturned trees, or other moist, mossy hummocky spots along the ground. They inhabit forested wetlands and shrubby understory areas along streams in mature mixed or hard-wood forest.

Stewardship Actions

Conserving forested wetlands and maintaining healthy riparian areas along watercourses will benefit these birds. Forestry operations too close to nesting sites will cause the birds to abandon their nests.

To reduce disturbance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs of birds between May 15 and July 31.

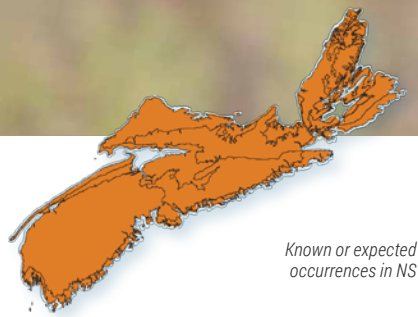
Legal Requirements – Canada warbler and their nests are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Header photo: Alix Arthur d'Entremont; (above) Peter Brannon

Chimney Swift



Known or expected occurrences in NS

Description

Chimney swifts (*Chaetura pelagica*) can grow up to 14 cm long, from beak to tail. They are dark brown with pale throats, and long narrow pointed wings that extend beyond their distinct short spiny tail that is used as a support brace while perching on vertical surfaces.

Swifts are often confused with bats due to their color similarities and habit of feeding in early morning hours and before sunset in the summer months. The diet is comprised entirely of winged insects captured by the swift's rapid flight over wetlands and forests.

Before settlement in North America, chimney swifts nested exclusively in large hollow trees, which were more common in the past than they are today. Larger trees still provide important nesting habitat, however most nests today are found in abandoned chimneys and in the high peaks inside of large old barns.

Stewardship Actions

Where practical, leave large dead trees, living cavity trees, and legacy trees standing in forest harvest or silviculture areas, and maintain existing old growth forest habitat. Maintaining healthy riparian areas along watercourses will also benefit these birds.

Legal Requirements – Chimney swift and their nests are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.birdscanada.org/research/speciesatrisk/

Photo: Alix Arthur d'Entremont

Common Nighthawk

Threatened

Known or expected occurrences in NS

Description

Common nighthawks (*Chordeiles minor*) can grow up to 25 cm long from beak to tail. Their dull, mottled brown-grey-buff colour makes them well camouflaged against the open ground habitat in which they nest (e.g. natural forest openings, forest harvest sites, barrens, bogs, dirt roads and gravel roof tops). These birds commonly utilize younger forest until the lower tree branches begin to touch and restrict access to the forest floor. Nighthawks have large eyes and wide mouths that help them capture flying insects over open habitats with abundant insects. They are easily recognized at dusk and dawn by their loud flight *"peent"* call and the distinctive white patch on the undersides of their long pointed wings. Like many aerial insectivores, the common nighthawk breeding population is declining throughout its range.

Stewardship Actions

To reduce disturbance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs between May 15 and July 31.

Maintaining naturally-occurring openings *(See Open Woodlands pg 50 and Persistent Stand Openings pg 52)* through careful forest harvest planning can preserve nesting habitat for nighthawks.

Legal Requirements – Common nighthawk and their nests are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

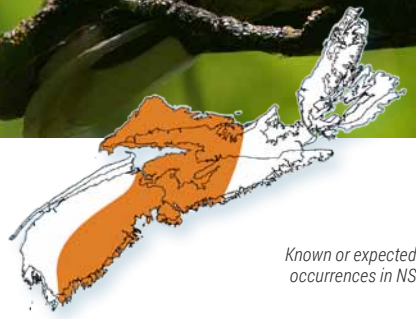
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.birdscanada.org/research/speciesatrisk/

Header photo and above: Alix Arthur d'Entremont

Eastern Whip-poor-will

Threatened



Known or expected occurrences in NS

Description

The Eastern Whip-poor-will (*Antrostomus vociferus*) can grow up to 25 cm long from beak to tail. These nocturnal ground nesting birds have large black eyes and mottled brown-grey coloration that helps camouflage them among the dry leaf litter of young deciduous and mixed forest. Their bills have a wide gape and are surrounded by long bristles. These help them capture flying insects in open habitats.

Eastern Whip-poor-will have always been an uncommon breeder throughout Nova Scotia. These birds are rarely seen but the unmistakable "*whip-poor-will*" call of males can sometimes be heard on warm summer nights. Like many aerial insectivores, the Eastern Whip-poor-will breeding population is declining throughout its range.

Stewardship Actions

To reduce disturbance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs of birds between May 1 and July 31.

Legal Requirements – Eastern Whip-poor-will and their nests are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.birdscanada.org/research/speciesatrisk/

Header Photo: Dr. Christian Artuso; (above) Dr. Richard Stern

Olive-sided Flycatcher

Threatened

Known or expected occurrences in NS

Description

The olive-sided flycatcher (*Contopus cooperi*) can grow to 20 cm long from beak to tail. It has a relatively large head with a dark pointed bill; olive-grey coloring on its face, back and sides; and distinguishing faded white underparts from its throat to its belly. Its most recognizable feature may be its song, that sounds like a whistled "*quick, free beer.*"

They are often observed perched or flying from tall dead branches and snags to feed on flying insects high in the air. They inhabit softwood forest edges and open areas within forested wetlands, bogs, beaver ponds, meadows and streams. Nests are usually placed in a living, spindly spruce on the wetland edge.

Stewardship Actions

Leave dead trees standing in any forest harvest or restoration areas, especially along forest edges and forest openings near wet areas. Conserving forested wetlands and maintaining healthy riparian areas along watercourses will benefit these birds.

To reduce disturbance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs of birds between May 1 and August 31.

Legal Requirements – Olive-sided flycatcher and their nests are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Photos : Alix Arthur d'Entremont

Rusty Blackbird

Endangered

Known or expected occurrences in NS

Description

Rusty blackbirds (*Euphagus carolinus*) can grow as long as 25 cm from beak to tail. They are mostly black overall, with yellow eyes, a pointed bill, and a long rounded tail. Females are a dull brown.

During the breeding season this blackbird is more solitary than other more common blackbirds (e.g., grackle, red-winged blackbirds), and seeks softwood forests with wet areas (such as streams, beaver ponds, swamps and bogs) as breeding habitat. Nests are usually constructed in a small bushy spruce or fir on the edge of small wetlands at low height. Breeding pairs will call loudly when any disturbance is in the immediate area of an occupied territory, making them highly visible. Rusty blackbirds forage on the ground, flipping over leaves and twigs looking for insects.

Photos : Alix Arthur d'Entremont

Stewardship Actions

Conserving forested wetlands and maintaining healthy riparian areas along watercourses will benefit these birds.

To reduce disturbance where nesting pairs of birds, or nests, have been identified, avoid forest operations in the vicinity of the nests or pairs of birds between May 1 and August 31.

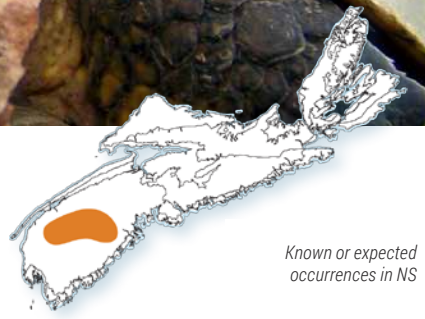
Legal Requirements – Rusty blackbird and their nests are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Blanding's Turtle

Endangered



Known or expected occurrences in NS

Description

Blanding's turtles (*Emydoidea blandingii*) are less than 30 cm long and have a distinguishing yellow chin, and helmet-shaped shell that is variably spotted or streaked with greyish-yellow.

In Nova Scotia, these turtles are only known to occur in several small separate populations in the interior southwestern end of the province. They spend most of their lives in wetlands and waterways and build their nest in early summer in a variety of habitats including lakeshores, rocky outcrops, roadsides and gravel roadbeds, and other clearings. Forests, sometimes considerable distances from water, are used for travel and feeding during the spring, summer and fall.

Stewardship Actions

Any activity that degrades riparian areas, overwintering ponds or impacts the flow of water along waterways has the potential to degrade habitat for turtles. Maintaining natural vegetated buffers along waterways, and consideration of seasonal sensitivities, are some of the best ways to help protect Blanding's turtles (*See Watercourse Management Zones, pgs 70–73*).

Adjust the timing and location of motorized vehicle use during forest operations in Blanding's turtle habitat.

Legal Requirements – Blanding's turtle and their nests are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

www.speciesatrisk.ca/blandings/

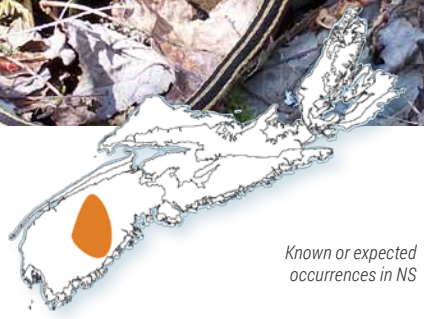
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.novascotia.ca/just/regulations/ and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Photo: Alain Belliveau, AC CDC

Eastern Ribbonsnake

Threatened



Known or expected occurrences in NS

Description

Eastern ribbonsnakes (*Thamnophis sauritus*) can grow to 70 cm long. They have three bright yellow parallel stripes running the entire length of their body, and a small white "teardrop-shaped" marking in the front of each eye.

In Nova Scotia, these harmless snakes are known only to occur in the interior southwestern portion of the province. During warmer months eastern ribbonsnakes spend most of their time in freshwater wetlands—including still-water streams, lakeshores, marshes, swamps, fens and bogs. They can also be seen along roads, and have been reported to climb above the ground into shrubs and small trees. The snake will overwinter deep underground in wooded areas.

Stewardship Actions

Maintaining buffers along waterways can help protect eastern ribbonsnakes (*See Watercourse Management Zones, pgs 70–73*). Uneven-aged forest management can also reduce impacts on overwintering sites and wetlands that are adjacent to upland habitats.

Learn to recognize and watch for eastern ribbonsnakes, especially on roads and other cleared areas.

Legal Requirements – Eastern ribbonsnake are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

www.speciesatrisk.ca/ribbonsnake/

www.novascotia.ca/just/regulations/ and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

Photo: DNR (Peter Neily)

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Wood Turtle

Known or expected occurrences in NS

Description

Wood turtles (*Glyptemys insculpta*) are normally less than 22 cm in length, with a shell made up of several bumpy pyramid-shaped brown shields with yellowish radiating streaks. The underside of the neck and legs are orange-red. Like most turtles, wood turtles are long-lived, with adults reaching 30–35 years or more.

Wood turtles live in meandering rivers and streams, adjacent riparian areas, vernal pools and wet forested flood plains. They usually build their nest in early summer along streamside sand bars and other gravel areas—including roadsides and gravel pits. On warm summer days wood turtles spend more time on land, and bask in sunny openings.

Stewardship Actions

Any activity that degrades riparian areas, or overwintering ponds, or that impacts the flow of water along waterways has the potential to degrade habitats for turtles. Maintaining vegetated buffers along waterways, and consideration of seasonal sensitivities, are some of the best ways to help protect wood turtles.

(See Watercourse Management Zones, pgs 70–73)

Crown Forest Policy — Wood turtle **Special Management Practices** (SMPs) specific to forest operations in Nova Scotia are available on-line *(See "LINKS")*.

Adjust the timing and location of motorized vehicle use during forest operations in wood turtle habitat.

Legal Requirements — Wood turtles and their nests are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

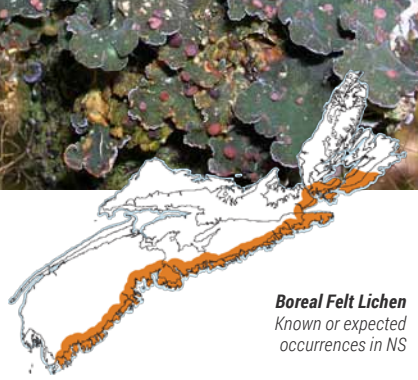
www.novascotia.ca/just/regulations/
and search for "**Wildlife Habitat and Watercourses Protection Regulations**"

novascotia.ca/natr/wildlife/biodiversity/species-list.asp

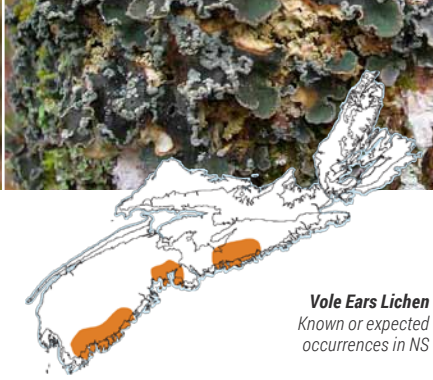
Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Photo: Alain Belliveau, AC CDC

Boreal Felt & Vole Ears



Boreal Felt Lichen
Known or expected occurrences in NS



Vole Ears Lichen
Known or expected occurrences in NS

Description

The boreal felt lichen (*Erioderma pedicellatum*) is an epiphytic (grows on trees), foliose (leafy) lichen. It occurs almost entirely on the trunks of balsam fir, and less commonly on black spruce and red maple. It is found in boggy balsam fir forest with a cool moist oceanic climate, often at or near the base of north facing slopes. Many boreal felt lichen sites occur along the border of open peatlands along small streams (i.e., fens). Good habitat indicators are sphagnum moss and cinnamon fern.

The lichen can be threatened by forestry and other land use practices if they disrupt the moist microclimate that is essential for the species. It is also sensitive to air pollution, acid rain, and habitat loss due to forestry and development.

Photos: Rob Cameron

Stewardship Actions

The objectives of the recovery strategy are: 1) maintain thalli and habitat at sites where boreal felt lichen is known to occur; 2) mitigate threats to boreal felt lichen; and 3) undertake research to fill knowledge gaps and refine the identification of critical habitat.

Crown Forest Policy — The following are summarized from the **Special Management Practices** for boreal felt lichen. Complete guidelines are available on-line *(See "LINKS")*.

- All areas of proposed forest harvesting and silviculture operations on provincial Crown lands which overlap with polygons identified in the habitat model will be surveyed for the presence of boreal felt lichen (BFL). Surveyors must be recognized experts in field identification of lichens.

- Forested buffers are required around each boreal felt lichen occurrence. In addition to the requirements under the **Wildlife Habitat and Watercourses Protection Regulations**, where a BFL occurrence is located within a peatland, or in a forest stand immediately adjoining a peatland, a forested buffer equal to or greater than 20 m in width will be maintained around the perimeter of the peatland.

LINKS *For detailed and up-to-date information*

General information
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Special Management Practices
novascotia.ca/natr/wildlife/habitats/terrestrial/

Species at Risk Public Registry
www.sararegistry.gc.ca

Species at Risk in Nova Scotia, Identification and Information Guide
(includes Information and photos)
www.speciesatrisk.ca/SARGuide/

Vole ears lichen

Note: Vole ears lichen (*Erioderma mollissimum*) is also an endangered species. It occurs in coastal forest habitat (similar to boreal felt lichen), and is typically found on red maple. If this species is found during a survey for boreal felt lichen, then similar guidelines will be applied.

A status report for vole ears is available at: www.sararegistry.gc.ca

Legal Requirements – Boreal felt and vole ears lichens are legally protected in Nova Scotia *(See pgs 82–85).*

Atlantic Coastal Plain Flora

Known or expected occurrences in NS

Description

Atlantic Coastal Plain Flora (ACPF) is a unique group of unrelated plants that are mainly restricted to the flat land along the Atlantic Coast from Florida to Nova Scotia called the Atlantic coastal plain. They are found throughout NS but concentrated in the southwest part of the province, mainly along inland lake and river shores, in wetlands, and along the coast in salt marshes.

There are over 90 species of ACPF in Nova Scotia. Over one third of these plants are found nowhere else in Canada. Some are globally rare and NS has some of the best remaining habitat for these species in North America. Many ACPF species are at risk of being lost from this province. A number of these plants are listed as species at risk and protected under the federal **Species at Risk Act** and provincial **NS Endangered Species Act**. It is important to maintain ACPF habitats so species designated sensitive or secure do not become at risk.

The ACPF species at risk that are legally protected include:

- Plymouth gentian
- Water pennywort
- Pink coreopsis
- Thread-leaved sundew
- Spotted pondweed
- Golden-crest
- Red root
- Tubercled spike-rush
- New Jersey rush
- Long's bulrush
- Sweet pepperbush
- Eastern baccharis
- Eastern lilaeopsis

An ACPF species at risk Recovery Team assists in the conservation and recovery of ACPF, focusing their efforts on the at risk species in Southwest Nova Scotia. Priority lakeshores, bogs and fens have been identified and maps and information is available on the Recovery Team website *(See "LINKS").*

Photo: Alain Belliveau, AC CDC

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Stewardship Actions

ACPF are threatened by habitat modification from activities such as shoreline development, road building, infilling, and nutrient run-off. These species occur in low nutrient environments where competition from other species is low. They can become displaced if water nutrient levels increase and allow more common and competitive species to move in.

Crown Forest Policy –

- A **Forested Special Management Zone** (FSMZ) should be established next to known populations of ACPF species at risk. This FSMZ includes the **Special Management Zone** (SMZ) required under the **Wildlife Habitat and Watercourses Protection Regulations**. The buffer is established from the outer edge of the wetland vegetation, not the outer edge of water.
- No harvesting is recommended within the SMZ to minimize blowdown and soil exposure.
- It is recommended that the FSMZ be maintained in a non-clearcut condition by utilizing partial harvesting methods.
- Harvesting in the FSMZ should be cut to length, leaving branches on site.
- Extraction trails in the FSMZ should be minimized and extra precaution taken to reduce the possibility of erosion or sedimentation.

Legal Requirements – The ACPF species listed in this section are legally protected in Nova Scotia *(See pgs 82–85)*.

LINKS *For detailed and up-to-date information*

www.novascotia.ca/just/regulations/
and search for "**Wildlife Habitat and Watercourses Protection Regulations**" (downloadable PDF)

ACPF Recovery Team
www.speciesatrisk.ca/coastalplainflora/

For more information about the ACPF species at risk—

Atlantic Coastal Plain Flora in Nova Scotia, Identification and Information Guide
www.speciesatrisk.ca/coastalplainflora/guide/

Specific information on species recovery—

Recovery Strategy and Management Plan for Multiple Species of Atlantic Coastal Plain Flora in Canada is available at **Species at Risk Public Registry**
www.sararegistry.gc.ca

Thread-leaved sundew

Photo: Ruth Newell

Golden crest (Lophiola aurea)

Photo: Dr. John Brazner

Plymouth gentian (Sabatia kennedyana)

Photo: Reg Newell

Pink coreopsis (Coreopsis rosea)

Photo: David Mazerolle, AC CDC

Sweet pepperbush (Clethra alnifolia)

Photo: Alain Belliveau, AC CDC

Red root (Lachnanthes caroliana)

Photo: Dr. John Brazner

Red root (Lachnanthes caroliana)

Photo: Dr. John Brazner

Long's bulrush (Scirpus longii)

Photo: David Mazerolle, AC CDC

Water pennywort (Hydrocotyle umbellata)

Photo: Alain Belliveau, AC CDC

PLANTS & TREES

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

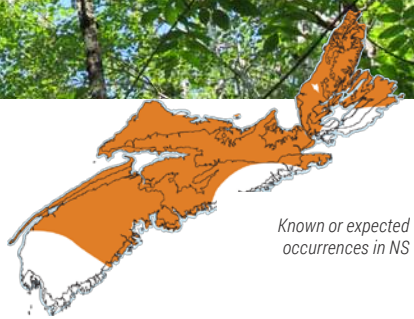
Black Ash

Threatened

Description

Although black ash (*Fraxinus nigra*) is known in 11 counties of Nova Scotia, mature individuals are rare. Black ash is wind-pollinated—flowering in late spring, dispersing seed in October. Seeds may stay dormant for several years before germinating. It is moderately shade intolerant and seedlings are poor competitors. Black ash can sprout vigorously from stumps after cutting.

Black ash can be confused with introduced species such as European ash, which has been planted as an ornamental. However, the introduced species is generally near human settlement and regenerates along roadsides, old pastures and fields. It is not often found in the wet habitats preferred by black ash. Black ash has significant cultural importance to the Mi'kmaq of Nova Scotia and was historically the favoured wood used for basket making.



Known or expected occurrences in NS

Identification Notes

Compound leaves are opposite and composed of 7–11 stemless narrow leaflets with fine teeth and tufts of hair along the midvein below.

Terminal buds are conical, brown to black with the first pair of lateral buds injected some distance below the terminal (can be quite variable).

Bark is light gray, soft, with corky ridges that are easily rubbed off by hand.

Header and bark photos: DNR (Eugene Quigley); Inset: Mark MacPhail

Stewardship Actions

Black ash is slow growing and prefers nutrient rich soils like those associated with floodplains and toe slopes along swamps.

In Nova Scotia black ash seed has been collected from trees growing on floodplains. These trees were 12–14 m tall, 28–36 cm in diameter, and 70 to 100 years old. Black ash in forested swamps is typically small, usually 4–8 m tall and less than 16 cm in diameter.

Black ash is particularly susceptible to fungal diseases, invasive species such as the Emerald Ash Borer, and poor, stunted growth.

Best Management Practices –

- Forestry operations should be modified to avoid damaging black ash and altering the site.
- Where black ash occurs, consider maintaining adjacent wooded buffer to help protect the habitat.

Natural occurrences of black ash should be reported to the toll-free reporting line (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Legal Requirements – Black ash is legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

General information
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Specific information on species recovery—

The **NS Status Report** for black ash:
novascotia.ca/natr/wildlife/biodiversity/pdf/Fraxinus_nigra_Provincial_Status_report.pdf (downloadable PDF)

Species at Risk Public Registry
www.sararegistry.gc.ca

Photo: DNR (Eugene Quigley)

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

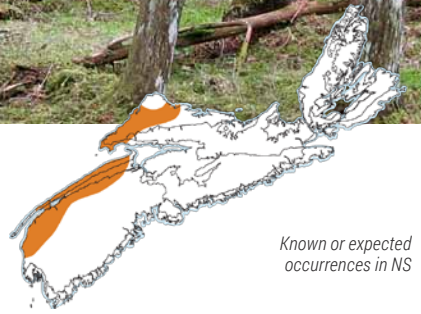
Eastern White Cedar

Vulnerable

Description

Eastern white cedar (*Thuja occidentalis*) is a shade-tolerant species and typically occurs in cool, moist habitats that are nutrient rich. It can also occur on poorly drained soils associated with swamps along slow moving streams. Mature trees can attain heights of 14–18 m, diameters of 28–38 cm, with ages of 125–150 years.

Cedar is an uncommon tree in Nova Scotia. Its population is fragmented—comprised mostly of small stands that appear genetically separate from each. Most populations are found in the Western ecoregion (700) with a few scattered locations known in the Northumberland Lowlands (530) and Cumberland Marshes (550) ecodistricts. Old field cedar forests are known on the North Mountain (920) ecodistrict. On the alluvial soils along the Annapolis River and its tributaries, cedar is scattered from Kingston to Bridgetown. Cedar on shallow soils over bedrock is scattered along the Valley Slope (710) ecodistrict near Lawrencetown.



Known or expected occurrences in NS

Although ornamental Eastern white cedars have been planted around homes and in gardens, these trees are not considered part of the native population and are not covered under the NS Endangered Species Act.

(above, and left)
Whitewash lichen commonly found on cedar

Photos: DNR (Peter Neily)

Stewardship Actions

Forestry operations should be modified to avoid harvesting cedar.

Best Management Practices –

- Where cedar occurs as a significant component of a stand, consider maintaining adjacent wooded buffer to help protect the species and its habitat.
- Exercise caution when logging in stands containing cedar to avoid damaging crown, stem, and roots of cedar trees.
- Cedar that have regenerated onto old fields from adjacent natural populations are likely off-site, and do not require conservation These cedar do not represent the ecosystem conditions of natural populations.

The Forest Ecosystem Classification for Nova Scotia (2010) describes two Cedar Forest Vegetation Types:

CE1 Eastern white cedar / Speckled alder / Cinnamon fern / Sphagnum

CE2 Eastern white cedar - Balsam fir / Stair-step moss

Natural occurrences of cedar should be reported to the toll-free reporting line (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Legal Requirements – Eastern white cedar is legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

General information
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

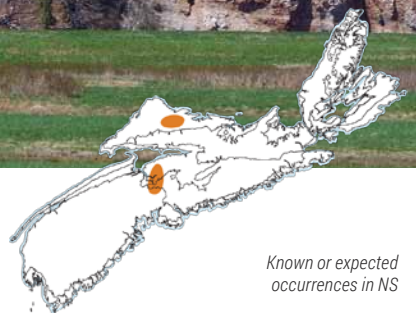
A **status report** including a map of known locations of cedar is available at:

novascotia.ca/natr/wildlife/biodiversity/species-recovery.asp#cedar

Photo: Alain Belliveau, AC CDC

It is illegal to kill or disturb Endangered or Threatened species at risk. Report sightings by phone toll-free (1-866-727-3447) or on-line at www.speciesatrisk.ca/sightings

Ram's Head Lady's Slipper



Known or expected occurrences in NS

Description

Ram's head lady's slipper (*Cypripedium arietinum*) is a small, herbaceous, perennial, orchid found in moderately open forests associated with gypsum bedrock (karst). It is found on outcrops, cliff tops, river banks, moderate to steep slopes and in sinkholes. Forest cover at known sites includes deciduous-dominated, conifer-dominated, and mixed stands of young-intermediate to mature forest.

Stewardship Actions

Gypsum mining, forestry and cattle grazing are demonstrated threats at particular known sites. Competition with exotic species, particularly glaucous sedge (*Carex flacca*), may be a threat at some sites. All-terrain vehicle traffic is a potential, local threat, and housing or other development could affect populations not yet discovered. For the most part, sites that support ram's head lady's slipper have inoperable and/or difficult conditions for forest harvesting; requiring caution for both worker and machine safety.

Best Management Practices – Avoid forest operations in the vicinity of ram's head lady's slipper populations, in order to reduce risk of disturbance to habitat and individuals,

Legal Requirements – Ram's head lady's slipper are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

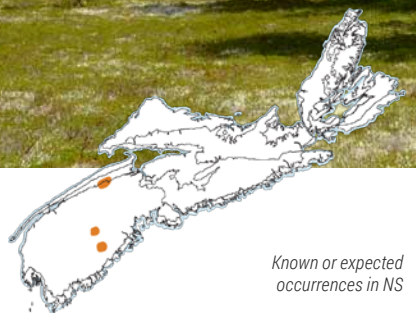
General information
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

The **NS Status Report** on ram's head lady's slipper, showing known populations and potential habitat (downloadable PDF):
novascotia.ca/natr/wildlife/biodiversity/species-recovery.asp

More information (including photos):
Species at Risk in Nova Scotia, Identification and Information Guide
www.speciesatrisk.ca/SARGuide/

Main photo: Reg Newell; Inset: Alain Belliveau, AC CDC

Rockrose



Known or expected occurrences in NS

Description

Rockrose (*Helianthumum canadense*) is a perennial herb with showy yellow flowers and in Nova Scotia is generally associated with the dry, sandy broom crowberry (*Corema conradii*) barrens (heathland) of the Annapolis Valley. Only about 3% of these barrens remain. Currently there are about 5500 mature rockrose plants at seven sites. In Nova Scotia, populations are concentrated within the three closely associated communities of Kingston, Greenwood and Green Acres, Kings County, and at two small sites in Queens County.

Stewardship Actions

Threats to rockrose include the historic and ongoing land use change: agriculture, housing development, sand quarrying and other forms of development, and all-terrain vehicle traffic. Also, changes in natural disturbances including suppression of fire, loss of caribou (grazing suppressing competition) and invasive species such as Scotch pine (shading) have altered the habitat for rockrose.

Best Management Practices – Avoid forest operations in the vicinity of rockrose populations, in order to reduce risk of disturbance to habitat and individuals.

Legal Requirements – Rockrose are legally protected in Nova Scotia *(See pgs 82–85).*

LINKS *For detailed and up-to-date information*

General information
novascotia.ca/natr/wildlife/biodiversity/species-list.asp

The **NS Status Report** on rockrose, showing known populations (downloadable PDF):
novascotia.ca/natr/wildlife/biodiversity/species-recovery.asp#rockrose

More information (including photos):
Species at Risk in Nova Scotia, Identification and Information Guide
www.speciesatrisk.ca/SARGuide/

Main photo: DNR (Sean Basquill); Inset: Alain Belliveau, AC CDC

NOTES

Appendices

Appendix A
Glossary

A

Acadian Forest – broadly defined as that area where red spruce is characteristic, along with eastern hemlock, eastern white pine, sugar maple, yellow birch, and beech

Arboreal – adjective that describes the habitat defined by species living in the canopies of trees [1]

Alluvial – sediments deposited by streams and rivers (floodplains, deltas, etc.). These deposits are younger than glacial deposits and may or may not contain rock (gravel/ cobbles).

B

Basal Area – the cross-sectional area of a tree stem measured at a fixed point above ground and expressed as a ratio of stem area to land area (m^2/ha) [1]

Bed – the "bed" of a watercourse means that portion within a defined flow channel containing predominantly mud, silt, sand, gravel or rock

Best Management Practices (BMPs) – see definition page 10

Biodiversity – the variety and interconnectedness of all life, including plants, animals, and other organisms, the genes they contain, and the systems and processes that link them [2]

Boles – the stem of a tree once it has grown to substantial thickness, and is generally capable of yielding sawtimber, veneer logs, large poles, or pulpwood. Seedlings, saplings, and smaller poles have stems rather than boles [1]

C

Clearcuts – the removal of the entire stand in one harvest cutting with the reproduction obtained artificially or naturally from advanced regeneration, seeding from adjacent stands, trees cut during the clearing operation or seed trees [3]

Climax Species – species that typically dominate stand composition during the late stages of natural succession. These are usually the longest lived and most shade tolerant species characteristic of the climatic and site conditions within an ecosystem [4]

Coarse Woody Debris – see page 16

Corridors – a physical link, usually a swath of uncut trees, and connecting two areas of habitat that is different from the habitat on either side [1]

Corvid – any of a family (***Corvidae***) of stout-billed birds including crows, jays, magpies, and the raven

Crown closure – the area covered by the vertical projection of a tree canopy to a horizontal plane [1]

Crown Forest Policy – see definition page 10. This policy applies to all or any part of land under the administration of the Minister of Natural Resources.

E

Ecodistrict – a subdivision of ecoregion and the third level of the Nova Scotia ecological land classification system. It is based on distinct assemblages of relief, geology and landform. There are 39 ecodistricts in Nova Scotia.

Ecoregion – the second level of the Nova Scotia ecological land classification system, used to characterize a distinctive regional climate as expressed by vegetation. There are nine ecoregions identified in Nova Scotia.

Ecosite – the smallest unit of the Nova Scotia ecological land classification system. Ecosites represent ecosystems that have developed under a variety of conditions and influences, but which have similar moisture and nutrient regimes.

Ecosystem – a complex system of living organisms (plants,animals, fungi, and microorganisms), their environment (soil, water, air, and nutrients), and the interacting processes among them

Edaphic – the dominance of soil and site over climate in vegetation development

Ephemeral – typically used to describe things found in nature that last for brief periods of time

Even-age – describes a forest, stand, or Vegetation Type in which relatively small age differences exist between individual trees

Ericaceous Species – plants in or related to the heath family (*Ericaceae*) usually found on acidic (nutrient poor) soils including *Kalmia spp., Vaccinium spp.* and *Rhododendron spp.* [1]

F

Forest Ecosystem Classification (FEC) – see page 11

Forest Management Guides – Stand-level management decisions are determined from forest management guides using data collected in the pre-treatment assessment. Guides have been prepared for several forest groups from Nova Scotia's Forest Ecosystem Classification. These include: Tolerant Hardwoods (TH), Tolerant Softwoods and Mixedwoods (SH, MW), Spruce Pine (SP), and Intolerant Hardwoods (IH). The guides are found at: novascotia.ca/natr/forestry/programs/timberman/pubpres.asp

FSMZ (Forested Special Management Zone) – a treed buffer zone, with specific forest harvest guidelines, defined in the Atlantic Coastal Plain Flora Special Management Practices. See **Recovery Strategy and Management Plan** at: www.sararegistry.gc.ca

H

Hibernation – a dormant condition characteristic of certain mammals in which greatly reduced metabolic activity is triggered by the onset and duration of winter or a cold spell [1]

Hibernacula – see page 46

I

Invasive Species – an alien (or non-native) species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health; only a small portion of non-native species are invasive

*Cotton-grass (Eriophorum spp.) is a typical plant associated with treed wetlands (**edaphic** conditions). This wetland is in Riversdale, Colchester County.*

Photo: DNR (Peter Neily)

Invertebrates – animals without backbones such as insects, shellfish and worms [1]

K

Karst – surface and subsurface features created by the dissolving of soluble rock such as limestone and gypsum which results in features such as caverns and sinkholes [5]

L

Late-successional – On zonal Acadian Forest ecosites late-successional species include hemlock, red spruce, white pine, sugar maple, yellow birch, and American beech; while on zonal Maritime Boreal ecosites and edaphically influenced sites (e.g. dry and wet soils, nutrient poor soils) balsam fir, red maple and black spruce are more likely to form the climax forest [4]

Legacy Patches (Clumps) – see page 19

Legal Requirements – see definition page 10

M

Marsh – an area of permanent standing or slow moving water that is vegetated in whole or in part with plants adapted to live in water or waterlogged soils

Mast – see page 22

Migration – regular seasonal movement of bird and animal populations to and from different areas, often considerable distances apart [1]

N

Natural Disturbance – a natural force that causes significant change in a forest stand structure and/or composition. e.g. fire, wind, flood, insect damage, or disease

P

Partial Harvesting – removal of only a portion of the trees from a forest stand.

Peatland – a treed or tall shrub dominated wetland with water tables typically at or just below the surface, on organic soils

Pre-commercial Thinning – treatment is used to reduce the number of trees in young stands before the stems are large enough for commercial use

Pre-treatment Assessment (PTA) – site and forest conditions that will serve as a basis for stand-level management plans. For further information refer to the PTA website: novascotia.ca/natr/forestry/programs/timberman/pta.asp

R

Raptor – predatory birds including eagles, hawks, falcons and owls

Refugia – locations and habitats that support populations of organisms that are limited to small fragments of their previous geographic range [1]

*Berries of the wild raison shown here are an example of soft **mast**– the fruit of a woody tree or shrub that is a food source for wildlife.*

Riparian – the terrain, vegetation, or simply position adjacent to or associated with a stream, floodplain, or standing waterbody [5]

S

Sapwood – the outer layers of xylem tissue lying immediately interior to the cambium, the living part of the wood [1]

Senescence – generally described as the process of aging in mature individuals (trees), typical toward the end of an organism's life [1]

Selection Harvesting – removal of the mature timber, usually the oldest or largest trees, either as single scattered individuals or in small groups at relatively short intervals, repeated indefinitely, by means of which the continuous establishment of reproduction is encouraged and an uneven-aged stand is maintained [3]

Shade Tolerance – a condition whereby trees are capable of successful growth and reproduction beneath the shading canopy of other or similar species

Shelterwood – a harvesting system where mature timber is removed in a series of cuttings, which extend over a relatively short portion of the rotation, by means of which the establishment of essentially even-aged reproduction under the partial shade of seed trees is encouraged [3]

*Bald eagle perches in a **snag** after capturing an eel. (South River, Antigonish County)*

Photo: CNS (Len Wagg)

Silviculture – activities undertaken to control the characteristics of a forest stand or site, to help meet forest management objectives

Sinkholes – a funnel-shaped depression common in karst topography caused by the dissolving of underlying limestone or gypsum bedrock

Snags – in this guide, snags are dead trees larger than 7.5 cm in diameter at breast height (1.3 m) and standing at 45° or more

Special Management Practices (SMPs) – all management practices, developed by the provincial government, that are designed to protect biodiversity and/or reduce associated risks to priority species and habitats. These practices are mandatory on provincial Crown lands, and their application on other lands is strongly encouraged. A current list of SMPs can be viewed on-line: novascotia.ca/natr/wildlife/habitats/terrestrial/

Special Management Zones (SMZ) – the area defined in the Wildlife Habitat and Watercourses Protection Regulations as a 20 m zone on each side of the aquatic resource where certain conditions apply regarding harvest

Stewardship – the responsible use and conservation of natural resources in a way that takes full and balanced account of the interest of society, future generations, and other species [6]

Successional Stages – plant community development which proceeds through a number of distinct steps (e.g. early, middle, late) that replace one another in a predictable sequence

Super Canopy – see page 26

Swamp – a treed or tall shrub dominated wetland with water tables typically at or just below the surface, on mineral soils

T

Talus – a form of colluvium deposit, characterized by excessive surface stoniness, usually found at the base of steep slopes or cliffs [1]

Thalli *(pl. of thallus)* – vegetative body consisting of both algal and fungal components, as in lichens

Thermal Cover – cover used by animals to lessen the effects of weather on body temperature [1]

U

Uneven-age – a forest, stand, or Vegetation Type in which intermingling trees differ markedly in age. An uneven-aged stand contains at least three well-defined age classes.

V

Vegetation Type – recurring and identifiable forest plant communities which reflect differences in site conditions, disturbance regimes and/or successional stage

Vernal Pools – small (typically less than 0.5 ha), shallow wetlands that lack permanent inlet or outlet streams. They often dry out in the summer, then refill with autumn rains and spring snow melt.

Vertebrates – animals with backbones or spinal columns such as mammals, birds, amphibians, reptiles and fish

Watercourse – the bed and shore of a river, stream, lake, creek, pond, marsh, estuary or salt-water body that contains water for at least part of each year

Z

Zonal Site – a site with conditions that could potentially support establishment of a zonal climax forest which reflects regional climate norms and is not unduly affected by local extremes in soil and site conditions

This cow moose and her calf are part of the Cape Breton Island population, which is not considered endangered. (Cape Breton Highlands National Park)

Photo: CNS (Len Wagg)

Sources

1 Dunster, J. and K. Dunster. 1996. Dictionary of natural resource management. UBC Press. 363 pp.
2 Environment Canada. 1995. Biodiversity Convention Office.
3 Smith, D. M. 1962. The practice of silviculture. 7th edition. John Wiley and Sons, Inc. 578 pp.
4 Nova Scotia Department of Natural Resources. 2012. Old forest policy. Report FOR 2012-4. 15 pp.
5 Caboue, M. et al. 1996. Terminology of ecological land classification in Canada. Natural Resources Canada, Can. For. Serv., Inf. Rep. LAU-X-114E. 62 pp.
6 Nova Scotia Department of Natural Resources. 2011. The Path We Share — A Natural Resources Strategy for Nova Scotia (2011–2020), 82 pp.

Appendix B
Scientific and Common Names

Plants

Vascular Plants

Common Name	*Scientific Name*
Balsam fir	*Abies balsamea*
Baneberry	*Actaea spp.*
Beaked hazelnut	*Corylus cornuta*
Beech	*Fagus grandifolia*
Blackberry	*Rubus spp.*
Black ash	*Fraxinus nigra*
Black cherry	*Prunus serotina*
Black crowberry	*Empetrum nigrum*
Black spruce	*Picea mariana*
Bloodroot	*Sanguinaria canadensis*
Blue cohosh	*Caulophyllum thalictroides*
Broom crowberry	*Corema conradii*
Bulblet bladder fern	*Cystopteris bulbifera*
Canada lily	*Lilium canadense*
Choke cherry	*Prunus virginiana*
Cinnamon fern	*Osmunda cinnamomea*
Cow-wheat	*Melampyrum lineare*
Eastern baccharis	*Baccharis hamilifolia*
Eastern lilaeopsis	*Lilaeopsis chinensis*
Eastern white cedar	*Thuja occidentalis*
Elderberry	*Sambucus spp.*
Elm	*Ulmus americana*
Glaucous sedge	*Carex flacca*
Golden crest	*Lophiola aurea*
Hay-scented fern	*Dennstaedtia punctilobula*
Hemlock	*Tsuga canadensis*
Huckleberry	*Gaylussacia baccata*
Hyssop-leaved fleabane	*Erigeron hyssopifolius*
Ironwood	*Ostrya virginiana*
Jack-in-the-pulpit	*Arisaema triphyllum*
Lady fern	*Athyrium filix-femina*
Leatherwood	*Dirca palustris*
Long's bulrush	*Scirpus longii*
Meadow-rue	*Thalictrum pubescens*
Mountain-ash	*Sorbus americana*
Mountain laurel	*Kalmia latifolia*
New Jersey rush	*Juncus caesariensis*
Ostrich fern	*Matteuccia struthiopteris*
Pin cherry	*Prunus pensylvanica*
Pine barren golden heather	*Hudsonia ericoides*
Pink coreopsis	*Coreopsis rosea*
Plymouth gentian	*Sabatia kennedyana*
Ram's head lady's slipper	*Cypripedium arietinum*
Raspberry	*Rubus spp.*
Red baneberry	*Actaea rubra*
Red maple	*Acer rubrum*
Red oak	*Quercus rubra*
Red pine	*Pinus resinosa*
Red spruce	*Picea rubens*
Redroot	*Lachnanthes caroliana*
Rice grass	*Oryzopsis asperifolia*
Rockrose	*Helianthemum canadense*
Round-leaved sundew	*Drosera rotundifolia*
Scotch pine	*Pinus sylvestris*
Sedges	*Carex spp.*
Sensitive fern	*Onoclea sensibilis*
Serviceberry	*Amelanchier spp.*
Shepherdia	*Shepherdia canadensis*
Spotted pondweed	*Potamogeton pulcher*
Sugar maple	*Acer saccharum*
Sweet pepperbush	*Clethra alnifolia*
Tamarack	*Larix laricina*
Thread-leaved sundew	*Drosera filiformis*
Three-toothed cinquefoil	*Sibbaldiopsis tridentata*
Trembling aspen	*Populus tremuloides*
Tubercled spikerush	*Eleocharis tuberculosa*
Water pennywort	*Hydrocotyle umbellata*
White ash	*Fraxinus americana*
White pine	*Pinus strobus*
White spruce	*Picea glauca*
Wild apple	*Malus pumila*
Wild leek	*Allium tricoccum*
Wild raisin	*Viburnum nudum*
Woodland horsetail	*Equisetum sylvaticum*
Yellow birch	*Betula alleghaniensis*
Yellow lady's slipper	*Cypripedium parviflorum*

Non-Vascular Plants

Bryophytes

Common Name	*Scientific Name*
Sphagnum moss	*Sphagnum spp.*

Lichens

Common Name	*Scientific Name*
Boreal felt lichen	*Erioderma pedicellatum*
Dixie reindeer lichen	*Cladonia subtenuis*
Grey reindeer lichen	*Cladina rangiferina*
Old man's beard	*Usnea spp.*
Reindeer lichen	*Cladonia spp.*
Vole ears lichen	*Erioderma mollissimum*
Whitewash lichen	*Phlyctis argena*

Fungi

Common Name	*Scientific Name*
White-nose syndrome	*Pseudogymnoascus destructans*
Black chanterelles	*Craterellus spp.*
Hemlock varnish shelf fungus	*Ganoderma tsugae*

Animals

Birds

Common Name	*Scientific Name*
American woodcock	*Scolopax minor*
Bald eagle	*Haliaeetus leucocephalus*
Bank swallow	*Riparia riparia*
Barred owl	*Strix varia*
Bicknell's thrush	*Catharus bicknelli*
Black-backed woodpecker	*Picoides arcticus*
Blue jay	*Cyanocitta cristata*
Broad-winged hawk	*Buteo platypterus*
Canada warbler	*Cardellina canadensis*
Chimney swift	*Chaetura pelagica*
Common nighthawk	*Chordeiles minor*
Eastern whip-poor-will	*Antrostomus vociferus*
Falcons	*Falco spp.*
Grackle	*Quiscalus quiscula*
Great blue heron	*Ardea herodias*
Great horned owl	*Bubo virginianus*
Kingfisher	*Megaceryle alcyon*
Merlin	*Falco columbarius*
Northern goshawk	*Accipiter gentilis*
Northern saw-whet	*Aegolius acadicus*
Olive-sided flycatcher	*Contopus cooperi*
Osprey	*Pandion haliaetus*
Peregrine falcon	*Falco peregrinus anatum/tundrius*
Pileated woodpecker	*Dryocopus pileatus*
Raven	*Corvus corax*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ruffed grouse	*Bonasa umbellus*
Rusty blackbird	*Euphagus carolinus*
Sharp-shinned hawk	*Accipiter striatus*
Vesper sparrow	*Pooecetes gramineus*
Warblers	*Dendroica spp.*
Wood duck	*Aix sponsa*
Yellow-bellied sapsucker	*Sphyrapicus varius*

Common Name	*Scientific Name*
Amphibians and Reptiles	
Blue-spotted salamander	*Ambystoma laterale*
Blanding's turtle	*Emydoidea blandingii*
Eastern painted turtle	*Chrysemys picta picta*
Eastern ribbonsnake	*Thamnophis sauritus*
Garter snake	*Thamhophrs sirtalis pallidula*
Red efts (Red-spotted newt)	*Notopthalmus viridescens viridescens*
Spring peeper	*Pseudacris crucifer*
Snapping turtle	*Chelydra serpentina*
Wood frog	*Lithobates sylvaticus*
Wood turtle	*Glyptemys insculpta*
Yellow-spotted salamander	*Ambystoma maculatum*
Invertebrates	
Carpenter ants	*Camponotus spp.*
Earthworm	*Lumbricus terrestris*
Emerald ash borer	*Agrilus planipennis*
Fairy shrimp	*Eubranchipus intricatus*
Mole crickets	*Family: Gryllotalpidae*
Spruce bark beetle	*Dendroctonus rufipennis*
Mammals	
American marten	*Martes americana*
Black bear	*Ursus americanus*
Beaver	*Castor canadensis*
Bobcat	*Lynx rufus*
Canadian lynx	*Lynx canadensis*
Eastern chipmunk	*Tamias striatus*
Eastern coyote	*Canis latrans*
Fisher	*Martes pennanti*
Gaspé shrew	*Sorex dispar ssp. gaspensis*

Common Name	*Scientific Name*
Little brown myotis	*Myotis lucifugus*
Long-tailed shrew	*Sorex dispar*
Mink	*Neovison vison*
Moose	*Alces alces americanus*
Muskrat	*Ondatra zibethicus*
Northern myotis	*Myotis septentrionalis*
Northern flying squirrel	*Glaucomys sabrinus*
Otter	*Lontra canadensis*
Porcupine	*Erethizon dorsatum*
Raccoon	*Procyon lotor*
Red fox	*Vulpes vulpes*
Red squirrel	*Tamiasciurus hudsonicus*
Red-backed vole	*Myodes gapperi*
Rock vole	*Microtus chrotorrhinus*
Skunk	*Mephitis mephitis*
Snowshoe hare	*Lepus americanus*
Southern flying squirrel	*Glaucomys volans*
Star-nosed mole	*Condylura cristata*
Tri-colored bat	*Perimyotis subflavus*
Voles	*Microtus spp.*
White-tailed deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*

Appendix C
Forest Ecosystem Classification Units

Summary of Forest Groups, Vegetation Types (VTs) and variants within the provincial forest ecosystem classification (FEC) system ***(See pg 11)***

Forest Group	Forest Group Code	Number of VTs	Number of Variants
Cedar Forest	CE	2	1
Coastal Forest	CO	7	1
Floodplain Forest	FP	6	1
Highland Forest	HL	4	1
Intolerant Hardwood Forest	IH	7	3
Karst Forest	KA	2	0
Mixedwood Forest	MW	5	1
Old Field Forest	OF	5	0
Open Woodland	OW	6	0
Spruce Hemlock Forest	SH	10	1
Spruce Pine Forest	SP	10	5
Tolerant Hardwood Forest	TH	8	4
Wet Coniferous Forest	WC	8	3
Wet Deciduous Forest	WD	8	1
Total	**14**	**88**	**22**

Vegetation types (VTs) and their associated ecosite groups

(AC = Acadian, MB = Maritime Boreal) *

VT Code	VT Name	AC	MB
CE1	Eastern white cedar / Speckled alder / Cinnamon fern / Sphagnum	X	
CE1a	(Poison ivy variant)	X	
CE2	Eastern white cedar – Balsam fir / Stair-step moss	X	
CO1	Black spruce – Balsam fir / Foxberry / Plume moss		X
CO2	White spruce – Balsam fir / Foxberry / Twinflower		X
CO2a	(Black crowberry Headland variant)		X
CO3	Red spruce / Mountain-ash / Foxberry		X
CO4	Balsam fir / Foxberry – Twinflower		X
CO5	White birch – Balsam fir / Foxberry – Wood aster		X
CO6	Red maple – Birch / Bunchberry – Sarsaparilla		X
CO7	White spruce / Bayberry		X
FP1	Sugar maple – White ash / Ostrich fern – Wood goldenrod	X	
FP2	Red maple – Red oak / Bellwort – Nodding trillium	X	
FP2a	(Sugar maple variant)	X	
FP3	Red maple / Sensitive fern – Rough goldenrod	X	
FP4	Balsam poplar – White spruce / Ostrich fern – Cow-parsnip	X	
FP5	Black cherry – Red maple / Rough goldenrod – Jack-in-the-pulpit	X	
FP6	White spruce / Wood goldenrod / Shaggy moss	X	
HL1	Balsam fir / Mountain-ash / Large-leaved goldenrod		X
HL1a	(White birch / Wood sorrel variant)		X
HL2	White spruce / Wood aster		X
HL3	Yellow birch – Balsam fir / Eastern spreading wood fern – Wood sorrel		X
HL4	Birch / Wood fern – Wood sorrel		X
IH1	Large-tooth aspen / Lambkill / Bracken	X	
IH1a	(Red oak variant)	X	
IH2	Red oak – Red maple / Witch-hazel	X	
IH2a	(Red oak variant)	X	
IH3	Large-tooth aspen / Christmas fern – New York fern	X	
IH4	Trembling aspen / Wild raisin / Bunchberry	X	
IH5	Trembling aspen – White ash / Beaked hazelnut / Christmas fern	X	
IH6	White birch – Red maple / Sarsaparilla – Bracken	X	
IH6a	(Aspen variant)	X	
IH7	Red maple / Hay-scented fern – Wood sorrel	X	
KA1	Hemlock / Christmas fern – White lettuce – Wood goldenrod	X	
KA2	Sugar maple / Christmas fern – Rattlesnake fern – Bulblet bladder fern	X	
MW1	Red spruce – Yellow birch / Evergreen wood fern	X	
MW2	Red spruce – Red maple – White birch / Goldthread	X	
MW2a	(Aspen variant)	X	
MW3	Hemlock – Yellow birch / Evergreen wood fern	X	
MW4	Balsam fir – Red maple / Wood sorrel – Goldthread	X	

*** DEFINITIONS**

Acadian Ecosite Group – contains 17 ecosites representing a full range of forest site conditions. Zonal sites are associated with climax forest containing mainly shade tolerant and shade-intermediate species such as red spruce, hemlock, white pine, sugar maple, yellow birch, beech, white ash and red maple.

Maritime Boreal Ecosite Group – includes 11 ecosites representing a range of forest site conditions. Exposure and climate differentiates the maritime Boreal group from the Acadian group. Zonal climax forests contain mainly balsam fir, white spruce, black spruce, red maple and white birch.

Refer to **Forest Ecosystem Classification for Nova Scotia (2010)** for further information. The NS FEC is available on-line at: novascotia.ca/natr/forestry/veg-types

VT Code	VT Name	AC	MB
MW5	White birch – Balsam fir / Starflower	X	
OF1	White spruce / Aster – Goldenrod / Shaggy moss	X	X
OF2	Tamarack / Speckled alder / Rough goldenrod / Shaggy moss	X	X
OF3	White pine – Balsam fir / Shinleaf – Pine-sap	X	
OF4	Balsam fir – White spruce / Evergreen wood fern – Wood aster	X	X
OF5	Trembling aspen – Grey birch / Rough goldenrod – Strawberry	X	
OW1	Jack pine / Huckleberry / Black crowberry / Reindeer lichen	X	X
OW2	Black spruce / Lambkill / Reindeer lichen	X	X
OW3	Red spruce / Red-berried elder / Rock polypody	X	
OW4	Red pine – White pine / Broom crowberry / Grey reindeer lichen	X	
OW5	Red oak / Huckleberry / Cow-wheat – Rice grass / Reindeer lichen	X	
OW6	White birch – Red oak – White ash / Marginal wood fern – Herb-Robert	X	
SH1	Hemlock / Pin cushion moss / Needle carpet	X	
SH2	Hemlock – White pine / Sarsaparilla	X	
SH3	Red spruce – Hemlock / Wild lily-of-the-valley	X	
SH4	Red spruce – White pine / Lambkill / Bracken	X	
SH4a	(Red spruce variant)	X	
SH5	Red spruce – Balsam fir / Schreber's moss	X	
SH6	Red spruce – Balsam fir / Stair-step moss – Sphagnum	X	
SH7	White spruce – Red spruce / Blueberry / Schreber's moss	X	
SH8	Balsam fir / Wood fern / Schreber's moss	X	

VT Code	VT Name	AC	MB
SH9	Balsam fir – Black spruce / Blueberry	X	
SH10	White spruce – Balsam fir / Broom moss	X	
SP1	Jack pine / Bracken – Teaberry	X	X
SP1a	(Black spruce variant)	X	X
SP2	Red pine / Blueberry / Bracken	X	
SP2a	(Black spruce variant)	X	
SP3	Red pine – White pine / Bracken – Mayflower	X	
SP3a	(Black spruce variant)	X	
SP4	White pine / Blueberry / Bracken	X	X
SP4a	(Black spruce variant)	X	X
SP4b	(Huckleberry variant)	X	X
SP5	Black spruce / Lambkill / Bracken	X	X
SP6	Black spruce – Red maple / Bracken – Sarsaparilla	X	X
SP7	Black spruce / False holly / Ladies' tresses sphagnum	X	X
SP8	Black spruce – Aspen / Bracken – Sarsaparilla	X	
SP9	Red oak – White pine / Teaberry	X	
SP10	Tamarack / Wild raisin / Schreber's moss	X	
TH1	Sugar maple / Hay-scented fern	X	
TH1a	(Beech variant)	X	
TH1b	(Yellow birch variant)	X	
TH2	Sugar maple / New York fern – Northern beech fern	X	
TH2a	(Yellow birch variant)	X	
TH3	Sugar maple – White ash / Christmas fern	X	
TH4	Sugar maple – White ash / Silvery spleenwort – Baneberry	X	
TH5	Beech / Sarsaparllla / Leaf litter	X	
TH6	Red oak – Yellow birch / Striped maple	X	

VT Code	VT Name	AC	MB
TH7	Yellow birch – White birch / Evergreen wood fern	X	
TH8	Red maple – Yellow birch / Striped maple	X	
TH8a	(White ash variant)	X	
WC1	Black spruce / Cinnamon fern / Sphagnum	X	X
WC2	Black spruce / Lambkill – Labrador tea / Sphagnum	X	X
WC2a	(Huckleberry – Inkberry variant)	X	X
WC3	Jack pine – Black spruce / Rhodora / Sphagnum	X	X
WC3a	(Black spruce variant)	X	X
WC4	Red pine – Black spruce / Huckleberry – Rhodora / Sphagnum	X	
WC5	Red spruce – Balsam fir / Cinnamon fern / Sphagnum	X	X
WC6	Balsam fir / Cinnamon fern – Three seeded sedge / Sphagnum	X	X
WC7	Tamarack – Black spruce / Lambkill / Sphagnum	X	X
WC7a	(Huckleberry – Inkberry variant)	X	X
WC8	Hemlock / Cinnamon fern – Sensitive fern / Sphagnum	X	
WD1	White ash / Sensitive fern – Christmas fern	X	
WD2	Red maple / Cinnamon fern / Sphagnum	X	X
WD3	Red maple / Sensitive fern – Lady fern / Sphagnum	X	X
WD4	Red maple / Poison ivy / Sphagnum	X	X
WD4a	(Huckleberry – Inkberry variant)	X	X
WD5	Trembling aspen / Beaked hazelnut / Interrupted fern / Sphagnum	X	
WD6	Red maple – Balsam fir / Wood aster / Sphagnum	X	X
WD7	Balsam fir – White ash / Cinnamon fern – New York fern / Sphagnum	X	
WD8	Red spruce – Red maple / Wood sorrel – Sensitive fern / Sphagnum	X	

Appendix D
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Appendix E
Ecoregions and Ecodistricts of Nova Scotia

Northern Plateau 100

Cape Breton Highlands
- Cape Breton Highlands 210
- Victoria Lowlands 220

Nova Scotia Uplands
- Cape Breton Hills 310
- Inverness Lowlands 320
- Pictou Antigonish Highlands 330
- Cobequid Hills 340
- Cobequid Slopes 350
- Mulgrave Plateau 360
- St. Marys River 370
- Central Uplands 380

Eastern
- Rawdon / Wittenburg Hills 410
- Eastern Granite Uplands 430
- Eastern Interior 440
- Governor Lake 450

Northumberland / Bras d'Or
- Bras d'Or Lowlands 510
- St. George's Bay 520
- Northumberland Lowlands 530
- Cumberland Hills 540
- Cumberland Marshes 550
- Chignecto Ridges 560

Valley and Central Lowlands
- Annapolis Valley 610
- Minas Lowlands 620
- Central Lowlands 630

Western
- Valley Slope 710
- South Mountain 720
- Clare 730
- LaHave Drumlins 740
- Rossignol 750
- Sable 760

- Western Barrens 770
- St. Margaret's Bay 780

Atlantic Coastal
- Cape Breton Coastal 810
- Eastern Shore 820
- South Shore 830
- Tusket Islands 840
- Sable Island 850

Fundy Shore
- Parrsboro Shore 910
- North Mountain 920

The ecoregions and ecodistricts shown here are described in the Ecological Land Classification for Nova Scotia, available on-line at: novascotia.ca/natr/forestry/ecological/ecolandclass.asp