WOODLOT MANAGEMENT HOME STUDY MODULE

MODULE 4:
Woodlots and Wildlife

MANUAL HSC 2007-1

NOVA SCOTIA
Natural Resources

PREFACE

Small woodlots make up almost 50 per cent of Nova Scotia's forests. Decisions by woodlot owners have a huge influence on wildlife in this province.

In this revised module, called *Woodlots and Wildlife*, students reading the five-lesson course are joined in an imaginary classroom with fictional instructor Carl, a regional wildlife biologist with Natural Resources, and fictional students Dan and Joan Barr.

Dan owns a 95-hectare woodlot on the sloping face of the Cobequid Hills in Colchester County. Dan is a retired heavy equipment mechanic. Joan was a teacher, but became an at-home mom when Michael was born 28 years ago and never returned to the classroom. Dan grows and cuts a few Christmas trees that he sells from his front lawn and to the Cooperative in Truro. Dan's woodlot is an heirloom—his great grandfather once homesteaded and had a farm here. The farm buildings are gone now, except for large rocks that outline the foundation. Dan now has a camp here. Besides having an interest in wildlife, Dan and Joan have an added interest in the course since they know Carl, the instructor.

Carl once owned a big English setter dog and used to hunt for woodcock in the big alder stands on Dan's woodlot. The Barrs have known Carl for several years and often talk about wildlife.

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LESSON ONE: **Understanding Wildlife On The Woodlot**

Wildlife Redefined

In his younger days, Dan was a keen hunter and regarded wildlife mostly as game animals. Joan is always looking up the names of plants or birds in books and is now a good botanist and birder.

There was a time when wildlife were thought of only as game animals, or animals to be hunted. In the early 1970s when Carl started with the Nova Scotia Department of Natural Resources, the Wildlife Division of the department was concerned primarily with waterfowl, moose, deer, bear, upland game, and furbearers. Although scientists and naturalists at universities and at the Nova Scotia Museum of Natural History studied ''non-game'' wildlife in an academic sense, ''non-game'' wildlife had no legal protection and were mostly ignored. Economic development proceeded without concern for wildlife that did not earn their importance as sport animals.

A Wildlife Policy for Canada (1990) has redefined wildlife to mean ''all wildlife: wild mammals, birds, reptiles, amphibians, fishes, invertebrates, plants, fungi, algae, bacteria, and other wild organisms.''

Scientists have documented or named 1.7 million species of plants, animals, bacteria, and fungi worldwide and estimate many millions more (perhaps 14 million) currently unnamed.

It is difficult to think of bacteria in the same way as a bald eagle. But a conversation with persons that study small organisms would explain how important, for both good and bad, these small micro-organisms are in our lives.

Fortunately today's society has a broader appreciation for wildlife and is realizing the affects that humans have in disrupting life systems. The Wildlife Division now has expanded to include a program devoted to Biodiversity and to Species at Risk. Also there is a Forest Habitat program that integrates wildlife conservation methods with forest management.

Biodiversity

BIODIVERSITY includes all forms of life as well as the different levels at which life—trees and other plants, invertebrate and vertebrate animals, fungi, and microorganisms—operates, from genetic differences among individuals to complex interactions within ecosystems. The term biodiversity encompasses both biological "structures" (genes, organisms, populations, or communities) and biological "processes" (energy transfer, nutrient cycling, and succession).

The complexity of wildlife becomes more impressive when one considers wildlife in terms of biodiversity. Within each individual species there is genetic variation. For example, because of geographic separation over many years, a population of brook trout in Annapolis County in western Nova Scotia will vary genetically from brook trout on the Cobequid Hills in Colchester County and will vary even more from brook trout in Newfoundland. This genetic variation gives living things the potential to adapt and thus survive changes in their environment.

Biodiversity also importantly looks at species in the context of ecological relationships. The ecological importance of wildlife is explained in the next section.

PHOTO: DAN BANKS

Wildlife Importance

RECREATIONAL

Woodlot owners know how lucky they are to own woodland. Many owners have built camps on their woodlots. Joan teases Dan that his camp is where he goes away to pout, although she, herself, greatly enjoys the quiet there. By "going to the woodlot" they get outdoors and away from concrete, artificial light, and noise to renew their spirit. Wildlife is an important part of that experience. Each walk through the woodlot differs with the changes in the seasons. Ostrich ferns along a rich river interval change from springtime fiddleheads to metre-high summer fronds. Joan and Dan watch cedar waxwings eat springtime apple blossoms and find bear droppings under apple trees in the fall. During the class Carl teases Dan that with the name Barr, he is related to the bears that visit his woodlot.

The recreational importance of wildlife is supported by an Environment Canada report that found in the one year, 1996, 630,000 Nova Scotians spent 65.8 million days in direct and indirect wildlife-related activities such as viewing, hunting, fishing, or visiting natural areas. Another example of wildlife recreation, in 2005, 1240 observers participated in 35 Christmas Bird Counts in different communities across Nova Scotia.

ECONOMIC

The same Environment Canada report found that again in the year 1996, Nova Scotians spent 244.8 million dollars on wildlife-related activities. Tourists come to Nova Scotia to see our spectacular landscapes and our wildlife. Guides, taxidermists, outdoor supply stores, trappers, and birdseed suppliers earn money from wildlife.

ECOLOGICAL

Certainly the greatest importance of wildlife and biodiversity is ecological. Each woodlot parcel in Nova Scotia contributes to an ecosphere of life that surrounds our planet. The ecosphere provides essential services for our survival. It cleans the air we breathe, recycles and purifies water, absorbs waste we produce, provides us with food, fuel, and shelter, and stabilizes and moderates climate. Green plants produce oxygen and remove carbon dioxide. Fungi and bacteria decompose the dead and recycle nutrients back for the living.

At the genetic level, variety stored in genes gives organisms the ability to adapt to changes in the environment, such as climatic change or disease. Forest communities that are simplified with reduced genetic diversity lose adaptability or resiliency.

Many common medicines, such as the heart medicine digitalis, come from nature. As far back as 1785, an extract from foxglove (***Digitalis purpurea***) was prescribed for treating irregular heart rhythm.

There are many more examples and great potential for future discoveries. Some researchers are looking at why the skin of tropical frogs has such high resistance to infection. Medical researchers connected to space travel are studying black bears to determine how they can hibernate and not have tissue or bone damage.

Sometimes we may think that certain species have no value. The truth is that the real contribution or ecological importance of an unappreciated species has not yet been discovered. It is important to remember that species and ecosystems have evolved over thousands of years, and most occurred here before the arrival of humans. They all have intrinsic value. Unintelligent tinkering and the loss of one species could put the survival of many other dependent species at risk.

MYCORRHIZAL FUNGI

Mycorrhizal fungi form a partnership with trees and most other plants by intertwining with the roots of plants. These beneficial fungi are filamentous themselves and serve as a secondary root system. They extend far out into the soil and extract nutrients, such as nitrogen and phosphorous, and water for their host plant. In return, the plant supplies carbohydrates to the fungi. This partnership is believed to have evolved early in the evolution of plants and enabled plants to survive in stressful locations where nutrients were scarce.

A third organism enters the relationship at night. Flying squirrels emerge from daytime hiding places in tree cavities to dig up mushrooms and truffles. The squirrels, in turn, spread fungal spores in their droppings.

Even the maligned porcupine has a role. Imagine a porcupine inadvertently dropping branches down to a starving deer or creating openings in the forest canopy allowing sunlight to penetrate to the forest floor.

PHOTO: FRAN SPALDING

Understanding Wildlife Habitat

All living things require food and water. Living things also require shelter for protection from climate or from dangers such as predators. The foods eaten, the use of water, and how and where wildlife seeks cover can take many forms. Also the availability of food, water, and cover must be relatively accessible, within the limits of the species daily or seasonal mobility. Carl explains wildlife habitat as having four parts—food, water, cover, and spatial relationships.

The study of nature is so interesting because each species has diverse physical and behavioral adaptations to claim their share of food, water, cover, and space.

FOOD

Food provides the energy for a species to grow, for body maintenance, and for reproduction. When one considers that a hen black duck with a clutch of 12 eggs has laid her own weight in eggs, the investment in energy for reproduction is considerable. A female green frog will lay 1000 to 5000 eggs. A male green frog will spend weeks calling in his "loose banjo string" like call, defending a favorite spawning site.

Carl believes that one of the most amazing and probably the least appreciated process in nature is ***photosynthesis***. To understand the strategies of all organisms for obtaining food, it is important to know

that all food is initially the result of photosynthesis. Plants, energized by sunlight, are able to convert minerals into carbohydrates, fats, and proteins.

Photosynthesis is the beginning of the amazing journey of energy and basic materials of life from plant to animal to decomposer. The energy stored by plants is passed to other species by a series of steps of eating and being eaten. Plants are the ***primary producers***. ***Herbivores*** are the plant feeders, capable of converting energy stored in plant tissue to animal tissue. Insects, rodents, and hoofed animals are examples of herbivores. Herbivores have adaptations, such as the structure of their teeth, complicated stomachs, and long intestines, to eat diets high in cellulose.

Herbivores in turn are the energy source for the

A deer mouse eats the seeds of sensitive fern. A pine martin eats the mouse. Fly larvae and carrion beetles decompose the martin droppings.

carnivores, adapted for a diet of flesh. Carnivores themselves are eaten by larger carnivores. Carnivores have evolved specialized body parts that help them capture and consume their prey. Hawks and owls have sharp talons for holding prey and hooked beaks for tearing flesh. Mammalian carnivores have canine teeth for biting and piercing. Some consumers are *omnivores*, eating both plant and animal matter. A red fox will feed on berries, small rodents, and even dead animals.

Decomposers make up the final feeding group. Bacteria, yeast, and fungi are a large part of this group. They break down the remains and wastes of others into simpler substances and eventually into inorganic minerals, making them available again for use by photosynthetic plants.

WATER

Most wildlife species must consume water daily. For most terrestrial woodlot wildlife in Nova Scotia, water is readily available and rarely a ***limiting factor***. (In a desert environment, water is a limiting factor.) However the life strategies of aquatic species, such as beaver or frogs, are more critically linked to water bodies. A woodlot without permanent water will not have the larger bullfrog or green frog species, because the tadpoles of these frogs must over-winter in water. These big tadpoles, with hind legs developing, are often seen along lake or pond shores.

COVER

Cover provides an animal with protection from the weather and from predators. Deer, during winters of deep snow, will ‘‘yard’’ in mature softwood stands, because falling snow is caught on the boughs in the tree canopy and deer mobility on the forest floor is easier. The same trees provide protection from wind. As will be explained further in later lessons, cavities in trees and spaces within logs are cover for numerous species for dens, nests, resting, and escape.

SPATIAL RELATIONSHIPS

Abundant food, quality cover, and water must be inter-mixed and available over the space for which the species has an ability to travel. Habitat would be poor if, for example, a snowshoe hare had to travel a long distance between places where they hide and places to feed. It would be a fast food takeout in reverse with predators waiting for food to drive by. A beaver pond would not stay occupied if aspen trees and other foods were not available within a short carry distance of the pond.

A beaver pair locates all their life needs along a section of watercourse. They create an area of deep water by building a dam, create a lodge within the pond, and find necessary foods within the pond and along its borders. If food becomes scarce, they move up or down stream and create more dams and a new lodge. In their second year, young beaver born to the adult pair are forced to disperse—to find mates and new pond opportunities elsewhere. Serious fights result if dispersed young or other beaver attempt to live within the occupied territory.

The space and arrangement over which an organism obtains food, water, and cover varies in size for different species. Space for a plant might cover 1.0 square metre, as far as the plant’s roots or limbs and leaves reach. The yearly movements of a moose could range over 10 square kilometres. To maintain wildlife on a woodlot it is important

to have an inter-dispersion of forest types and other aquatic and non-forest habitat types.

Looking For Just The Right Place To Live

Nova Scotia has over 1700 species of plants. The physical appearances of these Nova Scotia plants are often very different. Over evolutionary time the shapes of plants have evolved in divergent ways, resulting in diverse structural survival advantages. Like animals, plants need space, water, and food in the form of minerals. Like animals, plants need cover or at least the protected conditions where they are not killed by climatic extremes. Unlike animals, the majority of plants need sunlight for photosynthesis. ***Saprophytes*** are an exception among plants. Saprophytes, such as the white-coloured Indian pipe, have lost the ability for photosynthesis. Like scavengers, they draw nourishment from dead plant and animal material. Each plant species competes with other plants for space, water, food, and sunlight. One strategy is to grow tall above all other plants. Trees are the giants of the plant world. Smaller plants have adapted by growing away from the trees or have adapted to live with them. Tough plants like cord grasses grow in salt marshes where trees cannot grow and are able to withstand daily submersions in salt water. Heath plants grow in bogs or on rocks where tree growth is poor. Insectivorous plants, such as the pitcher plant and sundew, live in bogs and supplement their need for nitrogen by catching insects. Cattails and water lilies grow out of the shadow of trees in wetlands. Some plants, like northern beech fern, are shade tolerant and able to grow under the trees. Trout lilies and spring beauty do grow on the forest floor under hardwoods. In May before hardwood leaves open, these ***vernal*** plants have a flash of growth and blossom in the warm sunlight before the tree canopy closes. Some plants, such as fireweed and goldenrod, are pioneer species growing in forest openings. They produce thousands of airborne seeds that seek out new openings. The location where a plant or an animal finds the perfect conditions for its genetic strategy to survive is called its ***niche***.

Following plants in the food chain, the herbivores, carnivores, and decomposers compete with types of their own and elbow into a niche somewhat different than their closest competitor. Barred owls, for example, will hunt at night, while northern goshawks hunt in the day. American goldfinches feed regurgitated seeds to their young, unlike many other birds that feed insects to young.

FERNS AND FERN-LIKE PLANTS

In Nova Scotia there are 81 ferns and fern-like plants. These plants reproduce with spores and have no flowers. The group includes True Ferns, Horsetails, Club-Mosses, and Quillworts. Each of the 81 fern and fern-like plants has a niche where growing conditions are "just right."

Population Ups And Downs

Everyone has noticed year-to-year fluctuations in numbers of wildlife. Wildlife populations change in response to factors such as diseases, predation, weather extremes, exploitation, and habitat conditions. At times, two or more mortality factors will function together to decrease a population. For example, deer weakened by starvation becomes more prone to predation or death from cold weather. In nature, birth rates attempt to replace numbers lost to mortality factors. One of nature's survival strategies is to produce many offspring, calculating that a few will survive to reproduce the next generation.

By far the most important remedy for high mortality is habitat condition. When a population is severely reduced, recovery is usually assured if good habitat exists in which populations can grow. Also in good habitat there is more stability and more resistance to wide population fluctuations. Habitat is the ultimate limiting factor. In good habitat, wildlife have better food and cover and are in better physical condition to withstand disease and climate extremes. There is better survival of young.

Quiz

1. What percentage best describes small private woodlot ownership in Nova Scotia?

- ❑ (a) 74%
- ❑ (b) 48%
- ❑ (c) 26%
- ❑ (d) 33%

2. Wildlife does not include fish.

❑ True ❑ False

3. A Carrion Beetle is a

- ❑ (a) Carnivore
- ❑ (b) Herbivore
- ❑ (c) Decomposer
- ❑ (d) Primary Producer

4. Trout Lilies blossom under the leaf canopy of hardwoods.

❑ True ❑ False

5. The place where a Trout Lily grows best is known as its

- ❑ (a) Cover
- ❑ (b) Niche
- ❑ (c) Biodiversity
- ❑ (d) Tree Cavity

6. The loss of one species is no consequence.

❑ True ❑ False

LESSON TWO: **Features That Contribute To Wildlife Habitat On Woodlots**

In Lesson One, students were introduced to general information to understand wildlife: the redefinition of wildlife, the concept of biodiversity, and to the general habitat needs of wildlife. Lesson Two examines more specifically forest structures and characteristics that contribute to wildlife habitat in a woodlot. This knowledge prepares the woodlot owner to recognize and to better protect or manipulate woodlot features that affect wildlife habitat.

The Acadian Forest

Forests in the Maritimes are part of the Acadian Forest Region. Prior to European settlement, and compared to today, the forests in Nova Scotia were much different. The forest contained a greater quantity of longer-lived and shade-tolerant tree species. No one, of course, can quantitatively describe this early forest; however, Carl refers to a report titled *Old-growth forests in the Acadian Forest Region*. The authors, with knowledge of ecological succession, geology, fire disturbance, and other information, project that 50 per cent of the Maritime landscape may have been dominated by late-successional old growth forest types. Land grant surveys made during the early days of European settlement support this projection.

THE ACADIAN FOREST IS SUB-DIVIDED INTO 9 MAJOR DOMINANT FOREST TYPES:

(1a) Upland Hardwood – Sugar Maple, Beech, Yellow Birch, White Ash, Ironwood

(1b) Bottomland Hardwood – Sugar Maple, Beech, Yellow Birch.

(2) Ridge-top Hardwood – Sugar Maple, Beech, Yellow Birch

(3) Upland Mixedwood – Sugar Maple, Yellow Birch, Red Spruce, Beech

(4) Mixedwood fire types – Jack Pine, Trembling Aspen, Black Spruce or White Pine, Red Oak, Red Pine

(5) Wet Calcareous – Eastern White Cedar, Black Ash, Red Maple (more common in New Brunswick)

(6) Wet acid peat Softwood – Black spruce, Tamarack

(7) Coastal Softwood – White Spruce, Balsam Fir or Red Spruce, Balsam Fir

(8) Highland Softwood – Balsam Fir, Black Spruce, White Spruce

(9) Tolerant Softwood – Red Spruce, White Pine, Eastern Hemlock

It would not be accurate to imagine that a solid canopy of tall trees stretched across the whole province before European settlement. While there were more older trees than exist today, life did eventually end for the light-hogging forest giants. Natural disturbances—including windstorms, fire, ice, insects, and pathogens—created patterns of dead and renewing forests. Small canopy gaps, created by a falling tree or a group of trees, gave shade-tolerant understory trees the room and sunlight they needed to grow quickly and capture a place in the canopy. Larger openings gave mid-tolerant and shade intolerant tree species the chance to become established. The result was a highly varied forest, with different stages of succession, trees of all sizes and ages, and a variety of stand sizes and shapes. There were accumulations of woody debris on the forest floor. Standing trees offered many cavities for occupation by wildlife. At times, scattered tall pines or spruce poked above the canopy forming another layer called the ***supercanopy***.

Nova Scotia wildlife evolved amongst this forest mosaic for many thousands of years, and it is in this self-sustaining forest that habitat conditions

are best for Nova Scotia wildlife. To manipulate wildlife habitat when managing woodlots, we look to lessons learned from the natural disturbance processes in Acadian forests.

Diversity

Habitat diversity means more wildlife. As explained in Lesson One, wildlife habitat must provide food, cover, and water, and have spatial arrangement. Some forest species find their niche within a single forest stand, but other wildlife might require a variety of forest stands. The more diverse the mix of forest stands, each with its own tree species composition, age structure, shape, and size, the more diverse the habitat opportunities are for associated plants and animals.

To better understand woodland habitats, Carl asks the class to look at woodlot diversity from three perspectives: ***Looking Across, Looking Up***, and ***Looking Down***.

Looking Across refers to horizontal diversity or diversity looking across the landscape. **Looking Up** refers to vertical diversity in a forest stand or the diversity from ground level to tree tops. Looking Up also includes the important component of ***cavity trees*** and ***snags***. **Looking Down** refers to the important wildlife habitat of decaying logs. Looking down can also include the precautions taken to prevent soil erosion and nutrient loss.

The study of wildlife habitat features continues in Lesson Three where a fourth perspective, **Taking Care**, is discussed, but more on that later.

Looking Across
Horizontal Diversity

Carl talks about woodlot diversity that one sees looking across the landscape. Dan thinks about the view he sees if he takes the back road off the Cobequid Hills to his woodlot.

At one point he can see the four woodlot features that Carl talked about. Dan can see the different types of forest tree communities—the different tree species groups of Hardwoods, Softwoods, and Mixed-woods. He can see that different stands in the tree associations have different ages—a reflection of past harvests and natural disturbance processes. He can see that each young and old stand has its own shape and size. He can see the arrangement of trees.

Looking across the landscape the arrangement (or mosaic pattern) of forest types, forest ages, stand shapes and sizes, and the added inter-dispersed features such as watercourses or old fields, is a measure of diversity. The greater the forest mix, the greater are the opportunities for wildlife to find their appropriate niche.

NATIVE TREE SPECIES COMPOSITION

Trees were referred to in Lesson One as the giants of the forest. Trees dominate the lives of the other community members. Each of the province's 10 native softwoods and 14 (more or less) commercial hardwood trees has its own habitat preferences, yet often grow in combination with other tree species. Hemlock grows mostly in patches along rich north slopes and ravines or mixed with shade-tolerant trees such as red spruce and sugar maple. Balsam fir grows best on moist well-drained soils. Black spruce grows chiefly on poorly drained soils, but associates with balsam fir and white spruce on better soils. White birch prefers mineral soils and open sunlight.

Nova Scotia has a natural diversity of forest communities. Different regions of Nova Scotia have different climate influences and different geological history, and this influences what forest types will grow. Coastal regions are foggy and temperatures are moderated. Interior areas are dryer and hotter. Some soils are glacial granitic soils and while others are sandy plains. The hardwood hills in Colchester County have a different forest, and a somewhat different wildlife population, than the fog-covered softwood forests along the coast of Guysbourgh County.

The Department of Natural Resources has mapped regional differences in what is called an **Ecological Land Classification**. There are nine ***ecoregions*** for Nova Scotia. Ecoregions are further divided into ***ecodistricts***. To learn more, see Ecological Land Classification in the references. For this lesson, it is enough to know that when trying to understand woodlot diversity, the location of a woodlot in Nova Scotia will reflect on resident plants and animals.

Woodlot owners should recognize the influences of regional conditions and should manage the local native trees. Over time, these trees have the best-adapted genetics to the regional growing conditions. They should encourage shade-tolerant trees that once were dominant in their region.

HARDWOODS AND SOFTWOODS

The obvious difference between coniferous trees and deciduous trees is the shape of their leaves and the year-long retention or seasonal loss of foliage. Generally, hardwoods support a richer diversity of life, but both have their benefits. Most softwoods are more shallow rooted and do not do not carry up minerals from deep in the earth. Conifer leaf litter is acidic and decomposes slowly, and hence limits the abundance especially of soil invertebrates. Softwood forests provide better winter cover for species such as deer and spruce grouse. Within predominately softwood forests, woodlot owners should retain some hardwood. Similarly within hardwood forest, woodlot owners should retain some softwood. Mixedwood stands have the benefits of both tree types.

KEEPING ALL THE PARTS

Sometimes a woodlot has small stands of less common tree species, for example red oak in northern Nova Scotia, a patch of eastern hemlock, black cherry on alluvial soils, or a rare species such as eastern cedar. Perhaps the woodlot once was an old farm and now has apple trees crowded by white spruce, an old field, or old-field alders. All these different parts add to the habitat variety of the woodlot and increase the opportunities that a larger number of wildlife species will find their habitat needs. Care must be taken not to eliminate these elements. Dan thinks of his woodlot because it once was a farm and has lots of old apple trees and fields grown up in alders.

MAST

Mast includes nuts, seeds, berries, and fruits produced by trees, shrubs, vines, and herbaceous plants. Nuts and seeds are "hard mast;" fruits and berries are "soft mast."

The seeds of maples, birches, ashes, and conifers provide important hard mast for small mammals and birds. Acorns of red oak are particularly rich in protein and fat. Red oak produces a heavy crop every two to five years, and trees begin peak production after 25 years.

Beech used to be a very important source of beechnuts, but it now suffers from beech bark disease. Early nineteen-century farmer in western Nova Scotia on small farms corralled livestock under beech, and this practice illustrates the potential high food production of beech. In Maine beechnuts are a very important black bear food in fall. It is a shame that this tree has declined.

Black cherry is an important large tree producer of soft mast. Mountain ash, serviceberry, chokecherry, pin cherry, and elderberries are other important soft mast examples. Herbaceous plants such as raspberries and blackberries are well known. Less known are fruits produced on plants such as false Solomon seal, wild strawberry, clintonia, painted and nodding trilliums, and many more. These quickly disappear as grouse and other wildlife feed across the forest floor.

This section on mast has a similar theme to sections on Native Tree Species Composition and Keeping All the Parts. Woodlot owners should observe all the native plants that produce mast and find ways to encourage these plants. There is no need to introduce exotic berry plants. Introductions can sometimes go wrong by introducing invasive plants or pathogens.

STAND AGES, SIZES, AND SHAPES

Taking clues from past natural disturbances of the forest, we do not suggest that woodlot owners set forest fires or import insect pests. Rather, when forest products are harvested from a woodlot, the harvest technique can potentially produce a balance of forest ages, create forest edge, and create

a variety of stand shapes, and in a pattern that has good interdispersion.

Carl explains that there is a change of thinking on the often-used clearcut harvest method that regenerates shade intolerant tree species. In years past, wildlife management was somewhat guided by an interest to manage deer. Clear-cuts were thought fine if lots of edge and a good representation of different successional stages were created.

The trouble is that this even-aged harvest management approach often regenerates fewer long lived species.

For specific tree species and site conditions, even-aged forest management still is a necessary practice. However, if conditions allow, a portion of woodlots should be managed to create uneven-aged selection methods. Module Two of the Woodlot Home Study Course has a section on uneven-aged selection methods.

FOREST SUCCESSION

Following a disturbance, forests re-grow. Initially the site is open with many herbaceous plants, such as raspberries. In 10 to 20 years, the new forest forms a thick canopy, and lush vegetation on the forest floor begins to thin and die out. In the next 20 to 80 years, ***subdominant*** trees in the canopy die and more light reaches the forest floor and plants can survive in the understory. As the forest ages even more, light reaches the forest floor and more plants invade and survive.

Some wildlife species prefer the young forest and some the older forest. Some prefer different successional stages at different times. In fall and early winter, moose are found in young forests. In late winter, deeper snows force moose under mature softwoods.

OLD FORESTS

One challenge to integrating wildlife interest with forestry interest is that forests are now grown with shorter rotations. Sawmill technology allows use of smaller trees. It is perhaps not realistic to try to reproduce forests with ages as they were before European settlement, but there is concern that wildlife species that depend on old stands are suffering from a lack of habitat. Old growth forest is discussed further in Lessons Three and Five.

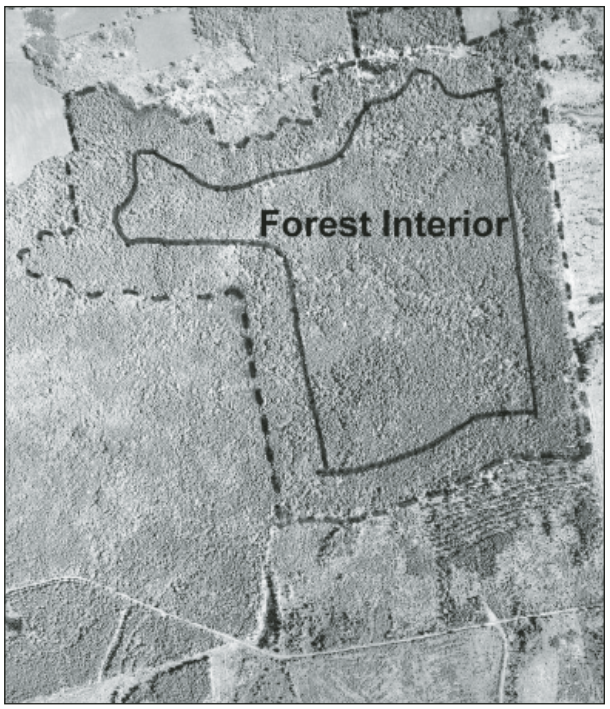
EDGE

Edge can be man-made or can occur naturally. A shoreline is a natural edge. The phenomenon of wildlife richness at edges is that wildlife has simultaneous access to two desired forest habitat types.

Edges can take several shapes. Some are abrupt and others merge gradually. Some have high contrast and others less. Some edges are irregular and others straight. The forest edge created by the woodcutter shown in the picture is a man-made, abrupt, and high contrast edge.

Carl explains that natural disturbances (mortality) in mature forests leave canopy openings with a variety of sizes and shapes. Most disturbances result from numerous scattered deaths of single trees. There are also many small patch disturbances of 0.1 to 0.8 hectare in size. Larger disturbances such as forest fires occur but less often. Some dominant forest types are more prone to whole stand replacing disturbances through fire and wind than others. Jack pine, for example, requires a fire for renewal. Surrounding each of these disturbance openings, whether small or large, there is edge.

FOREST INTERIOR SPECIES



The creation of edge can be carried too far. It is possible to have a "see-through" woodlot made up entirely of edges. In the past when wildlife management focused largely on deer and snowshoe hare, it was a recommended practice to create diversity by artificially creating edges. This was great for edge and early succession species. However, another group of species, called

forest interior species, were neglected by the edge/succession approach.

Edges are sunnier, warmer, windier, drier, and more exposed to major weather events. Some wildlife prefers or at least tolerates this exposure. There are more disturbances, such as roads and predators, at edges. Forest interiors, on the other hand, are sheltered and secluded. Within the damper interior, a greater abundance of insects and other invertebrates exist. Many bird species, such as thrushes, choose the interior as their niche: away from edges where predators prowl, they have better nesting success.

Forest interior is habitat deep within woodlands and thus requires larger blocks of mature forest. This interior habitat is thought of as a "core" or "heart" of a forested block. It is a central portion separated by a distance of at least 100 metres from edges.

Carl suggests a portion of a woodlot be managed as a larger block to maintain or create forest interior habitat, possibly by combining blocks using uneven-aged harvest selection methods. Larger blocks are also possible if neighbours combine stands along property lines.

At the same time, other portions of a woodlot might have forest stands that require an even-aged harvest approach. Using both harvest techniques would provide habitat both for the species that prefer interior stands and vertical diversity and for the species that prefer edges and regenerating intolerant tree species.

Looking Up
Vertical Diversity

Vertical diversity refers to the extent to which plants are layered or stratified within a stand. Vertical diversity is probably of greatest importance to forest birds, although mammal species like red squirrel, fisher, and bats function in both horizontal and vertical dimensions.

Joan is a bird watcher. As Carl explains vertical diversity to the class, she remembers a particularly active area for birds that she saw during a recent walk with Dan. She had tried to identify several bird species whose songs had caught her attention. She remembered how her view into the tree tops was obscured by several layers of vegetation. She heard the high-frequency calls of golden-crowned kinglets and finally spotted the active kinglet in the tree top. She saw a brown creeper working the lower tree trunks. Deeper into the shaded forest floor, she heard an ovenbird's territorial song. Joan realizes that she has seen the benefits of vertical forest diversity first hand. A stand with a high degree of vertical diversity characteristically has multiple vegetative layers. A highly developed, uneven-aged, deciduous forest could have four layers. There is a canopy of dominate or codominate trees. Beneath this are a lower tree canopy, then a shrub layer, and a ground layer of herbs, mosses, and ferns. Any supercanopy tall pine above the hardwoods canopy adds a fifth layer.

Stratification is less in softwood forests than hardwoods, except where the upper canopy is opened through age and natural mortality or by uneven age harvest. Spruces and balsam fir also have spiral-like crowns that create a fairly open canopy near the tops of the trees. Further down the tree the dense canopy tapers out and comes together. In the higher open canopy, birds can hunt amongst the boughs or "hawk" for flying insects in the open space between trees, like cedar waxwings and flycatchers do.

Vertical diversity is usually lacking in early and mid successional stages. Carl earlier expressed a concern for the decreasing amount of older forests. It is not until later successional stages that vertical diversity develops.

Cavity Trees And Snags

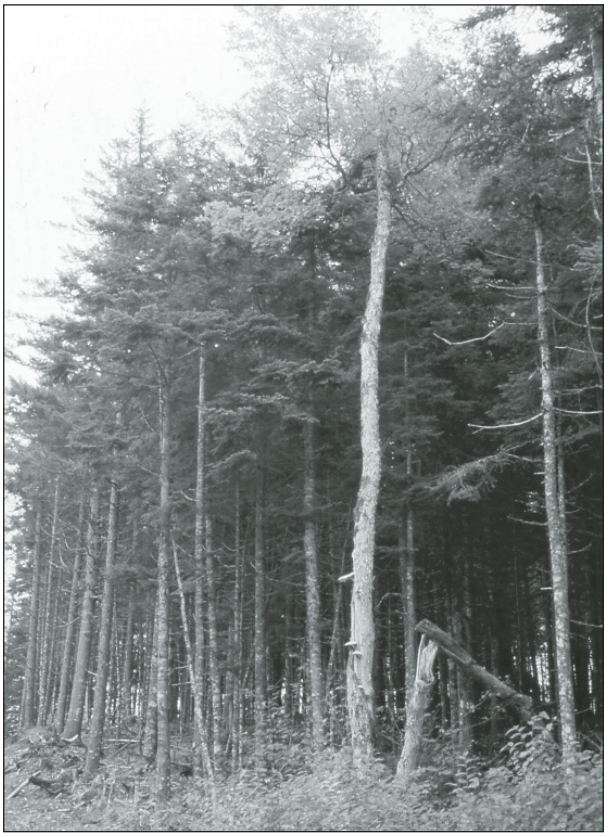
PHOTO: DNR

A pileated woodpecker peers out from a tree cavity.

Cavity trees, simply stated, are nature's birdhouses. Cavity trees are live, partly live, or dead trees. They have sufficient diameter that woodpeckers can excavate cavities and have enough space within the tree trunk to lay eggs and fledge young. A cavity might occur in a tree without a woodpecker's help, through a combination of injury to a tree and decay.

Snags are trees that are partly alive or no longer alive. The terms snag, wildlife tree, and cavity tree overlap somewhat in meaning. Snags provide perches and are likely to develop cavities. The more valuable snags are those with larger diameters and thus have the potential to provide larger animals with nest, den, or feeding opportunities and later will persist longer as fallen logs.

For a long time the significance of cavity trees for wildlife was unappreciated by biologists. It is now known that about 25 per cent of our forest birds and mammals require cavity trees. Cavity trees are used by a succession of species, for perches, nest and roost holes, dens, and foraging sites. Use continues



A conk is evidence that decay has entered a tree. Such trees become good cavity trees. If a tree suffers an injury, decay-causing fungi enter and become established in the tree. The tree responds by forming a firm boundary to contain the infection. The barrier zone is the tree's defence in separating older infected wood from new wood that forms. If a tree is 10 cm when injured, the greatest diameter of decayed wood will be 10 cm—about the right diameter for excavation by a Downy Woodpecker. Woodpeckers recognize trees with decayed centres and excavate through sound wood to create nesting cavities. Conks are a means by which humans can recognize an infected tree.

by another assemblage of wildlife as the log falls down and rots away.

Woodpeckers are termed ***primary excavators*** and are responsible for the majority of "bird house" openings that we see on trees. The woodpeckers chisel out new cavities each nesting season. In the following years the cavities are available to ***secondary nesters***, such as chickadee, nuthatch, saw-whet owls, kestrels, tree swallows, or flying squirrels. Chickadees and nuthatches will dig out their own cavities if the wood is soft. Larger tree cavities are made by pileated woodpeckers or can result from tree injuries that gradually become larger by decay. The larger cavities become dens and nest sites for larger species, such as marten, fisher, raccoon, and barred owl.

Looking Down
Decaying Logs

Old loggers had the notion that fallen and rotting trees within the forest were a wasted product. Thinking has changed. Forest ecologists use the term ***coarse woody debris*** for this material, and a quantity of this material on the forest floor is vital for forest diversity.

Downed woody material is used for nesting and cover, as a source of and a place to store food, as lookout, drumming, sunning, and preening sites, and as natural bridges across openings and streams. Large logs are particularly valuable and persist longer. Large logs with hollow portions may be used as dens by larger mammals.

As a log decays and settles, there is a change in occupants. As decay advances, the log becomes more important as a habitat for tunnelling invertebrates and small mammals. The logs over time absorb moisture and become inhabited by amphibians. The red-backed salamander lays eggs amid the moisture of decayed logs and does

PHOTO: DNR

not need to return to ponds to breed like most amphibians. In addition to providing wildlife habitat, downed woody material is nursery for regenerating trees and understory plants.

Woodlot owners that appreciate wildlife and biodiversity need to look at their ownership in the three perspectives—**across, up,** and **down**, that Carl describes. Having healthy and diverse habitats is the foundation for diverse wildlife populations.

PHOTO: D. L. HARRIS

QUIZ

1. Shade-tolerant trees regenerate in the shade.

❑ True ❑ False

2. Forest Interiors are

❑ (a) Warmer

❑ (b) Sunnier

❑ (c) Drier

❑ (d) Secluded

3. A live Yellow Birch with cavity holes is an example of a

❑ (a) Log

❑ (b) Snag

❑ (c) Cavity Tree

❑ (d) Edge

4. The dominant forest that grows in the Maritime Region is known as the Acadian Forest.

❑ True ❑ False

5. As Coarse Woody Debris decays and settles it is important for

❑ (a) Tripping Over

❑ (b) Moisture

❑ (c) Bruising Shin

❑ (d) Mouse Habitat

6. A forest with vertical diversity has trees of all sizes and ages.

❑ True ❑ False

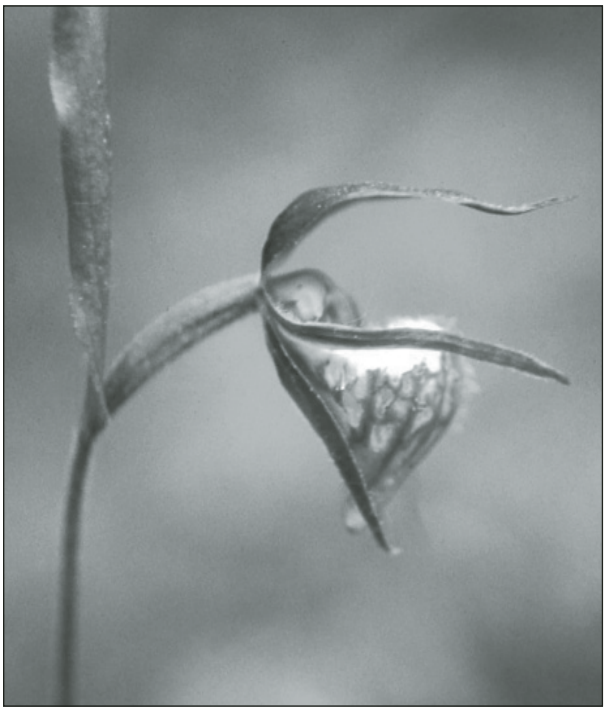
LESSON THREE: **Habitats And Species Of Special Conservation Concern**

Some species and habitats are more vulnerable than others or occur in low numbers. Some species have the misfortune of having their habitats lost or degraded by the building of urban habitats for humans. Humans have also introduced contaminants that pollute or poison. Humans have over exploited some species or introduced invasive species that have displaced native species.

Some generalist species (American crow) adapt readily to man-made environments, while other more specialized species (ram's head lady slipper) do not.

Many ***endangered***, ***threatened*** and ***vulnerable*** species occur in oceans (north Atlantic right whale) or along coastlines (piping plover) so of course are not directly influenced by woodlot activities. Many species thrive and are common in woodlots (snowshoe hare) and are not a conservation concern. However, some species are rare or have specialized habitats and require special attention.

Lesson Three first describes sensitive and important woodlot habitats that require special care when doing forest management. Lesson Three next describes woodland species that for various reasons have low population numbers and again require special care. Some of these species are so close to nonviable population sizes that they have special protection by provincial and federal laws.



Taking Care
Habitats Sensitive To Forestry

Woodlot habitats are important to wildlife, but without care, sensitive habitats on woodlots can be destroyed or degraded by forestry activities.

RIPARIAN AND STREAM ECOSYSTEMS

Wildlife is proportionally most numerous along watercourses. Within the watercourses and the special habitat alongside, there are a multitude of values for wildlife and water quality that need special attention. Riparian Zones are lands adjacent to streams, rivers, lakes, and other water bodies. Riparian zones have rich, moist soils and often unique and diverse vegetation. Periodic flooding and deposition of alluvial sediments and a flow of nutrients from upland areas builds rich productivity. Riparian zones are linear and are natural wildlife travel corridors. Moving away from the watercourse, there is a series of natural edges from the water to the upland. The riparian zone shades the watercourse and is a supply of woody debris and logs into the watercourse. Branches and trees enter the stream and provide substrate and in-stream habitat for invertebrates and fish. Water falling over large logs dig out pool habitat, creating essential deep-water areas for brook trout. Most nutrients in a watercourse come from the riparian zone. Remember the food chain in Lesson One where food energy started with photosynthesis. Leaf litter and other detritus that enter the watercourse are the start of in-stream food chains. Energy flows through bacteria feeding on decaying plants, to stonefly larvae, to trout. Yes, if the imagination is stretched, fish come from trees.

Trout and salmon, particularly sensitive among

fish, require clean water streams with sediment-free bottoms. The riparian zone moderates flooding and buffers the movement of sediments into the stream.

In Lesson One we learned that wildlife are adapted to "just the right place to live." Plants along a riparian zone are adapted to an occasional periodic flooding, but the reward for this adaptation allows them to live in a niche with excellent moisture and fertility. Some are adapted to living closer to the stream than others. The animals that use the riparian zone also show a gradient of dependence on water. The fish and dragonfly nymphs are totally dependant to life in water. The dragonfly will eventually emerge and feed over the water's edge and through the riparian zone. Many amphibians lay eggs in water but spend the majority of their lives within the terrestrial riparian zone. Wood turtles hibernate on the bottom of streams, lay eggs in sand and gravel stream banks, and feed throughout the riparian zone. Raccoons often forage along stream banks, but are equally comfortable living in town and eating garbage. Most woodland terrestrial vertebrates visit water to drink or to find food and shelter in the forest alongside a brook. Watercourses and riparian zones are special places.

Later in Lesson Four students will learn about provincial regulations that protect watercourses.

VERNAL POOLS

Vernal pools are depressions within a woodlot that become water filled in the spring. Pond size might vary from 10 m^2 to 1000 m^2. How long water remains in these pools is highly variable. Water in some pools might remain only a few weeks, while others are almost permanent, perhaps only drying out in years of drought. They are particularly important for certain amphibians, reptiles, and invertebrates. A very important feature of vernal pools and their inhabitants is the absence of adult predatory fish. Spring peepers, wood frogs, and yellow and blue spotted salamanders breed in these pools. These pools are frequently visited by typical wetland species such as mink, great blue heron, and wood turtles, where they find rich feeding opportunities. Numerous upland birds and mammals go to these pools to drink, bathe, and feed.

Equally important is the forested habitat adjacent to vernal pools since it is here that the amphibians spend the terrestrial portions of their life cycle.

Although not required by law, "Special Management Zones" should be maintained around vernal pools. The surrounding forest is critical to maintaining water quality, shade, and litter for the pool.

Woodlot owners should examine their property in spring to identify these sites.

BEAVER-INFLUENCED ECOSYSTEMS

Woodlot owners either love beaver or hate beaver. The experience of flooded roads or land is a cause of conflict between woodlot owners and wildlife. Beaver ponds are a temporary wetland and the wetland cycles through successional stages. For the first seven years after the establishment of a new beaver flowage, there is high productivity. Nutrients are released from newly flooded soils. As organic material accumulates on the pond bottom, productivity declines. Beaver move to a new site after their food supply is depleted. The beaver dam falls into disrepair and a there is a new period of great productivity as a meadow develops. Over time trees will again grow on the meadow and beaver return to begin the cycle anew.

Each stage of the cycle provides habitat and a changing assemblage of wildlife.

Installing "beaver puzzles" is a solution that prevents road flooding and accommodates the tremendous wetland habitats created by beavers. To install a beaver puzzle, you put a drain through the dam to hold the water at an acceptable and stable

level. The siphon device deadens the sound of the escaping water. The beaver cannot figure out the location of the leak and therefore cannot reapair it.

Carl shows a picture of some DNR summer students installing a Clemson Leveler. This was a successful experiment with Ducks Unlimited and a woodlot owner that had a valuable wetland but a flooded road problem.

WOODLAND SEEPS AND SPRINGS

Probably many woodlots have wet sites that remain unfrozen in the winter. They are not identified as a stream since there is no streambed. At these wet spots, groundwater flows to the surface and saturates the soil. Small streams might start, but may return underground. Common sense dictates that you avoid using logging equipment at these sites.

Plants such as water pennywort, jewelweed, or sensitive fern often dominate these sites. These seeps are a source of water for wildlife during winter months. The sites provide early green vegetation, earthworms, and insects to sustain early migrants such as robins and woodcock.

Extensive logging or the operation of heavy equipment will destroy or degrade these sites.

DEER WINTERING AREAS

Dan Barr knows that his woodlot is used in the winter by deer. In winter he sees deer and finds their beds in the snow. In spring he finds large numbers of deer pellet piles throughout his softwood stands and on trails along the brooks. Dan's woodlot is on the south slope of the Cobequid Hills. As snowfall deepens each year, deer migrate off the elevated Cobequid Hills into conifer forests at lower elevations. One winter after Dan had done a harvest, he counted 60 deer feeding on the lichens on branches over his cut area.

The biggest winter deer concentrations in Nova Scotia are adjacent to summer ranges that occur over higher elevations, such as north of the Bras d'Or Lakes or the Cobequid Hills where deer must

PHOTO: DNR

move in winter to south facing slopes. Deer must move off the high ground in winter because snow melts less and accumulates. Deer winter concentrations in western Nova Scotia, with less high topography, are more local and in smaller groups. Deer also often move to coastal locations in winter and are known to eat seaweed.

Winters in Nova Scotia are variable. In winters of very deep snow, deer must seek the shelter of softwood cover. If the mobility of deer is very restricted, the deer have the ability, but not an indefinite ability, to remain inactive and survive on body fat.

Extensive forest harvest that removes limited softwood cover opportunity will greatly reduce deer numbers, particularly in areas where there are large winter concentrations of deer. In Cape Breton when spruce budworm drastically removed softwood cover, deer numbers crashed.

For a woodlot owner with a known "deer yard," it is important of course to maintain softwood stands suitable for winter cover.

Maintaining deer cover benefits other wildlife species as well. The softwood habitat is important for fisher. Several birds—including merlin, black-backed woodpecker, and pine grosbeak—also occur in this mature softwood forest.

NEST SITES FOR HERONS AND WOODLAND RAPTORS

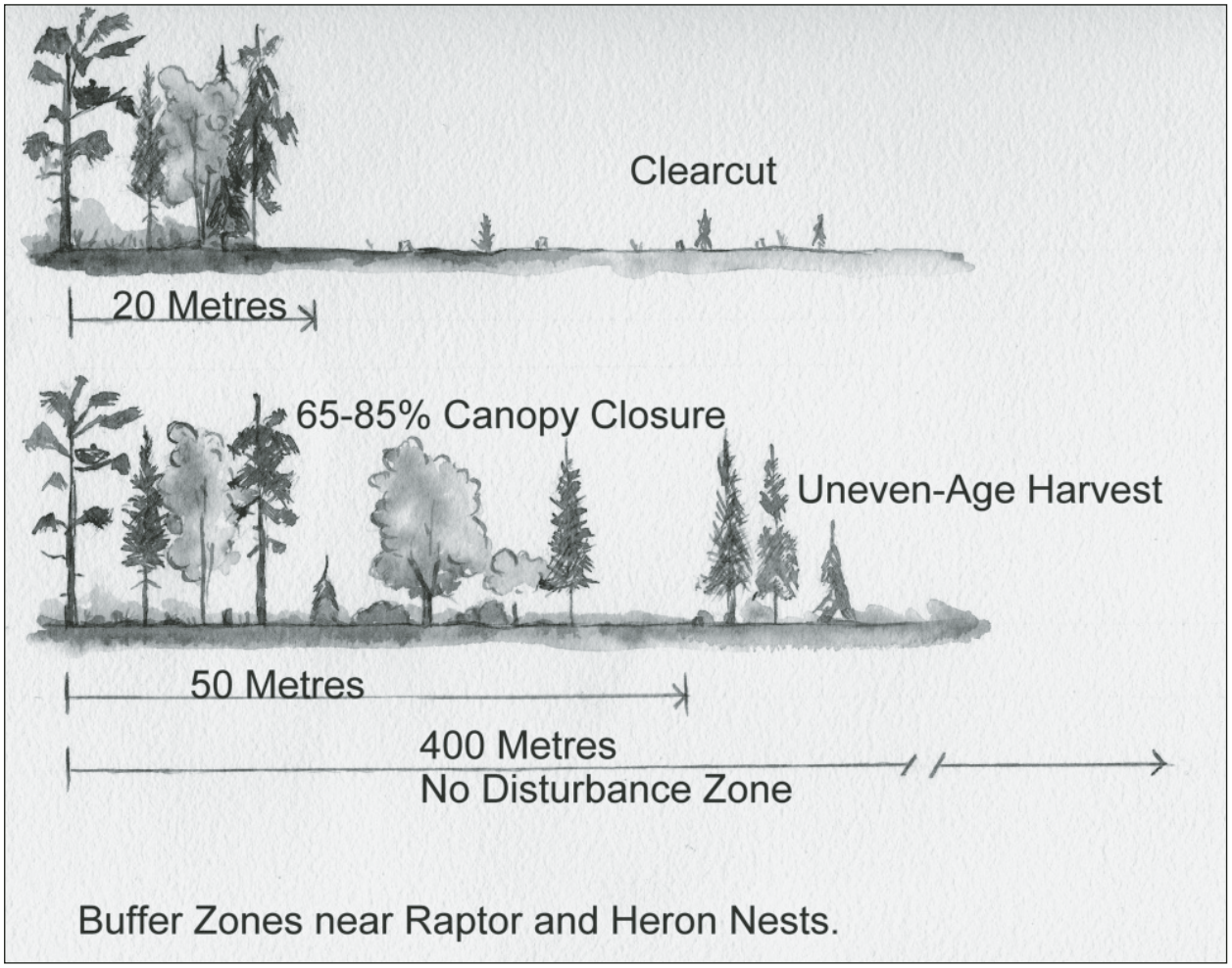
Great blue herons nest in colonies and build stick nests in treetops. For the most part in Nova Scotia great blue herons nest on isolated islands, but colonies sometimes are found in forested inland locations. They often travel considerable distances from their nesting sites to feeding areas. At one Nova Scotia island, great blue herons are known to make 16 km round trips from the young in nests on the island to coastal wetlands on the mainland where they catch food.

PHOTO: D. L. HARRIS

Great blue herons are easily disturbed by human activity. Adults will flush if intruders approach within 100 to 200 metres. Herons, like raptors, are more sensitive during the courtship and nest-building stage of nesting. Older nestlings might leap from nests if disturbed before they are able to fly.

Unlike herons, nests of hawks, eagles, and owls, have nests widely dispersed. Different species have different preference for where they choose to nest. Some (broad-winged and goshawk) prefer unbroken tracts of forest and others (kestrel and red-tailed hawk) prefer forest interspersed with large openings. The saw-whet owl nests in tree cavities. Several other birds of prey use stick nests. For the most part, raptor species and forest management are not in conflict. Woodlot owners should be on the lookout for raptor nests. Owls are often incubating in March and many hawks in April and May.

When you locate a raptor nest or heron colony, establish a protective management zones around the nest. Exact recommendations for these zones vary, but all are meant to achieve the same purpose. Create an inner zone closest to the nest or colony with restricted tree harvest and no disturbance during nesting times. The width of the buffer zone



will vary depending on whether there is a planned surrounding clearcut or a selective cut. If a clearcut is occurring next to a nest, New England literature recommends that you leave a 20-metre uncut buffer. Some species, such as herons or goshawks, are more sensitive to disturbance than others. Talk to regional biologists at Natural Resources for specific advice. Establish an outer zone that allows usual forest activity, but with no high disturbance activities such as harvest or road building during the nesting period.

OLD GROWTH FOREST

Definitions for old growth forest are confusing. If a forest is allowed to develop through hundreds of years, the tree species that are long-lived and shade tolerant will eventually dominate. These trees are 100 to 200 years old, and sometimes over 300 years.

The age of an old growth forest is much older than an economically mature forest, ready to be cut and rotated for the next crop.

Old growth forests have many features that contribute to wildlife biodiversity. These features are vertical diversity, lots of cavity trees and downed coarse woody debris, and habitat for forest interior species.

The Department of Natural Resources has information on maximum ages for several NS tree species. (Bruce Stewart).

Species	Literature Source	Collected by NS DNR From Old Growth Stands
Red Spruce	400	294
Hemlock	988	333
White Pine	450	288
Black Spruce	250	203
Balsam Fir	200	173
Sugar Maple	400	254
Yellow Birch	300	313
Red Oak	300	159
Beech	366+	132

In providing old-growth habitat, as Carl mentioned in Lesson Two, there is a challenge to accommodate the interests of both wildlife managers and the forest industry. Society requires forest products and the family incomes from the forest industry; however, forests should remain healthy and maintain biodiversity. There are many good people in forestry who also want healthy and biodiverse forests.

Woodlot owners should consider preserving stands that now exhibit old growth forest characteristics or to look at the best remaining opportunities to restore over time a portion of a woodlot as old growth.

How to recognize old growth:

- old trees (shade-tolerant species)
- large diameter trees (40–60 cm)
- large dead wood (snags and fallen trees)
- multiple understory tree layers
- canopy openings
- primal conditions (no logging evidence)

There is a species of tiny stalked "stubble" lichen that resembles whiskers. Known as frosted glass-whiskers, this lichen is listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). It occurs only in old growth hardwood forests in Cape Breton. The entire present known physical area of coverage for this lichen is one square metre.

Woodlot owners should also begin the conversion from even-aged stand management to uneven-aged stand management. This is not a quick process and will require children and grandchildren to complete. This converted forest would have old growth forest characteristics, but it is not necessarily meant as a hands-off forest. Woodlot owners can choose to harvest quality trees, yet still retain old-growth characteristics.

During this class discussion on old growth, Dan Barr thinks of his son, Michael, who now works on the oil rigs. He thinks Michael will carry on his interest in the woodlot. When Michael is home, he spends a lot of time at the camp and has installed a solar electrical system. Mike also helps Dan with Christmas tree shearing.

The children of many of his neighbours now live in cities. Dan worries that they are becoming less connected to the land. He also worries that long term interest by dedicated woodlot owners will be a problem.

RARE PLANT AND ANIMAL SITES

Plants or animals in Nova Scotia are often rare because they are at the southern or northern limit of their preferred range. Some plants arrived in Nova Scotia when glaciers were retreating thousands of years ago. As climate warmed a few of these Alpine species still persisted in small numbers by growing in hostile locations such as cliff faces. Nova Scotia was also once a much warmer place. Blanding turtles once occurred widely, but now are restricted to central western Nova Scotia where summer temperatures are warm enough to allow the eggs to hatch.

Some species, such as hepatica, are rare because of agriculture and urban development. The NS Department of Natural Resources maps sites of rare species when they are discovered. During environmental assessments, developers are required to check this mapping. Many rare species are associated with wetlands and riparian zones, and their occurrences here emphases that these areas require protection or only low impact activities.

Rock faces, natural caves within gypsum formations, and old quarries might have unique wildlife use. Three species of bats hibernate in Nova Scotia. To hibernate they require access into old mines or natural caves. These mines and caves have the milder temperatures and high humidity that allow the bats to hibernate successfully. Woodlot owners should regard bats as friends since they consume huge quantities of moths. An old quarry might have snake ***hibernacula***. Rare plants such as showy lady slipper might be found near gypsum areas.

Nova Scotia Significant Species And Habitat ('Sighab') Database

The DNR Wildlife Division has an online mapping database with location information for significant wildlife species and habitat in Nova Scotia. For more information on the Sighab database and to view the database online visit the following NS DNR Wildlife Division website: *http://www.gov.ns.ca/natr/wildlife/Thp/disclaim.htm*

The following nine types of habitat polygons are mapped:

- species at risk as designated by the NS Endangered Species Act
- other species of concern with red or yellow status
- deer wintering areas
- moose wintering areas
- important migratory bird habitat

- freshwater habitats
- rare plant sites
- ecological sites
- other significant habitats

Woodlot owners can view online maps and determine if any significant habitat polygons occur on their woodlot. Regional biologists and the Wildlife Division keep a database with details about each polygon. For example, if a site was visited there might be data on the number of rare plants counted or perhaps the number of young in an eagle's nest. Some of this data is sensitive and only released on a need-to-know basis. If a woodlot owner does see a polygon on their property, then they can contact the regional biologist for further information. The biologists are more than glad to have contact with owners of significant habitats.

The Significant Habitat Mapping is far from complete. Woodlot owners are encouraged to report sightings of rare species to regional biologists.

Species At Risk

There is a wealth of information on Species at Risk presently on the Internet. The Department of Natural Resources Biodiversity web page at *http://www.gov.ns.ca/natr/wildlife/biodiv/biodiversity_datainfo.htm* has some very useful links.

The Nova Scotia Endangered Species Act

In 1999 Nova Scotia enacted the Nova Scotia Endangered Species Act. Through this act, those Nova Scotia species thought most at risk are designated and recovery teams are formed to write recovery plans. For example, there is a recovery plan for Blanding's turtles written by several persons knowledgeable about this species.

Species listed up to the year 2006 in Nova Scotia are:

ENDANGERED

Blanding's Turtle[1] (Western Nova Scotia)
Roseate Tern[1]
Piping Plover[1]
Harlequin Duck[1]
Pink Coreopsis[1] (Coastal Plain Flora)
Thread-Leaved Sundew[1] (Coastal Plain Flora)
Eastern Mountain Avens[1] (Brier I/Digby Neck)
American Marten*
Water Pennywort (Coastal Plain Flora)
Plymouth Gentian[1] (Coastal Plain Flora)
Atlantic Whitefish[1] (Petite Riviere Watershed)
Canada Lynx (Cape Breton)*
Mainland Moose*
Boreal Felt Lichen[1]*

THREATENED

Peregrine Falcon[1]
Golden-Crest[1] (Coastal Plain Flora)
Redroot[1] (Coastal Plain Flora)
Eastern Ribbon Snake[1] (Western Nova Scotia)
Tubercled Spikerush[1] (Coastal Plain Flora)
Yellow Lamp Mussel[1] (Cape Breton)

VULNERABLE

Sweet Pepperbush[1] (Coastal Plain Flora)
Wood Turtle[1]*
New Jersey Rush[1] (Coastal Plain Flora)
Long's Bulrush (Coastal Plain Flora)
Bicknell's Thrush[1]*
Prototype Quillwort[1] (Lakes)
Eastern Lilaeopsis[1] (Estuaries)
Eastern White Cedar*

[1] Indicates the species is listed also by federal legislation.

** Species marked '*' are those most likely affected or have dependence on forest environments.*

The other species are unlikely to be encountered on a woodlot. Coastal Plain Flora is usually found on lakeshores such as Ponhook or Molega Lakes in western Nova Scotia. As the water level of these lakes drop in summer exposing the shoreline, these plants take this short opportunity to grow and blossom without the competition from other plants.

The following is information on the forest-related species designated by the Nova Scotia Endangered Species Act.

American Marten

The Cape Breton population of Marten is likely less than 50 animals. At present there is no evidence of breeding and there has been extensive loss and degradation of suitable habitat. Marten were trapped extensively throughout Nova Scotia since the 1700s until the season was closed in the early 1900s due to low numbers. The species was thought to have been extirpated from the mainland, and several re-introductions have been attempted. There have been some very recent records of Marten in southwest Nova Scotia. However, the status of the Marten on the mainland is considered "data deficient." More research is required.

Canada Lynx

Lynx formally occurred in areas of suitable habitat across mainland Nova Scotia and Cape Breton Island. The current population is very small and restricted to two areas in the highlands of Cape Breton Island. Historic and current threats to Lynx include harvesting, competition from bobcats and coyotes, habitat loss, disease, and climate change.

Mainland Moose

The native population of moose in Nova Scotia is limited to about 1000 in isolated sub-populations across the mainland. The population has declined by at least 20 per cent over the past 30 years, with much greater reductions in distribution and population size over more than 200 years, despite extensive hunting closures since the 1930s. The decline is not well understood, but involves a complex of threats including over harvesting, illegal hunting, climate change, parasitic brainworm, increased road access to moose habitat, spread of white-tailed deer, very high levels of cadmium, deficiencies in cobalt, and possibly an unknown viral disease.

Moose on Cape Breton Island are not risk as they are abundant and the result of a re-introduction of moose from Alberta in the 1940s.

Boreal Felt Lichen

This small, inconspicuous lichen has experienced a dramatic decline of over 90 per cent in occurrences and individuals over the last two decades. Boreal Felt Lichen is now known in Nova Scotia from only one site that includes three individuals all within an area of only a few hundred square meters. The primary threats to Boreal Felt Lichen are atmospheric pollutants and acid precipitation, which can cause the death of individuals and disrupt reproduction. The lichen can also be threatened by forestry and other land use practices if they disrupt the moist microclimate that is essential for the species.

Wood Turtle

There may be 2,500 Wood Turtles widely dispersed across river habitats in Nova Scotia, but information suggests that this species is declining. Like other turtles, this species is of concern because even low mortality rates of adults can have serious population impacts. Threats to wood turtles in Nova Scotia include alteration and destruction of river and stream habitats and translocations of turtles by people.

Bicknell's Thrush

Bicknell's Thrush is of concern because of habitat change, low numbers, patchy distribution, and low reproductive potential. However, little is known about this secretive species. It breeds in Quebec, New Brunswick, Nova Scotia, and the northeastern United States. In Nova Scotia, it is currently restricted largely to Cape Breton Island, although historically it was found on a few offshore islands in the southwest part of the province. Habitat has been altered in Nova Scotia over the last century by infestations of spruce budworm and forest management practices

Eastern White Cedar

Cedar is an uncommon tree in Nova Scotia and currently only 32 stands in five counties have been identified. The population is fragmented and comprised of mostly small stands that appear genetically separate from each. Most populations are different from populations in NB and PEI. Almost all of the cedar is located on private land and only one stand is formally protected. In the recent past, stands have been lost to forest harvesting and highway construction. Ornamental cedars of the same species have been planted around homes and in gardens; these trees are not considered part of the native population and are not covered by the listing under the act.

General Status Of Species In Nova Scotia

Besides those species designated by the NS Endangered Species Act, there are many other Nova Scotia species that occur in low numbers or have limited habitats and these have not yet been elevated to a legal status. The General Status Assessment process is a "first alert" system that provides an overall indication of how well species are doing in Nova Scotia. *http://www.gov.ns.ca/natr/wildlife/genstatus/*

The website above is a neat web site where knowledgeable groups of botanists, zoologists, and other scientists in Nova Scotia have ranked the rarity of vascular plants, birds, mammals, amphibians, reptiles, and several invertebrate groups. **Red** status means known or thought to be at risk; **Yellow**, sensitive to human activities or natural events; and **Green**, not believed to be sensitive or at risk.

Woodlot owners, if finding and identifying an unusual species, could check this web site and determine the status of the species. As an example, the database gives the status of 1115 vascular plant species.

STATUS	VASCULAR PLANTS
Red	*170*
Yellow	*144*
Green	*703*
Undetermined	*98*

Joan Barr identified Canada lily on her woodlot where it grows close to a stream. Carl told her that it has provincial Yellow status.

COSEWIC and SARA

COSEWIC stands for the Committee on the Status of Endangered Species in Canada. SARA stands for the Government of Canada Species at Risk Act.

In 2004 the federal government enacted the Species at Risk Act. The federal government relies on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to decide which species are designated by SARA. COSEWIC is an independent committee of scientists that assesses and designates which wild species in Canada are in danger of disappearing. On the recommendation of COSEWIC the federal government makes a decision to list a species under the Species at Risk Act.

Including the year 2006, the Committee on the Status of Endangered Species in Canada has included 529 species of mammals, birds, reptiles, amphibians, fishes, arthropods, mollusks, vascular plants, mosses and lichens as ***Extinct*** (13), ***Extirpated*** (22), Endangered (205), Threatened (136) and Special Concern (153).

Many of the COSEWIC species are already identified in the Nova Scotia list. Additionally listed by SARA for Nova Scotia are:

Endangered – Eskimo Curlew and Bay of Fundy Atlantic Salmon
Threatened – Striped Bass
Special Concern – Rusty Blackbird, Barrow's Goldeneye Duck, Ipswich Sparrow, Short-eared Owl, American Eel, Frosted Glass-whiskers Lichen, and Monarch Butterfly

Environment Canada's Species at Risk Website Federal government species at risk website containing information on species at risk in Canada, federal legislation, searchable database, funding opportunities information, and more. *http://www.speciesatrisk.gc.ca/*

Becoming A Better Naturalist

This module has several references to books and websites. Many are the books that Joan Barr and Carl use. Learning to identify plants and other wildlife on a woodlot can greatly enrich your enjoyment of the woodlot. Importantly the woodlot owner will become a better land steward, learning to identify species of conservation concern.

QUIZ

1. Wetlands that do not retain water year round are not important.

❑ True ❑ False

2. Some plants and animals are rare because

❑ (a) They are at the southern end of their range

❑ (b) They are at the northern end of their range

❑ (c) They are affected by human activities

❑ (d) They require specialized habitats

3. A Yellow Status species is?

❑ (a) Known or thought at risk

❑ (b) Not believed to be sensitive or at risk

❑ (c) A good colour combination with purple

❑ (d) Sensitive to human activities or natural events

4. Most food energy in streams comes from shoreline plants.

❑ True ❑ False

5. Woodlot owners who can identify plants and animals are better able to manage and protect rare species.

❑ True ❑ False

6. It is all right to carry on forest harvest and cause disturbances near Heron or Eagle nests if

❑ (a) Outside the nesting period

❑ (b) If the nest is not visible

❑ (c) Eggs are not laid yet

❑ (d) Activities are more than 400 metres away

LESSON FOUR: **Understanding The Wildlife Habitat & Watercourses Protection Regulations**

In 1988 the Nova Scotia Department of Lands and Forests published Forest/Wildlife GUIDELINES and STANDARDS for Nova Scotia that were designed to maintain or enhance fish and wildlife habitats in the forest environment. The guidelines were implemented on Crown lands and encouraged on private lands. The guidelines explained many of the topics (Forest Diversity, Edges and Wildlife Corridors, Special Management Zones near Watercourses, Cavity Trees, Snags and Downed Trees, Deer Wintering Areas, and Birds of Prey and Heron Colonies) that are explained also in Lessons Two and Three of this module.

In 2002 some of the guidelines became law. This was at the urging of many in the forest industry to create fairness. Good corporate citizens followed the guidelines, but some other individuals gained an advantage by not. Under the Forest Act the Wildlife Habitat and Watercourses Protection Regulations make into law two main topics: (1) ***Legacy Clumps*** (Leaving islands of uncut trees within harvested areas, and (2) ***Special Management Zones*** (Leaving uncut trees along watercourses).

Carl is having trouble keeping the attention of students during this lesson, as they get caught up in stories about the old days when game wardens chased deer poachers and not forest cutters. Harold, one of the class members, tells a story of when he was young and more foolish. He would carry a rifled slug in his boot during the grouse season, before the deer season opened. One day the game warden, Hughie MacIsaac, checked him for his license and asked to see his shotgun shells. Although Harold described how guilty he must have looked, Hughie did not ask him to remove his boot.

Wildlife Habitat and Watercourses Protection Regulations

At the beginning of the lesson Carl hands out a copy of the regulations.

Dan Barr is considering a four-hectare harvest within his woodlot near Brandy Brook, so he is interested how the regulations will affect him.

Most of the WH&WP Regulations appear in this lesson, but students with Internet connections can view the complete regulations at the link below. **Take note, also, that the regulations may have been updated since this module was printed.**
www.gov.ns.ca/natr/wildlife/thp/wildl_hab.html

LEGACY CLUMPS

A clearcut and many shelterwood cuts are severe site-altering disturbances. Understory plants, and other forest living organisms, are suddenly "homeless" and exposed to greater extremes of temperature and weather. The harvest removes many tree-dependent organisms such as lichens and invertebrates.

The term "**Legacy**" refers to keeping a remnant or sample of the original species that lived in the stand before the harvest. Legacy clumps of uncut trees are left within the harvest area. As trees regenerate in the harvested area, there is an expectation that descendents of species with the same genetics that lived in this forest 30 or 40 years ago will survive in the clump and repopulate into the surrounding forest. As explained in Lesson One, the conservation of local biodiversity maintains forest adaptability and resiliency.

Lesson Two also explained the importance of having cavity trees and snags as a component of wildlife habitat. The legacy clumps are intended to provide present and future cavity trees, snags, and

downed woody debris. Taller trees, still standing within the clump as the surrounding area re-establishes, provide vertical diversity.

Section 4 of the Wildlife Habitat and Watercourses Protection Regulations describes the legal language for the positioning and the size **Legacy Clumps**. Note that this definition of "harvest" does not apply to land clearing operations such as for agriculture or urban development. All types of harvest are included and not just clear cutting,

"*Harvest*" means a forestry operation that removes primary forest products from an area of forestland, but does not include the removal of Christmas trees or a forestry operation whose primary purpose is to convert the land to a non-forestry use;

LEGACY TREES AND HABITAT STRUCTURE

4 (1) On any harvest site comprising an area greater than 3 hectares of forest land, the forestry operator shall ensure that at least 10 living, or partially living, trees are left standing for each hectare of forest land cut.

(2) The trees required to be left standing pursuant to subsection (1) shall be

(a) in the same proportion by species as the forest stand being cut;

(b) as large as or larger than, in height and diameter, the average height and the average diameter, measured at a height of 1.3 m from the ground, of the trees within the forest stand being cut; and

(c) clumped together in accordance with the following:

(i) each clump shall contain no fewer than 30 trees,

(ii) there shall be at least one clump for each 8-hectare area, or part thereof, of forest land cut,

(iii) where there is more than one clump, clumps shall be situated no more than 200 m apart and at least 20 m but no more than 200 m from the edge of the forest stand being cut,

(iv) where there is one clump, it shall be situated at least 20 m but no more than 200 m from the edge of the forest stand being cut, and

(v) there shall be no harvesting of trees within any clump.

(3) Trees required to be left standing pursuant to subsection (1) shall not be removed before the next harvest.

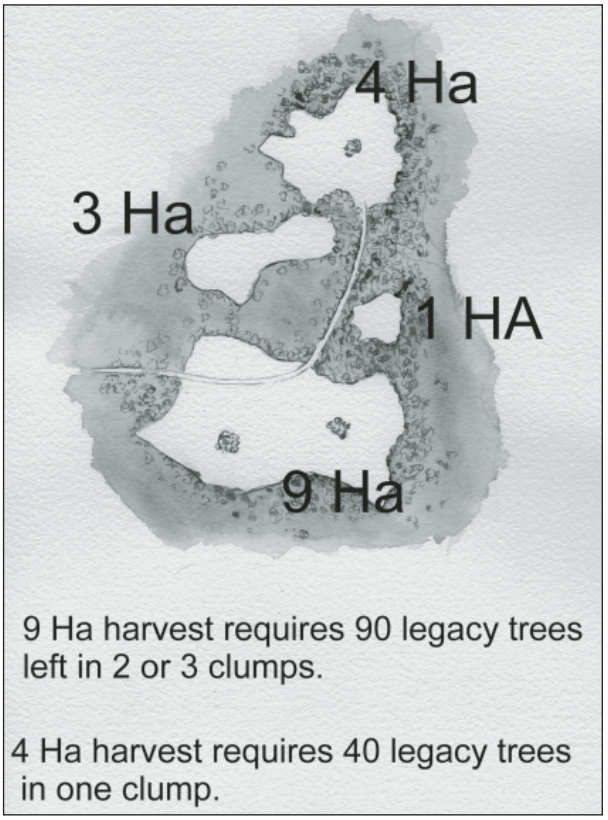
(4) A forestry operator shall ensure that levels of snags and coarse woody debris on all harvested sites are similar to natural patterns to the fullest extent possible.

So what does this mean? Unfortunately for the average person, when regulations are written they must be done so in precise language to withstand arguments and scrutinizing in a justice system. The following comments and illustrations are hoped to offer clarifications.

- If a harvest is greater than 3 hectares, then 10 trees per hectare must be left in a clump within the harvest area. For example if Dan makes a 4-hectare harvest, he is required to leave one clump with 40 trees.
- Trees must be alive or partly living. Dead trees do not count.
- The trees in the clump must be representative of the tree species being cut. This subsection prevents a contractor from leaving a clump of tamarack or aspen (or less commercially valuable trees) while taking surrounding spruce. If resident wildlife was adapted to a forest of spruce, tamarack, and aspen, then a legacy of

all these trees should be left. Law enforcement would result for blatant misrepresentation of stand tree species in the clumps. There would be tolerance for some deviation from exact percentages when an honest effort is made.

- The legacy trees must be average size or larger than the average size of the harvested stand. This prevents intentionally choosing clump sites with small trees, as was done when following the previous 1988 guidelines. The woodlot owner has the option of selecting legacy clump sites that might have a few large yellow birch or other long-lived tree species that would provide good cavity tree anchors within the clump. The clump might also be situated around a ***vernal pool***, thus shading this springtime pool.
- There must be at least one clump for each 8 hectares harvested.
- Clumps must have a minimum of 30 trees or a minimum of 80 trees dependant on the number of clumps left per 8-hectare area. An 8-hectare harvest would require one clump of 80 trees or two clumps with no clump having less than 30 trees. A 24-hectare harvest site would require 240 trees in total, and could have 3 clumps with 80 trees each, 8 clumps with 30 trees each, or some combination in between. Some biologists think that biodiversity, or survival of more organisms into the next rotation, is better preserved by a few large clumps instead of several smaller legacy clumps. Also larger clumps will have more wind firmness.
- There are rules on distances where clumps are separated in relation to other clumps and the uncut forest edge. Clumps must have a distance of more than 20 metres and no more than 200 metres from other clumps or the unharvested edge of the cut. The idea is to ensure a somewhat even distribution of the clumps over the harvest site.



- Once a clump is established, the legacy trees cannot be harvested. Even in the event of blow down the trees cannot be taken. They can be regarded as the woodlot owner's gift to wildlife and to the future forest. The fallen tree will provide valuable fallen logs.
- While the regulations do not stipulate a shape for the clumps, round shapes likely will better withstand blow down by wind.
- There is a provision to leave Snags and Coarse Woody Debris over the harvest site. For most harvest operations and especially in central regions affected by Hurricane Juan in 2003 the quantity of standing dead and fallen coarse woody debris is not an issue. It is more an issue where full tree harvest occurs and the whole tree is taken to roadside.

Sections 5 to **9** pertain to **Special Management Zones** (**SMZ**) along watercourses.

"*Watercourse*" means 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.

For the purpose of this watercourse definition, marshes are defined as an area of permanent or slow moving water that is partly or entirely vegetated with aquatic plants. By this definition, ***bogs*** or ***meadows*** are not included. On Crown lands Carl when reviewing harvest plans requires a forested SMZ around some bogs and at the upland edge of ***Fens*** (grassy wetlands) that border streams since he believes they add to the habitat mix, in particular providing forested travel corridors. The 1988 Guidelines advocated SMZ for these wetlands and Natural Resources by policy still requires them on Crown lands.

Woodlot owners are encouraged to also follow this practice for extra habitat and water protection.

"*Special management zone*" means an area of forest required to be established adjacent to a watercourse in accordance with Sections 5 and 6 to protect the watercourse and bordering wildlife habitat from the effects of forestry operations;

Determining average width of watercourse

5 For the purposes of Sections 6 and 7, the average width of a watercourse shall be determined by measuring the width of the bed of the watercourse at 10 approximately equidistant locations extending along the entire portion of the watercourse situated within or adjacent to the forest land where a forestry operation is carried on, and taking the average of the measurements.

Special Management Zones

6 (1) Where the average width of a watercourse situated on or adjacent to forest land on which a forestry operation is carried on is equal to or greater than 50 cm, a forestry operator shall establish or ensure the establishment of a special management zone of at least 20 m in width along all boundaries of the watercourse.

(2) Where the land on which a special management zone is established pursuant to subsection (1) 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.

- Many streambeds are obviously greater than 50 centimetres in width. Only when deciding whether the stream is borderline between greater or lesser than 50 cm is a measurement necessary. If not sure do the measurement and don't risk a violation. Also importantly, it is the measure of the streambed and not the water surface. Water flow volume varies with season. Streambed is defined:

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

- Where the water flow has scoured the stream bottom is not hard to determine. Sometimes a stream will flood its banks. The floodplain beside a stream where flood tolerant grasses and shrubs might grow is not considered part of the streambed.

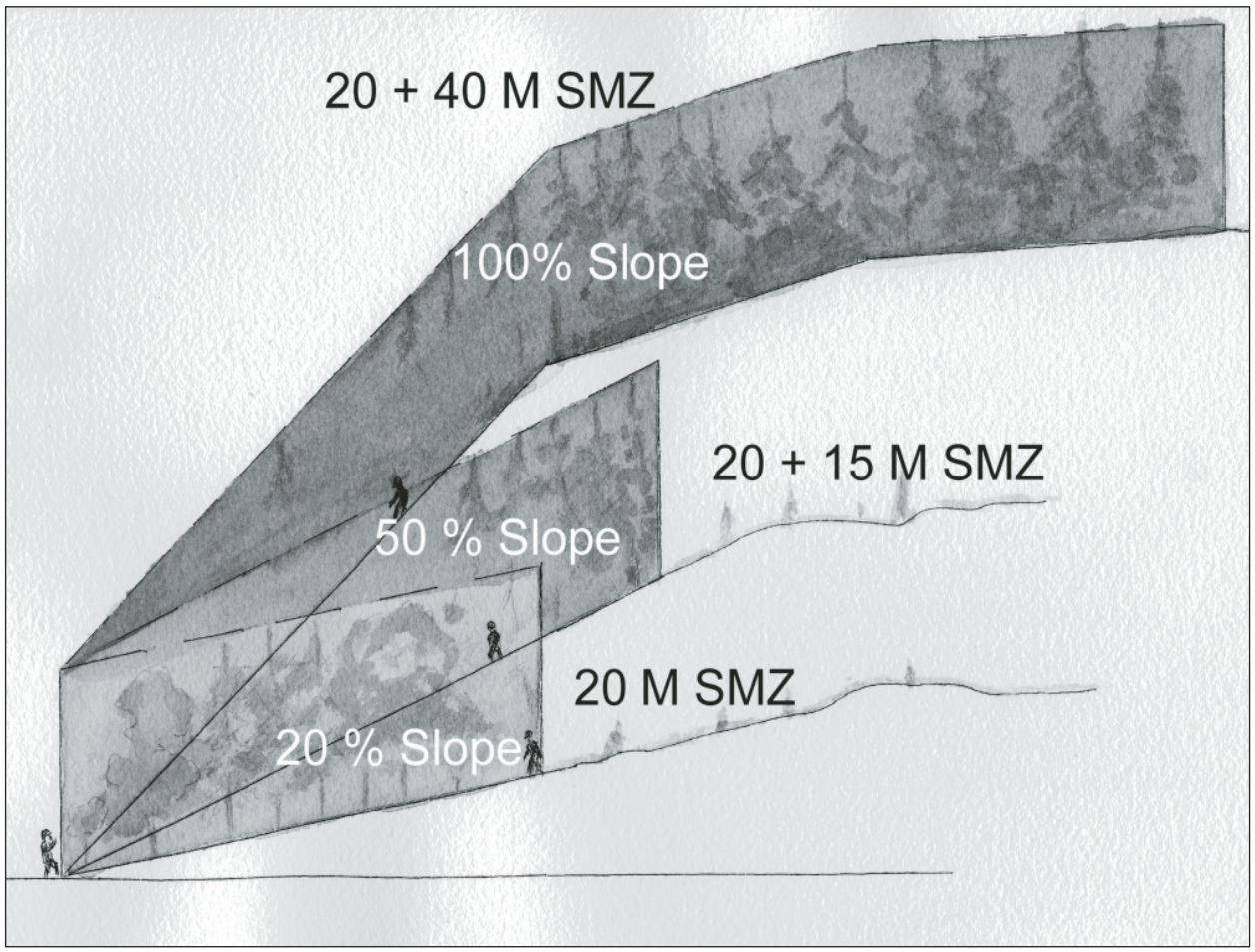
- Banks of steams are often undercut by the stream and this "hidden" distance of bed under the bank must also be measured. Brook trout often hide in these crevices, which are important stream habitat. A mink will check out all these

over hanging streambanks as it hunts along the stream.

- The streambed width measurement is the average of ten equidistant measurements. The calculated average of all measurements determines whether the width is above or below 50 cm along the whole length of the watercourse adjacent to the planned harvest. Even if the width of the streambed is less than 50 cm at a few measurement points the SMZ must be applied between the stream and the whole harvest site.

In Dan Barr's example along Brandy Brook, Dan's harvest will border the stream for 200 metres. Dan would try to make measurements at 10, 30, 50, 70, 90, 110, 130, 150, 170, 190 metres along the watercourse. He averages a streambed width of 1.4 metres, so will require a 20-metre or wider SMZ.

- For watercourses wider than 50 cm then a 20 metre Special Management Zone is necessary. The width of the SMZ can increase up to 60 metres where slopes are very steep.



LAND RISE AT 20 METRES FROM Streamside Slope	Percent Slope	Compass Degrees	Width SMZ
0 metre	0%	0	20
2	10%	4.5	20
4	20%	9	20
6	30%	13.5	25
8	40%	18	30
10	50%	22.5	35
12	60%	27	40
14	70%	31.5	45
16	80%	36.0	50
18	90%	40.5	55
20	100%	45	60

- Professional Forest Technicians use a clinometer for determining stream bank slope. The technician stands next to the stream and sights 20 metres up the bank to an eye level point there. Some hand compasses have a pendulum. By sighting up the slope with the compass held on its edge, the degrees of slope can be calculated. If degrees are 9 or less then no additional SMZ width is required.

(3) No forestry operator shall within a special management zone

(a) permit the use of, use or operate a vehicle for forestry operations within 7 m of the watercourse;

(b) reduce the basal area of living trees to less than 20 m^2 per hectare; or

(c) create an opening in the dominant tree canopy larger than 15 m at its greatest dimension.

(4) Despite clause (3)(a), the operation of a vehicle for the purpose of watercourse crossings approved by the Department of Environment and Labour is permitted within a special management zone.

- Harvest of trees within the SMZ is permitted. Vehicles however are not permitted within 7 metres of the watercourse and only a partial harvest is permitted. No activity can occur that causes sediment being deposited in the watercourse. Within a SMZ a woodlot owner has the option to remove certain valuable sawlog trees or perhaps do a pre-merchantable or a merchantable thinning.
- A partial harvest is allowed within the SMZ but the basal area cannot be reduced more than 20 M^2. Forest Technicians use a ***Wedge Prism*** for calculation of basal area. Information on measuring Basal Area is offered in the references.

"*basal area*" means the surface area of the cross-section of the trunks of the standing trees, measured at a height of 1.3 m from the ground;

- To ensure an even distribution of remaining trees, only single trees or small patches of trees can be taken. No opening can be created in the dominant canopy greater than 15 metres.

- The Department of Environment and Labour approval is required for stream crossings where vehicles must approach and cross a stream. It is encouraged when building roads across streams, keep the right of way narrow and do not create an opening in the dominant canopy more than 15 metres wide.

PROTECTION OF WATERCOURSE LESS THAN 50 CM WIDE

7 Where the average width of a watercourse situated on or adjacent to forest land on which a forestry operation is carried on is less than 50 cm, no forestry operator shall permit the use of, use or operate a vehicle for forestry operations within 5 m of the watercourse, except for the purpose of watercourse crossings approved by the Department of Environment and Labour.

PROVISIONS APPLYING TO ALL WATERCOURSES

8 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.

9 No forestry operator shall conduct any activity within 20 m of the edge of any watercourse that would result in sediment being deposited in the watercourse.

- For watercourses that have an average width measurement less than 50 cm, then the harvest of trees are permitted. No vehicle can be operated within 5 metres of the watercourse. Understory and non-commercial vegetation should be disturbed as little as possible. Remember that deposition of sediment into the watercourse could result in a violation, so take care.

FINAL LESSON COMMENT

No one likes regulation, but the WH&WP Regulations were made law for a good reason and do not place excessive hardship on woodlot owners. Woodlot ownership is a privilege and comes with responsibility.

Non-compliance, whether intentional or unintentional, could result in fines or embarrassment.

If there is any doubt or question, please consult with the staff at the Department of Natural Resources.

QUIZ

1. The purpose of Legacy Clumps is

   ❑ (a) Enable organisms to survive until the forest again matures

   ❑ (b) Provide Coarse Woody Debris

   ❑ (c) Provide present and future cavity trees

   ❑ (d) Provide vertical diversity

2. A 3 Hectare clearcut requires 1 Legacy Clump.

   ❑ True ❑ False

   (Hint: Read Regulation 4 (1))

3. If trees left in a Legacy Clump blow down, it is all right to harvest them.

   ❑ True ❑ False

4. A streambank along a 1 metre wide stream with a 28% slope requires a

   ❑ (a) 20 M SMZ

   ❑ (b) 24 M SMZ

   ❑ (c) 28 M SMZ

   ❑ (d) Requires only a 5M vehicle exclusion zone

5. A contractor leaves a 15 M wide uncut zone along a stream but maintains a 20 M2 basal area. Is this legal?

   ❑ Yes ❑ No

6. A contractor wishes to harvest near a stream but in mid-winter the width of the stream cannot be determined. The contractor should

   ❑ (a) Measure percent slope and assume the stream requires a SMZ.

   ❑ (b) Take a chance and not leave a SMZ

   ❑ (c) Suggest to landowner that harvest occur after winter.

   ❑ (d) Wonder why Hughie did not look in Harold's boot.

LESSON FIVE: **Planning For Woodlot Wildlife**

In Lessons One to Four, the features within a woodlot that determine habitat for forest wildlife were explained. Attention was given to species and habitats of conservation concern. The legal responsibilities for the Wildlife Habitat and Watercourses Protection Regulations were explained. Now, in Lesson Five, students will put this collective knowledge to use and incorporate wildlife into woodlot planning.

Carl points out that he is not a forester nor does he own a woodlot. He hopes in this lesson to interact with woodlot owners to combine his knowledge of wildlife habitat with the hands-on know-how of people that wear chain saw pants and hard hats.

Goals

Everyone's goal for wildlife on their woodlot will be different. For some people, their woodlot is a recreational property and wildlife is important above everything else. For others, wildlife is a value, but the woodlot must generate an income.

In general, forestry on woodlots is done at a smaller scale and for a more variety of products than on large industrial lands. As a consequence, many small woodlots do provide diverse wildlife habitats. For some owners, the management for wildlife and biodiversity will require a change from past approaches and likely require economic concessions, but in the long term they will have a healthier woodlot.

Doing An Inventory

Most woodlot inventories begin with an air photo and a walk about the property. When forest technicians do this inventory, they draw lines on an air photo around the different stands and indicate the tree species and age. They make recommendations on when and how a stand should be harvested. They might indicate where an access road should be built. They would indicate where Special Management Zones are required along a watercourse. The inventory is sometimes slanted towards forest economic values, but is a good map of the woodlot on which to map further wildlife values.

Air photographs have a scale of 1:10,000. This makes distance and area conversion on the photographs easy. One centimeter equals 100 metres. One square centimeter equals one hectare.

Other maps are 1:10,000 Forest Cover Maps interpreted from air photographs by Natural Resources and a visit to a District DNR office might obtain a photocopy of the portion covering a particular woodlot. These maps have information on stand tree species, stand heights, and volumes. The air photos and the cover mapping are usually done every 10 years, so they can lag behind current conditions.

Carl recounts to the class that he used to mark softwood, mixedwood, and hardwood stands on these maps with colored pencils, but now fancy forestry maps can be printed using computers with GIS (Geographic Information System) software programs.

Owners of long time family woodlots know their woodlot very well and have a lot of this information and history of past harvests in their head. However, obtaining a recent air photo and marking the locations of stands on an air photo is a great way to review.

Checking for Significant Habitats and Species

Good planners within the forest industry take the extra step of checking the DNR Significant Habitat and Species Mapping. Woodlot owners can also view this mapping through the Internet. Remember that there are many, maybe most, significant

habitats not yet discovered and the DNR mapping is always a work in progress. Woodlot owners have an advantage in knowing what is present because of familiarity with their property.

RECOMMENDATIONS:

- ***Establish Special Management Zones as required by the WH&WP Regulations. Additional to the regulations, establish SMZ to protect and provide riparian habitat surrounding vernal pools and all wetlands. In some locations widen the SMZ. Combine the SMZ with other lands to develop as old growth forest, or harvest by single tree and small patch uneven-age harvest methods. Avoid abrupt, long edges along narrow Special Management Zones but design rather with additional variable width and with feathered edges.***
- ***Avoid laying out roads and skid trails during winter, because small streams may not be visible. Identify streams, ponds, wetlands, seeps, and vernal pools in early spring.***

WATERCOURSES, WETLANDS, AND RIPARIAN AREAS

Wet areas must be protected and forestry operations planned to avoid these areas. Important wildlife habitats not to overlook are vernal pools and woodland springs and seeps. When planning for roads, it is especially important to think hard, with map in hand, and avoid or minimize stream crossings.

RECOMMENDATIONS:

- ***Be on the lookout for large stick nests. Listen and watch for the presence of raptors or herons.***
- ***Be familiar with the habitats where rare plants and animals could occur, and be alert for their presence.***
- ***Be familiar with the native tree composition within the woodlot. Recognize any rare or uncommon species.***

ROAD LAYOUT

Wildlife managers are increasingly concerned about the amount of roads and other corridors crisscrossing forest environments. Roads are a barrier for species with small home ranges and limited mobility. Roads are psychological barriers for some larger animals. The increase in roads is thought a contributing factor to the decline in Nova Scotia mainland moose, because of vehicle collisions, disturbances, and greater access for poachers. The road footprint itself replaces growing space for plants. Roads are the major source of stream sedimentation.

RECOMMENDATIONS:

- ***Plan the lowest density of permanent roads. Avoid loop roads but promote cul-de-sac roads. Upgrade existing roads if possible. Plan the most efficient layout. Keep the cleared right of way to the minimum necessary to meet basic construction, maintenance, and traffic requirements. For stands under even-aged management and with few anticipated intermediate treatments, use temporary roads only. For uneven-aged management areas use as few skid trails and interior roads as possible. Plan winter logging.***
- ***Roads should not be built within riparian zones except where unavoidable. Avoid roads near all wetland habitats.***
- ***Locate new roads where there is less chance of flooding by beavers. Locate roads between watershed headwaters or avoid stream crossings below low gradient basins with high potential for beaver flooding. Use "beaver puzzle" devices if a problem develops to retain wetland habitat at an acceptable water level.***

DECIDING WHAT TO HARVEST AND HOW

Previous lessons taught the importance to wildlife of horizontal diversity across the landscape and vertical diversity within the stand. The importance of retaining forest interior for some species was also covered in Lesson Three.

Forest and wildlife managers, whether by intention or not, have done a good job in creating horizontal diversity. However they have been less successful at providing vertical diversity and retaining forest interior habitat. Planning for woodlot wildlife should make adjustments to provide larger blocks and manage these blocks with uneven-age selection methods.

UNEVEN-AGED MANAGEMENT AND VERTICAL STRUCTURE

In Nova Scotia there is a growing interest in restoring climax dominant, long lived and shade tolerant tree species of the Acadian Forest. This requires a major move away from even-aged harvest that has favored shade intolerant tree types. Today 91 per cent of Nova Scotia forests are even-aged and are less than 100 years old. The need will continue for even-aged management for some tree species, but woodlot owners should begin to study selection harvest methods and to manage a higher proportion of their woodlots for uneven-aged stands. This change will develop vertical stand structure and will develop wider expanses of tall canopy.

Carl states that he is no authority on uneven-aged management but has read that openings in the canopy, less than 6 metres wide, will favor shade-tolerant species such as sugar maples and eastern hemlock. Openings 10 to 50 metres wide will favor mid-tolerant species like oaks, white ash, and white pine. Openings that are greater than 50 metres wide will favor regeneration of white birch and popular. The light intensity in the openings determines which species gets a competitive edge.

A comparison of this adaptation can be made to Coastal Plain Flowers, growing on a lakeshore, where the plants get a competitive advantage because they are adapted to shoreline flooding. In the shade under a forest canopy young shade-tolerant trees have a competitive advantage for early but slow growth, because light conditions are too dim for shade-intolerant species.

Many types of wildlife will benefit when forest stands have multiple canopy layers. Woodlot owners should explore alternative silviculture and selection harvest methods that develop uneven-aged forests. Carl, for an example, points out a program in Ontario where Certified Tree Markers mark individual trees with different colour paints. Some are marked for harvest or cull. Some are marked for retention as wildlife tree or to continue growing. The result is a woodlot that is aesthetically pleasing, provides wildlife habitat, creates sustainable growing conditions, and provides a continuous supply of forest products. Much of the Algonquin Provincial Park is harvested by this method.

Dan Barr tells a story of his friend Tom who is a silviculture contractor and has switched from the traditional industrial approach to forestry. Originally the approach was to clearcut and plant using fast growing, non-native softwoods. Deadwood was eliminated and plantations were intended to resemble farm fields. Tom was dissatisfied with that approach and now is an advocate for restoring the Acadian Forest. On his own land Tom says he now makes it messy and leaves standing deadwood. Tom says the economics are poor right now, but his goal is to grow high-quality wood, not large volumes of wood. Tom favors long-lived species when selection cutting or thinning, underplants Acadian forest species, and protects hardwoods found in softwood stands. Some of Tom's land is old farm field grown with white spruce and balsam fir, which is not conducive to selection harvest methods.

RECOMMENDATIONS:

- ***A portion of the woodlot should be managed by uneven-aged harvest methods. Single tree selection produces most canopy layering. Combine with small group selection to create small openings or gaps in the canopy.***
- ***Maintain some softwood trees within hardwood stands and some hardwood trees within softwood stands. Retain supercanopy trees.***
- ***Within even-aged harvests follow WH&WP Regulations to retain clumps of trees. Also combine across the harvest site with additional individual trees of deep-rooted trees, such as white pine and red oak.***
- ***If plantations are necessary plant areas such as where white spruce was harvested and plant to restore Acadian species.***

NATIVE TREE SPECIES COMPOSITION

In Lesson Two the major Acadian forest types and their dominant tree species were listed. These are the native shade-tolerant trees that woodlot owners should try to encourage to become the dominant canopy trees on their woodlots. However, there are other associated shrub and smaller tree species that add to the collective diversity and should not be eliminated. Some are important fruit or seed trees for wildlife such as mountain ash or hazel.

RECOMMENDATIONS:

- ***Retain rare and uncommon tree species. Avoid eliminating naturally occurring species during selective harvests.***
- ***Maintain naturally uniform stands, such as hemlock slopes or black spruce bogs, rather than converting to mixed stands.***
- ***Maintain some softwood trees within hardwood stands and some hardwood trees within softwood stands.***

DEER WINTERING AREAS

Lesson Three discussed how to recognize locations with high winter deer concentrations. Deer yard management might appear as a contradiction to a recommendation for less even-aged forest management and more uneven-aged management. Deer are an edge species. They feed in openings and utilize early successional forest stages. Deer are becoming increasingly numerous on edges of towns. Only during the harder winters is softwood cover critical for deer. Deer numbers in Nova Scotia have greatly fluctuated over the years, increasing through years of little snow and declining sharply following hard winters.

Deer and other herbivores adapted to early succession forests will find food in the understory of uneven-age forests and at the edges of canopy gaps, but perhaps not in the quantity found over regenerating clearcut. A significant amount of even-aged harvest will continue even if there is a move towards selective harvests. Uneven-aged conifer forests will provide good winter cover.

RECOMMENDATIONS:

- ***When possible, schedule winter harvests.***
- ***Maintain a closed-canopy conifer over-story over at least 50 per cent of the DWA at any given time.***
- ***Disperse harvest units rather than concentrating in one area.***
- ***Widen the SMZ to 100 metres along each bank of larger streams where there is heavy deer movement. Maintain an unbroken conifer corridor along the shoreline.***

CHOOSING THE RIGHT CONTRACTOR

Some woodlot owners will hire contractors to do silviculture or harvest work. Seek out those contractors that understand Acadian forest processes and can begin restoration of multi-layered shade tolerant forests. Avoid contractors with

large equipment, designed only for clear-cutting, even though they maybe able to offer better prices.

RESTORING OLD GROWTH FOREST FEATURES

The class has learned that 400 years ago probably 50 per cent of Nova Scotia was covered in old growth forest. Today there is only 1 per cent old growth forest. In 1999 the NS Department of Natural Resources made a policy to protect and restore old growth forest on 8 per cent of Crown lands in each of the province's 38 EcoDistricts. Many of the locations that provide the best opportunities to accomplish this representation have been chosen. Many are not yet old growth forest, but are now reserved so that over time they will become old growth.

Woodlot owners should consider also devoting a portion of their woodlot to develop as old growth or at least have old growth features. Imagine the biodiversity benefit of 30,000 Nova Scotia woodlot owners contributing to a patchwork of mature, late successional forest across the province.

Carl has read an Extension Note from Ontario called Restoring Old-Growth Features to Managed Forests in Southern Ontario. Woodlot owners can develop the habitat features of old growth but continue to take forest products. It does not mean the forest is an economic loss. Like Dan's friend Tom, the idea is to grow quality wood instead of lots of wood. Rather than leaving the forest alone, faster results to develop old growth characteristics are obtained by thinning and cutting small and large holes in the forest canopy. This mimics natural disturbances and speeds up the process of developing stands of several ages and heights. Wildlife trees including cavity trees, snags, mast trees, and supercanopy trees are retained.

To develop more similarity to an original old growth stand, woodlot owners can keep a higher basal area and a greater number of large diameter (> 50cm) trees than specified in typical un-even aged management prescriptions.

WORK WITH NEIGHBORS TO COLLECTIVELY MANAGE AND PROTECT WOODLOTS

Many of Nova Scotia woodlots are long, narrow, rectangular shapes that often extend out behind farms. This is how land grants were made and how great grandparents divided land amongst children.

Planning and working with neighbors has the potential to greatly reduce the amount of road construction. A combined effort can create larger units of interior forest and old growth forest, and better provide deer wintering cover. There are likely many combinations where features on one woodlot depend on adjoining habitats. For example, one woodlot might have a large wetland and animals using the wetland also require the forest cover on the neighboring property. One woodlot might have the only softwood in a predominant hardwood area. Like-minded woodlot neighbors should talk to discuss options.

A Few Hands-On Projects

• ARTIFICIAL NESTING STRUCTURES

A woodlot with a good number of cavity trees does not need birdhouses, but they can be fun and are not discouraged.

The following link to the Cornell Lab of Ornithology provides a wealth of information *http://www.birds.cornell.edu/birdhouse/resources/*

Carl tells how he along with the North Colchester Forest Co-operative had erected and then banded young in 40 kestrel boxes near Tatamagouche. The birds laid eggs in early May. Eggs took 30 days to hatch and another 30 days for the young to fledge. The young were banded before fledging.

An acquaintance of Carl told of erecting chickadee houses near bogs and having boreal chickadees use them. Barred owls will use nest boxes and are an interesting bird to see and hear on a woodlot.

Bat houses are popular, although in a woodlot bats are just as likely to crawl up under loose bark. A band of tarp paper wrapped around a tree is a good alternative to wooden bat houses.

• WOODLAND PONDS

Lesson three exalted the benefits of having vernal ponds within a woodlot. Natural wetlands or watercourses enhance wildlife habitats. Carl provides a reference *A Guide to Creating Vernal Ponds.* If a woodlot lacks natural water features, constructing a pond will provide great wildlife benefits. Remember in Lesson Three, vernal ponds were described as highly variable in sizes and how long during the year they held water. A pond with permanent water is considered vernal if adult predatory fish are not present.

Trout should not be stocked into ponds when the woodlot owner wishes to benefit amphibians.

The reference above provides good information on what to consider and how to construct ponds and Carl will not repeat it here.

An important caution is to build these ponds away from natural wetlands and watercourses; otherwise you must get approval from the NS Department of Environment and Labor.

Ducks Unlimited is a good organization to contact for advice on building ponds and perhaps the names of good dozer operators.

• RENEW APPLE TREES AND OLD FIELD ALDER

Dan Barr's property once was a farm and now has a field that he keeps mowed and about 5 hectares of old field alder. There are several old apple trees along the old fencerows.

Several of the apple trees are in poor shape and crowded by softwoods. Carl has given Dan a pamphlet *Improving Wild Apple Trees for Wildlife* on how to renew old apple trees. The technique is simple—remove trees that compete for light, prune off deadwood, cup-shape the apple tree's crown, and fertilize.

The alders in the old fields are large and passing into a later successional stage of young trees. These alder stands provide a unique habitat used by many birds. Alders add nitrogen to soils, increasing the fertility for wildlife. Dan wants to retain the alders and has resisted recommendations by forestry people to clear the alders and plant softwoods.

Carl told him of work done in Maine, where strips are mowed through alder stands so alder stands are renewed. Over time three or four different aged strips are developed. This is described in *A Landowner's Guide to Woodcock Management in the Northeast*. Carl introduced Dan to a group called The Woodcock Conservation Society who contracts a large machine called a Hydro-Ax and mowed strips over a third of the alders.

WILDLIFE PLANTINGS

When managing for backyard birds, gardening books always recommend that you plant lots of berry-producing shrubs. Woodlots are different. They already contain shrubs and trees for cover and many native plants that produce hard and soft mast. Wild strawberries, raspberries, and chokecherries are already seeded across the woodlot in the droppings of birds and mammals.

Yet this should not discourage woodlot owners who wish to add food diversity to their woodlot. However, if you wish to add food diversity to you woodlot, we recommend that you plant native species or exotic species that are already well established. Consider cutting and propagating scions from wild apple trees—these produce many sweet apples that wildlife seems to like. Newly transplanted trees will need chicken wire protection for a few years.

COARSE WOODY DEBRIS

If a woodlot lacks a sufficient quantity of downed logs and other debris it is possible to drop cull trees and pile brush. Do not to remove good standing cavity trees. The following is a fancy example of

a brush pile of popular logs with a protective tarp paper cap.

Final Thoughts

Good habitat is the key to having wildlife on a woodlot. Wildlife has a broad definition and includes many groups of organisms. Having a diversity of habitats across the landscape and vertical diversity from ground level to treetop enhances habitat for forest wildlife. Horizontal and vertical diversity occurs naturally in native dominant forest types that have many tree sizes and ages.

A strategy for providing good wildlife habitat on woodlots is a harvest approach that restores native long-lived, shade-tolerant tree species and restores features that resemble old-growth forests. These features are a multi-layered forest with a good supply of cavity trees and both standing and fallen dead wood.

Care must also be taken to identify and protect sensitive and wet habitats.

There is no quick fix for restoring Acadian forest structures and processes. It is a life's work and it is hoped children and grand children are taught a land ethic and that good land stewardship will continue over many generations.

Quiz

1. White Birch is a shade intolerant species?

❑ True ❑ False

2. Benefits of Special Management Zones are?

❑ (a) Provides wildlife habitat

❑ (b) Buffers excessive runoff into streams

❑ (c) Provides in stream benefits such as logs and nutrients

❑ (d) A cool place to have a picnic

3. Openings in the canopy of 6 metres are likely to benefit sugar maple?

❑ True ❑ False

4. An air photo that has 10 cm = 1 km the scale is?

❑ (a) 1:50,000

❑ (b) 1: 20,000

❑ (c) 1:10,000

❑ (d) 1: 5,000

5. A woodlot with gypsum cliffs and sinkholes (kaarst topography) has the potential for

❑ (a) Bat Hibernacula

❑ (b) Calcareous plants such as yellow lady slipper

❑ (c) Snake Hibernacula

❑ (d) Difficulty to operate machinery

6. Woodlot owners are fortunate people.

❑ True ❑ False

GLOSSARY

Adaptability: The evolution of features that make a group of organisms better suited to live and reproduce in their environment.

Bacteriologist: A person that studies bacteria.

Basal area: The cross-sectional area of a tree at breast height expressed in square metres (m2), BA = 0.00007854 x Diameter Breast Height 2. This term can also be the combined basal area of all trees in a given area, expressed in square metres per hectare (m2/ha). It is a measurement to help calculate sustainable timber yield.

Biodiversity (biological diversity): Refers to the variety of life on 3 different levels: the variety of ecosystems (ecosystem diversity), the variety of species (species diversity) and the variety within species (genetic diversity).

Bog: a nutrient poor, acidic wetland. The source of most water is through precipitation. Peat accumulates on bogs.

Carnivore: An animal that eats other animals.

Cavity Tree: Living or dead trees with natural or excavated holes or cavities.

Clearcutting: A forest management method that involves the complete felling and removal of a stand of trees.

Climax community: A relatively stable and undisturbed plant community that has evolved through stages and adapted to its environment.

Climax forest: Plant community dominated by trees representing the culminating stage of natural succession for that specific locality and environment.

Climax species: Plant species that will remain essentially unchanged in terms of species composition for as long as the site remains undisturbed.

Clinometer: Hand instrument used by foresters and timber cruisers to measure vertical angles. Such angles, when correlated with specific distances, indicate the height of standing trees.

Coarse Woody Debris: Sound and rotting logs and stumps that provides habitat and a source of nutrients for soil development.

Conk: Visible fruiting body of a wood-destroying fungus, usually indicating rot in the underlying wood.

Cover: A hiding place or vegetative shelter for wildlife from predators or inclement weather.

Decomposer: An organism that breaks down the tissue and/or the structures of dead organisms.

Deer Yard: Softwood cover that provides cover for deer in winter.

Ecodistrict: A part of an ecoregion characterized by distinctive geologic, soil, water, fauna and land use.

Ecoregion: A part of an ecozone characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soil, water and fauna.

Edge: A loosely defined type of habitat that occurs at the boundary between two different habitat types.

Endangered: A species that is in danger of extinction.

Even-aged: A forest stand or type in which relatively small age differences (10-20 yr) exist between individual trees.

Extinct: No longer existing.

Extirpated: Refers to the local extinction of a species but exists elsewhere.

Fen: A peat wetland typically covered by sedges, having a saturated water regime, and having an open drainage system. Fens appear similar to bogs but are distinguished by watercourses that pass through them.

Food Chain: A number of organisms forming a series through which energy is passed. At the base of the chain (the producer, or first trophic level) there is always a green plant or other autotroph that traps energy, almost always from light, and produces food substances, thereby making energy available for the other (consumer) levels. Any natural community will have many interlinked food chains that make up a food web or food cycle

Forest canopy: The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.

Forest Interior Species: Species that occupy habitats away from edges.

Forest type: A group of forest areas or stands whose similar composition (species, age, height, and density) differentiates it from other such groups.

Gene: A discrete unit of hereditary information consisting of a specific sequence of DNA.

Generalist Species: Organisms that can survive under a variety of conditions.

Geographic Information System (GIS): An organized collection of computer hardware, software and geographic data designed for capturing, storing, updating, manipulating, analyzing and displaying all forms of geographically referenced information.

Green list: A list generated by the Nova Scotia Wildlife Division that indicates the status of a species. Species are placed on the Green List when they are not considered to be at risk. Populations are stable and key habitats are generally secure.

Group-selection method: A method of regenerating uneven-aged stands in which trees are removed in small groups.

Habitat: The environment in which a population or individual lives; includes not only the place where a species is found, but also the particular characteristics of the place (e.g., climate or the availability of suitable food and shelter) that make it especially well suited to meet the life cycle needs of that species.

Harvest: means a forestry operation that removes primary forest products from an area of forest land, but does not include the removal of Christmas trees or a forestry operation whose primary purpose is to convert the land to a non-forestry use. (WH&WPR definition)

Herbaceous: Having little or no woody tissue. Most plants grown as perennials or annuals are herbaceous.

Herbivore: Literally, an organism that eats plants.

Hibernacula: A secure area, usually a cave or a den of some sort, used by hibernating animals while in a state of torpor. Most hibernacula are dark and secluded so as to keep the hibernating animal out of harms way from predators or human disturbance.

High Grading: A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential. Poor quality, shade-loving trees tend to dominate in these continually high-graded sites.

Home-range size: An individual species' requirement for space. Both the size of an organism and its lifestyle determine its space requirements.

Insectivore: Literally, an organism that eats insects.

Inventory (forest): A survey of a forest area to determine such data as area, condition, timber, volume and species for a specific purpose, such as planning, purchasing, evaluating, managing or harvesting.

Landscape: Areas of land that are distinguished by differences in landforms, vegetation, land use, and aesthetic characteristics.

Legacy Clump: Groups of uncut trees left within harvests. The clumps provide present and future wildlife trees and provide a reservoir for organisms to survive until the forest again matures.

Limiting factor: A cause that alone or in combination with other causes prevents a population from increasing. Such causes might include mortality or physical and behavioral causes that limit reproduction.

Marking: The physical process of marking selected trees to be cut or left during a harvest.

Mast: Fruits or nuts used as a food source by wildlife. Soft mast includes most fruits with fleshy coverings, such as raspberries, or fruit of dogwood or mountain ash. Hard mast refers to nuts such as acorns and seeds such as in conifer cones.

Mature tree: A tree that has reached a desired size or age for its intended use. Size, age, or economic maturity varies depending on the species and intended use.

Meadow: a grassland area, usually low-lying and having moist soil.

Mortality Factor: A cause of mortality such as predation, accidents, disease, starvation.

Mycorrhizal Fungi: A beneficial group of fungi that live in and around the roots of plants.

Niche: The portion of the environment that a species occupies, defined in terms of the conditions under which an organism can survive.

Old growth stands: Forests distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development which typically differ from earlier stages in a variety of characteristics that may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function. The age at which old growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions and disturbance regime. For example, old growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of down woody material. However, old growth is typically distinguished from younger growth by several of the following structural attributes:

- Large trees for species and site.
- Wide variation in tree sizes and spacing.
- Accumulations of large-size dead standing and fallen trees that are high relative to earlier stages.
- Decadence in the form of broken or deformed tops or bole and root decay.
- Multiple canopy layers.
- Canopy gaps and understory patchiness

Omnivore: Literally, an organism that will eat anything. Refers to animals that eat both plants and animals.

Photosynthesis: The conversion of light energy to chemical energy that is stored in glucose and other organic compounds.

Pioneer Species: Species quick to populate a disturbed area. Usually have efficient dispersal adaptations.

Plantation: A stand of trees that has been grown through direct seeding or by planting seedlings.

Primary Excavator: Usually refers to woodpeckers that create cavities in trees and later occupied by secondary nesters.

Primary Producer: Usually a photosynthetic organism that ultimately provides food to all other levels.

Red list: A list generated by the Nova Scotia Wildlife Division that indicates the status of a species. Species are placed on the Red List when current knowledge suggests that these species are at risk. These species have declined, or are in immediate danger of declining, to nonviable population sizes.

Regeneration: The continuous renewal of a forest stand. Natural regeneration occurs gradually with seeds from adjacent stands or with seeds brought in by wind, birds, or animals. Artificial regeneration involves direct seeding or planting.

Riparian forest: At a large scale, it is the band of forest that has a significant influence on a stream ecosystem or is significantly affected by the stream. At a smaller scale, it is the forest at the immediate water's edge, where some specialized plants and animals form a distinct community.

Riparian area: The land adjacent to the normal high water line in a stream, river or lake, extending to the portion of land that is influenced by the presence of the adjacent ponded or channeled water. Riparian areas typically exemplify a rich and diverse vegetative mosaic reflecting the influence of available surface water.

Selection cutting: Annual or periodic cutting of trees in a stand in which the trees vary markedly in age. The objective is to recover the yield and maintain an uneven-aged stand structure, while creating the conditions necessary for tree growth and seedling establishment. Differs from selective cutting, in which the most valuable trees are harvested without regard for the condition of the residual stand.

Secondary nester: Refers to animals that occupy woodpecker nesting holes following woodpeckers.

Shade Tolerant: Tree relatively capable of developing and growing normally in the shade of, and in competition with, other trees.

Single tree selection: The selection of individual trees for harvesting.

Snag: A dead, but standing tree from which the leaves and most of the branches have fallen.

Special Concern: Similar to vulnerable.

Special Management Zone: means an area of forest required to be established adjacent to a watercourse in accordance with Sections 5 and 6 to protect the watercourse and bordering wildlife habitat from the effects of forestry operations. (WH&WPR definition)

Specialist Species: An organism that is adapted to a lifestyle specific to a particular set of conditions.

Stand: A community of trees possessing sufficient uniformity in composition, age, arrangement, or condition to be distinguishable from the forest or other growth on adjoining areas, thus forming a silvicultural or management entity.

Stream: A general term for a body of flowing water; natural water course containing water at least part of the year.

Streambed: The channel through which a natural stream of water runs.

Streambed: means that portion of a watercourse within a defined flow channel containing predominantly mud, silt, sand, gravel or rock. (WH&WPR definition)

Streambed undercut: A measure of the furthest point of protrusion of the bank to the furthest undercut of the bank. Streambank undercut provides cover for fish and may be conducive to producing high biomass of fish. Undercut is a good indicator of how successfully streambanks are protected under alternative and uses, such as livestock grazing and road building.

Succession: (1) Changes in the species composition of an ecosystem over time, often in a predictable order. In forests, it refers to the sequence of one community of plants gradually replacing another. (2) A term that may refer to plants or animals, succession is a progressive series of changes in the plant and animal life of a community from initial colonization to the establishment of a climax or final stage in which the plant or animal attains equilibrium with the environment.

Sustainable forest management: Management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for present and future generations.

Stratification: division of a forest, or any ecosystem, into distinct layers (or strata) of vegetation.

Threatened species: A species that is likely to become endangered if certain pressures are not reversed.

Tree, Dominant: The overstory tree species in a plant community which contributes the most cover or basal area to the community, compared to other life form or species.

Tree, Co-dominant: More than one dominant overstory tree species.

Tree, Sub Dominant: Trees species growing under dominant overstory tree species.

Tree, Super Dominate: Trees that protrude above the dominant tree canopy. For example, tall white pine growing above a closed canopy hardwood forest.

Uneven-aged management: The practice of managing a forest by periodically selecting and harvesting individual trees or groups of trees from the stand while preserving its natural appearance

Uneven-aged stand: A forest stand composed of trees of different ages and sizes.

Vernal: Refers to non-permanent wetlands that are usually water filled in springtime.

Vulnerable species: A species that is considered at risk because it exists in low numbers or in restricted ranges, due to loss of habitat or other factors.

Watercourse: means 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. (WH&WPR definition)

Wedge Prism: A forestry instrument used to measure basal area.

Understorey: The lower level of vegetation in a forest. Usually formed by ground vegetation (mosses, herbs and lichens), herbs and shrubs, but may also include subdominant trees.

Vertical diversity: A term used to describe forest structure, proceeding vertically through a forest canopy.

Yellow list: A list generated by the Nova Scotia Wildlife Division that indicates the status of a species. Species are placed on the Yellow list if they are considered species that are not currently at risk but may require special management to address concerns related to naturally low populations, limited provincial distributions or demographic/ life history features that make them vulnerable to human-related changes in the environment.

REFERENCES

Becoming a Better Naturalist

Following are selected references from Joan Barr's reference library:

Newcomb's Wildflower Guide has an easy to use key.

Roland's Flora of Nova Scotia revised by Marian Zinck. 1998. Two volumes.

Field Guide to Butterflies North America. National Audubon Society

Field Guide to Mushrooms North America. National Audubon Society

Peterson Field Guide Eastern Birds. Roger Tory Peterson. This is a classic and easy to use guide for beginners.

Field Guide to Birds of North America. National Geographic

The Sibley Guide to Birds. David Allen Sibley. National Audubon Society

Amphibians and Reptiles of Nova Scotia. John Gilhen. Nova Scotia Museum

Darn Metric

P.E. Trudeau gave Canada the metric system. Dan Barr will never think of his height other than in feet and inches but he is learning to think in hectares instead of acres. One hectare is 100 metres x 100 metres so that is easy to calculate.

1 Ha = 2.471 Acres
1 Acre = 0.4047 Ha
1 Metre = 3.281 Feet

PDF (Adobe Portable Document Format) Suggested Online Reading

For woodlot owners with computer savvy and computer access there are a number of Extension Notes and papers that will explain further the lessons in the Woodlot and Wildlife Module. Type key search words into a search engine, such as Google.

Betts, M.G. and G.J. Forbes (eds.). 2005. Forest Management Guidelines to Protect Native Biodiversity in the Greater Fundy Ecosystem. U. New Brunswick.

Biebighauser, Thomas R. A Guide to Creating Vernal Ponds. USDA Forest Service

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Dubé, Andréa L. 2006. Restoration of Acadian Old-Growth Forests: Attitudes and Behaviors of Private Woodlot Owners in Central Nova Scotia. Dalhousie U.

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Environment Canada. 1999. The Importance of Wildlife to Canadians. Survey (1996) Highlights.

Elliott, Catherine A. (editor) 1999. Biodiversity in the Forests of Maine: Guidelines for Land Management. U. Maine Coop. Ext.

Mosseler, A., J.A. Lynds, and J.E.Major. 2003. Old-growth forests of the Acadian Forest Region. NRC. Environ. Rev. 11 (suppl. 1).

Neily, Peter D. et al. 2003. Ecological Land Classification. NS Dept. Natural Resources.

Improving Wild Apple Trees for Wildlife. NS Dept. Lands and Forests, Extension Services Division

Ontario Extension Note. 1995. Cavity Trees are Refuges for Wildlife.

Ontario Extension Note. 1999. Restoring Old-Growth Features to Managed Forests in Southern Ontario.

Ontario Extension Note. 2000. Conserving the Forest Interior: A Threatened Wildlife Habitat.

Ontario Extension Note. 2003. Promoting a Healthy Forest Through Tree Marking.

Ontario Extension Note. ----. Do You Have a Healthy Woodlot?

Sepik, Greg F. et al. 1981. A Landowner's Guide to Woodcock Management in the Northeast. U. Maine.

WEB SITES GOVERNMENT AND NON GOVERNMENT ORGANIZATIONS

Nova Scotia Department of Natural Resources
with links to Wildlife Division and other DNR Divisions.
http://www.gov.ns.ca/natr/

Nova Scotia Museum of Natural History
and links to other nature sites.
http://museum.gov.ns.ca/mnh/

Nova Scotia Department of Environment and Labor
Regulates any work that affects streams or wetlands
http://www.gov.ns.ca/enla/

Service Nova Scotia Air Photo Products
http://www.gov.ns.ca/snsmr/land/products/air2.asp

Canadian Wildlife Service
Has an Atlantic office in Sackville, N.B.
http://www.cws-scf.ec.gc.ca/index_e.cfm

Nova Forest Alliance
Has an office at Stewiacke
http://www.novaforestalliance.com/default.asp?cmPageID=77

Bird Studies Canada
Has an Atlantic office in Sackville, N.B.
http://www.bsc-eoc.org/bscmain.html

Nova Scotia Nature Trust
Promotes stewardship of special places on private lands
http://www.nsnt.ca/

Canadian Parks and Wilderness Society (CPAWS)
http://www.cpaws.org/

Ecology Action Centre
http://www.ecologyaction.ca/

Nature Nova Scotia
Is a provincial organization representing several provincial naturalist groups
http://www.chebucto.ns.ca/Environment/FNSN/

Ducks Unlimited
Has an office in Amherst
http://www.ducks.ca/aboutduc/locations/index.html

Woodcock Conservation Society
http://www.whc.org/NovaScotiaWoodcockHabitatEnhancement.htm

QUIZ ANSWERS

LESSON ONE
1 (b),
2 False,
3 (c),
4 False,
5 (b),
6 False

LESSON TWO
1 True,
2 (d),
3 (c),
4 True,
5 (b)(d),
6 True

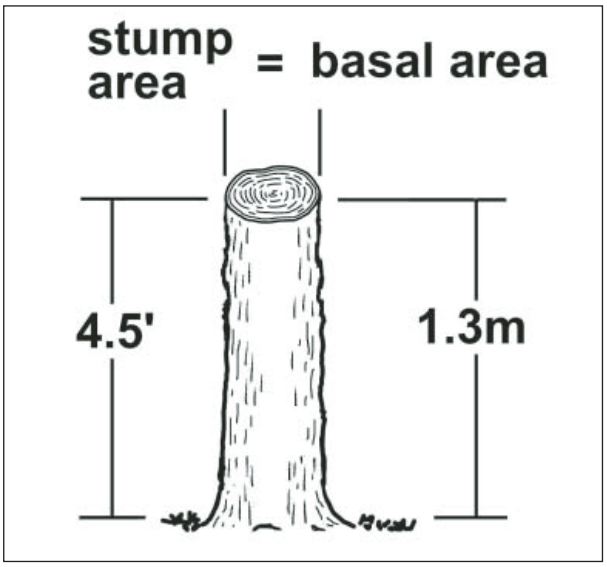
LESSON THREE
1 False,
2 (a)(b)(c)(d),
3 (d),
4 True,
5 True,
6 (a)(d)

LESSON FOUR
1 (a)(b)(c)(d),
2 False,
3 False,
4 (b),
5 No,
6 (a)(c)

LESSON FIVE
1 True,
2 (a)(b)(c)(d),
3True,
4 (c),
5 (a)(b)(c)(d),
6 True

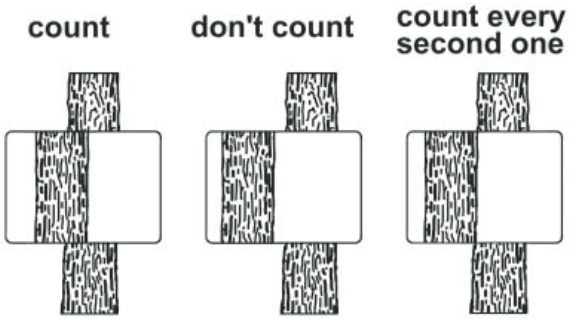
Understanding and Measuring Basal Area

Basal area (BA) is the area in square metres (or square feet) of the cross section of the trunk of a tree at breast height (1.3 m or 4.5 ft). It is most commonly used as an indicator of stand density and is expressed as square metres per hectare or square feet per acre.



BA is measured by adding the area of the stems at breast height of all the trees in the stand. Because of the time required to measure every tree, only a sample of the stand is measured. The sample is used to predict the total amount of basal area in the stand. This is the method used most by contractors and large forest industrial landholders.

The most common methods of sampling a stand to determine the basal area are to use a prism or relascope. These methods are quick and easy.



PRISM

Prisms can be purchased from most forestry supply stores. They can be used as follows:

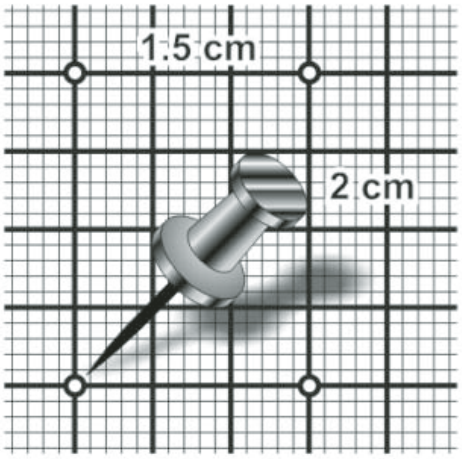
Go to a spot in a stand and do a complete circle, counting those trees that are completely displaced (see illustration below). **With a prism you need to use the prism as the centre of the plot and rotate around it**. Multiply the number of in trees by 2 to get the basal area for the stand in square meters per ha. (For example, if you count 20 trees, your basal area is 40 square metres per hectare).

RELASCOPE

The main advantage of a relascope is that it can be made inexpensively with some string or chain, and a stiff piece of cardboard or plastic.

A 2-factor relascope can be made in 5 steps:

1. Use a pin to prick corners on a stiff piece of cardboard or plastic as marked to the left. The opening must be exactly 1.5 cm wide as drawn below. **A 1 mm error in notch width will affect accuracy by approximately 10%**.
2. Connect the dots with a ruler and pencil.
3. Cut out the opening with scissors or a knife.
4. Cut the edges as drawn (dimensions are not critical).
5. Attach a string below the opening as shown. Knot the string exactly at 53 cm from the relascope. **A 1 cm error in string length will result in a 10 % error in accuracy.**



With a 2-factor relascope (i.e. BAF = 2) each tree that completely fills the opening will represent 2 square meters of basal area per hectare. (The way it works is this: BAF = a2/y2 x 2500 where a = notch width and y = length of string)

To use the relascope, hold the knot of the string to your face and pull the other end tight horizontally away from you. Go to a spot in a stand and do a complete circle using your eye as the centre of the circle, counting only those trees that completely fill the opening in the relascope. Multiply this number by 2 to get the basal area for the stand in square meters per ha. (For example, if you count 20 trees, your basal area is 40 square meters per hectare).