WILDLIFE & WOODLANDS

What you can do

The Environmental Coalition
of Prince Edward Island

CREDITS

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HOW TO USE THIS BOOKLET

Forests are complex communities and ecological forestry is equally complex. Chapters II - X in this booklet each contain two sections. The first section is a discussion of the issue with background information. The second section is on what you can do. You can read the whole booklet, one or two chapters, or just the 'what you can do' sections. Terms in **bold type** are defined in the glossary on page 29.

INSIDE FRONT COVER

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Preface

Forests have been my interest for a long time, starting from a love of the outdoors, growing with curiosity about woodland communities and continuing with employment in the forest industry. Yet as a treeplanter, woodsworker, naturalist and woodlot owner, I began to feel something was wrong. The **clearcut-replant-herbicide cycle** was not leading to healthy forests.

Books and magazine articles started appearing on ecological methods of forestry. Foresters, especially those trained in Europe and working in Canada, were voicing concerns over industrial-style management. I learned more about Dr. Stephen Manley's brief attempt to recreate the Acadian forest on this Island and had several opportunities to hear him speak and discuss his work. Equally important, I began writing to Dr. Alexander Jablanczy, a forest engineer with a doctorate of forestry and Ph.D. in forest ecology. These people, and others working for better forests in Canada and the United States, made it clear that forests were communities of living things, each playing an important role.

My association with the Natural History Society of Prince Edward Island, as past-editor of the Island Naturalist and organizer of the Montague-area Christmas Bird Count, heightened my interest in forest birds. In doing research on songbird decline, I found that experts were laying the blame on forest practices in North and South America.

This booklet provides information on how to restore healthy, productive forest communities and avoid potentially harmful practices. Information has been gleaned from writings by qualified foresters, research scientists, naturalists and woodlot owners. Until government and industry devote more resources to ecological forestry, most research will continue to be done on our own woodlots. Private landowners control 93% of forests in this province and our tax dollars fund government programs. It is up to individual woodlot owners to manage their woodlots well.

Woodlot owners have expertise and practical knowledge too often overlooked. It is for them this booklet was written, in hopes that we can make our forests a better place for all wildlife, including humans.

CHAPTER I

A look at the past

"The timber of the Island is allowed to be much better than the like species of the neighbouring parts of the Continent, being of a finer and closer grain and texture not so subject to shakes and defects; the pines, black birch, beech and maple are also larger than they are generally found on the adjacent part of the continent."

John Stewart, An Account of Prince Edward Island in the Gulf of St. Lawrence, North America, 1806

While the destruction of majestic **old growth forest** takes place across the country, it is hard to picture woodlands on Prince Edward Island as anything but insignificant. There are no stands of huge trees, no threatened lynx, bear, marten or moose.

Yet this Island once had all of these and allowed their extinction, a loss many still feel deeply. Records are sparse as to what exactly was here when the Micmac tradition of living gently on this land ran up against the first settlers from Europe, but those that exist paint an impressive picture. In 1534, Jacques Cartier sent word back to the French king that he found trees "wonderfully fair", describing cedars, pines, white elms, ash, willows and many others unknown to him.

This 'Acadian forest', mainly sugar maple, yellow birch, white pine, hemlock, beech, red spruce, red oak and white ash, was home to black bear, moose, lynx, marten, fisher, river otter and pileated woodpecker.

With the European settlement in the 1700's came large-scale clearing of forests for farming and shipbuilding - white pine up to six feet in diameter, yellow birch unequalled in the region. Unfortunately, the best forests, which had built up the richest soils, quickly fell to axe and fire. Clearing peaked at about 80% of available land by the late 1800's.

The Island has changed immensely since those times. Even from our incomplete accounts several birds, including the passenger pigeon and spruce grouse, no longer can be found. The pileated woodpecker has only recently returned and many insect-eating birds are here in far fewer numbers. Francis Bain,

Island naturalist and author of Birds of Prince Edward Island, described the scene in 1891. Boreal chickadees were nearly as abundant as black-capped chickadees and cliff swallows, nighthawks and chimney swifts were common.

Today, many of the gulls, blue jays, American robins and grassland birds such as bobolinks and brown-headed cowbirds are much more common. Skunks and raccoons have been introduced, while cats and dogs are ever-present in both urban and rural areas.

Much farmland has reverted to **early successional** tree species, such as white spruce, that thrive in full sunlight. These trees are not growing on healthy forest soils - they often seeded into worn-out agricultural land. Many **mixed wood forests** on the Island have high percentages of short-lived species - poplar, red maple, and balsam fir. Stands of more valuable, longer-lived Acadian species face increasing pressure from harvesting and few will ever achieve old age. This is the legacy with which we have been left.

CHAPTER II

An introduction to ecosystem management

"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise."
Aldo Leopold, A Sand County Almanac

There are two schools of wildlife (and forest) management. The most common is to decide what species to manage for (usually consumptive uses, products we consume in some way) and ensure proper habitat is available. A good example would be waterfowl management areas, where the focus is on production of ducks and geese. Often when we manage for one narrow purpose, we can do great damage to the other 'purposes' in the ecosystem.

The other school of thought is allow more natural habitat development to ensure a stable, mixed population of all the plants and animals that have evolved to become part of that ecosystem. An example of this would be preserving dune systems and

protecting the habitat for the animals that would normally live there. This method reflects the shift in the 1990's from endangered 'species' to endangered 'spaces', since habitat loss is considered to be the greatest cause of species extinction. It is estimated that by the year 2000, habitat loss will result in the extinction of 50,000 species annually worldwide.

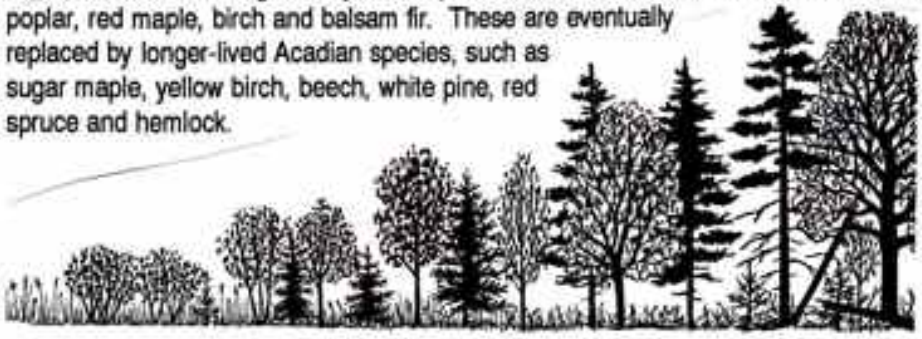
We need wood products from the forest, whether paper or building supplies or firewood. Yet we are only beginning to realize the value of other forest 'products' - clean water, storage of carbon, wildlife, food, esthetics, erosion control, etc. This is not an issue of wildlife conservation versus industrial use - creation or restoration of healthy forests will supply us with far more benefits, including wood, than tree farms.

Ecosystem management is the essence of natural selection forestry - treating the forest as a community of interdependent plants and animals. Fortunately, we still have remnants of Acadian forest left on which to build, although it will take vision, hard work and creativity to put things in order. Our choices are clear - we can focus on clearcuts and softwood plantations, trying to maintain unresilient, simple tree farms; we can let nature take its own course and, on most sites, progress naturally into mixed forests, a process that will take 100-200 years; or we can work with nature, using practices that help speed up natural succession.

An example of natural succession on one Prince Edward Island site

When a cultivated field is abandoned on Prince Edward Island, the forest that originally grew on there (in most cases the Acadian forest) returns only after a series of short-lived communities have preceeded it. These stages differ in structure and function from the climax forest that will develop.

Grasses soon are overgrown by white spruce and\or alder, which in turn give way to poplar, red maple, birch and balsam fir. These are eventually replaced by longer-lived Acadian species, such as sugar maple, yellow birch, beech, white pine, red spruce and hemlock.



Succession - from field to forest

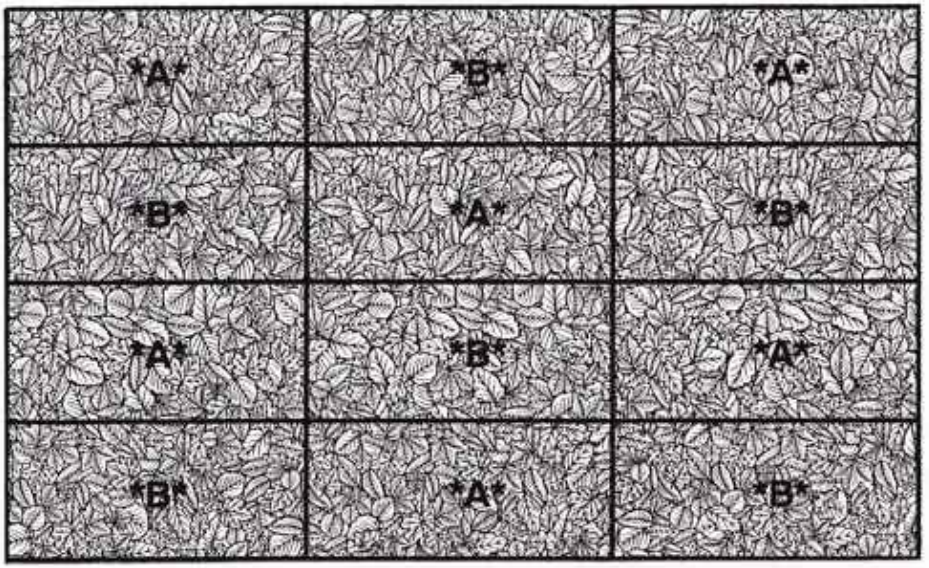
"Ecological succession is one of the few scientific laws that we have available when we manage natural systems like forests. The Acadian forest is a forest that must have succession - even with major players missing, the strength of succession is very prominent and very strong."

Dr. Stephen Manley, from a talk on Mixed Wood Forests

Ecological or natural succession is a series of changes that ultimately produces a climax community. This is the community that forms if land is left undisturbed and perpetuates itself as long as no disturbances occur. In each phase, plants or animals are present that make the best use of existing conditions. The main climax forest here is the Acadian forest, although others (black spruce-eastern larch communities around bogs, or wetlands in the western part of the Island that contain cedar and white elm) occur throughout the province. After a fire or clearcut, **early-successional species** occur that grow well in full sun but poorly in shade - **shade-intolerant species**. Raspberries, goldenrod, fireweed and short-lived shrubs and trees such as pin cherry, poplar and gray birch pioneer the site. These plants enrich the soil and improve conditions for later successional species. White spruce and alders dominate this phase in an old field.

Shrubs quickly shade out grasses and other plants needing full sunlight and early successional trees later shade out the shrubs. Maturing trees form a **closed canopy** under which the shade intolerant species do not reproduce well. Depending on available sources of seed, **shade-tolerant species** that can grow under the shade of other trees, will emerge under the closed canopy. As the short-lived, early successional species die, the forest moves into a **mid-successional stage**, with trees that can tolerate some shade. The forest continues succeeding until it enters its climax or **late successional** phase.

In this phase, shade intolerant species have been replaced by long-lived, shade tolerant species and the pattern of reproduction can continue indefinitely. Seedlings of sugar maple, yellow birch and red spruce, for example will grow well in the shade of their parents. This Acadian 'condition' also includes wildlife and plants other than trees, following their own succession.



One alternative to clearcutting the entire stand is to make small strip cuts, about 15 m x 30 m (50' x 100'). If possible, a buffer should be left around the entire stand.

What you can do

1. Stands of old field white spruce are dying prematurely and need to be **restructured** into **uneven-aged forests** with more variety. Unfortunately, there are no easy solutions. Large **clear-cuts** and softwood plantations have potential for severe impact and by allowing increased exposure to sunlight and wind, leave fewer management options. A more gentle approach might be to make narrow **strip cuts**, about 15 m (50 feet or 3/4 chain) wide and perhaps twice that length (see illustration above). Ideally, the strips would run east-west to reduce wind damage and be no longer than twice the width. The timetable would be something like this:

YEAR 1 - harvest all *A* strips, leaving clumps of trees for wildlife and any healthy trees other than white spruce. Remove some of the best spruce from the uncut strips. Depending on what seed sources are present in the area, you will get a wide range of plants regenerating naturally, including poplar and pin cherry. These early successional species help build soil and can provide shade and protection for later underplantings.

YEAR 3 - take a good look at the regeneration in the *A* strips. Under the shade of poplar and

pin cherry, which may be up to 2.75 m (9 feet) tall, plant Acadian species that would naturally occupy the site if you had 100-200 years to wait. About 40-50 yellow birch, sugar maple, hemlock, white pine or red spruce should be enough; less if you have some already growing naturally. In open areas, try planting white birch, white ash or red oak seedlings.
YEAR 10 - harvest all *B* strips, leaving clumps of **wildlife trees** and any healthy trees other than white spruce.
YEAR 13 - underplant *B* strips
YEAR 15 - remove most of the poplar and pin cherry from all *A* strips for firewood or to fuel an appropriately-designed **cogeneration system.**
YEAR 25 - remove most of the poplar and pin cherry from all *B* strips.

Depending on the size of the seedlings transplanted, you may have to protect them from mice and snowshoe hares. Taller seedlings will need less protection. If some white spruce in the strips does blow down, think of it as cheap fertilizer for your next crop of trees. This method of harvesting is more time-consuming and costly than removing the whole stand, but only in the short term. It is less disruptive to wildlife, conserves organic matter and soil nutrients and should make future financial inputs unnecessary. Remember that this is only one possible solution - other methods will arise as more expertise is developed by woodlot owners.

2. Most mixed wood stands contain a high percentage of short-lived species: poplar, pin cherry, fir and red maple, and balsam fir. Much restructuring can be accomplished using what is already growing on the site. In some cases a few light thinnings will be all the help a forest needs. Be aware of what species are **naturally regenerating** and favour the **shade-tolerant**, longer-lived species. In areas lacking naturally-occurring species such as eastern hemlock, red spruce or yellow birch, consider underplanting. Make small patch cuts, .1 to .4 hectares (1/4 to 1 acre), or narrow strip cuts and planted with Acadian species.

3. **Late successional forests** should be handled using **natural selection forestry** (see box on next page) and can be a source of valuable products. Treeplanting should not be necessary, except to add species that naturally would occur on the site.


Pin cherry


Trembling aspen


Gray birch

Harvesting rules for Natural Selection Forestry

These rules for natural selection forestry have been developed by Orville Camp, author of The Forest Farmer's Handbook and president of the Forest Farm Association. Mr. Camp is a leading proponent of sustainable logging practices and natural selection forest management in Oregon and across the continent.

1. **Address forest needs first.** In so doing, you will address yours.
2. **Always leave the stronger dominants.** Leaving the strong **dominant trees** will provide the best genetic traits for new stocking in which to best survive environmental extremes. Leaving the strong dominant trees will help maintain the forest health and avoid paying a high ecological price over the long term.
3. **Harvest only those trees that nature has selected for removal.** There are many indicators for determining which individuals nature has selected for removal. One of the best indicators, for example, is when two or more trees of the same age are competing for the same space and the growth rate of one starts tapering off. The one that starts tapering off with respect to the other is usually the one nature has selected out and can be removed. A major benefit in harvesting only naturally selected individuals is in being able to continue addressing the ecological needs of the forest ecosystem. Economically, the costs of using chemicals, slash burning and reforestation can be reduced to zero.
4. **Maintain suitable climate, soil and water conditions for all normally associated species.** These three essentials determine what can live in a given area. Canopy dominants control all three of these conditions below and should not be removed if they will substantially alter the climate below.
5. **Maintain habitat suitable for providing food, shelter and reproduction needs for all normally associated species.** All these needs must continue to be met for each species to survive.
6. **Maintain the natural selection system of "checks and balances" for keeping the forest ecosystem healthy and productive.** There must be adequate populations of all normally associated species for maintaining the best system of checks and balances.
7. **Remove no more than what the forest is truly capable of producing at any given time.** Overharvesting can substantially reduce production and seriously affect forest health or result in its death.
8. "Do I feel certain about my decision?" **The rule is: "When in doubt, don't!"** Get expert advice or evaluate the situation until you are satisfied with what you propose to do. You may never be able to replace what you are removing nor undo the damage caused by what you have removed. If you still can't decide, it's usually best not to do anything.

CHAPTER III

Why we need a healthy wildlife population

"The last word in ignorance is the man who says of an animal or plant: 'What good is it?' If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, had built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of tinkering."

Aldo Leopold, A Sand County Almanac

A healthy wildlife population has value in its own right - it belongs in the ecosystem and each species plays an important role. Stuart Hill, a McGill University entomologist and organic agriculture advocate, makes the point that 99% of all organisms are benign from a 'pest' point of view. When we encourage **monocultures**, we inevitably succumb to pesticide dependencies. Pesticides kill many non-target organisms. Each time we kill a non-target organism, we inherit its job in the system. We don't even recognize what most of these jobs are and even when we do, we don't perform them very well.

Insects, soil-dwelling organisms, invertebrates, fungi, etc. help break down decaying matter and make nutrients available for plants; birds help control the insects that can harm plants (a study in Washington State estimates that given the amount of spruce budworms eaten by evening grosbeaks, it would cost at least $1,820 per square km (.6 square miles) per year over a 100-year rotation to spray with insecticides to produce the same mortality); squirrels and birds play important roles in spreading seed; animals are very quick composters, turning plants into nutrients that are readily available to growing plants, which produce more food.

The point here is that natural systems are complex and involve vast numbers of interactions. Chris Maser describes a good example of such an interaction in The Redesigned Forest. He looked at just one role that northern flying squirrels play in Oregon's old growth forests. These squirrels nest in the **canopy** of large trees and come down to the forest floor at night to feed.

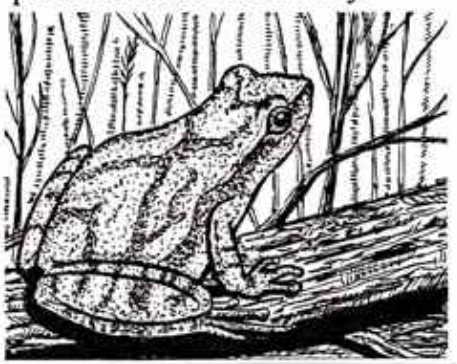
What you can do

1. Create walking/skiing trails through your forests so you and others can enjoy your woodlands at all times of the year. Learn what lives in the forest and how they relate to each other. Becoming more aware of the forest's inhabitants will give you valuable insights into how to harvest wood products and still maintain the integrity of the forest.
2. Leave slash (treetops and branches from the selective harvesting) for nesting sites and cover for many animals. Burning removes this habitat, releases carbon dioxide into the air (a contributor to global warming) and wastes valuable nutrients. Three logs placed together will provide a shaded, moist environment for salamanders.

3. Rodenticides used to protect seedlings from damage by mice can be harmful to hawks, owls and foxes that eat rodents and to non-target birds and mammals that eat the poisoned grain. Control weed competition around the seedlings, especially late in the fall, by mowing or mulching to remove shelter and food for rodents. Wrap fine wire mesh, tarpaper or plastic tree guards around the trunk to prevent seedling damage. Protect nest sites of all predators that control rodents and snowshoe hares that can damage regeneration.
4. Even when using selection harvesting, time your work to take place from late summer to early spring, outside of prime breeding season. Hawks and owls nest from March through mid-July and should have special protection zones. The general rule is no cutting within 100 m (110 yards) of these nests, although it would be safer to double this. Nest **buffers** themselves are no assurity of success. Even with buffers up to 200 hec-

tares (500 acres), nestling production of Northern goshawks in Arizona dropped by 94% when partial harvesting occurred outside the protected area.

5. Transplant wild trees and shrubs to provide more food and habitat for wildlife. Some of the fruit-bearing trees do well on the sides of roads or in small openings where there is more sun. These include serviceberry (Indian pear), apple, wild roses and mountain ash. Nut-bearing trees and shrubs, (oaks, beech, butternut and beaked hazelnut) tolerate more shade. See Tips on Transplanting in Appendix.
6. Until suitable habitat becomes available, create nesting boxes for tree swallows, American kestrels, etc. See Nest Boxes in Appendix.
7. Insecticides clearly harm insects and invertebrates with major roles to play in the ecosystem - as a source of food for birds, mammals, fish and amphibians, and through nutrient recycling and pollination. Remember the complexity of forest ecosystems. The death of non-target bees, for example, can seriously reduce the fruit-set on small shrubs. This adversely affects bird and mammal populations that feed on fruit. Insecticides also can have direct negative impacts on pond and stream life and forest birds and have no place in a forest community.



8. Respect habitat requirements of all forest inhabitants. Where do flying squirrels, essentially treetop dwellers, go after a clear-cut? No trees, no flying squirrels. Worse still, what about salamanders and frogs that spend time under logs and in moist woodlands? Amphibians, unlike plants and many invertebrates, have no resting, spore or seed phases to tide them over rapid changes, nor do they have wings to help them escape to new areas.

CHAPTER IV

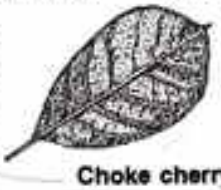
Maintaining variety

"An uneven-aged stand is particularly favourable to birds. Selection cutting provides a continuing supply of food and cover for wildlife throughout the life of the forest."

Fred Payne, Waterfowl Biologist, N.S. Department of Lands and Forests, Wood and Wildlife from Your Woodlot

People think of late successional, Acadian forests as full of large old trees, widely spaced and in a very steady state. This is only partially true. The Island's original forests were complicated and ever-changing. Besides the major species, other species were also present, including black spruce, white spruce, white birch, grey birch, red maple, striped maple, mountain maple, eastern larch, white elm, eastern white cedar, red pine, balsam fir, large-toothed aspen, trembling aspen, pin cherry, choke cherry and ironwood. Shrubs were even more numerous, with many types of alder, hawthorn, dogwood, serviceberry, elder, mountain ash, willow and hazelnut. The exact makeup depended on slope, soil conditions, available sunlight and drainage.

Even in late successional forests dominated by long-lived species, some trees were always dying and falling down. In these openings would grow young trees and shrubs. Depending on the size of the opening and the sources of available seed, very early-successional plants that grew in full sun might get a start until shade was created. Different levels of plants, from ground level (herbs like bunchberry) to shrub level (alternate-leafed dogwood) to canopy (sugar maple) provided a wide variety of shelter, nesting habitat and food sources.



Choke cherry

Red spruce

Sugar maple

Biological diversity, reflected in a wide variety of heights, ages and species, is the key to a healthy forest and wildlife community. A diverse forest provides for the needs of many animals suited to make use of that specific ecosystem.

What you can do:

1. Herbicides reduce the amount of diversity, especially in a young forest, and only compound already-serious problems. Chemicals such as Glyphosate (Roundup) always get a good safety rating from producers and promoters and a poor rating from conservationists. What we do know is that they poison plants and simplify an ecosystem. If you must control other species of plants, mow or use a mulch such as burlap or woodchips.

2. Clearcuts drastically alter wildlife communities. Inhabitants must find suitable, unoccupied habitat nearby or perish. No one knows how this affects animal populations - during breeding season, for example, territories are aggressively defended. Do parents spend time fighting off intruders instead of looking after their young? It is a fallacy to think there is a lot of empty, appropriate habitat nearby. The clearcut itself makes very poor habitat for most species of animals and takes a long time to recover and establish a stable wildlife community.

3. All plantings should include both deciduous and coniferous species, except in those rare areas where soil conditions dictate otherwise. Studies done on Prince Edward Island show a marked decrease in the diversity of birds in red pine plantations - they are among our worst wildlife habitats. A variety of species also protects against insects and diseases. F.S. Baker, author of Principles of Silviculture, notes "since most insects and diseases of forest trees are limited rather sharply to one or a few host plants, mixed stands offer far less opportunity for epidemics than do pure stands. In the case of insects, every tree in a pure stand offers food and a breeding ground. In the case of fungi, the liberated spores find favorable substrates everywhere. In both cases, destructive concentrations can readily be built up in pure stands."

4. Forests in this region should be full of trees of all ages. Even-aged plantations lack the diversity of levels that will best suit the habitat/food requirements of a wide variety of species.

5. If you are missing some species that should be in a natural forest in your area, try underplanting or interplanting. Both conifers and deciduous trees should be present in most forests, so you may want to try adding, for example, eastern hemlock, white pine or yellow birch. Mixes of species make good use of available sunlight, rainfall and nutrients.

CHAPTER V

Our fragmented forests

"It is now clear that to maintain a rich bird fauna, conservationists in eastern North America should focus on preserving large tracts of forest - of several hundred acres or more - rather than many small tracts. And contrary to traditional wildlife management, which often seeks to create edge habitat, protected woodlands should be spared intrusion by roads, power lines and clearcuts."

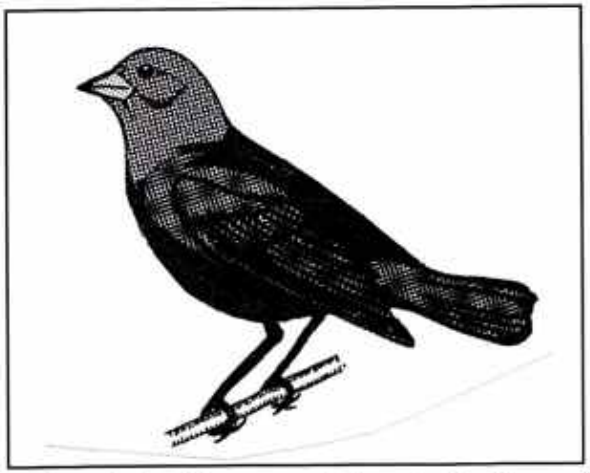
Raymond J. O'Connor, Professor of Wildlife at the University of Maine in Orono and coauthor of Farming and Birds.

Concern over songbird decline has grown over the past decade, as research scientists and amateur birders alike report a severe drop in the number of tropical migrants nesting in forests. While we have little data from Prince Edward Island, it is reasonable to assume that chopping forests into small pieces and creating large amounts of edge has caused the same problems here. Yet there has been an ominous silence about this potentially devasting development.

Edges are those areas where one type of ecosystem meets another, such as forest to field or forest to clearcut. The benefits of edges form the rationale for much forest management. Studies show that numbers and species of wildlife increase, notably game such as ruffed grouse and snowshoe hare. Clearcutting patches in continuous forest creates a lot of edge, benefitting a very specific type of wildlife, usually already common, at the expense of other, rarer species. Forest fragmentation, where we create a great deal of edge and deplete the amount of continuous forest, is taking place at an increasing rate in this province. Large tracts of forest are constantly being carved up by roads, clearcuts or developments.

In this fragmented habitat, certain predators or parasitical bird species thrive at the expense of other bird species. Blue jays, common grackles, crows, raccoons, skunks and even domestic cats and dogs are much more common along edges and can prey on eggs and nestlings. Species most at risk are the migrant songbirds. Some, like the ovenbird and black-and-white warbler, nest on the ground

where predation is especially high. Others build cup-shaped nests, more vulnerable than dome-shaped nests or tree cavities used by many year-round residents. Migrants also face the disadvantage of arriving late and leaving early. If they lose one clutch of eggs, there is not time to lay and raise another. They are also usually too small to fight off predators.

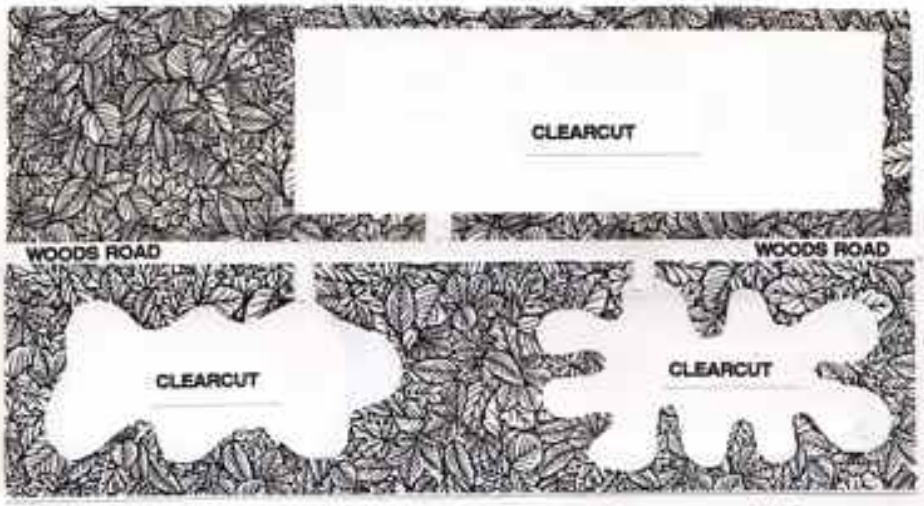


Parasitic brown-headed cowbirds, which lay eggs in nests of other birds, are also prospering. A female cowbird may lay up to 40 eggs per season, one or two eggs per nest. A cowbird will replace one of the eggs in a red-eyed vireo nest, for example, with her own. The parent vireo devotes so much energy to feeding the fast-growing cowbird young that its own offspring often do not survive. The open nests of migrant warblers, thrushes, vireos and flycatchers are easy targets for cowbirds.

A Wisconsin study showed nests at the edge of a forest to be five times as likely to contain cowbird eggs as those nests more than 275 m (300 yards) from the edge. In a large area of parkland in Maryland that continues to be fragmented, there were 198 pairs of breeding pairs of migrant songbirds for every 40 hectares (100 acres) of parkland in 1948. By 1986 there were only 31 breeding pairs of migrants every 40 hectares (100 acres). Other studies have shown that birds such as the barred owl, red-eyed vireo, scarlet tanager and ovenbird require large areas of unbroken forest.

Another associated problem with forest fragmentation is that the birds most effected are insect eaters - we simply do not know if the absence of these songbirds will lead to greater insect infestations in the future.

Prince Edward Island already has a lot of edges - roads, riparian zones, hedgerows dividing farm fields, even gardens and orchards. What we lack is continuous forest. To make matters worse, this is not just an isolated instance - it is happening across North America.



Roadways and clearcuts create edge in woodlots - not always a good thing.

What you can do

1. Use natural selection harvesting systems whenever possible.
2. Refrain from splitting up long, narrow tracts of forest with wide forest roads. An 18 m (60 ft)-wide road creates a lot of edge. Use narrow, curving roads wherever possible.
3. If you must clearcut, make small patch cuts, as few as possible, to restructure the stand into a later successional forest. A study in Illinois showed that openings less than .3 hectares (3/4 acre) did not attract edge species. In larger openings, edge species did show up, including brown-headed cowbirds. In openings .7 hectares (1 3/4 acres) and larger, cowbirds became particularly abundant.
4. Make sure there are large blocks of continuous forest in every area - whether it is publicly-owned Crown land or a group of woodlot owners getting together to address this problem. Meet with the other woodlot owners in your area to find ways to address this problem. Your forty acres of woodland may border on a piece of publicly-owned land. Cooperation between private woodlot owners and government agencies is the answer to keeping large blocks of forest intact.
5. Protect habitat for large predators, such as hawks and owls, that help control predators of songbird eggs and nestlings.
6. Make sure that your dogs and cats remain indoors or nearby your home. They should not have free range in surrounding woodlands.

CHAPTER VI

The importance of wildlife trees

"Reliance on bird boxes requires the placement of many types and sizes of nest boxes at various heights and densities throughout the forest. The boxes must be constructed, installed, cleaned and replaced periodically. The cost would be formidable and the results probably less successful than if snags were present."

USDA Forest Service, Wildlife Habitats in Managed Forests

The absence of snag trees (dead or dying trees used by a wide variety of wildlife for nesting, feeding and roosting) is another reason clearcuts are harmful to wildlife.

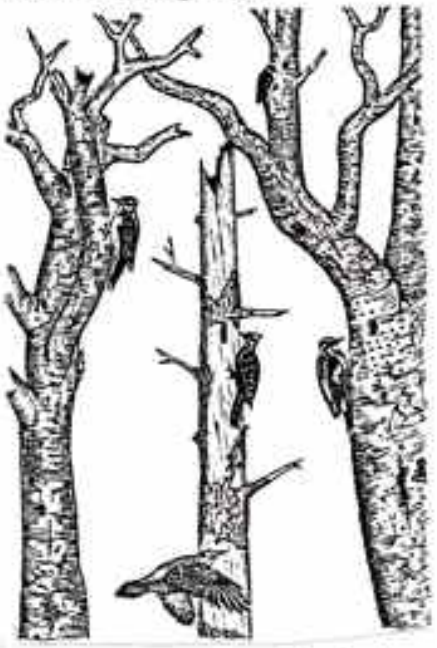
Many species of birds excavate cavities in decaying trees (or use older excavations) to nest in. The following birds make use of cavities for nesting on Prince Edward Island: wood duck, hooded merganser, merlin, American kestrel, eastern screech-owl, barred owl, northern saw-whet owl, pileated woodpecker, common flicker, yellow-bellied sapsucker, hairy woodpecker, downy woodpecker, black-backed woodpecker, three-toed woodpecker, tree swallow, black-capped chickadee, boreal chickadee, white-breasted nuthatch, red-breasted nuthatch, brown creeper and winter wren.

Others, like the bald eagle and osprey, often build their nests in dead or broken-topped trees. Hawks use snag trees as perches, while the loose bark of dead trees is an ideal roosting spot for little brown bats and spring peepers. Raccoons, red squirrels, northern flying squirrels and deer mice use cavities for nesting or denning.

Snags also provide habitat for ants and other important food sources for many birds. Remember that snags are not just home to birds and mammals - insects and other invertebrate, as well as fungi recycle dead tissues of the tree into new life. Even-aged, young softwood stands have a poor diversity of insects compared to older growth. In these stands, most insect species are plant eaters, while older forests have a greater abundance of predator and parasite species. Reducing bird and mammal populations that mainly eat insects can seriously affect the stand's ability to resist insect attacks.

What you can do

1. Again, the rule is no large clearcuts - even recent changes towards leaving select snag trees in clearcuts is unacceptable. Most are shallow rooted and too exposed to the wind. They will blow down within a few years, leaving the site without any snag trees for a long time.



2. When using natural selection forestry, leave a sufficient mix of wildlife trees in the forest. We do not know exactly how many to leave, but according to the Forest/Wildlife Guidelines and Standards for Nova Scotia, "Large trees over 50 cm (20 inches) diameter at breast height are better for cavity users because they provide habitat for both large and small wildlife species. Trees smaller than 20 cm (8 inches) dbh are of limited value to cavity nesters and will not provide nesting habitat for woodpeckers larger than the downy woodpecker, our smallest." The guidelines call for leaving 10 snags per hectare (4 per acre). So we would want at least that many continuously available in the forest. This means that young and middle age trees must be left to become future snags, not just the four old trees you leave for today. This is almost impossible to do in a clearcut.

3. If your woodland lacks snags but has large living trees, you may want to speed up the natural process and create snags by girdling a few trees, both coniferous and deciduous. With an axe or chainsaw, remove a complete ring of bark and **cambium layer** by axe or chainsaw to prevent the sap from rising in the tree.

4. Plan to allow some trees to become quite large. Studies on the pileated woodpecker in Oregon suggest that size of nest and roost trees is an important consideration. Research showed the smallest diameter nest tree to be 54 cm (24.5 inches) while the mean diameter was 84 cm (32 inches). This is hard to achieve on short-rotation plantations.

5. Make sure that there are logs on the ground or larger trees that have blown over throughout the forest. They provide drumming logs for ruffed grouse; perches for hawks and squirrels; and are full of insects and other invertebrate that serve as a food source for animals.

Fallen trees also are excellent nursery sites for yellow birch and hemlock seedlings, offering a moist environment and nutrients that are released slowly.

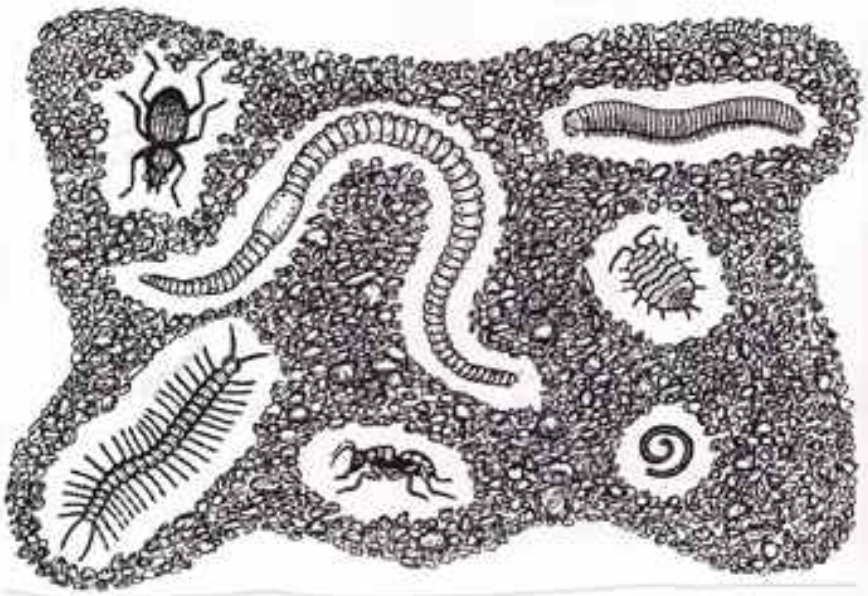
CHAPTER VII

Healthy soil in a healthy ecosystem

"Some years ago, scientists blocked off a small section of forest soil in New York state and removed the top layer of earth to a depth of one inch. In all, there was an average of 1,356 living creatures present in each square foot...Had an estimate been made of the microscopic population, it might have ranged up to 2 billion bacteria and many millions of fungi, protozoa and algae - in a mere teaspoonful of soil."

Peter Farb, The Forest

Although it is often overlooked, forests are only as healthy as the soil they grow on. Soils are full of a wide variety of living organisms, again each with roles to play and susceptible to poisons. If we remove too many nutrients from the site, or degrade the soil, we can create the same results that humans get from drinking polluted water or eating poor-quality food. When nutrients are lacking, unhealthy trees can easily succumb to insects, diseases and atmospheric pollution that stronger specimens might have weathered.



Soils are probably the most complex and least understood part of natural systems. Soil degradation is not easy to measure. It involves a combination of many effects; loss of biological diversity within the soil itself, destruction of soil structure, loss of nutrients and the enhanced development of acidic soils known as podzols.

Traditional harvesting on farm woodlots, while slowly degrading the quality of trees on site by removing only the best stock, was much less harmful to the soil than today's methods. Individual trees or small groups were removed and a lot of brush remained on site to protect the soil and provide nutrients for the next crop. Small equipment was used, often in the winter, creating less soil compaction. Contrast this with large-scale clearcuts where brush is burned, or whole tree harvests, where almost all above-ground brush is removed. In both cases, large amounts of nutrients are lost and heavy machinery is used that can lead to severe soil compaction.

Gordon Robinson, forester and author of The Forest and the Trees: A Guide to Excellent Forestry, worries about increased exposure to solar radiation and evaporation after clearcuts. "The normal soil life of fungi, bacteria, worms and all types of microscopic plants and animals is destroyed or at least greatly changed." Since health and vitality are important factors in preventing tree disease, trees growing on degraded soil are more susceptible to insect and disease damage.

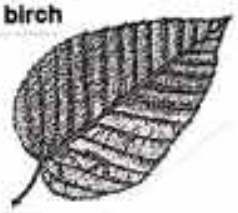
What you can do

1. Wherever possible, maintain a closed canopy, where the tree tops are close together and shade the forest floor. Exposure to sun and wind can quickly burn off organic matter in the soil and lead to degradation. A closed canopy permits a unique moisture-temperature-light balance without which the proper soil conditions for a healthy forest are unlikely to exist. Multiple levels of undergrowth combine with a closed canopy to ensure a gentle transfer of water into the soil, even after a heavy rainfall, and more gradual snow melt. This leads to fewer dry periods, more humidity and less runoff.

Red oak

White ash

Yellow birch



White pine

2. If a field is reverting to its natural state of forest, consider letting alders grow up and underplanting or interplanting with a mix of species. Alder leaves are unusually high in nitrogen and make yearly deposits to the soil bank. Alders also fix nitrogen from the atmosphere in root nodules and make it available to other plants. Acadian forest species can be planted this way, using tall transplants or protective cages to foil snowshoe hares.

3. Make sure there are a lot of deciduous trees in the forest. Leaves increase bacterial action and are great soil builders. Conifers can create a dense mat of acidic needles that decay slowly.

4. Not all plants feed from the same soil level and a mix of trees with shallow and deep roots will be less likely to exhaust the soil of specific nutrients. Also, each species cycles different nutrients through the soil, (for example, dogwood is known for making calcium available). Much work needs to be done in this area but encouraging a wide mix of plants just makes good sense.

5. Remove only the extra, or even less, that the forest produces each year. For example, if the rate of growth is 2.5 cord/ha (1 cord/acre) per year, you may want to remove an average of 1/2 or 3/4 of that amount every year. This will allow soil to be improved and trees to grow older and more valuable.

6. Avoid compacting forest soils by using light equipment when the land is dry and planning your extraction roads well. If you must use heavy equipment, it should have large 'floatation' tires to spread out the weight of the machine.

CHAPTER VIII

Trees along streamsides

"Small brook trout may live in the shelter of larger rocks or tree roots, darting out in search of food. Raccoon and mink prowl the banks and flip over stones to find hidden insects or try to capture fish; birds and animals of many kinds come to drink or bathe along its edges."

P.E.I. Department of the Environment, Wildlife and the Island

Streamsides play a key role in healthy wildlife communities and offer the richest diversity of any part of the forest. Shrubs and trees provide food and cover for many species of birds, amphibians and mammals. Plant species unique to narrow zones along streams add to the richness. These areas are also important as travel corridors, where animals can move from one area to another with some measure of protection.

Along streams, trees help reduce erosion and prevent waterways from silting up. Roots bind the soil together, leaf cover lessens the impact of heavy, potentially-eroding rains and large, dead trees on the ground can stop soil from moving downslope. Silt can smother the gravel beds needed for trout and salmon spawning habitat and destroy aquatic insects.

Shrubs and trees also shade waterways, preventing overheating that can be harmful to fish. Especially within older forests, logs and woody debris falling into streams create pools that provide useful habitat for fish.

What you can do

1. Always maintain cover along stream edges. The Forest/Wildlife Guidelines and Standards for Nova Scotia call for a special management zone of 20 m (66 ft) or more on either side of the stream. Herb Hammond, a British Columbia forester specializing in wholistic forestry, urges that no cutting at all should take place in very wide areas alongside streams. A cautious approach is certainly called for - concentrate on returning a healthy forest community to these areas. Some of the deeper valleys still have large specimens of Acadian species growing and may play an important role as sources of seed.
2. These are very productive areas for wildlife and the number of snags should be increased to 25-30 per hectare (10-12 per acre).
3. If the area beside a stream is full of dying trees, this is where you should concentrate your efforts. The Montague Watershed Project successfully underplanted yellow birch and hemlock along streams in the area.
4. Natural selection harvesting systems offer exceptional protection for streamsides, since the whole forest is maintained as a greenbelt.
5. Keep heavy harvesting machinery away from streamsides - if you must remove trees blocking a stream, use a winch or horse.
6. Make sure that any bridges meet or exceed standards set by the provincial Department of Energy and Forestry, to protect against erosion and siltation.

CHAPTER IX

The bigger picture

"If tropical forests continue to be cleared at the current rate, at least 225 million hectares (556 million acres) will be cleared by the year 2000; if destruction of the tropical rain forests continues unabated, an estimated 10 to 20 per cent of the earth's plant and animal life will be gone by the year 2000."

J. Gustave Speth, President, World Resources Institute

Much of what we consider our wildlife is not just our wildlife. It travels north or south on migration routes and is susceptible to acid rain and other pollution from as far away as the middle of the continent.

Many of the same migrants facing pressure in their Canadian nesting grounds face equal pressure in their winter habitat and along the migration routes themselves. As more tropical rainforests are lost to bulldozers and slash-and-burn farming, we can expect to see fewer and fewer of these migrants. This is just one of many reasons tropical deforestation must be stopped. Yet it is not enough to stop the cutting of the rainforest. We must set a good example in the rest of North America - in fact, far less damage has been done to the rainforests than to the forests of this continent, although they are quickly catching up.

What you can do

1. Join a rainforest action group and try to look at the big picture. It is not enough to tell people to preserve their trees because we are worried about global warming. We must provide markets for other forest products, such as the wide variety of nuts now being sustainably harvested. These groups also work to get governments and banks to cooperate in debt for land swaps, so that pressure is removed to liquidate every available asset.

World Wildlife Fund
60 St. Clair Ave. East, Suite 201
Toronto, Ontario M4T 1N5

Friends of the Earth
251 Laurier Ave. West, Suite 701
Ottawa, Ontario K1P 5J6

The Rainforest Action Network
301 Broadway, Suite A
San Francisco, California 94133

Western Canada Wilderness Committee
20 Water St.
Vancouver, B.C. V6B 1A4

The Rain Forest Foundation
P.O. Box 757
Plainville, Connecticut 06062

Probe International
100 College Street
Toronto, Ontario M5G 1L5

2. Make sure our own governments are protecting Canadian forests and harvesting them in a sustainable manner, one that benefits humans and wildlife. Local groups here are working on these issues, as well as national and international organizations.

Environmental Coalition of Prince Edward Island
126 Richmond St., Rm. 1
Charlottetown, P.E.I. C1A 1H9

Conservation Council of N.B.
180 St. John St.
Fredericton, N.B. E3B 4A9

Ecology Action Centre
3115 Veith St., 3rd floor
Halifax, N.S. B3K 3G9

Canada's Future Forest Alliance
Box 224
New Denver, B.C. V0G 1S0

3. Keep up the pressure for clean air legislation (reducing global warming and acid rain) and ecological reserves worldwide. These are just a few of the many groups working on these key environmental issues.

Canadian Parks and Wilderness Society
160 Bloor St. East, Suite 1150
Toronto, Ont. M4W 1B9

Pollution Probe
12 Madison Ave.
Toronto, Ontario M5R 2S1

Greenpeace Canada
578 Bloor St. West
Toronto, Ontario M6G 1K1

4. Recycle paper and use recycled paper products whenever possible. For every ton of paper produced, 17 trees die.

Recycled paper requires 50% less energy to produce than virgin paper and its manufacture results in 35% less water pollution. Reusing paper is the first step (computer paper printed on one side only and envelopes are much too valuable to use only once). When you must buy paper and paper products, look for recycled paper with a high content of 'post-consumer waste'. This means that it has a lot of fibre recovered from office paper recycling programs.

The Paper Source, Fallbrook, Ontario K0G 1A0, is one good outlet, and many printers and stationery stores now carry supplies made from recycled material.

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GLOSSARY

Buffer - an area of vegetation that is left or managed to reduce the impact of a treatment or action of one area on another.

Cambium layer - the narrow zone of cells between the inner bark and sapwood. It is the growth layer that produces new bark and wood.

Canopy - the cover of branches and foliage formed by the crowns of trees.

Clearcut - a harvest where all trees are removed from a given block or forest area.

Clearcut-replant-herbicide cycle - a common cycle in industrial-style forestry, producing an even-aged stand of one or more species.

Closed canopy - the condition that exists when the canopy created by trees or shrubs or both is dense enough to exclude most of the direct sunlight from the forest floor.

Cogeneration system - a facility that burns wood to produce steam and electricity.

Dominant trees - trees with crowns extending above the general level of the crown cover and receiving full sunlight from above.

Early successional trees - the initial trees in an ecological succession, for example, gray birch and pin cherry.

Late successional trees - the climax trees in an ecological succession, capable of perpetuating themselves if left undisturbed. These include sugar maple, beech, yellow birch, white pine, hemlock and red spruce on most sites.

Mixed wood forest - a forest composed of different species of trees, usually including coniferous and deciduous trees.

Monoculture - the use of land for growing one type of crop.

Mycorrhizal fungi - fungi that form a beneficial symbiotic association with plant roots.

Natural regeneration - seedlings, stump sprouts or root suckers that are growing on site without being planted by humans.

Natural selection forestry - a system where individual trees that nature has selected for removal are harvested. This is an ideal system for handling mixed wood, uneven-aged Acadian forests.

Restructured - changed from one level of succession to another. An example is a mixed wood stand with a low percentage of Acadian species in which succession is speeded up by removing some of the shorter-lived species.

Shade intolerant species - those trees which cannot reproduce and grow under shade of other trees.

Shade tolerant species - those trees which are able to reproduce and grow under shade of other trees.

Strip cut - a narrow clearcut, offering more protection from sun and wind than larger clearcuts.

Uneven-aged forests - stands that have trees of different ages.

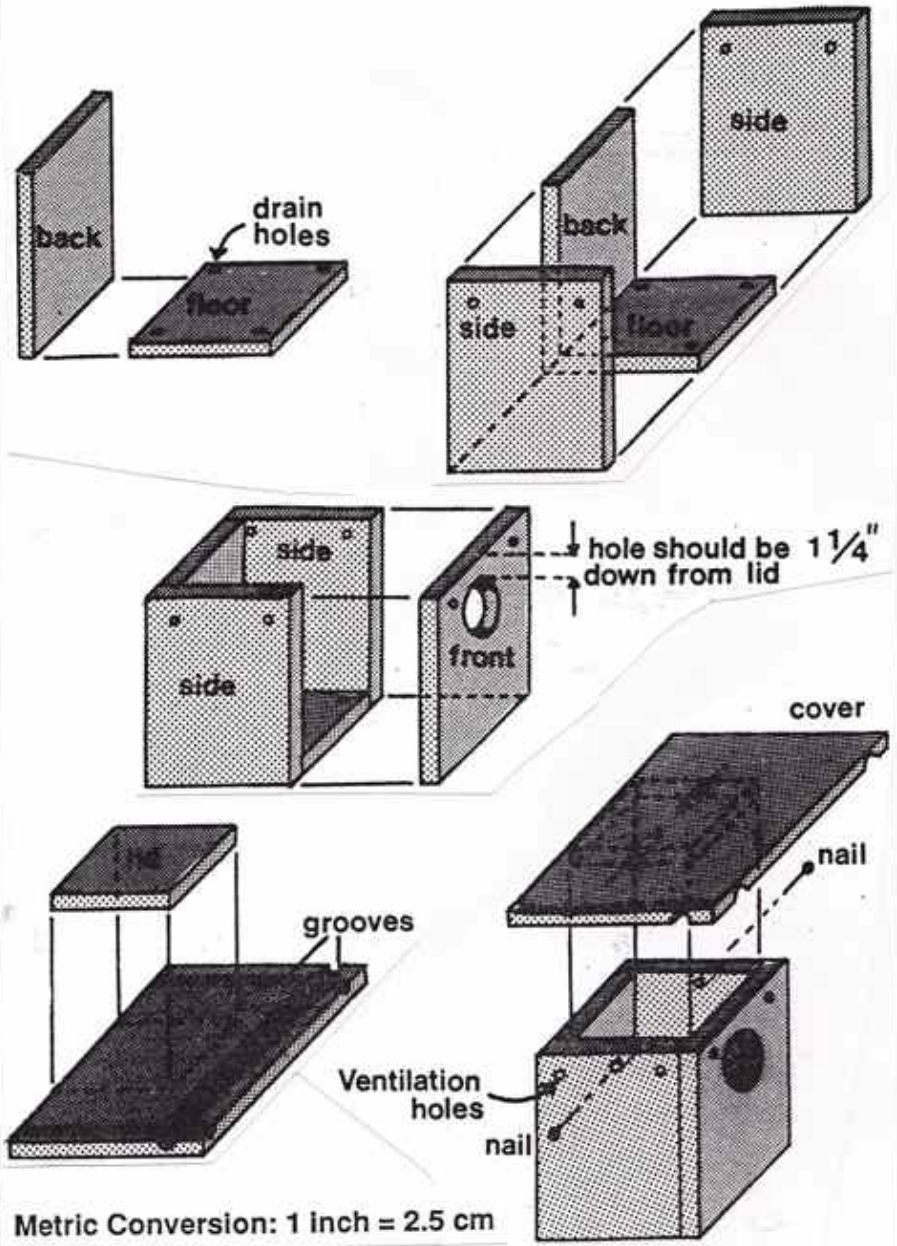
Wildlife tree - a dead or partially dead tree that is used in some way by one or more forms of wildlife.

APPENDIX A - TIPS ON TRANSPLANTING

1. One of the easiest ways to obtain seedlings that you can be sure are well-suited to your area is to find a woods road that has been constructed within the last 2-5 years. If it goes through an area with yellow birch and sugar maple, you should have no trouble finding seedlings of these species along the shoulders of the road just right for transplanting. Hemlock, white birch and red maple also seed in well along woods roads. Shrubs such as red-berried elder often spring up in areas along the road where stumps have been piled. It is important that you find out who owns the property and get permission to remove seedlings.
2. Public roadsides are good places to find serviceberry and mountain ash, two excellent shrubs for wildlife that are also visually attractive.
3. Identify hardwood seedlings when leaves are still on in summer or fall and mark them with flagging tape. Make sure they have grown from seed and are not sprouts growing up from cut stumps.
4. Seedlings 1'-2' can be dug up or smaller ones just pulled from the ground when the soil is wet in spring, before the leaves or new needles have come out. Smaller seedlings take longer to get established but are easier to transplant. If you prefer setting out larger transplants, move small seedlings to a nursery bed for 1-3 years. When transplanting larger seedlings or seedlings from the nursery, take as large a ball of earth as possible. Injured roots can lead to transplant shock.
5. Keep roots damp and do not expose them to wind. If they can not be planted right away, dig a trench deep enough for the seedlings' roots, put in your bundle of seedlings and cover the roots with earth.
6. Seedlings should be planted in the proper habitat. Shade tolerant seedlings (sugar maple, hemlock, etc) can be used in underplantings, while white birch, red oak and white ash can be used in openings.
7. Wisdom has it that you can plant a 50 cent tree in a $50 hole, but not the other way around. Take care to ensure that the hole is the proper size, the earth is loose and it is in the right location.
8. Plastic tree guard or wire cages should be used to protect tree seedlings from snowshoe hare damage. Hares often browse seedling tops when there is snow on the ground, so the protection may have to extend up to 4-6 feet high.

The forest committee of the Environmental Coalition of Prince Edward Island plans to develop an Acadian Forest Seed Exchange, where seeds and seedlings can be exchanged locally and expertise can be developed in growing trees and shrubs. Contact Bruno Peripoli at 583-2917 if you would like to be involved.

APPENDIX B - NEST BOX CONSTRUCTION



APPENDIX C - NEST BOX SIZES

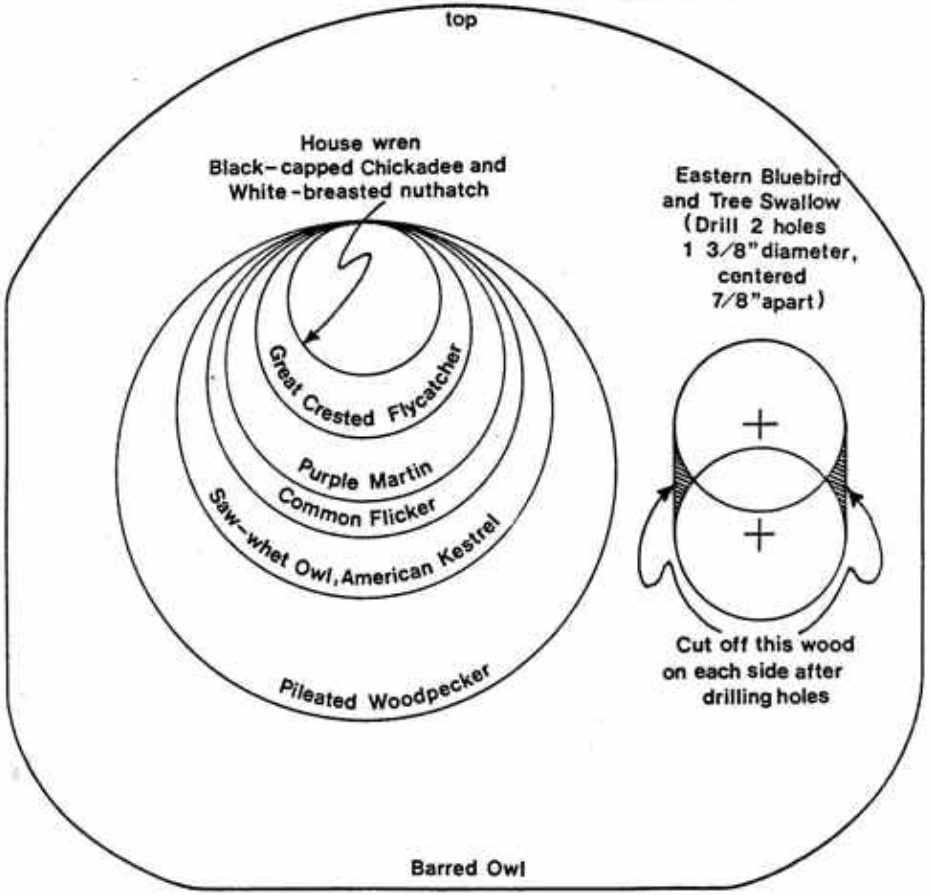
Metric conversion: 1 inch = 2.5 cm, 1 foot = 30 cm, 1 acre = 0.4 hectare

Species	Entrance hole diam. (inches)	Inside floor area (inches)	Height of wall panels (inches)	Min. Height above ground (feet)	On pole or tree near shrubs	On pole or tree in open areas	In woods	Maximum no. of pairs per acre	No. of eggs in a clutch	Incubation Period (days)	Age when young leave tree nest (days)
Chickadee	1 1/8	3 1/2 x 3 1/2	8	6	•		•	1-2	6-8	12	16
Nuthatch									5-9	12	18
Downy Woodpecker									4-5	12	24
Bluebird	1 1/2	4x4	10	7		•		1	4-5	12	15-18
Tree Swallow								8	4-6	14	16-20
House Sparrow								4	4-6	12	12-14
Hairy Woodpecker	2	5x5	12 1/2	10		•		1	3-6	14	24-26
Crested Flycatcher								1	4-8	15	13-15
Starling								4	4-6	12-14	16-18
Purple Martin			6	8		•		50	4-5	12-16	15-18
Common Flicker	2 1/2	6x6	15	10		•		2	6-8	14-16	25-28
Saw-whet Owl			12	12	•	•			3-7	21	
American Kestrel	3	7 1/2 x 7 1/2	17	15		•			4-5	28	24-26
Pileated Woodpecker	3x4	8x8	12-30	12			•		3-5	18+	26
Wood Duck	Oval	10x10	20	8	•	•			10-15	29	1-2
Hooded Merganser								2	10-12	31	1-2
Common Goldeneye									10-12	31	1-2
Barred Owl	6x6	12x10	20	20			•		1-4	32+	27-34

APPENDIX D - ENTRANCE HOLE SIZES

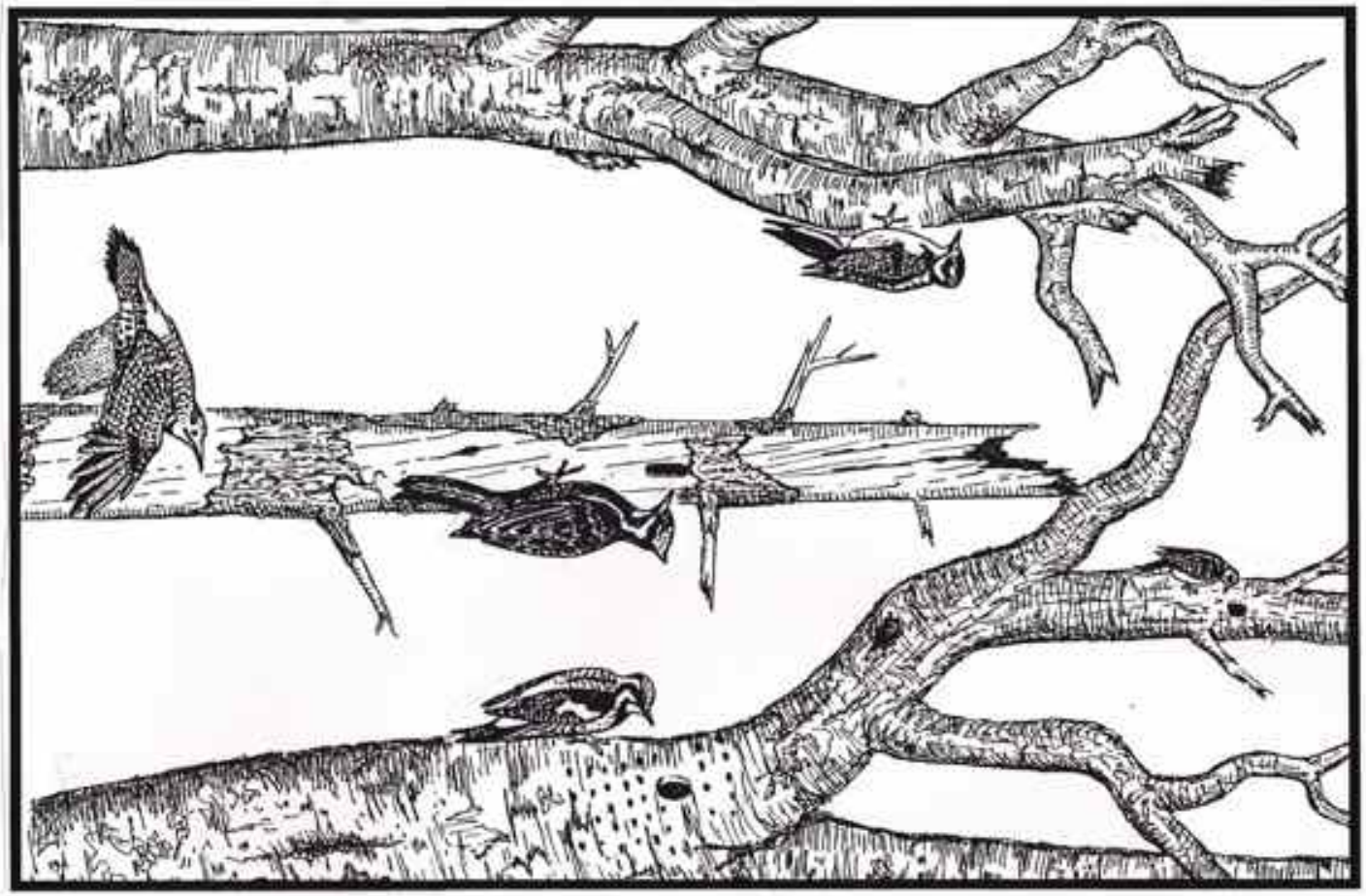
Please note that construction and placement is only part of the work involved in ensuring that nest boxes are put to good use. Old nesting material should be removed and the boxes thoroughly cleaned each year to control parasitic insects, mites and lice.

Trace onto wood using carbon paper



METRIC CONVERSION: 1 inch = 2.5 cm

BACK COVER



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CREDITS

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Research and writing: Gary Schneider
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Design and production: Gary Schneider
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HOW TO USE THIS BOOKLET

Forests are complex communities and ecological forestry is equally complex. Chapters II - X in this booklet each contain two sections. The first section is a discussion of the issue with background information. The second section is on what you can do. You can read the whole booklet, one or two chapters, or just the 'what you can do' sections. Terms in **bold type** are defined in the glossary on page 29.

INSIDE FRONT COVER