

EXTENSION NOTES



CONSERVING THE FOREST INTERIOR: A THREATENED WILDLIFE HABITAT

Only 200 years ago forests stretched nearly continuously across southern and eastern Ontario. The uplands were shaded by trees of all sizes, ages and successional stages. Natural openings were rare, irregular breaks in the leafy canopy. Today, the picture is very different. Forests now cover only about 20 per cent of land — one in five hectares — south and east of the Canadian Shield. This ranges from a high of 30 per cent — one in three hectares — in eastern Ontario, to a low of about three per cent forest cover in extreme southwestern Ontario. While we strive to manage the remaining woodlands sustainably, some wildlife populations struggle to adjust to the loss and fragmentation of forests.

Landowners are stewards of a great deal of forest habitat in southern Ontario. But these forests are broken into thousands of small woodlands ringed by roads, highways, farms, fields and rural and urban developments. Small, fragmented forests still sustain wildlife and produce wood fiber, but they often lack a high-quality habitat called the forest interior. The conservation values of this “deep woods” habitat warrant a closer look for woodland planning and management.

This Extension Note introduces you to the forest interior and the wildlife species that depend on this threatened habitat. It provides ideas on how landowners, conservation agencies and interested groups can protect and improve forest interior conditions in the fragmented forests of southern Ontario.



WHAT IS FOREST INTERIOR HABITAT?

The *forest interior* is habitat deep within woodlands. It is a sheltered, secluded environment away from the influence of forest edges and open habitats. Some people call it the “core” or the “heart” of a woodland. The presence of forest interior is a good sign of woodland health, and is directly related to the woodland’s size and shape. Large woodlands with round or square outlines have the greatest amount of forest interior. Small, narrow woodlands may have no forest interior conditions at all.

Forest interior habitat is a remnant natural environment, reminiscent of the extensive, continuous forests of the past. This increasingly rare forest habitat is now a refuge for certain forest-dependent wildlife; they simply must have it to survive and thrive in a fragmented forest landscape.

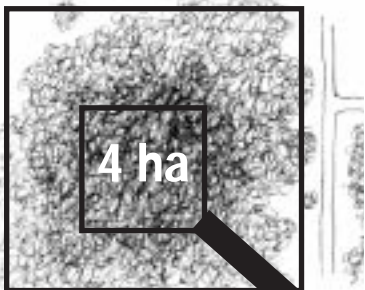
HOW IS EDGE HABITAT DIFFERENT FROM FOREST INTERIOR HABITAT?

Woodland edges are sunnier, warmer, windier, drier and experience more dramatic environmental changes than the forest interior. Edge habitats are also more prone to disturbance and support a larger variety and higher density of predators.

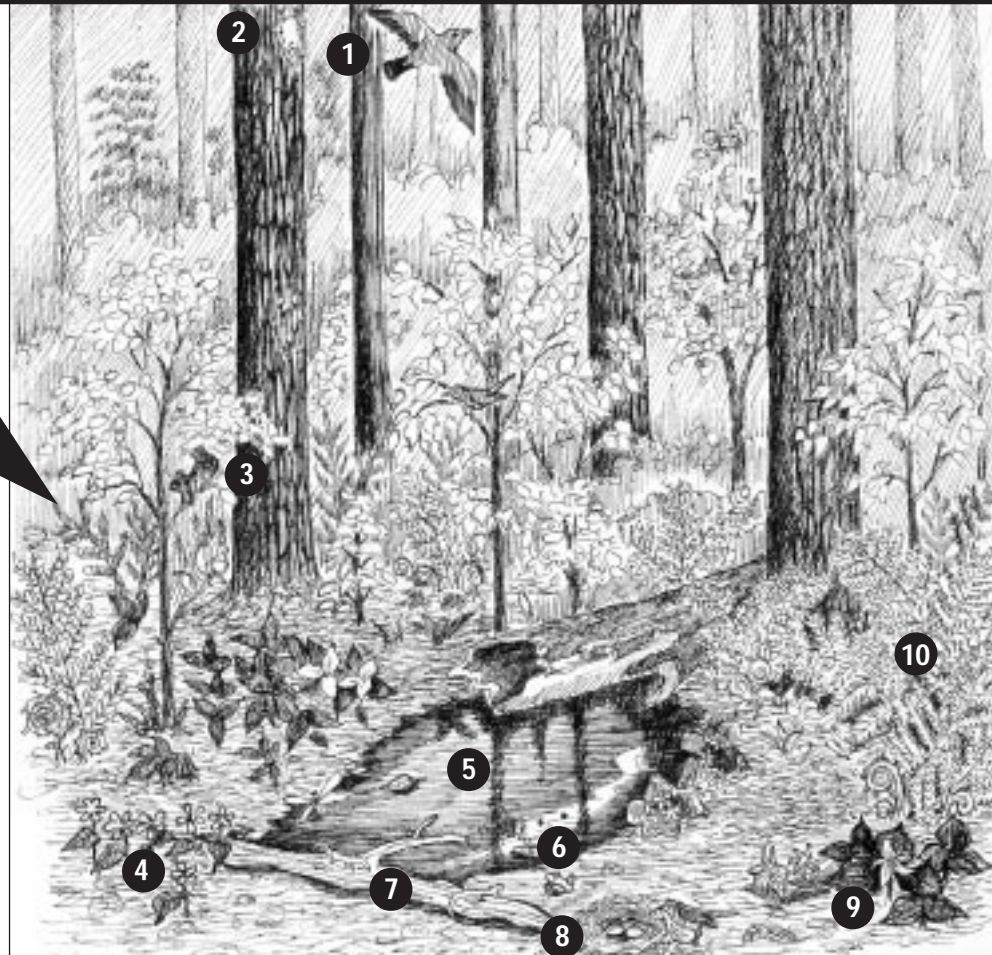
Wind and sun dry out forest edges, reducing the diversity and abundance of insects and other invertebrates that are important foods for wildlife that depend on forest interior habitat. Forest pools near edges tend to dry up, eliminating vital water sources for wildlife and habitat for aquatic insects, which are

critical food sources for many birds and amphibians. The pools are also critical breeding habitat for amphibians such as frogs, toads, and salamanders. “See-through” woodlands may be made up entirely of edge habitats, where winds bring in air pollution, diseases and seeds of non-native plant species. Invasive plants such as garlic mustard and glossy buckthorn may take over the forest floor of small fragmented woodlands. Forest edges are also more exposed to blowdown, noise pollution, motorized vehicles, vegetation clearing and urban development.

INTERIOR HABITAT



36 ha



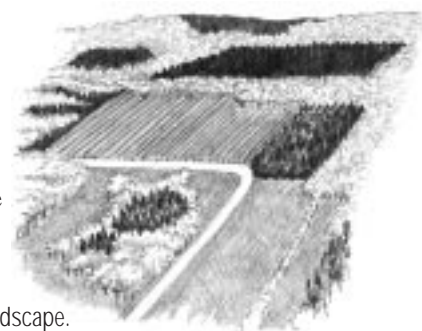
1. scarlet tanager
2. red bat
3. red squirrel
4. spring beauties
5. forest pool
6. aquatic insects
7. salamanders
8. ovenbird and nest
9. red trilliums
10. ferns

HOW DOES FOREST FRAGMENTATION AFFECT WILDLIFE?

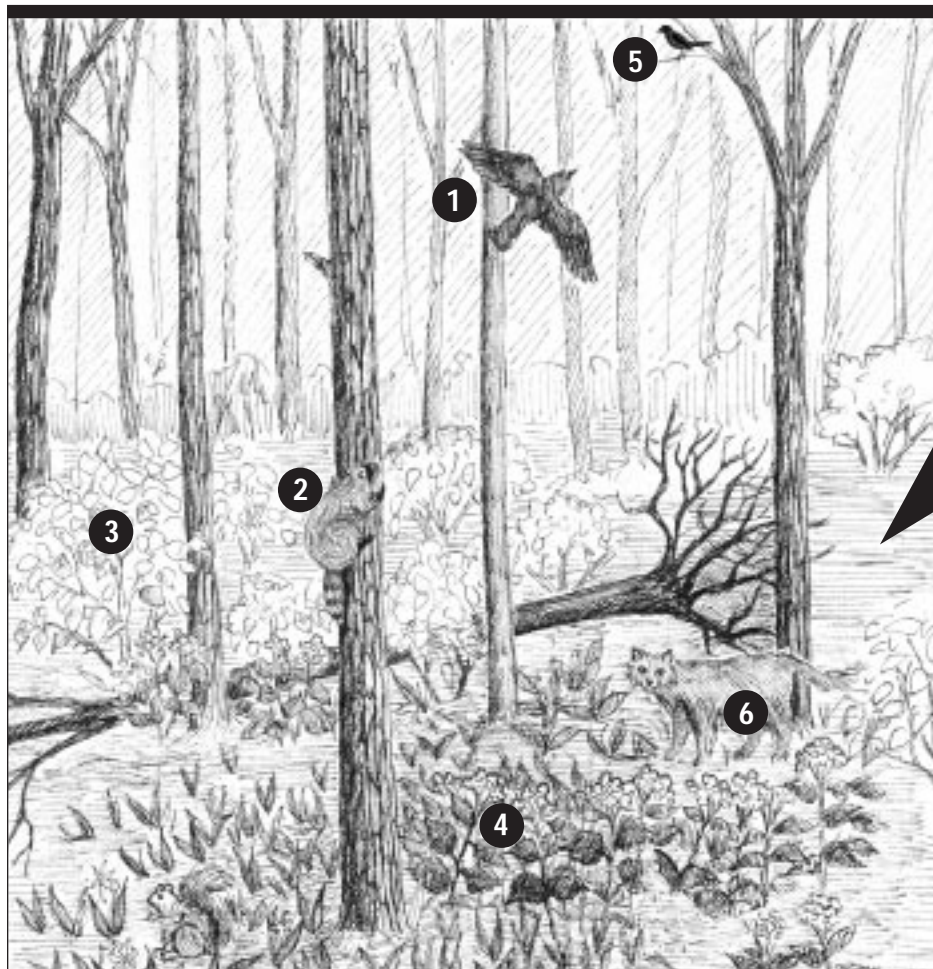
Experts believe that formerly continuous forested landscapes cannot sustain the natural diversity of plants and animals unless at least 25 to 30 per cent of the land is in forest or other natural cover. Fragmented woodlands — “islands of habitat,” as they are called — may simply be too small for some creatures, such as the fisher or red-shouldered hawk. Small isolated wildlife populations often have fewer young per pair, die at a younger age and have less genetic variability than populations of the same species that are not isolated. Small populations are also more likely to suffer declines due to disease, insect outbreaks or periodic weather events. These conditions create a recipe for long-term extinction.

Small forests support small numbers of wildlife. Some species are “area-sensitive” and tend not to inhabit small woodlands, regardless of forest interior conditions. Fragmented habitat also isolates local populations, especially small mammals, amphibians and reptiles with limited mobility. This reduces the healthy mixing of genetic traits that helps populations survive over the long run.

Bigger forests often provide a different type of habitat. Many forest birds breed far more successfully in larger forests than they do in smaller woodlots and some rely heavily on forest interior conditions. Populations are often healthier in regions with more forest cover and where forest fragments are grouped closely together or connected by corridors of natural habitat. The population size and number of young produced by forest bird populations are among the best indicators of forest interior conditions in a woodland. But as ecological research continues, we learn more about wildlife of the forest interior. Eastern red bats, for example, prefer to forage in forested areas and roost high in the foliage of large trees. Biologists have recently discovered that red bat roost trees, on average, are located almost 300 metres from a forest edge.



Typical fragmented landscape.



EDGE HABITAT



1. American robin
2. raccoon
3. glossy buckthorn
4. garlic mustard
5. brown-headed cowbird
6. domestic cat

WHY DO SOME FOREST BIRDS PREFER THE FOREST INTERIOR?

Each forest bird needs a particular type and arrangement of food, water, shelter and suitable nesting sites. Birds like robins, thrashers and cardinals find these habitat requirements at forest edges. Birds of the forest interior seek a different environment. They may actually avoid edges or have poor foraging and nesting success at edges. They find more of their preferred food (particularly insects on the ground and on foliage) deeper in the woods, as well as increased moisture, less nest disruption and fewer predators. These birds are better suited to larger forests in part because of the diversity of microhabitats such as small conifer stands, wet pockets of lowland hardwoods or rare vegetation that are mixed in with common woodland habitats. The variety contributes to greater species diversity and provides a greater variety of potential foods.

Predators of birds and nests, such as raccoons, opossums, common grackles, common crows, and grey squirrels, and domestic and feral cats, all frequent the rural and suburban environments around the forest edge. Biologists have found that 8 out of 10 nests of neotropical migrant birds in small woodlands (less than 100 hectares) may be lost to predators.

Many forest interior birds, such as the ovenbird and the hooded warbler, are ground-nesters or nest in low shrubs, making them especially susceptible to predators and disturbance. Nests laid in the deep forest interior have far lower, more “natural” predation rates.

Nests laid in the forest interior are also less susceptible to brown-headed cowbirds, a brood parasite that lays its eggs in other birds’ nests. Cowbirds look for active nests at the edge of forests and in forest clearings. In most cases the host bird actually raises the young cowbirds. Cowbirds grow more quickly than the young of the host species, so nestlings of the host bird may grow more slowly, die in the nest or may even be bumped out of the nest. Three out of four nests of forest birds in small woodlands may be “parasitized” in this way by cowbirds. Cowbirds prefer edges and open areas and avoid larger, mature woodlots where the upper branches of trees form a closed canopy.

Simply put, life for forest birds is more dangerous at the edge.

A TYPICAL FRAGMENTED LANDSCAPE

Forest interior conditions are extremely rare in the fragmented forest landscape of southern Ontario. This is the breakdown for two reasonably wooded regions of southern Ontario.

Location	▶ Eastern Ontario: United Counties of Leeds & Grenville ¹	▶ Southwestern Ontario: Lake Erie shoreline north to Woodstock and Six Nations Reserve ²
Total area	▶ 359,429 ha	▶ 360,000 ha
Total forest cover	▶ 139,664 (39 per cent of the land)	▶ 68,282 ha (19 per cent of the land)
Number of woodlands	▶ 8,537 fragmented woodlands	▶ 11,064 fragmented woodlands
Woodlands greater than 100 ha (250 acres)	▶ 256 (3 per cent of woodlands were large)	▶ 98 (1 per cent of woodlands were large)
Woodlands less than 100 ha (250 acres)	▶ 8,281 (97 per cent of woodlands are small)	▶ 10,965 (99 per cent of woodlands are small)
Woodlands less than 3 ha (7 acres)	▶ 6,208 (73 per cent of woodlands are very small)	▶ 8,912 (80 per cent of woodlands are very small)
Average woodland size	▶ 16 ha (40 acres)	▶ Average woodland size 6 ha (15 acres)

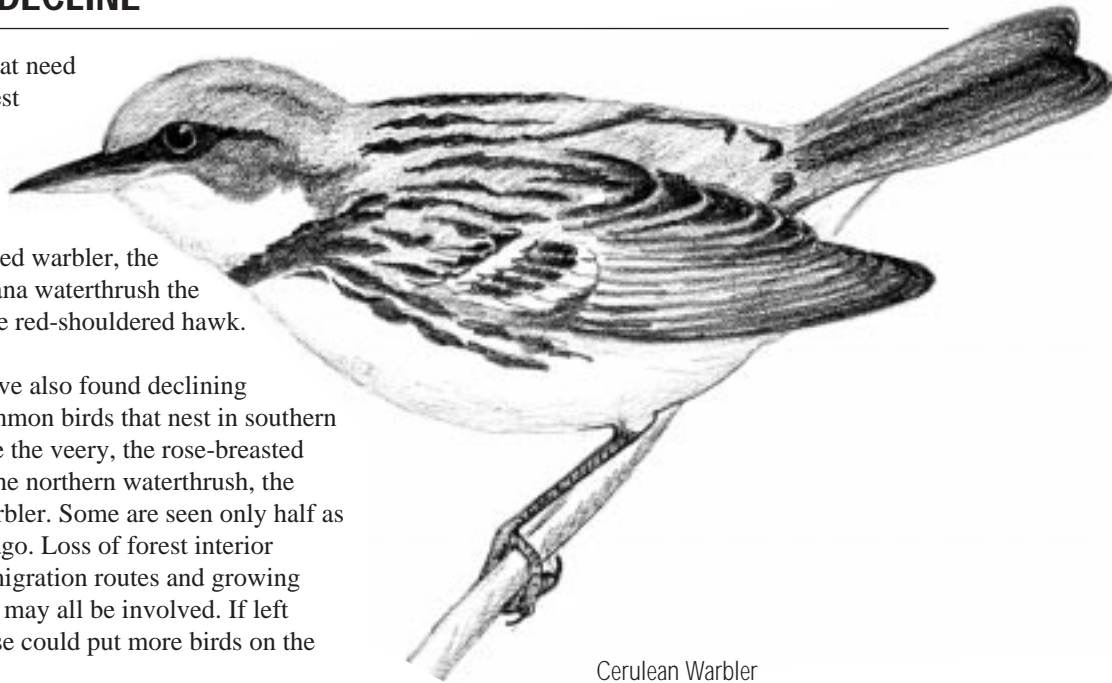
¹ Eastern Ontario Model Forest

² Pearce, C.M. 1993. *Coping with Forest Fragmentation in Southwestern Ontario*. In: *Size and Integrity Standards for Natural Heritage Areas in Ontario*. Proceedings of a Seminar. Parks and Natural Heritage Policy Branch, Ontario Ministry of Natural Resources, Huntsville, Ontario.

FOREST BIRDS IN DECLINE

Several forest bird species that need large forest areas — and forest interior conditions — have been included on Canada's national list of species at risk. These include the Acadian flycatcher, the hooded warbler, the cerulean warbler, the Louisiana waterthrush, the prothonotary warbler, and the red-shouldered hawk.

In recent years, biologists have also found declining numbers of several quite common birds that nest in southern Ontario forests. They include the veery, the rose-breasted grosbeak, the wood thrush, the northern waterthrush, the ovenbird and the Canada warbler. Some are seen only half as often as they were 30 years ago. Loss of forest interior habitat, habitat removal on migration routes and growing threats on wintering grounds may all be involved. If left unchecked, declines like these could put more birds on the endangered species list.



Cerulean Warbler

EXAMPLES OF BIRDS OF THE INTERIOR AND OF THE EDGE — HABITAT PREFERENCES OF SOME BIRDS OF FRAGMENTED FOREST LANDSCAPES IN SOUTHERN ONTARIO

BIRDS OF LARGE WOODLANDS WITH FOREST INTERIOR

Barred Owl
Pileated Woodpecker*
Hairy Woodpecker*
Acadian Flycatcher*
Veery*
Hermit Thrush*
Swainson's Thrush
Black and White Warbler*
Black-throated Green Warbler
Black-throated Blue Warbler*
Cerulean Warbler*
Blackburnian Warbler*
Mourning Warbler*
Canada Warbler*
Ovenbird*
Louisiana Waterthrush*
Northern Waterthrush*
Scarlet Tanager*

BIRDS OF LARGE WOODLANDS THAT MAY ALSO NEST NEAR EDGE

Ruffed Grouse
Wild Turkey
Red-shouldered Hawk
Yellow-bellied Sapsucker
Red-bellied Woodpecker
Least Flycatcher*
Great Crested Flycatcher
Eastern Wood-Pewee
Black-capped Chickadee
House Wren
Blue-gray Gnatcatcher*
Gray Catbird
Northern Mockingbird*
Wood Thrush
Red-eyed Vireo
Northern Parula*
Rufous-sided Towhee
Rose-breasted Grosbeak

BIRDS OF SMALL WOODLANDS OR EDGE HABITATS

Northern Bobwhite
Red-tailed Hawk
Great Horned Owl
Mourning Dove
Red-headed Woodpecker
Northern Flicker
Eastern Kingbird
Blue Jay
American Crow
American Robin
Cedar Waxwing
Brown-headed Cowbird
Common Grackle
European Starling
House Sparrow
White-throated Sparrow

Primary Source: Freemark, Kathryn. 1999. Area sensitivity and thresholds for birds in fragmented hardwood forests. Canadian Wildlife Service, Hull Quebec. This is a review of over 30 studies in the NE US and Canada. Asterisks () indicate birds that are known to decline significantly when forest habitat area is reduced.*

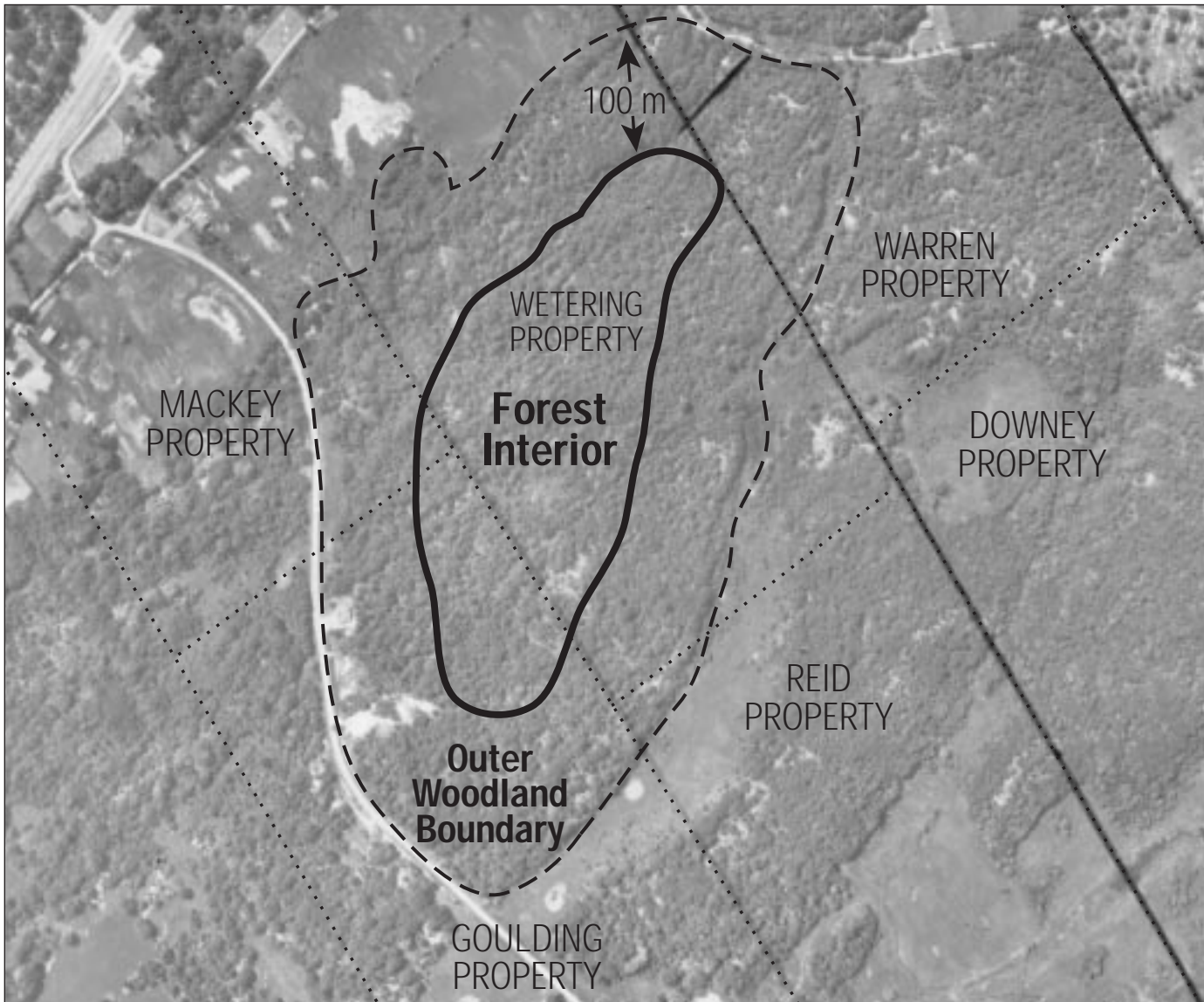
HOW DO I KNOW IF MY WOODLAND HAS FOREST INTERIOR?

Biologists may occasionally measure or pace into woodlands to determine the amount of forest interior habitat but are more likely to use satellite images and computer calculations. Landowners can use simple measurements, maps or air photos to search for forest interior themselves. Alternatively, the presence and, especially, successful nesting of forest interior species (listed in the table on the previous page) can indicate that a forest provides important forest interior habitat.

Find your property on a map and then use pencil to outline the edge of the entire woodland of interest. Estimate the amount of forest interior by drawing a line 100 metres in from the woodland edge or from any human-created opening such as a field, road, railway line or hydro right-of-way. The scale

around the edge of the map will tell you how much 100 metres is on your map. Ontario Base Maps, Forest Resource Inventory maps and aerial photos, available through the Ministry of Natural Resources, are most useful because they are usually more recent than topographic maps. Most are at the same scale, making 100 metres roughly 1 cm on the map or photo.

After drawing the lines from each edge, the area inside the 100 metre limit is your forest interior. Every 1 cm x 1 cm square inside the 100 metre limit equals one hectare. If you have 40–100 hectares or more, you (and your neighbours) have a woodland with valuable forest habitat. Your next step could be to look for plants and animals of the forest interior.



Use an air photo to determine the amount of forest interior your woodland provides.

HOW CAN I CONSERVE FOREST INTERIOR HABITAT?

1. HELP PROTECT THE LARGEST WOODLANDS

Large forested areas that are greater than 200 hectares have the most interior habitat. These “mega-woodlands” are very rare in southern Ontario but are vital to the protection and eventual recovery of threatened forest wildlife. Large woodlands support larger and more stable populations of all forest wildlife, and are your best bet for protecting typical forest birds. Woodlands greater than 200 hectares are particularly valuable, but woodlands in the 100 hectare range may still harbour most of the typical community of forest birds. Larger woodlands have greater ecological health and may have greater growth rates and productivity over the long term. This makes sustainable forest management and financial revenue from forest products more realistic goals. Forest management planning advice is also obtained more cost-efficiently for larger woodlands.



Black-throated Green Warbler

CHANGING IDEAS ABOUT “EDGE”

Landowners who have listened to messages from conservation agencies over the years may find a focus on forest interior to be a break from the past. Even a decade ago, agencies and landowners often sought the greatest amount of diversity through greater, artificially-created edges. This was done with the best of intentions and with the best information available at the time. But just as improved knowledge and scientific study have changed (for the better) how we manage sustainably for timber and farm crops, so has greater understanding of ecology changed traditional views on habitat enhancement.

The shift came slowly after long term bird-banding studies, countless hours of field observation, satellite imagery, computer models, geographic information systems and the cooperation of hundreds of landowners made it possible to see declining trends in forest bird populations that are directly related to the loss of forests and forest interior.

FOREST BIRDS HELP FOREST TREES

Warblers, vireos, and other insect-eating birds consume vast quantities of forest insects. There would be far more devastating outbreaks of gypsy moth, forest tent caterpillar and other pests without these birds in the forest. But even when foliage-eating insects are at lower (non-outbreak) numbers, they can have serious impacts on forest trees and tree growth.

Forest researchers in the southwestern U.S. covered white oak tree seedlings with netting and left others open to the sky to compare what happens to seedlings' insect populations with and without the feeding by birds. They found that plants had twice as many foliage-eating insects when nets kept the birds away. They also found that insects consumed 25 per cent of the total leaf area — equal to one in four leaves — when they were free of bird predation. This is twice the damage caused when birds were able to do their job of eating insects.

Natural biological control is not limited to insects. Porcupines, for example, can damage many species of hardwood and other trees by feeding on bark and twigs. Their main natural predator, the fisher, needs landscapes with larger tracts of forest. Without this habitat (and without the fishers) porcupine feeding often goes unchecked.

2. PROTECT WOODLANDS WITH FOREST INTERIOR IN MUNICIPAL PLANS AND DEVELOPMENTS

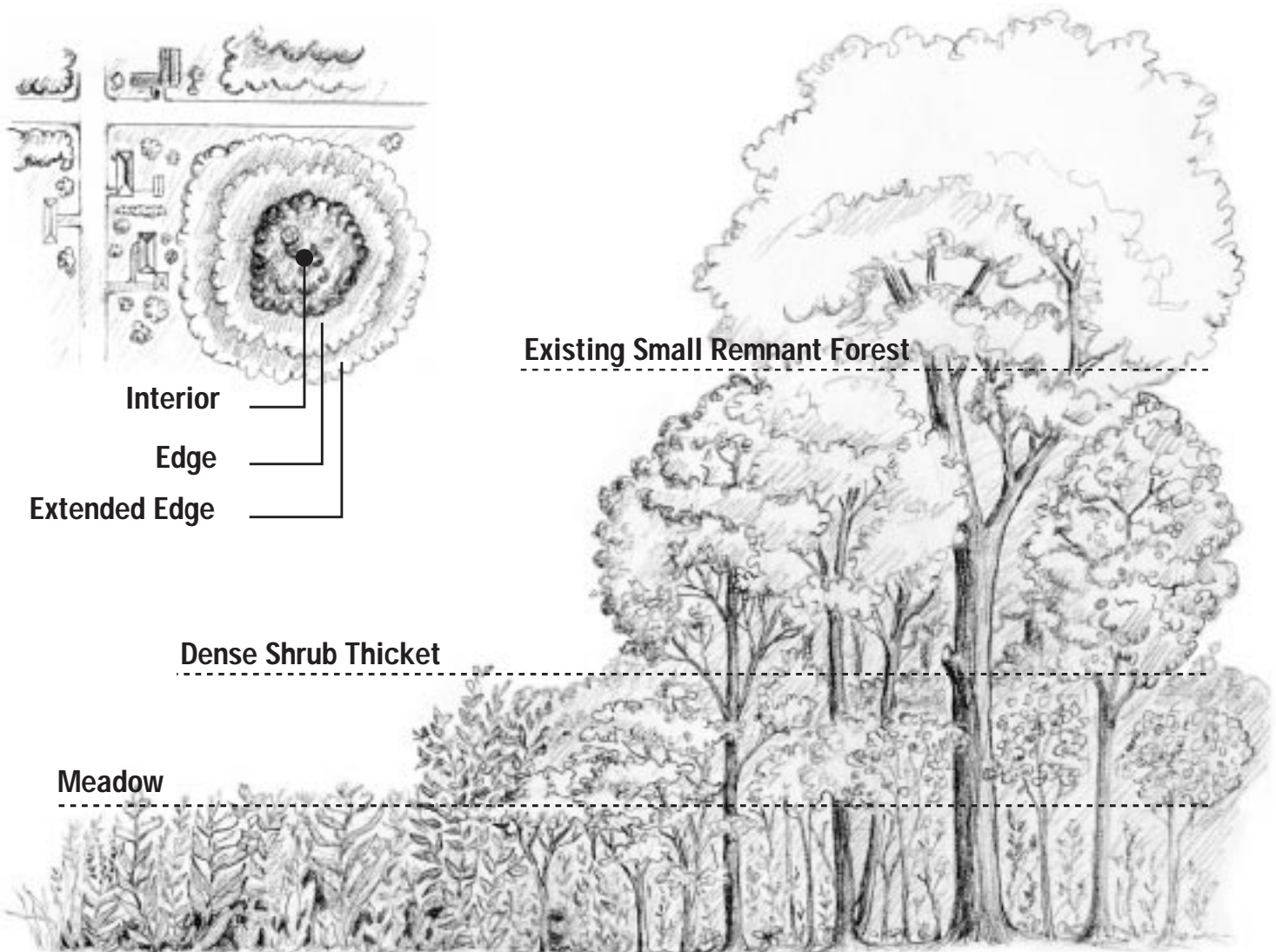
Large forests with extensive forest interior and habitat for threatened or endangered forest interior birds should receive special consideration in planning documents and in development proposals. Local input is often needed to raise the profile of these significant habitats in the municipal planning process. At the scale of the individual property, buildings should be kept at a distance from woodlands. Buffers should be maintained or created around small woodlands, especially where they are adjacent to high-density human habitation.

3. IDENTIFY FOREST INTERIOR IN WOODLAND MANAGEMENT PLANS

Landowners can identify forest interior protection for wildlife habitat as a property objective in forest and resource management plans. These plans help you look ahead and encourage you to think about how to improve your forest over time. The plans may also make you eligible for tax breaks or special management or assistance programs.

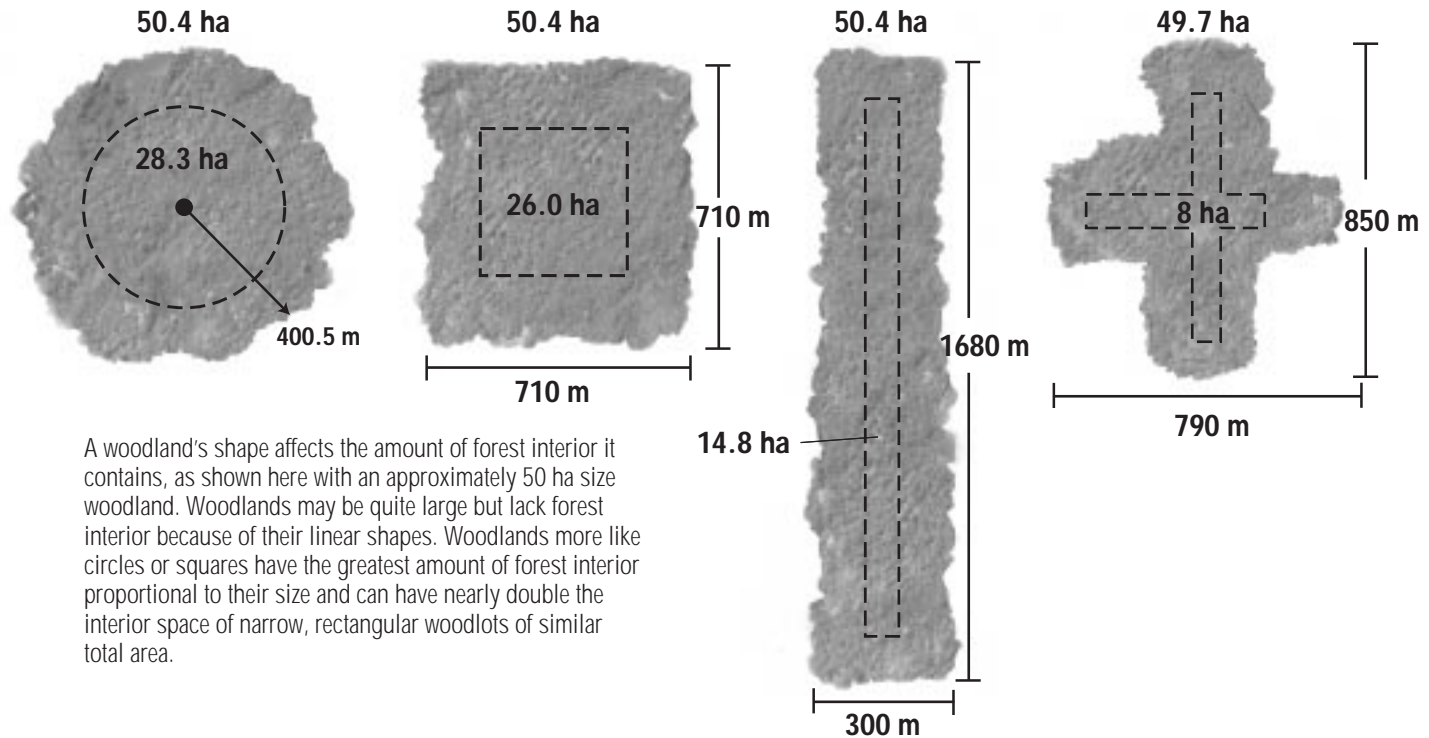
If you plan to cut your woodland, maintain an interior-protecting buffer by reducing the harvesting of trees along the edge, along riparian corridors or around forest pools (even

BUFFER PLANTINGS



Planting and maintaining a 100 metre or wider border around small woodlands that support forest interior birds is a valuable landscaping technique that limits access and provides some natural buffering. Consider a planting that provides a gradual transition from meadow to shrub-thicket to the actual edge of the existing small forest. Alternatively, consider planting a border of dense conifer seedlings.

FOREST GEOMETRY



A woodland's shape affects the amount of forest interior it contains, as shown here with an approximately 50 ha size woodland. Woodlands may be quite large but lack forest interior because of their linear shapes. Woodlands more like circles or squares have the greatest amount of forest interior proportional to their size and can have nearly double the interior space of narrow, rectangular woodlots of similar total area.

those that dry up in the summer). Forest interior conditions can be maintained through selection harvests when roads and landings are minimized and non-permanent, and when harvesting activities take place in the winter (non-breeding) season. Simply not scheduling any harvesting activities in the forest interior is also considered good management. Refer to the Extension Notes *Do You Have a Healthy Woodlot?* for help in planning woodland activities that help forest interior and habitat conditions.

4. PROTECT OLD-GROWTH FORESTS OR MANAGE WOODLANDS FOR OLD-GROWTH CONDITIONS

Forest interior conditions are common elements of old-growth forests or forests that contain sections of large, old, mature trees. You can adjust single-tree selection silviculture prescriptions (that aim to optimize timber production) to maintain old-growth forest interior habitat. This includes leaving a higher basal area and a greater number of larger diameter (greater than 50 cm DBH) trees than specified in typical prescriptions. Maintaining surface water sources such as springs, seeps and pools is also important. Refer to the Extension Notes *Restoring Old-Growth Forest Features to Managed Forests in Southern Ontario* and *The Old-Growth Forests of Southern Ontario* for ideas.

5. WORK WITH NEIGHBOURS TO COLLECTIVELY MANAGE AND PROTECT LARGE WOODLANDS

Properties boundaries are often the hidden cause of fragmentation. Conflicting management objectives among neighbours can reduce forest interior values in a number of properties. Long-term cooperation and multi-property planning are needed if landowners hope to increase the size of, and connections between, fragmented forests or if they wish to conserve habitat conditions in large woodlands. Look at your land as just one part of the larger landscape. What position does your property occupy? Does it have forest interior habitat, old-growth, wetlands or connecting corridors to habitat on neighboring properties? Ask yourself what you and your neighbours can do together to benefit woodland habitat. This could involve simply leaving things be — southern Ontario has many fine examples of private stewardship. Conservation agencies and groups encourage this cooperative approach and welcome the participation of interested landowners.

6. ENCOURAGE NATURAL SUCCESSION OR PLANT NATIVE TREES IN FOREST CLEARINGS

You can greatly increase the amount of forest interior by reforesting permanent fields within woodlands. The benefits are most dramatic in large woodlands. For example, planting trees in a one hectare field within a small woodland may only create one hectare of forest interior. The same-sized field in a large woodland may create 50 hectares of forest interior, depending on the shape of the woodland.

You may not want to plant trees in small openings (less than one hectare) because natural succession will likely restore the forest for you. You can encourage natural regeneration and germination of seeds around the forest edge by gradually exposing mineral soil with passes of a cultivator over several years. Refer to the Extension Note *Management Options for Abandoned Farm Fields* for more information.

7. INCREASE THE SIZE OF WOODLANDS BY PLANTING NATIVE TREES AROUND THE EDGE

Use annual planting projects to reduce edge and “round out” your woodland. You can use fast-growing conifer plantations as stepping stones to increased forest interior. If plantations

exist adjacent to natural forest, they can be managed to increase species diversity and vertical structure. Refer to the Extension Note *Managing Regeneration in Conifer Plantations to Restore a Mixed Hardwood Forest* for management approaches or a number of other Extension Notes that provide information on preparing for, planting, and protecting trees. Consider planting a few rows of conifer trees around the edges, especially the southern and most exposed edges of smaller woodlots with remnant forest interior habitat.

NATURAL FOREST GAPS IN THE FOREST INTERIOR

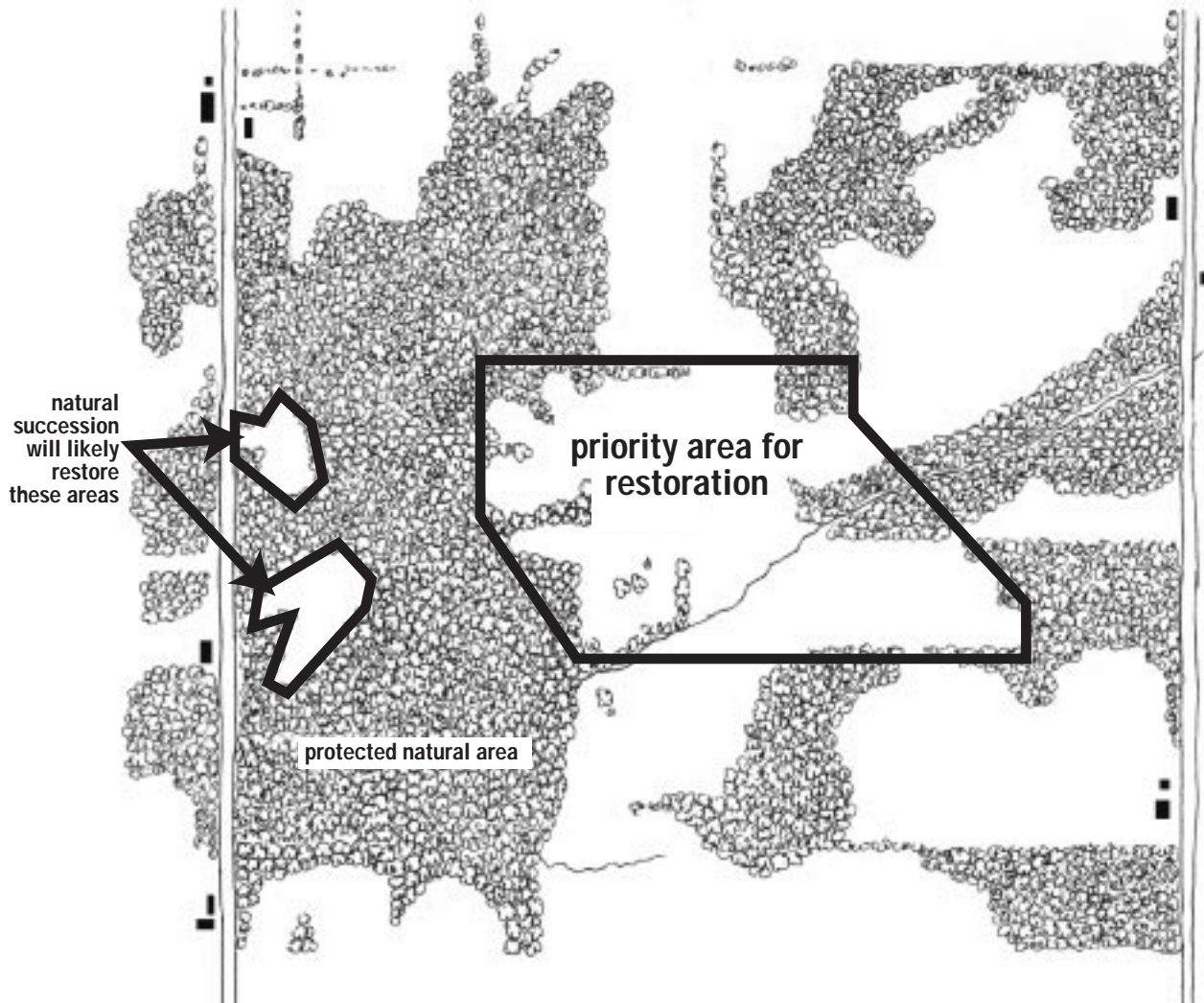
When old towering trees die they create openings and edge habitat in the forest interior. But the gaps are short-term. Many plant species are ready for this event and grow rapidly upwards into the available space. Some forest interior species, such as the hooded warbler, actually prefer small natural gaps in the midst of, and ringed by, a tall forest canopy.



Canopy gaps are created when small groups of trees die from old age or disease.

RESTORING THE CORE

A large clearing within a woodlot drastically decreases the amount of interior habitat while increasing the amount of edge. These clearings differ from natural canopy gaps in many ways (see sidebar on previous page). Planting trees in these openings has tremendous conservation benefits.



8. CONNECT THE WOODLOTS

You can create wildlife travel corridors and expand forested areas by connecting existing woodlots, old fields, wetlands, lakes and waterways with natural vegetation. If two woodlots are close together, plant native trees between them to create one larger forest. Plant natural vegetation along the edges of lakes, rivers, streams, creeks, and riparian areas because these natural features make the best wildlife corridors. You can choose to enhance hedgerows and windbreaks as well because they need to be more than a single line of trees to be a suitable wildlife corridor.

9. ASK FOR HELP

Protection and restoration of large woodlands and woodlands with forest interior are two of the most important things landowners can do for wildlife in southern Ontario. But often these projects are large, complicated and costly. Ask conservation groups or government agencies for help to tie-in to existing programs. Contact the Ontario Ministry of Natural Resources or the Ontario Ministry of Agriculture, Food and Rural Affairs or your local Conservation Authority for information on existing stewardship and tree planting assistance programs.

GLOSSARY

BIODIVERSITY

Also called biological diversity, this term refers to the variety of and variability among living organisms and ecosystems. Biodiversity includes all the different plants, animals and other species, but also how they are grouped together in natural communities and how they interact with the physical environment.

CANOPY

The forest canopy is the layer of foliage formed by the crowns of older trees. It shades the layers of vegetation below.

(WILDLIFE) CORRIDOR

Linear naturally-vegetated areas — ranging from hedgerows to river valleys — that link or border natural areas in the countryside. Corridors provide passage for animals and reproductive interchange between populations of plants and animals in fragmented landscapes.

FOREST INTERIOR

Blocks of forest more than 100 metres inside a woodland. This is roughly three to five tree-lengths away from a woodland edge, road, utility corridor or any large, usually permanent, opening inside a woodland. The 100 metre distance is a minimum because large openings cause changes to forest environments 300 metres or more inside woodlands.

NEOTROPICAL MIGRANTS

Birds that breed here but migrate to Central and South America in winter.

NATURAL HERITAGE

Natural means to exist or be caused by nature, and heritage is a valuable thing worthy of protection that we pass on to future generations. Natural heritage, therefore, refers to all wild plants and animals and, especially, the natural places they inhabit because habitat is the key to sustaining species — as a living heritage — over the long term.

VERTICAL STRUCTURE

Distinct layers of vegetation in forests. Beginning at the top and descending toward the forest floor, the layers include the dominant trees of the canopy which shade the understorey trees, saplings and shrubs. Cavity trees and supercanopy trees add further diversity to this structure.

FURTHER READING

There are nearly a dozen Extension Notes to help you in the tree planting projects suggested here. For information contact the LandOwner Resource Centre at 1-800-387-5304. The following Extension Notes provide related information about forest interior habitats:

- *Do You Have a Healthy Woodlot?*
- *Restoring Old-Growth Features to Managed Forests in Southern Ontario*
- *The Old-Growth Forests of Southern Ontario*
- *Managing Regeneration in Conifer Plantations to Restore a Mixed Hardwood Forest*
- *Management Options for Abandoned Farm Fields*

For additional information consider the following publications:

- Bird Studies Canada/Long Point Bird Observatory. 1998. *Conserving Woodland Birds in Southern Ontario*. Bird Studies Canada. 16 pp. Fact sheet available by calling 1-888-448-2473 or www.bsc-eoc.org
- Lompart, C., J. Riley and J. Fieldhouse. 1997. *Woodlands for Nature: Managing your woodland for wildlife and nature appreciation*. Federation of Ontario Naturalists, Don Mills, Ont. 1-800-440-2366.
- Riley, J.L. and P. Mohr. 1994. *The Natural Heritage of Southern Ontario's Settled Landscapes*. Ontario Ministry of Natural Resources Natural Heritage Information Centre, P.O. Box 7000, 300 Water Street, Peterborough, Ontario K9J 8M5 1-800-667-1940.

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