Great Lakes Fact Sheet

How Much Habitat is Enough?

Second Edition

The past two centuries of settlement around the Great Lakes have degraded or eliminated much of the basin's original fish and wildlife habitat. Reduced forest cover and loss of interior forest habitat have reduced available breeding habitat for songbirds. Loss of streamside trees and shrubs has resulted in warmer, sediment-laden streams to the detriment of Brook Trout and other native cold-water fish. Extensive drainage and conversion of wetlands threatens the Least Bittern and other wetland-dependent species with a critical lack of breeding and nesting habitat.

The first edition of the *Framework* was prepared in 1998 by Environment Canada's Canadian Wildlife Service and its Great Lakes 2000 Cleanup Fund (now known as the Great Lakes Sustainability Fund), the Ontario Ministry of Natural Resources and the Ontario Ministry of the Environment. It was revised in 2004 to ensure that the guidelines are based upon the most current science. Two guidelines, *Amount of Natural Vegetation Adjacent to a Wetland* and *Percent of an Urbanized Watershed that is Impervious*, have substantially changed since the first edition. Four additional guidelines have been slightly modified – *Wetland Size, Wetland Shape, Total Suspended Sediments* and *Fragmented Landscapes and the Role of Corridors*.

The scale of loss and degradation makes restoration a daunting task. *How Much Habitat is Enough?*, the second edition of *A Framework for Guiding Habitat Restoration in Great Lakes Areas of Concern (Framework)*, provides guidance in selecting where wetland, riparian and forest habitat can be restored most effectively and efficiently. The key parts of the *Framework* are its 18 guidelines, which can be adopted or adapted for local watersheds, and background information based on existing literature and practices.

The *Framework* is intended for anyone planning habitat restoration and protection. It helps guide decisions regarding:

- how much habitat is needed to support a natural, functioning ecosystem, and;
- priority locations for wetland, riparian and forest rehabilitation and protection across a watershed or landscape.

Grass Pink Orchid / Douglas A. Wilcox
Fragrant White Water Lily / John Mitchell

Environment Canada Environnement Canada

Applications in the Great Lakes and Beyond

The *Framework* was developed to inform habitat restoration within Great Lakes Areas of Concern (AOCs). This focus does not necessarily limit the geographic applicability of the *Framework* – emphasis has been placed on using experiences and scientific literature that generate guidelines applicable to AOCs and the rest of the Great Lakes basin. Indeed, it has been widely used throughout the basin, and occasionally beyond.

Setting Habitat Restoration Targets – Considerations

The *Framework* is meant to guide, not dictate, local decisions. It provides planners and rehabilitation teams with the best available science to enable them to make their own decisions on how much habitat is required to rehabilitate local watersheds and landscapes. The *Framework* is intended to be adaptable.

The guidelines are based on scientific literature and field studies concerning the amount of habitat required to provide for the ecological needs of fish and wildlife in wetlands, riparian areas and forested areas. Additional equally important categories of habitat such as grassland and lake habitat warrant further investigation as the state of ecological knowledge develops.

Tulip Tree Leaf / Canadian Wildlife Service

Protect First, Restore Second and Keep What Exists

It is most efficient and effective to maintain biodiversity by protecting existing wildlife habitat, which already supports wild populations. Project planning should seek to ensure, above all else, that existing habitat is not lost.

Maintaining biodiversity extends beyond protecting habitat to the thresholds within the *Framework*. The *Framework* provides guidance on the minimum habitat required to begin to support viable wildlife populations and should be seen as starting point not a final goal. Even watersheds that have abundant high-quality habitat may suffer negative, and possibly irreversible, losses of wildlife when habitat is lost or degraded.

The Remedial Action Plan Connection

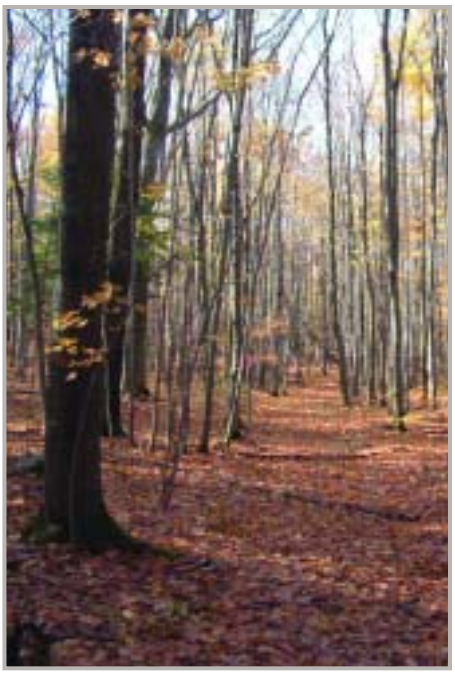
In 1986, through the Great Lakes Water Quality Agreement, the United States and Canada agreed to clean up 43 AOCs across the Great Lakes basin, which have impairments such as contaminated sediments, eutrophication (excess nutrients), degraded fish and wildlife populations, and loss of fish and wildlife habitat. Over a decade later, comprehensive Remedial Action Plans (RAPs) document implementation strategies designed to lead to the rehabilitation of AOCs. Considerable progress has been made in rehabilitating and protecting fish and wildlife habitat in these areas and elsewhere in the Great Lakes basin. To date, two of the 17 original Canadian AOCs (Collingwood Harbour and Severn Sound) are no longer designated as AOCs.

The guidelines contained in the *Framework* were developed to help RAP teams devise criteria to measure progress toward "delisting" an AOC and, after delisting, to provide further habitat restoration guidance. Innovative fish and wildlife rehabilitation planning and implementation initiatives first conducted in AOCs are now finding widespread application in other jurisdictions.

Pay Attention to History

Past and present conditions should guide restoration decisions. A review of the original habitat conditions can be used to establish historically-appropriate targets. For example, if prior to European settlement a watershed was comprised of 60 percent wetland cover and the current amount of wetland is 15 percent, the locally established target would be higher than the 10 percent guideline suggested in the *Framework*. While the historic condition provides the direction for restoration, the existing condition indicates how far the system is from being healthy and what needs to be improved.

Knowledge of the magnitude of impacts on habitat helps to envision what might reasonably be achieved with existing restoration technology and land-use patterns. However, in some urban watersheds viable wildlife habitat can only be provided partially through restoration and creation of habitat that emulates pre-European settlement conditions. New baselines for habitat and ecosystem functions may have to be established, and innovative systems devised to compensate for the effects of lost habitat and to mitigate the impact of urban centres on the surrounding landscape.



Upland Forest / Canadian Wildlife Service

Planting to Restore Wetlands / Canadian Wildlife Service

Special Species

The *Framework* gives general guidance for providing wildlife habitat. Specific habitat requirements are often considered for key or targeted species present within the watershed or local area. Their presence will likely be a driving force in the prioritization of habitat rehabilitation and protection projects. Whenever possible, projects should benefit species which are designated federally under the *Species at Risk Act* or provincially under the *Endangered Species Act*. Plans for habitat rehabilitation should take into account attributes that would benefit such species.

The Greater Landscape

The guidelines and thresholds in the *Framework* are not landscape or watershed specific. Restoration activities better address ecosystem integrity guidelines when considered in the context of surrounding land uses. A matrix of varying proportions of rural and urban land uses and cover types influences the quality of individual habitats, ecological functions, and composition of flora and fauna species. For example, a given percentage of forest cover in a largely urban watershed may not provide habitat for the same number of forest bird species as it might in a rural landscape.

Other natural heritage plans should also be considered. Broader strategies such as the Big Picture project for Ontario's Carolinian life zone can help to link local strategies to larger landscapes or may provide further guidance for priority restoration and protection projects.

Muskrat / Eric Dresser

The Guidelines

Wetland Habitat Guidelines

Wetland loss and degradation have been significant, particularly in southern Ontario. A high proportion of Great Lakes fish and wildlife species, including many species at risk, inhabit wetlands during part of their life cycles. Wetlands provide essential habitat and also perform many water quantity and quality improvement functions, including attenuating stream flows and filtering sediments.

White Bog Orchid / Graham Bryan

Ten percent of a watershed, and six percent of any sub-watershed should be comprised of wetlands

Approximately 70 percent of southern Ontario's original wetlands have been lost. Experience in the Great Lakes basin has shown that when wetlands comprise about 10 percent of a watershed, flooding is greatly reduced and base flows are better maintained. Wetlands should be well distributed across each sub-watershed.

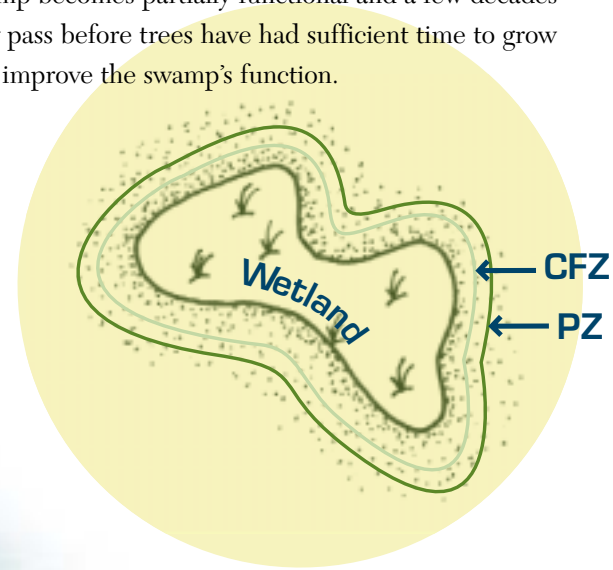
The Critical Function Zone and Protection Zone of a wetland should be naturally vegetated

Uplands adjacent to wetlands provide a variety of critical functions for wetland-associated fauna. Part of this upland is the Critical Function Zone (CFZ) – an area within which functions and attributes related to the wetland occur. This area could include nesting habitat for wetland waterfowl or a groundwater recharge area important for wetland function. The CFZ needs to be protected from adverse affects arising outside of the wetland, such as contaminants and intrusions, by a Protection Zone (PZ). The PZ is in effect a buffer or filter strip, varying in size with required function. The combined zones represent the naturally vegetated adjacent lands needed around a wetland. The CFZ for attributes associated with wetlands can only be determined based on site-specific knowledge of those attributes and their sensitivities, and on management objectives. Where the CFZ is not derived from site-specific characteristics, the following are minimum guidelines:

- the catchment of a bog should be naturally vegetated;
- 100 metres adjacent to a fen should be naturally vegetated or a distance as determined by a hydrological study – whichever is greater, and;
- 100 metres adjacent to swamps and marshes should be naturally vegetated.

Rehabilitation activities should focus on swamp and marsh wetland types

There are four types of wetlands in the Great Lakes basin: marshes, swamps, bogs and fens. Bogs and fens are rare habitats in the lower Great Lakes and are highly susceptible to changes in nutrient and water inputs, making them very difficult to rehabilitate once disturbed. The best management strategy for these types of wetlands is to protect them by securing their water sources and not altering their watersheds. Marshes are more readily restored due to their dynamic water and nutrient regime, and related higher primary productivity. A newly-created marsh exhibits some functions within a year or two. It may be several years before a created swamp becomes partially functional and a few decades may pass before trees have had sufficient time to grow and improve the swamp's function.



Wetland rehabilitation should be strategically located in a watershed

Wetlands are beneficial anywhere within a watershed; however, particular ecological functions can be met by restoring wetlands in key locations, such as headwater areas to protect the sources of streams, groundwater recharge areas for maintaining stream flow and temperature, floodplains for flood attenuation and water storage, and coastal areas for fish production. Special attention should be paid to historic wetland locations and the site and soil conditions.

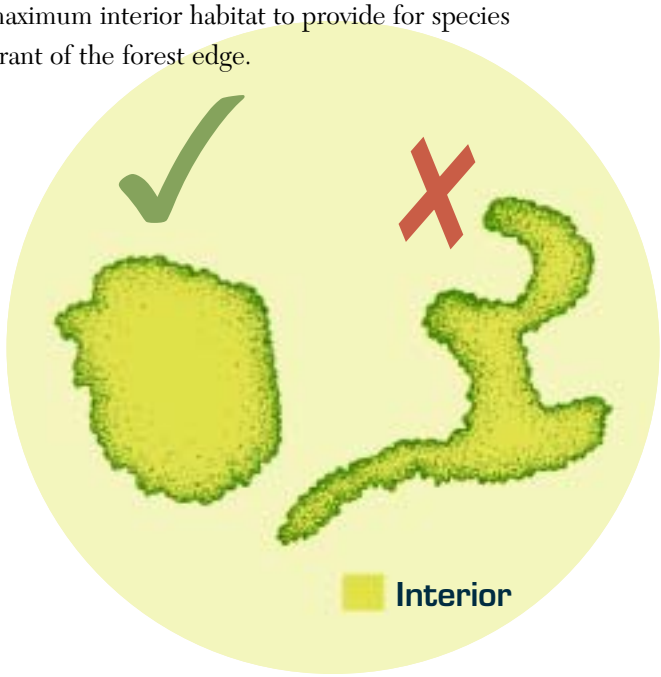
Coastal Wetland Restoration / Canadian Wildlife Service

Swamps and marshes should be of a sufficient size to support habitat heterogeneity and there should be a variety of wetlands across a landscape

Large swamps tend to have greater habitat heterogeneity (varied habitat), which in turn tends to support more wildlife species. Marshes also benefit from this effect in terms of "interspersion" or juxtaposition of different marsh communities (e.g., emergent versus submerged vegetation). Smaller marshes will be less likely to have multiple marsh communities of sufficient size for use by wildlife. However, wetlands of various sizes, types, and hydroperiods will be used by wildlife, including small wetlands used by breeding amphibians and seasonally flooded wetlands used for fish spawning.

Regularly-shaped swamps

Swamps should be regularly shaped with minimum edge and maximum interior habitat to provide for species intolerant of the forest edge.



Forest Habitat Guidelines

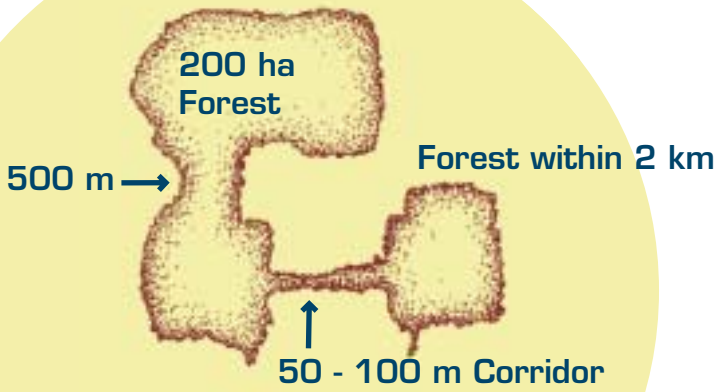
The amount of forest cover, size of individual forest patches, forest type, and linkages to other patches in a landscape determine their ability to support wildlife species which depend upon them. This is particularly true for mammals and forest interior birds that require extensive forests (note that forest birds are used as indicators of the quality of the forest because they are easily surveyed and more is known about their habitat requirements and distribution than any other group of wildlife).

Thirty percent forest cover

As the amount of forest habitat in an area declines, so does the number and percent of expected forest bird species within the range. In one study, statistical analysis was used to demonstrate that forest interior birds continued to increase in number to at least 35 percent forest cover at a scale of 10 000 hectares; to approximately 24 percent at a scale of 40 000 hectares, and; up to 20 percent at a scale of 90 000 to 160 000 hectares. This analysis points out that the *Framework*'s guidelines work best when they are fine-tuned for local variables, including the scale at which they are applied.

At least one 200-hectare forest patch that is a minimum of 500 metres wide

A number of reports have demonstrated that the larger a forest habitat is, the more species it will support. A range of forest patch sizes has been suggested for different species. In one study, four large forest patches ranging in size from 140 to 201 hectares were surveyed in the Severn Sound AOC. From this work, it was determined that a single tract of 140 hectares was too small to support the regional forest bird community. At least one 200-hectare patch on a landscape unit should support over 80 percent of expected forest bird species. Several large tracts (i.e., greater than 200 hectares) are recommended to support 90 to 100 percent of expected forest bird species.



Ten percent of the watershed should be forest cover 100 metres or further from the forest edge; Five percent of the watershed should be forest cover 200 metres or further from the forest edge

Certain bird species, when breeding, avoid forest edges in small, fragmented forests. Negative effects of small forests (without 100 or 200-metre forest interior) include increased predation and parasitism, desiccation by wind, insufficient food, and a higher susceptibility to catastrophic events such as fire, floods or human disturbances such as adjacent development. A minimum width of 500 metres is important in defining the ability of a forest to support edge-intolerant bird species, which tend to nest 200 metres from the edge. Therefore, a forest width of 500 metres provides a 100 metre-wide band of habitat for these species.

Maidenhair Fern / Canadian Wildlife Service

Mixed Forest / Canadian Wildlife Service

Scarlet Tanager / Walter B. Fechner

Forest patches should be circular or square in shape

Square or circular habitats provide the greatest amounts of interior for species such as edge-intolerant birds, while linear or irregularly-shaped habitats of similar size contain little or no interior. Forested areas with high interspersion and edge favour common generalist species, such as House Sparrows, as opposed to the more uncommon area-sensitive specialists such as Ovenbirds.

Forest patches should be within two kilometres of one another

Studies have found that abundant forest cover within two kilometres of a particular forest patch is a significant predictor of the presence of edge-intolerant bird species. Close proximity of forest patches also facilitates wildlife movement among them. When rehabilitating habitats, focusing on areas that are near other natural areas is most effective.

Corridors designed to facilitate species movement should be a minimum of 50 to 100 metres wide; Corridors to accommodate breeding habitat must consider target species requirements

Wider corridors are more effective at facilitating species movement. Suitable habitat must be provided within the corridor for the target species that are expected to move along it. Vegetation composition in the corridor should be similar to that within the nodes that it connects. In addition, the corridor should be continuous, maintaining a minimum width along its entire length (e.g., 100 metres wide along the entire corridor).

Watershed forest cover should be representative of the full diversity of forest types found at that latitude

Although forest cover may be plentiful in a watershed, it may consist of early to mid-successional plant communities, mostly conifer plantations, or a variety of non-native species. Choosing forest types for restoration requires some knowledge of the pre-settlement landscape as guidance.

Riparian Habitat Guidelines

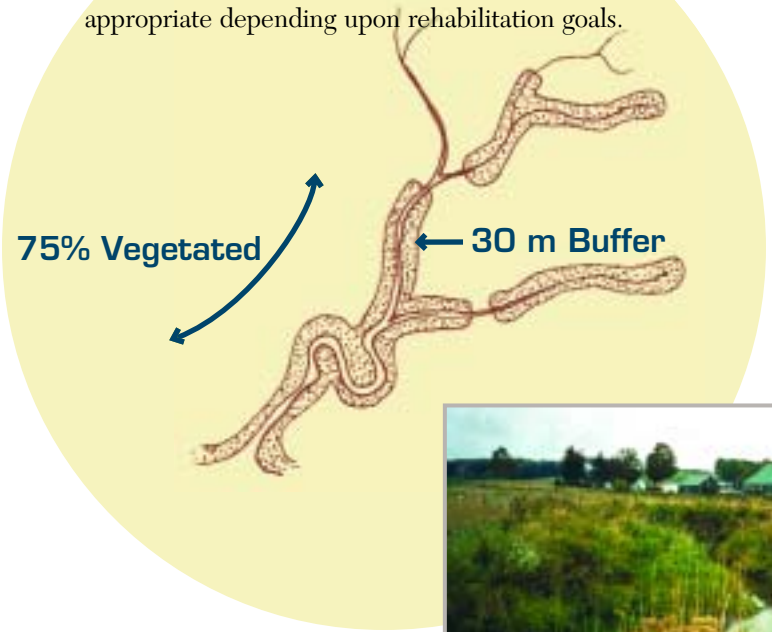
Riparian refers to all habitat within a stream corridor or valley, particularly the shrubs and trees on the stream bank. Riparian habitats provide important fish and wildlife habitats, such as natural linkages among different habitat features that create critically important wildlife migration corridors.

Seventy-five percent of stream length naturally vegetated

Stream degradation occurs when riparian vegetation amounts to less than 75 percent cover along streams. In particular, first to third order streams in headwater areas (cold-water or cool-water streams) with permeable soils benefit greatly from shading and leaf matter provided by adjacent overhanging vegetation, which serves as food for benthic invertebrates. Streams of all orders benefit from being vegetated (even if the amount of vegetation is less than 75 percent) because riparian vegetation maintains water temperature, ensures bank stability, filters out excess nutrients and suspended solids, protects fish communities, and supports good water quality.

Thirty-metre wide stream buffers

Ideally, streams should have a 30-metre wide, naturally vegetated buffer on both sides to reduce nutrients and sediments reaching the stream. When choosing a suitable stream buffer width for specific sites, take into account factors such as the nature of the watercourse (stream order and class), soil types, slopes, and adjacent uses. Buffer widths from three to 200 metres may be appropriate depending upon rehabilitation goals.



Total Suspended Sediment (TSS) concentrations below 25 milligrams per litre or be consistent with Canadian Council of Ministers of the Environment (1999) guidelines regarding Protection of Aquatic Life

Suspended sediments may affect aquatic habitat adversely by filling in interstices of coarse substrate, thereby limiting habitats for aquatic invertebrates. Under extreme conditions, fish eggs may be smothered, fish that feed by sight may have difficulty finding food, gills may become clogged, and disease may occur. Plant communities may be affected adversely by reduced light penetration into the water column (i.e., reductions in the extent of submerged vegetation). Maintaining TSS values below 25 milligrams per litre by implementing urban stormwater controls and rural non-point source best management practices should result in lower turbidity and fewer harmful effects on the stream and its biota.

Less than 10 percent of an urbanized watershed should be impervious

Less than 10 percent imperviousness (hard surfaces) in an urbanized watershed should maintain stream water quality and quantity, and leave biodiversity relatively unimpaired. An upper limit of 30 percent represents a threshold for degraded systems. The goal should be to avoid extreme peak flows through incrementally minimizing hard surfaces, making use of porous pavements, and disconnecting roof downspouts.

Buffers decrease sedimentation and provide a wildlife corridor / Great Lakes Sustainability Fund

Blue Flag Iris / Douglas A. Wilcox

Case Study

The Terrestrial Natural Heritage Approach

The Toronto and Region Conservation Authority's (TRCA) approach to terrestrial natural heritage planning involves measuring the condition of natural systems in a watershed. The basic unit of measurement is the individual habitat patch. Values for patches can be combined to assess natural systems at various scales such as subwatershed, watershed, municipality, and so on. The result is a value for a whole natural system based on:

- quantity (the percent natural cover in a region);
- quality (the average habitat patch size, shape and matrix influence);
- distribution (the distribution of that quantity and quality of natural cover across the landscape or watershed).

Identifying and setting targets based on quantity, size and shape of habitat patches is similar to the *Framework* approach, but the Terrestrial Natural Heritage Approach also recognizes a matrix influence. The matrix influence is a measure of the positive or negative influence that a habitat patch receives from its surroundings. Numeric values are assigned to the effect that different land uses (within two kilometres) will have on a given patch of habitat and individual patches are scored as to matrix influence. By averaging scores across an area, knowledge can be gained as to the health of the overall natural system in relation to land-use planning decisions.

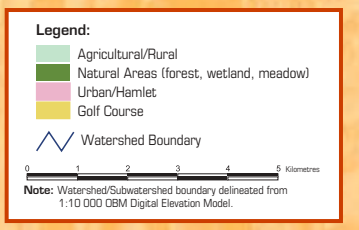
Urban land uses generally have a negative impact on wetlands, meadows and other natural habitats because they block the movement of species and energy, and harbour negative influences such as pollution, refuse, recreational pressures, dogs and cats, invasive species, and more. Therefore, they receive a base value of negative one. Agricultural land uses are more conducive to species movements and can have positive and negative impacts for biodiversity. Their value is generally seen as neutral with a point value of zero. A habitat patch can have a synergistic and beneficial relationship with other natural cover in the surrounding area, and hence natural cover is assessed a point value of one.

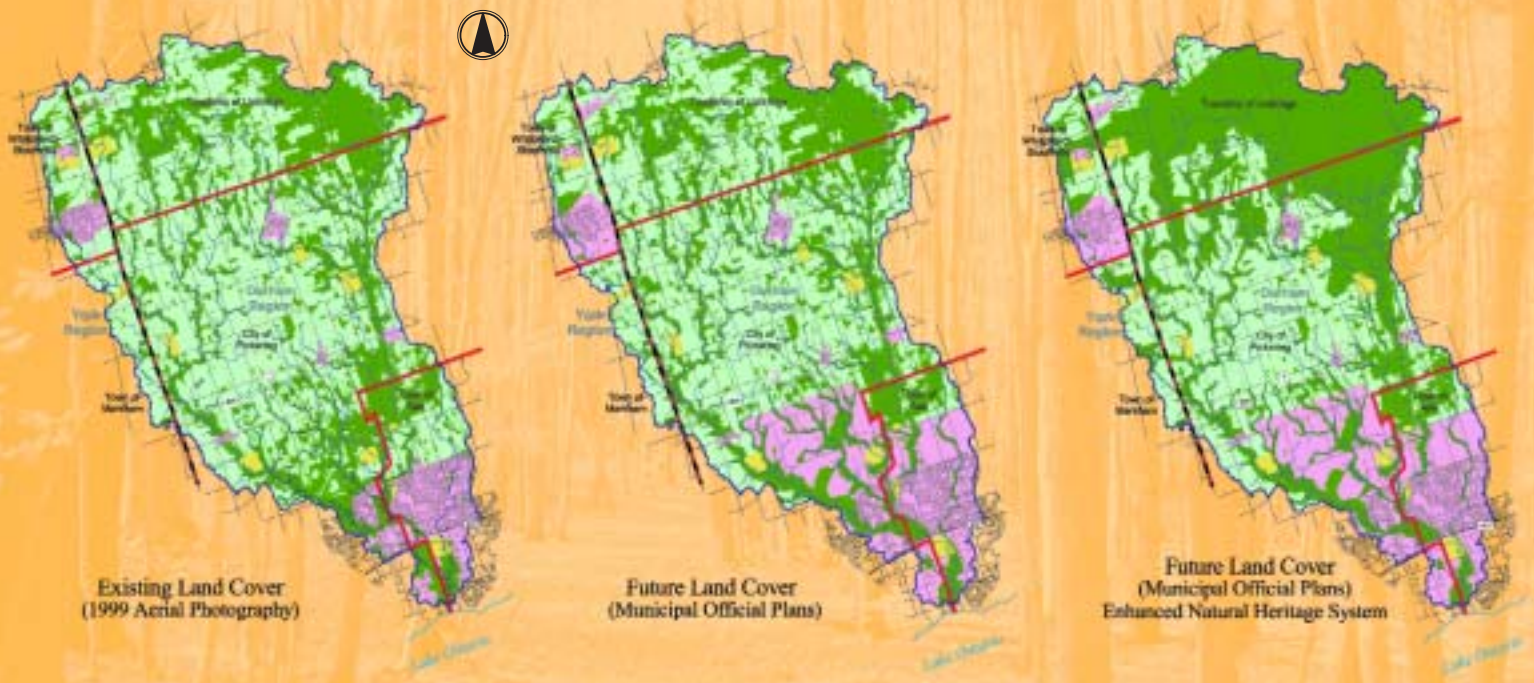
By accounting for matrix influence, it is possible to refine choices of desirable locations for restoration, and to gain a clearer understanding of the condition of natural systems and of the potential consequences of planning and restoration actions on the future condition of those systems.

Rocky Stream / Canadian Wildlife Service

Duffins Creek watershed

In developing the Watershed Plan for Duffins Creek, the natural system was evaluated and, through modeling of an improved natural system, targets were set for the amount and distribution of natural cover, the size and shape of habitat patches, and the matrix influence within two kilometres of habitat patches. Initially, the existing natural cover in the Duffins Creek watershed was identified as individual habitat patches, which were then scored to reveal differences in the quality of patches and, by extension, the average quality of the natural system throughout the watershed. Next, planned urbanization and other human impacts, such as roads, were mapped. Lastly, the projected or targeted extent of the improved natural system was mapped. The projected extent of natural cover reflected where habitat could best be restored to achieve the highest scores for patch quality based on the location in the watershed, size, shape and matrix influence.





Links to Local Municipal Land-Use Planning

The *Framework* can be applied in land-use planning to address specific issues and needs from a scientific basis. Use of the science-based guidelines to formulate planning and policy decisions can make such decisions more defensible and provide a rationale for directly protecting habitat or initiating restoration projects. It can guide protection of existing types of habitat to ensure sensitive species, such as forest birds, will have sufficient habitat to breed. It can quantify adequate wetland coverage to ensure flood suppression.

Habitat protection can be linked with restoration to provide sustainable natural heritage systems. Currently, Official Plans recognize natural heritage in the form of existing habitat. This habitat is often fragmented or reduced and may not yield viable habitat for wildlife. The *Framework* can be used to proactively identify and set aside lands where restoration can occur to make the existing natural heritage system more complete, through local restoration plans or actually within Official Plans.

There may be opportunities to extract, or adapt, guidelines from the *Framework* and build them into Official Plans. In one example, the City of Windsor developed a policy on a particular project to minimize impervious surface treatments using the impervious surface area guideline in the *Framework*.

Stream with Riparian Cover / Eric Dresser

Case Study

Adopting and Adapting Framework Guidelines in Severn Sound

The Severn Sound AOC was recently removed from the list of Great Lakes AOCs, partly due to the restoration of fish and wildlife habitat. One of seven delisting objectives set to guide restoration efforts was "to rehabilitate tributaries and riparian areas for fish and wildlife habitats". Various indicators were used to measure restoration progress toward objectives, with many indicators introduced or modified while restoration was proceeding from the late 1980s to 2002. These included guidelines from the first edition of the *Framework*, which were either directly adopted or adapted to local conditions as indicators to measure success in meeting delisting objectives (see accompanying table).

Adopting Framework *guidelines*

Many *Framework* guidelines were used directly as upland habitat indicators. Given past and present local conditions, it was deemed reasonable to adopt *Framework* guidelines, such as minimum 30 percent forest cover and the presence of at least one 200-hectare forest patch that is minimum 500 metres wide.

Adapting Framework *guidelines*

Some *Framework* guidelines were adapted for local conditions and then used as indicators, reflecting available resources and an effort to prioritize efforts where restoration would be most beneficial. For example, the *Framework* guideline *75 percent of stream length should be naturally vegetated* was modified to: *At least 75 percent of first to third order streams should be naturally vegetated.*

Importance of local conditions

Studies were conducted of local conditions to refine restoration planning and, if needed, modify *Framework* guidelines for use in the AOC. One general *Framework* rationale is that upstream stream reaches are colder, but it was found in the AOC, due to groundwater inputs, that many higher order streams, even fourth or fifth order streams, were colder than first or second order streams. Hence, vegetation would play a smaller role in maintaining cold-water stream systems. Moreover, forest cover was not established along all stream banks due to natural meander belts and marsh vegetation. These reaches, however, naturally supported cool and cold-water habitat conditions that would be expected on a forested reach.

Identifying habitat and changes in habitat

Geographic Information System (GIS) mapping based on current and historic aerial photos and maps allowed wetland, forest and riparian habitat coverage to be assessed and compared over the years, in some cases as far back as 1953. Through this comparison, trends in habitat could be noted and targets for the AOC refined. GIS analysis also allowed restoration projects to be located to best meet habitat targets.

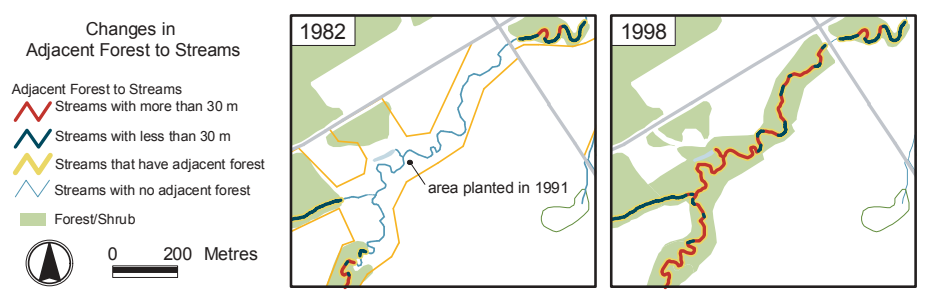
Results

Overall forest cover increased in most sub-watersheds due to planting and natural succession, although restoration and protection will be needed to provide adequate interior forest habitat to address ongoing residential development. There was a steady increase in natural vegetation along stream courses, with much of this success attributable to restoration efforts and better stream buffer awareness among landowners. The percent wetland area guideline of 10 percent of watershed was not met, with the exception of Sturgeon River and Wye River watersheds. The percent wetland area guideline of six percent for sub-watersheds was generally met with the exception of the Coldwater River.

The Severn Sound AOC guidelines and habitat trends

Guidelines	Local Target	1982	1998	Difference
Forest Habitat Guidelines				
Forest cover	>30%	32%	38%	6%
Size of largest patch	>100 ha	163 ha	199 ha	36 ha
Forest >100 m from edge	>10%	6%	11%	5%
Forest >200 m from edge	>5%	1%	3%	2%
Riparian Habitat Targets				
First to third order streams with natural vegetation	>75%	47%	57%	10%
First to third order streams with >30 m natural vegetation	>75%	29%	40%	11%
First to third order steams with natural vegetation plus wetlands	>75%	57%	64%	7%
First to third order streams with >30 m natural vegetation plus wetlands	>75%	36%	44%	8%
Wetland Habitat Targets				
Wetlands in watershed	>10% (sub >6%)	7%	7%	
Amount of vegetation: mean width	>240 m	71 m	122 m	51 m

An example of strategic restoration



The effect of a 1991 Severn Sound AOC restoration project is shown in the diagrams below. There was an increase in habitat between 1981 and 1998 in terms of percentage of vegetated stream length and percentage of stream with a 30-metre buffer.

Plan for the long term

Measuring change in ecosystem health is difficult. Full benefits will not be seen until restoration sites mature. Also, different restoration projects took place at different times, and in the interim land development and other human activities cause ongoing habitat loss. Vigilance and ongoing restoration will be needed to maintain adequate habitat in Severn Sound and elsewhere in the Great Lakes basin.

This fact sheet is available on-line at the following URL: www.on.ec.gc.ca/wildlife. All publications are available in both HTML and PDF formats. For more information, or to request a copy of the full guide, *How Much Habitat is Enough? (Second Edition)*, please contact:

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