INDICATOR 12

How are urbanization and development affecting the availability of habitats for fish, wildlife and birds that depend on interior forest areas?

CBEP Goal: Minimize adverse environmental impacts to ecological communities from the use and development of land and marine resources.

Status

Forests provide essential habitat to many of Maine's native birds, fish, and mammals. Certain species, including large herbivores and predators such as fishers, hawks and owls, roam over large areas of forest and thus cannot survive in the small forests found in suburban areas. Many species of migrant songbirds, including many warblers, are forest specialists, nesting successfully only in large blocks of forest. While the Casco Bay watershed is still largely forested, forest interior habitat may be in short supply.

While to most humans there may appear to be little difference between the edge and the interior of a forest, there can be profound differences from the perspective of the animals and plants that live there. The edges of forests have a different microclimate from the interior. They often are sunnier, windier, and drier than the depths of the woods. Proximity to other habitats, such as lawns or agricultural fields, brings its own challenges. For example, invasive species like Eurasian bittersweet and house sparrows are far more abundant. Many predators, from raccoons to house cats, are less common in deep woods than near open habitats. The brown-headed cowbird, which lays its eggs in the nests of other birds, favors open habitats as well. Certain wildlife species are sensitive to human disturbance, and thus are most common in the deep woods where people are less active.

Forest interior wildlife includes songbirds such as the wood thrush, scarlet tanager, and many warblers; larger birds, including woodpeckers, hawks, and owls; and forest interior mammals such as fisher, lynx, and bear. Even some small rodents and insects have been shown to be much more abundant in interior forest.

Maine's Beginning with Habitat Program recently analyzed land cover data derived from satellite imagery from 1999-2001 to shed light on the availability of deep forest habitats throughout Maine (Beginning With Habitat 2010). The resulting geographic dataset represents large – more than 500 acre – contiguous areas of forest that are at least 300 feet away from other habitats. Such areas are most likely to provide significant interior forest habitat.

Jerry Oldenettel | Kelly Colganazar | Eric Bégin | USFWS

Clockwise from top left: Scarlet tanager, wood thrush (with young cowbird, a nest parasite), brook trout, and lynx are among the species in Maine that need interior forest habitat.

Even in a largely forested watershed such as Casco Bay, suitable habitat for forest specialists may be uncommon. Their ideal habitat occurs only in large areas of forest that are compact in shape and are located far from most human activity. Almost 69 percent (676.0 square miles) of the 986 square mile Casco Bay watershed is forested (Maine Office of GIS 2004). In contrast, only 172.6 square miles (17.5 percent) of the watershed consists of interior forest habitat, the majority of which is located in the upper portions of the watershed. Interior forest is far less abundant in the more highly developed coastal communities, where suburban lands, abundant roads, powerlines, and other linear infrastructure cut the forest into smaller areas that provide little true interior forest habitat.

Trends

Most of New England, including Maine, has been gaining forest area for much of the last 150 years. That long-term trend reflects shifts in the rural economy: the agricultural production that fed eastern cities first moved to the Midwest and then overseas. Today, abandoned agricultural lands are a major component of the landscape of the Casco Bay watershed. Their presence is revealed by the presence of stone walls, old apple trees, and other, more subtle evidence of past agriculture in the midst of large areas of forest.

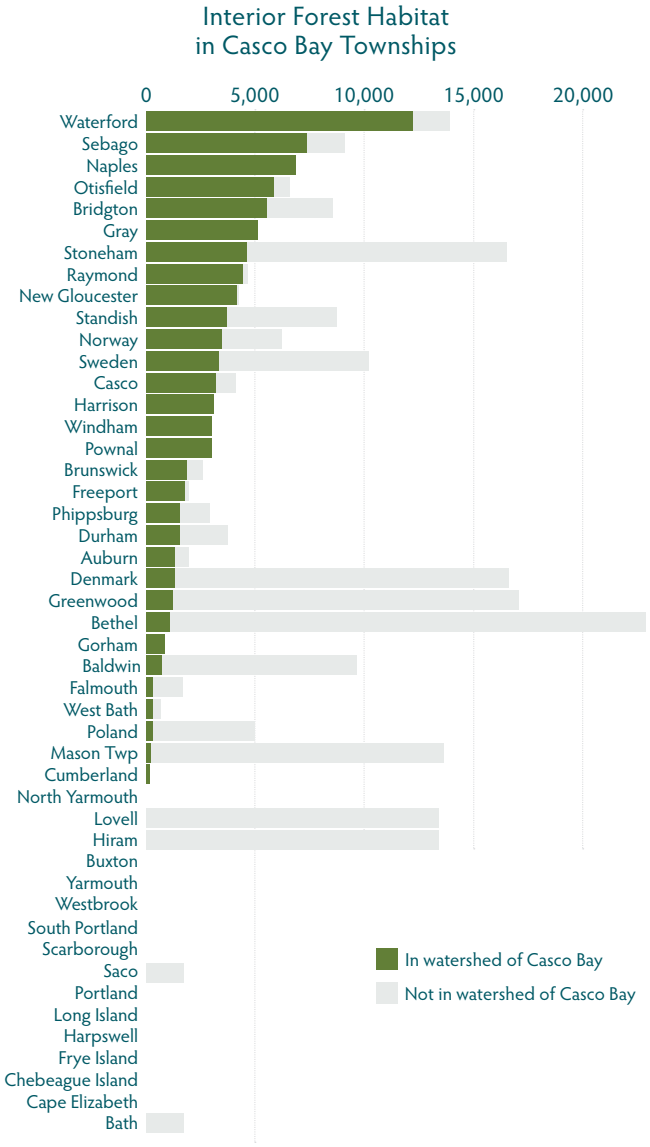
Only in recent decades, as development patterns have converted more and more forest to suburb (The Brookings Institution 2006), has that long-term trend been reversed. Where characteristic exurban development patterns are most intense – along the route 95 and 295 corridors and near Portland, Brunswick, and the other regional service center communities – interior forest habitat has undoubtedly declined in recent decades. The extent and speed of those declines, however, is poorly known.

The Beginning with Habitat program has only recently begun explicitly mapping interior forest habitat. Its analysis was first made available in 2009, but the underlying satellite data on which it is based dates back a decade. Rigorous, geographically defined trend analysis will require generation of new geographic data from historic sources and acquisition of new imagery. (Note: In the 2005 *State of the Bay* report, CBEP reported on "Undeveloped Blocks of Land," a related metric that sheds light on similar issues. That metric was based on the same land use data, harking back to the same satellite imagery as the interior forest metric.)

Actions/Solutions

The Beginning with Habitat program was founded to help educate towns about the value of protecting wildlife habitat. Its habitat maps, land use analysis, and related products together provide a important planning toolkit to help local communities achieve this goal.

Other approaches may prove important for the long-term protection of interior forest habitat. Land trusts, towns, and state agencies are finding creative ways to support conservation of forest area for a host of reasons. Protection of forests not only provides habitat for forest interior wildlife, but can also support forest-dependent jobs, and protects the character of our communities. The forests of the Casco Bay watershed also provide important ecosystem services of direct benefit to our society, such as carbon sequestration and provision of clean water. Acquisition of land or conservation easements provides direct habitat conservation (see Indicator 13), and support the economic viability of forest-dependent land uses, from traditional forestry, to carbon sequestration markets and markets for ecosystem services.



The majority of the interior forest habitat in the Casco Bay watershed lies within the northern and western towns at the headwaters of the Sebago Lake / Presumpscot River watershed. The more developed coastal communities contain little or no interior forest habitat.

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Interior Forest Habitat

While forest land is still abundant in the Casco Bay watershed, much of it offers little suitable habitat to wildlife that depends on deep forest habitat. While forests are widespread except in the heart of the Portland metropolitan area, interior forest habitat is much more concentrated away from the coast. Roads and developed lands near the coast divide forest into patches too small to provide secure habitat for forest interior specialists. Data: Beginning with Habitat and Maine Office of GIS

Riparian Buffers in the Casco Bay Watershed

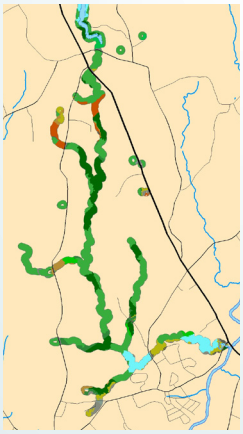
Introduction

Riparian buffers are the narrow strips of land adjacent to streams, rivers, lakes and the coast. Well-vegetated buffers, especially forested and wetland buffers, are important to supporting good water quality, and to improving fish and wildlife populations.

Vegetated buffers slow water, help shorelines resist erosion, and filter runoff, which limits the delivery of sediment and associated pollutants to streams. Buffers, especially wetland buffers, are also excellent at absorbing macronutrients like nitrogen and phosphorus, further protecting water quality.

Forested buffers shade the water, reducing temperatures and increasing dissolved oxygen levels. They also provide dead leaves, which, by providing food directly or indirectly to aquatic organism, are a major energy source for stream ecosystems. Logs and woody debris derived from riparian trees provide shelter for aquatic organisms along the shore. Woody debris influences stream channel development, and contributes to development of pools, backwaters and other stream features that make for good fish habitat. In some of the watershed's sandy or clay-lined coastal streams, rocks are rare, making woody debris one of the few places where aquatic insects can attach to hard surfaces, and avoid being washed downstream.

Riparian forests also provide important sheltered corridors for wildlife reluctant to cross open land. In agricultural and suburban landscapes, the long, sinuous strips of forest remnants that often lie along streams can link together patches of forest that would otherwise be isolated, supporting robust populations of woodland wildlife, and facilitating annual migration of forest birds and animals (see Indicator 12).



Land use in the 50-meter riparian zone of Mill Brook.

Status

GIS technology can be used to combine information on land cover (Maine Office of GIS 2006) with data on the locations of aquatic areas like streams, lakes, and the ocean (Maine Office of GIS 2004). The result characterizes land use in areas close to aquatic habitats, as shown in the example above.

The majority of the Casco Bay watershed and a majority of the riparian areas within it remain forested. 70.7 percent of the watershed is forest or wetland. The 50-meter riparian buffer zone adjacent to Casco Bay itself (65.9 percent) is slightly less forested than the landscape as a whole, presumably because people like to live and work along the shore. The buffer areas along the watershed's lakes and ponds (75.3 percent) and especially along streams and rivers (83.1 percent), in contrast, are more likely to be forested than is typical for the watershed as whole.

The proportion of buffers within each subwatershed – the HUC 12 subwatersheds – of the Casco Bay watershed that remains in forest or wetland varies from a low of 27 percent in the highly urbanized Fore River subwatershed to 98 percent along the Northwest River. The percentage of riparian buffers that remains in forest and wetland is correlated with the proportion of each subwatershed that is either forest or wetland. Thus the abundance of riparian forest and wetland is lowest near the coast, and greatest in the largely forested upper watershed.

Trends

Riparian buffer analysis has not previously been carried out throughout the watershed, and available historic land cover data used slightly different methods for determining what constituted forest or wetland. Accordingly, we do not have rigorous information on trends in riparian buffer condition.

As with the other Casco Bay watershed habitat indicators, however, the driving force behind long-term trends in the condition of riparian vegetation is land use change, along with the economic choices, policy decisions, and social forces that shape land use decisions.

Maine has several laws that protect shorelines and riparian areas. Its Shoreland Zoning Act, for example, requires towns to adopt land use regulations that apply within the "shoreland zone" – areas within 250 feet of pond and lakes, rivers, tidal waters and wetland, as well as those within 75 feet of streams. Rules generally include restrictions on construction and clearing of vegetation. The Natural Resources Protection Act offers additional protection for lands adjacent to coastal wetlands, some freshwater wetlands, great ponds, rivers and streams.

References

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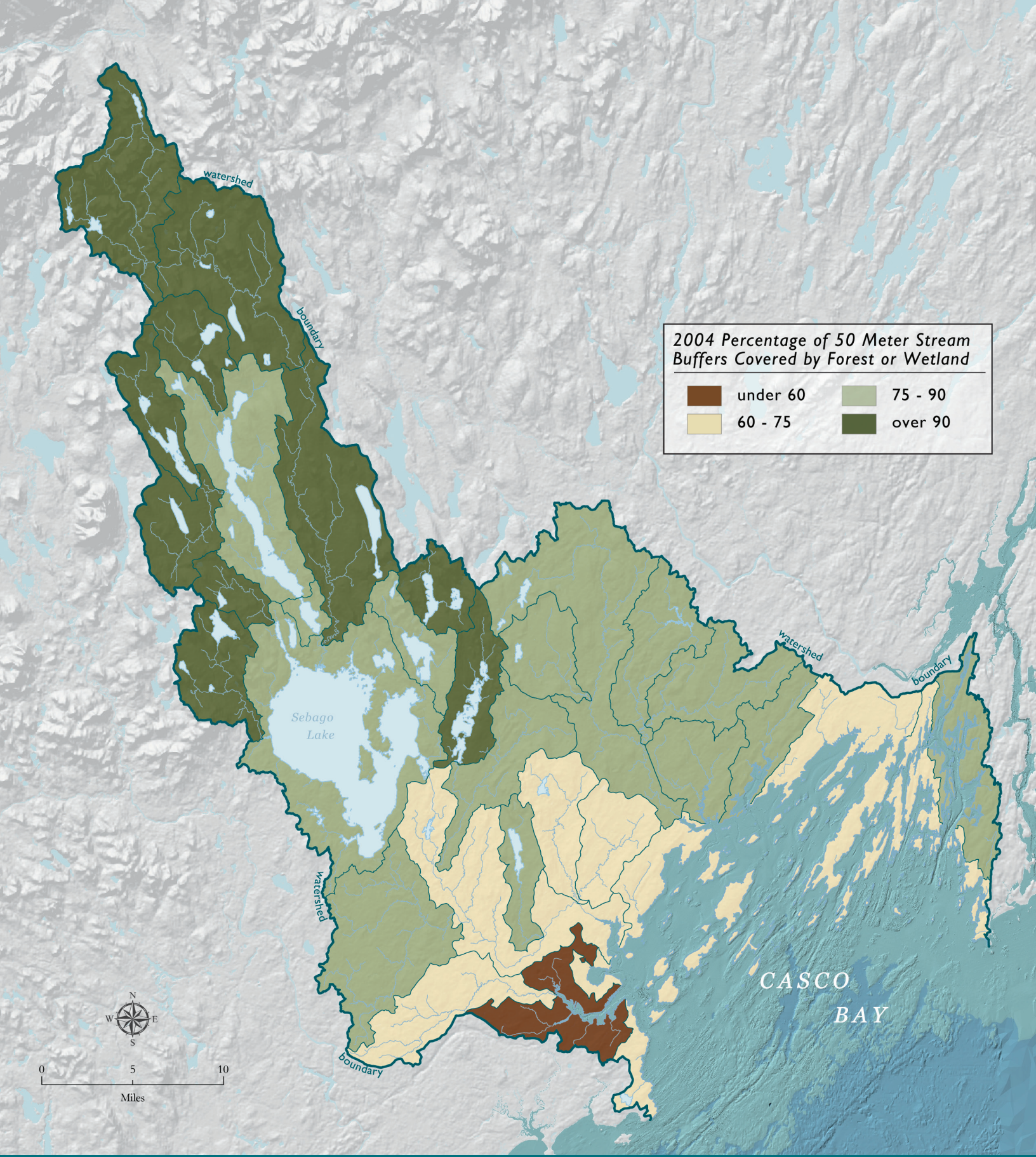
Maine Office of GIS. 2004. WQPONDS, WQSTREAMS, WQRIVERS, and WQCOAST datasets. Geographic data available through Maine Office of Geographic Information Systems. http://megis.maine.gov/catalog/



Condition of Riparian Buffers by Subwatershed

Fish Passage Survey

While habitat fragmentation has been studied extensively in upland forests, it is also a significant problem in rivers and streams. Flowing waters are often crossed by many roads and are blocked by large and small dams. Without proper design, construction, and maintenance, dams and culverts can block the movement of fishes and other aquatic organisms. The effects of such fish passage barriers on long distance migratory fish species like Atlantic salmon and alewives are significant. The effects on resident species are less well understood.

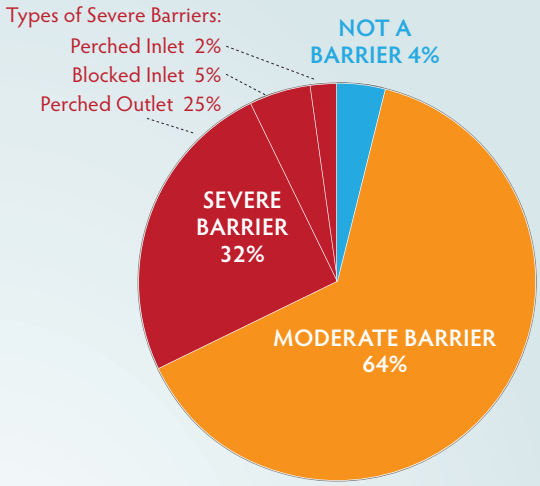
In 2009, CBEP seasonal staff, working with volunteers from Trout Unlimited and personnel from the U.S. Fish and Wildlife Service Gulf of Maine Coastal Program Office, visited over 700 potential fish passage barriers in the Royal River and lower Presumpscot River watersheds. They collected detailed data from over 480 culverts and approximately 30 dams. The survey was the first in the state to be carried out in a region that is largely urban and suburban; previous Maine surveys were focused on more rural landscapes, especially forested watersheds.

About one-third of culverts in the region never permit fish to pass. The majority of culverts are partial barriers to fish movement – blocking access some of the time, or to certain species of fish. Only a handful of crossings never restrict movement of fishes.

U.S. Fish and Wildlife staff analyzed the data to identify priority restoration opportunities in the study area, both for restoring access of anadromous fishes to stream habitat and for restoring access to lake habitat – which is particularly important to alewives, one of the most abundant anadromous species in the region. The results of those analyses provide CBEP and its partners with a "to do" list for fish passage restoration.

CBEP staff have also developed a tool – based in part on methods pioneered by the Piscataqua Region Estuaries Partnership under their Climate Ready Estuaries project – that provides a rough estimate of the relative flood risk at each culvert. Using the geometric data about each culvert collected during the field survey, along with the geographic information derived from GIS analysis, CBEP compared culvert flow capacity with expected storm flows.

Analysis of the results showed significant overlap between culverts that block fish migration and culverts that may pose higher than average flood risk. That insight has led to conversations with local communities, the Maine Department of Transportation, and the Cumberland County Emergency Management Agency to identify sites where culvert replacement would simultaneously serve environmental, infrastructure and public safety goals.



Results of 2009 field survey. Most culverts are fish passage barriers. A quarter of all culverts are impassable to fish because their outlet is perched significantly above the elevation of the stream. Since most of Maine's anadromous fishes don't jump, these culverts effectively block upstream movement of many anadromous fishes.