Birds at Risk

The Importance of Canada's Boreal Wetlands and Waterways

October 2011

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The Boreal Songbird Initiative (BSI) is a non-profit organization dedicated to outreach and education about the importance of the boreal forest region to North America's birds, other wildlife, and the global environment. BSI works to mobilize environmental and birding groups and individuals to influence Canadian government and industry policies. BSI is a project of the Pew Environment Group. www.borealbirds.org.

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EXECUTIVE SUMMARY

The boreal forest of Canada is a critical stronghold of our planet's bird life, supporting large portions of the global population of many species. Billions of birds migrate to and from the boreal region and reproduce in the short boreal summers, largely because of the region's abundant wetlands and undammed waterways.

The prodigious number of insects hatched from the water, and creatures living in it, are staples of birds' diets. This watery habitat provides shelter and nesting grounds as well as food for migrants. It has also, until recently, contributed to keeping industrial development in check.

But the boreal forest is under pressure from industrial development and climate change. Hydropower has flooded former habitat, while logging and industry such as tar sands oil extraction, strip-mining, and drilling operations have impacted forest habitat and decreased water quality. Climate change is melting permafrost, desiccating wetlands, and potentially creating ecological imbalances that could undermine the land's ability to support the large percentage of the world's bird populations that depend on the boreal forest.

This report looks at three natural areas in the boreal forest that are critical for birds, but that are coming under pressure from industry, hydropower, and climate change. We discuss some strong policy steps governments must take in order to protect the watery forest and the great biodiversity of birds it supports.

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Top: The Athabasca River snakes south of Fort McMurray in Alberta, Canada.
Above: Syncrude processing facility and upgrader mars the boreal landscape.

INTRODUCTION

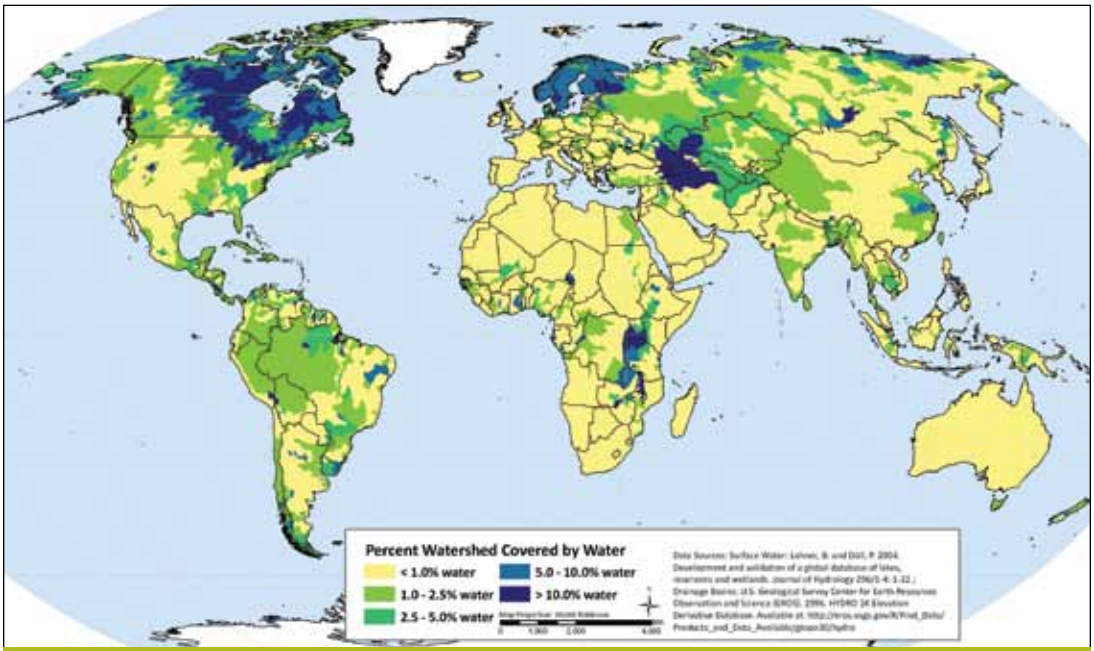
Canadians have reason to be proud when it comes to their water. More surface freshwater is held within Canada than in any other country. The vast majority lies inside the great boreal forest region, which covers 5.8 million km^2 (1.4 billion acres) and stretches from Newfoundland and Labrador to the Yukon.[1] All this water, coupled with the region's compact growing season, makes the boreal forest intensely productive for all forms of life, but particularly birds. Billions of birds, representing more than 300 species, choose Canada's boreal forest as their nesting place and home for several months of the year. In one of the world's largest migrations, 90 percent of the country's total bird population—a total of 3 to 5 billion birds—leaves the boreal forest each fall for wintering grounds in the United States and the tropics, only to return each spring to Canada to nest.

The region's abundant bird and water resources are intertwined with the way of life of many of Canada's Aboriginal peoples, who have lived throughout the boreal region for millennia, relying on the forest and water for food, transport, and other elements of survival. When we consider how to ensure a sustainable future for birds and other wildlife within the boreal, we must acknowledge that the rights and traditional ways of Canada's indigenous peoples are essential to conserving the integrity of the boreal ecosystem.

Unfortunately, the waterways and wetlands of Canada's boreal forest are under increasing pressure. The impact of industry is leading to increased habitat loss for bird populations across Canada, while global warming leads to changes that compromise the integrity of the boreal forest's pristine wetlands and water resources. This report highlights the global significance of the wetlands and waterways of the Canadian boreal forest for birds. It outlines some of the main threats to birds and their habitats, including threats to the health and viability of Canada's migratory birds once they leave the forest.

Oscar Lake in the Northwest Territories.

In examining the importance of Canada's wetlands and waterways for birds, we look at three critical habitat areas: the Hudson Bay and James Bay Lowlands, the Peace-Athabasca Delta, and the Lake Superior Watershed. The report concludes with policy recommendations to maximize conservation opportunities and minimize threats to birds and bird habitat.



Canada's boreal forest houses the world's largest concentrations of surface freshwater.

I. WATER: THE DEFINING ELEMENT OF THE BOREAL

This section is primarily excerpted from A Forest of Blue – Canada's Boreal Forest: The World's Water Keeper, *by Jeffrey Wells, D. Roberts, P. Lee, R. Cheng, and M. Darveau. Pew Environment Group, 2011.*

Canada's boreal forest region includes the world's highest concentrations of large wetlands, lakes, and undammed rivers. There are more than 800,000 km^2 (308,881 mi^2) of surface freshwater within its borders, encompassing an area larger than most countries.[2] This massive store and flow of freshwater plays an important role in stabilizing the Earth's climate and feeding the productivity of its oceans. The boreal's ice-locked and water-saturated forests and peatlands, and the sediments in its lakes and deltas, are some of the largest storehouses of carbon on the planet.[3] Waterways and wetlands of Canada's boreal forest are among the world's most pristine, with naturally low levels of nitrogen and phosphorus, low levels of human-caused pollutants, and few alien species.

Clearwater River in Alberta.

Confluence of Carcajou River and the Mackenzie River in the Northwest Territories.

LAKES AND RIVERS

Canada's boreal forest region contains more than 600,000 large lakes and millions of small lakes.[4] Four of the world's ten largest lakes lie wholly or partly within Canada's boreal. Lake Superior, the world's largest freshwater lake[5] at 84,500 km^2 (32,625 mi^2), receives most of its water input from Canada's boreal forest. Also within the region are Great Bear Lake and Great Slave Lake, the world's fifth- and seventh-largest freshwater lakes by surface area.

Among the region's rivers—the greatest number of large undammed rivers in North America—the longest is the 4,200-kilometer-long (2,620-mile)Mackenzie River and its headwaters. The many free-flowing rivers of Canada's boreal forest provide massive amounts of fresh water, sediments, and nutrients to the Atlantic, Pacific, and Arctic oceans, fueling a critical engine of large ocean currents and productivity that influences global climate and marine biodiversity. The estuary and marine environments at the mouths of these river systems provide the key to healthy marine ecosystems that support rich marine fisheries, major seabird colonies, and marine mammal populations.

WETLANDS

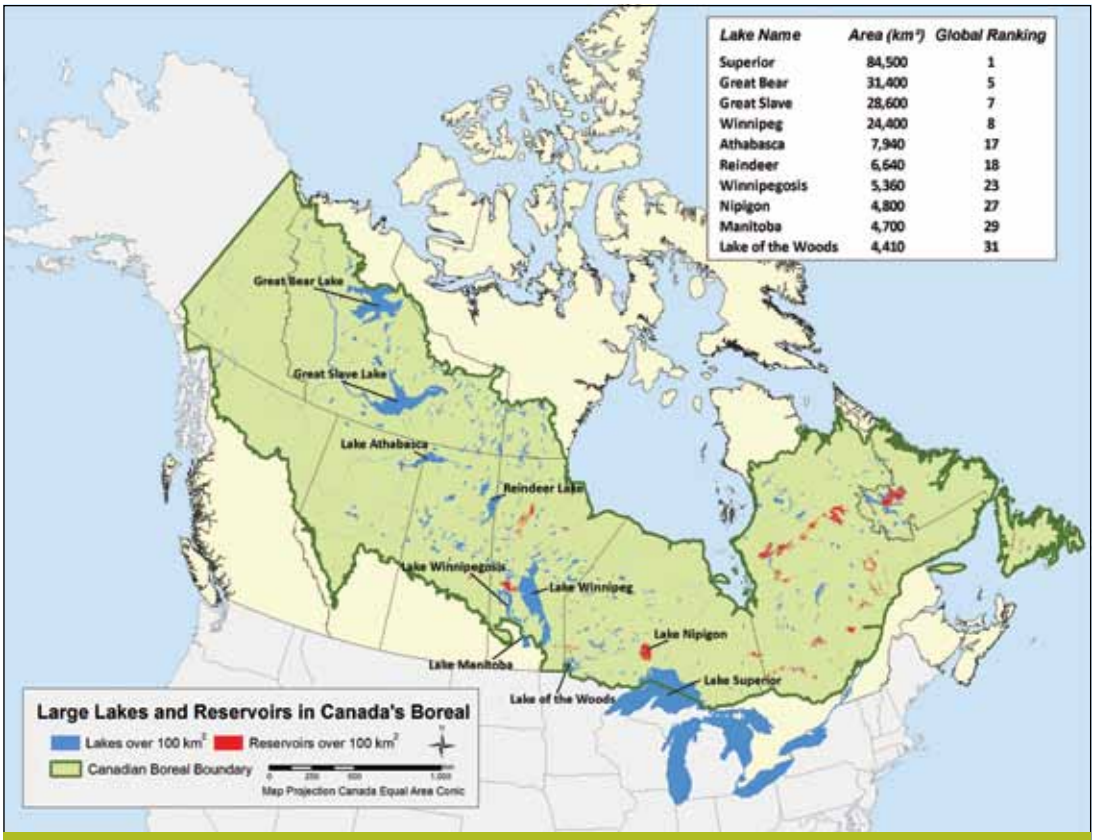
Canada's boreal forest contains what may be the world's largest total area of wetland habitat. Wetlands extend over an estimated 1.19 million km^2 (459,375 miles^2). Boreal wetlands include a wide variety of habitats, from seasonally flooded (swamps) to vast expanses of water-saturated peatlands (bogs and fens), to shallow open-water basins, marshes, and tundra.

Wetlands play a critical role in maintaining boreal ecosystems. They recharge groundwater aquifers, absorb and filter contaminants, regulate river flow by absorbing excess flow during wet periods and providing water during dry periods, and provide habitats for waterfowl, fish, and other wildlife. They take up and release greenhouse gases, making them key regulators of climate through their role in the global carbon cycle.[6]

Wetlands that accumulate large amounts of dead vegetative material are commonly termed peatlands, and are the world's most efficient ecosystem at storing carbon.[7] Peatlands, which are widely distributed across boreal regions, accumulate and store carbon at higher rates per area than any other terrestrial ecosystem.[8] Canada contains 34 percent of the world's total peatland area, with the highest concentrations in the Hudson Plains ecoregion.[9]

A lake and wetland complex in Ontario's boreal forest.

Billions of birds, representing more than 300 species, choose Canada's boreal forest as their nesting place and home for several months of the year.



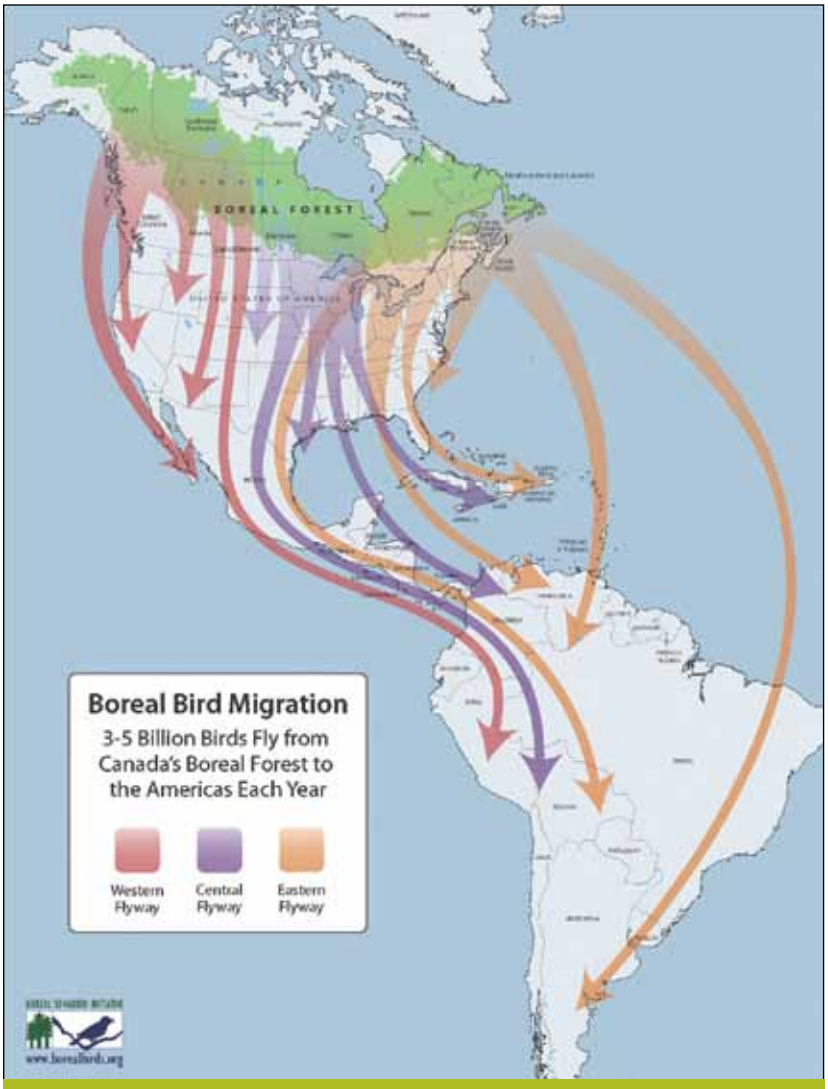
Major lakes and reservoirs in Canada's boreal forest.

Dammed and free-flowing rivers in Canada's boreal forest.

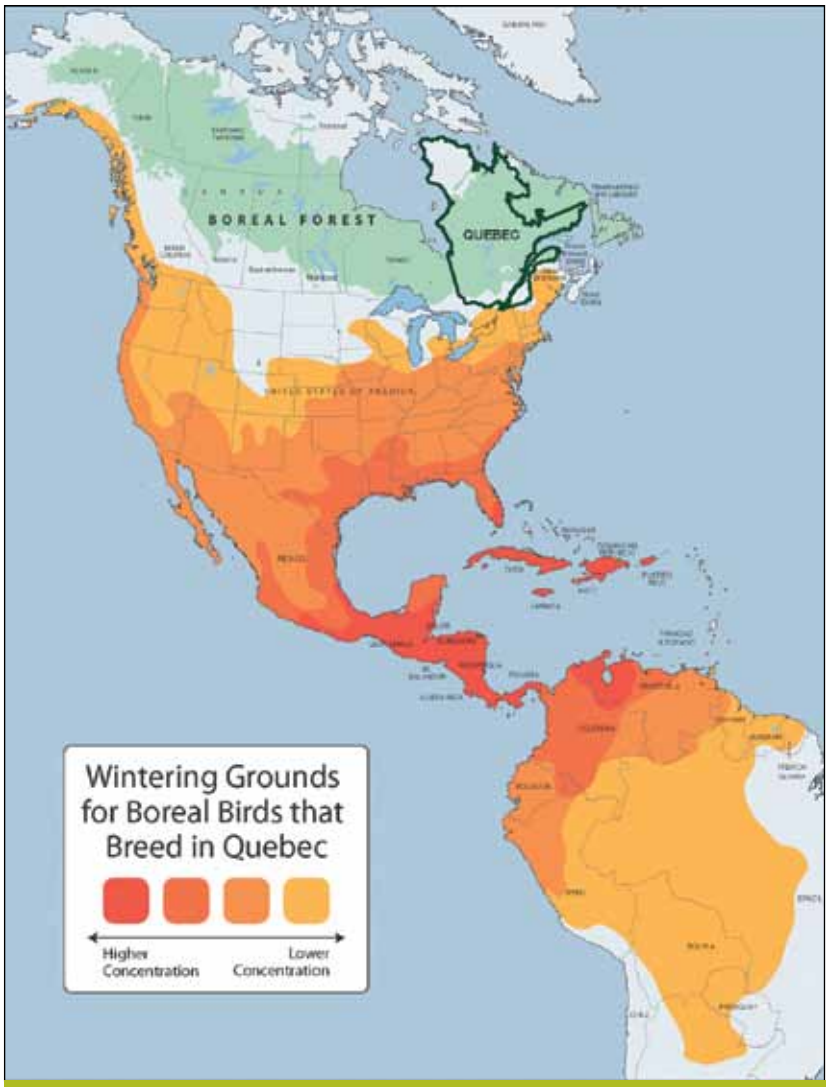
II. BOREAL FOREST: BIRD NURSERY OF THE NORTH

The North American boreal forest supports more than 50 percent of the global populations of 96 bird species, including landbirds, shorebirds, and waterbirds.[10] The boreal is critical to the majority of iconic species such as the Common Loon, Whooping Crane, Canada Warbler, and White-throated Sparrow.

While boreal forest wetlands provide abundant habitat for a multitude of wildlife, birds are the most visible. Canada's boreal forest is estimated to support between 1 and 3 billion breeding birds each year. In the fall, when adults are joined by the new generation of young, a total of 3 to 5 billion birds migrate south to winter in areas from southern Canada to southern Argentina.



Boreal-breeding birds migrate south as far as South America.



Birds that breed in Quebec can be found wintering all across the Americas, with particularly high concentrations in Central America and the Caribbean.

The birds' spring return from their wintering grounds after a long migration coincides with a surge in available food throughout the boreal forest. The wetlands and waterways play a crucial role in providing this feast. Insects are hatched from the multitude of water bodies as soon as the ice melts, yielding a protein bonanza for the birds' survival. Swarms of midges, mosquitoes, black flies, and a host of other insects define the months of June and July in the boreal. Many species of birds, and later their young, take full advantage of this rich food source and its abundant larvae either directly or indirectly.

Boreal breeding birds and their offspring also feed on fish and aquatic invertebrates that live in the waterways, as well as the abundant seed and fruit crops of summer. Aside from food, the boreal forest provides birds with shelter, space, and water so that they can successfully raise their broods and prepare for a highly risky migration across vast distances. Upon leaving their boreal forest nursery after breeding, these migrant birds deliver their ecological services across the Americas, preying on insects, pollinating flowers, dispersing seeds and, in some cases, providing food to local people.

Winter Destinations of Boreal Landbirds

About 90 percent of all bird species and individuals leave their breeding grounds in Canada's boreal forest after the short breeding season. For landbirds alone, the top five wintering destinations are:[11]

Destination	Est. number of wintering birds
USA	1,150,000,000
Mexico	680,000,000
Brazil	200,000,000
Columbia	110,000,000
Venezuela	60,000,000

The Rusty Blackbird: A 90 Percent Population Decline


Rusty Blackbird

© Jeff Nadler

If you are a birder, finding a Rusty Blackbird has become more difficult in the last 40 years. For every 10 Rusty Blackbirds observed in the 1960s, we are seeing but one today—more than a 90 percent population decline. This downward spiral has prompted the Canadian government to add the bird to the Species at Risk Act, according it "Special Concern" status. The Rusty Blackbird breeds in the boreal forest from Newfoundland to Alaska, as far north as the tree line, always nesting near water.[12] The bird's name actually refers to both the rusty hue that the feathers have in the fall, and the bird's squeaky song, reminiscent of a rusty gate swinging open. In addition to habitat loss across the boreal forest from logging, mining, oil and gas development, and flooding from hydro-electric projects, this species faces threats to its wintering areas in the United States. It associates with other blackbirds (e.g., Red-winged Blackbird, Brewer's Blackbird, Common Grackle, and Brown-headed Cowbird), which are considered crop pests in many states and have historically been subject to massive eradication campaigns. Perhaps some of the Rusty Blackbird's decline is attributable to "collateral damage" from the poisoning of millions of blackbirds in the southeast during the fall and winter, as well as from the massive loss of forested wetlands in the southeastern United States.[13]

LANDBIRDS AND WATER

We often do not think of landbirds when we think of water, but clean water and insect-filled wetlands are a central reason why so many landbirds breed in Canada's boreal forest. Most species adapt their diets to fully profit from the bounty of newly hatched insects to sustain them after long migrations from Latin America and the Caribbean, and into the short summer breeding season. Landbirds that breed in or close to wetlands are particularly reliant on boreal forest wetlands for survival.

Boreal Forest Songbird Populations

Species	% global range in Canadian Boreal Forest
Palm Warbler	98
Connecticut Warbler	92
Swamp Sparrow	80
LeConte's Sparrow	70
Rusty Blackbird	70
Alder Flycatcher	63
Northern Waterthrush	56

Palm Warblers are known for heavily relying on boreal peatlands and wetlands.

© Ashley Hockenberry

The Canada Goose is one of many waterfowl species that nest in the boreal.

NESTING GROUNDS FOR WATERFOWL

All waterfowl depend upon wetlands for safety, shelter, and food. Boreal wetlands provide these basic necessities on a large scale that has enabled populations of waterfowl to thrive. In conjunction with adjacent and connected forest and riparian ecosystems, boreal wetlands provide nesting habitat for an estimated 26 million waterfowl comprising 35 species.[14] An estimated 38 percent of all the waterfowl of Canada and the United States breed in the boreal forest of North America. For 16 species of the most widely hunted and watched ducks, geese, and swans, the boreal forest supports a large percentage of North American populations.

In the eastern Canadian boreal forest, Quebec and Ontario now support the bulk of the world's breeding population of American Black Ducks. A significant number of the world's Hooded Mergansers are also dependent upon the eastern Canadian boreal forest, as are many sea ducks, like the eastern populations of Harlequin Duck and Barrow's Goldeneye, both listed as a species of special concern by the Canadian Federal Government's Species at Risk Act (2010).

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American Black Duck: A Puddler in Trouble

Though their breeding range extends south to Wisconsin in the west and New Jersey in the east, most American Black Ducks breed in the eastern boreal forest. All spend their winter in the eastern United States and extreme southeastern Canada along the southern Great Lakes, the southern St. Lawrence River, and Nova Scotia. Their white wing linings contrast with their dark-chocolate-colored body in flight. At rest, from a distance, they are easily confused with the females of the much more common Mallard. As with many species of waterfowl, the American Black Duck has a close relationship with the beaver—a mammal that is closely associated with the southern boreal forest—using beaver ponds as feeding and rearing areas. American Black Duck populations declined gradually over several decades, based on winter flyway surveys, apparently due to a combination of habitat loss and hunting pressure. More recently, studies of breeding grounds in Canada have shown stable or slightly increasing populations.[15]

FEEDING GROUNDS FOR SHOREBIRDS

Canada's boreal forest wetlands are also vital breeding and migratory stopover habitats for shorebirds—a term typically reserved for sandpipers and plovers. Approximately 75 percent of all regularly occurring North American shorebird species use boreal forest wetlands. As many as 7 million shorebirds are estimated to use the wetlands for breeding, and millions more depend on them as stopover locations during migration. The birds are sustained by the innumerable invertebrates harbored in the mud and soils of the wetlands, including insect larvae, worms, crustaceans, and molluscs, which are the basis of the shorebird diet.

Shorebirds with greater than 50 percent of their breeding populations in North America's boreal forest region include the Greater and Lesser Yellowlegs, Solitary and Spotted Sandpiper, Least Sandpiper, Wandering Tattler, Surfbird, Whimbrel, Semipalmated Plover, Hudsonian Godwit, Short-billed Dowitcher, Wilson's Snipe, and Red-necked Phalarope.[16]

Solitary Sandpiper: The Shorebird of the Boreal Forest[16]

Solitary Sandpiper

The Solitary Sandpiper is one of the species of shorebird most reliant on the wetlands of Canada's boreal forest. This small wader's range stretches from Labrador to Alaska. Never far from water, the sandpiper differs from other North American shorebirds by nesting in trees, often choosing to nest in the abandoned nests of others species such as American Robins. Its breeding biology is poorly understood because, as with many species in the boreal forest, it nests in places that are very difficult to access and usually thick with mosquitoes and blackflies when the birds are breeding. Mosquito larvae, along with a range of other aquatic invertebrates, worms, snails, and even small fish and tadpoles make up the Solitary Sandpiper's diet. The species also differs from many of its congregatory cohorts in that it is usually solitary during migration, as its name implies.[17] The Solitary Sandpiper winters in a range that extends from northern Mexico to Argentina. In contrast to many of the Arctic breeding shorebirds that winter in coastal regions, the Solitary Sandpiper over-winters along the shorelines of forested lakes, ponds, and rivers, and along drainage ditches in agricultural areas.[18] In the Pantanal region of Brazil, the largest South American wetland habitat after the Amazon, the Solitary Sandpiper is reported as the most common species of North American shorebird encountered during the Austral summer. The species' inaccessible breeding and wintering ranges and solitary nature make tracking the population extremely difficult. Conceivably, a large proportion of the Solitary Sandpiper's population could vanish without anyone noticing. A warmer and drier climate induced by global warming could dry the small ponds and wetlands where the species breeds and transform its habitat, leading to population declines. Such a possibility highlights the importance of protecting the boreal forest and its wetlands and also the need to find new ways of monitoring this species.

HAVEN FOR WATERBIRDS

Canada's boreal forest wetlands are critical for a host of waterbird species, a group that includes a wide range of loosely related species from loons to gulls. For many waterbirds, the boreal forest is the prime breeding area. The majority of the world's Pacific Loons, Horned Grebes, Red-necked Grebes, American Bitterns, Yellow Rails, Soras, Mew Gulls, and Bonaparte's Gulls all depend upon watercourses and wetlands in the Canadian boreal forest for successful reproduction. For the loons and grebes, the abundant fish populations of the waterways are the main draw. American Bittern and Yellow Rail depend upon the myriad sedge meadows, cattail marshes, fens, beaver marshes, and delta marshes associated with coasts around Hudson and James Bay. White Pelicans and Caspian Terns also have large nesting colonies at sites within Canada's boreal forest region.

As many as 7 million shorebirds are estimated to use the boreal forest wetlands for breeding, and millions more depend on them as stopover locations during migration.

Yellow Rail: Habitat Threatened

The Yellow Rail is a tiny, secretive marsh bird listed federally in Canada as a species of "Special Concern." This diminutive bird is rarely seen, but its strange clicking "song"—which sounds remarkably like two stones being tapped—reveals its presence. It breeds across much of the south-central boreal forest from Great Slave Lake to the coastal wetlands along the Saint Lawrence River and New Brunswick. The species winters almost entirely in southeastern coastal marshes and wetlands of the United States from the Carolinas to Texas. The highest concentration of breeding Yellow Rails is believed to occur in the salt marshes around James Bay.[19] Despite their remoteness, these boreal wetlands, not unlike prairie potholes, are susceptible to the effects of rapid climate change. For much of the boreal forest region, climate change models predict much warmer and drier summers. This will mean both more fires and more desiccation of wetlands. When combined with loss of habitat from industrial activity, these changes pose tangible threats to this diminutive denizen of the boreal wetlands. Protecting the integrity of coastal marshes from the Carolinas to Texas is also critical to assuring that the Yellow Rail has adequate wintering habitat.[20]

III. AN INTEGRAL CONNECTION: INDIGENOUS PEOPLES, BIRDS, AND WATER

The rich ecology of the boreal forest has supported human populations for millennia. There are hundreds of distinct Aboriginal communities and dozens of Métis[21] communities within Canada's boreal whose lives are intimately linked to the region's land, water, and birds. For the people who have lived on the land for generations, the region's abundant bird and water resources are intertwined with their way of life, their survival, adaptation strategies, and well-being. To most of the boreal's Aboriginal peoples, the forest ecosystem and their traditional culture are one and the same. They do not separate themselves from the forests, rivers, birds, and other wildlife when they talk of their homeland.

Lillian Trapper, Land Use Plan Coordinator for the Moose Cree First Nation adjacent to James Bay, has lived in the heart of the boreal forest most of her life. Trapper, her family, and the Cree communities to which they belong are intimately tied to the rhythms of the seasons expressed through phenomena like freeze-up and goose migration. Geese have sustained the Cree for millennia. Below, Lillian describes the goose hunt and how important it is to the James Bay Cree.

The spring and fall bird migrations are also important to the people of Fort Chipewyan—a Dene, Cree, and Métis community on the edge of the Peace-Athabasca Delta in northern Alberta. Community members hunt waterfowl in the migration seasons, including Mallard, Common Goldeneye, and Canada Goose. Some types of birds, such as loons, are considered sacred by the Dene. Documents of community experience have recorded that Elders could listen to the loons talk and learn what was happening around the water.[22] The people in Fort Chipewyan have noticed declines in waterfowl over the last 40 years. John and Alice Rigney live in Fort Chipewyan and reiterate the importance of the region's migratory bird population (see page 15).

© Ted Cheskey

"Geese are a main staple food for the people of James Bay. During the spring goose migration, community schools close up to two weeks as most people are out on the land at their family camps for the spring goose hunt. This is one of the people's most important seasonal cultural events. It's a time for gathering, sharing, learning, and reconnecting ourselves to the land. Knowledge of values and morals are passed on and the traditional teachings associated with the hunt are shared that include respect, patience, honour, and gratefulness, to name a few. We are taught to respect one another along with our roles and for the handling of geese, such as not to be wasteful with what the goose provides. We are taught patience to be able to sit in a blind for hours early in the morning, then again late into the evening, and to clean each bird properly. We are taught to honour a young hunter for his first goose kill. We are taught to be grateful for our harvest by giving thanks to the Creator, may it be one goose or many that are harvested. The goose hunt is not just a goose hunt. There is so much more as it is a lifestyle from our ancestors and for our future generations as well. There is no place else that I am aware of where people see geese, they get so excited, anxious, and start calling them and without any bird-calling devices. You should hear our children. Geese are so important to us that you can say that it's in our blood."

– Lillian Trapper, Moose Cree First Nation

© David Hawkins

"Birds are a sign of spring, a very big part of the spring awakening we experience in the north. After the six-month deep freeze of winter, spring is an exhilarating time when the grass turns green, the mosquitoes hum, and bird songs fill the air. In March and April, Dene, Cree, and Métis hunters have always gathered in prime locations to harvest ducks and geese, as millions of birds from every flyway converge on the Peace-Athabasca Delta. In fall, as flocks of geese honk overhead, the birds disappear until only about 15 species like ravens, grouse, chickadees, owls, and grosbeaks remain. Every reduction in migratory bird populations affects the quality of our environment, whether it is a warbler or a swan."

– John and Alice Rigney, Fort Chipewyan

Lesser Yellowlegs

© Glen Tepke

RECOGNIZING INDIGENOUS LAND AND RESOURCE RIGHTS

When the boreal forest is threatened by industry, natural occurrences, or habitat loss, it's not just birds and wildlife that are impacted. The Indigenous peoples who call the boreal forest home and rely upon the many resources it offers—from water and fish to wildlife and mineral and forestry resources—are deeply influenced by changes to the forest and its landscapes. More and more, governments, companies, and non-governmental organizations are realizing the importance and necessity of ensuring that Aboriginal rights and titles are respected in all land-use decisions. Canada took an initial step toward recognizing the rights of First Nations and Inuit Peoples to their lands, territories, and resources by signing the United Nations Declaration on the Rights of Indigenous Peoples in late 2010. A key tenet of the Declaration recognizes "the urgent need to respect and promote the inherent rights of indigenous peoples which derive from their political, economic and social structures and from their cultures, spiritual traditions, histories and philosophies, especially their rights to their lands, territories and resources."

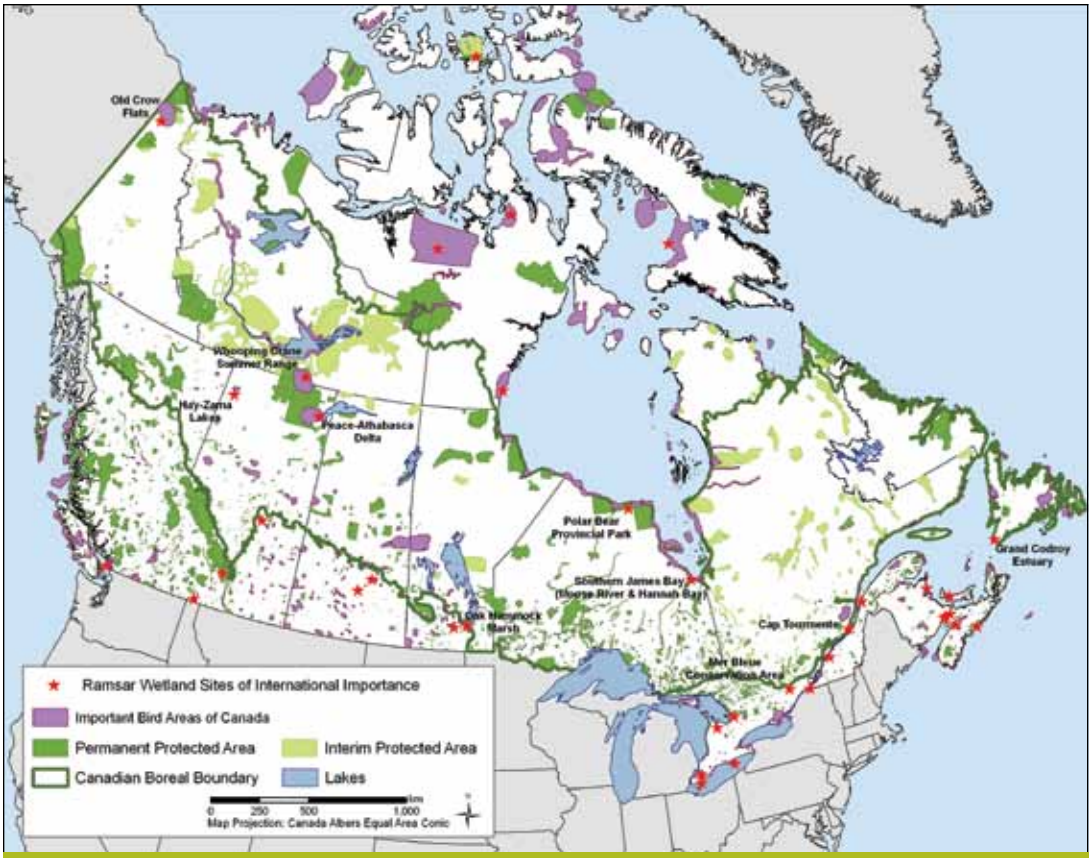
IV. THREATS TO THREE CRITICAL BOREAL WETLANDS

While the vast boreal forest region holds many wetlands and waterways that are highly significant for birds, this report highlights three places as case studies: the Hudson and James Bay Lowlands, the Peace-Athabasca Delta, and Lake Superior. All three areas are under threat from diverse industrial pressures and climate change.

The water-rich lowland plains extending inland to the Canadian Shield from Hudson and James Bay provide breeding habitat for numerous species of water-dependent birds, and core habitat for entire populations of several species. Coastal wetlands, deltas, and tidal flats, and adjacent waters along the Hudson and James Bay Lowlands region of Manitoba, Ontario, and Quebec provide habitat of global significance for migrant and non-breeding waterfowl, shorebirds, and waterbirds, as evidenced by the many Important Bird Areas (IBAs). Yet this area faces challenges posed by mining and by existing and proposed large hydropower projects. The Peace-Athabasca Delta in northern Alberta has been designated as a Wetland of International Importance under the Ramsar Convention,[23] as well as a global-level IBA. Unfortunately, this area has experienced problems, such as poor water quality and pollution due to hydropower, tar sands mining, and agriculture. Lake Superior, which drains a large area of the southern boreal forest, is the largest freshwater lake on Earth, supporting a vast array of birds in the forests and wetlands within its drainage basin. It is also a region, unfortunately, that is experiencing habitat degradation and loss caused by forestry and other industrial development.

In addition to these challenges, none of these areas are immune to the effects of climate change. The impacts of climate change include drying of wetlands, changing species composition in the aquatic systems and forests, and increased frequency of forest fires. Climate change is changing the ecology of the boreal forest, and with it, likely, the abundance and distribution of bird species.

A closer look at these three critical boreal wetlands shows some of the major challenges for the birds that live and breed in these regions.



Ramsar Wetlands and Important Bird Areas of Canada.

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The James Bay Lowlands of Ontario.

© Garth Lenz

Hydropower is a major concern within the Hudson and James Bay Lowlands.

HUDSON AND JAMES BAY LOWLANDS: THE IMPACT OF HYDROPOWER

The Hudson and James Bay Lowlands in Ontario, Quebec, and Manitoba are marked by a multitude of rivers, lakes, and muskeg. These wetlands provide a breeding habitat for a staggering 28 species of waterfowl, 21 waterbird species (e.g., loons, herons, rails, gulls, and terns), and 19 species of shorebirds. For many of them, the lowlands are the species' core breeding range.

Because of their geography and rich resources, James Bay and Hudson Bay also act like giant funnels that concentrate migrating birds in large numbers. In the late summer and fall, these birds move from their Arctic and Sub-Arctic breeding grounds toward their wintering grounds in the southern United States, the Caribbean, Mexico, Central America, and South America. Along the coastal tidal flats, marshes, and deltas, these migrants gather to fuel up and build fat supplies for their long journeys south, and in many cases begin a molt, the process in which birds replace old and damaged feathers. Snow Geese leave here to travel to their winter quarters in the southern United States, and in the Gulf of Mexico. Shorebirds that feed here may make another stop or two in southern Canada or the United States, or they may fly directly to wintering grounds in the Gulf of Mexico, the Caribbean, or South America.

Thirty-three Important Bird Areas have been identified in or along Hudson and James Bay coasts and islands (including Manitoba and Nunavut). The 16 IBAs in James Bay cover much of the coastal zone. According to Lillian Trapper, recognizing only the sites used by the birds is inadequate as a conservation approach:

> "From a First Nation perspective with holistic thinking, all systems and cycles need to be considered. Therefore, we have trouble separating the forests and rivers from the coastline, as the geese use these places along their seasonal migratory routes. If the coastal IBAs depend on the forests and watercourses that drain them for their nutrients, these forests should also be part of the IBAs."

The sites on James Bay provide essential habitat for migratory birds along their migration paths. Productivity in the coastal IBAs depends upon the rivers and streams that flow into James Bay. Some rivers drain thousands of square kilometers of boreal shield before tumbling off the granite heights into a slower serpentine form that snakes through the muskeg of the lowlands. The mighty Moose, Albany, Attiwapiskat, and Ekwan rivers on the Ontario side, and the La Grande, Eastmain, Rupert, Harricana, Nottoway, and Great Whale rivers on the Quebec side, along with thousands of small streams that drain the muskeg in the interior boreal forest, carry the nutrient loads and silt that feed and nourish the coastal marshes.

Within the boreal forest surrounding Hudson Bay and James Bay, many of the great rivers have been dammed or diverted, including the Churchill and Nelson rivers in Manitoba and the Ogoki and Mattagami rivers in Ontario. Some of the largest dams and water diversions are in Quebec. The reservoirs created by the James Bay Project in Quebec cover an area more than 13,300 km^2 (5,135 mi^2)—making them the largest bodies of water ever created by humankind. One of the reservoirs, Caniapiscau, is now the largest impounded lake in Quebec.[24]

Hydroelectric projects are promoted as clean energy, but they can cause major negative impacts to ecological and human communities. While a lake created behind a dam seems benign enough, in reality the flooded area represents permanently lost habitat for the species that lived and reproduced in the forests and wetlands that were flooded. The reservoirs created in the James Bay Project flooded an area representing habitat that could have supported as many as 5 to 10 million birds. This flooded area also represents the loss of other forest and wetland functions and ecological services, such as carbon sequestration.

The James Bay Project has had profound impacts on Cree communities in the region as well, including loss of traditional hunting and fishing grounds, displacement of communities, and social effects.[25] One of the most direct and obvious impacts has been mercury contamination of fish in the reservoirs. Inundation of soil and vegetation as reservoirs fill behind the dams has long been known to result in large increases in mercury, which accumulates in aquatic systems and reaches the highest levels in predatory fish and birds. Fish from reservoirs in the James Bay Project area have been unsafe to eat since the early 1980s, effectively removing a traditional food source that had been used by the Cree for thousands of years.

Currently, Quebec exports massive amounts of electricity to adjacent provinces and the United States, as the hydroelectric installations create more electricity than is needed in the province. The people and birds that depended on the now-flooded areas are paying the price.

Surf Scoter: A Sitting Duck

The Surf Scoter is a heavy-bodied "sea duck."[26] It has one of the most remarkable bills of any duck and most birds. The upper part of the male's bill is swollen and a multicolor mix of white, red, yellow, and black near the base, framed in the velvety black feathers of the head. Some Cree people from coastal James Bay recall playing with the bills from hunted birds as toys in their childhood. The scoter uses its bill to capture a range of invertebrate food. On the breeding grounds, the species eats mainly aquatic invertebrates, while the main food staple of scoters wintering along the ocean coasts appears to be mussels. Along James Bay, molting scoters gather in large numbers over shallow shoals to feed on the shellfish. Its breeding range spans the boreal forest from Alaska to the north shore of the Saint Lawrence River of Quebec, with a large area east of the James Bay coast in Quebec being especially important. Flooding of forested habitat from the hydro-electric megaprojects in Quebec east of James Bay removes prime breeding habitat for this species.[27] Virtually all Surf Scoters spend their winters along the coasts of North America.


Surf Scoter

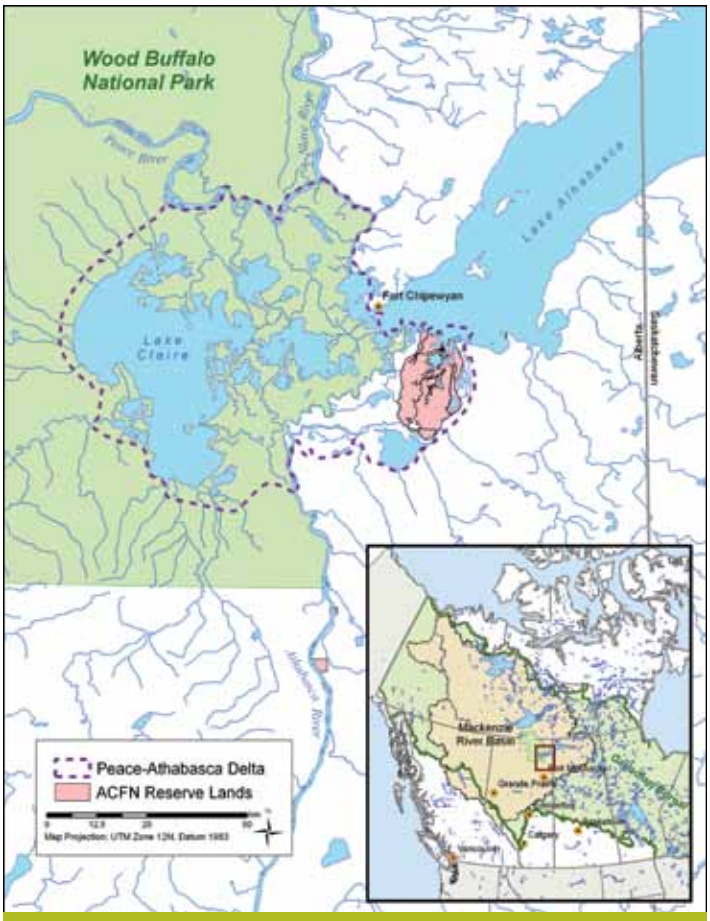
PEACE-ATHABASCA DELTA: WATER QUALITY THREATENED

The Peace-Athabasca Delta, known as the PAD, is recognized as a wetland of global significance under the Ramsar Convention. The PAD provides vital habitat for ducks and geese migrating to and from their breeding grounds on the Mackenzie River lowlands and delta, other Arctic river deltas, and western Arctic islands. About 80 percent of the Peace-Athabasca Delta lies within Wood Buffalo National Park, a UNESCO World Heritage site. The PAD is a globally significant area because it is located far enough north that it supports waterfowl from the Pacific, Central, and Mississippi flyways.[28]

More than 400,000 waterfowl have been recorded in the Delta during spring migration, and during fall migration estimates have exceeded 1 million. In the late 1950s and early 1960s estimates were as high as 320,000 pairs of breeding ducks. More recently, breeding estimates have been lower, with records showing about 120,000 pairs of dabbling ducks such as Mallard, Gadwall, American Wigeon, and Northern Pintail and about 40,000 pairs of diving ducks such as Canvasback, Redhead, and Lesser Scaup.

In all, 215 bird species have been recorded in the PAD region, including the globally endangered Whooping Crane. Wood Buffalo National Park, which lies adjacent to the PAD, is the only natural breeding ground for this majestic crane.

Unfortunately, human activities upstream threaten the quality and quantity of water that sustains the PAD's wetlands, and these effects are exacerbated by climate change. The Bennett Dam, on the Peace River's upper reaches in British Columbia, has reduced flows into the PAD since the 1960s, especially the high spring flows that originally filled thousands of small ponds that are vital for waterfowl breeding sites. Tar sand oil strip-mining and drilling operations, and subsequently their air and water pollution and water use, affect the quantity and quality of the flow of the Athabasca River into the PAD.



The Peace-Athabasca Delta and Athabasca Chipewyan First Nation Reserve Lands.

Whooping Crane

Whooping Crane: Home in the Delta

The story of the Whooping Crane is a remarkable one. In 1941, only 15 were known in the wild. Great efforts have been made to protect and recover this species, and in 2009, 273 were counted at the white crane's wintering area near Corpus Christi, Texas. For most of this time the entire natural population of the Whooping Crane has been breeding in Canada's Wood Buffalo National Park, adjacent to the Peace-Athabasca Delta, though efforts to introduce a population in northern Wisconsin recently bore fruit after many years.[29] Whooping Cranes and other wetland birds in the Peace-Athabasca Delta region face many threats, despite the remoteness of this massive wetland area. Hotter, dryer summers and less snow in the winter—both symptoms of climate change—have contributed to an increasing shortage of the water that sustains the wetlands. These changes are once again threatening the future of the Whooping Crane.

LAKE SUPERIOR WATERSHED: THE EFFECTS OF LOGGING

Lake Superior covers 82,100 km^2 (31,698 mi^2) and is approximately the same size as New Brunswick and Prince Edward Island combined.[30] It is the largest freshwater lake on Earth by surface area and the third-largest by volume. It is also the deepest Great Lake, with a maximum depth of 406 m (1,332 ft). There are 2,938 km (1,825 mi) of shoreline. The Lake Superior watershed radiates out around the lake to cover 127,700 km^2 (49,305 mi^2).

Between 25 million and 127 million birds live within this watershed.[31] This area is known for the ancient exposed granites of the Canadian Shield. The impervious bedrock and thin soils mean imperfect drainage, which leads to numerous lakes and wetlands, making the Lake Superior watershed an area of high significance for many wetland-dependent birds. Some of the highest densities of several boreal species recorded in the second *Breeding Bird Atlas of Ontario* occurred in the Lake Superior watershed, including Alder Flycatcher and the federally threatened Olive-sided Flycatcher, two aerial insectivores with a preference for wet habitat.

Logging is the predominant human activity in the Lake Superior Basin, as the area falls entirely within the road-accessible part of the southern boreal forest. In Ontario, most of the north is Crown land, administered by the province and leased to forestry companies. The forestry companies replant trees after cutting, but manipulation of the regenerating forest through herbicides, pesticides, and broad-scale mechanical harvesting can result in a forest lacking diversity.

While many species of birds do occupy the managed forests, many other species are absent, as these managed forests lack their more specialized habitat requirements. Also, pesticide applications for spruce budworm, a cyclic caterpillar that feeds on the leaves of spruce trees, reduce food supply for a number of bird species that eat these caterpillars. Budworm-eating bird species include Blackpoll, Bay-breasted, Tennessee, and Blackburnian warblers.

Forestry operations can also affect bird populations by leading to degradation of rivers and lakes from erosion caused by logging roads, reducing food supplies for birds and other wildlife. Additionally, road building and improper placement and maintenance of culverts can impair natural water flows, negatively affecting aquatic animal communities. Fortunately, many forest companies are adopting more sustainable practices, such as protecting sensitive ecosystems (e.g. riparian zones) in their harvesting operations, managing for key species, and including biodiversity protection within their management regimes. A recent Best Management Practice adopted in Quebec will lead to the protection of 6,300 km^2 of riparian habitat.

The Lake Superior watershed is particularly important for the Alder Flycatcher and the federally threatened Olive-sided Flycatcher.

Logging poses a serious threat to many birds in the Lake Superior watershed.

Canada Warbler: Threatened Species Calls Lake Superior Home

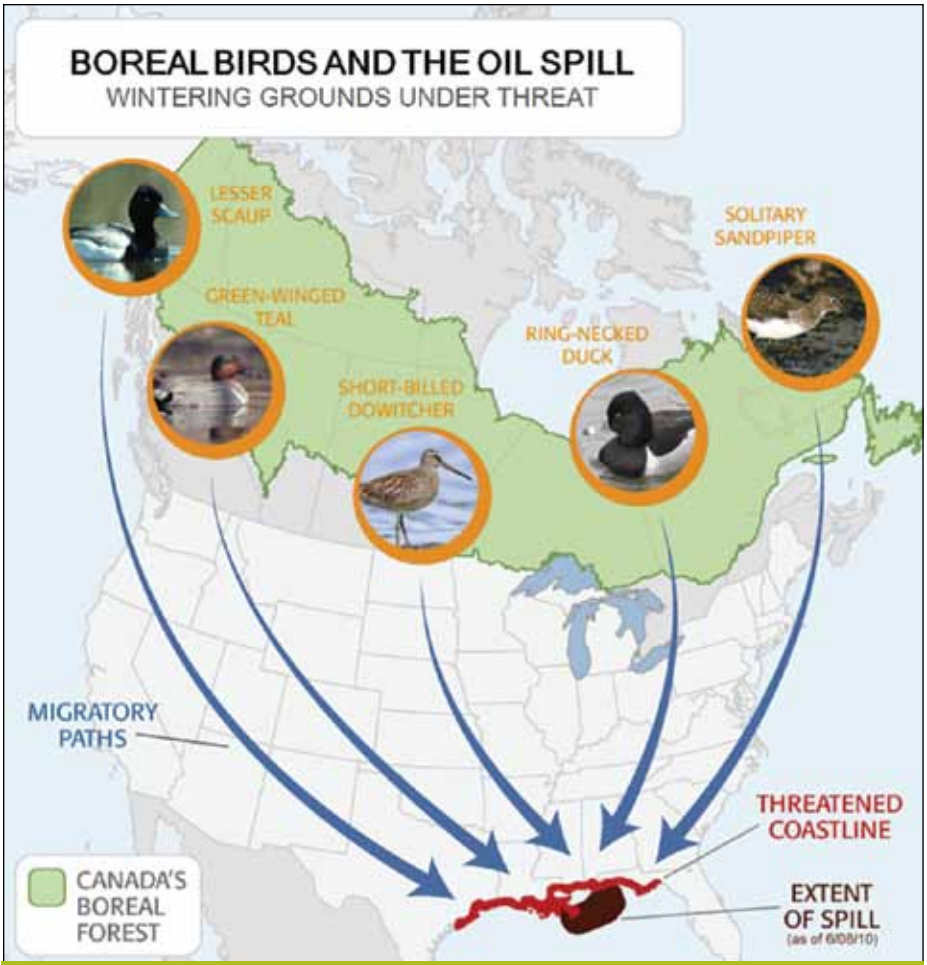
The Canada Warbler was recently accorded the status of "threatened" under the Canadian Species at Risk Act. It reaches some of its highest densities on the northern and eastern sides of Lake Superior. Its full range spans the boreal forest from the Peace River headwaters in British Columbia to Newfoundland, extending into the central United States along the Appalachian Mountains. On the Canadian Shield around Lake Superior, the Canada Warbler is considered by some as the "portage bird," typically encountered along the portage trails that canoeists use to avoid rapids or waterfalls. It builds its nests close to the ground in the tumbled-over root masses that are typical of moist forests with shallow-rooted trees, or in mossy boulder-strewn areas. While most of the Canada Warbler population nests in Canada, this small bird, weighing only 10 to 12 grams (less than an ounce), migrates far south to winter in the eastern Andean slopes and the upper Amazon Basin of northern South America.[32,33]

V. BEYOND THE BOREAL: THE GULF OIL SPILL

Though the Gulf of Mexico seems remote from the boreal forest, the Gulf Coast region is the winter home and migratory stopover location for millions of boreal birds. The impact of the Deepwater Horizon oil spill of April 2010—one of the worst environmental disasters ever to occur in the United States—still reverberates through the Gulf ecosystem. Its effects are particularly visible in the images of oiled birds. However, less visible effects of the spill continue to impact the food chain and habitat of boreal migratory birds that depend on the Gulf Coast region as wintering habitat or as a critical stopover before the flight across the Gulf of Mexico to winter in Central and South America.

Impacts on habitat and ecological productivity are likely to go on for years, as has been shown from the Exxon *Valdez* and other oil spills.

From 20 percent to more than 50 percent of the breeding populations of Lesser Scaup, Green-winged Teal, Northern Pintail, and American Wigeon live within the boreal forest and are particularly reliant on the Gulf Coast. Ducks Unlimited estimates that 13 million North American ducks winter along the Gulf Coast and in its inland marshes. For example, an estimated 40 percent of the Green-winged Teal population and 30 percent of Lesser Scaup winter on the Gulf Coast. Greater Snow Geese from Hudson and James Bay also over-winter along the Gulf Coast in significant numbers. These waterfowl are not only important parts of local ecological communities, but also provide food and sustenance for hunters and many indigenous communities in the boreal forest. Scientists will undoubtedly continue to track the health and well-being of migratory birds as the long-term effects of the Gulf oil spill are revealed in the coming months and years.



Numerous birds that breed in the boreal spend their winters in the region affected by the 2010 Gulf oil spill.

Short-billed Dowitcher: Returning to the Gulf

The Short-billed Dowitcher is one boreal bird species that uses the Gulf as an over-wintering site. It is a medium-size shorebird with a long, straight bill that it uses like a sewing machine needle to probe for food. The species has three distinct races that breed in separate regions of the boreal. *Limnodromus griseus caurinus* is limited to northwestern British Columbia, southern Alaska, and southwestern Yukon. The range of *L. g. hendersoni* stretches across northern Alberta to north-western Manitoba, and *L. g. griseus* breeds around James Bay and east to western Labrador. The Gulf Coast and Atlantic wintering population is believed to be made up entirely of *hendersoni* and *griseus* and includes approximately one-third of the entire population of these races.[34]

The Short-billed Dowitcher, like many other shorebirds, feeds along the tidal zone. It is here that it could come into contact with oil, oily sediment, or toxic by-products taken up by the arthropods, worms, crustaceans, and molluscs on which it feeds.

Short-billed Dowitcher

Lesser Scaup: Millions Over-winter in the Gulf

The Lesser Scaup's breeding range stretches from eastern Ontario to the boreal forest of Alaska, and south into the prairies. About 70 percent of its total population is estimated to be within the boreal forest.[35] The "Bluebill," as it is called by hunters, is very similar to the slightly larger Greater Scaup, which has a more limited breeding range farther north. Like most duck species, the male departs once nesting is initiated, leaving the female to brood the eggs and tend the ducklings until they are able to fend for themselves. Like many species of waterfowl, Lesser Scaup ducklings will sometimes congregate in a "crèche" that includes dozens of ducklings from several broods, along with a few females. The Lesser Scaup is a diving duck that feeds on a wide range of prey from aquatic invertebrates, including molluscs, arthropods, crustaceans, worms, plants, seeds, and even the occasional fish. One feeding technique involves rapidly moving its beak underwater through benthic matter, filtering out prey items. More than 1 million of these birds (approximately 30 percent of the estimated total population) over-winter along the Gulf Coast from Florida to Texas.

Lesser Scaup

VI. PRESERVING BIRDS THROUGH POLICY

Governments can support the bird life that depends on the boreal forest through some crucial policy options:

Recognize the global conservation and cultural value of Canada's boreal forest

In the United Nations' 2011 International Year of Forests, the recognition of Canada's boreal forest—its wetlands and waterways, along with the birds and other biodiversity that they support—should be a national priority. More waterways, lakes, and wetlands within Canada's boreal forest should be recognized as either Ramsar Wetlands of International Importance or UNESCO World Heritage sites. A current example is the proposed Pimachiowin Aki World Heritage site, championed by First Nations and supported by the governments of Ontario and Manitoba.

Adopt the principles of the Canadian Boreal Forest Conservation Framework

The Canadian Boreal Forest Conservation Framework is a bold plan developed by a coalition of Aboriginal leaders, industry, and conservation groups that proposes a new vision for ensuring a sustainable future for Canada's boreal forest region and the peoples that call it their home. This vision acknowledges that:

- Subject to the free, prior, and informed consent of affected Aboriginal governments, the number and size of protected areas within all jurisdictions of Canada's boreal forest should be increased, conserving at least 50 percent of the region from industrial activity.
- State-of-the-art sustainability practices should be in place for areas where industrial development occurs, and development should not go forward without free, prior, and informed consent of affected Aboriginal governments.

Preserve healthy water ecosystems through effective land management

For the health of the birdlife and boreal habitat, it is critical to maintain healthy aquatic ecosystems that can support people, birds, and other wildlife, by keeping at least 50 percent of entire river, lake, and wetland ecosystems, off-limits to large-scale industrial activities and by ensuring state-of-the-art sustainability practices on the remaining landscape. Resource managers and policymakers must protect critical habitat from the fragmentation caused by hydropower development. Protection of river systems, from headwater to mouth watershed, will be needed to ensure that the full complement of migratory fish are sustained and their populations remain healthy, which in turn will help sustain First Nation communities, bird populations and the rest of the ecosystem. Such protection is needed to compensate for freshwater habitat and biodiversity already lost to hydropower development.

Forestry operations across the boreal region must adopt and implement the best sustainable management practices and adhere to standards that not only ensure sustainable forestry, but also allow biodiversity to flourish. Incorporating Bird Conservation Region Plan priorities into individual Forest Management Plans, and ensuring that these plans are operationalized, monitored, and transparent, will be an important part of this process.

Protect key areas such as the Mackenzie Basin, the James Bay Lowlands, and the Peace-Athabasca Delta

Conservation objectives must be given high priority in the Mackenzie watershed, the James Bay Lowlands, and the Peace-Athabasca Delta in partnership with (and with the leadership of) Aboriginal communities. For example, Aboriginal Peoples must be included in negotiations for a new water management strategy for the Mackenzie Basin to mitigate the effects of tar sands and other development on local communities and on internationally significant natural areas such as the Peace-Athabasca Delta and Wood Buffalo National Park. In the James Bay lowlands, Cree communities must lead on land-use planning opportunities and resource management decisions to ensure that their cultural values—including the ecological values that support both historical traditions and rich coastal bird and wildlife populations—are protected and allowed to thrive.

VII. CONCLUSION

While much of the world faces water shortages or loss and degradation of aquatic ecosystems, Canada's boreal forest remains by comparison an aquatic paradise. With this type of habitat becoming increasingly rare in the rest of the world, the vast wetlands and pristine waterways of Canada's boreal forest become even more important for bird populations on a global scale. These wetlands and waterways offer some of the most critical breeding and migratory stopover habitat for billions of wetland-dependent birds in the Western Hemisphere. Canadian governments, environmentalists, and scientists must work to raise awareness of the global significance of the wetlands and waterways of the country's boreal forest and of the human and environmental pressures that threaten them. Governments and other decision makers have a responsibility to develop innovative ways to ensure that the wetlands and waterways of Canada's boreal forest remain healthy and strong for generations to come.

Fortunately, there are a number of opportunities for Canada's federal, provincial, and territorial governments, Aboriginal governments, and Canadian and international organizations to apply visionary solutions to ensure that the wetlands and waterways of Canada's boreal forest remain one of the world's most significant bird habitats. Governments and organizations should take strong steps to protect this critical habitat before those opportunities are gone forever.

The vast wetlands and waterways of Canada's boreal forest provide immense opportunities for bird-friendly conservation.

ENDNOTES

1 Although this report refers to the boreal forest in Canada, the same stories, lessons, and conclusions can be made about the boreal ecosystems of Alaska.

2 Environment Canada. 2009a. *Canada's 4th National Report to the United Nations Convention on Biological Diversity*. Ottawa, Ontario.

3 Carlson, M., J. Wells, D. Roberts. 2009. *The Carbon the World Forgot: Conserving the Capacity of Canada's Boreal Forest Region to Mitigate and Adapt to Climate Change*. Boreal Songbird Initiative and Canadian Boreal Initiative, Seattle, Washington and Ottawa, Ontario. 33 pp.

4 Minns, C.K., J.E. Moore, B.J. Shuter, and N.E. Mandrak. 2008. "A Preliminary National Analysis of Some Key Characteristics of Canadian Lakes." *Canadian Journal of Fisheries and Aquatic Science* 65: 1763-1778.

5 By surface area.

6 Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, D.C.

7 Parish, F., A. Sirin, D. Charman, H. Joosten, T. Minayeva, and M. Silvius, editors. 2007. *Assessment on Peatlands, Biodiversity and Climate Change: Executive summary*. Global Environment Centre, Kuala Lumpus and Wetlands International, Wagerningen.

8 Carlson, M., J. Wells, D. Roberts. 2009. *The Carbon the World Forgot: Conserving the Capacity of Canada's Boreal Forest Region to Mitigate and Adapt to Climate Change*. Boreal Songbird Initiative and Canadian Boreal Initiative, Seattle, Washington, and Ottawa, Ontario. 33 pp.

9 Figure 5 in Gorham, E. 1991. *Northern Peatlands: Role in the Carbon Cycle and Probable Responses to Climatic Warming*. Ecological Applications 1(2): 182-195.

10 Blancher, P., and J. Wells. 2005. "The Boreal Forest Region: North America's Bird Nursery." *American Birds* 59:30-39.

11 Blancher, P. 2003. *Importance of Canada's Boreal Forest to Landbirds*. Canadian Boreal Initiative and Boreal Songbird Initiative, Ottawa, Ontario, and Seattle, Washington.

12 Avery, Michael L. 1995. *Rusty Blackbird (Euphagus carolinus), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/200 doi:10.2173/bna.200

13 Wells, J. 2007. *Birder's Conservation Handbook: 100 North American Birds at Risk*. Princeton University Press, Princeton, NJ.

14 Blancher, P., and J.V. Wells. 2005. *The Boreal Forest Region: North America's Bird Nursery*. American Birds, The 105 Christmas Bird Count. Available from: http://www.audubon.org/BIRD/CBC/105thSummary.html

15 Longcore, Jerry R., Daniel G. Mcauley, Gary R. Hepp and Judith M. Rhymer. 2000. *American Black Duck (Anas rubripes), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/481

16 Blancher, P., and J.V. Wells. 2005. *The Boreal Forest Region: North America's Bird Nursery*. American Birds, The 105 Christmas Bird Count. Available from: http://www.audubon.org/BIRD/CBC/105thSummary.html

17 Moskoff, William. 1995. *Solitary Sandpiper (Tringa solitaria), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/156doi:10.2173/bna.156

18 Many species of shorebirds gather in large flocks on migration. Some species, such as the Semipalmated Sandpiper, number in the hundreds of thousands or even millions.

19 Michel Robert, Benoît Jobin, François Shaffer, Luc Robillard and Benoit Gagnon 2004. "Yellow Rail Distribution and Numbers in Southern James Bay, Québec, Canada." *Waterbirds: The International Journal of Waterbird Biology*, Vol. 27, No. 3 (Sept., 2004), pp. 282-288.

20 Wells, J. 2007. *Birder's Conservation Handbook: 100 North American Birds at Risk*. Princeton University Press, Princeton, NJ.

21 A person of mixed blood; *especially often capitalized*: the offspring of an American Indian and a person of European ancestry. Source: http://www.merriam-webster.com/dictionary/metis

22 Athabasca Chipewyan First Nation (ACFN). 2003a. *Traditional Land Use Study*. Fort Chipewyan, Alberta.

23 The Convention on Wetlands (Ramsar, Iran, 1971)—called the "Ramsar Convention"—is an intergovernmental treaty that commits countries to maintain the ecological character of their Wetlands of International Importance and to plan for the "wise use" of all of the wetlands in their territories. http://www.ramsar.org/

24 Hydro-Quebec Project on James Bay Road: http://www.jamesbayroad.com/hydro/index.html

25 McDonald, M., et al 1997. *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion*.

26 Diving ducks dive under the water in pursuit of prey. In the case of Scoters, they dive to get to molluscs such as mussels and clams. Some other divers, such as the mergansers, pursue fish.

27 Savard, Jean-Pierre L., Daniel Bordage and Austin Reed. 1998. *Surf Scoter* (Melanitta perspicillata), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/363 doi:10.2173/bna.363

28 IBA Canada website; *Peace-Athabasca Delta Important Bird Area (IBA) Site Summary—Fort Chipewyan, Alberta*. http://www.ibacanada.ca/site.jsp?siteID=AB002&lang=EN

29 Wells, J. 2007. *Birder's Conservation Handbook: 100 North American Birds at Risk*. Princeton University Press, Princeton, NJ.

30 See *Superior Pursuit: Facts About the Greatest Great Lake* http://www.seagrant.umn.edu/superior/facts

31 Based on a range of 2 to 10 birds per hectare.

32 Reitsma, Len, Marissa Goodnow, Michael T. Hallworth and Courtney J. Conway. 2010. *Canada Warbler* (Wilsonia canadensis), *The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/421doi:10.2173/bna.421

33 Wells, J. 2007. *Birder's Conservation Handbook: 100 North American Birds at Risk*. Princeton University Press, Princeton, NJ.

34 Jehl, Jr., Joseph R., Joanna Klima and Ross E. Harris. 2001. *Short-billed Dowitcher (Limnodromus griseus), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/564 doi:10.2173/bna.564

35 Austin, Jane E., Christine M. Custer and Alan D. Afton. 1998. *Lesser Scaup (Aythya affinis), The Birds of North America Online* (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/338 doi:10.2173/bna.338

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