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Danger in the Nursery

Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest

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About Boreal Songbird Initiative

The Boreal Songbird Initiative (BSI) is a nonprofit organization dedicated to outreach and education about the importance of the Boreal forest region to North America's birds. BSI works to mobilize environmental and birding groups and individuals to protect North America's birds. More information about the Boreal Songbird Initiative is available at www.borealbirds.org.

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Executive Summary

Each spring more than half of America's birds flock to the Canadian Boreal forest to nest. There, a square mile (2.5 square kilometers) of forests, lakes, river valleys, and wetlands can support as many as 500 breeding pairs of migratory birds. Yet almost all the biggest oil companies are mining and drilling important Boreal forest and wetlands—that could eventually cover an area the size of Florida —to access thick, low-grade petroleum. Canada and the United States must protect migratory birds and bird habitat from this new form of high-impact energy development.

Tar sands oil development creates open-pit mines, habitat fragmentation, toxic waste holding ponds, air and water pollution, upgraders and refineries, and pipelines spreading far beyond the Boreal forest. This development is destroying habitat for waterfowl and songbirds that come from all over the Americas to nest in the Boreal. Each year between 22 million and 170 million birds breed in the 35 million acres of Boreal forest that could eventually be developed for tar sands oil. Faced with tar sands development, migrating birds don't just move elsewhere, since they depend on a certain type of habitat. Not only do many adult birds die when faced with lost and fragmented habitat and ponds of mining waste, but future generations of birds will have lost their chance to exist.

The Boreal forest tar sands area is incredibly important for birds as a breeding habitat and as a globally important flyway for a great abundance and diversity of wetland-dependent birds. Unfortunately the rapidly expanding industrial tar sands oil extraction operations increasingly place these birds at risk.

Virtually every facet of tar sands oil development has the potential to harm Boreal birds—many of which are migratory birds that are protected by treaty and national law. Combining the various estimates of the loss of birds from mining and in situ operations, this report projects a cumulative impact over the next 30 to 50 years ranging from a low of about 6 million birds lost to as high as 166 million birds lost. Beyond the direct habitat effects, there are many other impacts to birds that, while harder to quantify, are known or expected to cause significant problems for birds and other wildlife.

- **Tar Sands Mining Causes Bird Habitat Loss:** The projected strip-mining of 740,000 acres (300,000 hectares) of forests and wetlands in the tar sands will result in the loss of breeding habitat for between 480,000 and 3.6 million adult birds. The corresponding impact on breeding will mean a loss of 4.8 million to 36 million young birds over a 20-year period, and 9.6 million to 72 million birds over a 40-year period.

- **Tailings Ponds Result in Oiled Birds:** Annual bird mortality from landing and drowning in the oily water in current tar sands tailings ponds could range from more than 8,000 birds to well over 100,000. A doubling of tailings ponds—likely with proposed tar sands mining expansions—would increase projected annual bird deaths to between 17,000 and 300,000 individuals.

- **Tar Sands Drilling Fragments Bird Habitat:** Tar sands drilling projects are projected to result in the loss of more forest-dependent bird habitat than strip-mining and could harm as many as 14.5 million breeding birds from direct habitat loss and as many as 76 million birds from fragmentation and habitat degradation over a 30- to 50-year period.

- **Water Withdrawals Harm Wetlands and Water Habitats:** Current tar sands operations are permitted to remove enough water to meet the needs of a city of 3 million people, and water removal is projected to increase by 50 percent as planned tar sands projects become operational. Changes to Alberta's rivers and underground reservoirs could have profound impacts on the hundreds of thousands of birds that are dependent on the wetland habitats in the tar sands and Peace-Athabasca Delta and other parts of the Mackenzie River watershed.

- **Air and Water Toxins Bioaccumulate:** Major impacts are likely from tar sands air and water pollution, which causes the accumulation of toxins in tissues, and from acid rain and nitrogen deposition, air pollution, and heavy metals. Birds can inhale, ingest, or come into contact with contaminants; these contaminants can build up in the tissues and lead to weakened birds, problems with reproduction, and often to eventual death. Pollution can also lead to changes in habitat and food, which will indirectly harm the health of birds. And these effects are not limited to birds—tar sands toxins can affect other wildlife and local human populations as well.

- **Global Warming Contributed to by Tar Sands Is Already Affecting Boreal Birds:** The tar sands are Canada's fastest growing source of greenhouse gas emissions, producing as much as three times the global warming pollution per barrel from the production process as conventional oil production. The Boreal ecosystem is at the frontlines in feeling the impacts of global warming—and so are Boreal birds. Long-distance migratory birds may arrive too late to find food as insects emerge earlier in the spring due to warmer temperatures. Birds that hoard food to get through the winter and to start feeding their young in the spring may find that the food spoils before the first freeze. Global warming could hit ducks especially hard as wetlands become drier.

Recommendations for Protecting Boreal Birds

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The Bay-breasted Warbler (top), the White-throated Sparrow (center), and the Gray Jay (bottom), are extremely reliant on the Boreal forest for habitat.

Many scientific reports on the status of the planet's birds over the past 20 years warn of drastic declines and looming extinctions. This report echoes these cautions and challenges decision-makers and companies to get it right in Canada's Boreal forest, while there is still time to save the great bird nursery of the Americas. Tar sands oil development should not be the solution to our fuel needs. Both Canada and the United States have a choice to make between fuels that harm the environment (including damage to critical bird habitat) and clean energy now.

An immediate solution to the pace of development and to environmental problems relating to tar sands oil development is a moratorium on new projects and project expansions and clean up of existing projects. Alberta needs to prove that even the current level of production can be done without serious environmental impacts. At the same time, U.S., Canadian, and domestic and international regulations must be strengthened to protect the Boreal forest and the birds who make the forest their home. And oil companies should adhere to strict standards of best practices for their current operations in order to protect habitat and minimize their impact on land, air, and water.

CHAPTER 1

Canada's Boreal Forest: North America's Nesting Bird Destination

The Canadian Boreal is one of the world's most important breeding areas for migratory birds, with 1 billion to 3 billion individual birds from at least 300 species known to regularly breed there.[1] Approximately 30 percent of all shorebirds (7 million) and 30 percent of all landbirds (1 billion to 3 billion) that breed in the United States and Canada do so within the Boreal.[2] The section of the Boreal forest that sits over the tar sands region of Alberta is part of the forest that is rapidly being fragmented by oil development. As much as 34 to 66 percent of the Canadian Boreal forest—up to 438 million acres (177 million hectares)—may no longer be intact.[3,4] In Alberta, 86 percent of the Boreal forest is no longer considered intact.[5] This puts valuable bird habitat at risk.

The section of the Boreal forest underlain by tar sands in Alberta is critical not only as traditional breeding habitat for its 22 million to 170 million birds, but also as a globally important flyway for a great abundance and diversity of wetland-dependent birds. Unfortunately, the rapidly expanding industrial oil extraction operations in Alberta's Boreal forest place these birds increasingly at risk on a massive scale.

The Boreal Forest Is a Critical Ecosystem

The tar sands deposits lie in the Boreal Plains ecozone, which covers 183 million acres (74 million hectares) and extends across British Columbia, Northwest Territories, Alberta, Saskatchewan, and Manitoba. Forest cover is predominantly coniferous, and black spruce, white spruce, jack pine, and tamarack are principal species. Hardwoods, particularly trembling aspen, white birch, and balsam poplar, are well represented and are often mixed with conifers.[6] This is one of the most productive forest areas in western Canada.

Approximately 35 percent of the Boreal Plains is composed of wetlands, including bogs, fens, swamps, marshes, and shallow open-water ponds. Some areas of the Boreal Plains have 85 to 95 percent wetland ground coverage, and these areas can stretch as wide as 120,000 acres (48,500 hectares). These extensive wetland and water areas combine with complex uplands to create a diverse mosaic of bird habitats. Most of these wetlands are connected through surface and groundwater hydrology and are highly susceptible to damage from tar sands development.

> *Each year between 22 million and 170 million birds breed in the 35 million acres of Boreal forest likely to be developed for tar sands in Alberta.*

Using satellite imagery, scientists documented that less than 20 percent of the 182 million acre (73 million hectare) Boreal Plains ecozone (the portion of the southern Boreal extending from the eastern foothills of the Canadian Rockies to south-central Manitoba) remains in large, intact forest landscapes.[7] Between 1990 and 2000, one million acres (406,000 hectares) of the southern Boreal of Saskatchewan and Manitoba and more than 5.9 million acres (2.4 million hectares) of the Boreal of Quebec were disturbed by human-caused influences, including forestry, road-building, and other infrastructure development.[8]

The region of the Boreal that covers northeastern Alberta is a biologically rich area that is known to support at least 292 species of breeding birds, including most of the declining species and 65 bird species of conservation concern.[9,10] While Boreal forest habitat supports densities of breeding birds ranging from 0.64 to 4.86 breeding individuals per acre depending on habitat type, studies of breeding birds in northern Alberta have found some of the highest densities anywhere within the Boreal, often exceeding 4.86 birds per acre.[11]

The area is also an important migratory corridor for large numbers of ducks, geese, cranes, and shorebirds. Many of these birds use the Peace-Athabasca Delta directly to the north (and downstream) or portions of the river system near agricultural areas along the western and southern edges of the tar sands as staging areas.[12] Surveys in the 1970s estimated up to 1.4 million waterbirds using the Delta in fall migration.[13] Limited aerial surveys of shorebirds in the Delta in 1999 found single-day counts of 11,000 and 14,000 birds.[14] In some years, the bulk of the world's population of birds such as Ross's Goose has migrated through the Boreal forest.[15] In other years, they are joined by large numbers of White-fronted Geese, Lesser Sandhill Cranes, and central flyway populations of Canada Geese.[16] Aerial surveys of the Peace-Athabasca Delta in late June and July 1998-2001 found as many as 400,000 molting ducks, coot, and geese.[17] In August and September in those same years, numbers peaked at 800,000 individuals.[18]

Table 1. Cumulative Declines in Some Boreal-Dependent Birds, 1968–2006[a]

Species	40-Year Decline (%)
Horned Grebe	> 60%
Lesser Yellowlegs	> 90%
Short-billed Dowitcher	> 50%
Boreal Chickadee	> 70%
Olive-sided Flycatcher	> 70%
Bay-breasted Warbler	> 70%
Blackpoll Warbler	> 80%
Canada Warbler	> 80%
Dark-eyed Junco	> 40%
White-throated Sparrow	> 30%
Evening Grosbeak	> 70%
Rusty Blackbird	> 90%

[a] From Canadian portion of Breeding Bird Survey, except for Short-billed Dowitcher, which is referenced in Wells, J.V. 2007. *Birder's Conservation Handbook: 100 North American Birds at Risk.* Princeton University Press, Princeton, N.J.

The Boreal Forest Supports Large Populations of Songbirds, Shorebirds, and Waterfowl

The Boreal supports more than 25 percent of the global populations of 149 bird species and the bulk of some of North America's most abundant bird species.[19] An estimated 38 percent (26 million) of all of the waterfowl of Canada and the United States breed in the Boreal. More than 208 million Dark-eyed Juncos, 116 million White-throated Sparrows, 96 million Yellow-rumped Warblers, 102 million American Robins, and 73 million Swainson's Thrushes are among the abundant birds that rely on the Canadian Boreal for breeding every year.[20]

Virtually all species of Boreal nesting birds also make use of parts of the Boreal during migration. Some birds rely more on the Boreal for migratory stop-over habitat than for breeding or wintering. For example, the White-rumped Sandpiper does not breed in the Boreal but makes extensive use of Boreal wetlands during fall and spring migration.[21] Other shorebirds such as the Pectoral Sandpiper that have insignificant portions of their breeding range in the Boreal, are also highly reliant on Boreal wetlands during migration.[22] Many waterfowl species also regularly migrate through a large part of the Boreal.

Within the tar sands, surveys at or over tailings ponds and small natural lakes have regularly documented tens of thousands of waterbird migrants. For example, a spring 2003 survey documented more than 16,000 birds, largely geese, ducks, and shorebirds; however, radar suggested that at least four times that many (64,000) may have actually passed over, as many birds may go visually undetected, especially at night.[23] At Gordon Lake, south of Fort McMurray, one-day counts as high as 5,600 have been documented during the spring, and estimates during fall migration of up to 100,000 ducks have been reported.[24] Kearl Lake has had single-day spring counts as high as

2,700 birds, and of more than 1,000 birds at McClelland Lake.[25,26] A study in 1972-73 in Syncrude's tar sands lease area found over 1,000 waterbirds present each day during spring and fall migration.[27] The same study documented 1,500 ducks using a section of the Athabasca River on a single day during spring migration. A 1984 study, also on the Syncrude lease, reported more than 18,000 geese observed passing over during fall migration.[28]

Similarly, at Utikuma Lake on the southwest edge of the tar sands, aerial surveys documented over 100,000 waterbirds of 29 species using the lake including up to 20,000 gulls, 8,000 Canvasbacks, 5,000 Lesser Scaup, 4,900 Bufflehead, 4,500 Western Grebes, and 4,000 Mallards.[29] The Peace-Athabasca Delta has also been estimated to support as many as 130,000 breeding waterfowl—birds that must pass over or near the tar sands during migration.[30] Among these breeding birds have been as many as 20,000 Mallards, over 15,000 Lesser Scaup, nearly 10,000 Canvasbacks, 7,000 Common Goldeneye, and 5,000 Bufflehead.[31]

Approximately 94 percent of individual birds migrate out of the Boreal after breeding, heading to other countries in the Western hemisphere, or even outside the hemisphere.[32] More species winter in the United States (the lower 48 states) than in any other country or region—a total of 204 species, or approximately 63 percent of Boreal breeding birds.[33]

Tar Sands Development Puts Some of the World's Most At-Risk Birds in Danger

Recent global assessments have shown that an ever-increasing number of bird species are at risk. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species now includes more than 10 percent of the world's birds in some conservation concern category, and BirdLife International has documented a doubling of the extinction rate of birds in the last century.[34] In North America alone, more than 400 bird species are list as being of conservation concern on one or more conservation lists, and there are more than 70 North American species on the IUCN Red List.[35]

Some of North America's most rapidly declining birds are among those most reliant on the Boreal. Waterfowl like Greater and Lesser Scaup have declined by about 150,000 birds a year since the late 1970s,[36] and the three scoter species have dropped by more than 50 percent since the 1950s.[37] Another wetland bird species, the Horned Grebe, has declined by 60 percent since the late 1960s.[38]

Two of the species showing the most severe documented declines are species that are highly reliant on the Boreal forest—the Lesser Yellowlegs and the Rusty Blackbird. Both have seen drops of more than 90 percent over the last 40 years.[39] Other species have had less severe but still steep declines, including the Olive-sided Flycatcher (70 percent decline), Canada Warbler (80 percent decline), Bay-breasted Warbler (70 percent decline), Evening Grosbeak (70 percent decline), White-throated Sparrow (30 percent decline), and the Short-billed Dowitcher (50 percent decline in some populations).[40]

Many of the waterbird and shorebird species that migrate through the Boreal forest are already at risk in their range, including the endangered Whooping Crane that nests just to the north of the tar sands.

Many of the shorebird species that have been documented migrating through the Boreal forest where tar sands are being developed are birds of conservation concern that have shown significant declines and/or have relatively small populations that place them at higher risk. Shorebird species that have been documented in the region include Black-bellied Plover and American Golden-Plover, Lesser Yellowlegs, Sanderling, Semipalmated Sandpiper, White-rumped Sandpiper, Pectoral Sandpiper, Stilt Sandpiper, and Red-necked Phalarope.[41]

The only wild, migratory population of the highly endangered Whooping Crane nests solely in and near northeastern Wood Buffalo National Park to the north of today's open-pit mines.[42] Birds from this population migrate over the Boreal tar sands region and occasionally stop over at wetland locations.[43]

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OLIVE-SIDED FLYCATCHER

The Olive-sided Flycatcher migrates as far south as Bolivia and Amazonian Brazil during the winter, the longest migration of any North American passerine. It nests in the Boreal, including in the Boreal forest underlain with tar sands. The flycatcher has had one of the largest declines seen in the past 40 years (76 percent). It is on Canada's official list of threatened bird species and considered a species of concern in the United States.[a]

[a] Wells, J.V. 2007. Birder's Conservation Handbook: 100 North American Birds at Risk. Princeton University Press, Princeton, NJ.

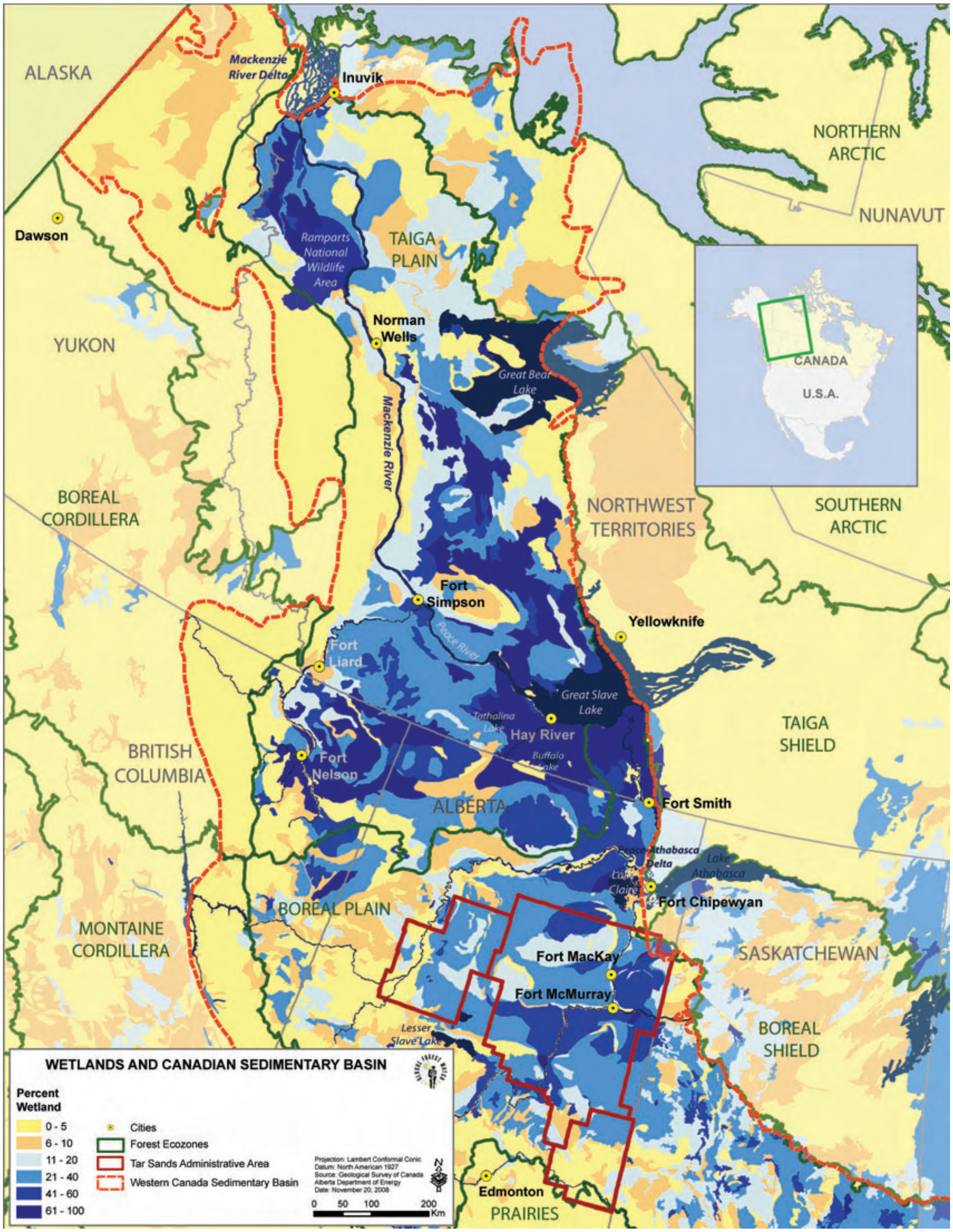
Table 2. At-Risk Birds of the Tar Sands Region

Common Name (Family in Bold)	Scientific Name	Alberta Species at Risk	Committee on the Status of Endangered Species in Canada (COSEWIC)	Canadian Species At Risk Act	IUCN Red List 2008
Ducks, Geese, and Swans (Anatidae)					
Trumpeter Swan	Cygnus buccinator	At Risk			
Northern Pintail	Anas acuta	Sensitive			
Green-winged Teal	Anas crecca	Sensitive			
Greater Scaup	Aythya marila				
Lesser Scaup	Aythya affinis	Sensitive	C3-Status Evaluation Needed (Low Priority)		
Harlequin Duck	Histrionicus histrionicus	Sensitive			
White-winged Scoter	Melanitta fusca	Sensitive			
Partridges, Grouse, Turkeys, and Old World Quail (Phasianidae)					
Sharp-tailed Grouse	Tympanuchus phasianellus	Sensitive			
Grebes (Podicipedidae)					
Pied-billed Grebe	Podilymbus podiceps	Sensitive			
Horned Grebe	Podiceps auritus	Sensitive			
Western Grebe	Aechmophorus occidentalis	Sensitive	C1-Status Evaluation Needed (High Priority)		
Pelicans (Pelecanidae)					
American White Pelican	Pelecanus erythrorhynchos	Sensitive			
Bitterns, Herons, and Allies (Ardeidae)					
American Bittern	Botaurus lentiginosus	Sensitive			
Great Blue Heron	Ardea herodias	Sensitive			
Hawks, Kites, Eagles, and Allies (Accipitridae)					
Osprey	Pandion haliaetus	Sensitive			
Bald Eagle	Haliaeetus leucocephalus	Sensitive			
Northern Harrier	Circus cyaneus	Sensitive			
Northern Goshawk	Accipiter gentilis	Sensitive			
Broad-winged Hawk	Buteo platypterus	Sensitive			
Swainson's Hawk	Buteo swainsoni	Sensitive			
Golden Eagle	Aquila chrysaetos	Sensitive			
Caracaras and Falcons (Falconidae)					
American Kestrel	Falco sparverius		C2-Status Evaluation Needed (Medium Priority)		
Peregrine Falcon	Falco peregrinus	At Risk	Special Concern	Threatened	
Rails, Gallinules, and Coots (Rallidae)					
Yellow Rail	Coturnicops noveboracensis			Special Concern	
Sora	Porzana carolina	Sensitive			
Cranes (Gruidae)					
Sandhill Crane	Grus canadensis	Sensitive			
Whooping Crane	Grus americana	At Risk		Endangered	Endangered
American Golden-Plover	Pluvialis dominica		C3-Status Evaluation Needed (Low Priority)		
Piping Plover	Charadrius melodus	At Risk		Endangered	Near Threatened
Sandpipers, Phalaropes, and Allies (Scolopacidae)					
Upland Sandpiper	Bartramia longicauda	Sensitive			
Long-billed Curlew	Numenius americanus	Sensitive		Special Concern	
Red Knot	Calidris canutus	May Be at Risk			
Semipalmated Sandpiper	Calidris pusilla		C1-Status Evaluation Needed (High Priority)		
Buff-breasted Sandpiper	Tryngites subruficollis		C1-Status Evaluation Needed (High Priority)		Near Threatened
Red-necked Phalarope	Phalaropus lobatus		C1-Status Evaluation Needed (High Priority)		
Red Phalarope	Phalaropus fulicarius		C3-Status Evaluation Needed (Low Priority)		

Table 2. At-Risk Birds of the Tar Sands Region (Continued)

Common Name (Family in Bold)	Scientific Name	Alberta Species at Risk	Committee on the Status of Endangered Species in Canada (COSEWIC)	Canadian Species At Risk Act	IUCN Red List 2008
Skuas, Gulls, Terns, and Skimmers (Laridae)					
Caspian Tern	Sterna caspia	Sensitive			
Forster's Tern	Sterna forsteri	Sensitive			
Black Tern	Chlidonias niger	Sensitive			
Typical Owls (Strigidae)					
Northern Hawk Owl	Surnia ulula	Sensitive			
Barred Owl	Strix varia	Sensitive			
Great Gray Owl	Strix nebulosa	Sensitive			
Short-eared Owl	Asio flammeus	Sensitive		Special Concern	
Goatsuckers (Caprimulgidae)					
Common Nighthawk	Chordeiles minor	Sensitive	Threatened		
Woodpeckers and Allies (Picidae)					
Black-backed Woodpecker	Picoides arcticus	Sensitive			
Pileated Woodpecker	Dryocopus pileatus	Sensitive			
Tyrant Flycatchers (Tyrannidae)					
Olive-sided Flycatcher	Contopus cooperi		Threatened		Near Threatened
Least Flycatcher	Empidonax minimus	Sensitive			
Eastern Phoebe	Sayornis phoebe	Sensitive			
Great Crested Flycatcher	Myiarchus crinitus	Sensitive			
Eastern Kingbird	Tyrannus tyrannus		C3-Status Evaluation Needed (Low Priority)		
Swallows (Hirundinidae)					
Bank Swallow	Riparia riparia		C2-Status Evaluation Needed (Medium Priority)		
Barn Swallow	Hirundo rustica	Sensitive	C1-Status Evaluation Needed (High Priority)		
Chickadees and Titmice (Paridae)					
Boreal Chickadee	Poecile hudsonica		C3-Status Evaluation Needed (Low Priority)		
Creepers (Certhiidae)					
Brown Creeper	Certhia americana	Sensitive			
Wrens (Troglodytidae)					
Sedge Wren	Cistothorus platensis	Sensitive			
Wagtails and Pipits (Motacillidae)					
Sprague's Pipit	Anthus spragueii	Sensitive		Threatened	Vulnerable
Wood-Warblers (Parulidae)					
Cape May Warbler	Dendroica tigrina	Sensitive			
Black-throated Green Warbler	Dendroica virens	Sensitive			
Blackburnian Warbler	Dendroica fusca	Sensitive			
Bay-breasted Warbler	Dendroica castanea	Sensitive			
Common Yellowthroat	Geothlypis trichas	Sensitive			
Canada Warbler	Wilsonia canadensis	Sensitive	Threatened		
Emberizids (Emberizidae)					
Baird's Sparrow	Ammodramus bairdii	May Be at Risk			
Blackbirds (Icteridae)					
Bobolink	Dolichonyx oryzivorus	Sensitive			
Rusty Blackbird	Euphagus carolinus	Sensitive	Special Concern	Special Concern	Vulnerable
Baltimore Oriole	Icterus galbula	Sensitive			
Fringilline and Cardueline Finches and Allies (Fringillidae)					
Evening Grosbeak	Coccothraustes vespertinus		C2-Status Evaluation Needed (Medium Priority)		

Figure 1. Wetlands Coverage in the Boreal Region Impacted by Tar Sands Development



Source: Global Forest Watch Canada.

The Boreal in Alberta and in the Northwest Territories that are feeling the impact of tar sands development are rich in wetlands, providing critical habitat for many shorebirds and waterbirds.

CHAPTER 2

Tar Sands Operations Create a Web of Danger for Boreal Birds

Alberta's tar sands production has doubled over the last 10 years to approximately 1.32 million barrels per day of crude bitumen in 2007.[1] The environmental "footprint" of tar sands development has grown so rapidly that the United Nations Environment Program identified the Athabasca tar sands as of one of the world's top 100 hotspots of environmental change.[2] Although tar sands development has already caused significant damage in the region, development is still in the very early stages; there are many development proposals underway that would put the Boreal forest even more at risk. If current proposed and approved projects are developed as planned, tar sands development may reach 4.5 million barrels per day in 2020.[3]

Tar sands lie 100 feet or deeper beneath the Boreal forest and consist of a mixture of sand, clay, silt, and water with approximately 10 percent bitumen—the tar-like substance that can be converted to synthetic oil. Today, most tar sands oil production results in vast open-pit mines—some as large as three miles wide and 300 feet deep. But only a fraction of the bitumen deposits are close enough to the surface to be mined. The bulk of the established reserves (82 percent) are deeper and must be extracted by injecting high-pressure steam into the ground to soften the bitumen so it can be pumped to the surface. Both mining and in situ drilling cause habitat loss and fragmentation, damage delicate wetlands, produce air and water contaminants, use large quantities of water, produce high amounts of greenhouse gas emissions, and are spurring industrialization of the Boreal and other ecosystems even beyond the immediate area underlain with tar sands.

Tar Sands Mining Destroys Boreal Bird Habitat

Estimates show that approximately 740,000 acres (300,000 hectares) of the tar sands will be strip-mined to access bitumen deposits over the next 30 to 50 years.[4] Already, existing mines encompass approximately 160,000 acres (65,000 hectares). Strip-mining wipes out all wildlife and plant habitat. The site preparation process requires draining all lakes, ponds, or other wetlands, diverting any streams and rivers that flow through the mineable area, clearcutting forests, and removing all vegetation. Then, hydraulic shovels and trucks are used to dig as deep as 300 feet into the earth to remove the forests, peat, and ultimately, the tar sands layer.

Boreal forest habitat supports densities of breeding birds ranging from 0.64 to 4.86 breeding individuals per acre, depending on habitat type.[5] Based on these density estimates, the projected strip-mining of 740,000

Tar sands development would turn pristine Boreal wilderness into a network of industrial sites.

acres of forests and wetlands in the tar sands will result in the loss of breeding habitat for between 480,000 and 3.6 million adult birds. In addition, this loss of breeding habitat represents a loss of opportunity for continued production of young birds by future breeding adults. Almost no habitat restoration work is undertaken in a mined area during the first 20 years of a project, and there is no evidence to date to show that any tar sands mined areas can be restored to their prior habitat conditions.[6] The reclamation performance of the tar sands industry has been very poor to date. Until very recently, none of the land reported as reclaimed by industry was certified by the Alberta government.[7] The reclamation of peatlands (fens or bogs) in the Athabasca Boreal region has not yet been demonstrated.[8] Thus, it is reasonable to expect that there will be no production of young birds from mined tar sands areas for at least 20 to 40 generations. Using an average productivity of one fledgling per breeding pair, this would represent lost production ranging from 4.8 million to 36 million young birds over a 20-year period and between 9.6 million and 72 million birds over a 40-year period. Unfortunately, there is no evidence that bird productivity in mined tar sands areas will ever return to pre-mining levels.

Tailings Ponds From Mining Trap Birds in Oily Waste

Containing a toxic mixture of bitumen, salts, naphthenic acids, and polycyclic aromatic hydrocarbons (PAHs) together with water, sand, silt, and fine clay, tar sands tailings ponds are produced as a by-product of mining. Naphthenic acids, when first released from the mining process, can be acutely toxic, as can PAHs. Both naphthenic acids and PAHs can have sublethal impacts on animals including carcinogenic and mutagenic effects.[9]

These watery waste dumps represent a serious threat to the hundreds of thousands of waterfowl that migrate through the Athabasca River valley each year. The name "tailings ponds" suggests small bodies of water, but these waste holding facilities and their associated dikes are some of the largest human-made structures in the world.[10] The largest tailings ponds measure more than 3 miles across.[11]

As some of the largest bodies of water in the area, these tailings ponds represent seemingly attractive short-term resting stops for upward of 400,000 migrant waterfowl heading to the Peace-Athabasca Delta and beyond.[12] Unfortunately, these ponds also can serve as death traps for waterfowl and shorebirds, which can become oiled with waste bitumen after landing in a pond.[13] Oiled birds can become weighed down and incapable of flight or can face death from hypothermia after their feathers lose their insulating properties.[14] Heavily oiled birds often sink rapidly, making it difficult to measure the number of birds killed on the tailings ponds. The deadly effects of these tailings ponds are most likely to be seen during early spring, when natural water bodies are still frozen and the tailings ponds are the area's only open water, and during severe weather conditions, when migrating birds are forced out of the sky into any seemingly suitable habitat.[15] Such an event occurred in May 2008 when at least 500 ducks died after landing on a Syncrude tailings pond.[16] At least 38 species have been documented as casualties on tar sands

> *The projected strip-mining of 740,000 acres of forests and wetlands in the tar sands will result in the loss of breeding habitat for between 480,000 and 3.6 million adult birds over the next 30-50 years. The corresponding impact on breeding will mean a loss of 4.8 million to 36 million young birds over a 20-year period and a loss of 9.6 million to 72 million birds over a 40-year period.*

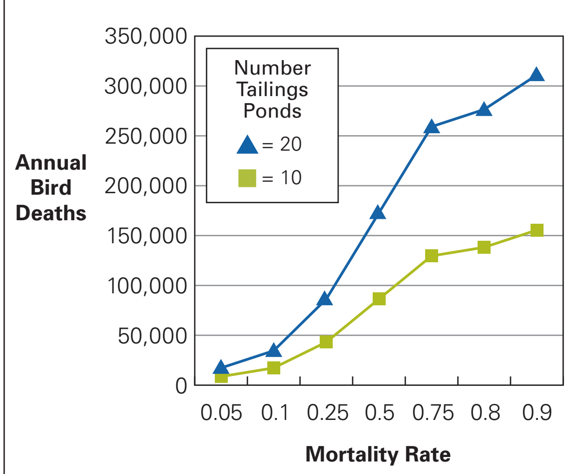
tailings ponds, including many waterfowl and shorebird species but also, perhaps surprisingly, landbirds such as Red-tailed Hawk, Willow Ptarmigan, Evening Grosbeak, and Tree Swallow.[17]

Alberta's tar sands tailings ponds can measure as much as 3 miles across. They are seemingly attractive resting stops for migrating waterfowl—but once birds land in the oily water, they often sink rapidly and die.

TAILINGS POND BIRD MORTALITY

It is difficult to estimate the number of birds that may be killed annually at tar sands tailings ponds, but one recent paper noted that hundreds of birds are typically known to be oiled every year at each of 10 or more tailings ponds in the region.[18] Little public information is released about bird deaths, making it difficult to know the true number, but such an estimate could place the number of birds killed annually at a thousand or more. Given the oiling and mortality rates reported in several sources and the hundreds of thousands, or even millions, of migratory birds that pass over the Boreal forest underlain with tar sands each spring and fall, it is expected that the true number is much higher.[19] The spring 2008 event in which virtually all of the 500 ducks that landed on the Syncrude tailings pond died within hours shows the risk that these tailings ponds present to wetland-dependent flocking birds.[20]

Figure 2. Bird Deaths at Tailings Ponds

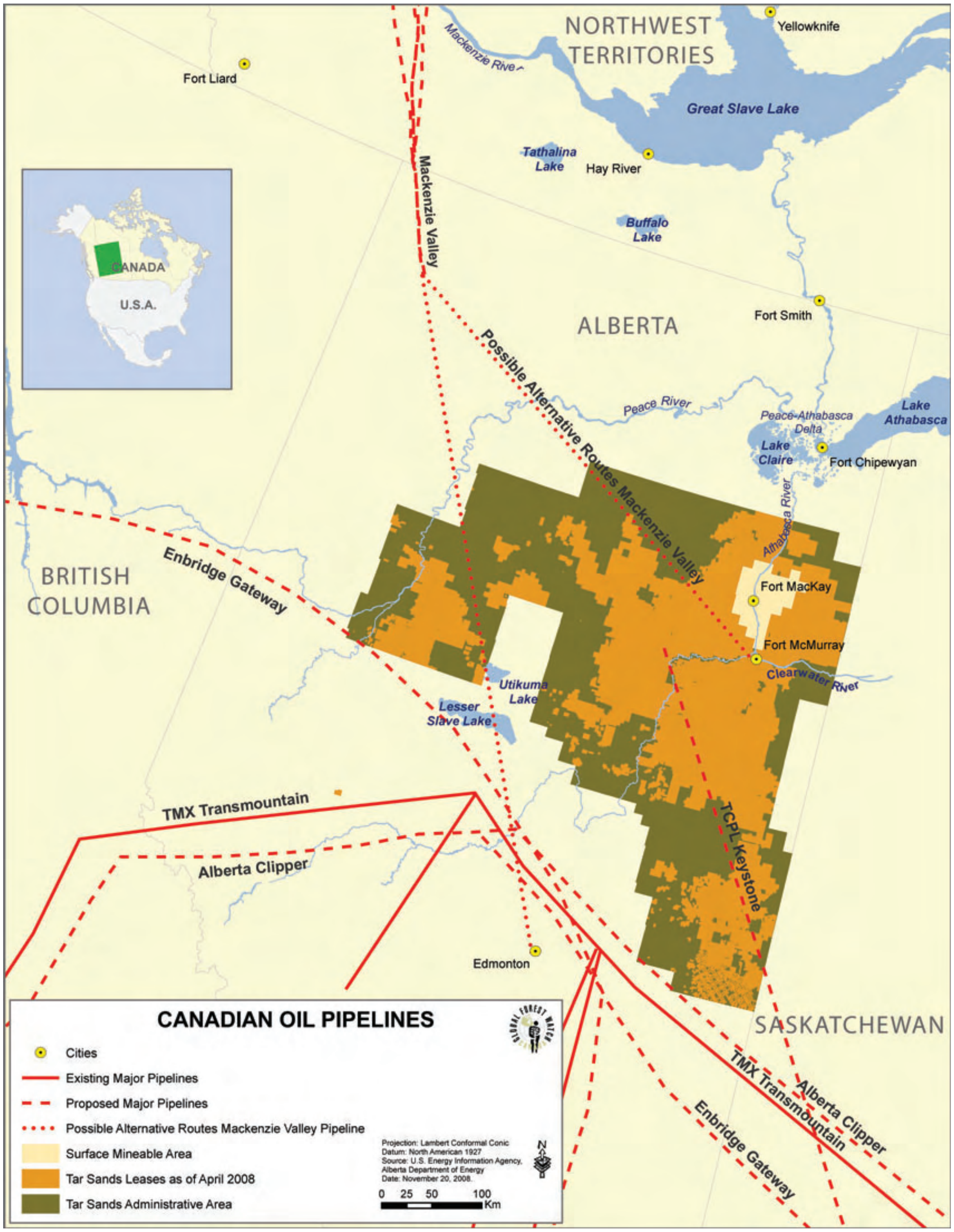


Number of birds that could be killed at the approximately ten existing tailing ponds (green square) or a doubling of tailings ponds (blue triangle) at different rates of mortality ranging from 5 percent to 90 percent.

Conservative projections using recently published landing rates of birds on tailings ponds with deterrent systems show that annual bird mortality on current tar sands tailings ponds could range from more than 8,000 birds to well over 100,000, depending on mortality rates during oiling events, which have been documented to be as high as 80 percent to 90 percent in some instances.[21,22] As tar sands operations increase and more tailings ponds become operational, the risk will increase as well. A doubling of tailings ponds—likely under the current mining capacity expansion—would increase annual projected bird deaths to between 17,000 and 300,000 individuals. If, even irregularly or under adverse weather conditions, a large flock or flocks of migrating birds died in these ponds, as occurred in spring 2008 when 500 birds died in one incident, it could represent a loss of a significant proportion of the population in species with limited numbers and/or in species that are experiencing significant declines. For example, the Lesser Scaup, which has declined by some estimates by as much as 70 percent in the last three decades, is one of the most widely reported casualties of tar sands tailing ponds.

> *Annual bird mortality on current tar sands tailings ponds could range from more than 8,000 birds to well over 100,000. A doubling of tailings ponds would increase projected annual bird deaths to range from 17,000 to 300,000 individuals.*

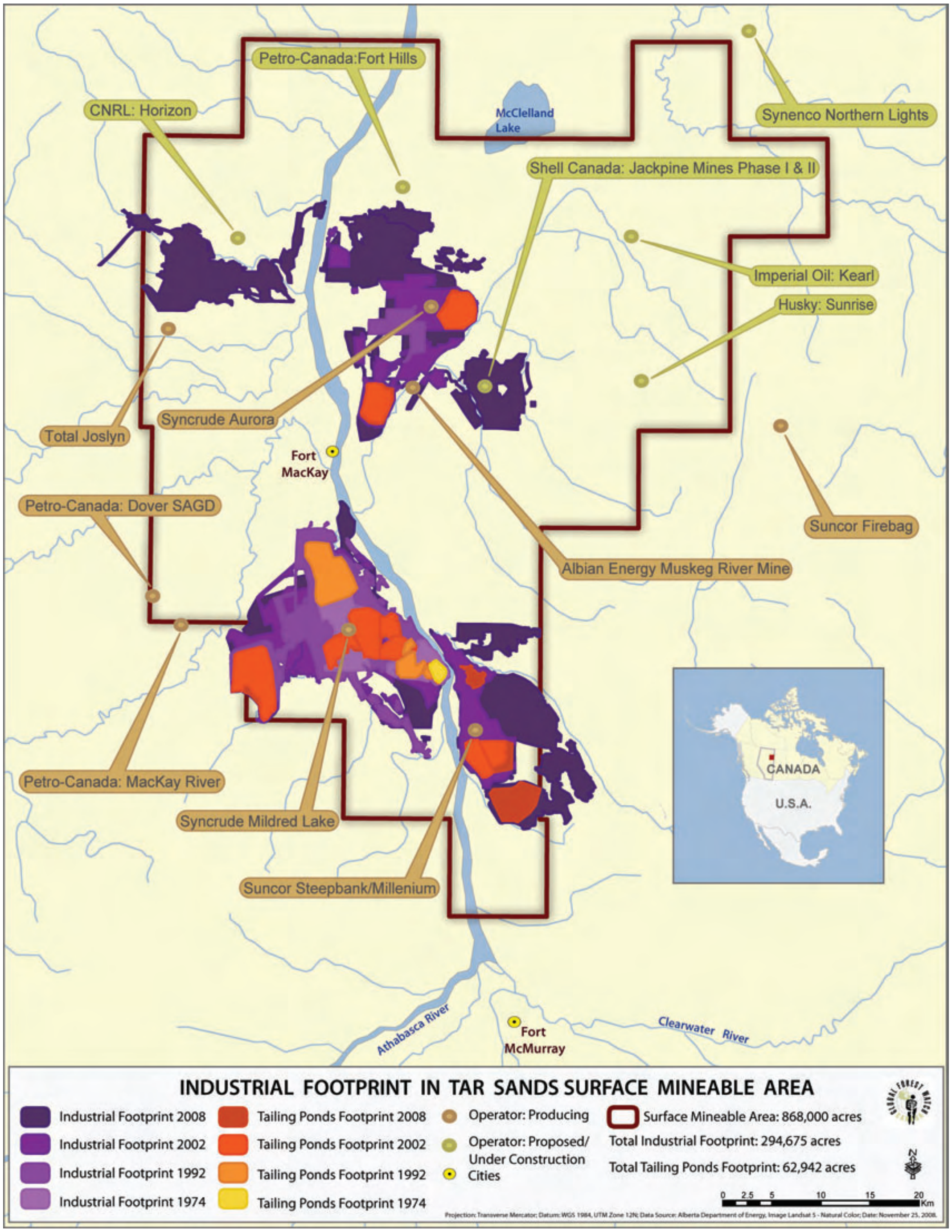
Figure 3. Tar Sands and Pipelines



Source: Global Forest Watch Canada.

The Alberta tar sands lie at the center of a network of proposed and existing pipelines. The tar sands administrative area is approximately the size of Florida. While a portion of the region is already being strip-mined for tar sands oil, most of the area will eventually be drilled using systems such as steam assisted gravity drainage (SAGD). The majority of the area was already under agreements between the Alberta government and oil companies by April 2008.

Figure 4. Industrial Footprint in Tar Sands Mining Area, 1974-2008



This map shows the change in the industrial footprint of the tar sands mines and tailings ponds from 1974-2008 in the mineable tar sands. The companies shown on this map are some of the major players both in the mineable tar sands region and the in situ development region.

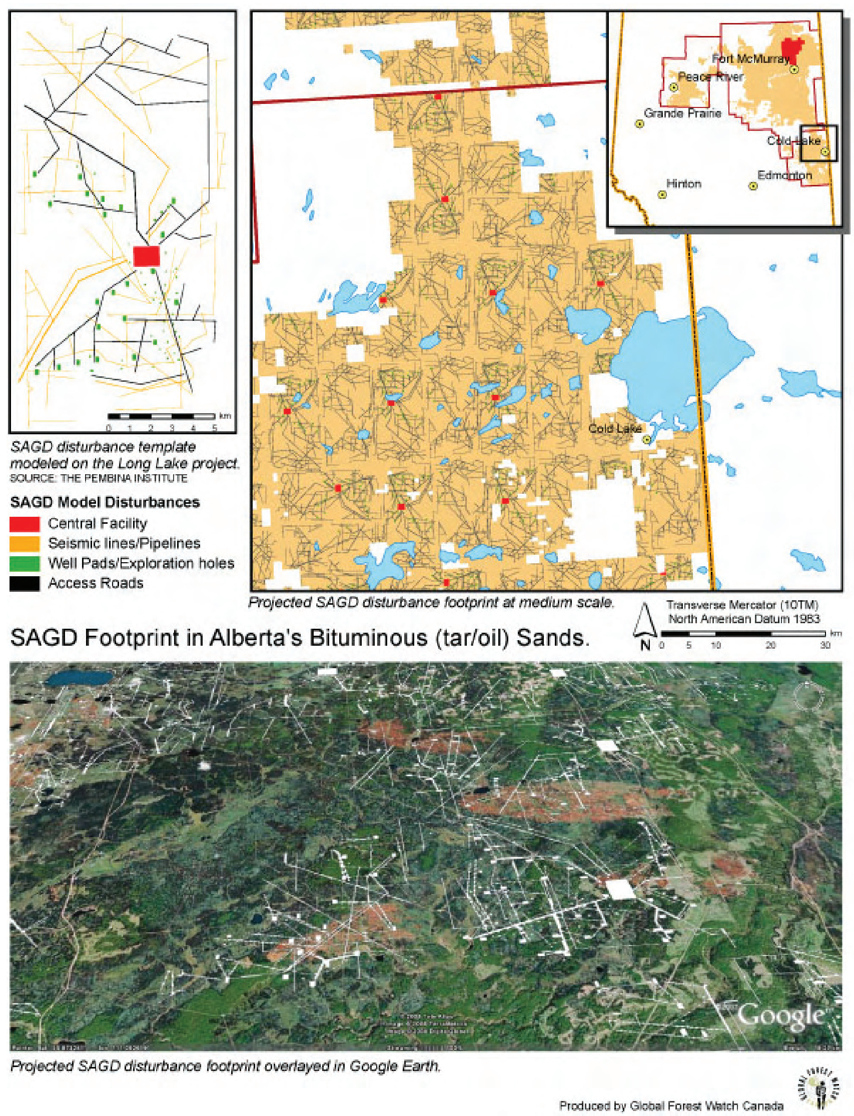
Tar Sands Drilling Fragments Bird Habitat

While the loss of habitat from tar sands strip-mining is significant, it represents just a small part of the habitat loss that is projected to occur as the even wider-reaching in situ drilling gets underway. More than 80 percent of established tar sands reserves are too deep for recovery via strip-mining and must instead be extracted using in situ drilling techniques that need a dense network of roads, pipelines, well pads, compressor stations, and energy generation facilities. Current leases for in situ development, which cover more than 43 percent of the 35 million acres of Boreal forest tar sands, are projected to remove more than 1.2 million acres of habitat for infrastructure – more than will be removed by strip-mining.[24,25] This will result in the loss of habitat for an additional 777,000 to 5.8 million forest-dependent breeding birds and will eliminate the next generations of millions of young birds.[26] If leases are eventually extended as planned to the entire 35 million acre region then these estimates of direct loss of bird habitat would be more than doubled to impact between 2 million and 14.5 million forest-dependent breeding birds.

Most of the disturbances associated with in situ development are widely distributed across the project area, and the ecological effects of these disturbances extend into adjacent forest, meaning that a majority of the remnant forest will be affected.[27] Numerous bird studies have shown that as habitats become fragmented, specific species are lost from isolated habitat patches. Individuals of species that are able to persist in fragmented landscapes, at least in the short term, face a variety of fragmentation-caused "edge effects" that can decrease survival and reproduction. These edge effects include changes in microclimate near a forest edge, the establishment of introduced plants and animals, more frequent habitat disturbances, an increase in the numbers of predators and brood parasites in an area, and even changes in social structure, mating success, and evolutionary pressures. Isolated populations occurring in habitat patches are also more vulnerable to catastrophic events, both natural and human-made.[28]

Many Boreal forest birds show decreased densities of birds in landscapes with high levels of fragmentation and industrial development and disturbance. Reductions in abundance as high as 50 percent to 80 percent have

Figure 5. In Situ Drilling Fragments the Boreal Forest



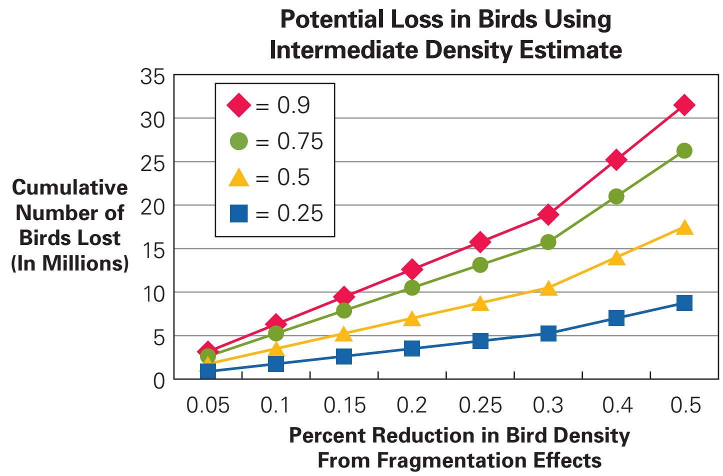
been calculated as possibilities for many of Alberta's forest-dependent species in regions with high levels of fragmentation and disturbance.[29] A recent landscape modeling study showed that Ovenbirds would decline by 34 percent in future decades in the Alpac Forest Management Area portion of the Alberta tar sands if current energy and forestry development trends continue—showing the additional stress to bird habitat caused by cumulative effects of forestry and tar sands activities in this region.[30]

Recent research also has documented that the high noise levels of industrial activities decrease bird density near the noise source.[31] For example, the existing 5,000 compressor stations used in current in situ oil extraction operations in Alberta's Boreal region are projected to have resulted in 85,000 fewer birds than otherwise would have been present.[32] With the projected five-fold increase in tar sands development over the next 30 to 50 years, habitat degradation from noise effects at compressor stations alone could result in 425,000 fewer birds.

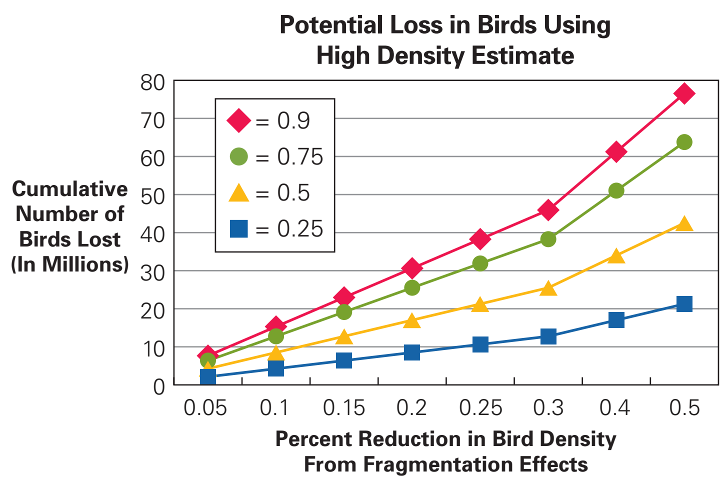
Tar sands drilling projects are projected to result in the loss of more forest-dependent bird habitat than strip-mining and could harm as many as 14.5 million breeding birds.

Combining the various estimates of the loss of birds from mining and in situ operations, we project a cumulative impact ranging from a low of about 6.4 million birds lost to as high as 166 million forest-dependent birds lost over 30 to 50 years. This represents a potential decline of between 10 to 50 percent of forest-dependent breeding birds based only on loss of adult breeding birds. And even beyond the direct habitat effects outlined here, there are many other impacts to birds that, while harder to quantify, are known or expected to cause further major negative problems for birds and other wildlife as tar sands development increases.

Figures 6 and 7. Potential Loss of Birds Using Intermediate and High Density[a] Estimates



Fragmentation has been documented to result in a decline in the density of many forest-dependent birds. We modeled how many birds would be lost if fragmentation caused a reduction from an average breeding bird density of 2 birds per acre. We modeled the impact of reductions in density ranging from 5% to 50% over 25%, 50%, 75% or 90% of the tar sands region.



Here we model how many birds would be lost if fragmentation caused a reduction from an average breeding bird density of 4.86 birds per acre. We modeled the impact of reductions in density ranging from 5% to 50% over 25%, 50%, 75% or 90% of the tar sands region.

[a] Calculating projections of numbers of forest-dependent birds lost as a result of the cumulative impact of all forms of habitat fragmentation and degradation within the Boreal forest underlain with tar sands (but not including direct habitat loss) using an intermediate breeding bird density estimate (2 birds per acre) range from a low of 875,000 birds assuming minimal expansion of the current tar sands footprint and a very slight (5 percent) density reduction effect to 31.5 million assuming 90 percent of the tar sands are impacted with a large (50 percent) reduction effect. Using high density estimates (4.86 birds per acre), the number of birds lost from habitat fragmentation and degradation ranges from 2 million to 76 million.

The Athabasca River flows through tar sands mines north to the Peace-Athabasca Delta.

Tar Sands Water Withdrawals Harm Wetlands and Water Habitats

Water withdrawals from tar sands operations have had and will have increasing impacts on wetland and aquatic habitats that provide vital breeding and migratory stop-over habitat for birds. Tar sands surface mining, in situ extraction, and upgrading use large volumes of water taken from the Athabasca River for mining and from underground saline aquifers for in situ extraction. The tar sands surface mining operation itself requires the total draining, destruction, and removal of the wetland habitats overlying the targeted bitumen deposit. An estimated 40 percent of the 740,000 acres of habitat that will be removed in the tar sands strip-mining process are wetlands.[33] Wetland habitats in the Boreal forest where tar sands development is taking place are known to support dozens of wetland-dependent breeding birds, including American Bitterns, Short-billed Dowitchers, Yellow Rails, Rusty Blackbirds, Solitary Sandpipers, Wilson's Snipe, Palm Warblers, LeConte's Sparrow, and Nelson's Sharp-tailed Sparrow.[34]

The surface mining operations also require groundwater to be pumped out from within the deposit and surrounding areas to decrease water pressure to prevent or slow water seepage into the open-pit mine.[35] This process effectively lowers the water table in the surrounding area and causes the drying of wetlands nearby—particularly under drought conditions, which are expected to occur more frequently in this region because of global warming.

Current tar sands mining operations are permitted to use 523 million cubic meters of water per year.[36] Water use by tar sands mining operations is projected to double by 2010 as planned tar sands projects become operational.[37] For a species like the Short-billed Dowitcher, whose global breeding range largely overlaps with the tar sands, the loss of nesting habitat could have severe implications.

VULNERABLE WETLAND-DEPENDENT SPECIES

Northern Pintail
Lesser Scaup
Short-billed Dowitcher
Lesser Yellowlegs
Yellow Rail
LeConte's Sparrow
Nelson's Sharp-tailed Sparrow
Rusty Blackbird

TAR SANDS INDUSTRY BLOCKS WETLAND PROTECTION

In September 2008, Alberta's tar sands industry, through its representatives the Canadian Association of Petroleum Producers and the Alberta Chamber of Resources, was the only stakeholder at Alberta's Water Council to oppose proposed requirements to compensate for wetland loss caused by development activities in Alberta. Alberta lacks a wetland policy for its forested regions.

There is increasing concern among many aquatic scientists and Aboriginal communities that water removal from the Athabasca River during low-flow periods may increase mortality of fish and other aquatic organisms that are a food source to some birds, and that it may also damage aquatic habitats and adjoining habitat.[38] Low flows may prevent recharge of floodplain wetlands that require periodic inundation and can increase the concentration of pollutants in the water.

Already the Peace-Athabasca Delta has experienced major habitat changes from drier conditions that could be worsened by lower water flows in the Athabasca River. All of these changes could have profound impacts on the hundreds of thousands of birds that are dependent on the wetland habitats in the tar sands and Peace-Athabasca Delta and other parts of the Mackenzie River watershed.

In addition to the impacts of water withdrawals for mining, in situ drilling operations also use substantial amounts of water – mostly from underground reservoirs. The water used for in situ extraction is both fresh and brackish water (saline), and the process often adds solvents to decrease bitumen viscosity during recovery. The water used in drilling operations is mostly recycled, with wastewater stored in small, often saline wastewater ponds. This means that aquifers are depleted for in situ drilling operations. The impact on wetlands through drainage and through possible contamination is still not clearly understood and could potentially put critical wetland habitats at risk.

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EVENING GROSBEAK

At one point, the Evening Grosbeak was one of the most common backyard birds in southern Canada and much of the United States, but sightings in the United States are becoming increasingly rare. The Evening Grosbeak has experienced a 70 percent to 80 percent decline over the last 40 years.[a] It specifically needs coniferous forest for its nesting, making it vulnerable to the loss and fragmentation of Boreal forest clear-cutting associated with tar sands.

[a] Butcher, G. S., and D. K. Niven, *Combining data from the Christmas Bird Count and the Breeding Bird Survey to Determine the Continental Status and Trends of North American Birds*, National Audubon Society, Ivyland, PA.: 2007; Bonter, D.N., and M.G. Harvey, "Winter survey data reveal rangewide decline in Evening Grosbeak populations," *Condor* 110(2):376–381, 2008.

PEACE-ATHABASCA DELTA: WETLAND OF INTERNATIONAL IMPORTANCE[a]

The Peace-Athabasca Delta is one of the largest Boreal deltas in the world and is one of the most important waterfowl nesting and staging areas in North America. It has been recognized internationally under the Ramsar Convention on Wetlands (designated in 1982) and as a World Heritage Site under the UN Convention concerning the Protection of the World Cultural and Natural Heritage. All of the four major flyways in North America converge on the Peace-Athabasca Delta. Breeding tundra swans; snow, white-fronted, and Canada geese; Ross's goose; and a variety of ducks stop there or take a break on their way to the Mackenzie River lowlands, Arctic river deltas, and Arctic islands. Up to 400,000 birds may use the delta in the spring, with more than 1 million birds making the delta their home in the autumn. Tar sands mining is directly upstream from the delta along the Athabasca River, and tar sands water withdrawals may contribute to future lower water levels in the delta, especially in the winter.

[a] Designated in 1982 under the Convention on Wetlands of International Importance (Ramsar Convention) http://www.mb.ec.gc.ca/nature/whp/ramsar/df02s06.en.html.

Tar Sands Toxins Weaken and Kill Boreal Birds

We are only beginning to understand the current and projected impacts on birds from the toxins that seep into the air and water from tar sands operations. The largest danger to birds is likely to come from the accumulation of toxins in tissues, from the degradation of aquatic ecosystems from acid rain and nitrogen deposition, and from air pollution. Inhalation or ingestion of the toxins, as well as external contact with the feathers, skin, and eyes, can also harm birds. Birds can also be impacted indirectly by changes in amount and quality of habitat, food sources, and other ecosystem effects as a result of contaminant impacts.

The tar sands industrial process releases contaminants into the air through the upgrading and refining process, through emissions from large vehicles and machines, and from tailings ponds, and into the water through leakage from tailings ponds and from the release of treated water into the Athabasca River. Contaminants released into the air include nitrogen oxides, sulphur dioxide, heavy metals, particulates, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs).[39] Many of these also eventually are deposited into aquatic systems through rainfall and runoff.

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Tar sands industrial facility and tailings ponds.

AIR POLLUTION CARRIES TOXINS TO BIRDS

Particulates can deposit in the lungs and cause various respiratory problems. VOCs include known cancer-causing chemicals and some can be toxic, though generally they are thought to disperse rather quickly. Therefore, impacts from VOCs are expected to be highest close to the pollution source, but they also contribute to ground-level ozone and smog.

Heavy metals, including mercury, lead, and cadmium, are released into the air from tar sands refining processes and machinery emissions and from leakage and emissions from tailings ponds.[40] They have been shown to cause death at high levels of exposure, and all are known to have a variety of sub-lethal effects on the behavior and physiology of birds that can put them at increased risk of mortality.

Some of the most well-documented direct contaminant impacts to birds are those from heavy metals. Heavy metals are absorbed by microorganisms that are then eaten by larger organisms, which are successively preyed upon by increasingly large organisms. At each step in the food chain, the amount of the heavy metal is concentrated or, in some cases, magnified because animals excrete only a portion of the total amount of accumulated heavy metals in their bodies. Eventually animals can accumulate high levels of these heavy metals in their bodies, leading to sub-lethal effects on behavior and immune response that can lower fitness and, at very high levels, can lead to death.

Mercury has been documented in birds to cause embryo malformations, reduced egg weights and reduced growth in chicks, lower chick survival, behavioral abnormalities, and sterility.[41] Lead is known to have a wide-ranging effect on the behavior of birds and to cause impaired locomotion and other neurological effects.[42] Cadmium can cause sub-lethal impacts to birds at lower concentrations than mercury or lead.[43] These impacts include behavioral changes, eggshell thinning, and damage to testes. Cadmium is also known generally to cause kidney toxicity and to be a carcinogen in animals.[44]

Nitrogen oxides and sulphur dioxides released into the air cause acid rain and smog. Nitrogen oxides, when flushed by rain into aquatic systems, can cause wetlands to become stagnant by stimulating increased growth of algae.

Pollutants and contaminants can impact bird populations through the changes and degradation in ecosystems caused by acid rain and nitrogen deposition.[45] In the northeast United States and southeastern Canada, thousands of lakes, streams, and ponds have been damaged by acid rain; in many, the aquatic invertebrate and fish populations have been decimated, with unknown effects on bird species dependent on wetland ecosystems.[46] Acid rain can also impact birds by depleting calcium in the soil so that less is available to female birds for egg production, causing reductions in reproductive success.[47] A study by researchers at the Cornell Lab of Ornithology in 2002 found that in areas with high levels of acid rain, Wood Thrushes showed lowered probabilities of breeding—a result that may be linked to decreases in calcium availability in such regions.[48] Other studies have documented lower reproductive success and lower eggshell thickness in acidified areas as compared to non-acidified areas.[49] Acid rain could also increase uptake of heavy

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LESSER YELLOWLEGS

The Lesser Yellowlegs starts out its journey to the Canadian Boreal from as far south as Tierra del Fuego, Argentina. With large portions of its breeding range in Alberta, Canada, the Lesser Yellowlegs is affected by tar sands pollution.

TAR SANDS AIR AND WATER CONTAMINANTS

- Nitrogen oxides
- Sulphur dioxide
- Particulates
- Volatile organic compounds (VOCs)
- Heavy metals (including mercury, lead, cadmium)
- Salts
- Ammonia
- Polycyclic aromatic hydrocarbons (PAHs)
- Naphthenic acids

metals by birds and decrease numbers of insects and other invertebrates that provide food for landbirds and their nestlings.[50,51]

Acid rain emissions from tar sands operations are estimated to eventually impact a minimum of 124,000-247,000 acres (500 to 1,000 sq. km.) of land habitat and a minimum of 25 lakes that do not have the capacity to buffer against its acidity.[52] Certainly the hundreds of thousands of birds that occur in the acidified habitats have the potential to be impacted adversely.

DIRECT CONTAMINATION FROM TAR SANDS TOXINS CAN HARM BOREAL BIRDS

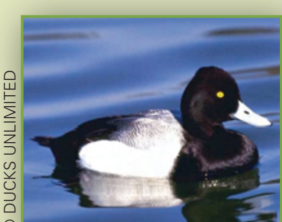
Direct contamination of natural aquatic systems from leakage of tailings ponds and experimental reclamation ponds in the tar sands is well-documented, and includes PAHs and naphthenic acids.[53] In many of these contaminated wetlands, fish and amphibians are unable to survive.[54] The impacts of PAHs on birds are becoming better known and include developmental abnormalities and mortality in embryos, reduced egg production, increased clutch or brood abandonment, reduced growth, and increased organ weight.[55,56] Population level effects have also been documented. For example, female Harlequin Ducks with chronic exposure to PAHs after the *Exxon Valdez* oil spill in Alaska showed higher mortality rates as compared to those in unoiled areas, and consequently bird density in oiled areas was lower than in unoiled areas.[57] Many PAHs are known to be carcinogenic, and large amounts are emitted from the tar sands process.[58,59]

Studies of naturally-occurring and experimentally introduced birds on or near these contaminated wetlands have documented decreased nestling growth rates, higher levels of PAH contaminants in tissues, higher parasite loads in nestlings, and higher nestling mortality under adverse weather conditions than in nearby uncontaminated wetlands.[60] The extent of these contamination effects throughout the watershed under tar sands development or proposed for development has not been evaluated.

IMPORTANCE OF BIRDS TO ABORIGINAL COMMUNITIES

The spring and fall migrations are important to Fort Chipewyan, a Dene, Cree, and Metis community downstream from the tar sands development. Community members hunt waterfowl in the migration seasons, collect eggs, and use the feathers and skins. Types of waterfowl used by the communities include Mallard, Common Goldeneye, and Canada Goose. Some types of birds, such as loons, are considered sacred by the Dene. It was reported that Elders in a community could listen to the loons talk and they would tell them what was happening around the water.[a] The communities have noticed increasing declines in waterfowl over the last 40 years from a number of causes, most recently likely including the scale of the tar sands mining.

[a] Athabasca Chipewyan First Nation Land Use Study.



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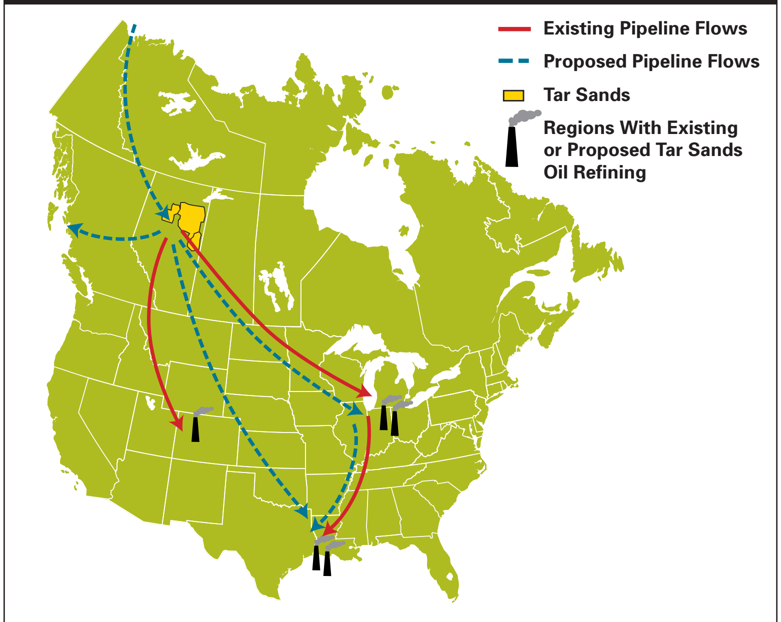
LESSER SCAUP

The migration path of the Lesser Scaup passes through the section of the Boreal forest affected by tar sands development. The Scaup has experienced an overall 70 percent decline in population over the last 50 years.[a] In particular, Lesser Scaup are at risk of mistaking toxic tar sands tailings ponds for natural bodies of fresh water on which they can land.

[a] Wilkins, K. A., M. C. Otto, G. S. Zimmerman, E. D. Silverman, and M. D. Koneff. 2007. *Trends in duck breeding populations, 1955-2007. Administrative Report - July 11, 2007.* U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Laurel, MD.; Afton, A. D., and M. G. Anderson. 2001. *Declining scaup populations: a retrospective analysis of long-term population and harvest survey data.* Journal of Wildlife Management 65:781-796.

Figure 8. Map of Tar Sands Existing and Proposed Pipelines and Refineries (in Canada and in the United States)



Beyond Alberta—Impacts of Tar Sands Pipelines and Refineries

UNITED STATES – CANADIAN TAR SANDS PIPELINES AND REFINERIES CONNECTIONS

Tar sands oil and migrating birds coincidentally follow a similar path on some of the routes between Canada and the United States. For example, the Great Lakes are one stop on an avian highway, known as the Mississippi Flyway, stretching more than 3000 miles from the Mackenzie Delta in Canada's Northwest Territories to the Mississippi Delta. During the spring migration, large numbers of ducks, geese, shorebirds, blackbirds, sparrows, warblers, and thrushes fly through the Chicago region north to nest in the Boreal—some as far west as Alberta's Boreal forest underlain with tar sands or the Northwest Territories' Mackenzie River and Delta.

More than 100 species that migrate through or winter in the Great Lakes area nest exclusively or largely in the Boreal. The Common Loon, a species whose haunting cries embody the wilderness that is the Boreal, passes over the Great Lakes in the hundreds during November as it migrates to its coastal wintering grounds. The Rusty Blackbird, a species that has declined by an estimated 90 percent over the last 30 years within its Boreal breeding range, is an October migrant in wet woodlands in the Chicago area. The Boreal breeding Bonaparte's Gull, a dainty gull that nests in trees including in northeastern Alberta, sometimes numbers in the thousands along the Chicago waterfront during late fall and winter.

At least 40 of the 100 Boreal breeding species that the Great Lakes region hosts migrate to Central or South America to spend the winter. Swainson's Thrushes, for example, which migrate through in September and October, will spend the winter in lush tropical forests in the foothills of the eastern Andes Mountains from Venezuela to Brazil.

Yet, the Great Lakes region is playing a role in the destruction of the nesting grounds of the very birds cherished there. The Great Lakes region is the largest recipient in the United States of tar sands oil. For instance, most of the Chicago area refineries are currently refining some version of tar sands oil – blended bitumen or heavy crude oil. A number of the area refineries, including BP Whiting, ConocoPhillips Wood River, Citgo Lemont, and ExxonMobil Joliet, have the capacity to refine blended bitumen/heavy crudes already. An increasing number of these and other regional refineries are planning major expansions to take tar sands oil and these expansions are requiring new and expanded pipelines throughout the region as proposed by Enbridge and by a partnership between Transcanada and ConocoPhillips.

A recent University of Toronto study of the impact of tar sands refining on the health of the Great Lakes spells out how new transcontinental pipelines stretching from Alberta into the heart of the Great Lakes region and massive refinery expansions in the U.S. Midwest are creating a "pollution delivery system" that threatens the air and water quality, as well as human health.[61] The report outlines significant and growing damage already underway from refineries and pipelines—and calls for more research on the particular health threats that are likely unique to low grade bitumen products.[62]

The U.S. Rockies region likewise regularly hosts more than 60 bird species that nest in the Boreal. These include waterfowl such as the American Wigeon, Green-winged Teal, Common Goldeneye, and Bufflehead, shorebirds such as the Lesser Yellowlegs, Least Sandpiper, and Wilson's Snipe, and a great diversity of songbirds, many of which are popular backyard feeder birds such as American Tree Sparrow, White-crowned Sparrow, and Dark-eyed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BLACK-THROATED GREEN WARBLER

The Black-throated Green Warbler ranges over the eastern United States and Canada, breeding as far west as the Boreal in northeastern Alberta. With its bright yellow face and its persistent song of "zoo-zee, zoo-zoo-zee," this bird is easy to recognize during breeding season. The Alberta government has identified the Black-throated Green Warbler as at risk of long-term decline due to habitat loss.

Junco. Tar sands oil also flows to refineries in the Rockies region of the United States, specifically to the newly expanded Suncor refinery outside of Denver.

MACKENZIE VALLEY PIPELINE PROPOSAL—IMPACT OF FUELING THE TAR SANDS

The proposed Mackenzie Gas Project would be a source of natural gas for tar sands extraction.[63] This $7 billion proposed project would result in a 700-mile-long gas pipeline that would stretch the length of the Mackenzie Valley, in Canada's Northwest Territories, carrying natural gas from the Mackenzie Delta on the Arctic Ocean to northern Alberta.

Natural gas from the Mackenzie Delta would be extracted using a network of wells, pipelines, roads, and other facilities and shipped south along large transmission pipelines.[64] Heavy machinery would be deployed to construct the infrastructure, and new underground pipelines would tunnel under or cross 580 rivers and streams. The environmental impacts from gas development include clearing of vegetation, fragmenting habitat, damaging permafrost, and soil erosion. The Mackenzie Valley pipeline would also provide access to markets for other gas producers, and it is potentially just a first phase in the industrialization of the Mackenzie Valley. The pipeline could facilitate other developments such as increased oil, gas, and mining in the region. The valley, once open, could be subject to additional pipelines as well as feeder lines, mining projects, and a network of roads that would fragment the area, accelerating further damage to wildlife and ecosystems.

The Mackenzie River watershed, which encompasses one-fifth of the land area of Canada, provides important breeding habitat for more than 300 species of birds.[65] In fact, the region represents more than 10 percent of the total North American breeding range of over 100 species.[66] Of these, 40 species have 20 percent or more of their North American breeding range in the Mackenzie watershed.[67] Among these are several birds, such as Whooping Crane, Surf Scoter, Lesser Yellowlegs, Short-billed Dowitcher, and Bonaparte's Gull, whose global populations are highly dependent on the wetlands of the Boreal forest region.[68]

In addition to supporting an abundance of breeding birds, the Mackenzie River and Mackenzie Delta serve as important staging areas and migratory resting points for large numbers of migratory waterfowl. The importance of the Mackenzie watershed for waterfowl populations has been recognized through the designation of five Important Bird Areas (IBAs) in the region. The Mackenzie River Delta IBA, the Kuguluk River IBA, the Lower Mackenzie River Islands IBA, and the Middle Mackenzie River Islands IBA are all globally significant bird areas, while the Brackett Lake IBA is significant on a continental level.[69] Significant numbers of Black Brant, Lesser Snow Goose, Greater White-fronted Goose, Tundra Swan, Cackling Goose, and Canada Goose rely on these IBAs as staging areas or migratory resting sites.[70] Large numbers of shorebirds also migrate through the Mackenzie Delta, although this phenomenon has not


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The Mountain River, a tributary of the Mackenzie River, runs through the Northwest Territories, Canada.

TAR SANDS PIPELINES WILL STRETCH ACROSS NORTH AMERICA

The tar sands lies at the center of a proposed spiderweb of pipelines and industrialization. In addition to the proposed Mackenzie Gas Project, there is a proposed natural gas pipeline from Alaska that could bring fuel to the tar sands, a proposed oil pipeline from the tar sands through British Columbia that could open up the delicate coastal ecosystem to oil tanker traffic, and several proposed pipelines to carry high-pressure bitumen for upgrading and refining in the United States.

been studied in detail.[71] In addition, the Mackenzie Delta provides important nesting habitat for several shorebird species, including American Golden-Plover, Whimbrel, and Hudsonian Godwit, all of which have been identified as Species of High Concern in the Canadian Shorebird Conservation Plan.[72]

WHOOPING CRANE

Whooping Cranes were nearly extinct in 1941 with a population low of just 15 birds. Now, the population of the largest North American crane has reached a worldwide total of 470 birds in three populations. The Whooping Cranes nest in bulrush marshes or other wetland vegetation. The migratory Whooping Crane population breeds entirely within the Boreal, specifically in Wood Buffalo National Park. The breeding success of the cranes is jeopardized in dry years. Most global warming scenarios predict more dry years within the region where Whooping Cranes nest. The Whooping Crane's wintering grounds are also subject to change with global warming. The migratory population of Whooping Cranes from the Boreal winters in the Aransas National Wildlife Refuge in Texas, where birds feed on blue crabs and find habitat in the shallow marshes in the low-lying coastal land. Sea level rise as a result of global warming is expected to flood these marshes, erode beaches, and potentially increase the salinity of the rivers and groundwater, affecting the availability of the crabs for food.[a]

[a] Schyler, Krista, *Refugees at Risk; the Threat of Global Warming*, Report by Defenders of Wildlife, 2006.

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SHORT-BILLED DOWITCHER

The Short-billed Dowitcher requires streams, ponds, and peatlands to reproduce, habitat that is put in jeopardy by tar sands operations. With an estimated 97 percent of the species' North American population breeding in the Boreal forest, the population of the Short-billed Dowitcher has already dropped from 500,000 to 1 million in 1900 to around 150,000 to 175,000 birds today. Any additional stressors, such as those from tar sands oil extraction, could be devastating. The Short-billed Dowitcher migrates from northern South America to the Boreal each spring. One of the major stopovers on its migration is in coastal Texas near Galveston and Houston, the site of a potential major pipeline and refinery expansion for tar sands oil.

In 2007, at the urging of the Fort Good Hope Dene First Nation, the 3.8 million acre Ramparts River and Wetlands was created as Canada's newest National Wildlife Area in the Northwest Territory. Identified as a Key Terrestrial Migratory Bird Habitat Site by the Canadian Wildlife Service, this critical waterfowl breeding site provides excellent nesting, brood-rearing, and staging habitat for ducks, geese, and loons, and supports more than one percent of the Canadian populations of scaup, scoters, and Pacific Loons. Recent survey data indicates that as many as 94,000 paired waterfowl inhabit the area during the breeding season. Thousands of non-breeding waterfowl and breeding and non-breeding waterbirds (such as loons and grebes) are also found throughout the region during spring, summer, and fall.[73]

A recent landscape modeling analysis was used to predict the ecological effects of development in the southern Dehcho region, just north of Alberta's Boreal forest underlain with tar sands.[74] Under current business-as-usual development practices, the report predicts that the southern Dehcho populations of Bay-breasted Warbler, an old forest specialist, and Ovenbird, a mature forest specialist, would both decrease by 21 percent in the face of expected cumulative resource development, including the effects of the proposed Mackenzie Gas Pipeline.

CHAPTER 3

Global Warming Impacts on Boreal Birds

Canada's Boreal region plays several roles in the growing challenge of global warming: it is a major storehouse of carbon, and as a region it is already feeling the impacts of global warming. Greenhouse gas emissions from tar sands contribute to global warming and the impact global warming has on the Boreal ecosystem and the birds that depend upon the Boreal.

The circumpolar Boreal forest is the world's largest terrestrial storehouse of carbon, exceeding even the total carbon stored in the Amazon. Carbon is stored in terrestrial vegetation, forests, soils, peat, and lake sediments.[1] At the same time, the Canadian Boreal is home to one of the fastest growing greenhouse gas sources: tar sands oil production, which generates almost three times as much global warming pollution as conventional oil production because of the large amounts of energy needed to extract, upgrade, and refine the bitumen.[2] Canada's tar sands are the single largest contributor to global warming pollution growth in Canada.[3] Tar sands-related global warming pollution is projected to more than quadruple to between 108 and 126 megatons by 2015.[4]

The Boreal forest is already being impacted by global warming. Temperatures in the Boreal forest are rising: seasons are shifting and fires are increasing, as is forest depredation by insects.[5] Impacts of global warming in the Boreal can lead to increases in greenhouse gas emissions as the large amount of carbon stored in the Boreal is released through disturbances, changes in hydrology, and other impacts.

The impacts of global warming in the Boreal affect all of the species that live there—especially nesting migratory birds, which require a delicate balance of habitat conditions. Further the contribution of tar sands oil development to global warming does not stop in the Boreal, but adds to adverse conditions for birds around the world. Global warming is already having significant impacts on the timing of species' life cycles.[6] The impacts of climate change on the distributions and abundances of

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Global warming is already harming Boreal forests and waters.

A total of 1,111 bird species (11 percent of the world's bird species) are considered to be at risk, as many as 200 of which may disappear within the next 20 years.

species are already widespread, and even greater changes are predicted for the future.[7] Many seasonal biological phenomena such as plant growth, flowering, animal reproduction, and migration depend on the accumulated temperature—organisms require the appropriate amount of heat at the required times to develop from one point to another in their life cycle.[8] As the globe warms, animals will shift both their ranges and densities.[9] Species within a community will change in various ways in reaction to climate change that can cause a restructuring of communities and predator-prey interactions.[10]

Global warming is already shifting bird distributions and altering their migration behavior and habitat, and even diminishing their survival ability. A total of 1,111 bird species (11 percent of the world's bird species) are considered to be at risk, as many as 200 of which may disappear within the next 20 years.[11] To date, the primary threat to birds worldwide has been habitat loss and fragmentation, but global warming is growing as a threat.

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GRAY JAY

Global warming could affect the survival of Gray Jays and other food-hoarding birds. Gray Jays in the southern Boreal may be most affected by recent warmer autumns, in which the cached food can spoil before it has a chance to freeze. The hoarded food is an important resource that allows Gray Jays to survive through the winter and early spring. The Gray Jays also rely on stores of frozen food to feed their young, which typically hatch in April. Scientists found that the birds had more young in years after cold autumns than after warm autumns.[a] Gray Jays are extremely reliant on the Boreal: 89 percent of the species population breeds there.[b]

[a] Waite, T.S., and D. Strickland, "Climate change and the demographic demise of a hoarding bird living on the edge," *Proc Biol Sci.*, 2006, 273: 2809–2813.

[b] Blancher, P., and J.V. Wells, *The Boreal Forest Region: North America's Bird Nursery*, Boreal Songbird Initiative, Canadian Boreal Initiative, and Bird Studies Canada, 2005.

Global warming is already being felt at higher latitudes, making the Boreal region especially sensitive. Boreal regions have warmed by as much as 4 degrees Celsius over the 20th century, while much of the tropics have shown little change.[12] Therefore, there is a clear expectation of stronger shifts in timing of ecological events at higher latitudes including leaf-out, insect emergence, flowering, fruiting, mating, nesting, and many others.[13] Birds are limited in their distributions not only by habitat and food availability, but also by their physiology. Bird communities as we currently know them may look quite different in the future. The ranges of some species will shift north, and some may be replaced by species from farther south. As species move, they will face new prey, predators, competitors, and habitat loss threats.

As tar sands production continues, the negative effects of global warming in the Boreal region are likely to accelerate. For example:

- **Long-distance migratory birds may arrive too late to find food.**[14] Long-distance migrants, such as many of those that summer in the Boreal forest, face greater challenges because of global warming. Research in eastern North America has documented that in the spring, short-distance migrant birds are arriving 12 to 14 days earlier now than they were 50 or 100 years ago, while long distance migrants are arriving only three to four days earlier. These birds use seasonal changes in daylight rather than climatic cues to start their migrations northward. Insects in the northern breeding grounds are also hatching earlier in the spring. When insects emerge sooner, birds must lay eggs sooner if they are to raise their young when caterpillars and other insects are at maximum abundance. As a result, many of these birds may arrive on the breeding grounds too late to provide adequate food for their young.

- **Birds that hoard food may find the food spoils before the first freeze.**[15] Some birds hoard food to get through the winter and early spring and to feed their young – which can hatch early in the spring. With global warming causing warmer autumns in the Boreal region, later freezes could affect food-hoarding birds.

- **Global warming could hit ducks especially hard as wetlands become drier.** Canada's Boreal forest is dotted with wetlands critical to sustaining North America's duck populations. Twelve to 14 million ducks depend on this habitat each summer.[16] Vast Boreal forest wetlands breeding grounds could dry up from the high temperatures and drought associated with increasing global warming. Scientists have already observed widespread disappearance of small ponds and marshes in Boreal forests attributed to the melting of subsurface permafrost.[17] For example, between 1950 and 2002, the total surface area of closed-basin ponds in subarctic regions studied within Alaska showed decreases ranging from 31 percent to 4 percent, and the total number of ponds showed decreases ranging from 54 percent to 5 percent.[18]

Of particular concern is the Boreal Plains, where the tar sands lie. The climate here is sub-humid with annual precipitation averaging less than 400 mm. In addition, annual potential evaporative transpiration is greater than precipitation, with the result that the ecozone is relatively dry, putting wetland and water habitats at greater risk.[19]

CHAPTER 4

The Path Forward for Boreal Bird and Habitat Protection

Many scientific reports on the status of the planet's birds over the past 20 years warn of drastic declines and looming extinctions. This report echoes these cautions and challenges decision-makers and companies to get it right in Canada's Boreal forest, while there is still time to save the great bird nursery of the Americas.

Tar sands oil development should not be the solution to our fuel needs. Both Canada and the United States have a choice to make between fuels that harm the environment (including damage to critical bird habitat) and clean energy now. An immediate solution to the pace of development and to environmental problems relating to tar sands oil development is a moratorium on new projects and project expansions and clean up of existing projects. Alberta needs to prove that even the current level of production can be done without serious environmental impacts. At the same time, U.S., Canadian, and domestic and international regulations must be strengthened to protect the Boreal forest and the birds that make the forest their home. And oil companies should adhere to strict standards of best practices for their current operations in order to protect habitat and minimize their impact on land, air, and water.

Stop Granting Approvals for New Tar Sands Developments: Alberta should implement a moratorium on new tar sands lease sales, and Alberta and Canada should halt project approvals until long-term mitigation strategies and conservation measures are in place.

Protect Bird Habitat and Regulate Environmental Impacts of Tar Sands Developments: Canada and Alberta have weak environmental laws, especially for regulating the tar sands industry. The regulatory authority of the Canadian federal government is limited to instances where a proposed project requires a federal approval or permit, most commonly related to the Department of Fisheries and Oceans jurisdiction—although the federal government could exercise this authority related to migratory birds or birds listed under the Species-at-Risk Act and their habitat as well. Since the tar sands are a provincial resource, the government of Alberta is the primary regulator. Tar sands development is still reviewed on a project-by-project basis, despite the process in place to discuss how to deal with the cumulative impacts of such a major undertaking. Provincial regulation of waste management, water withdrawals, water pollution, air pollution, and habitat destruction and reclamation are insufficient and not well enforced. Specific actions should include:

- Alberta should immediately implement the wetland policy recommended by the Alberta Water Council.[1]

- Alberta should require clean up of and best management practices in existing tailings ponds and prohibit creation of new tailings ponds.

- Alberta should put strict and enforceable cumulative limits for land, water (quantity and quality), and air protection in place.

- At a minimum, Alberta should follow the recommendation of the Alberta Cumulative Environmental Management Association (CEMA) and protect up to 40 percent of northern Alberta and complete land use planning and an interconnected network of protected areas that include migratory bird habitat for the rest of Alberta.[2]

- Canada should legislatively protect the areas identified in the Northwest Territories Protected Areas Strategy.[3]

- Canada and Alberta should put in place absolute greenhouse gas emissions reduction requirements for companies operating in the tar sands.

Ensure Best Practices in the Tar Sands: Multiple and cumulative impacts of tar sands development are not being managed sustainably and industry players need to become a big part of the solution—a leader that quickly and deliberatively moves to a truly sustainable future. As a starting point, all energy companies need to support a process to mitigate their developments by offsetting their industrial footprint, remediating their toxins in air and watersheds, restoring and reclaiming their land developments, actively advancing the social, cultural and economic conditions of Aboriginal communities, and lobbying governments and their energy company peers for increased conservation across the Mackenzie watershed. Specific actions should include the following:

- Oil companies should clean up existing tailings ponds, including better management to prevent leaks, and should use dry tailings for all future waste disposal.

- Oil companies should actively engage in conservation planning and establishment of protected areas that have the confidence of environmental organizations, Aboriginal communities, and the Alberta government.

- Oil companies should reduce total greenhouse gas emissions and set and implement benchmarks to achieve a carbon neutral tar sands.

- Oil companies should put into place best practices to prevent damage to critical bird habitat.

- Oil companies should immediately restore damaged Boreal forest and wetlands landscapes to their original habitat quality and should put in place policies for public transparency around reclamation project performance and cost.

- Recognizing the reclamation lag times and uncertain success will mean that reclamation is not enough of a mitigation measure, oil companies should establish biodiversity offsets that will provide for no net loss of bird habitat.[4]

- Oil companies should work with Aboriginal communities to address social, cultural and economic concerns rising from tar sands development impacts on land and water, including concerns about impact on waterfowl as sustenance and as a source of livelihood.

Implement Laws Protecting Migratory Birds: Both the United States and Canada have laws protecting endangered and threatened bird species, including the U.S. Endangered Species Act and the Canadian Species-at-Risk Act. Both countries are signatories to the U.S.-Canada Migratory Bird Treaty and have implementing legislation in place. However, these regulations are not being enforced in the face of large-scale development such as tar sands oil extraction. Specific actions should include:

- Canada, Alberta, and the United States should fully implement the requirements of the Migratory Bird Treaty regarding the impact of tar sands development on migratory birds and their habitat.

- Canada, Alberta, and the United States should fully implement the requirements of the U.S. Endangered Species Act and the Canadian Species-at-Risk Act concerning the impact of tar sands extraction and associated pipeline development on threatened and endangered species of birds and their habitat.

Move Away from Dependence on Tar Sands as a Fuel Source: Fortunately, we have solutions at hand to guide us towards a clean fuel future, including increasing the efficiency of cars and trucks, developing environmentally sustainable ways to fuel our vehicles, and limiting the production of high-carbon fuels. These are the types of policies that the U.S. and Canadian governments should support, rather than policies that provide incentives for tar sands development. Specific actions should include:

- The U.S. and Canadian governments should not provide governmental incentives for expansion of tar sands oil imports into the United States, including incentives for pipelines, refineries, and technology for tar sands oil.

- The U.S. and Canadian governments should oppose expansions of and proposals for new pipelines and refineries for tar sands oil.

- The U.S. and Canadian governments should support inclusion of lifecycle analysis of greenhouse gas emissions of tar sands oil fuels—and lifecycle analysis of other environmental impacts, including impact on migratory birds—in government legislation and rules concerning fuel use and procurement.

- The U.S. and Canadian governments should put in place a low-carbon fuel standard to drive reductions in greenhouse gas emissions associated with production of transportation fuels.

- The U.S. and Canadian governments should support environmentally sustainable alternatives to using tar sands oil to meet our transportation fuel needs.

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mammal predators) and proximity to source populations. A study in northeast British Columbia found that the cumulative impacts of development caused a decline in habitat quantity for 22 percent of the species studied (forest interior birds and habitat specialists) and an increase in habitat for 78 percent of the species studied (shrubby, second growth and open habitat species and habitat generalists) and a corresponding increase in species diversity. C. Nitschke. 2008. "The Cumulative Effects of Resource Development on Biodiversity and Ecological Integrity in the Peace-Moberly Region of Northeast British Columbia, Canada." *Biodiversity Conservation* 17:1715-1740.

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CHAPTER 3

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CHAPTER 4

1. See, Alberta Water Council, *Alberta Water Council Recommendations for a New Wetland Policy*(2008), http://www.albertawatercouncil.ca/Portals/0/pdfs/WPPT%20Policy%20web.pdf. *The Alberta Water Council Recommendation for a New Wetland Policy* was submitted to the Minister of Environment in September 2008. The Alberta Chamber of Resources and the Canadian Association of Petroleum Producers submitted non-consensus letters to the Chair of the Alberta Water Council as they objected to the principle of no-net loss of wetlands. These letters can be found on the Alberta Water Council web site at http://www.albertawatercouncil.ca/Projects/WetlandPolicyProjectTeam/tabid/103/Default.aspx.

2. For the text of the CEMA recommendations, see the Terrestrial Ecosystem Management Framework at: http://www.cemaonline.ca/content/view/75/182/.

3. For more information on the NWT Protected Areas Strategy, see http://www.nwtwildlife.com/pas/.

4. Information on industry best practicesin establishment of biodiversity offsets is available at: http://www.forest-trends.org/biodiversityoffsetprogram.