EARTHJUSTICE ecojustice

September 22, 2011

VIA CERTIFIED MAIL AND EMAIL

The Honorable Ken Salazar
Secretary of the Interior
1849 C Street, N.W.
Washington, D.C. 20240

Re: [Corrected] Petition for certification of Canada pursuant to 22 U.S.C. § 1978 for failing to prevent or mitigate the impacts of tar sands extraction on 130 migratory bird species, including whooping cranes, as well as on woodland caribou.

Dear Secretary Salazar:

On behalf of Center for Biological Diversity, Clean Water Action, Council of Canadians, Environmental Defence, Forest Ethics, Friends of the Earth, National Wildlife Federation, Natural Resources Defense Council, Nebraska Sierra Club, Sierra Club, and Voices for Progress, Earthjustice and Ecojustice Canada submit this petition for certification of Canada, pursuant to the Pelly Amendment to the Fisherman's Protective Act of 1967 ("Pelly Amendment"), 22 U.S.C. § 1978, for Canada's failure to prevent takings of woodland caribou and migratory birds, including whooping cranes, that result from large-scale tar sands development in Alberta, Canada.

I. INTRODUCTION

The Pelly Amendment requires the Secretary of the Interior ("Secretary") to certify to the President when he finds that foreign nationals, "directly or indirectly, are engaging in trade or taking which diminishes the effectiveness of any international program for endangered or threatened species." 22 U.S.C. § 1978(a)(2).

Extraction of oil from Alberta's tar sands directly kills migratory birds in tailings ponds and contaminated wetlands, and indirectly kills migratory birds by causing widespread damage to important migratory bird habitat. Mistaking tailings ponds for natural ponds, waterfowl and shorebirds land in the tailings pond and become oiled with waste bitumen and toxic elements. They then drown, die from hypothermia, or suffer from ingestion of toxins. Endangered whooping cranes (*Grus americana*) are particularly vulnerable to the risk of landing in a tailings pond, as the entire global population of wild, migratory whooping cranes migrates through the tar sands region twice each year. Toxins from the tailings ponds and pollutants from other aspects of tar sands operations leak into wetlands and forests, contaminating important habitat

for migratory birds. Strip-mining of over1850 square miles—nearly the size of Delaware-- in Alberta's boreal forest would result in the loss of important breeding habitat for millions of birds.

Tar sands development also destroys critical habitat for threatened[1] woodland caribou (*Rangifer tarandus caribou)* that live in local herds and do not migrate. Roughly one third of Alberta's woodland caribou lives in the tar sands region. All caribou herds in the tar sands area have declined more than 50 percent over their last three generations. Anthropogenic habitat disruption and fragmentation—including tar sands exploration, infrastructure development and industrial activities—are the driving forces of this population decline.[2]

As a significant contributor to global warming, tar sands operations also indirectly impact migratory birds and caribou by increasing insects and wildfires in boreal forests, droughts in wetlands, and causing dramatic shifts in vegetation and predators in their habitats.

These impacts of tar sands extraction, coupled with Canada's failure to effectively regulate the tar sands industry to mitigate these impacts, diminish the effectiveness of two international programs for endangered or threatened species: (1) the Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere, *opened for signature* Oct. 12, 1940, 56 Stat. 1354, 161 U.N.T.S. 193 (entered into force Apr. 30, 1942) ("Western Hemisphere Convention"); and (2) the Convention Between the United States and Great Britain on behalf of Canada] for the Protection of Migratory Birds, Aug. 16, 1916, 39 Stat. 1702, T.S. No. 628 ("Migratory Bird Convention") (collectively, "the Conventions"). The United States is a party to both the Western Hemisphere Convention and the Migratory Bird Convention. Canada is a party to the Migratory Bird Convention. Together, the Conventions protect at least 130 bird species, including the endangered whooping crane, and also protect the threatened woodland caribou. *See* Organization of American States, *La Convencion para la Proteccion de la Flora, de la Fauna y de las Bellezas Escenicas Naturales de los Estados Americanos: Listas de Especies de Fauna y Flora en Vias de Extincion en los Estados Miembros* (1967) at 27, 33 ("Western Hemisphere Convention, Annex"); Migratory Bird Convention, art. 1. S*ee also* 50 C.F.R. § 17.11(h) (listing species protected pursuant to the Endangered Species Act, 16 U.S.C. § 1531 *et seq.*, which implements several international conventions designed to conserve species facing extinction, including the Western Hemisphere Convention and the Migratory Bird Convention); 50 C.F.R. § 10.13 (listing species protected under the Migratory Bird Convention, as implemented by the Migratory Bird Treaty Act, 16 U.S.C. § 703 *et seq*.). Because, as described below, tar sands extraction directly and indirectly harms these species, the effectiveness of these two Conventions in protecting these species is diminished. Oil extraction from the tar sands thus meets the conditions of the Pelly Amendment and requires certification to the President.

This petition requests that the Secretary of the Interior investigate tar sands extraction activities in Alberta, Canada to determine whether those activities are diminishing the effectiveness of relevant international programs. If the Secretary so determines, this petition requests the Secretary to certify to President Obama that the taking of woodland caribou and migratory birds, including whooping cranes, due to large-scale tar sands development in Alberta, Canada diminishes the effectiveness of the Western Hemisphere Convention and the Migratory Bird Convention.

II. LEGAL FRAMEWORK

A. The Pelly Amendment

Under the Pelly Amendment, when the "Secretary of the Interior finds that nationals of a foreign country, directly or indirectly, are engaging in trade or taking which diminishes the effectiveness of any international program for endangered or threatened species, the Secretary making such finding shall certify such fact to the President." 22 U.S.C. § 1978(a)(2). The Pelly Amendment defines "taking" to mean to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect," or to attempt to do any of the above, to species to which an international program for endangered or threatened species applies. 22 U.S.C. § 1978(h)(5). The Pelly Amendment defines "international program for endangered or threatened species" as "any ban, restriction, regulation, or other measure in effect pursuant to a multilateral agreement which is in force with respect to the United States, the purpose of which is to protect endangered or threatened species of animals." 22 U.S.C. § 1978(h)(4).

Under the Pelly Amendment, the Secretary must, as appropriate, monitor activities of foreign nationals that "may affect" relevant international programs and investigate activities that "may be cause for certification" to determine whether those activities are diminishing the effectiveness of relevant international programs. 22 U.S.C. § 1978(a)(3).

Though the Secretary is not required to certify "every departure" from a treaty covered by the Pelly Amendment, the Secretary's discretion to determine whether actions "diminish the effectiveness" of an international species protection program does not give the Secretary license to ignore actions contrary to the spirit or terms of the species protection program. *Japan Whaling Ass'n v. Am. Cetacean Soc'y.*, 478 U.S. 221, 234 (1986). The Secretary must base the "diminishing the effectiveness" determination on "conservation factors alone." *Greenpeace USA v. Mosbacher*, 719 F. Supp. 21, 24 (D.D.C. 1989) (citing *Japan Whaling*, 478 U.S. at 233). Once the Secretary has determined that foreign nationals are diminishing the effectiveness of an international program for the protection of endangered or threatened species, his duty to certify is non-discretionary. *American Cetacean Soc'y. v. Smart*, 673 F. Supp. 1102, 1105 (D.D.C. 1987) ("While the Secretary has discretion to make that determination, once it is made, certification is mandatory."). Although Canada is not a party to the Western Hemisphere Convention, the Secretary may certify an offending country's activities even if the offending country files an objection to a treaty or is not a party to the treaty. *See Japan Whaling*, 478 U.S. at 227.

B. The Western Hemisphere Convention

The Western Hemisphere Convention, negotiated under the auspices of the Organization of American States, entered into force with respect to the United States in 1942. The Convention begins by stating that the objective of the Parties is:

> [T]o protect and preserve in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds, in sufficient numbers and over areas extensive enough to assure them from becoming extinct through any agency within man's control.

Western Hemisphere Convention, pmbl. The Convention calls upon states to take special measures to "prohibit hunting, killing and capturing of members of the fauna" in natural parks

and to adopt, or propose to adopt "suitable laws and regulations for the protection and preservation" of fauna within their national boundaries but outside of national parks or reserves. Western Hemisphere Convention, arts. III, V. Providing special protection for endangered or threatened species, the Western Hemisphere Convention requires states to "adopt appropriate measures for the protection of migratory birds of economic or aesthetic value or to prevent the threatened extinction of any given species." *Id.* art. VII.

The Convention established an annex listing species whose protection it "declared to be of special urgency and importance" and called for those species to "be protected as completely as possible, and their hunting, killing, capturing, or taking ... allowed only with the permission of the appropriate government authorities in the country." *Id.* art. VIII. The annex lists two species that are threatened by tar sands development—the whooping crane and woodland caribou. *See* Western Hemisphere Convention, Annex; 50 C.F.R. § 17.11(h). The U.S. law implementing the Western Hemisphere Convention, the Endangered Species Act, establishes an Endangered Species List. *See* 16 U.S.C. §§ 1531(a)(4)(C), 1537a(e). The Endangered Species List also includes the whooping crane and the woodland caribou. *See* 50 C.F.R. § 17.11(h).

The Western Hemisphere Convention is a "multilateral agreement which is in force with respect to the United States, the purpose of which is to protect endangered or threatened species of animals." 22 U.S.C. § 1978(h)(4). Actions that "diminish[] the effectiveness" of the Convention are thus subject to action under the Pelly Amendment. *See* 22 U.S.C. § 1978(a)(2).

C. The Migratory Bird Convention

The Migratory Bird Convention, a bilateral treaty signed by the United States and Great Britain, on behalf of Canada, entered into force in 1916. *See* Migratory Bird Convention, art. IX; 16 U.S.C. § 712(2). In its preamble the Convention calls for protection of endangered and threatened migratory bird species:

> Whereas, many of these species are … *in danger of extermination through lack of adequate protection* during the nesting season or while on their way to and from their breeding grounds;
>
> [The Parties], being desirous of saving from indiscriminate slaughter and of insuring the preservation of such migratory birds as are either useful to man or are harmless, have resolved to adopt some uniform system of protection which shall effectively accomplish such objects, and to the end of concluding a convention for this purpose.

Migratory Bird Convention, pmbl. (emphasis added).

The U.S. law implementing the Migratory Bird Convention, the Migratory Bird Treaty Act (MBTA), makes it unlawful "by any means or in any manner" to take, kill, or attempt to take or kill "any migratory bird, any part, nest, or egg of any such bird." 16 U.S.C. § 703(a). U.S. courts have found that deaths of protected birds resulting from oil sump pits and other contamination related to oil production are takings or killings under the MBTA. *See United States v. Moon Lake Elec. Ass'n, Inc.*, 45 F. Supp. 2d 1070, 1083 (D. Colo. 1999) (citing three cases in which the United States charged oil companies for deaths of protected birds resulting

from the oil company's construction, maintenance, or operation of its oil sump pits). The killings for which the oil companies were charged in these cases included incidental, not necessarily targeted, kills. *Id.*

At least 130 bird species that breed in, or migrate through, habitat located in the tar sands area are protected by the Migratory Birds Treaty Act. *See* Migratory Bird Convention, Annex 1 (attached hereto); 50 C.F.R. § 10.13. Those species include water and shore birds (including cranes, ducks, geese, sandpipers, egrets and herons) and insectivorous birds (including sparrows, thrushes, phoebes, flycatchers, chickadees, woodpeckers, wrens, swallows, and finches). One of those species, the whooping crane, is listed as endangered in the United States. 50 C.F.R. § 17.11(h).

The Migratory Bird Convention is a "multilateral agreement which is in force with respect to the United States, the purpose of which is to protect endangered or threatened species of animals," namely migratory birds. 22 U.S.C. § 1978(h)(4). Actions that "diminish[] the effectiveness" of the Convention are therefore subject to action under the Pelly Amendment. *See* 22 U.S.C. § 1978(a)(2).

III. TAR SANDS EXTRACTION DIMINISHES THE EFFECTIVENESS OF THE WESTERN HEMISPHERE CONVENTION AND THE MIGRATORY BIRD CONVENTION.

A. The Tar Sands Extraction Process

Tar sands, also called bitumen sands or oil sands, are a type of unconventional petroleum deposit containing naturally occurring mixtures of sand, clay, water, and a dense and extremely viscous form of petroleum referred to as bitumen.[3] Tar sands underlie over 54,000 square miles—roughly the size of Florida—of the Athabasca, Cold Lake, and Peace River regions of northeast Alberta, Canada.[4] The tar sands area includes boreal forest, peat bogs, grasslands, lakes, rivers, fens, swamps, marshes, and shallow ponds.[5] The region is highly vulnerable to water pollution, as roughly 40 percent of the area is wetlands that are often connected by groundwater or surface hydrology.[6] Tar sands oil development creates large open-pit mines, toxic waste tailings ponds, extraction wells, noisy compressor stations, refineries, upgrading facilities, and networks of new roads, seismic lines, and pipelines.[7] This infrastructure reduces wetlands and forest land area, fragments forest-based habitat, lowers the water table, and generates significant noise, air, and water pollution.[8]

Tar sands within 250 feet of the surface can be extracted through strip mining, while sands below this threshold must be extracted by *in situ* drilling, involving injection of high-pressure steam into wells to soften the bitumen and reduce the viscosity of the oil so it can be pumped out.[9] Tar sands extraction is highly energy and water intensive. By 2007, tar sands operations were permitted to remove enough water to meet the needs of a city of three million people.[10] Water removal is projected to increase by at least 50 percent as additional projects become operational.[11] Tar sands mining operations alone were licensed to divert 172 billion gallons of water in 2008, about seven times as much as the annual water needs of the Edmonton area.[12]

Tar sands development reduces wildlife habitat through physical destruction due to the processes of mining and the creation of vast tailings ponds, as well as through fragmentation of mature forests by infrastructure for oil exploration, drilling, transport, and processing. By 2010, there were 95 active tar sands projects, with 89 drilling projects and six mines. [13] Strip mining, which involves clear-cutting forests and removing all vegetation, soils and earth above the tar sands layer, has already destroyed 256 square miles of natural landscape, with 586 square miles under active development—just one third of the total mineable area of 1850 square miles.[14] Studies have found no evidence that strip mined areas can be restored to their prior habitat conditions, despite elaborate restoration attempts by industry.[15]

Mined tar sands must be processed to separate the bitumen from the mixture of water, sand, silt, and clay.[16] After excavation, the mined sand is trucked to an extraction plant, mixed with hot water and caustic soda, and agitated to create a bitumen froth.[17] The bitumen floats to the top of the mixture, where it is separated and converted to synthetic crude oil.[18] Water and solids removed during processing are sent to vast tailings ponds that are some of the largest human-made structures on earth, covering over 65 square miles as of 2010.[19] Roughly 222 billion gallons of tailings currently require long term containment; this volume is expected to grow to over 264 billion gallons by 2020, and remain that high for at least 40 years.[20] Tailings ponds contain a toxic mixture of bitumen salts, naphthenic acids, and polycyclic aromatic hydrocarbons (PAHs) suspended in water, sand, silt, and clay.[21] The ponds also contain heavy metals including arsenic, cadmium, copper, lead and zinc, all of which are priority pollutants under the U.S. Clean Water Act.[22]

Tar sands operations create significant levels of air and water pollution that contaminate wetlands and waterways through direct water contamination or deposition of airborne particulates through rain or snow.[23] A scientific review of tar sands pollution concluded that "present levels of some contaminants pose an ecosystem or human health risk" and that the "projected tripling of tar sands activities over the next decade may result in unacceptably large and unforeseen impacts to biodiversity [and] ecosystem function."[24]

Pollutants from tar sands operations[25] are released into the environment through permitted discharges to land and air; leakage and evaporation from tailings ponds and pipelines; spills of bitumen, oil, or wastewater; emissions from smokestacks; windblown coke dust and dry tailings; outgassing from mines; and other activities including transportation, landscape "dewatering," and construction of mines, ponds, roads, pipelines, and other facilities.[26]

Tar sands contaminants—including13 priority pollutants of the U.S. Clean Water Act—have been documented in the Athabasca River system downstream from tar sands development at levels greater than could have come from natural seepage from the bitumen layer.[27] Contaminants were also found in snowpack over 30 miles from tar sands pollution sources.[28] Mercury, arsenic and PAHs have been found in the lower Athabasca River system and its tributary, the Muskeg River.[29] In one documented incident, when a tar sands mine drainage ditch shunted water into the Muskeg River, it caused higher downstream levels of sulfate, sulfide, iron, and phenols.[30] Significant releases of pollutants from tar sands operations caused by tailings ponds spills and a pipeline break into the Athabasca River were documented in 1967-68, 1970, 1982 and 2007. [31] Impacts of these spills were not investigated by the Canadian government.[32]

Seepage from tailings ponds also substantially contributes to wetlands contamination.[33] When the Athabasca River flows into the Peace-Athabasca Delta, contaminates including arsenic and mercury accumulate in wetlands.[34] In 2009, the seepage rate from all tar sands tailings ponds was estimated at three million gallons per day.[35] Researchers noted that "[l]eakage of toxins from tailings ponds may be a concern for decades, if not for centuries."[36] In addition, saline groundwater is increasingly used in drilling.[37] When such water is disposed of in small wastewater ponds, it can leak into and contaminate wetlands.[38]

Tar sands operations also emit nitrogen oxides, which cause smog and are deposited into wetlands through rain and runoff. Resulting algal blooms and increased aquatic plant growth lead to eutrophication and hypoxic conditions of wetlands.[39] Particulate dust carries a range of toxic chemicals and causes respiratory and cardiovascular problems.[40] It also collects on ice and snow and is carried into wetlands during snowmelt, resulting in ecosystem impacts known to reduce biodiversity.[41]

Sulfur dioxide from tar sands operations causes acid rain that is projected to negatively impact up to 390 square miles as a result of planned expansion of tar sands operations.[42] At least 25 regional lakes that will be affected already lack the capacity to buffer additional acidity.[43]

Tar sands oil production emits three times the global warming pollution per barrel as conventional oil due to large amounts of energy needed for extraction, upgrading, and refining.[44] Emissions of carbon dioxide from the Canadian oil sands are expected to reach 108 megatonnes by 2020—one fifth of Canada's current national emissions.[45] Extracting and processing the estimated 315 billion barrels of crude oil from tar sands would emit roughly 27 billion metric tons of CO_2 equivalent GHGs. Burning this oil would release another 135 billion metric tons of carbon dioxide.[46]

According to James Hansen of NASA:

> The tar sands of Canada constitute one of our planet's greatest threats. They are a double-barreled threat. First, producing oil from tar sands emits two to three times the global warming pollution of conventional oil. But the process also diminishes one of the best carbon-reduction tools on the planet: Canada's Boreal Forest. This forest plays a key role in the global carbon equation by serving as a major storehouse for terrestrial carbon – indeed, it is believed to store more carbon per hectare than any other ecosystem on Earth. When this pristine forest is strip mined for tar sands development, much of its stored carbon is lost.[47]

In 2010, a Royal Society of Canada Expert Panel determined that greenhouse gases from tar sands are "a major environmental issue" that will continue to increase:

> Greenhouse gas emissions (GHG) from the oil sands are a major environmental issue. Although substantial progress has been made in reducing the quantity of GHG emitted per unit of production … the rapid pace of growth in bitumen production means direct oil sands GHG emissions have grown substantially. With current and projected developments, direct GHG emissions will continue to grow at a time when Canada has accepted targets for substantial overall reductions in response to the Copenhagen Accord. Technological solutions such

as carbon capture and storage (CCS) will not be sufficient to eliminate projected GHG emissions increases from oil sands over the next decade.[48]

B. Tar Sands Extraction Results in Takings of Migratory Birds, Diminishing the Effectiveness of the Western Hemisphere Convention and the Migratory Bird Convention.

a. The impacts of tar sands operations of migratory birds.

Millions of waterfowl migrate through the tar sands area each year en route to and from their northern breeding grounds.[49] During migration, waterfowl are attracted to water bodies for foraging, roosting, nesting, and resting purposes. Unfortunately, the toxic tailings ponds created as a result of tar sands extraction also attract waterfowl. Shorebirds also mistake the tailings ponds' oily shorelines for mudflats. When the Athabasca River and other natural wetlands are frozen in early spring, migrating birds are particularly vulnerable to landing on tailings ponds as stopover sites, as the ponds are the only unfrozen water source available due to the warm effluents. They are also the largest bodies of water in this part of the migratory flyway. Even when other open water sources are available, tailings ponds still attract large numbers of migratory waterfowl.[50]

When waterbirds and shorebirds land on tailings ponds, they can come into contact with bitumen wastes that weigh them down and cause them to become incapable of flight. Up to 80 to 90 percent of oiled birds drown, or die from hypothermia when their oiled feathers lose the ability to insulate.[51] Birds can also absorb tar sands toxins through inhalation, ingestion, and skin contact.[52] As an Alberta court explained in a case involving the death of approximately 1600 migratory ducks after they landed in an oil company's tailing pond in the Alberta tar sands:

> Birds that attempt to preen bitumen from their feathers and those that forage on the shores of the pond may ingest bitumen which is toxic to them. Even a light oiling can interfere with a bird's reproductive abilities. Relatively small amounts of some petroleum products may also result in high levels of mortality for bird embryos.[53]

As of 2010, 43 species of birds—mostly waterbirds protected by the Migratory Bird Convention— have died from exposure to tar sands tailings ponds.[54] Bird species in drastic population decline are at particular risk when flocks land on tailings ponds for stop-overs.[55] At least nine species found in the tar sands region and protected by the Migratory Bird Convention have lost over 50 percent of their population over the past 40 to 50 years, including horned grebe, lesser yellowlegs, short-billed dowitcher, boreal chickadee, olive-sided flycatcher, evening grosbeak, lesser scaup, greater scaup, and northern pintail.[56] The population of lesser scaup, for example, has declined as much as 70 percent in the past 30 years. [57] These waterfowl are a widely reported casualty of tailings ponds.[58]

In addition to the direct and immediate harm caused to waterfowl and shorebirds by tailings ponds, other sources of pollution from tar sands operations are also harmful to migratory birds. For example, when heavy metals such as mercury, lead, and cadmium accumulate in wetlands, they magnify in the food chain and build up in birds' tissues, causing problems with overall health, reproduction, and behavior. These effects increase risk of death for adult birds, as well as embryo malformations, reduced egg weights, and reduced chick survival.[59] Tar sands

pollutants in wetlands also affect the food chain for fish-eating birds by killing fish or causing severe deformities, lesions and other health problems in fish.[60] Acid rain caused by emissions of air pollutants from tar sands operations is harmful to birds because it can increase birds' uptake of heavy metals.[61] It also depletes calcium in the soil, leaving less available in the food chain for successful egg production.[62] In addition, acid rain decimates populations of aquatic invertebrates, insects and fish, which are important food sources for waterbirds and insectivorous birds.[63]

Tar sands operations also destroy vast areas of breeding habitat for migratory birds. The boreal forest of northeast Alberta is a key breeding area for over 292 species of birds, at least 130 of which use the tar sands area and are protected by the Migratory Bird Convention.[64] One square mile of forest in the northeast Alberta can support as many as 500 breeding pairs of migratory birds, some of the highest densities anywhere within Canada's boreal forest.[65] Between 22 million and 170 million birds breed each year in the tar sands area.[66] A 2009 study estimated that the impacts of tar sands operations on habitat have caused the loss of 58,000 to 402,000 birds.[67] Because the industrial footprint of the tar sands is likely to double in the next 15 years, habitat loss will continue to increase mortality rates of migratory birds.[68] The effects of tar sands mining and drilling on bird habitat are projected to reduce the forest-dependent bird population by between 10 to 50 percent.[69] Strip mining of the 1,200 square miles currently allocated for mines will destroy habitat for an estimated 480,000 to 3.6 million adult birds.[70] Drilling infrastructure could eliminate or fragment another 19,000 square miles of migratory bird habitat.[71] Tar sands operations will also reduce bird births, with one estimate ranging from 9.6 million to 72 million fewer birds being born over a 40-year period.[72]

Tar sands extraction also reduces viable bird habitat by reducing water available to natural ecosystems, as very little of the water used in operations is returned to the natural cycle.[73] Most of the water used in tar sands mining operations comes from the Athabasca River.[74] Up to 15 percent of the river's weekly flow can be taken,[75] causing concerns that low-flow periods will increase mortality of fish and other aquatic organisms that are a source of food for birds.[76] Low flows may also increase concentrations of pollutants and eliminate the annual floods that are critical for nutrient deposition in the floodplain.[77] Mining also "dewaters" areas surrounding the mines by diverting streams from the mineable area, draining adjacent wetlands, and lowering the water table to keep water out of the open pit.[78] As mining operations change regional wetlands, rivers, and underground reservoirs, they threaten hundreds of thousands of migratory birds dependent on these wetlands.[79]

Fragmentation of forests from tar sands drilling and transportation infrastructure leaves fewer areas of closed forest canopy and more forest "edges," where forests meet clearings.[80] Fragmented forests have different microclimates than intact forests, as well as more frequent habitat disturbances, an increase in bird predators and parasites, and invasions of introduced plants and animals. [81] Forest fragmentation also leads to changes in bird social structure and mating success, which decrease survival and reproduction of breeding birds.[82] Isolated bird populations in forest patches are more vulnerable to catastrophic weather or human disturbances.[83]

Noise pollution from compressor stations also impacts bird breeding success. The 5,000 existing compressor stations may have reduced local bird populations in Alberta by 27,000 birds due to habitat loss, and an additional 85,000 birds from noise effects.[84] Expansion of drilling as

planned could eliminate another 425,000 birds from the noise effects of compressor stations alone.[85]

Climate change that will be worsened by tar sands development threatens migratory birds as well. Temperatures in Canada's boreal forest have already risen up to four degrees Celsius in some areas over the past century. This causes dramatic changes in timing of ecosystem events including emerging of springtime insects and mating and nesting of birds.[86] Migratory birds may arrive too late to take advantage of the insect emergence, which is key to providing adequate food for nestlings.[87] Global warming is also shifting bird distributions and altering their migration behavior and habitat, diminishing their survival ability and threatening some species with extinction.[88] As ranges shift north, some species will be replaced by species from further south. All will face habitat loss as well as new competitors, prey, and predators.[89] Moreover, as water tables near mines are lowered during "landscape dewatering," surrounding wetlands become drier.[90] Such dewatering particularly impacts waterbirds, as drier wetlands will be more strongly affected by late summer droughts that are projected to become more common in the region due to global warming.[91]

b. Harms to migratory birds caused by tar sands operations diminish the effectiveness of the Western Hemisphere Convention, the Migratory Bird Convention, and U.S. domestic conservation programs.

The wide-spread and severe impacts on migratory bird species caused by Canadian tar sands operations diminish the effectiveness of domestic and international efforts to protect migratory birds. In May 2011, U.S. Secretary of Interior Salazar released, on behalf of seven federal agencies and others, the 2011 *State of Birds Report*, which emphasized that international cooperation is essential to protect U.S. birds:

> More than half of U.S. birds spend a large part of the year outside of the U.S. We spend millions of dollars on their conservation in the U.S., yet unless we work to stop the decline of habitats beyond our borders, we are jeopardizing our investments at home. International conservation efforts rely on partnerships and local programs that can implement bird conservation on the ground. Continued support for international programs that foster these partnerships is essential.[92]

Similarly, international efforts to protect migratory birds can be threatened by destructive domestic activities within one country along the migration route. The Migratory Bird Convention and the Western Hemisphere Convention are examples of such international conservation efforts that can be effectively implemented to support the successful domestic programs for the conservation of U.S. birds. However, the effectiveness of these efforts is significantly diminished by tar sands extraction in Canada.

A species of particular concern and the subject of rigorous conservation efforts in the United States is the endangered whooping crane. As North America's tallest bird and one of its rarest, the whooping crane has long been a symbol of international conservation efforts.[93] In 1941 the population had fallen as low as 16 adults due to hunting and habitat destruction.[94] Today the whooping crane population is growing, but the species remains endangered and vulnerable to catastrophic natural and anthropogenic threats, including the threats posed by tar

sands operations. In 2010, the global population of wild whooping cranes was just 383 birds, 270 of which migrate over the tar sands region twice each year from Alberta and the Northwest Territories to coastal Texas.[95] These 270 cranes are the only migratory whooping cranes remaining. Pairs, family groups or small flocks fly up to 6000 feet, then glide downwards on thermal currents, covering up to 430 miles per day.[96] They descend by nightfall, landing opportunistically at any available water body along their migration route.[97] The cranes take flight again only when wind conditions are right.[98] They may stay at stopover locations overnight, or up to one week in spring and two weeks in fall.[99] Only four percent of crane stopovers are documented by human observers, but the majority of these occur within 100 miles of the cranes' main migratory corridor.[100] According to U.S. Fish and Wildlife Service Whooping Crane Coordinator Tom Stehn:

> Just having one known whooping crane stopover in a county in the data set roughly means that you can expect at least one whooping crane group to stop in that county in any given year. … Whooping cranes often do not use traditional roost sites, but stop wherever they happen to be late in the day when they find conditions no longer suitable for migration. Although some areas are used regularly by multiple cranes, the possibly more common situation is to have a few cranes stopping at a small wetland or farm pond for a night at a location that they may never use again in their life time. … This can make for a very unpredictable pattern of stopover use depending on daily weather conditions. … [Cranes] occasionally interrupt daytime migration flights to drink and/or forage in an agricultural field or wetland for a brief period.[101]

In the 1980s, radio-telemetry studies documented that the migrating whooping cranes fly over the tar sands area and land on many different water bodies within their migratory corridor.[102] (See Annex II.) In 1981, one group was grounded northeast of Fort McMurray for a week due to dense smoke from forest fires.[103] A second group stayed on the ground in the Birch Mountains northwest of Fort McMurray for two days due to unfavorable weather and adverse winds.[104] In 2006, a family group of possibly oil-stained whooping cranes were photographed during a fall migration stopover on the Platte River in Nebraska.[105] (See Annex III, Figures 5 and 6 for photos.) A contaminants expert at the USGS Patuxent Wildlife Research Center commented on the incident at the time:

> The durability of the staining and the uniform pattern on all three birds are compatible with some type of oil-based staining that occurred as the birds were wading through water. The dark brown (almost black) color would indicate exposure to either crude oil (oil field waste ponds), lubricating oils from waste water retention ponds (industrial or refining complexes), or one of the heavier fuel oils (Nos. 4-6). Gasoline and kerosene would have produced little visible stain and diesel fuel would have left a light brown stain.[106]

United States Fish and Wildlife Service Whooping Crane Coordinator Tom Stehn also commented on the incident:

> [E]xperts I consulted all indicated the material looked like oil. This "oiling" occurred somewhere between Wood Buffalo National Park in

> N.W.T., Canada and the Platte River, Nebraska. … Although there is no proof, it seems possible to me that the oiling may have occurred in the tar sand operations in Canada.[107]

During the fall migration of 2010, whooping cranes fitted with Global Positioning Systems (GPS) transmitters were documented making stopovers in the tar sands region, in both the surface mineable area and the drillable area.[108] (See Annex II.)

According to the Government of Alberta, whooping cranes face the greatest threat from habitat loss and degradation during migration:

> Conversion of wetlands for development (be it agricultural, urban, commercial, or recreational), oil exploration, or road construction is the most significant threat affecting the overall vulnerability of cranes. ... Wetland conversion reduces habitat suitability and availability. [109]

According to the U.S. Fish and Wildlife Service, wetland mosaics provide the most suitable stopover habitat for whooping cranes and should be available every ten miles—at a minimum—throughout their migratory corridor.[110] As described above, tar sands development seriously threatens intact wetland mosaics as stopover habitat. (See Annex II, Figure 4 for a map of anthropogenic disturbance in Alberta's whooping crane migratory corridor.)

In addition, whooping cranes are threatened by global warming, which causes changes in their breeding habitat (as discussed above for migratory birds in the boreal forest), as well as increases in the salinity of wetlands and viability of prey species in their wintering habitat due to sea level rise.[111] Droughts exacerbated by climate change can dry up wetland breeding areas, reduce food supplies, and increase vulnerability of whooping crane chicks and nests to predation.[112] According to the Government of Alberta, "the threat of global warming and the predicted outcome on the environment has the potential to seriously impact existing [whooping] crane habitats." [113]

Thus, while we do not know of confirmed instances of whooping cranes landing in tar sands tailings ponds, it is clear that the cranes use the tar sands area for stopovers; some cranes have possibly been oiled somewhere along their northern migration corridor; and tar sands tailings ponds pose a threat to the entire global population of migratory whooping cranes. In addition, tar sands extraction is reducing suitable stopover habitat for whooping cranes in the tar sands region, and contributing to global warming that will alter their breeding, migration, and wintering habitats.

In conclusion, tar sands extraction diminishes the effectiveness of the Western Hemisphere Convention and the Migratory Bird Convention, *see* 22 U.S.C. § 1978(h)(5), by harassing, harming, wounding, killing, or trapping protected migratory birds—including endangered whooping cranes. The threats that tar sands operation pose to protected birds include: 1) bird deaths as a result of landing in tailings ponds during migration; 2) contamination of wetlands in the region and downstream; 3) damage to and reduction of suitable breeding habitat, due to, among other harms, forest fragmentation, noise, diversion of vast quantities of water and lowering of the water table, damage to food sources, wetlands eutrophication, and acid

rain and deposition of other air pollutants; and 4) accelerating global warming and its negative impacts on migratory birds.

C. Tar Sands Extraction Results in Takings of Woodland Caribou, Diminishing the Effectiveness of the Western Hemisphere Convention.

Another species protected by the Western Hemisphere Convention and threatened by Canadian tar sands operations is the woodland caribou. Woodland caribou are medium-sized members of the deer family. Both males and females have antlers, long legs, and wide hooves adapted to harsh winters and deep snow. They have low reproductive potential and require large tracts of intact, low-productivity, mature to old conifer forests—both peatlands and uplands—that contain terrestrial lichens, their preferred winter food source.[114] They avoid younger and more productive forests that support other ungulates, thus avoiding predation by wolves. [115] Although they wander extensively throughout the year, woodland caribou are not migratory—their winter and summer ranges overlap.[116] Population densities are naturally very low, with just one caribou every 3 to 13 square miles.[117] Calving sites are also highly dispersed – roughly six square miles apart-- which minimizes population density and predation risk.[118]

Caribou survival rates and their rate of population growth are significantly lower in ranges with more anthropogenic and natural disturbance, or in close proximity to these disturbances.[119] With fragmentation, forest floor and light conditions change, favoring species other than lichens.[120] Abundance of younger forest increases populations of other ungulates, which spread parasites and attract wolves.[121]

Roughly one third of Alberta's woodland caribou (population 2,315 adults) lives in the tar sands region in fixed home ranges that are increasingly fragmented by tar sands extraction activities.[122] There are thirteen caribou herds in the tar sands region: Red Earth, Richardson, West Side Athabasca River, Nipisi, Chinchaga, Cold Lake, and East Side Athabasca River (further divided into Algar, Egg-Pony, Bohn, Christina, Wiau, Wandering, and Agnes). [123] All have anthropogenic disturbance in their home ranges. (See Annex IV, Figures 7 and 8 for maps of disturbance and caribou habitat in the tar sands region as a whole, and in the Lower Athabasca region.)

All of the herds are small in size and rarely mix with other herds, if at all.[124] Populations are so isolated that there are discrete genetic types of woodland caribou on either side of the Peace River.[125] Even small declines in survival of adult females can lead to large declines in populations, and all herds in the tar sands have suffered declines in numbers of adult females since 2002.[126]

Woodland caribou population declines in Alberta are a result of habitat disturbance and loss due to mines, well sites, pipelines, roads, seismic lines, transmission corridors, logging, and, in some cases, forest fires.[127] Tar sands oil development has led to high levels of caribou habitat disturbance, resulting in smaller, more isolated and less contiguous habitat patches and creating barriers to caribou movement. [128] By 2010, there were 34 current or approved tar sands operations in woodland caribou habitat, and 12 proposed operations.[129]

The Canadian government has conceded that the current level of anthropogenic disturbance is already beyond the biologically acceptable threshold for self-sustaining caribou

populations in Alberta, and all herds in Alberta are at elevated risk of local extinction.[130] To be precise, 39 to 49 percent of individual caribou herd ranges in the tar sands area are already within 1600 feet of some kind of anthropogenic disturbance.[131] This is worrisome, as current understanding of caribou population dynamics indicates that disturbed areas must not encompass more than about one-third of a population's range if the population is to persist.[132] Indeed, all of the woodland caribou herds in the tar sands region have declined more than 50 percent over their last three generations,[133] and face a high probability of extinction within 40 years.[134] The Cold Lake herd is particularly vulnerable, and expected to fall below 10 individuals in less than 20 years. [135]

It is also important to note that there is a delay between habitat loss and local extinction: a population may persist for decades following habitat degradation before a herd disappears entirely.[136] Habitat alternation and loss also increases the number of caribou predators, namely wolves; not only does it make it easier for predators to move across the landscape and prey on caribou, it also creates conditions that attract alternative prey, thereby increasing the number of caribou predators.[137]

Woodland caribou also reduce their use of otherwise suitable habitat because of its proximity to human infrastructure or habitat disturbances, such as roads, well sites and seismic lines. In fact, the physical footprint that results from direct loss of habitat may be relatively small compared to the functional loss of habitat as a result of caribou avoidance. For example, woodland caribou avoid roads and well sites by approximately 820 feet and 3,200 feet, respectively.[138] This loss of functional habitat is thought to be the single most detrimental factor affecting woodland caribou.[139] For example, a study of the caribou population on the west side of the Athabasca River found that just one percent of habitat was directly lost—primarily due to seismic lines—but 48 percent was functionally lost as a result of reduced use behavior by caribou.[140] A 2011 study of habitat selection and wolf predation on the population on the east side of the Athabasca River found that physiological stresses resulting from intense, widespread levels of human activity may play a primary role in caribou population decline.[141] The study concluded that functional habitat loss may have more to do with human use than with industrial infrastructure (seismic lines, roads, and pipelines) alone: nutritional and physiological stress levels were highest when humans were more active in the landscape, and stress levels returned to normal when oil crews left the area.[142] The authors recommended clustering human activity on the landscape, both physically and temporally, and minimizing secondary roads.[143]

Global warming, accelerated by tar sands extraction, also threatens woodland caribou. Warming increases populations of mountain pine beetles in the boreal forest, resulting in the death of mature trees and decline of terrestrial lichens that caribou depend upon for winter forage.[144] As vegetation types shift northward with regional warming, lichen will be more quickly outcompeted by grasses and shrubs.[145] Extreme weather events, including unusually deep snow or ice crusts atop snow—caused by freezing rain or melting snows that refreeze—create difficult grazing conditions for caribou that may result in starvation and death.[146] Caribou herd population declines have also been linked to winters with heavy snow.[147] Regional warming is expected to cause warmer and longer summers and greater variety in snow conditions that will affect the growth and distribution of plants eaten by caribou.[148] Warming air temperatures also cause changes in insect emergence, abundance and activity, causing caribou to spend more time running from mosquito and fly harassment and less time foraging, resulting in

poor body conditions. [149] Warming also causes increases in the frequency and severity of forest fires; changes in abundance, type and quality of forage; changes in conditions for diseases and parasites; and increased caribou predation, as deer and moose expand northwards and are followed by wolves and other predators.[150]

The urgent need to protect woodland caribou from industrial development, in particular tar sands development, has been outlined in numerous reports and studies. A 2011 report concluded that:

> [T]he situation is critical and immediate action is required. None of the herds are currently self-sustaining and most will be functionally extirpated within three decades if current population trends continue. Population declines may even accelerate in the face of continued industrial expansion. … *It will not be possible to add any new industrial features to most caribou ranges for several decades without making matters worse for caribou.*[151]

The Athabasca Caribou Landscape Management Options report of 2009 concluded that "management action is needed NOW" as woodland caribou "will not persist for more than two to four decades without immediate and aggressive management intervention."[152] Further, "[t]ough choices need to be made between the management imperative to recover [woodland] caribou and plans for ongoing bitumen development and industrial land-use. [153] It also concluded that "the highest risk to caribou occurs in areas with thick bitumen deposits" and that the industrial footprint in caribou habitat should be reduced in size and duration.[154]

A 2011 panel of 23 woodland caribou experts recommended that the relatively more intact ranges of Chinchaga, Red Earth, West Side Athabasca River and East Side Athabasca River should be the focus of Alberta's land use planning to create an overarching caribou protection plan.[155] Among their findings:

> [T]o conserve woodland caribou means dispensing with business as usual, which has demonstrably and repeatedly failed to meet caribou conservation needs. … While it is tempting to regard predators as the culprits in the decline and demise of woodland caribou, the ultimate cause is human activities. … To proceed headlong with industrial exploitation in caribou range in the face of known uncertainties is to risk foreclosing on options. … Science suggests keeping caribou in the boreal forest is achievable. Society will need a new way of thinking—based on forethought and wisdom—to make it happen.[156]

Finally, a 2010 report determined that woodland caribou will be extirpated from most of the tar sands region in Alberta if industrial activity is allowed to continue unabated and without habitat restoration.[157] Even the Alberta government's Endangered Species Scientific Sub-committee recently recommended that Alberta's caribou be uplisted from "threatened" to "endangered."[158]

In conclusion, tar sands extraction in Alberta diminishes the effectiveness of the Western Hemisphere Convention by harassing, harming, wounding, or killing threatened woodland caribou through oil extraction activities that 1) directly destroy or degrade caribou habitat; 2)

cause functional habitat disturbance through human activities and sensory disturbance; 3) create forest conditions that attract caribou predators; and 4) accelerate global warming and its negative impacts on woodland caribou.

D. Canada has failed to effectively regulate the tar sands industry to mitigate the impacts of tar sands extraction.

Canada has failed to effectively regulate the tar sands industry to prevent or mitigate the environmental impacts of the tar sands industry. Canada has not introduced any tar sands specific regulations, and there is no indication that measures to reduce emissions from new or existing tar sands development will be introduced anytime soon.

While federal authorities exist for regulating fisheries, navigable waters, toxics, and climate change, and mandating environmental assessments, the Canadian government has fallen short in its implementation of these authorities in the context of the tar sands industry. For example, the federal government does not regulate toxic substances such as naphthenic acids that are utilized and released in the extraction process.[159] By comparison, naphthenic acids are listed as hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act.[160] Canada has also failed to prosecute or prevent the leakage of contaminated tailings ponds into surface and groundwater despite overwhelming evidence that such leakage occurs.[161] Required measures for the protection of waterfowl from the lethal risks posed by tailings ponds are inadequate or non-existent.[162] Although the federal Department of Fisheries and Oceans has the authority to limit water diversions, there are currently no enforceable conditions placed on permits for water withdrawals.

Canada has also failed to monitor water quality and quantity in the tar sands region despite its legislative obligations to do so.[163] The federal government has announced plans to introduce a monitoring system, but the information collected will only be useful in addressing the environmental impacts of the tar sands if it is accompanied by adequate regulations and enforcement, which do not currently exists. Finally, environmental assessments of the impacts of tar sands activities on the environment are inadequate.[164] In particular, the joint provincial-federal regulatory panels appointed to conduct the assessments do not sufficiently assess the cumulative impacts that tar sands operations will have on the environment (including the effects on wildlife, such as whooping cranes), or they conclude that the significant adverse effects caused by tar sands operations will be mitigated through unproven technologies. Canada has also refused to implement protections for species at risk that are being decimated by tar sands development. For example, the federal government was legally required to produce a recovery strategy to protect woodland caribou and its habitat in 2007.[165] A proposed recovery strategy was finally just released - more than four years overdue – which will likely ensure the extirpation of the Alberta herds.. Despite that fact, the federal government has refused to recommend emergency protections for woodland caribou in the tar sands region, a decision that was recently overturned by the Federal Court as it was contrary to the evidence that exists of the imminent threats faced by those woodland caribou.[166]

This weak regulatory environment, lack of enforcement of existing laws, and the overwhelming influence of the oil and gas industry in Canada have allowed the tar sands industry to expand at break-neck pace without regard for the devastating impacts on migratory birds, woodland caribou, and the ecosystems on which they rely. Canada has been unwilling to

put mechanisms in place that would prevent or mitigate such harms and thus contributes to the diminishment of the effectiveness of domestic and international efforts to protect these species.

IV. THE SECRETARY MUST CERTIFY TO THE PRESIDENT THAT TAR SANDS EXTRACTION DIMINISHES THE EFFECTIVENESS OF THE WESTERN HEMISPHERE CONVENTION AND THE MIGRATORY BIRD CONVENTION.

The Secretary of the Interior must investigate activities of foreign nationals that engage in tar sands extraction, as these activities "may affect" the Western Hemisphere Convention and the Migratory Bird Convention, or "be cause for certification." 22 U.S.C. § 1978(a)(3). If the Secretary determines that tar sands extraction is diminishing the effectiveness of the Western Hemisphere Convention or the Migratory Bird Convention, the Secretary must certify this fact to the President. *See* 22 U.S.C. § 1978; *American Cetacean Soc'y.*, 673 F. Supp. at 1105. As demonstrated above, the facts unequivocally show that tar sands extraction is resulting in threats to migratory birds, including whooping cranes, and woodland caribou. "Conservation factors," which in this case would include the status of populations of protected birds and caribou, threats to those populations, scope and fragmentation of habitat, migration patterns, environmental stressors, and other factors, demonstrate that tar sands extraction is diminishing the effectiveness of the Western Hemisphere Convention and the Migratory Bird Convention. *See Greenpeace USA*, 719 F. Supp. at 24 (citing *Japan Whaling*, 478 U.S. at 233).

Though the Secretary need not certify "every departure" from a treaty covered by the Pelly Amendment, discretion to determine whether actions "diminish the effectiveness" of an international species protection program does not permit the Secretary to ignore actions contrary to the spirit or terms of the species protection program. *Japan Whaling*, 478 U.S. at 233, 234. Tar sands extraction, as currently practiced, is contrary to the spirit and terms of the Western Hemisphere Convention and the Migratory Bird Convention. The Western Hemisphere Convention calls upon states to "adopt appropriate measures for the protection of migratory birds ... to prevent the threatened extinction of any given species," art. VII, and to provide protection "as completely as possible" of birds protected by the Convention. Art. VIII. Similarly, the purpose of the Migratory Bird Convention is to "sav[e] from indiscriminate slaughter and ... insur[e] the preservation of migratory birds "in danger of extermination through lack of adequate protection" during the nesting season or during migration. Migratory Bird Convention, pmbl. Because tar sands extraction results in killings and takings of species protected by these Conventions, the Secretary must certify this fact to the President.

V. CONCLUSION

Tar sands extraction is directly killing and destroying important habitat of 130 migratory bird species—including the endangered whooping crane—protected by the Western Hemisphere Convention and the Migratory Bird Convention. Tar sands operations also threaten woodland caribou protected by the Western Hemisphere Convention. These activities constitute takings of protected fauna within the meaning of the Pelly Amendment. Canada has failed to take appropriate steps to ensure that tar sands development does not result in takings of these species. As a result, Canada and the oil companies engaged in tar sands extraction in Canada have diminished the effectiveness of the Western Hemisphere Convention and the Migratory Bird Convention, and in particular, those Conventions' provisions requiring special protection for listed species, including whooping crane and woodland caribou. Accordingly, the undersigned

groups respectfully request that the Secretary (a) investigate tar sands extraction activities in Alberta, Canada, as these activities may "be cause for certification" under the Pelly Amendment, 22 U.S.C. § 1978(a)(3); (b) determine that tar sands extraction "diminishes the effectiveness" of the Western Hemisphere Convention and the Migratory Bird Convention, 22 U.S.C. § 1978(a)(2); and (c) certify these facts to the President. *See* 22 U.S.C. § 1978(a)(2).

Sincerely,

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56. Wells, J. *et al.*, *Danger in the Nursery: Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest*, Natural Resources Defense Council (2008), http:/www.nrdc.org/wildlife/Borealbirds.asp

57. White, J., *Status of the Whooping Crane (*Grus Americana*) in Alberta*, Alberta Environment, Fisheries and Wildlife Management Division and Alberta Conservation Association, Wildlife Status Report No. 34 (2001), http://www.srd.alberta.ca/FishWildlife/SpeciesAtRisk/DetailedStatus/documents/whooper.pdf

58. World Resources Institute, *Eutrophication and Hypoxia*, http://www.wri.org/project/eutrophication/about

59. Woynillowicz, D. et al., *Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush*, The Pembina Institute (2005), http://www.pembina.org/pub/203

ANNEX I: SPECIES PROTECTED BY THE MIGRATORY BIRD CONVENTION THAT BREED OR MIGRATE THROUGH THE TAR SANDS REGION

The following list of migratory birds in the tar sands region were sourced from *Guideline for wetland establishment on reclaimed oil sands leases (2nd edition)* Alberta Environment (2008), http://environment.gov.ab.ca/info/library/8105.pdf at 318-322, Appendix E1, as well as J. Wells et al., *Danger in the Nursery, Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest* (2008), and compared with the 1995 Protocol Amending the Migratory Birds Convention, http://www.treaty-accord.gc.ca/text-texte.asp?id=101587. For scientific names, see the Migratory Birds Treaty Act List at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

1. American Avocet
2. American Bittern
3. Bobolink
4. Bufflehead
5. Canvasback
6. Boreal Chickadee
7. American Coot
8. Sandhill Crane
9. Whooping Crane
10. Short-billed Dowitcher
11. American Black Duck
12. Harlequin Duck
13. Ring-necked Duck
14. Ruddy Duck
15. Wood Duck
16. Great Egret
17. Alder Flycatcher
18. Great-crested Flycatcher
19. Least Flycatcher
20. Olive-sided Flycatcher
21. Yellow-bellied Flycatcher
22. Gadwall

23. Marbled Godwit
24. Barrow's Goldeneye
25. Common Goldeneye
26. American Goldfinch
27. Canada Goose
28. Ross' Goose
29. Snow Goose
30. Eared Grebe
31. Horned Grebe
32. Pied-Billed Grebe
33. Red-necked Grebe
34. Western Grebe
35. Evening Grosbeak
36. Bonaparte's Gull
37. California Gull
38. Franklin's Gull
39. Glaucous Gull
40. Herring Gull
41. Iceland Gull
42. Mew Gull
43. Ring-billed Gull
44. Great Blue Heron
45. Dark-eyed Junco
46. Killdeer
47. Eastern Kingbird
48. Ruby-crowned Kinglet
49. Arctic Loon
50. Common Loon
51. Red-throated Loon

52. Mallard
53. Common Merganser
54. Hooded Merganser
55. Red-breasted Merganser
56. Common Nighthawk
57. Red-breasted Nuthatch
58. Oldsquaw or Long-tailed Duck
59. Northern Oriole
60. Red Phalarope
61. Red-necked Phalarope
62. Wilson's Phalarope
63. Eastern Phoebe
64. Say's Phoebe
65. Northern Pintail
66. American Pipit
67. Redhead
68. Common Redpoll
69. American Robin
70. Buff-breasted Sandpiper
71. Least Sandpiper
72. Semipalmated Sandpiper
73. Solitary Sandpiper
74. Spotted Sandpiper
75. Upland Sandpiper
76. Greater Scaup
77. Lesser Scaup
78. Surf Scoter
79. White-winged Scoter
80. Northern Shoveler

81. Pine Siskin
82. Common Snipe
83. Sora
84. American Tree Sparrow
85. Chipping Sparrow
86. Clay-colored Sparrow
87. Fox Sparrow
88. LeConte's Sparrow
89. Lincoln's Sparrow
90. Savannah Sparrow
91. Sharp-tailed Sparrow
92. Song Sparrow
93. Swamp Sparrow
94. Vesper Sparrow
95. White-crowned Sparrow
96. White-throated Sparrow
97. Bank Swallow
98. Barn Swallow
99. Cliff Swallow
100. Tree Swallow
101. Trumpeter Swan
102. Tundra Swan
103. Western Tanager
104. Blue-winged Teal
105. Cinnamon Teal
106. Green-winged Teal
107. Arctic Tern
108. Black Tern
109. Caspian Tern

110. Common Tern
111. Hermit Thrush
112. Swainson's Thrush
113. Philadelphia Vireo
114. Red-eyed Vireo
115. Solitary Vireo
116. Warbling Vireo
117. Bohemian Waxwing
118. Cedar Waxwing
119. American Wigeon
120. Eurasian Wigeon
121. Willet
122. Black-backed Woodpecker
123. Pileated Woodpecker
124. Three-toed Woodpecker
125. Western Wood-Pewee
126. House Wren
127. Marsh Wren
128. Winter Wren
129. Greater Yellowlegs
130. Lesser Yellowlegs

ANNEX II: WHOOPING CRANE MIGRATION THROUGH ALBERTA'S TAR SANDS

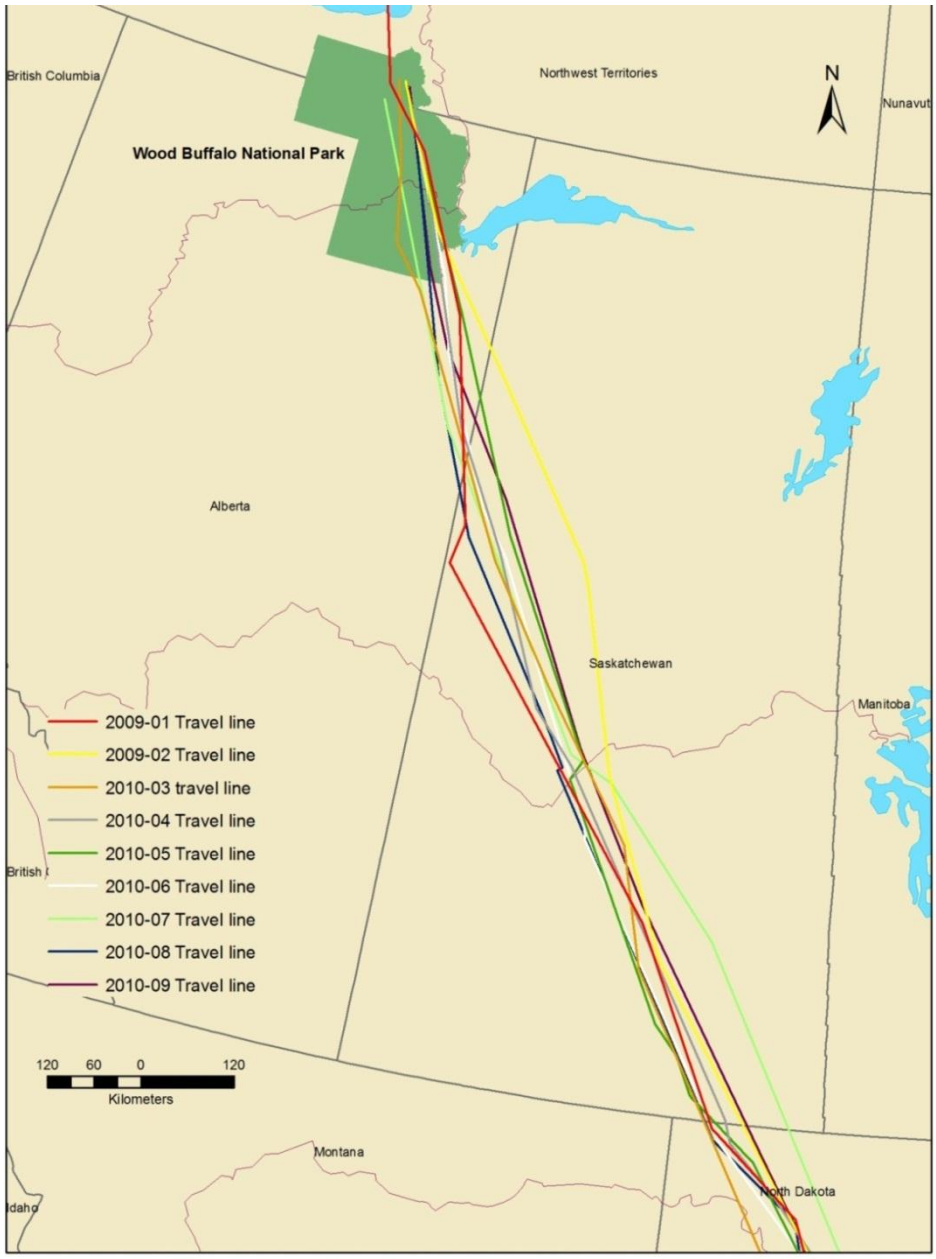

Figure 1. Migration Routes of GPS-tracked Whooping Cranes in Canada fall 2010, Source: Walter Wehtje, *Aransas Wood Buffalo Population Radio-Marked Whooping Crane Fall 2010 Migration Report*, The Crane Trust (unpublished report of April 2011) at 8.

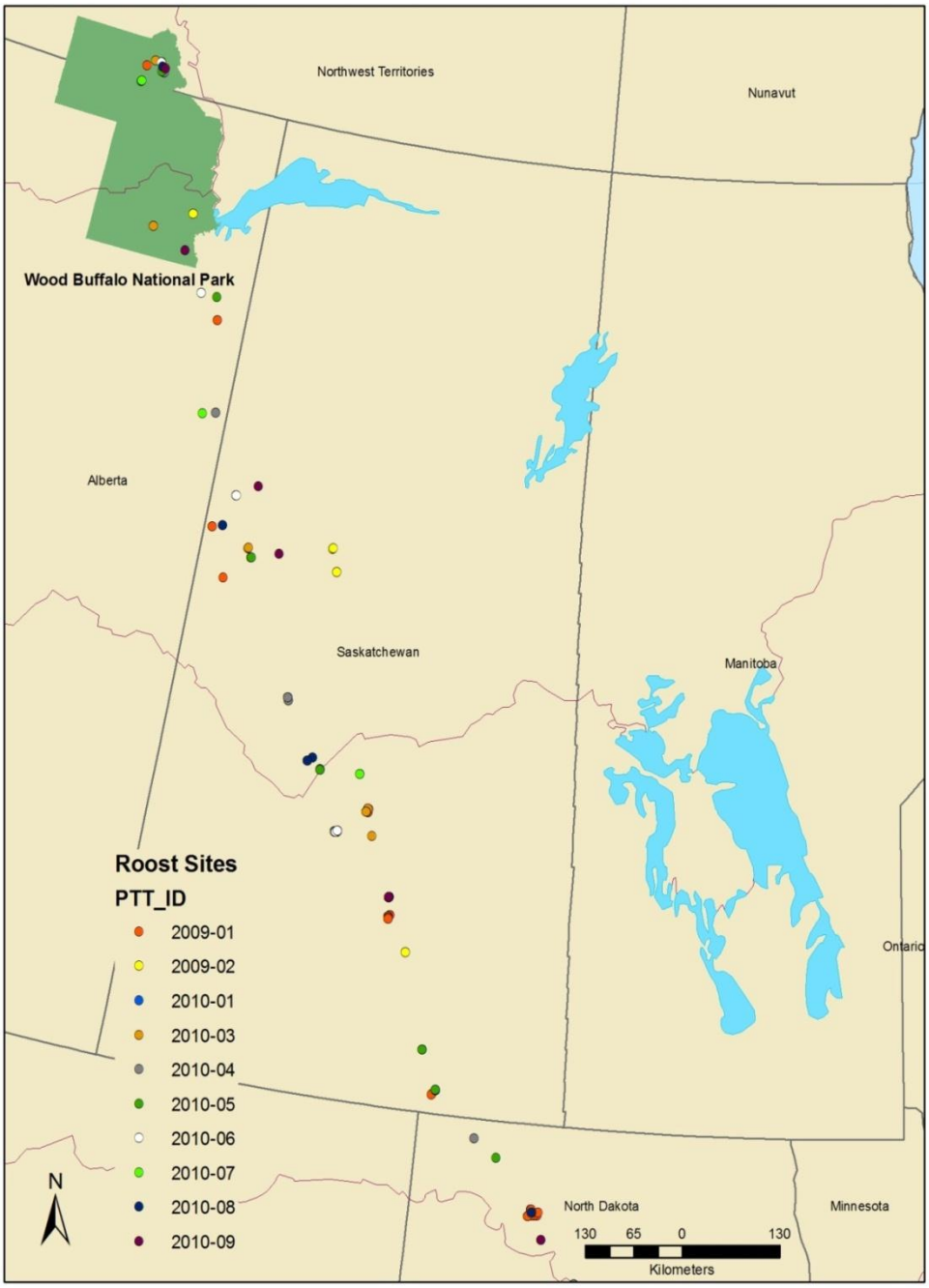

Figure 2. Migration roost sites of GPS-tracked whooping cranes in Canada during fall 2010 (Note: 2010-01 travel route not shown as there were too few data points to provide an accurate representation of its travel route). Source: Walter Wehtje, *Aransas Wood Buffalo Population Radio-Marked Fall 2010 Migration Report*, The Crane Trust (unpublished report of April 2011) at 8.

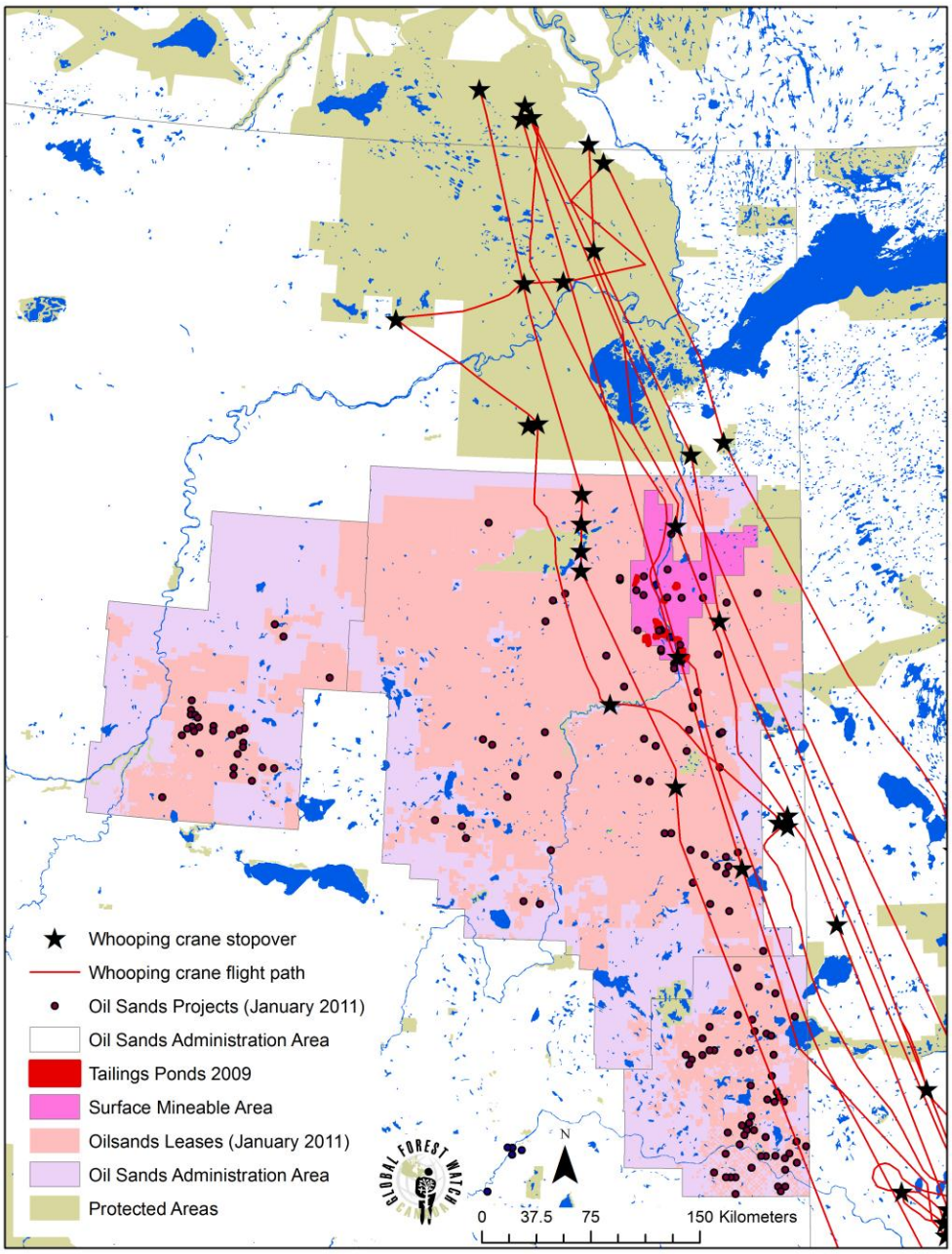

Figure 3. Whooping crane stopover spots and flight paths in Alberta Oil Sands Region (1981, 1982, 1983). Source: P. Lee, *Whooping Cranes (*Grus Americana*) in Alberta's Oil Sands Region***,** Global Forest Watch Canada International Year of Forests Publication #9 (2011), available at: www.globalforestwatch.ca, using stopover data from E. Kuyt, *Aerial Radio-tracking of Whooping Cranes Migrating Between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-84*, Environment Canada, Canadian Wildlife Service Occasional Paper No. 74 (1992).

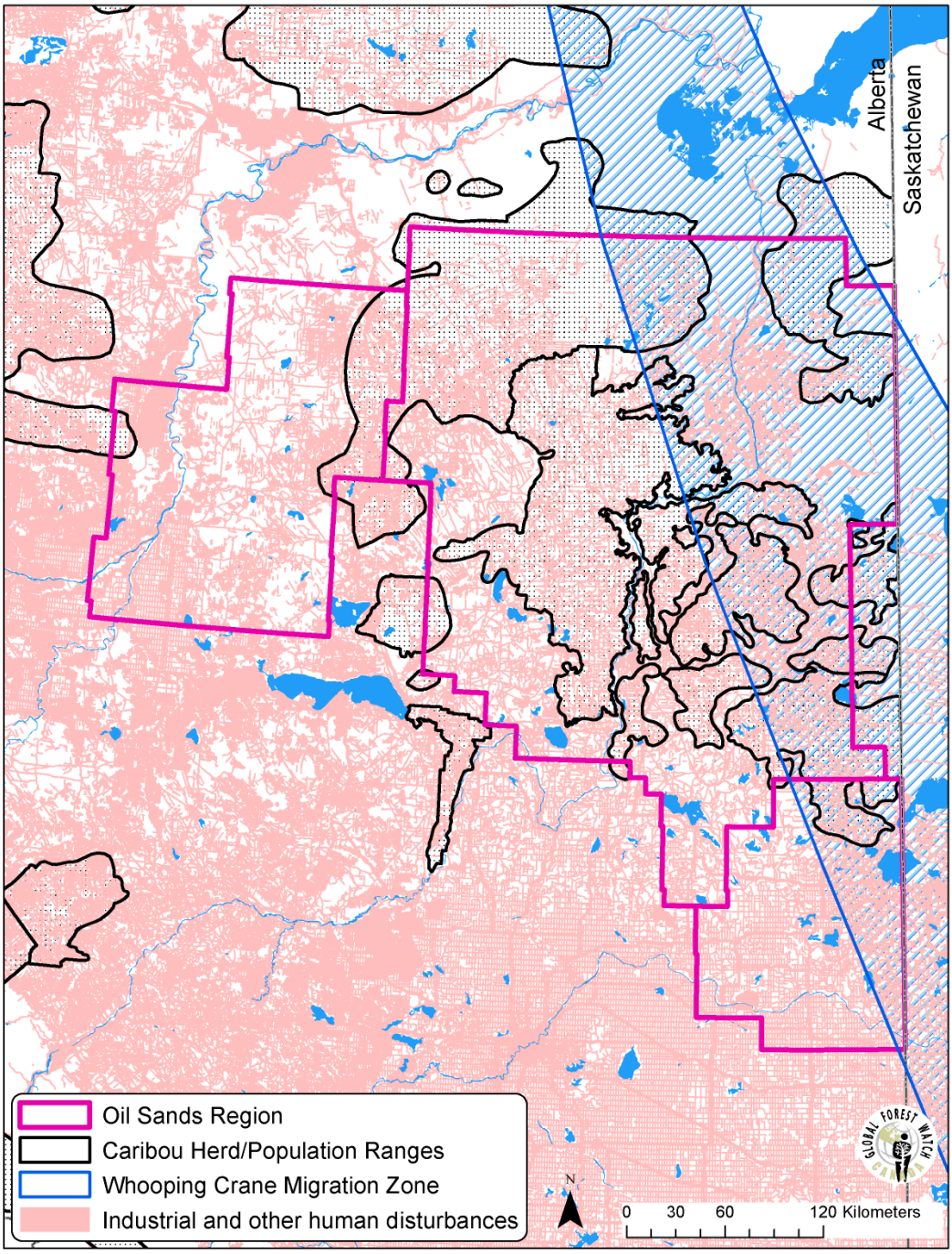

Figure 4. Anthropogenic disturbance in the whooping crane migratory corridor of Alberta. Source: Global Forest Watch Canada (August 2011), www.globalforestwatch.ca

ANNEX III: PHOTOGRAPHS OF POSSIBLY OIL-STAINED WHOOPING CRANES AT THE PLATTE RIVER, NEBRASKA, FALL 2006.

Figure 5. Stained Whooping Cranes on the Platte River, Nebraska, 2006. (The bellies of whooping cranes are normally pure white.) According to the U.S. Fish and Wildlife Service Whooping Crane Coordinator, it is possible that the cranes were oiled at an Alberta tar sands tailings pond. Credit: Michael Forsberg.

Figure 6. Possibly oiled Whooping Cranes in flight at the Platte River, Nebraska, Fall 2006. The underbellies of Whooping Cranes are normally white. Credit: Whooping Crane Journey North, *Tom Stehn's Report: Migration Dangers* (March 16, 2007) http://www.learner.org/jnorth/crane/spring2007/Update031607_Stehn.html.

ANNEX IV: CARIBOU HABITAT DISTURBANCE IN THE TAR SANDS REGION

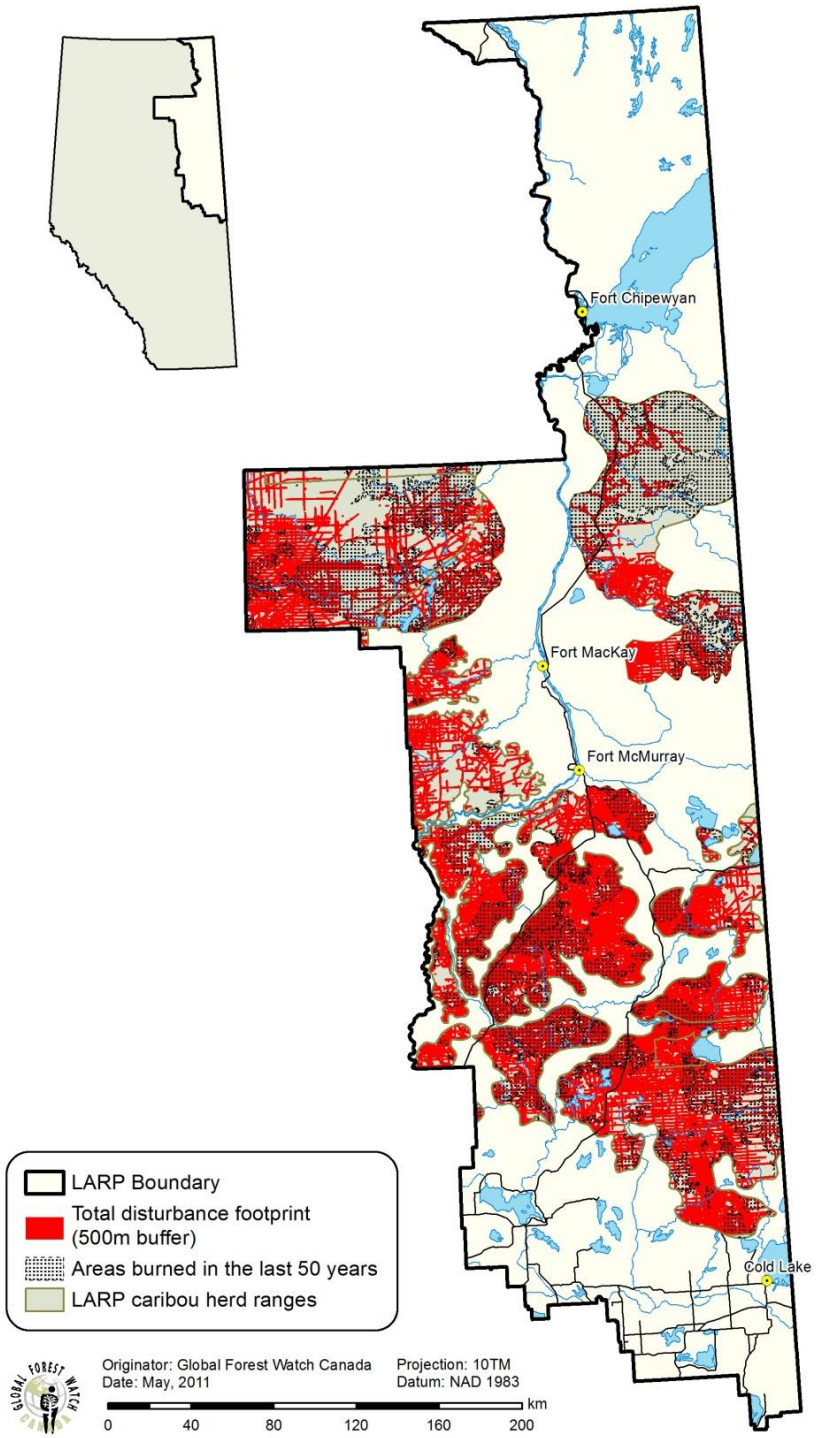

Figure 7. Anthropogenic footprint and fire disturbance in woodland caribou herd ranges in the Lower Athabasca Regional Plan of Alberta. Source: P. Lee et al., *Anthropogenic and Fire Disturbances in Woodland Caribou Herd Ranges in the Lower Athabasca Regional Plan Area, Alberta*, Global Forest Watch Canada International Year of Forests Publication #8. (2011).

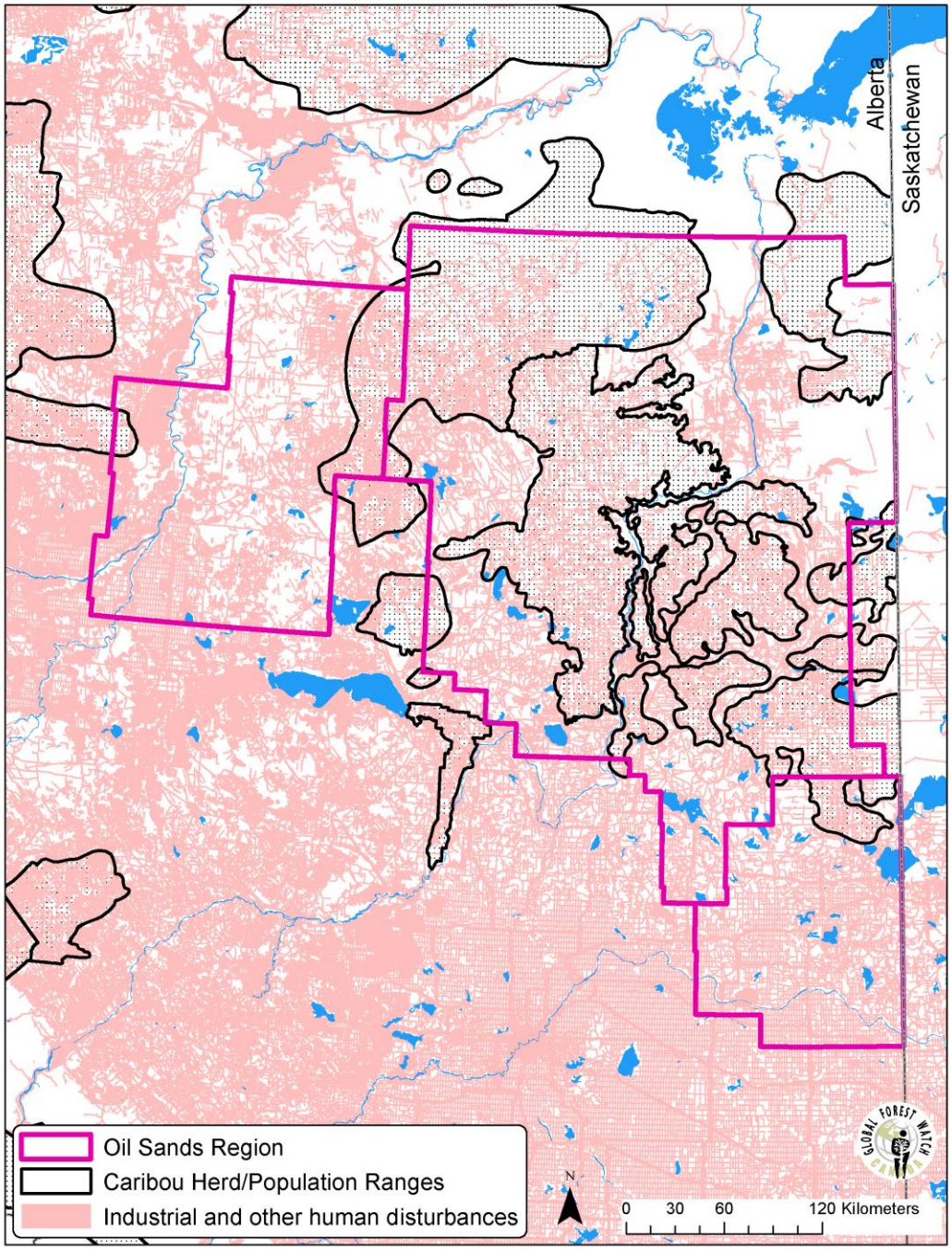

Figure 8. Anthropogenic disturbance in woodland caribou herd ranges in the tar sands region. Source: Global Forest Watch Canada (2011). This dataset, *Canada Access*, was selected by Environment Canada for their Canada-wide analysis and report: "Environment Canada, *Scientific Review for the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada* (2008).

ENDNOTES

[1] Woodland caribou are considered endangered in the United States and threatened in Alberta and Canada. The endangered woodland caribou of the United States live in the Selkirk mountains of Idaho and Washington. Harms to woodland caribou in the tar sands region do not directly affect U.S. woodland caribou, but local extinctions of Alberta caribou could diminish options for caribou conservation measures in the United States, including possibilities for captive breeding, relocation or reintroduction.

[2] D. Cichowski, *Status of the Woodland Caribou (*Rangifer tarandus caribou*) in Alberta*: *Update 2010*, Alberta Sustainable Resource Development, Alberta Wildlife Status Report No. 30 (2010), http://www.srd.alberta.ca/FishWildlife/SpeciesAtRisk/DetailedStatus/Mammals/documents/Status-WoodlandCaribou-inAlberta-Jul-2010.pdf, (hereinafter Cichowski 2010) at 55.

[3] Alberta Environment, *Alberta's Oil Sands: Opportunity, Balance I* (March 2008), http://www.environment.alberta.ca/documents/Oil_Sands_Opportunity_Balance.pdf.

[4] Government of Alberta, Energy, *Oil Sands Facts and Statistics*, http://www.energy.gov.ab.ca/OilSands/791.asp (last revised 5/19/2011, accessed 5/29/2011). For a detailed map of the tar sands region, see Government of Alberta, *Alberta's Leased Oil Sands Area* (2010), http://www.energy.alberta.ca/LandAccess/pdfs/OSAagreesStats_July2010.pdf.

[5] J. Wells et al., *Danger in the Nursery: Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest*, Natural Resources Defense Council (2008), http:/www.nrdc.org/wildlife/Borealbirds.asp (hereinafter Wells et al. 2008) at 1.

[6] Wells et al. 2008 at iv; D. Woynillowicz et al., *Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush*, The Pembina Institute (2005), http://www.pembina.org/pub/203 (hereinafter Woynillowicz et al. 2005) *citing* P. McEachern and T. Charette, *Lakes in Alberta's Boreal Forest*, Lakeline (Winter 2003/04).

[7] Government of Alberta, *Alberta's Oil Sands: Facts About The Resource* (February 2011), http://www.oilsands.alberta.ca/FactSheets/About_Albertas_oil_sands.pdf (hereinafter Government of Alberta/Facts about the Resource 2011)

[8] Wells et al. 2008 at iv.

[9] Government of Alberta, Energy, *Oil Sands Facts and Statistics*, http://www.energy.gov.ab.ca/OilSands/791.asp (revised July 29, 2011, accessed August 1, 2011).

[10] Wells et al. 2008 at vi.

[11] Wells et al. 2008 at vi.

[12] The Pembina Institute, *OilSandsWatch.org*, *Water Impacts* (updated May 2011, accessed August 1, 2011), http://www.pembina.org/oil-sands/os101/water (hereinafter Pembina 2011) *citing* Alberta Environment, *Water Diversion by Oilsands Mining Projects in 2008* (data received March 2010); and EPCOR Water Services, 2008 Performance Based Regulation Progress Report (2009) at 8.

[13] Government of Alberta/Facts about the Resource 2011

[14] Government of Alberta/Facts about the Resource 2011

[15] Wells et al. 2008 at 8; *see also* S. Kean, *Eco-Alchemy in Alberta*, 326 Science 5956, 1052, 20 (November 20 2009); *and* Pembina Institute, *Pond 1 Backgrounder* (2010), http://pubs.pembina.org/reports/pond-1-backgrounder.pdf ((hereinafter Pembina 2010 Backgrounder)

[16] Woynillowicz et al. 2005 at 3, 11.

[17] Shlumberger Ltd, *Water Management for Oil Sands mining operations* (2011) , http://www.heavyoilinfo.com/feature_items/water-management-for-oil-sands-mining-operations#dewatering-of-the-open (accessed August 1, 2011).

[18] Shlumberger Ltd. 2011.

[19] Government of Alberta, *Alberta's Oil Sands, Tailings*, (March 2011), http://www.oilsands.alberta.ca/FactSheets/fs_Tailings_online.pdf (tailings ponds cover 170 square kilometers); Bruce Peachey, *Strategic Needs for Energy Related Water Use Technologies*, New Paradigm Engineering Ltd February, 2005 http://www.aeri.ab.ca/sec/new_res/docs/EnergyINet_and_Water_Feb2005.pdf at 38 (tailings ponds are some of the largest manmade structures on earth).

[20] T. Simieritsch et al, *Tailings Plan Review, An Assessment of Oil Sands company Submissions for Compliance with ERCB Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*, Pembina Institute (2009), http://pubs.pembina.org/reports/tailings-plan-review-report.pdf.

[21] Wells et al. 2008 at 8.
[22] Pembina 2010 Backgrounder citing E. Allen, *Process water treatment in Canada's oil sands industry: 1. Target pollutants and treatment objectives*, 7 J. Environ. Sci. 123 (2008); U.S. Environmental Protection Agency, *Priority Pollutants* (accessed August 1, 2011) http://water.epa.gov/scitech/methods/cwa/pollutants.cfm.
[23] Wells et al. 2008 at 14-15; K. Timoney, K. and P. Lee, *Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence*, 3 The Open Conservation Biology Journal (2009) (hereinafter Timoney and Lee 2009) at 71-77, *citing* P. Addison and K. Puckett, *Deposition of atmospheric pollutants as measured by lichen element content in the Athabsca oil sands area*, Can. J. Bot. 1980, and R. Pauls et al., *Pollutant deposition impacts on lichens, mosses, wood and soil in the Athabasca oil sands area*, Syncrude Canada Ltd (1996).
[24] Timoney and Lee 2009 at 65.
[25] Such pollutants include particulate matter ($PM_{2.5}$ and PM_{10}); sulfur dioxide; nitrogen oxides; hydrogen sulfide; salts; heavy metals, including mercury, lead, cadmium, arsenic, antimony, copper, strontium, uranium, barium, and selenium; VOCs, including benzene, xylene, ammonia, and formaldehyde; and over 28 kinds of PAHs, including dibenzothiophenes, naphthalenes, phenanthrenes, benzopyrenes, and fluoranthenes.
[26] Timoney and Lee 2009 at 65.
[27] E. Kelly et al, *Oil sands development contributes elements toxic at low concentrations to the Athabasca River and its tributaries*, 107 PNAS 37, 16178 (2010) http://www.pnas.org/content/107/37/16178.full.
[28] D. Schindler, *Tar sands need solid science*, 468 Nature (November 25, 2010), http://www.nature.com/nature/journal/v468/n7323/full/468499a.html; Kelly et al. 2010 at 16178.
[29] Timoney and Lee 2009 at 78.
[30] Timoney and Lee 2009 at 76, *citing* RAMP (Regional Aquatics Monitoring Program), *Regional Aquatics Monitoring Program, 2006 Technical Report, Final* (2007); Alberta Environment, *Overview of water quality in the Muskeg River basin July 1972 to March 2001* (2001); Golder Associates, *Oil Sands Regional Aquatics Monitoring Program (RAMP) five year report. May 2003* (2003); Shell, *Albian Sands Energy Inc. Muskeg River Mine Expansion Project. Responses to Alberta Environment Request for Clarification of Supplemental Information Provided, Application No. 004-20809* (2006).
[31] Timoney and Lee 2009 at 78.
[32] Timoney and Lee 2009 at 78.
[33] Timoney and Lee 2009 at 78.
[34] Timoney and Lee 2009 at 72,74.
[35] Timoney and Lee 2009 at 72.
[36] Timoney and Lee 2009 at 72.
[37] Government of Alberta, *Facts About Water in Alberta*, (December 2010) http://environment.gov.ab.ca/info/library/6364.pdf at 42. "Enhanced recovery of conventional oil reserves requires water (or another fluid, like carbon dioxide) to displace oil in a formation for extraction. This requirement is to maintain pressure in the oil reservoir. Surface water or fresh groundwater is normally used but industry has been steadily increasing its use of saline groundwater."
[38] Wells et al. 2008 at 15.
[39] Wells et al. 2008 at 16; *and see* World Resources Institute, *Eutrophication and Hypoxia* (accessed June 2011), http://www.wri.org/project/eutrophication/about. When algae and plants die, the process of decomposition uses oxygen in the water. In still water, oxygen levels become too low for slow-moving or attached animals to survive. This can cause major changes in community food webs.
[40] U.S. Environmental Protection Agency, *Particulate Matter*, http://www.epa.gov/ncer/science/pm/.
[41] D. A. Grantz et al., *Ecological effects of particulate matter*, 29 Environment International 2, 213 (2003).
[42] Woynillowicz et al 2005at 51, *citing* Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Environmental Impact Assessment Appendices for the Muskeg River Mine Expansion*, Appendix 2-9, Air and Noise Modelling Methods, 107-8, (2005); *and* N0x/S02 Management Working Group, *N0x and S0x Sensitivity Mapping*, (2004).
[43] Woynillowicz et al. 2005 at 51.
[44] Woynillowicz et al. 2005 at 22.
[45] Schindler 2010.
[46] U.S. Environmental Protection Agency, *Greenhouse Gas Equivalency Calculator, Calculations and References, Barrels of Oil consumed*, http://www.epa.gov/cleanenergy/energy-resources/refs.html#oilc (noting 0.43 metric tons of carbon dioxide per barrel of crude oil consumed);Woynillowicz et al. 2005 at 22 (estimating 315 billion barrels of

recoverable oil in the tar sands region (at 1), and estimating that production of oil from tar sands emits 85.5 kg CO2eq per barrel of oil).

[47] J. Hansen, *Obama's tar sand trap*, The Guardian, February 18, 2009, http://www.guardian.co.uk/commentisfree/cifamerica/2009/feb/17/barack-obama-canada-climate-change.

[48] P. Gosselin et al., *The Royal Society of Canada Expert Panel, Environmental and Health Impacts of Canada's Oil Sands Industry* (December 10, 2010), http://www.rsc.ca/documents/RSCreportcompletesecured9Mb_Mar28_11_000.pdf.

[49] K. Timoney and R. Ronconi , *Annual Bird Mortality in the Bitumen Tailings Ponds in Northeastern Alberta, Canada*, 122 The Wilson Journal of Ornithology 3, 569, 570 (2010), http://www.bioone.org/doi/full/10.1676/09-181.1; E. Butterworth et al., *Peace-Athabasca Delta Waterbird Inventory Program: 1998-2001 Final Report*, Ducks Unlimited Canada (2002), http://www.ducks.ca/conserve/programs/boreal/pdf/pad2001.pdf ; *see also* Wells et al. 2008; *and* Timoney and Lee 2009. Millions of waterfowl, shorebirds and insectivorous birds protected by the Migratory Bird Convention winter in the United States and migrate north to breed in in Artic river deltas, Arctic islands, the Mackenzie River lowlands, Wood Buffalo National Park, and the Peace-Athabasca Delta of Alberta. All four of North America's major flyways converge on the Peace-Athabasca Delta alone, which is the largest inland boreal delta in the world and the most important waterbird staging area in Canada. Over one million protected birds converge on the Delta in the fall, and over 130,000 waterfowl breed there in spring, including over 15,000 lesser scaup, up to 20,000 mallards, nearly 10,000 canvasbacks, 7,000 common goldeneye, and 5,000 bufflehead. One study noted 18,000 geese over a tar sands lease area; other studies have noted as many as 2,700 ducks or 5,600 waterbirds at lakes in the tar sands during a single day.

[50] R. Ronconi and C. St. Clair, (2006); *R. v. Syncrude Canada Ltd.*, 2010 ABPC 229 (2010), ¶ 15.5, http://www.canlii.org/en/ab/abpc/doc/2010/2010abpc229/2010abpc229.pdf. In one study, up to 45 percent of waterfowl flying over a tailings pond landed in it, with ducks and shorebirds making over 50 percent of the landings.

[51] Ronconi and St. Clair 2006; *see also R. v. Syncrude Canada Ltd.*, 2010 ¶ 12 ("Bitumen mat on the surface of the tailings pond can trap the waterfowl that land on it and the birds will eventually sink with the bitumen. As bitumen contamination increases, birds lose buoyancy and the insulating effect of feathers. There is a loss of the feathers' waterproofing, leading to hypothermia or drowning. Birds will lose their ability to fly. A heavily oiled bird will almost certainly die."); id. ¶ 13 ("The mat was described as being several inches thick, viscous and cohesive with the consistency of a frothy roofing tar. It moves within the pond and eventually sinks, taking birds with it in this case. The mat found on April 28, 2008 covered a significant part of the pond."

[52] Wells et al. 2008 at 15.

[53] *R. v. Syncrude Canada Ltd.*, 2010 ¶ 13.

[54] Timoney and Ronconi 2010 at 569. Species killed by tailings ponds are primarily mallard, common goldeneye, northern shoveler, lesser scaup, American coot, grebes, mergansers, geese, and shorebirds, including semipalmated sandpiper, pectoral sandpiper, stilt sandpiper, lesser yellowlegs and greater yellowlegs.

[55] Timoney and Ronconi 2010 "Open pit bitumen extraction may exert population-level impacts upon migratory and resident birds, and is capable of causing mass mortality events."

[56] Wells et al. 2008 at 3, 17; Migratory Bird Convention, Protocol updating Article I at http://www.treaty-accord.gc.ca/text-texte.asp?id=101587.

[57] Wells et al. 2008 at 9

[58] Wells et al. 2008 at 9;

[59] Wells et al. 2008 at 15-16. *citing* N. Fimreite, *Accumulation and Effects of Mercury on Birds* in *The Biogeochemistry of Mercury in the Environment*, Elsevier Press (1979) at 601-627; R. Eisler, *Mercury Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*. U.S. Fish and Wildlife Service: Biological Report 85 (#1.1) (1987); D. Thompson, *Mercury in birds and terrestrial mammals* in *Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations*, W.N. Beyer et al., eds., (1996) at 341-356; D. Evers, and T. Clair, eds., *Biogeographical Patterns of Environmental Mercury in Northeastern North America*, 14 Ecotoxicology (2005). Mercury is known to cause embryo malformations, reduced egg weights and reduced growth in chicks, reduced chick survival, behavioral abnormalities and sterility. Lead is known to cause impaired locomotion and other neurological effects. Cadmium is carcinogenic and causes kidney toxicity, eggshell thinning, damage to testes, and behavioral changes. When first released into the tailings ponds, polycyclic aromatic hydrocarbons (PAHs) and naphthenic acids can be acutely toxic to birds, or have carcinogenic and mutagenic effects. Effects of PAHs include increased mortality of bird embryos, developmental abnormalities, reduced egg production, increased clutch abandonment, reduced growth, and increased organ weight.

[60] Schindler 2010.
[61] Wells et al. 2008 at 16.
[62] Wells et al. 2008 at 16.
[63] Wells et al. 2008 at 17.
[64] Wells et al. 2008 at 2, 4-5; Migratory Bird Treaty Act List, http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html; Migratory Bird Convention, Protocol updating Article I at http://www.treaty-accord.gc.ca/text-texte.asp?id=101587.
[65] Wells et al. 2008 at iv, 2.
[66] Wells et al. 2008 at iv.
[67] Timoney and Lee 2009 at 71.
[68] Timoney and Ronconi 2010 at 574.
[69] Wells et al. 2008 at 13.
[70] Wells et al. 2008 at iv.
[71] Wells et al. 2008 at 12.
[72] Wells et al. 2008 at 8.
[73] M. Griffiths et al., *Troubled Waters, Troubling Trends: Technology and Policy Options to Reduce Water Use in Oil and Oilsands Development in Alberta*, The Pembina Institute, (2006) at 85.
[74] Government of Alberta, *Facts About Water in Alberta* (2010) http://environment.gov.ab.ca/info/library/6364.pdf at 42 (hereinafter Government of Alberta 2010 Water).
[75] Government of Alberta 2010 Water at 42.
[76] Wells et al. 2008 at 14.
[77] Wells et al. 2008 at 14.
[78] Shlumberger Ltd. 2011.
[79] Wells et al. 2008 at vi.
[80] Wells et al. 2008 at 12.
[81] Wells et al. 2008 at 12.
[82] Wells et al. 2008 at 12-13, citing 16 studies between 1995 and 2008.
[83] *See, e.g.*, E. Bayne et al., *Modeling and field-testing of Ovenbird (Seiurus aurocapillus) responses to boreal forest dissection by energy sector development at multiple spatial scales*, 20 Landscape Ecology 2, 203 (2005).
[84] E. Bayne et al, *Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest*, 22 Conservation Biology 5, 1186 (2008) at 1192.
[85] Wells et al. 2008 at 13.
[86] Wells et al. 2008 at 21-22.
[87] Wells et al. 2008 at 21-22.
[88] Intergovernmental Panel on Climate Change, AR4 Working Group II, (2007), *Freshwater wetlands, lakes and rivers*, http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch4s4-4-8.html ("The seasonal migration patterns and routes of many wetland species will need to change and some may be threatened with extinction.").
[89] *See, e.g.*, C. Parmesan, *Ecological and Evolutionary Responses to Recent Climate Change*, 37 Annual Review of Ecology, Evolution and Systematics 637 (2006); *see also* T. Dawson et al., *Beyond Predictions: Biodiversity Conservation in a Changing Climate*, 332 Science 6025, 53 (April 1, 2011).
[90] M. Griffiths et al., *Troubled Waters, Troubling Trends: Technology and Policy Options to Reduce Water Use in Oil Sands Development in Alberta*, the Pembina Institute (2006) at 71.
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