



PLANNING FOR THE FUTURE

PRAIRIE HABITAT JOINT VENTURE: THE WESTERN BOREAL FOREST

IMPLEMENTATION PLAN 2013-2020

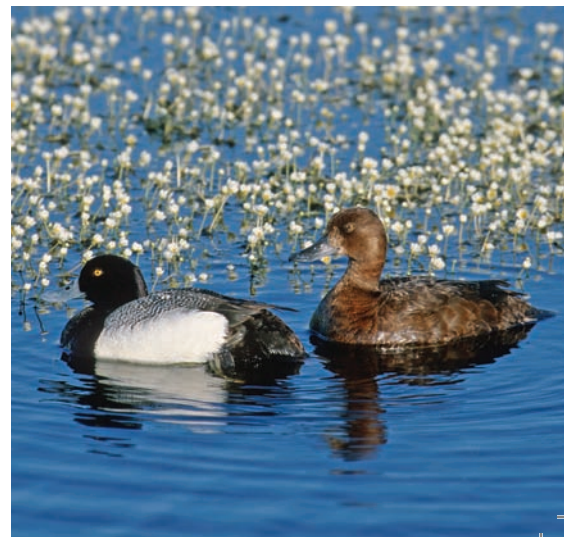
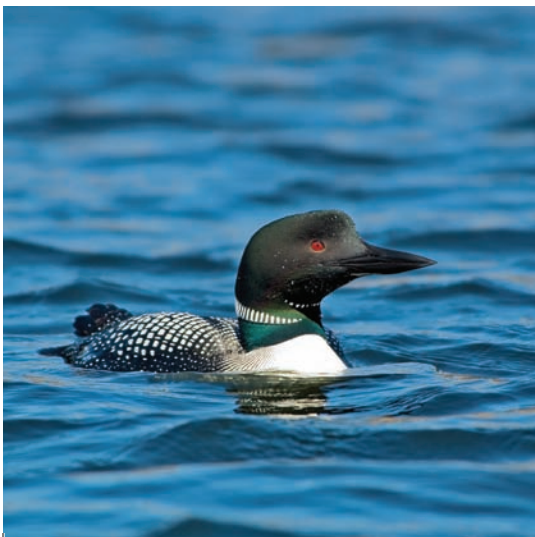
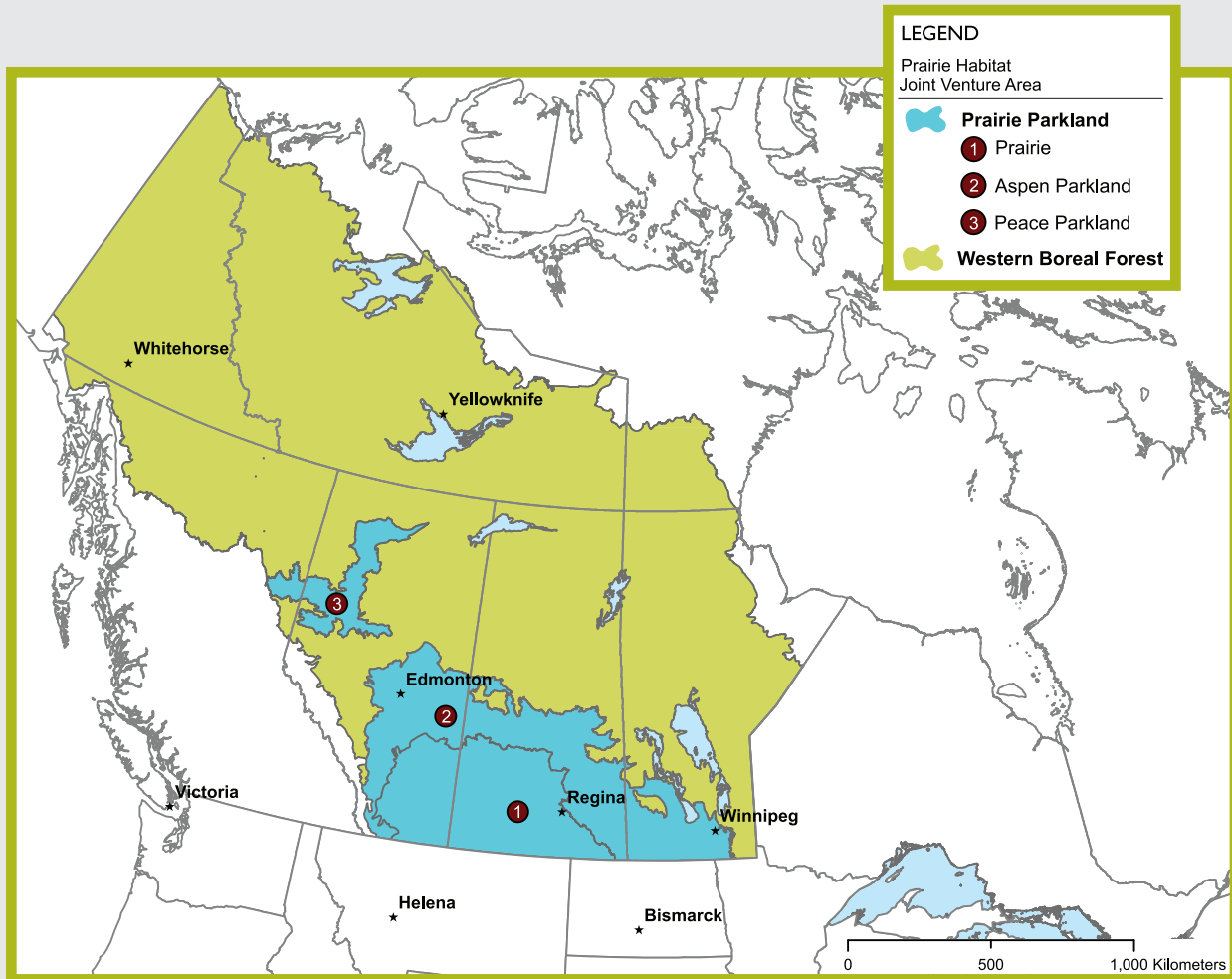


FIGURE 1

The Prairie Habitat Joint Venture planning area including the Prairie Parkland Region and the Western Boreal Forest.



On the cover:

Large Photo: Aerial View of Western Boreal Forest/©Ducks Unlimited Canada

Left to Right:

1. Common Loon/©Ducks Unlimited Canada/Brian Wolitski
2. Boreal Wetland/©Ducks Unlimited Canada
3. Lesser Scaup Pair/©Ducks Unlimited Canada

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The PHJV's accomplishments would not be possible without the ongoing commitment of the *North American Wetlands Conservation Act*, the International Boreal Conservation Campaign and a combined total of 61 First Nations, academic, industrial, government and non-governmental partners that have supported wetland-habitat conservation across the WBF since 2001.



The Western Boreal Forest/©Ducks Unlimited Canada

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PREFACE

In 1986, the North American Waterfowl Management Plan (NAWMP) partnership was founded with the goal to restore waterfowl populations to 1970s numbers by implementing conservation projects across priority landscapes in Canada and the United States — Mexico joined in 1994. One of the continent's first NAWMP priority landscapes was Canada's Prairie Parkland Region where as much as one third of continental waterfowl populations breed. The Prairie Habitat Joint Venture (PHJV) partnership was formed to consolidate the efforts of many conservation agencies in Alberta, Saskatchewan and Manitoba.

The PHJV has become a leader in developing conservation projects that benefit waterfowl and other migratory birds and the wetland habitats upon which they depend.

Since the inception of NAWMP nearly 30 years ago, the business of conservation has changed considerably. To remain relevant and to continue to achieve challenging habitat and population targets, conservation partnerships across North America must be resilient and adapt their programs and policies to ever-changing socioeconomic and environmental conditions. The PHJV's planning, implementation and evaluation efforts have always been guided by a series of habitat implementation plans. The plans are modified regularly to reflect current and anticipated landscape conditions, socioeconomic trends, emerging priorities for bird conservation and new knowledge about bird populations and their habitats. In short, habitat implementation plans have evolved to meet persistent and new challenges facing the waterfowl-conservation community. This *PHJV Habitat Implementation Plan, 2013-2020: The Western Boreal Forest* builds on past accomplishments and reinforces an enduring legacy of strong partnerships and science-based information to guide innovative actions for achieving conservation goals.

This Plan is comprised of two parts in separate documents. Part One identifies the Prairie Parkland Region's habitat objectives and related work. Part Two focuses on

conservation planning for the Western Boreal Forest (WBF). The PHJV has developed individual plans for these two high-priority regions due to their distinct land-tenure systems, differing land-uses and environmental threats and distinct conservation partners. The remarkable diversity and abundance of bird species across the entire PHJV area results from the region's highly productive and diverse wetland and upland habitats and the movement of these birds among prairie, parkland and western boreal forest biomes. While many wetland-associated species are boreal specialists that use the prairie biome during migration, others have stronger affinities to the prairie biome and seek refuge in boreal wetlands during prairie droughts. Thus, the PHJV understands that long-range planning for multi-species habitat conservation must consider these interactions to ensure the long-term conservation of critical wetland and associated upland habitat across the Prairie Parkland Region and the WBF in both Canada and the United States.

The PHJV remains firmly committed to maintaining and restoring wetlands and landscapes capable of sustaining healthy waterfowl populations and vibrant rural communities. Yet, PHJV partners have long recognized that improved information and planning tools could help to guide habitat programs beyond waterfowl species to include many shorebird, waterbird and landbird species. For example, the

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advent of decision-support tools for marshbirds inhabiting the Prairie Parkland Region is transforming this vision in all three Prairie Provinces. The PHJV envisions a future wherein decision-support tools will help to inform the biological basis for habitat investments for all bird species, including in the WBF.

Finally, the *NAWMP 2012: People Conserving Waterfowl and Wetlands* revision, challenged the NAWMP community to broaden its efforts to build support for conservation by focusing investments in places that provide the greatest benefits to birds and to people, by supporting waterfowl

hunting traditions and by engaging diverse communities of conservation supporters. This Plan begins to incorporate these objectives, and presents ways that existing or new information and initiatives could advance these and other NAWMP priorities. It sets out clear wetland and upland habitat objectives for sustaining the PHJV's diversity and abundance of waterfowl and other birds. Achieving these objectives is ambitious, and will be accomplished with strong partnerships, a common vision and a sustained commitment — for waterfowl, the environment and for people.

The PHJV remains firmly committed to maintaining and restoring wetlands and landscapes capable of sustaining healthy waterfowl populations and vibrant rural communities.



The Western Boreal Forest is among the most important waterfowl breeding areas in North America./©Ducks Unlimited Canada

EXECUTIVE SUMMARY

When the North American Waterfowl Management Plan (NAWMP) was launched in 1986, its visionaries recognized that the Canadian Prairie Parkland Region would be crucial to its success. Shortly thereafter, the Prairie Habitat Joint Venture (PHJV) began implementing habitat programs across the Region — in Alberta, Saskatchewan and Manitoba — signaling the clear intent to retain, restore and manage the natural wetland and upland habitats needed to sustain healthy waterfowl populations. Strong partnerships among conservation agencies and other organizations and individuals emerged, and remain today.

However, the success of NAWMP also relies on functional ecosystems outside of the Prairie Parkland Region. To the immediate north, Canada's Western Boreal Forest (WBF) is a vast, wetland-rich area with duck numbers surpassed only by the Prairie Parkland Region. The WBF also is critical to populations of prairie ducks and many other wetland-associated birds, which move between these biomes during the Prairie Parkland Region's regular wet-dry cycles. Over the past decade, the PHJV recognized increasing habitat threats to the WBF and responded by expanding the partnership to include wetland-waterfowl conservation in this ecologically and spatially linked biome.

Since its inception, PHJV activities have been guided by a series of habitat implementation plans which serve as conservation roadmaps that are adjusted periodically to reflect:

- changing socioeconomic, policy and environmental conditions

- improving knowledge about duck population responses to habitat conditions
- understanding of habitat conservation alternatives
- growing interest in identifying ways to enhance all-bird conservation

With 10 years of WBF conservation planning and implementation underway, new information on bird ecology and spatial distribution and better integration within the conservation community, the PHJV is well-positioned to advance its conservation goals. The PHJV has re-shaped its WBF habitat and policy objectives for the next 8-year cycle (2013-2020) and beyond, to 2030. And, as advocated during the NAWMP 2012 revision process, explicit human dimensions objectives to develop support for conservation have been identified for the first time and will be refined and implemented during this next delivery cycle.



Nearly 50% of Canada's Western Boreal Forest is considered waterfowl habitat and is used by millions of ducks annually./
©Ducks Unlimited Canada/Krause & Johansen



Since 2007, when the PHJV's previous habitat plan was implemented, most duck populations have responded well to improving pond and upland habitat conditions within the Prairie Parkland Region. While pond abundance is not recorded in the WBF, hence there is no widespread record of wetland conditions, duck counts indicate that scaup and scoter have been consistently below NAWMP goals. Meanwhile, mallard and American wigeon populations in the WBF were below goals during the past decade, but exceeded them in 2014. In general, other ducks in the WBF were at or above NAWMP goals in recent years, including 2014. Populations of non-game bird species are not well monitored in the WBF — although about 40% of priority wetland-associated species within the biome appear to have negative population trends. Nine of the wetland-associated species are listed as Species at Risk in Canada, for which five are landbirds and four are waterbirds.

In the WBF, threats to wetland ecosystems due to climate change, especially in Canada's North, and widespread industrial expansion in Canada's South, represent significant conservation challenges. The delivery programs focus on managing the effects of industrial landscape changes and have had tremendous success delivering on-the-ground habitat conservation. The PHJV has influenced 52.4 million acres of protected lands and 0.7 million acres of sustainable land-use areas from 2001-2012 in the WBF. About 33.7 million of those acres are considered waterfowl habitat, ~9% of the total estimated WBF waterfowl habitat. In total, \$113 million was allocated to WBF programs during 2001-2012, with \$69 million spent on habitat stewardship (\$21.4 million) and securement (\$47.6 million) and the balance (\$44 million) allotted to evaluation, policy adjustment, communications and education and coordination. The PHJV will continue to achieve success by implementing programs and policies that retain the long-term productive capacity of WBF landscapes. Currently, the need for habitat restoration is uncertain and will be investigated in the next five years. The PHJV's WBF habitat retention objective is to conserve ~30.7 million acres of core waterfowl habitat by 2020, with about half in protected lands and half in sustainable land-use areas. Because over 90% of the WBF is Crown- or First Nations-owned and industry-worked, various direct, government-led securement programs or regulatory options

and industry-led planning and practices (e.g., government or corporate policies) provide the best opportunities for the PHJV to influence WBF conservation outcomes. The PHJV also will continue to work with First Nations communities and other stakeholders to advance protected land and sustainable land-use habitat objectives, which will benefit people at the local, jurisdictional, national and continental levels.

With 10 years of WBF conservation planning and implementation underway, new information on bird ecology and spatial distribution and better integration within the conservation community, the PHJV is well-positioned to advance its conservation goals.

The PHJV's success can be attributed to the emphasis on program evaluation, including adaptive management, and the willingness to modify, add or eliminate conservation delivery approaches in response to new information. This pattern will continue in the next implementation cycle to ensure that resources are wisely invested and to gain new knowledge that will guide future policy and program decisions. For example, the PHJV will investigate:

- which specific landscape changes are limiting waterfowl, and why
- effectiveness of wetland policies
- anticipated impacts of future climate and land-use changes on duck populations
- habitat associations for non-game birds
- improved methods for spatially targeting conservation
- the relative importance of various ecological goods and services (EGS) to key stakeholders and linkages between EGS and waterfowl and their habitat

The PHJV's WBF program has advanced significantly in the last decade, enabling partners to set aggressive, yet achievable, habitat and evaluation objectives for 2013-2020. The PHJV's ongoing commitment to collaborative stakeholder engagement and other partnerships will help to ensure success through continually learning and adapting WBF conservation activities toward the best possible outcome for migratory birds and for people.

INTRODUCTION

The Prairie Habitat Joint Venture (PHJV) planning area includes two regions of Canada (Figure 1): the Prairie Parkland Region and the Western Boreal Forest (WBF). Combined, these are the two most important breeding areas for waterfowl in North America. The PHJV's Habitat Implementation Plans for these two regions are produced as separate, companion documents because of regional differences in conservation challenges and associated strategies needed to achieve objectives, their unique land-tenure systems and the distinctive governance structures which create unique partnership opportunities.

In Canada, the WBF has on average similar numbers of waterfowl in its surveyed portions as the Canadian Prairie Parkland Region (Figure 2), albeit comprised of different species that are distributed over an area five times larger. The WBF is considered a “safety net” for prairie populations in periods of drought, with birds moving north when prairie breeding habitat is limited. The WBF is also important to many shorebird, waterbird and landbird species. As well, the Boreal Transition Zone (BTZ) at the southern fringe of the WBF is considered to have some of the highest avian diversity in Canada.

When the North American Waterfowl Management Plan (NAWMP) was formed between Canada and the United States in 1986 (Mexico joined in 1994), planners acknowledged the importance of the WBF but assumed it

to be “intact” and not under imminent threat. However, the pace and extent of habitat change in the Region has grown rapidly since then with both traditional, (e.g., forestry, oil and gas) and newly emerging industrial activities, such as hydraulic fracturing or “fracking”, which have the potential to negatively impact water, wetlands and waterfowl. This growth spurred a re-evaluation of the original NAWMP assumption that the WBF was not under threat. The re-evaluation concluded that WBF habitats were indeed threatened and in 2001, the PHJV mandate expanded to include the WBF.

The PHJV component of the WBF extends from the Ontario-Manitoba to Yukon-Alaska borders. Ninety four percent of this vast area is owned by federal, provincial,

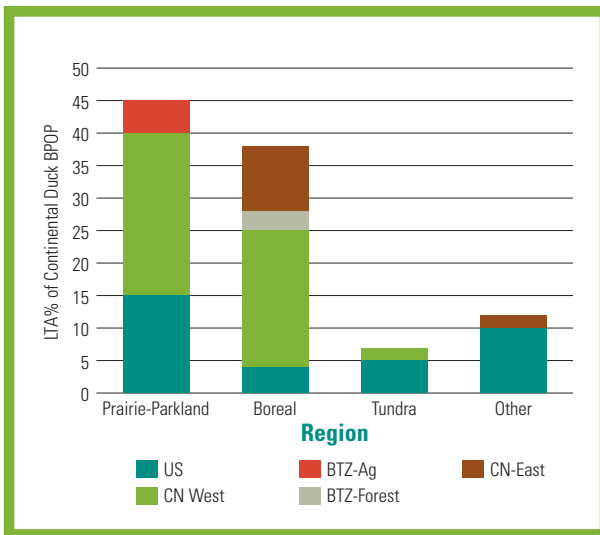


Green-winged Teal Pair in Flight/©Ducks Unlimited Canada/Tye Gregg



FIGURE 2

Regional contributions to long-term average (1960-2012) continental breeding duck populations (BPOP). CN West represents the entire PHJV region within the prairie and boreal bars. The Boreal Transition Zone (BTZ) is associated with the Western Boreal Forest, as defined by Ducks Unlimited Canada. The BTZ population average was separated into forested and agricultural components based on the proportion of these habitat types present within the Land Cover of Canada data. "Other" includes regions in Eastern Canada outside the boreal or areas in the United States outside the BPOP survey area where surveys are conducted using similar methodology.



territorial or First Nations governments with land-use decision-making administered through various levels and departments of these governments. Resource development is by the mining, oil and gas, forestry, hydro-electric and agricultural sectors. Achieving WBF goals — to protect critical habitat and to ensure that development is sustainable — can therefore only occur by influencing public land-use policies and government and industry practices.

Most of the PHJV's early WBF activity focussed on gathering data to ensure effective conservation as little was known about the Region's waterfowl and other birds. Over time, these activities have evolved to include habitat-delivery programs focussed on habitat retention through protection and sustainable land-use (SLU), consistent with the PHJV vision and mission. The purpose of this Plan is to outline habitat implementation over the next 8-year horizon.

PHJV Vision

Healthy prairie, parkland and boreal landscapes that support sustainable bird populations and provide ecological and economic benefits to society.

PHJV Mission

Provide leadership to achieve healthy and diverse waterfowl and other bird populations through conservation partnerships. These partnerships strive for sustainable and responsible management of the landscape taking into account social, economic and environmental factors.

PHJV Goals

Bird Goals

- Sustain waterfowl populations equivalent to 1955-2014 averages
- Sustain populations of other wetland-dependent birds

Habitat Goals

- Retain current biological function of wetlands and associated uplands
- Set habitat objectives for priority species of waterfowl and other wetland-dependent birds

Human Dimension Goals

- Work with northern communities and other stakeholders to meet mutual conservation goals
- Grow support for boreal waterfowl and non-game bird conservation

The PHJV component of the WBF extends from the Ontario-Manitoba to Yukon-Alaska borders. Ninety four percent of this vast area is owned by federal, provincial, territorial or First Nations governments with land-use decision-making administered through various levels and departments of these governments.

THE WESTERN BOREAL FOREST

Status of Bird Populations

Waterfowl

The following trend review is based on data from the U.S. Fish and Wildlife Service/Canadian Wildlife Service Waterfowl Breeding Population and Habitat Survey (WBPBS) conducted annually across the Prairie Parkland Region and parts of the WBF. It is limited to 8 species that have $\geq 25\%$ of their traditional survey area population in the WBF. Population estimates for the Prairie Parkland Region and WBF strata from the WBPBS were summed separately. In instances where strata contained both the Prairie Parkland Region and WBF biomes, stratum-specific population estimates were partitioned to each biome by multiplying the proportion of area of each biome within the stratum by its respective population estimate. BTZ population estimates were included in the WBF.

Over the past decade, however, WBF populations of scaup, scoter, mallard and American wigeon have been generally lower than revised NAWMP goals.

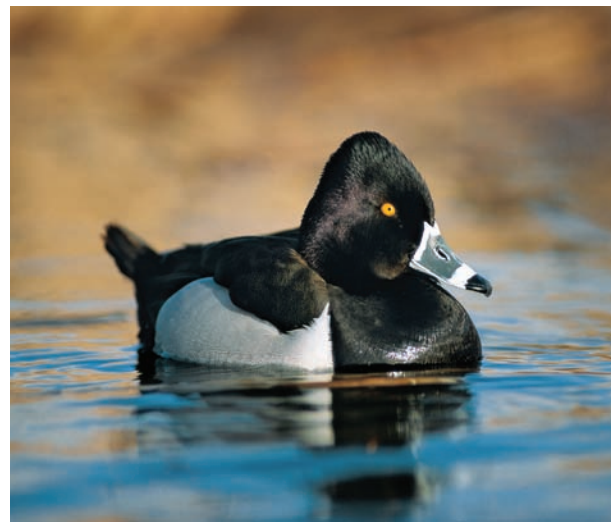
The status of WBF ducks relative to NAWMP goals is highly variable among taxa, with no definitive pattern specific to foraging guilds or relative to timing of typical clutch initiation dates. Scaup (both lesser and greater), scoter (white-winged, black and surf) and canvasback were below NAWMP goals for the Region in 2014, while green-winged teal, American wigeon, bufflehead and ring-necked duck were above the goal (Table 1). Over the past decade, however, WBF populations of scaup, scoter, mallard and American wigeon have been generally lower than revised NAWMP goals (Table 1).

This shift in relative importance of taxa appears to have occurred gradually over time, with most populations showing linear trends since the late 1970s (Figure 3 and 4). Exceptions to this pattern are scoter, with 10-year running average populations that remained largely stable until about 1988, after which populations shifted to a lower, yet apparently stable level, and scaup, whose populations have

shown a slight recent increase. Cumulatively, population trends do not appear fully compensatory and overall WBF waterfowl populations have declined by about 20% since the 1970s, though are still generally stable compared to U.S. and Canadian prairie populations (Figure 5).

These two results suggest that anthropogenic changes in the WBF could be negatively affecting population trajectories in several boreal-breeding duck species.

It is not known whether any of these trends are related to WBF habitat changes. However, Drever et al. (2012) examined the role of variation in spring phenology and density dependence on population sizes of boreal-breeding mallard, American wigeon, scaup and scoter. Their results were consistent with the hypothesis that climate change is and may continue to have a negative effect on scaup and scoter populations, through a possible mismatch in timing of food availability, but not American wigeon or mallard. As well, analyses by Ducks Unlimited Canada indicate a high degree of negative spatial correlation between the population trajectories of duck species and cumulative industrial development. These two results suggest that anthropogenic changes in the WBF could be negatively affecting population trajectories in several boreal-breeding duck species.



Ring-necked Duck /©Ducks Unlimited Canada/Krause & Johansen



TABLE 1

Running 10-year average duck counts in the PHJV-WBF (2005–2014), revised NAWMP goals for the PHJV, and percent difference between recent average count and both long-term average (1955–2014) and 80th percentile (aspirational NAWMP goal) counts. Species included have about 25% or more of their Traditional Survey Area populations in the WBF.

Species	PHJV-WBF		NAWMP Revision — PHJV			
	2014 estimate	2014 ten-year average	Long-term average (1955-2014)	Long-term 80th percentile	% difference from long-term average	% difference from LT 80th percentile
Mallard (<i>Anas platyrhynchos</i>)	2,872,158	2,221,457	2,627,617	3,056,214	-16	-27
Green-winged Teal (<i>Anas crecca</i>)	1,928,021	1,539,439	1,100,561	1,335,502	40	15
American Wigeon (<i>Anas americana</i>)	1,558,188	959,728	1,202,099	1,506,776	-20	-36
Dabbling ducks	6,358,367	4,720,624	4,930,277	5,534,004	-4	-15
Scaup (<i>Aythya</i> sp.)	2,333,626	2,203,583	2,984,904	3,549,502	-26	-38
Ring-necked duck (<i>Aythya collaris</i>)	1,004,088	778,313	522,721	675,339	49	15
Bufflehead (<i>Bucephala albeola</i>)	937,731	963,596	627,768	877,983	53	10
Scoter (<i>Melanitta</i> sp.)	660,975	636,292	825,877	1,104,645	-23	-42
Goldeneye (<i>Bucephala</i> sp.)	382,446	554,175	380,980	524,070	45	6
Canvasback (<i>Aythya valisineria</i>)	162,529	216,662	207,937	245,783	4	12
Diving ducks	5,481,395	5,352,621	5,550,187	6,101,073	-4	-12
All Ducks	11,839,762	10,073,245	10,480,464	11,647,222	-4	-14

FIGURE 3

Trends in 10-year running average populations of dabbling ducks in the Western Boreal Forest. All species have at least 25% of their Traditional Survey Area population in the WBF. AGWT- American green-winged teal, AMWI- American wigeon, MALL- mallard.

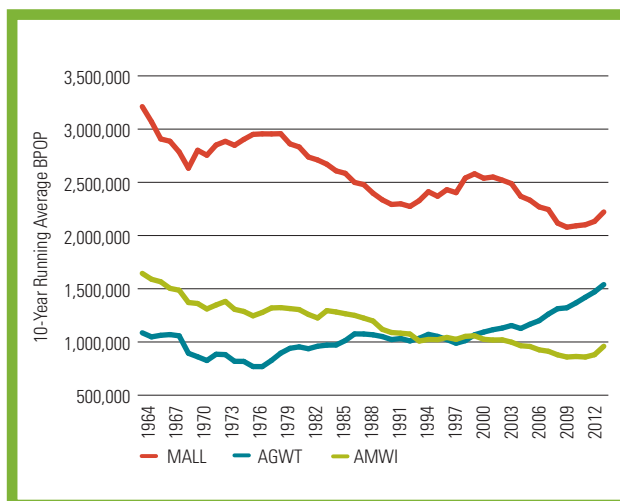


FIGURE 4

Trends in 10-year running average populations of diving and sea ducks in the Western Boreal Forest (WBF). All species have at least 25% of their Traditional Survey Area population in the WBF. GESC- lesser and greater scaup combined, BUFF- bufflehead, RNDU- ring-necked duck, GESCO- white-winged, black and surf scoters combined, GEGO- common and Barrow's goldeneye combined, CANV- canvasback.

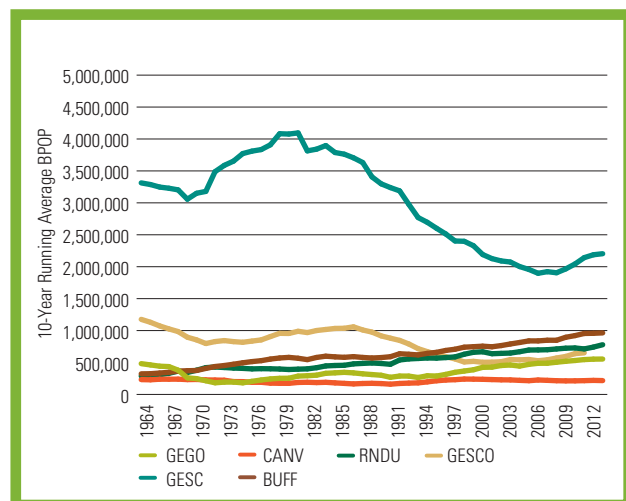
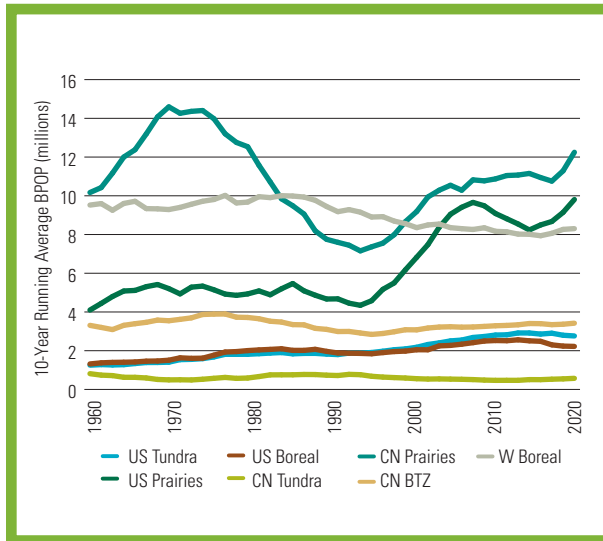


FIGURE 5

Trends in 10-year running average populations for ducks within different regions of the traditional survey area.



Shorebirds, Waterbirds and Landbirds

Similar to the PHJV Habitat Implementation Plan for the Prairie Parkland Region, the WBF Implementation Plan highlights a subset of shorebird, waterbird and landbird species from Bird Conservation Region (BCR) Strategies relevant to the WBF (Appendix 1). The BCRs that overlap with the WBF include BCR 6 (Boreal Taiga Plains; Environment Canada 2013a), BCR 4 (Northwestern Interior Forest; Environment Canada 2013b) and the Prairie and Northern Region (PNR) portions of BCR 7 (Taiga Shield and Hudson Plains; Environment Canada 2013c) and BCR 8 (Boreal Softwood Shield; Environment Canada 2013d) (Appendix 2). The BCR plans designate priority species as those that are of conservation concern or management concern, or stewardship species that typify the local avifauna and/or have a large proportion of their range within the region. Rather than focusing on all non-game species in the WBF, this Plan selects a subset of BCR-Plan priority species that use wetlands and water bodies in the WBF and thus have the potential to benefit from habitat implementation directed at waterfowl conservation. At this point in time, many information gaps exist in the WBF with respect to species distribution and trends (see below). As the PHJV continues to move towards all-bird conservation, this list may be expanded to include other non-wetland-associated species.

The list includes 14 shorebirds, 23 waterbirds and 20 landbirds (Appendix 1; scientific names of species are

included there). Thirty of these species are considered boreal specialists, with greater than 50% their breeding range within the entire boreal forest (Wells and Blancher 2011). All species breed in the WBF, although some species' breeding ranges extend northward into the Arctic (e.g., semipalmated sandpiper, dunlin) or southward into the prairies (e.g., western grebe, black tern, yellow rail). As such, 27 of these species are also listed in the Prairie Parkland Region Plan (Appendix 2 therein), due to their range overlapping with BCR 11 (Prairie Potholes). The selected species occupy a variety of wetland habitats typical of the WBF, ranging from lakes and ponds to marshes, swamps and fens.

Precise population trend data for the WBF for many of these species are lacking, due to their populations being sparsely distributed over a large area and low coverage of the Breeding Bird Survey (BBS) or other monitoring programs in the Region. Annual trends from the BBS are shown in Appendix 1, where trend information is taken from BCR 6 as this Region is geographically the largest within the WBF. Nearly half of the species have low precision on their population trend estimates, highlighting the need for enhanced monitoring in the WBF. For example, the solitary sandpiper breeds almost exclusively in the Canadian boreal, and yet very little is known about its ecology or population status. Its remote breeding habitats are difficult to access and its tendency to be found individually during migration makes population monitoring via established shorebird migration monitoring programs difficult. Threats, such as climate change and wetland loss, therefore have the potential to cause untracked population declines in this species. In general, about 40% of these 57 species may have negative population trends.

The WBF occupies about 750 million acres, of which an estimated 47% is waterfowl habitat.

Nine of the wetland-associated species are listed as Species at Risk in Canada, for which five are landbirds and four are waterbirds. For example, the rusty blackbird is designated as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The population is thought to have declined by almost 88% over the past 40 years (COSEWIC 2006). The majority of the rusty blackbird's breeding range is in the WBF and it is closely associated with forested wetlands for breeding. With such a high dependence on wetlands, this species has the potential to benefit greatly from wetland protection in the WBF.



Rusty Blackbird/©Ducks Unlimited Canada

Rather than focusing on all non-game species in the WBF, this Plan selects a subset of BCR-Plan priority species that use wetlands and water bodies in the WBF and thus have the potential to benefit from habitat implementation directed at waterfowl conservation.

Status of Habitat

Habitat State

The WBF occupies about 750 million acres, of which an estimated 47% is waterfowl habitat (see Waterfowl Process section for definition and data sources), with varying distributions among jurisdictions (Table 2). The WBF is generally a peatland-dominated system i.e. bogs and fens (National Wetlands Working Group 1997), with about 150 million acres of peatland and 100 million acres of open water. It is the hydrologic interconnectedness of these peat and open-water systems that make this landscape sensitive to habitat changes, particularly in the core ecozones for waterfowl (Boreal and Taiga Plains). While expansion of industrial activity in the WBF is generally considered to be rapid, particularly in Alberta and Northeastern British Columbia, limited trend information has been compiled for changes to WBF habitat in recent decades. Estimates for agricultural encroachment between 1966 and 1994 (Hobson et al. 2002) in Saskatchewan indicate that forest

conversion rates in the BTZ were more than three times the global average. More recently, Global Forest Watch (Lee et al. 2006) estimated the anthropogenic footprint in the WBF exceeds 87 million acres. Currently, 52% of the land base outside of protected land (permanent, interim and proposed; see Conservation Status section) throughout the entire Canadian boreal forest is considered intact, meaning a near absence of anthropogenic features such as forestry, mining, agriculture, roads, towns or oil and gas infrastructure (Figure 6). The remaining area largely falls within what is considered the “working forest”, where development ranges from the occasional seismic line to the complete removal of habitat in the mineable oil sands region of Northeastern Alberta. The degree of overlap between these activities and waterfowl habitat is uncertain at this time, but is assumed to be considerable given the extent of area affected by anthropogenic activities and the abundance of wetlands in the WBF.

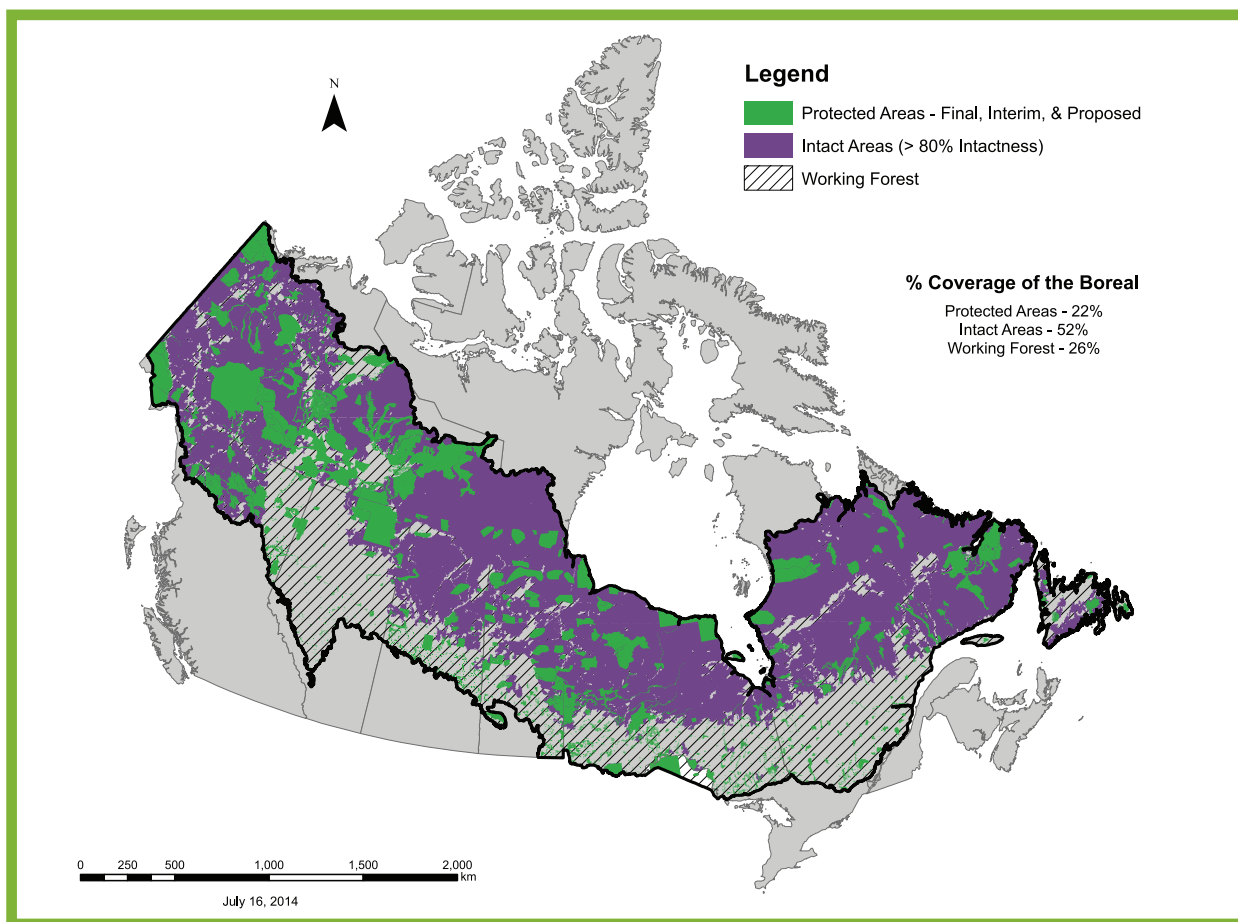
TABLE 2

Distribution of predicted waterfowl breeding population, waterfowl habitat and total area among Western Boreal Forest jurisdictions. Estimates exclude agricultural lands within the BTZ and Peace Parkland, which contain about 11% of waterfowl in Western Boreal Ecozones.

Jurisdiction	% Waterfowl	% Waterfowl Habitat	% Total Area
Yukon	13	5	14
Northwest Territories	30	39	30
Nunavut	4	6	3
British Columbia	6	5	10
Alberta	15	8	13
Saskatchewan	16	14	13
Manitoba	16	22	18

FIGURE 6

Protected, non-working (intact) and working forest areas of the Canadian boreal forest.



Conservation Status

Currently, as a result of broad-based collaborative partnerships between environmental non-governmental organizations, governments, First Nations and industry, there are over 158 million acres in Canada's boreal forest that have been placed in some form of protected status collectively called "protected lands" in this Plan. Protected lands result from two processes. First are government-led protected-area initiatives where the ultimate end point is >10 year protection, termed "long-term protected lands".

Existing and proposed protected lands collectively contain about 22% of the Canadian boreal forest.

Prior to that designation, proposed protected areas may be withdrawn from development and placed in interim protection. Interim protection typically lasts 1-5 years while the protection process is underway, and is renewable if final decisions are not made by the end of the term, hence these areas are considered "short-term protected lands". Second, land-use planning processes designate conservation

zones that are protected lands with limited to no allowable development. These areas are subject to renewal when land-use plans receive periodic review, typically at 5-year intervals, and are also referred to as "short-term protected lands".

An additional 72 million acres has been proposed as protected lands, meaning that they are recognized in various protected area or land-use planning initiatives but have not yet reached interim withdrawal stages or designation as conservation zones. Existing and proposed protected lands collectively contain about 22% of the Canadian boreal forest (Figure 7). Most of these areas are located in the WBF. It should be noted that although protected lands may be proposed for short-term or long-term conservation, the PHJV needs to ensure that these lands obtain final status and remain conserved during renewal periods (see Conservation Programs for related tactics).

In addition, there are about 165 million acres of land in the working forest that have some form of sustainable land-use (SLU) status, called "sustainable land-use areas" or "SLU areas" in this plan. Sustainable land use is defined

as: *The management of landscape resources that maintain economic benefits and social values, while ensuring the conservation of ecosystems services, including sustaining waterfowl populations at goal levels.* Generally, SLU areas are created through private land management, conservation/cooperative land-use agreements, Crown agreements, industrial agreements, extension, policy and integrated land-use planning (terminology as per NAWMP 2013). While the specific criteria for designating SLU status are under revision, the areas depicted in Figure 7 are either forestry tenure areas under green-forest certification standards (Forest Stewardship Council, Sustainable Forestry Initiative, Canadian Standards Association) or northern land-use plans that permit limited industrial activity, both of which have varying degrees of considerations for waterfowl and their habitat. Industrial sectors also typically overlap on the landscape, meaning that even if SLU

practices are being used by one industry, the cumulative levels or methods of development on any given parcel of land may or may not be sustainable from a waterfowl perspective. Thus, there is a need to ensure SLU practices are cumulatively benefitting waterfowl.

Accomplishments

Habitat

Of the more than 323 million acres in some form of conservation across the entire Canadian boreal forest, the PHJV has claimed influence on 52.4 million acres of protected lands and 0.7 million acres of SLU areas in the WBF during 2001-2012 (Table 3). About 33.7 million of those acres are waterfowl habitat (see *Waterfowl Process* for definition), which is about 9% of the total WBF waterfowl habitat and contains 7% of the estimated WBF waterfowl population.

FIGURE 7

Current conservation status of the Canadian boreal forest and proportion of waterfowl affected. Sustainable land-use areas shown largely represent green-certified forest areas and northern land-use plans. Pledged conservation is also shown for areas under government commitments (Plan Nord, Quebec; Far North Act, Ontario), which establish a framework that balances protection and sustainable land-use. The stippled area in Quebec depicts the regulated riparian protection in the commercial forest zone.

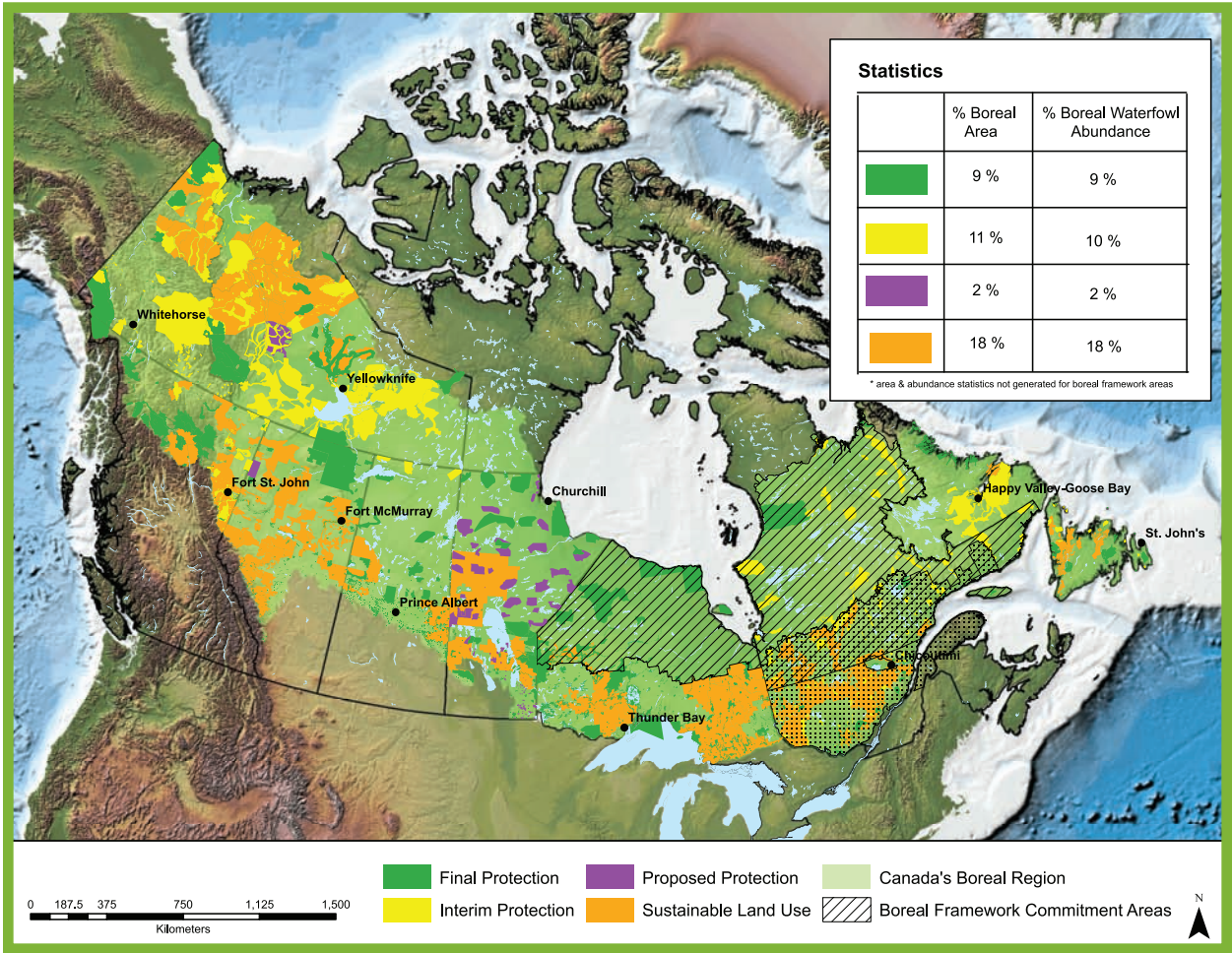


TABLE 3

Influenced acres claimed through PHJV activities in the Western Boreal Forest, 2001-2012. No acres were claimed prior to 2001. Waterfowl = acres of waterfowl habitat. See Conservation Status section for a definition of protected lands and sustainable land-use areas.

	Protected Lands					
	Long-term		Short-term		Sustainable Land-use Areas	
Jurisdiction	Total	Waterfowl	Total	Waterfowl	Total	Waterfowl
Yukon	1,935,152	320,469	1,086,954	579,729	0	0
Northwest Territories	8,807,944	2,660,734	37,880,712	28,997,177	0	0
British Columbia	0	0	1,135,785	195,166	0	0
Alberta	0	0	0	0	21,987	11,994
Saskatchewan	865,115	635,665	0	0	687,518	269,518
Manitoba	0	0	0	0	0	0
Total	11,608,211	3,616,868	40,103,451	27,772,072	709,505	281,512

Expenditures

Collectively, 17 environmental non-governmental organizations, government departments and industrial companies associated with the PHJV, and reporting to the NAWMP National Tracking System, have spent about \$113M on boreal conservation activities during 2001-2012 (Table 4). This equates to about \$3.40 per waterfowl-acre in some form of conservation.

Setting Habitat Objectives — Biological Foundations

Waterfowl Target Landscapes

With generally the same number of ducks as the Canadian prairies, but five times the land mass, on average WBF duck populations are distributed at much lower densities. However, recent pan-Canada modeling efforts (Barker et al. 2014a & 2014b) suggest that boreal duck pairs may be

sufficiently aggregated for effective spatial planning. The PHJV is still exploring limitations of this new planning tool and is developing Target Landscapes as part of a pan-Canadian boreal forest planning effort. However, preliminary target areas have been established in each Canadian WBF jurisdiction, under the criteria of having at least five target areas within each jurisdiction (Figure 8). These areas were selected visually based on aggregations of duck pairs developed after removing ducks predicted in long-term protected lands (9% ducks, 9% area) and on agricultural lands (9% ducks, 2% area). The proposed target areas contain about 40% of the ducks in 30% of forested area within the WBF boundary.

Waterfowl Process

Because several ecozones within the WBF extend beyond PHJV boundaries, development of PHJV habitat objectives for the WBF was integrated within a larger, Canada-wide boreal waterfowl planning effort. Habitat objectives were developed based on the duck distribution patterns predicted by the pair-distribution models (Barker et al. 2014a & 2014b) being used to develop target areas. Firstly, all waterfowl habitat across the Canadian boreal forest was identified based on Ducks Unlimited Canada's Hybrid Wetland Layer (Ducks Unlimited Canada 2010b). This geographic information system product was derived by merging Canvec and Earth Observation for Sustainable Development earth cover data and categorizing the landscape into open water, undefined vegetated wetlands and uplands. Waterfowl habitat was defined as open water and any of the other two habitat classes within 400 metres (437 yards) of the open water boundary. Recognizing that waterfowl will nest more than 400 metres from open water, this value contained the maximum value for most species

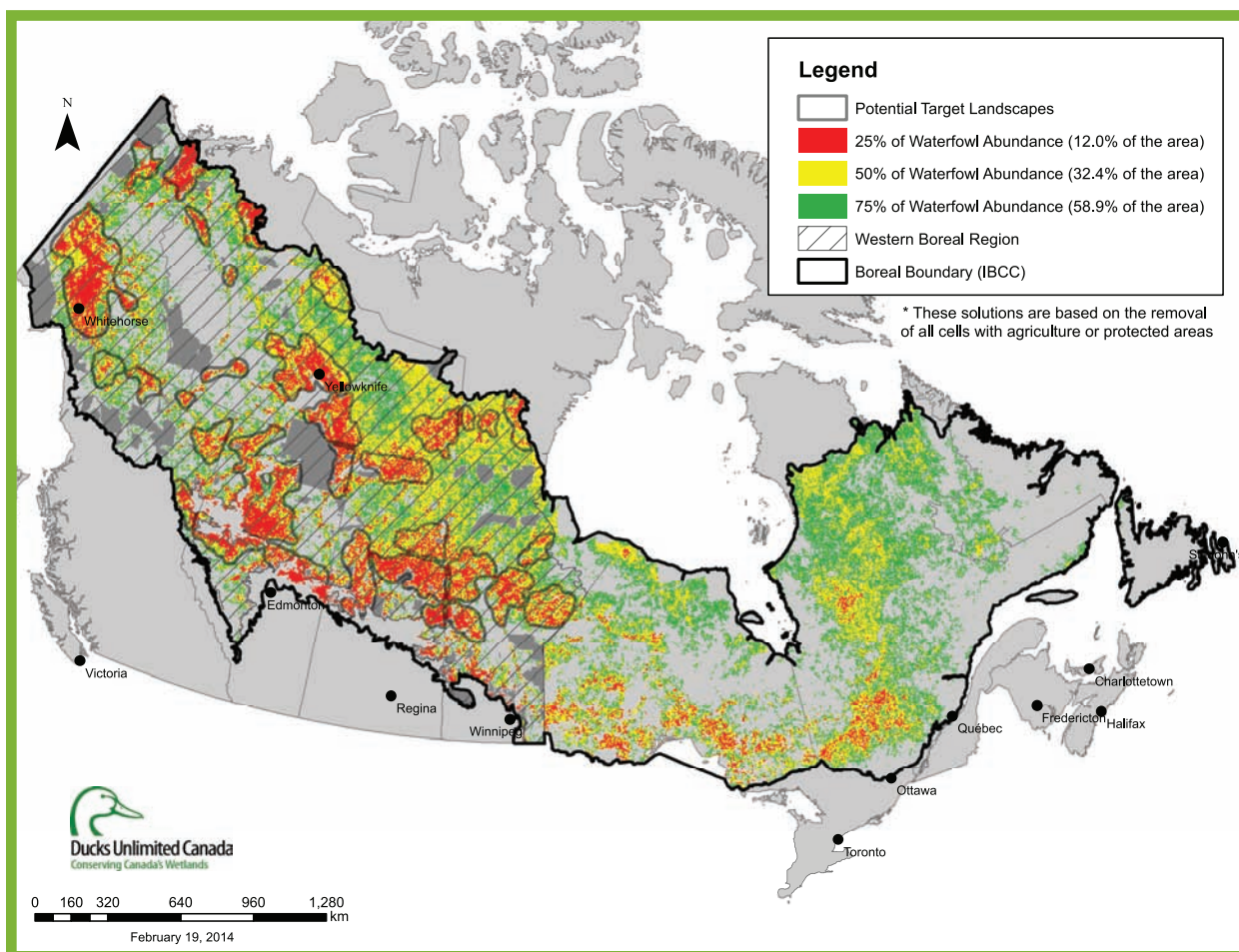
TABLE 4

Expenditure summary for PHJV Partners, 2001-2012. Data from the NAWMP National Tracking System.

Activity	Expenditure
Communication and Education	\$ 12,449,967
Coordination	\$ 6,317,991
Enhancement	\$ 127,153
Evaluation	\$ 12,910,459
Management	\$ 8,212
Policy Support	\$ 9,860,929
Reconnaissance and Design	\$ 2,459,841
Securement	\$ 47,630,307
Stewardship	\$ 21,474,837
Total	\$ 113,239,696

FIGURE 8

Waterfowl distribution across the Canadian boreal forest and potential Target Landscapes in the PHJV Region outside of long-term protected and agricultural lands. The underlying duck distribution map was developed by deriving minimum area aggregations of predicted duck pairs. Colors represent quartiles of the population. Red areas have the highest density duck habitat (25% of the duck population on 12% of the land base). The next two quartiles occupy 20% (yellow) and 27% (green) of the land base, respectively. Collectively, 75% of the waterfowl population is estimated to occur on 59% of the entire Canadian boreal forest.

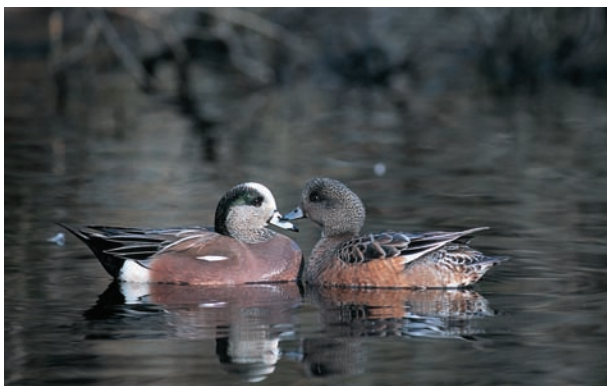


reported in the literature and was deemed reasonable for conservation planning (Duck Unlimited Canada 2010a).

Waterfowl habitat outside permanently protected areas was then considered as “potentially at risk” from industrial

development based on the following assumptions:

- a) Industrial activities negatively affect waterfowl populations (see Appendix 3) and b) Unforeseen resource extraction practices may emerge (e.g., hydraulic fracturing or fracking). This approach does not consider near-term



American Wigeon Pair/©Ducks Unlimited Canada/Krause & Johansen

The PHJV habitat objective for the WBF over the next 25 years equates to the amount of duck habitat required to support 75% of the duck population predicted within the potentially at-risk habitat.

threats of known industrial activities or potential effects of climate change, hence does not identify high-priority habitat that is at risk now. Thus, habitat goals presented below were considered as interim. A more thorough risk assessment to refine short-term habitat delivery objectives will be conducted during this implementation cycle. Long-term habitat objectives were set based on an aggressive target for duck population occupancy (see below), within the context of a broader boreal conservation effort in partnership with the International Boreal Conservation Campaign (IBCC). The IBCC began as a collaboration among Ducks Unlimited Canada, Ducks Unlimited Inc., and the Pew Charitable Trusts with the goal of conserving 1 billion acres of North American Boreal forest within 10 years, 50% in protected lands and 50% in SLU areas. The IBCC will achieve this goal through public education and partnering with Canadian and international conservation organizations, corporations and Indigenous and First Nations to build strong support for Canadian boreal forest conservation, and by working with governments at various levels (national, provincial, territorial, local). The partnership provides significant U.S. non-federal match for *North American Waterfowl Conservation Act* dollars. However, the PHJV's 8-year habitat objectives were derived based on assessments of likely protected land and SLU-area habitat accomplishments, given the political climate and protected area/land-use planning processes currently underway within each jurisdiction. Many PHJV partners are already engaged in these processes.

Habitat Objectives

Upland and Wetland Retention

The PHJV's WBF activities are primarily retention based, so the ultimate goal is no net loss of habitat function, which involves countering both degradation and loss. The PHJV habitat objective for the WBF over the next 25 years equates to the amount of duck habitat required to support 75% of the duck population predicted within the potentially at-risk habitat (i.e., outside of long-term protected lands). This generally corresponds to the red, yellow and green areas in Figure 8 and is referred to as "core waterfowl habitat" — about 66% of this habitat is within the WBF (286 million acres). The PHJV's 8-year habitat objective is to conserve about 30.7 million acres of core waterfowl habitat, with about half in protected lands and half in SLU areas (Table 5). The Northwest Territories' (NWT) protected acre objectives include conversion of about 4.7 million waterfowl acres in interim land withdrawal (short-term protected lands), already claimed in Table 2, to long-term protected lands. *(The NWT habitat objectives are aspirational and will be finalized after consultation with the Government of NWT, Wildlife Advisory Boards and other agencies.)*

Because the PHJV may not always have full control over the location of on-the-ground conservation outcomes in the WBF, largely due to land ownership (see Partnership section), the descending order of priority for PHJV leadership in spatial targeting is to guide conservation actions towards 1) WBF target areas, 2) core waterfowl habitat outside target areas and 3) any other waterfowl

TABLE 5

Eight-year (2013-2020) total and waterfowl habitat objectives within the Western Boreal Forest. Thirty percent (4.7 million acres) of Northwest Territories protected lands are transfer of claimed interim withdrawal acres to long-term protection status, hence will not be additive to overall acre accomplishments. All units are in millions of acres. Waterfowl = waterfowl habitat component of total acres (see text for a definition).

Jurisdiction	Protected Lands		Sustainable Land-use Areas	
	Total	Waterfowl	Total	Waterfowl
Yukon	3.8	1	4.1	0.8
Northwest Territories	15.6	9.5	16.8	4.9
British Columbia	0.4	0.2	0.8	0.2
Alberta	7.51	3.1	26.1	6.6
Saskatchewan	0.3	0.1	5.4	1.7
Manitoba	3.3 ¹	2.4	0.7	0.5
Total	30.8	16.1	53.7	14.6

¹ Protected land objectives in Alberta and Manitoba are 93% and 29% completed, respectively, with the following accomplishments in 2013: Lower Athabasca Regional Plan (Alberta) and Little Grand Rapids and Pauingassi Land-use Plans (Manitoba).



Partnerships with First Nations and other stakeholders are key to implementing habitat conservation programs in the Western Boreal Forest./©Ducks Unlimited Canada

habitat that is near but not currently included in planning boundaries (e.g., expanding or redrawing a proposed protected-area boundary to maximize waterfowl habitat conservation).

Wetland Restoration

There are no PHJV habitat-restoration objectives in the WBF because it is assumed that the carrying capacity of the WBF is at the desired level. Knowledge of how to restore function to degraded or lost boreal wetlands, particularly bogs, fens and swamps also is somewhat limited. However, negative population trends of key boreal waterfowl species suggest that this assumption might not be fully correct. Thus, the PHJV may need to consider how best to plan for the possibility that restoration becomes a higher priority for bird conservation. One such approach would be to support the development of boreal wetland-restoration techniques so that they are available if or when the need arises.

Human Dimension Objectives: Building Support for Conservation

Accomplishments

The PHJV's WBF accomplishments benefit people at various scales from the local to continental levels. Many conservation accomplishments in the Northwest Territories and the Yukon Territory, for example, have occurred through collaboration with First Nations communities. Wetlands are a focal point for traditional lifestyles (travel corridors, traditional foods, etc.) meaning that these communities often share interest in conserving the same habitats that are a priority for the PHJV. First Nations also possess significant political influence for affecting WBF land-use decisions, which further benefits collaborative efforts with PHJV partners. In addition, the biodiversity and

ecological goods and services (EGS) benefits of wetlands are recognized and valued by many other Canadians, industries working in the WBF, governments and environmental non-governmental organizations. For example, the migration of wetland-dependent birds represents the export of EGS values to other parts of the continent. As well, the carbon stores and sequestration potential of the 150-million acres of WBF peatlands and other wetland types (National Wetlands Working Group 1997) are considered continentally and possibly globally important for carbon market interests such as conservation offsets. Thus, the 33.7 million acres of WBF waterfowl habitat already conserved by the PHJV, plus other WBF wetland habitats, such as peatlands and swamps (National Wetlands Working Group 1997) within those conservation area boundaries, contribute to NAWMP's human dimension objectives.

Objectives

The PHJV will continue to work with First Nations communities and other WBF stakeholders to advance protected land and SLU habitat objectives that benefit people at the local, jurisdictional, national and continental levels. This collaboration will help garner support for future PHJV initiatives. In addition, future human dimensions research in the WBF should assess the relative importance of various EGS to key stakeholders and establish linkages between EGS and waterfowl and their habitat. Carbon and water quantity/quality should be two focal components of EGS. These efforts are essential to building a stronger case statement for boreal habitat conservation, hence broadening the PHJV's support base.

The carbon stores and sequestration potential of the 150-million acres of WBF peatlands and other wetland types are considered continentally and possibly globally important for carbon market interests such as conservation offsets.

Conservation Programs

Retention: Protection and Sustainable Land-use

Because over 90% of the WBF is Crown-owned (or in some cases First Nations-owned), various direct, government-led securement programs provide the opportunity for the PHJV to influence conservation outcomes. In addition, governmental regulatory systems guide how industries can operate on the land base via policies, regulations, guidelines and other instruments, although some leading companies aspire to exceed regulatory requirements for sustainable development through improved planning

The science support for PHJV policy efforts will be strengthened by evaluating hypotheses that relate land-use change and PHJV programs to waterfowl abundance and productivity.

and activities. For the forestry industry, companies can certify their forest-management practices to one of three internationally recognized certification programs. Such certification programs do not exist with other industries (e.g., energy sector), although some companies are looking to continually improve their environmental performance. Given these circumstances, the two main vehicles for retaining the function of the WBF for waterfowl are influencing the establishment of long-term protected lands and advancing SLU practices through extension work. These end points are typically achieved by working within multi-stakeholder, collaborative processes associated with government policies and regulations, green-certification protocols, industry associations and corporate policies and practices. The following overarching tactics will be used to achieve WBF habitat objectives.

Tactic 1: Develop effective national, provincial/territorial policies that conserve all wetlands, not just agricultural/settled-area wetlands. Government policy efforts will include:

- Informing and influencing government-led policies, legislation and regulations that have significant impact on waterfowl habitat within and outside target areas (e.g., provincial/territorial wetland policies, broad-based land-use strategies, industrial land-use regulations)
- Engaging in programs that flow out of existing legislation and regulations which will result in land-use decisions that align with PHJV waterfowl habitat conservation objectives (e.g., land-use planning and Crown-land designation programs)



The PHJV works with partners in the Western Boreal Forest to help design better roads in wetland-rich areas in order to maintain the natural flow of water and nutrients/©Ducks Unlimited

- Informing and influencing specific government-led industry operating guidelines, codes of practices and standards (e.g., wetland and waterfowl conservation and road placement guidelines)
- Engaging with specific government initiatives to address information gaps that are linked to supporting PHJV policy objectives
- Collaborating with all levels of government to ensure adaptive management policies and practices for sustainable-development objectives are in place

For wetland-dependent birds in the WBF, species status, distribution, trends and habitat associations are poorly known.

Tactic 2: Maintain existing protected land objectives and continue to expand protected-land objectives in key waterfowl-habitat areas.

- Ensuring that short-term protected lands:
 - Receive long-term protection when proposed under government protected areas processes and have adequate management plans and monitoring programs
 - Are renewed when they are part of existing land-use plans undergoing periodic review
- Helping to advance proposed protected lands in core waterfowl areas to long-term protected status
- Assisting in the development and implementation of legislative options to establish protected areas in the Northwest Territories (*the Territorial Government has taken over this responsibility from the Federal Government*)
- Promoting the protection of key waterfowl habitat in largely intact landscapes that are not currently in a proposed designation, and where threats are imminent

Tactic 3: Develop an effective sustainable land-use program that promotes PHJV conservation in non-protected areas of the WBF.

- Reviewing existing practices and regulations for waterfowl-habitat sustainability
- Developing and testing sustainable land-use practices, which may be above regulatory requirements, that conserve waterfowl habitat
- Ensuring that green-certification associations incorporate adequate wetland-conservation standards into their respective certification processes



Waterfowl nests, such as this lesser scaup nest, are located using radio telemetry./©Ducks Unlimited Canada

- Collaborating with industry associations to develop and promote industry codes of practice that sustain waterfowl habitat
- Establishing formal stewardship agreements with industry with the goal of developing and implementing sustainable land-use practices, including establishing protected lands in their operational areas
- Engaging in collaborative land-use planning or monitoring processes with the ultimate goal to minimize the cumulative effects of development, e.g., joint (multi-industry) road planning or government-led monitoring initiatives

Research and Evaluation

Waterfowl

The PHJV's success in the WBF will depend on its relevance to external policy-based processes and stakeholders. Given the limited knowledge about wetlands and waterfowl in the WBF, and the great value of that information for creating conservation opportunities, a long-term role for the PHJV will be to continue to bring key scientific information to WBF planning processes.

The science support for PHJV policy efforts will be strengthened by evaluating hypotheses that relate land-use change and PHJV programs to waterfowl abundance and productivity (see Assumptions and Adaptive Management Needs section). The PHJV will use this information to guide the development and/or evaluation of SLU practices related to waterfowl habitat-conservation programs. Conservation planning tools that create a defensible and objective framework to guide PHJV decision-making will also be developed. These tools will include waterfowl-distribution mapping, spatial assessments of habitat risk and scenario models connecting current and potential habitat conditions to waterfowl abundance and indices of productivity. Such tools will be critical to refining

habitat objectives, developing future budget scenarios and measuring PHJV success beyond acres conserved, including evaluation of provincial wetland policies. Unfortunately, no wetland inventories exist currently in WBF jurisdictions with sufficient spatial resolution, coverage or other defined standards to facilitate full implementation or large-scale evaluation of potential wetland policies. The PHJV must play a role in ensuring the tools required to implement wetland policies are developed. In addition, the case for waterfowl conservation will be strengthened by linking waterfowl habitat to other EGS that may have greater relevance to society, (e.g., carbon offsets). Finally, the WBF has and will continue to be impacted by climate change. A core long-term objective is to evaluate how climate change a) interacts with industrial landscape changes and may limit waterfowl, b) alters the value of PHJV investments and c) influences the locations and types of future PHJV conservation in the WBF. This information will form the basis of the PHJV's climate change adaptation strategy.

Shorebirds, Waterbirds and Landbirds

For wetland-dependent birds in the WBF, species status, distribution, trends and habitat associations are poorly known. This uncertainty limits the PHJV's capacity to assess the impacts of landscape changes on these species and to develop, prioritize and evaluate targeted conservation actions. Thus, immediate research priorities for non-game species are to establish population inventories and identify habitat associations for key species. These priorities could be completed through retrospective analyses of available data and targeted field surveys. A second research priority is to link indices of productivity to habitat covariates through directed studies, enabling the PHJV to evaluate potential impacts of landscape change on populations. Finally, longer-term priorities will involve establishing population objectives and evaluating how PHJV programs influence the abundance and productivity of wetland-dependent birds, achieved through additional research and monitoring and/or model-based approaches using information collected above.

...the WBF has and will continue to be impacted by climate change.

Communications and Education

The PHJV will deliver communications and education programs that promote wetland conservation in the WBF by developing support tools and products that help partners advance PHJV goals. Implementation plans, reports, fact sheets and related documentation, plus hosting workshops, are a few examples of how the PHJV increases wetland- and waterfowl-conservation awareness and provide guidance to government, industry, environmental non-governmental organizations and the public.



Communicating the various benefits wetlands provide to Western Boreal Forest stakeholders is a high priority for the PHJV./
©Ducks Unlimited Canada

At a more organizational level, the PHJV recognizes that working with northern partners is critical to its success and will expand existing partnerships with various stakeholders in the North. For example, by identifying potential areas of collaboration through regular discussions with Territorial Governments, wildlife advisory boards and land-use planning boards, the PHJV will increase trust and its level of influence.

Coordination

In Manitoba, Saskatchewan and British Columbia, coordination of the PHJV's WBF activities is implemented mainly by Ducks Unlimited Canada. In the Yukon and the Northwest Territories, coordination of the PHJV's WBF activities is implemented by both Ducks Unlimited Canada and Environment Canada. In Alberta, the Alberta NAWMP partnership and Ducks Unlimited Canada play key roles in coordinating and facilitating WBF research, evaluation, policy development and communications and education.

...with over 600 First Nations communities located in the WBF, they are a major government influence on land-management decisions.

Partnerships

The WBF is largely publicly owned whereas land in the Prairie Parkland Region is mainly privately owned. Therefore, governments (federal, provincial, territorial, First Nations) hold the land-use decision power. For example, with over 600 First Nations communities located in the WBF, they are a major government influence on land-management decisions. These governments are politically driven by industries that lease extraction or use rights for the land base. Much like the Prairie Parkland Region, there are numerous stakeholders within the WBF and each has a target of interest — for the PHJV this is waterfowl, other birds and their habitats. The PHJV interests may at times be secondary to the multitude of other interests that land managers and decision makers must address. Because of this complexity, conservation success in the WBF often takes considerable time to achieve. However, once achieved, the benefits can be substantial (e.g., the Sahtu Land-use Plan took 15 years to be approved, but resulted in over 40 million acres in protection and sustainable development). It is evident that the success of the PHJV's WBF programs will depend on developing long-term, strategic partnerships with governments, environmental non-governmental organizations and industries that support the Region's habitat objectives for waterfowl and other birds.

Expenditure Forecast

Between 2013-2020, the PHJV is expected to spend about \$47.4 million to achieve WBF habitat goals (Table 6). The funding is anticipated to leverage, minimally, \$52.8 million in non-PHJV partner funds in the WBF through the International Boreal Conservation Campaign, for a total of about \$100.2 million.

TABLE 6

Expenditure forecast for the Prairie Habitat Joint Venture, 2013-2020.

Activity	Expenditure Forecast
Communication and Education	\$ 3,000,000
Coordination	\$ 2,880,000
Enhancement	\$ 0
Evaluation	\$ 7,024,000
Management	\$ 5,528,000
Policy Support	\$ 4,328,000
Reconnaissance and Design	\$ 640,000
Securement	\$ 12,000,000
Stewardship	\$ 12,000,000
Total	\$ 47,400,000

Assumptions and Adaptive Management Needs

The PHJV's WBF conservation activities focus on preventing industrial activities from occurring in key waterfowl areas (protected lands) or ensuring others occur in a manner that does not reduce waterfowl carrying capacity (SLU areas). These activities assume that the many industrial changes in WBF habitats cumulatively have negative effects on waterfowl settling and demography, with some individual sources, such as roads, having significant impacts. The two main assumed pathways are reduced food availability due to the altered flow of nutrients and water into wetlands (wetland loss or degradation hypotheses) or increased predation due to upland fragmentation (upland degradation hypothesis). Most WBF conservation activities are based on wetland hypotheses, with the corollary assumption that maintaining natural hydrology is the key to maintaining waterfowl carrying capacity. Science-based support is limited for these planning assumptions.

As a science-based-partnership, the PHJV needs to assess how the ecological function of acres conserved is maintained. Maintaining ecological function relies heavily on the accuracy of assumptions about factors limiting ducks, how they act and thus, what is needed to prevent or minimize negative effects. Testing planning assumptions is a core adaptive management need in the WBF. The primary evaluation objectives are to determine the individual and cumulative effects of significant landscape changes on waterfowl, clarifying underlying biological mechanisms and scaling up outcomes of habitat delivery to predicted population-level benefits. This approach will help to ensure that PHJV activities are focussed on the landscape changes most influential to waterfowl populations, and thus are having the intended biological effect.

Evaluating the effectiveness of PHJV activities requires tracking actual outcomes of actions and comparing them to those predicted. This means assessing the overall contribution of PHJV actions to the net change in risk of functional loss (i.e., quality) and availability of WBF waterfowl habitat. Therefore, monitoring landscape change and outcomes associated with PHJV activities are two essential components of the PHJV's adaptive management processes. Currently, there is limited ability to measure net change in habitat quality and risk of functional loss which is why it is important to develop this capability during this current implementation cycle.

Until stronger linkages between habitat conditions and the WBF capacity to support waterfowl have been developed, the PHJV's main measure of progress will be

acres of waterfowl-habitat conserved relative to spatial and numerical benchmarks established through spatial targeting. Modeled duck distributions will be used to further assess the biological value of those acres (e.g., determine the percentage of WBF duck populations within those acres).

Future Challenges

Increased industrial activity in the WBF represents one of the most significant conservation challenges for the future. However, overlain on this threat is the potential impact of climate change. While the WBF is expected to warm 40% more than the global average (Soja et al. 2007), the degree to which priority waterfowl habitats are likely to change in quality or location is not fully known. In the WBF of Alaska, for example, there appears to be a long-term declining trend in wetland surface area (Riordan et al. 2006) related to terrestrialization of wetlands and possibly the loss of permafrost (Roach et al. 2011). Changes in invertebrate communities in these areas have been attributed to the effects of climate change (Corcoran et al. 2009). Whether

Increased industrial activity in the WBF represents one of the most significant conservation challenges for the future. However, overlain on this threat is the potential impact of climate change.

such alteration of habitat quality is occurring in Canada's WBF is unknown (but see Drever et al. 2012). It is predicted that climatic envelopes will shift northward; as of yet there are no predictions for spatial variation in resilience or migration of existing waterfowl and waterbird habitats in response to this change. Finally, the role of climate change in moderating, enhancing or overwhelming the assumed effects of industrial activities has not been fully explored. The PHJV's future challenge is to determine the appropriate strategy that balances investments between current locations of core habitat and threats, and where they may occur in the future.



Red-necked Grebe with Chick on Nest/©Ducks Unlimited Canada

Conclusions

The PHJV's WBF activities have expanded significantly as a result of the 2007-2012 Implementation Plan. However, several waterfowl species are 20-30% below NAWMP goals. In addition, a limited, but growing body of evidence, supports the early PHJV conclusion that rapid habitat changes caused by industrial activities (and more recently climate change) may be negatively impacting WBF waterfowl populations. More work is needed to verify which specific landscape changes are affecting waterfowl and to understand the associated biological mechanisms to ensure conservation actions are targeted appropriately. Meanwhile, the PHJV will continue to influence both government policies and regulations and corporate policies and practices based on current biological expertise and knowledge.

More work is needed to verify which specific landscape changes are affecting waterfowl and to understand the associated biological mechanisms to ensure conservation actions are targeted appropriately.

This Plan sets an ambitious 25-year objective to conserve 286 million acres of waterfowl habitat for at least 7.5 million waterfowl. Strong partnerships with the International Boreal Conservation Campaign, the *North American Wetlands Conservation Act*, First Nations and other stakeholders are essential. These partnerships will help leverage strategic capital and position the PHJV to maximize waterfowl conservation efforts now and into the future.

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Boreal wetlands have complex hydrology that may make them sensitive to landscape changes/©Ducks Unlimited Canada

APPENDICES

APPENDIX 1:

Wetland-associated non-game species that share similar habitats with waterfowl in the Western Boreal Forest.

Species are taken from BCR plans for regions 6, 4, 7 and 8 (PNR component only for regions 7 and 8), where reasons for inclusion as priority species include conservation concern, management concern and whether it is a stewardship species (Environment Canada. 2013a, b, c, d). Shown is the bird group (shorebirds (S), waterbirds (W) and landbirds (L)) to which the species belongs; the BCR Plan(s) in which it is listed as a priority species; the long-term

annual trend, 95% credible interval and reliability based on the BBS (shown for BCR 6 unless otherwise indicated) and a general description of its primary habitat within wetlands and water bodies of the Western Boreal Forest. If BBS trend information is unavailable, a status of declining or increasing may be noted if specified in Species at Risk documents. Species with a * are listed as Species at Risk in Canada, and species with a + are considered boreal specialists.

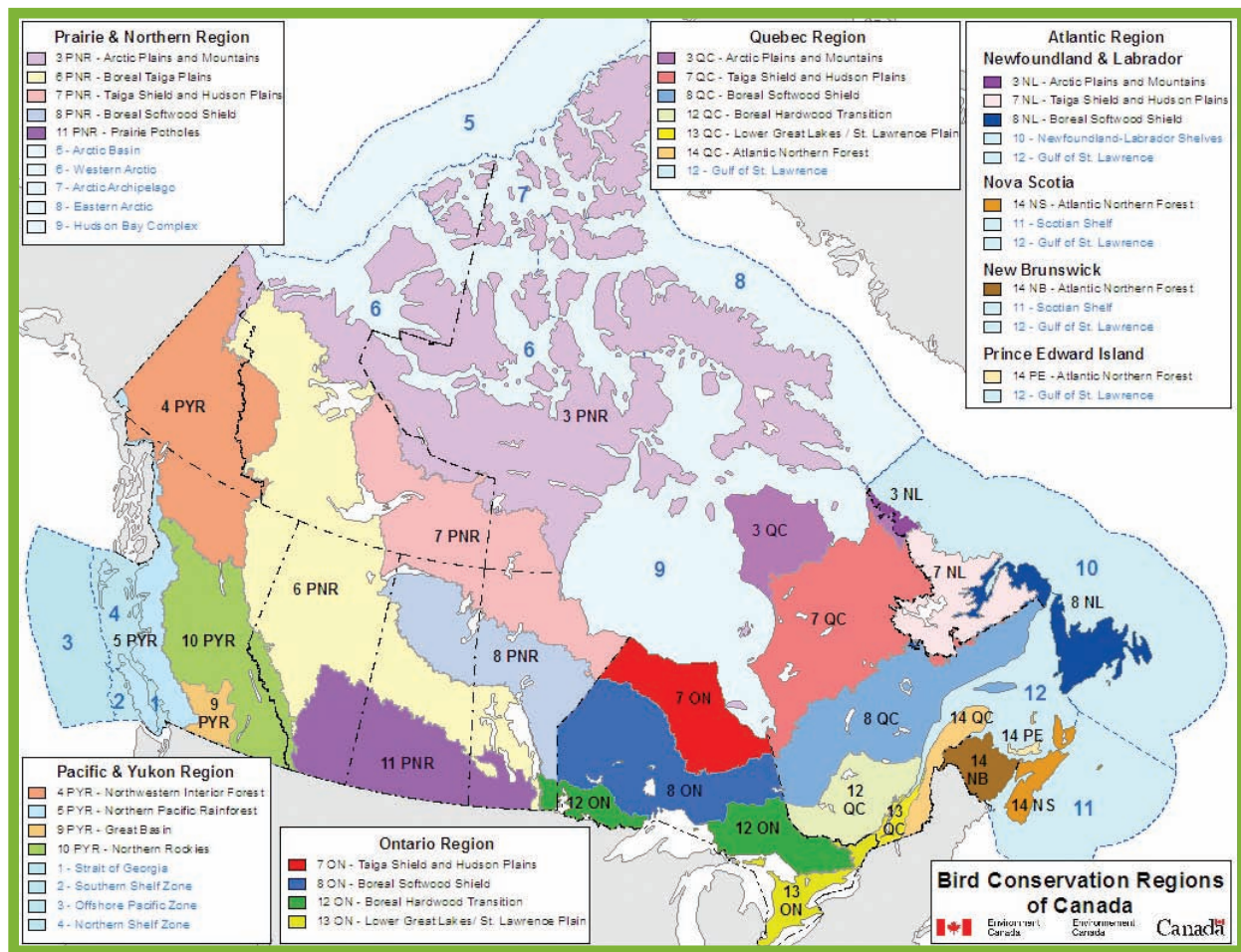
Species	Group	BCR plan	Annual Trend — BCR 6; Reliability	Primary Wetland Habitat Description
Alder Flycatcher+	L	6, 4, 8	-3.19 (-4.13, -2.21) medium	Bog
American Bittern	W	6, 7, 8	-2.3 (-5.59, 0.797) medium	Marsh; Shallow water
Arctic Tern+	W	6, 4, 7	-4.06 (-11.2, 5.37) low (BCR 4)	Marsh; Perennial stream and river
Black Tern	W	6, 4, 8	-4.2 (-8.53, -0.3) low	Shallow water; Marsh; Perennial pond/small lake
Black-crowned Night-Heron	W	6	-2.96 (-12.2, 6.95) low	Marsh; Swamp; All types of waterbodies
Bonaparte's Gull+	W	6, 4, 7, 8	-10.7 (-19.3, -3.78) low	Marsh; Bog; All types of waterbodies
Caspian Tern	W	6, 7, 8	-1.69 (-11.8, 11.6) low	Shallow water; Perennial large lake
Common Loon+	W	6, 4, 7, 8	1.85 (0.419, 3.37) medium	Marsh; Perennial large lake
Common Nighthawk*	L	6, 4, 7	-7.25 (-10.6, -4.29) low	Bog
Common Tern+	W	6, 7, 8	-2.41 (-6.79, 1.84) low	Marsh; Perennial pond/small lake
Common Yellowthroat	L	6, 8	-1.74 (-2.75, -0.83) medium	Bog
Connecticut Warbler+	L	6, 8	-1.43 (-3.34, 0.867) medium	Bog
Dunlin	S	7	NA	Fen
Eared Grebe	W	6	-0.359 (-12, 12.1) low	Marsh; Shallow water; Perennial pond/small lake; Artificial waterbody
Forster's Tern	W	6	-2.13 (-9.36, 7.69) low	Marsh; Perennial pond/small lake

Species	Group	BCR plan	Annal Trend — BCR 6; Reliability	Primary Wetland Habitat Description
Greater Yellowlegs+	S	6, 7	2.6 (-1.57, 6.66) low	Marsh; Bog; Perennial pond/small lake
Horned Grebe*+	W	6, 4, 7, 8	-1.83 (-4.48, 0.971) medium	Shallow water; Perennial pond/small lake; Artificial waterbody
Hudsonian Godwit+	S	6, 7	NA	Marsh; Bog; Fen; Perennial large lake; Mudflat/salt marsh
Killdeer	S	6, 4, 8	-4.67 (-5.67, -3.69) medium	Marsh; Shallow water
Le Conte's Sparrow+	L	6	-2.33 (-4.04, -0.512) medium	Marsh; Bog; Fen
Least Sandpiper+	S	6	-1.58 (-13.7, 21.1) low (BCR 7)	Bog; Marsh; Wet sedge meadows; Perennial pond/small lake
Lesser Yellowlegs+	S	6, 4, 7, 8	-5.69 (-8.53, -3.22) medium	Marsh
Little Gull+	W	7	NA	Marsh
Marbled Godwit	S	6	2.59 (0.487, 4.69) medium	Shallow water; Marsh
Mew Gull+	W	4	-4.41 (-13.3, 4.77) low (BCR 4)	Riparian shrub
Nashville Warbler	L	8	-0.691 (-3.06, 1.82) medium	Bog; Fen; Conifer swamp
Nelson's Sparrow	L	6	-0.072 (-5.28, 4.21) low	Fen; Marsh; Perennial pond/small lake
Northern Harrier	L	6	-3.64 (-5.4, -2.08) medium	Marsh
Olive-sided Flycatcher*+	L	6, 4, 7, 8	-3.9 (-6.45, -1.33) low	Bog
Pacific Loon+	W	6, 4, 7	-1.25 (-12.1, 8.73) low (BCR 7)	Shallow water; Marsh; Perennial stream or large lake
Palm Warbler+	L	7	-1.6 (-5.65, 2.4) low	Fen
Peregrine Falcon*	L	6, 4, 7, 8	increasing	All types of wetlands
Pied-billed Grebe	W	6, 4, 8	-0.143 (-2.96, 2.63) medium	Marsh; Perennial or non-perennial pond/small lake
Purple Martin	L	6	-0.444 (-4.14, 3.74) low	Bog
Red-necked Grebe+	W	6, 4	-0.139 (-1.64, 1.49) medium	Perennial large lake
Red-necked Phalarope+	S	6, 4, 7, 8	-3.38 (-12, 10.8) low (BCR 7)	Marsh; Fen; Perennial pond/ lake
Red-throated Loon	W	7	6.62 (-9.37, 29.2) low (BCR 4)	Bog; Shallow water
Ross's Gull*	W	7, 8	NA	Fen; Shallow water
Rusty Blackbird*+	L	6, 4, 7, 8	-1.32 (-12.6, 11.9) low	Bog

Species	Group	BCR plan	Annal Trend — BCR 6; Reliability	Primary Wetland Habitat Description
Sedge Wren	L	6, 8	-0.013 (-3.78, 2.64) medium	Marsh; Fen
Semipalmated Sandpiper	S	6, 4, 7	NA	Fen; Perennial pond/small lake
Sharp-tailed Grouse	L	6	0.98 (-3.93, 9.69) low	Marsh
Short-billed Dowitcher+	S	6, 4, 7, 8	1.99 (-10.1, 24.2) low (BCR 7)	Marsh; Fen; Bog
Short-eared Owl*	L	6, 4, 7, 8	decreasing	Bog; Marsh
Smith's Longspur	L	6, 4, 7	NA	Marsh; Fen
Solitary Sandpiper+	S	6, 4, 7, 8	0.288 (-4.12, 3.93) low	Bog; Perennial pond/small lake
Sora+	W	6, 4, 7, 8	0.638 (-1.78, 3) medium	Marsh; Non-perennial pond/small lake
Swamp Sparrow+	L	7, 8	3.23 (1.14, 4.97) medium	Bog; Marsh; Fen
Virginia Rail	W	6, 8	1.73 (-8.72, 9.35) low	Marsh; Shallow water; Non-perennial pond/small lake
Western Grebe	W	6	0.062 (-10.9, 12.1) low	Perennial large lake
Western Tanager	L	6	-0.222 (-2.52, 2) low	Bog
Whimbrel+	S	6, 4, 7	NA	Bog; Fen
White-throated Sparrow+	L	6, 7	-0.207 (-0.868, 0.431) medium	Bog
White-winged Crossbill+	L	6, 4, 8	3.33 (-5.16, 10.4) low	Bog
Whooping Crane*+	W	6	increasing	Marsh; Shallow water; Fen
Wilson's Phalarope	S	6	-5.62 (-11.4, -0.462) low	Shallow water; Marsh
Wilson's Snipe+	S	6, 4, 7, 8	0.942 (-0.247, 2.15) high	Marsh; Perennial pond/small lake
Yellow Rail*+	W	6, 7, 8	6.6 (-0.326, 13.9) low	Bog; Fen; Marsh

APPENDIX 2:

Appendix 2. Map of Bird Conservation Regions and sub-regions in Canada.
From <https://www.ec.gc.ca/mbc-com/default.asp?lang=En&n=3C2CA334-1>.



APPENDIX 3:

Assumptions in the Prairie Habitat Joint Venture's Adaptive Management Cycle

The successful implementation of the Prairie Habitat Joint Venture's (PHJV) activities in the Western Boreal Forest (WBF) is based on a number of assumptions and uncertainties including:

Biological Justification: It is assumed that cumulative industrial activity and/or climate change reduces the quantity and quality of wetlands and that cumulative industrial activity reduces the quality of uplands due to fragmentation leading to increased predation rates. It is also assumed that negative effects on wetlands can be avoided if natural hydrology is maintained. Although there is some evidence to support these assumptions, until further research confirms relationships between landscape change and waterfowl, uncertainty will remain about the PHJV's appropriate focus on government policy and industry practices. Also, it is assumed that the carrying capacity of the WBF is currently at North American Waterfowl Management Plan goals and that what has been defined as potentially at-risk habitat is truly at risk over a timeframe relevant to the PHJV's activities. The latter assumption is based on the recent emergence of industry practices, such as fracking, that were barely heard of 5 years ago. Furthermore, it is assumed that the base waterfowl distribution model used for planning represents true distributions of waterfowl. The PHJV recognizes that models are projections of reality, and that the models used, while the best current estimate of distribution patterns, have inherent uncertainties that may require adaptive revision of plans as models are tested, refined and retested.

Government Policy: Current government policies and associated regulatory frameworks do not provide an optimal means to regulate resource-based industries and maintain waterfowl habitat across the WBF. Also, it is assumed that through knowledge transfer, government policies can be influenced in a direction that will result in reduced risk of impact on waterfowl habitat. As such, there remains a level of uncertainty as to the effectiveness of the PHJV's government policy initiatives.

Industry Practices: Some industry practices are assumed to have a negative impact on waterfowl habitat. Alternate approaches to operational planning and on-the-ground operations that reduce the risk of negative impact on waterfowl habitat can occur. Since industry is required to address multiple ecological, social and economic elements, there is a level of uncertainty as to whether such alternate approaches can be broadly implemented. This may vary among industries.

Ecosystem Services: Governments and industry are increasingly required to address a multitude of ecological, social and economic issues that go far beyond maintaining healthy ecosystems for waterfowl. It is assumed that SLU policies and practices that address ecological goods and services (EGS; e.g., water quality/quantity, carbon, caribou), yet still link to the PHJV's biological assumptions, will have significant waterfowl-habitat benefits. The PHJV will be more effective in accomplishing objectives by pooling the PHJV's interests with these other EGS values than by working separately.

On the inside back cover:

Boreal Winding River/©Ducks Unlimited Canada

On the back cover:

Left to Right:

Helicopter Survey/© Ducks Unlimited Canada

Boreal Crew/© Ducks Unlimited Canada

Boreal Wetland/© Ducks Unlimited Canada



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