Canadian
Intermountain
Joint Venture

Implementation Plan:
Wetlands and Associated Species

August 2010

North American Waterfowl Management Plan
Plan nord-americain de gestion de la sauvagine
Plan de Manejo do Aves Acuaticas de Norteamerica

Prepared by the Members of the

CIJV Technical Committee

August 2010

Principal Author:

Bruce Harrison	Ducks Unlimited Canada

Contributors:

Nancy Mahony	Environment Canada (Chair)
Brad Arner	Ducks Unlimited Canada
Andre Breault	Environment Canada
Dan Buffett	Ducks Unlimited Canada
Andrew Harcombe	Nature Conservancy of Canada
Jan Kirkby	Environment Canada
Kathleen Moore	Environment Canada
Ashley Page	Environment Canada
Tammy Tam	Ducks Unlimited Canada

All photos are provided courtesy of Ducks Unlimited Canada

Table of Contents

Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

The Canadian Intermountain Joint Venture (CIJV) is an ecologically-diverse "all-bird" habitat joint venture in the British Columbia (BC) Interior which primarily targets the habitat needs of breeding, staging and migrating birds. The CIJV includes five ecoprovinces and two Bird Conservation Regions (BCRs). Over 38 million dollars have been invested into CIJV habitat projects since its creation in 2003 specifically to secure and/or enhance over 108,000 hectares of wetlands and other habitats.

This Implementation Plan (IP) outlines the approach to be taken by the CIJV partners to meet our vision of "*a landscape that supports healthy populations of birds, maintains biodiversity and fosters sustainable resource use"*. The IP is consistent with the principles, objectives and priorities of the North American Waterfowl Management Plan (NAWMP), and is complementary to other planning documents currently available or relevant to conservation planning in the CIJV (e.g. CIJV Prospectus, BCR Planning documents). The focus is on wetlands and waterfowl species, and other water-associated birds are discussed where information is sufficient. The remaining priority habitat types will be added in subsequent versions.

Over 5% of the CIJV area is composed of wetlands, lakes and other water features, and the most productive wetlands are found in fertile floodplain valley bottoms and grassland plateaus at mid and low elevations. CIJV wetlands are threatened most by climate change and landscape-level alterations of habitat (e.g. forest die-offs due to a Mountain Pine Beetle infestation), but they are also subject to many stressors associated with human activities due to their occurrence in the low-lying areas most suitable for agriculture and settlement. Trends in wetland abundance are poorly understood for much of the JV due to a lack of data replicated over time, although trend information is available at the regional level in some cases. Climate change and increased human pressure on water sources are increasing the importance of wetlands in maintaining biological diversity, particularly in semi-arid landscapes. Unfortunately, in the absence of concerted and focussed intervention, wetland biodiversity will continue to suffer under most predicted climate change scenarios.

The CIJV priority waterfowl species were selected according to the NAWMP continental priorities and the significance of CIJV wetlands in maintaining continental populations. The goal for waterfowl is to maintain the current breeding population of 1.45 million birds, which is assumed to reflect near-historic (e.g. 1970s) levels for most species and habitats, except in some agricultural lands and urban areas. Other wetland-associated birds were prioritized according to Partners In Flight (PIF) criteria, and national waterbird and shorebird plans. Categorical population targets were set for these species according to the PIF methodology.

The biological foundation for the waterfowl component of this IP rests on geo-referenced landscape-level monitoring programs undertaken by the Canadian Wildlife Service (CWS) and Ducks Unlimited Canada (DUC) with financial support from the U.S. Fish and Wildlife Service and the Pacific Flyway Council. The principal program is the helicopter-based Waterfowl Breeding Population Survey of the Central Interior Plateau. Monitoring results are used to

generate three outputs: 1) Habitat-Species (HS) models indicate waterfowl breeding densities by habitat type. 2) HS models are linked with digital habitat summaries to produce annual region-specific breeding population estimates for all waterfowl species. 3) HS models are also used periodically to develop a Decision Support System (DSS) model that spatially ranks and predicts waterfowl use of all wetlands across the CIJV. DSS maps are the primary tools used to target wetland conservation actions in the CIJV.

The CIJV has set a preliminary habitat objective of 21,910 hectares, including wetlands and associated uplands, although there are uncertainties re: JV-wide habitat conditions and trends. This challenge is one of the priorities to be addressed by the JV Technical Committee over the next 3-5 years. Waterfowl-focused habitat objectives have also been identified for two waterfowl Priority Areas as defined by the DSS. To track efforts in securing lands for conservation, CIJV partners developed a new province-wide "Conservation Areas Database" consisting of spatial boundaries and attributes to complement existing datasets of parks and protected areas.

CIJV direct programs focus on securing and restoring key breeding habitats at high risk of loss or degradation. Indirect programs such as stewardship endeavour to change broad land use for the benefit of wetlands, while policy activities focus on influencing governments to conserve, restore and manage wetland ecosystems. Lower-cost and broader-scale stewardship and policy activities are considered a more cost effective way to impact waterfowl populations at a JV scale. The CIJV has always had a large and diverse range of partnerships, and this continues to be a good approach to making the best use of limited staff, expertise and financial resources. The five-year cost estimate to deliver the CIJV programs is $11,600,000.

Our understanding of landscape water distribution and abundance derives from two provincial datasets: the BC Freshwater Atlas (1:20,000) and the BC Watershed Atlas (1:50,000). Their static nature limits our ability to monitor changes over time, but DUC and CWS have recently begun initial work on a project to track trends in wetland distribution and spatial attributes at the landscape level. This project may help address a lack of fine scale coverage for most of the CIJV. We are also developing predictive models to assess the effects of climate change on wetlands. These models identify vulnerability to climate change across the CIJV, by wetland type and by species/group, under different climate change scenarios.

From a research perspective, partners are improving the HS models by adding covariates (e.g. upland context, moisture index, elevation) to decrease the variance observed in earlier iterations. The CIJV must also increase its understanding of limiting factors for waterfowl. We assume that wetland availability and capability for waterfowl are the most important predictors of breeding waterfowl use, but until a recent study of cattle grazing effects on wetlands and waterfowl, we had little knowledge of which specific elements (e.g. grazing pressure, hydrology, water chemistry) are most limiting. To learn more about the vital rate mechanisms underlying these relationships, DUC and CWS are researching the feasibility of a waterfowl nesting study under different levels of cattle grazing.

EXECUTIVE SUMMARY (CONTINUED)

The CIJV has identified six critical challenges related to Interior wetlands and the birds they support, and implementation activities will focus on these over the next 3-5 years. They include:

1. tracking populations of priority wetland birds via expanded monitoring programs;
2. understanding limiting factors affecting waterfowl through improved knowledge of vital rates and population dynamics;
3. improving habitat objectives by linking landscape changes to habitat-species models;
4. tracking changes in wetlands over time at fine- and landscape-scales;
5. expanding and targeting stewardship and policy activities, and evaluating their effectiveness;
6. increasing overall funding and capacity through partnership.

Despite these challenges, the CIJV is in a good position to move forward and grow, particularly with respect to its biological foundation. Partners recently completed a major review of all bird species, and this Implementation Plan represents a consensus position on the priority actions to be undertaken. As a next step, the CIJV Technical Committee will use the IP to develop a multi-partner work plan for delivering on priority actions. The IP reflects the overall adaptive approach taken by the CIJV partners in conservation planning and delivery, wherein monitoring and evaluation play integral roles. This plan is intended to be reviewed and updated at 3-5 year intervals.

PREFACE (SCOPE AND FORMAT)

The CIJV Implementation Plan (IP) focuses on wetlands and waterfowl species in particular (Phase 1) and it includes discussions on other water-associated birds where information is sufficient. As the North American Bird Conservation Initiative (NABCI) planning process is completed for the Bird Conservation Regions contained in the CIJV, the IP will be updated to address all priority habitats and species (Phase 2).

This IP meets the "Desired Characteristics for Habitat Joint Venture Partnerships" expressed by the Plan Committee in its March 2010 Guidance on *NAWMP Joint Venture Progress Reporting and Implementation Plan Endorsement*. The format of this IP is consistent with the Technical Expectations outlined in that document.

1. INTRODUCTION

The Canadian Intermountain Joint Venture (CIJV) is an "all-bird" habitat joint venture under the North American Waterfowl Management Plan (NAWMP) which primarily targets the habitat needs of breeding, staging and migrating birds, including waterfowl. Located in the Interior of British Columbia (BC) and the Rocky Mountain portion of Alberta (Figure 1), the CIJV was formally established in 2003 as a partnership of government agencies, First Nations, non-governmental conservation organizations, universities, industry and landowners. Despite this recent provenance, the CIJV was built on a foundation of many years of cooperative conservation activities among its major partners.

In addition to implementing NAWMP in the BC Interior, the CIJV was established to address the challenges of sustaining healthy populations of birds and other wildlife by providing regional implementation of the Canadian Shorebird Conservation Plan[1], the Framework for Landbird Conservation in Canada[2], and Canada's Waterbird Conservation Plan[3]. It facilitates and augments existing conservation initiatives and partnerships in the province, and complements adjacent joint ventures (e.g. Intermountain West JV) in conserving shared bird populations.

In 2003 the partners produced a CIJV Prospectus to describe the biological foundation of the Joint Venture[4]. As the program has developed, the CIJV has been responsive to direction provided by the NAWMP Committee. The Continental Assessment conducted in 2005 provided a necessary refocusing of efforts towards program evaluation and adaptive management, and this Implementation Plan will guide the conservation and science activities of the partners for years to come. Once the Plan has been updated to address all priority habitats, the wetlands component will be reviewed, and the entire document will be updated at 3-5 year intervals.

[1] Donaldson et al 2000
[2] Canadian Landbird Conservation Working Group 1995
[3] Milko et al 2003
[4] Canadian Intermountain Joint Venture Biological Foundation and Prospectus 2003

Currently, Environment Canada is developing all-bird conservation plans in each of Canada's Bird Conservation Regions (BCRs) to serve as a framework for implementing bird conservation across Canada. This Implementation Plan incorporates many of the elements of the plans for BCRs 9 and 10, particularly as they pertain to non-waterfowl species.

CIJV Vision

The Canadian Intermountain is a landscape that supports healthy populations of birds, maintains biodiversity and fosters sustainable resource use.

CIJV Mission

The partners also believe in an approach to conservation that meets the economic needs of those living and working in this unique area. This is embodied in the mission statement:

Working together to maintain, enhance, restore and manage habitat for the benefit of wildlife and people in the Canadian Intermountain.

The Canadian Intermountain region is bounded by the Coast and Cascade Mountains to the west, the Rocky Mountains to the east, the international boundary to the south and the boreal forest to the north (Figure 1). The region covers over 489,000 km^2, almost 50% of the area of BC, as well as the Rocky Mountains of Alberta. It is one of the most ecologically diverse regions in Canada, with elevation rising from 200 metres to almost 4,000 metres above sea level. This range in elevation and climatic conditions creates a tremendous diversity of habitat types including desert, grasslands, shrub-steppe, riparian, wetlands, dry and moist coniferous forests and alpine tundra. The most productive wetlands are found in fertile floodplain valley bottoms and grassland plateaus at mid and low elevations.

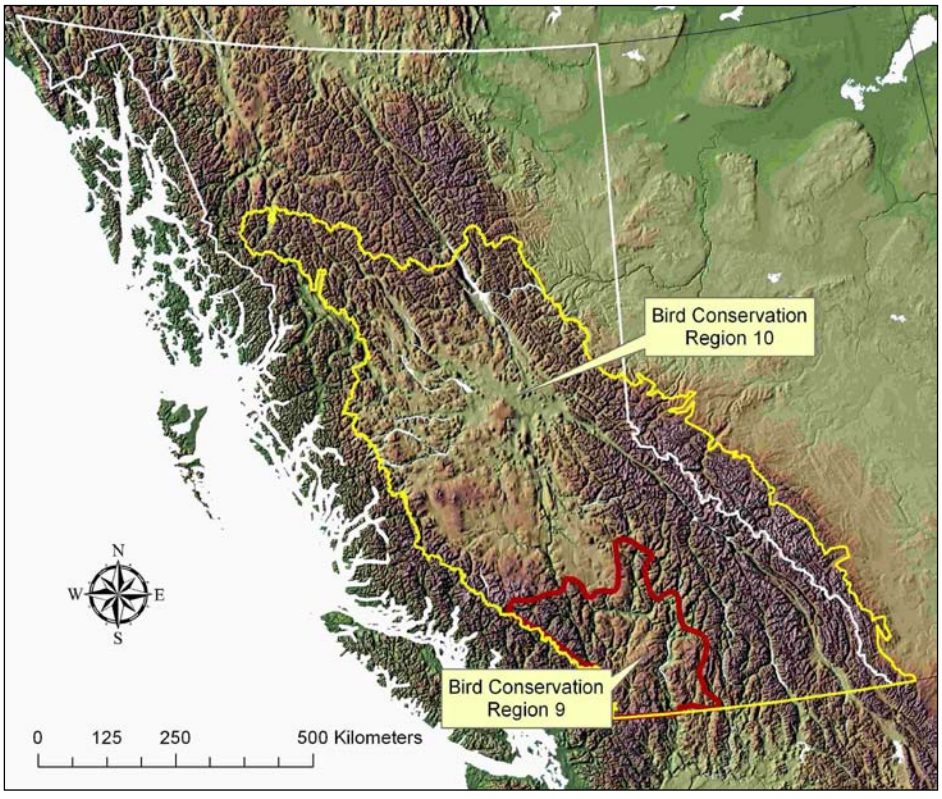

Figure 1: Map of CIJV area (yellow outline) showing the two BCRs within its boundaries

CIJV Conservation Accomplishments

Over 38 million dollars (cash and in-kind contributions) have been invested into CIJV habitat projects between 2003 and 20010 (Table 1). This has translated into the securement or enhancement of over 269,000 acres, or 108,000 hectares (Table 2).

Table 1: CIJV partner contributions since inception (2003-2010) [a]

Source	Total (2003-2010)
US	**$ 14,055,857**
Federal Government	$ 7,027,928
All Non-Federal Government	$ 7,027,929
CANADIAN	**$ 24,697,323**
Government	$ 11,321,927
Non-Profit	$ 12,125,539
Other Non-government	$ 1,249,857
Total	**$ 38,753,180**

[a] Source: Canadian National Tracking System, March 24, 2010

Secured lands include properties acquired by partners or where any of the partners has secured a permanent easement or long-term agreement (10 years +) with the landowner. Enhancement may occur in the same year as securement, or in subsequent years. Stewardship areas are counted when private landowners voluntarily adopt practices promoted by the JV partners. For a description of the tenures associated with all conserved lands, including lands secured prior to 2003, refer to p.29 (Assessment of the Conservation Estate).

Table 2: CIJV partner conservation accomplishments since inception (2003-2010) [a]

Activity	Expenditures	Acres	Hectares
SECUREMENT	**$ 24,087,895**	**269,179**	**108,935**
Acquisition	$ 18,090,454	31,667	12,815
Conservation Easement	$ 1,835,922	840	340
Conservation Agreement (minimum 10yrs)	$ 3,133,831	211,183	85,465
Crown Designation	$ 596,717	1,522	616
Lease	$ 0	115	47
Cooperative Land Use Agreement	$ 39,952	23,852	9,653
Other	$ 391,019	0	0
STEWARDSHIP	**$ 1,515,030**	**8,156**	**3,301**
ENHANCEMENT	**$ 5,496,837**	**119,030**	**48,171**
MANAGED	**$ 3,263,708**	**269,179**	**108,935**
OTHER	**$ 4,389,710**	**0**	**0**
Total [b]	**$ 38,753,180**	**269,179**	**108,935**

[a] Source: Canadian National Tracking System, March 24, 2010

[b] Secured, enhanced and managed acres are not additive. Acres are first secured, may then be enhanced and are subsequently placed under management.

2. BIOLOGICAL PLANNING

Biological Planning Units

The spatial planning unit for the CIJV is the ecoprovince. Under the provincial Ecoregion Classification System[5], an ecoprovince is an area with consistent climate or oceanography, relief, and plate tectonics. This unit was chosen based upon available data sources and monitoring programs, and its utility for distinguishing areas ecologically.

There are five ecoprovinces within the CIJV (Figure 2). All are used for breeding, staging and migrating of water-associated birds (although wintering use is typically highest in the Southern Interior Ecoprovince). For setting population and habitat objectives, the unit may be finer to match the resolution of available data. For example, from a waterfowl perspective, planning and modelling is often conducted at the ecosection level.

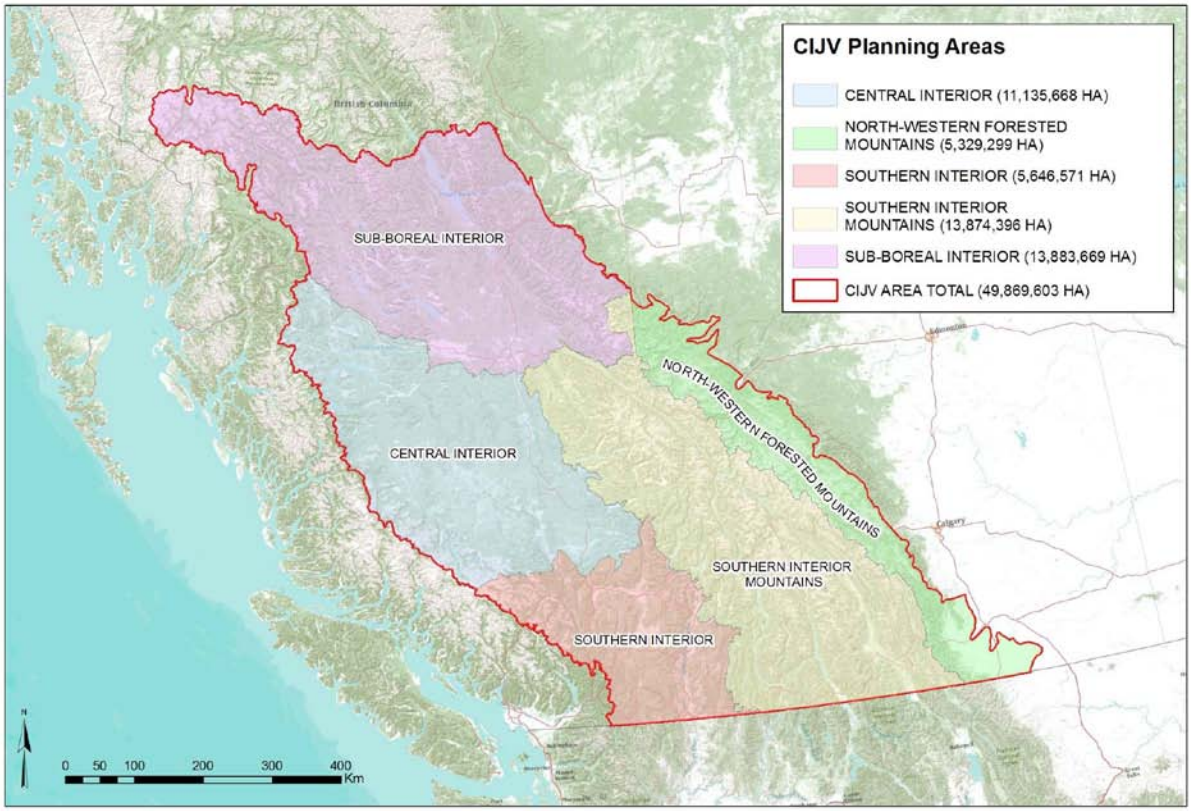

Figure 2: Ecoprovinces of the CIJV

The CIJV has considerably less data and program involvement in the Alberta portion of the Joint Venture (Northwestern Forested Mountains Ecoprovince), but much of the Alberta portion lies

[5] Demarchi 1996

within various National Parks, and the conservation concerns are relatively low. Correspondingly, this IP deals mainly with the BC portion of the JV. The CIJV will still look at opportunities to partner with Parks Canada (a former CIJV partner for several years) on scientific and wetland management initiatives.

The two Bird Conservation Regions[6] (BCRs) within the Canadian Intermountain correspond neatly with the ecoprovince units. The portion of the Great Basin BCR (9) within Canada corresponds to the Southern Interior Ecoprovince, whereas the Canadian portion of the Northern Rockies BCR (10) corresponds to the remaining ecoprovinces.

Priority Bird Species

All birds were originally prioritized at the BCR level for the CIJV Prospectus in 2003. In the Prospectus, priority species were grouped under general habitat categories and, for each species, the nature and level of conservation threat (e.g. habitat loss or degradation, change in water regimes, weed invasion) was assessed.

Priorities have since been revised on the basis of new information. For waterfowl, priority species were revised based on the 2004 NAWMP Implementation Framework[7] and recent CIJV-specific data on population trends from 2006-2009 helicopter surveys. For other wetland-associated birds, priorities were revised during development of the recent BCR 9 and 10 Bird Plans. The resulting Priority Species table for the CIJV now contains 14 waterfowl species and 21 other wetland-associated species (Table 3).

Table 3: Priority species of the CIJV

Group	Priority Species (in alphabetical order)
Waterfowl	American Wigeon, Barrow's Goldeneye, Bufflehead, Cinnamon Teal, Gadwall, Green-winged Teal, Hooded Merganser, Lesser Scaup, Mallard, Redhead, Ring-necked Duck, Ruddy Duck, Trumpeter Swan, White-winged Scoter
Other Wetland Birds	American Avocet, American Bittern, American White Pelican, Black Tern, California Gull, Caspian Tern, Clark's Grebe, Common Loon, Double-crested Cormorant, Franklin's Gull, Forster's Tern, Great Blue Heron, Horned Grebe, Northern Harrier, Peregrine Falcon, Red-necked Phalarope, Sanderling, Short-billed Dowitcher, Virginia Rail, Western Grebe, Wilson's Phalarope

[6] Bird Conservation Regions (BCR) are areas with similar physical features, vegetation, bird communities and habitat issues (Bird Studies Canada 2002) that were based on boundaries in the BC Ecoregion Classification System.
[7] North American Waterfowl Management Plan 2004

The BC Conservation Framework (described on 33) also prioritizes species, but these rankings have not yet been integrated into the CIJV process. Refer to Appendix 1 for a summary of how priority species rank under the Conservation Framework.

Priority Bird Species: Waterfowl

The Canadian Intermountain hosts significant proportions of Pacific flyway duck, goose and swan populations at various stages of their life cycles[8], but is most important as breeding habitat. Twenty-four species of waterfowl breed in the CIJV with an estimated population of 1.45 million birds (Appendix 2), representing 70% of the provincial waterfowl breeding population and roughly 4% of the breeding waterfowl population of Canada.

The significance of the CIJV to over-wintering, moulting and staging ducks is poorly understood, but it is believed that several million birds stage here at various times prior to moving to southern wintering areas in the western United States. Thousands of waterfowl are also believed to over-winter on the large lakes in southern BC[8].

Barrow's Goldeneye Male

Waterfowl Criteria

Waterfowl priorities were derived according to NAWMP status, population trend, conservation need, distribution and geographic significance (e.g. species which have a high percentage of their distribution in a given BCR were ranked high).

Refer to Appendix 1 for status of priority species within NAWMP Implementation Framework.

The North American Waterfowl Management Plan[7] prioritizes waterfowl species by conservation need within continental and regional contexts. Within the CIJV, the NAWMP priority species include Cinnamon Teal, Redhead, Gadwall, Ring-necked Duck, Lesser Scaup, American Wigeon, Harlequin Duck, White-winged Scoter and Bufflehead. Although the CIJV supports 5-10% of the world's breeding population of Harlequin Ducks, this species is not a CIJV priority due to its dependence on high-elevation streams, which are not considered to be at high risk and are not a conservation priority at this time.

[8] Canadian Wildlife Service and Ducks Unlimited Canada 2002

In addition to continental priorities, several species of waterfowl are of special interest due to the proportion of their continental populations which breeds locally. The CIJV supports 20-25% of the world's breeding population of Barrow's Goldeneye, 1-2% of the continental population of Mallards, over 15% of the continental breeding population of Hooded Mergansers, and 5% of the continental breeding population of Ruddy Ducks.

Priority Bird Species: Other Wetland Birds

In the CIJV, 17 species of waterbirds are known to breed or stage in wetlands, including colonial nesting species (e.g. Black Tern, Western and Eared Grebe, White Pelican) and solitary nesters (e.g. Common Loon, Horned Grebe). Many species of colonial waterbirds are suffering national and continental population declines[9], and BCR-scale population data for many species of solitary nesting waterbirds are poor or non-existent. Eighteen species of shorebirds also use interior wetland areas for migration and breeding. Across Canada, many shorebird populations have suffered recent declines but very little is known about the mechanisms causing these declines[1], and in the CIJV, our understanding is further hindered by a lack of basic information on their status and distribution. Although few sites attract large numbers of shorebirds, together these sites support a substantial number of birds. Alkaline wetlands are of particular importance to American Avocets.

In this IP, the identification of priority wetland bird species other than waterfowl was primarily derived from BCR Bird Plans. In each BCR, we reviewed the Partners in Flight (PIF) bird list (US and Canadian portions), the Birds of British Columbia[10], the Alberta Breeding Bird Atlas[11] and several other sources to compile a master list of >200 avian species known to regularly occur therein. Priority bird species for each BCR either:

1. Met the PIF criteria[12] for Continental or Regional Concern, or for Continental or Regional Stewardship (those having a high proportion of their global population or range within the ecological planning area), or
2. Met the criteria for National or Regional Concern under Canada's Waterbird Conservation Plan[3], or
3. Met the criteria for National or Regional Concern under Canada's Shorebird Conservation Plan[1], or
3. Are considered at risk according to provincial or federal designations:
    - Red- or Blue-listed species in British Columbia,
    - Endangered, Threatened or Special Concern in Alberta,
    - Species listed under the Species at Risk Act, and species assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Endangered, Threatened or Special Concern, or
5. Were added based on expert screening and review.

[9] Kushlan et al 2002
[10] Campbell et al 1990
[11] Federation of Alberta Naturalists 2007
[12] Rich et al 2004

This plan focuses solely on the wetland-associated species identified through the above processes. Other species will be handled and integrated in the next iteration of the IP.

Other Wetland Bird Criteria

Priority species were derived in BCR plans according to PIF status, population trend, distribution, provincial or national at-risk status and geographic significance (species which have a high percentage of their distribution in a given BCR were ranked high in this category).

Population Objectives

Population Objectives: Waterfowl

The CIJV Prospectus set the CIJV breeding waterfowl population objectives at "maintaining current levels". These objectives have not yet been explicitly captured into the NAWMP continental population objectives, although the NAWMP Science Support Team (NSST) has started work and asked individual JVs to identify how they would contribute to continental goals.

The CIJV goal is **to maintain an average breeding population of 1.45 million waterfowl.** This represents the most current estimate of the CIJV breeding population, of which Mallard are the most abundant (14%). This goal is assumed to reflect near-historic (e.g. 1970s) population levels for most species and habitats except for agricultural and urban landscapes where habitat losses and degradation have been the most severe since the 1970s (see footnote 8 for a more in-depth discussion of this assumption). Although waterfowl populations are assumed to be at near-1970s levels in rangelands, we also suspect they are depressed compared to historic levels due to the land use practices that began in the mid-1800s.

Table 4 shows population estimates/objectives for priority waterfowl species. Note that the listed trends are for continental populations and may not represent the situation in the CIJV. See Appendix 2 for estimated populations of all waterfowl species in each BCR. Estimates were derived from current or historic aerial and ground surveys that have been modeled at the

landscape level, bird atlases, published [13,14] and unpublished literature on waterfowl distribution, abundance and status, and expert opinion.

Table 4: Population objectives and trends for priority waterfowl species

Priority Species	Population Estimate / Objective [15]	Continental Trend [16]
American Wigeon	141,200	No trend
Barrow's Goldeneye [a]	60,000	Suspected stable
Bufflehead	186,000	Increasing
Cinnamon Teal	30,000	Suspected stable
Gadwall	54,000	Increasing
Green-winged Teal	108,000	Increasing
Hooded Merganser	80,600	Suspected increasing
Lesser Scaup	68,000	Suspected decreasing
Mallard [a]	200,000	No trend
Redhead	105,000	No trend
Ring-necked Duck [a]	100,000	Increasing
Ruddy Duck	54,000	Increasing
Trumpeter Swan	2,850 (wintering)	Increasing
White-winged Scoter	7,000	Suspected decreasing

[a] Estimates for these species have been revised since the CIJV Prospectus based on helicopter survey results and are meant to supersede previously-published population goals.

More recently, population levels have been updated and fine-tuned for smaller geographic areas (e.g. ecosections) using Habitat-Species models derived from the helicopter-based Waterfowl Breeding Population Survey of the Central Interior Plateau (p.14). Models are updated annually with the results of these ongoing surveys (Figure 3), which began in 2006. The repetition of the surveys has enabled us to better quantify variations in bird numbers, bird distribution and abundance across habitats for a broad suite of waterfowl species, and within five years we hope to set accurate and measurable "sideboards" (a range of variation) for CIJV population objectives. Data and planning efforts also feed into the Western Mallard Model currently in development by the USFWS and the Pacific Flyway Council.

[13] McKelvey and Munro 1983
[14] BC Waterfowl Technical Committee 1989
[15] From BC May Cooperative Ground Surveys, BC Waterfowl Breeding Population Survey of the Central Interior Plateau, and Campbell et al. 1990
[16] Continental trend since 1993; from North American Waterfowl Management Plan 2004

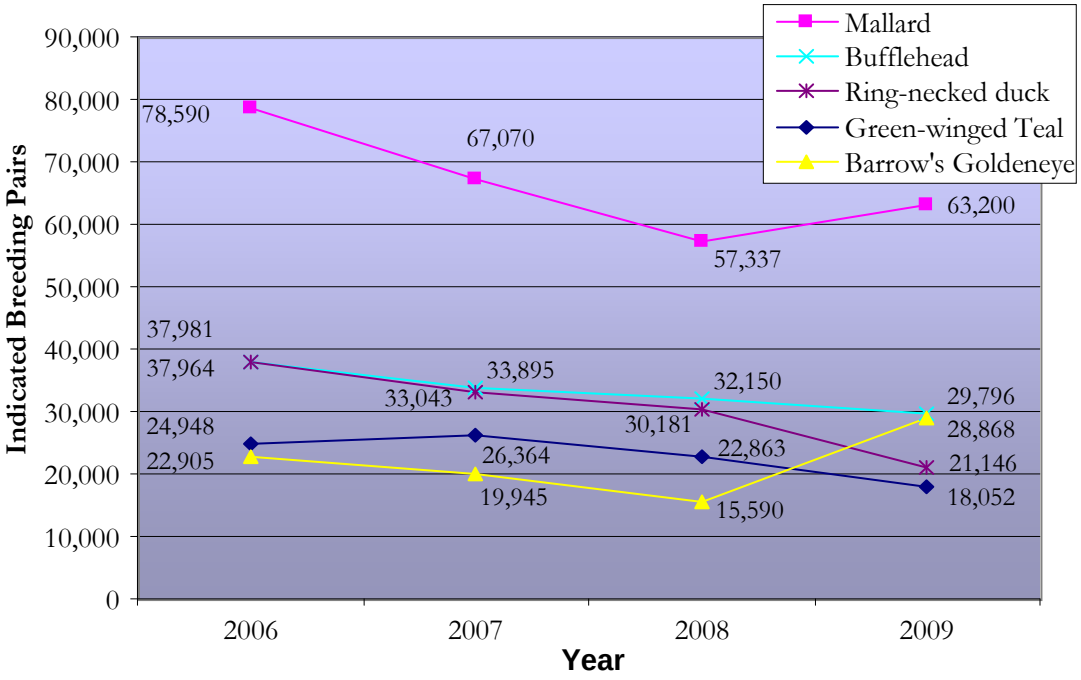

Figure 3: Trends in average Indicated Breeding Pair (IBP) counts for the 5 most common waterfowl species from Waterfowl Breeding Population Survey of the Central Interior Plateau.

Population Objectives: Other Wetland Birds

The BCR plans have established long term (30-year) population targets for priority species according to PIF methodology[17]. Population objectives were set relative to baseline levels of 1960s population sizes and were categorized from assessed population trends according to the following Population Trend (PT) rules:

- For species that have decreased more than 50% in the last 30 years (PT=5)
  - *Double the population*
- For species that have decreased more than 15% over the last 30 years (PT=4)
  - *Increase the population by 50%*
- For species with variable or unknown trends (PT=3)
  - *Maintain the population and assess trends*
- For species with stable or increasing trends (PT=2 or 1)
  - *Maintain the population*

Population trends were derived from provincial Breeding Bird Surveys or Continental Plans[1,3]. We used the highest PT score (either the PT score for all of a BCR or the PT score for just the Canadian portion of the BCR) to set population objectives. For species listed under the federal Species at Risk Act, we deferred to the population objectives contained in the species' Recovery Plan. Table 5 shows categorical objectives for priority species.

[17] Panjabi et al 2005

Table 5: Population objectives and trends for priority wetland bird species

Priority Species	Population Objective [a]	
	BCR 9 [b]	BCR 10
American Avocet	maintain/assess	maintain/assess
American Bittern	maintain/assess	double population
American White Pelican	maintain/assess	maintain/assess
Black Tern	increase by 50%	maintain/assess
California Gull	maintain/assess	maintain/assess
Caspian Tern	maintain/assess	
Clark's Grebe	maintain/assess	
Common Loon		maintain/assess
Double-crested Cormorant	maintain/assess	maintain/assess
Franklin's Gull		maintain/assess
Forster's Tern		maintain/assess
Great Blue Heron	maintain	maintain/assess
Horned Grebe	increase by 50%	increase by 50%
Northern Harrier	maintain/assess	increase by 50%
Peregrine Falcon	increase by 50%	increase by 50%
Red-necked Phalarope	maintain/assess	
Sanderling	maintain/assess	
Short-billed Dowitcher	maintain/assess	
Virginia Rail	maintain/assess	
Western Grebe	increase by 50%	increase by 50%
Wilson's Phalarope	maintain/assess	maintain/assess

[a] Blank cells indicate bird is not a priority species in that BCR.
[b] Draft objectives under review.

Limiting Factors

Limiting Factors: Waterfowl

This plan is based on the assumption that waterfowl population abundance in the CIJV is primarily limited by breeding habitat rather than by staging and wintering habitat values. The extent to which various components of the breeding habitat are limiting (e.g. water levels, invertebrate productivity, nesting habitat) is unclear and this issue is to be investigated further over the next few years. In general, the assumption is that wetland availability and capability for waterfowl are the most important predictors of breeding waterfowl abundance.

The following bullets outline our current understanding of what we believe are major limiting factors:

- Observations on past DUC marsh restoration and enhancement projects at mid- and low-elevation wetlands suggest that wetland quality is more limiting than wetland quantity[18,19]. Notable exceptions include the Okanagan, where valley-bottom wetlands have been mostly lost to development and channelization, and dryer Biogeoclimatic Zones where climate change and/or drought have reduced wetland availability.
- In the future, waterfowl populations may be most limited by climate change: modeling undertaken over the last two years has identified a risk to wetlands for various geographic areas and wetland types. Climate change is expected to have three major effects on wetlands: i) wetlands will become less abundant (fewer and smaller) due to water loss, ii) remaining wetlands will become shallower and less permanent, and iii) wetlands will change their chemical, thermal and biological characteristics (e.g. become eutrophic and lose ice earlier). Partners are actively studying this topic (p.48).
- Given the diversity in CIJV habitats and landscape types, there are likely multiple limiting factors. Many mid- and higher-elevation habitats in the CIJV are still relatively unaltered, and helicopter survey observations indicate that quality limitations may be natural for many wetlands, perhaps due to factors such as low food abundance[20]. Conversely, on more productive lower elevation wetlands, quality limitations are more likely a function of anthropogenic factors such as cattle grazing[21] (p.52).
- Not all species are necessarily limited by the same elements of breeding habitat, either. For example, in the Riske Creek area, wetland nitrogen content was found to be a determinant of wetland selection for Green-winged teal[22], although the authors did not examine the quality of adjacent nesting areas in wetland selection. Research in the same area found that the availability of cavity nesting sites was limiting for Barrow's Goldeneye[23].
- Hunting effort within the CIJV is relatively low, but harvest rates on CIJV waterfowl can be high for birds wintering along the Pacific Coast, and for Mallard, harvest rates are believed to be similar to the rest of the Pacific Flyway[19].
- Other potential limiting factors such as disease and environmental contaminants are assumed to have minor impacts on regional waterfowl populations based on current knowledge[19], although they may be of significance in localized areas.

Many of our assumptions about limiting factors are still relatively uncertain, and population objectives will be difficult to achieve without a better understanding of them. This type of information is discussed in greater detail in Section 6 Research.

[18] Biological Services Group 1990
[19] Breault 2007 pers. comm.
[20] Gunnarsson et al 2004
[21] Marty 2005
[22] Paquette and Ankney 1996
[23] Savard 1986

Limiting Factors: Other Wetland Birds

As with waterfowl, we assume that most waterbird and shorebird species are limited by breeding habitat, although there are notable wintering habitat issues for some species (e.g. most of the continental population of Eared Grebes winters in a few large hypersaline lakes in the west and southwest US to exploit abundant brine shrimp and alkali flies). The BCR planning process has included a Threats Assessment for BCRs 9 and 10, with the goal of creating a short list of the most severe threats for each priority species. This information is not yet linked to species population dynamics, but it may eventually help inform the study of limiting factors for some priority wetland birds. The Threats Assessment also created a "threat profile" for each BCR wherein it identified which threats are most severe and affect the greatest number of species.

Threats to priority species were identified through literature searches. Additional threats were sometimes included based on known activities within the BCR (e.g. mining, Mountain Pine Beetle salvage logging, wind farms, run-of-river and other independent power projects and recreational activities). A separate list of threats to priority species while they are outside the BCR (e.g. within migratory corridors and winter ranges) was developed from a literature search. Experts within Environment Canada were consulted regarding threats caused by contaminants, industrial activities, development and wind farms.

Threats were categorized following the International Union of Conservation for Nature (IUCN) *Classification of Direct Threats to Biodiversity*[24] to reflect the management actions that are necessary to address them. Threats were then ranked by species in terms of spatial extent and severity (both within the BCR and on migration/wintering ranges)[25]. Finally, a "threats matrix" was constructed from these scores to describe the overall magnitude of each threat.

[24] Salafsky et al 2008
[25] Salafsky et al 2003

Habitat-Species (HS) Relationships

Helicopter-Derived Breeding HS Model

The best model relating waterfowl and (selected) waterbird abundance was derived from the Waterfowl Breeding Population Survey of the Central Interior Plateau (Figure 4), conducted annually in May since 2006. These surveys sample waterfowl breeding pair density for each species by geographic location (ecosection), habitat type (wetland, stream, river) and habitat subcategory (wetland size class and river/stream order). Table 6 is an example of a breeding HS model for Mallard. The HS models are extrapolated to develop waterfowl population estimates according to the amount of wetland, river and stream habitat available in each ecosection, and for the period 2006-2009, the team has quantified interannual variability (Figure 5). There are also helicopter-derived models for two ecosections in the East Kootenays, dating from 2001 and 2004.

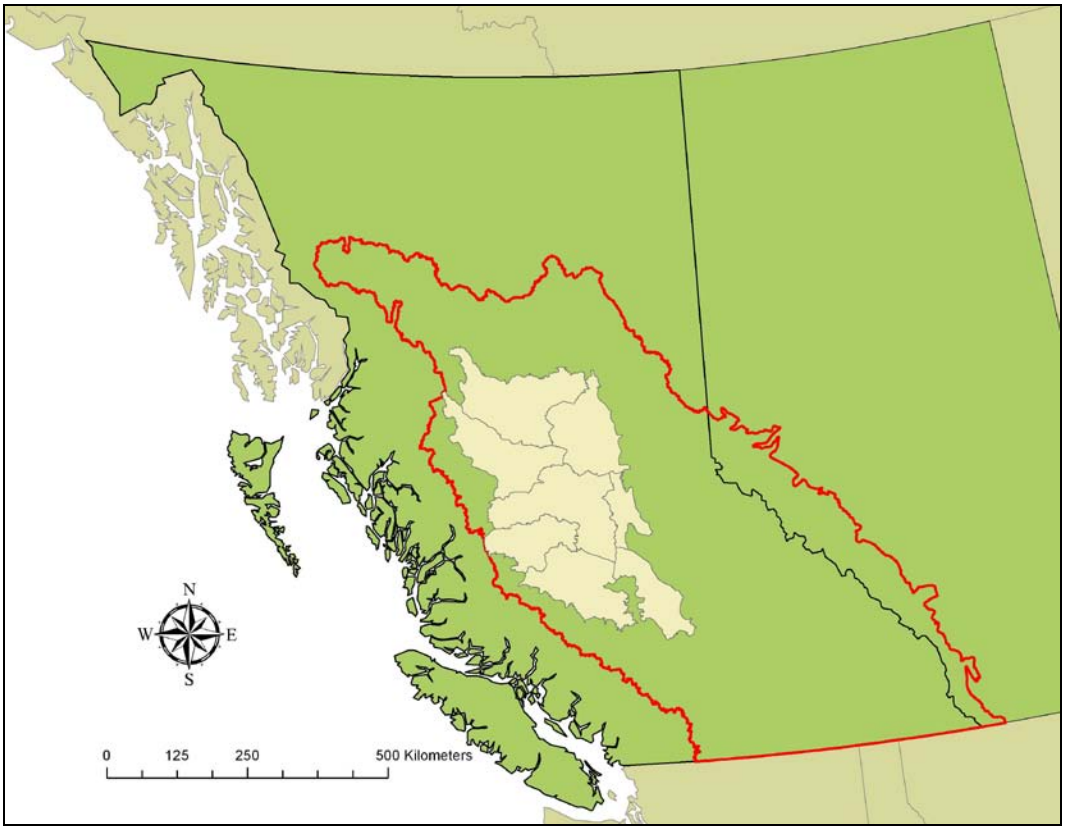

Figure 4: Ecosections sampled by helicopter in the Waterfowl Breeding Population Survey of the Central Interior Plateau

Rivers and streams are often overlooked in terms of their contribution to waterfowl production. However, the helicopter survey program has shown that these systems support a larger-than-expected proportion of the breeding waterfowl population. Waterfowl are most commonly found in low-flow rivers and streams. Beavers are common in stream systems, and provide significant

amounts of habitat for waterfowl in flooded reaches. Beaver ponds are particularly important for species such as Mallard, Ring-necked Duck, Bufflehead and Green-winged Teal.

Table 6: Example of breeding HS model

Species:	Mallard	Year:	2007
Geographic Area:	Chilcotin Plateau Ecosection		

Habitat Category	Habitat Subcategory	Indicated Breeding Pair (IBP) Density	Indicated Breeding Pairs
	Size Class (ha)	*IBP/ha of wetland*	*IBP*
	0-1	1.23	2,206
	1-2	0.27	349
	2-3	0.09	165
Wetlands	3-5	0.13	460
	5-10	0.13	868
	10-20	0.13	1,062
	20-50	0.21	2,915
	50+	0.04	1,312
	ALL		**9,335**
	Order [a]	*IBP/ha of river*	*IBP*
	1	0.00	0
	2	0.00	0
	3	4.88	58
	4	0.88	27
Rivers	5	0.00	0
	6	0.08	103
	7	0.00	00
	8	0.00	0
	9	0.00	0
	ALL		**189**
	Order [a]	*IBP/km of stream*	*IBP*
	1	0.05	164
	2	0.60	912
	3	0.26	221
	4	0.23	133
Streams	5	0.56	117
	6	0.00	0
	7	0.00	0
	8	0.00	0
	9	0.00	0
	ALL		**1,546**

[a] Order denotes the relative position of river or stream segments in a drainage network, where headwater segments are 1st order, a segment fed by two headwater streams is 2nd order, etc.

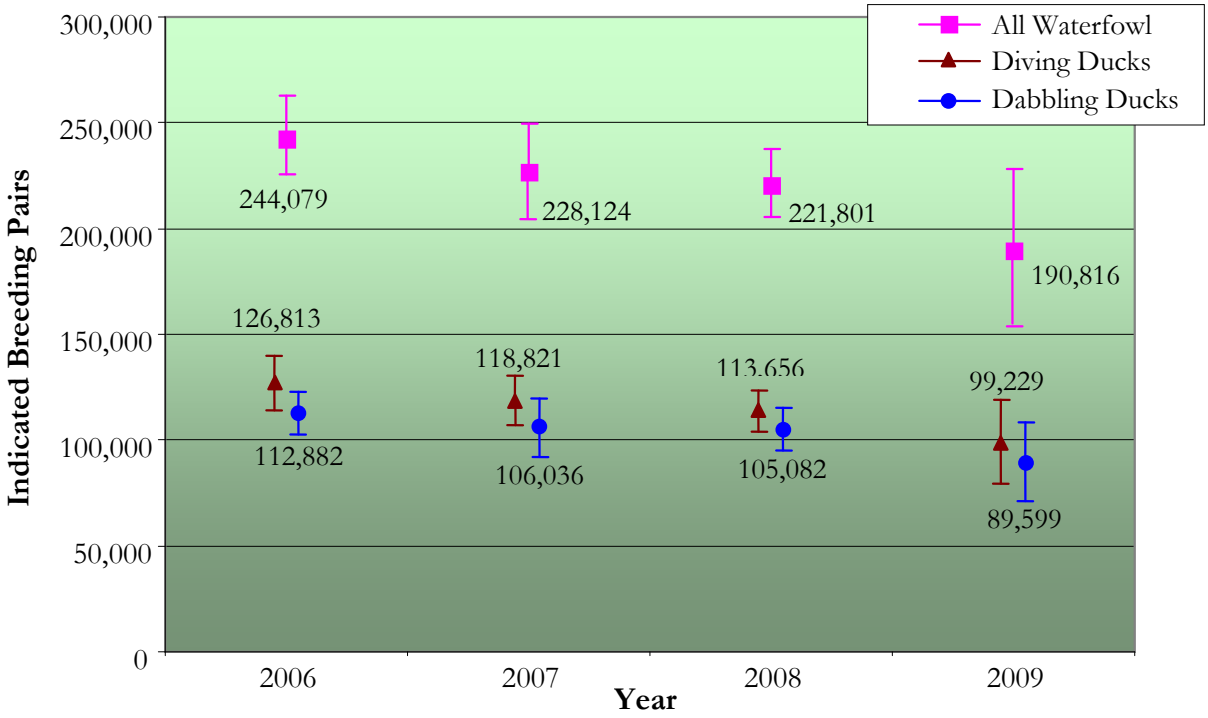

Figure 5: Estimated waterfowl populations throughout the Central Interior survey area by year for all waterfowl (squares), diving ducks (triangles), and dabbling ducks (circles). 95% confidence intervals are shown for each estimate.

Other Models

The CIJV also developed HS models based on a long-term (20+ years) Cooperative Ground Survey program. This survey program was slightly biased in terms of the habitat types sampled (e.g. it focussed on low-elevation grassland-associated wetlands) and therefore the random sampling of the helicopter survey approach produces models that are more representative of the CIJV as a whole. However, for certain locations, the ground survey models provide a reliable and precise assessment of habitat use.

The Canada Land Inventory (CLI) Land Capability for Waterfowl maps[26] identified the most important potential breeding areas for waterfowl through most of BC. The CLI maps also include special classes to identify key staging and migration habitats, many of which occur along valley floors where threats from development are particularly urgent. While key concentrations of high-quality habitats historically occurred in the Columbia, Kootenay and Parsnip River valleys, large portions of these valleys were inundated during hydroelectric developments, and many productive lakes and wetlands were replaced by low suitability reservoirs.

[26] Environment Canada 1981

There are no wintering waterfowl models due to a lack of data, although we know the wintering value of some landscapes can be high (e.g. Okanagan) where the mild climate and abundance of open water and feeding areas allow birds to shorten their southward migration.

Limited information is available on the distribution and abundance of moulting waterfowl in the CIJV, but occasional surveys indicate the presence of thousands of moulting waterfowl (primarily females) representing 13 species in specific portions of the CIJV. The most abundant moulters are Bufflehead, Lesser Scaup, Ruddy Duck, Ring-necked Duck, Barrow's Goldeneye and Gadwall[8].

The potential exists to develop models for some wetland birds (e.g. Common Loon, Sandhill Crane, Trumpeter Swan) based on existing monitoring programs, but at present the CIJV lacks the capacity for this. The BCR planning process will not provide information at a sufficient level to produce HS models, but there is a distinct need for such models and it is believed that actions within this plan will move the partners closer to achieving them.

3. CONSERVATION DESIGN

Landscape/Habitat Characterization and Assessment

Ecological Setting

The Canadian Intermountain is a landscape of widely varying elevation and climatic conditions. This has resulted in a tremendous diversity of habitat types including desert, grasslands, shrub-steppe, riparian, wetlands, dry and moist coniferous forests and alpine tundra. Sixty-three percent of the area is forested, with over 5% covered by lakes and wetlands, 1% in open native grasslands and the remaining area in other non-forested habitat (including urban, agriculture, alpine, rock and ice).

As a result of the range of habitats found within the CIJV, the region contains one of the most diverse breeding bird faunas of any Canadian region**.** Three hundred and seventy-three bird species have been recorded[27]. Of this number, 254 species are known to have bred in the area, while 83 species occur regularly during migration and/or in winter.

The Canadian Intermountain is also a managed 'working' landscape that sustains growing human populations. Resource-based industries including crop agriculture, ranching, forestry, mining, tourism and recreation form the economic foundation of most communities found within the CIJV. However, the cumulative activities that sustain local and regional economies and urbanizing communities can have a profound influence on bird and other wildlife populations.

For the CIJV Prospectus, habitat types were delineated using the provincial Broad Ecosystem Inventory (BEI)[28], a combination of ecoprovince and Biogeoclimatic Zone information. Some of the habitat types corresponded to specific Biogeoclimatic Zones (e.g. Ponderosa Pine and Douglas Fir woodland habitat type) whereas others spanned a number of Biogeoclimatic Zones (e.g. riparian or wetland/marsh habitat type).

More recently, the Technical Committee has generated CIJV-wide habitat type maps and statistics using several datasets (Table 7, Figure 6). The primary dataset was EOSD[29] which used Landsat and provincial forestry information to produce 1:70,000 land cover maps as of 2000 with 25m pixels. The forest classes were used as-is, while several of the non-forest classes were augmented with other datasets. Wetlands and lakes were derived from the BC Government 1:20,000 Freshwater Atlas developed from aerial photography. Finally, alpine, agriculture and rangeland/grassland areas were identified using BC Government 1:250,000 Baseline Thematic Mapping (BTM)[30] developed from Landsat and aerial photography. The Alberta portion of the CIJV, which is dominated by forests and unvegetated alpine areas, was derived exclusively from

[27] Cannings 1998
[28] BC Ministry of Sustainable Resource Management 2002b
[29] Earth Observation for Sustainable Development, Natural Resources Canada, Earth Sciences Sector 2009
[30] BC Ministry of Sustainable Resource Management 2002a

EOSD. Most of these datasets represent snap shots in time ranging from the early 1990s to 2000, although the Freshwater Atlas is updated occasionally.

Table 7: Cover Types within the CIJV (BC and AB portions)

Cover Type	Area (ha)	Percentage
Coniferous forest	27,661,529	55.5%
Shrubs / sparse trees	4,050,824	8.1%
Alpine	2,665,686	5.3%
Herbs	2,626,330	5.3%
Broadleaf forest	2,358,999	4.7%
Rock/rubble	1,799,946	3.6%
Water	1,597,148	3.2%
Barren land	1,438,012	2.9%
No data	1,399,636	2.8%
Mixedwood forest	1,255,510	2.5%
Ice/snow	1,095,229	2.2%
Wetlands	1,024,363	2.1%
Agriculture	459,499	0.9%
Grasslands	368,745	0.7%
Urban	68,208	0.1%
Total CIJV data area	**49,869,663**	**100.0%**

Despite the somewhat "patchwork" approach for estimating habitat structure at the JV scale, we are satisfied that it represents the best available data. The 1:20,000 BC Freshwater Atlas is a particularly useful database in spite of the only periodic updates. However, the CIJV also needs access to finer scale (1:20,000) data on rivers and streams, and on non-wetland habitat classes including riparian zones, grasslands, shrublands, and agriculture in various categories.

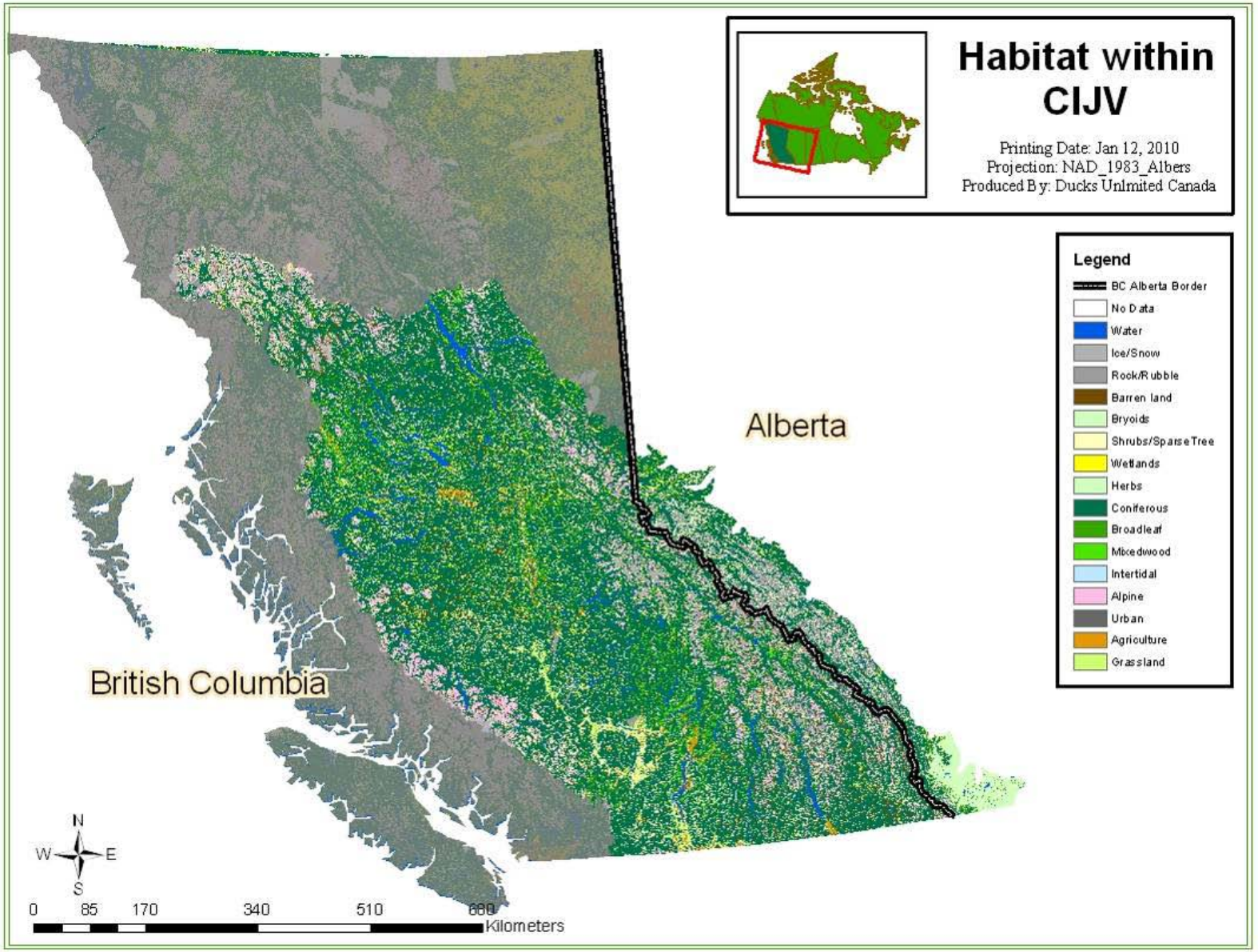

Figure 6: Map of cover types within the CIJV

Wetlands

Over 5% of the CIJV is composed of wetlands, lakes, and other water features (Table 7, Figure 6), representing 60% of the total area of these habitats in BC. Rivers and streams also represent a significant part of the CIJV, but they do not appear within the EOSD, and they are only represented as lines within the Freshwater Atlas unless very large. More than 90% of the CIJV is publicly-owned provincial Crown land[31] or federal Crown land, and the remainder is privately owned, First Nations reserves, or municipal parks. The majority of wetlands are therefore found on Crown land.

Within the CIJV, wetlands are very abundant in the Northern Rockies BCR and proportionately rarer in the dry Great Basin BCR (Table 8). The highest densities of wetlands are found at low and middle elevations in the Central Interior Ecoprovince (Figure 7); the lowest concentrations of wetlands are found in mountainous terrain.

Table 8: Number of lakes and wetlands in the BC portion of the CIJV, by size class and BCR[a]

Size Class (ha)	Great Basin BCR [b]	Northern Rockies BCR [b]	CIJV Total	Provincial Total
0-1	7,766	55,581	**63,347**	116,182
1-2	2,204	17,636	**19,840**	29,474
2-3	1,724	11,661	**13,385**	18,820
3-5	1,705	14,951	**16,656**	23,461
5-10	1,496	15,451	**16,947**	25,087
10-20	717	9,289	**10,006**	15,853
20-50	339	5,659	**5,998**	10,606
50+	145	2,888	**3,033**	7,321
Total	**16,096**	**133,116**	**149,212**	**246,804**

[a] Unadjusted data generated by a digital query of the B.C. Watershed Atlas
[b] Includes wetlands only from the British Columbia portion of the BCR

The CIJV's highly variable topography is reflected in its diverse wetland ecosystems (Figure 8), which range from large expanses of fen in central BC to the glacier-fed Columbia Wetlands complex in the southeast corner of the province. There has been no reliable ecozone-scale categorization of wetlands to date, although a 2004 project classified small wetlands for the Columbia Basin[32].

Wetlands occur in the eight different Biogeoclimatic Zones (geographical areas with a relatively uniform macroclimate, characterized by a mosaic of vegetation, soils and animal life reflecting that climate[5]) in a variety of sizes and forms, ranging from smaller marshes and ponds to extensive lakes. Wetlands common in the drier Bunchgrass and Interior Douglas Fir Zones and, to a lesser extent, in the Ponderosa Pine Zone are represented by cattail or bulrush marshes,

[31] BC Assessment Authority 2010
[32] Machmer 2004

willow-dominated fens and saline meadows or ponds dominated by alkali saltgrass. The Interior Douglas Fir and Ponderosa Pine Zones have significant wetland components in both forest and grassland landscapes. Wetlands in the Bunchgrass Zone are typically within agricultural or grazed landscapes with some wetlands adjacent to urban development. Due to commonly steep terrain in Interior Cedar-Hemlock and Montane Spruce Zones, wetlands in these regions are largely restricted to small fens, bogs and skunk cabbage swamps within forested landscapes.

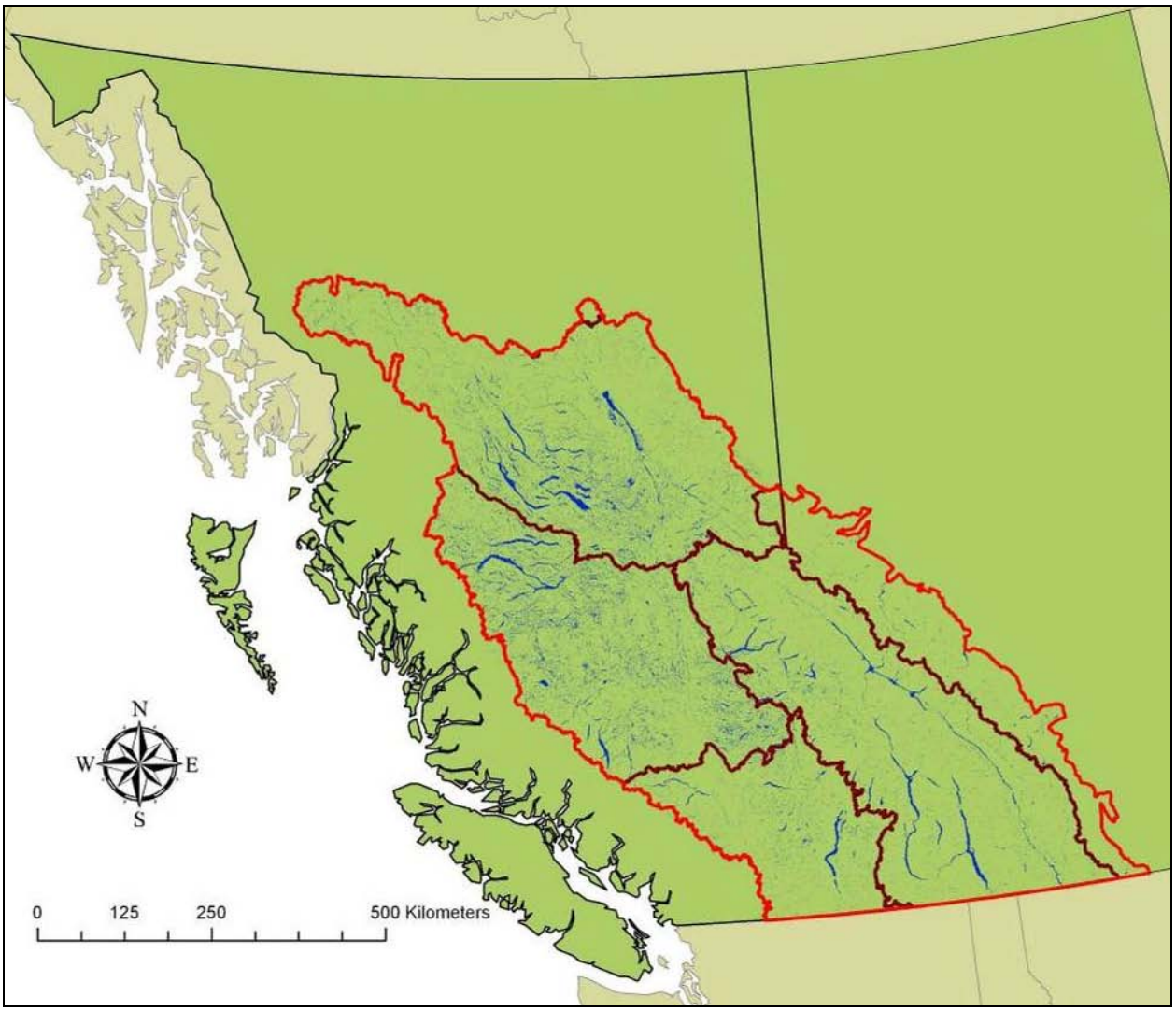

Figure 7: Wetlands, lakes and marshes in the CIJV

The most abundant wetlands are found in the forested landscapes of the Sub-boreal Pine-Spruce and Sub-boreal Spruce zones. Wetland communities here are dominated by scrub birch, willow and several sedge species. Many of the wetlands of the Sub-Boreal Pine-Spruce Zone are managed for hay production or grazing, but in the Sub-Boreal Spruce Zone, wetlands in agricultural landscapes are limited to valley bottoms along major rivers such as the Nechako.

Figure 8: Some common wetland types: grassland marsh (top); fen (middle); forested lake (bottom)

Wetland Habitat Drivers

Much of our knowledge of threats to wetlands derives from a provincial-scale study[33] which found that freshwater wetlands were threatened most by climate change, both in terms of degree of ecological impact and in terms of geographic extent. Hydrologic alterations and introduction of non-native species also ranked consistently high in the assessment.

Evidence of climate change in the CIJV over the last century generally points toward warming temperatures and declining snowpacks (despite more precipitation overall). From 1950 to 2007, Environment Canada data[34] show an increase in mean spring, summer and winter temperatures of up to 2.4 degrees, an increase in spring and fall precipitation of up to 0.4%, a decrease in winter precipitation of up to 0.3%, a decrease in snow cover days in late winter and a decrease in the ratio of snow to rain.

Other CIJV data show similar trends over the last century, including warmer temperatures and greater precipitation in all seasons except winter[35,36,37,38,39]. Rodenhuis et al[38] also reported later freeze-up, decreasing snowpacks and retreating and shrinking glaciers in the last two decades. Fluvial changes included trends toward earlier spring runoff by up to 30 days[34,35,37] in runoff regimes dominated by snowmelt water, and lower late summer flows[40].

There are strong commonalities in climate change predictions for the BC Interior over the next century under most modeling scenarios. Three Pacific Climate Impacts Consortium studies[36,37,38] predicted that for the period up to the 2050s, winter minimum and summer maximum temperatures will continue to rise, snowpacks will continue to fall despite increased winter precipitation, and glaciers will continue to lose volume. Spittlehouse[41] predicted that by 2080 summer precipitation will decrease, winters will be wetter but with less snow, and snow will melt earlier.

The expected effects of climate change on hydrological resources paint a mostly negative picture for wetlands (Figure 9): predicted changes in temperature and precipitation will generally increase wetland outputs (e.g. via evaporation and evapotranspiration), decrease inputs (e.g. via reduced streamflow and snowpack/glacial recharge of wetlands) and alter hydrologic cycles (e.g. earlier spring runoff). Glacial reductions will harm the predominantly glacial-fed wetlands in the Columbia Basin. Those wetlands which remain will experience even greater licensed water use[42].

[33] Veridian Ecological Consulting 2003
[34] Environment Canada 2008
[35] Zhang et al 2000
[36] BC MWLAP 2002
[37] Murdock et al 2007
[38] Rodenhuis et al 2007
[39] Dawson et al 2008
[40] Leith and Whitfield 1998
[41] Spittlehouse 2008
[42] Wilson and Hebda 2008

Figure 9: A dewatered wetland in an area experiencing local drought

In portions of central BC affected by the current Mountain Pine Beetle epidemic, now estimated at 16.3 million hectares[43], the interaction of various climate change effects is even more complicated. Evidence is starting to accumulate that death or removal of overstory cover at a large scale is having dramatic hydrologic effects such as increases in flooding, water yield, peak flows and runoff, and earlier runoff timing[44,45,46]. Widespread logging of beetle-infested stands may also impact watersheds as road construction and riparian salvage operations increase[47] and the hydrologic and habitat effects of logging accelerate. Although new forest-use codes of practice will protect some wetlands, others will be degraded and some practices can negatively impact downstream habitats.

Wetland ecosystems are also subject to many stressors associated with human activities due to their occurrence in the low-lying areas most suitable for agriculture and settlement (over 20% of CIJV lakes and wetlands occur within 10 kilometres of urban communities[4]). The CIJV endured much wetland habitat loss in the late 1800s and early 1900s, particularly in the agricultural areas along valley bottoms. Range and forest management practices have improved since that time, but expanding human populations are encroaching on remaining waterfowl habitats, reducing the availability of wetlands and often significantly decreasing the quality and carrying capacity of wetland and upland habitats.

[43] Province of BC 2010
[44] Redding et al 2008
[45] Uunila et al 2006
[46] Winkler et al 2008
[47] Eng 2004

Although the likelihood of outright wetland drainage or riparian clearing is lower today than historically, agriculture is of particular concern since heavy livestock grazing removes wetland vegetation (Figure 10), compacts soils, adds nutrients to water and promotes invasive species. Water extraction for irrigation of hay crops can dramatically change wetland hydrology and nutrient flow, and ecosystems are lost where reservoirs are developed. The use of fertilizers and other chemicals near wetlands may nutrient-load or pollute wetlands.

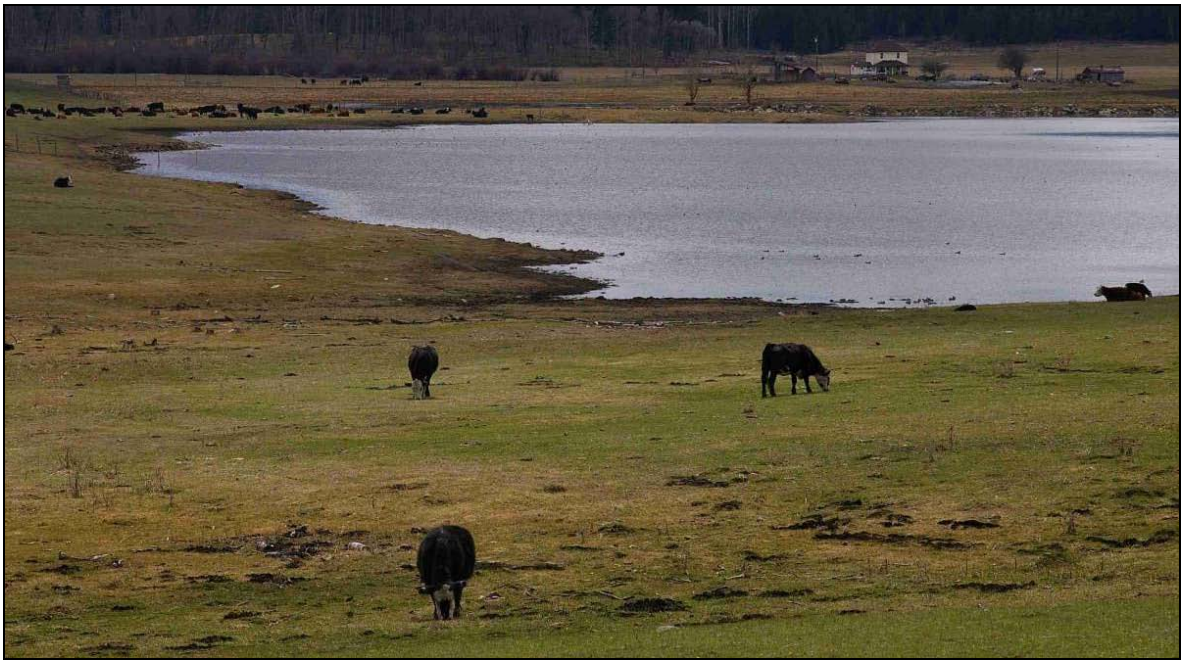

Figure 10: Example of cattle impacts on a wetland and surrounding uplands

Wetland Habitat Trends

Trends in wetland abundance are poorly understood for much of the CIJV due to a lack of replicated inventory data, but there is some regional information.

- In the Cariboo-Chilcotin, by 1983 [48] six percent of wetlands had been impacted since European settlement, mostly in the 1950's. Of impacted wetlands, two thirds were disturbed (e.g. via grazing and haying of meadows) and one third actually disappeared, mostly due to drainage of fens. The rate of wetland loss has likely remained low in recent years due to a general slowing of agricultural expansion (other than cattle grazing) and recognition of the value of stable, long-term water supplies.
- In the Columbia Basin, hydroelectric dams developed in the 1950s and 1960s have contributed to the loss of significant amounts of wetland habitat, including the flooding of

[48] McKenzie 1983

approximately 100,000 hectares of Columbia Valley lands and the conversion of 2,500 hectares of natural Kootenay River floodplains to agriculture[49].

- Trends in wetland abundance have been tracked for the Okanagan watershed. In the South Okanagan, 85 percent of the natural valley-bottom wetlands have been lost since European settlement[50] due to urban and agricultural developments which have occurred mostly in the valley bottom. A recent study[51] found that between 1800 and 2005, 92% of shrubby birch/dogwood wetlands (Figure 11) and 40% of cattail marshes had disappeared in the valley. Overall, low elevation wetlands had declined by 84%, and the Okanagan River, channelized and dyked in 1948, had declined by 93% from 212 ha to 15 ha.

Although it is difficult to measure, wetland condition may be declining where drought has dried wetlands (e.g. at low elevations in south-central BC) or where anthropogenic pressures are high (e.g. valley-bottoms and transportation corridors).

Implications for Bird Populations

Climate change and increased human pressures on water means wetlands are increasingly important in maintaining the biological diversity within semi-arid landscapes. Unfortunately, in the absence of partnership intervention, wetland biodiversity will continue to suffer under most predicted climate change scenarios.

A predictive model for wetland response to climate change in central and southern BC is currently underway by the University of British Columbia (UBC), CWS and DUC (p.48), and is expected to stimulate further study. Results so far indicate that wetlands will decline in area and number, and small or shallow wetlands at low elevations will dry the most. Since these wetlands provide some of the most productive waterfowl habitat, the prognosis is not good for waterfowl and other wetland obligate birds which use them for breeding and migration. Sorenson et al[52] predicted that in North America, warming of 2.5 degrees would reduce waterfowl habitat by two thirds. We are not yet able to quantitatively predict effects on waterfowl populations in the CIJV.

In addition to the drying trend, wetlands are also expected to change their thermal and chemical characters (e.g. become eutrophic due to an increase in primary productivity) and become ice-free earlier[53], and most wetland-dependent species will shift in range and abundance. In arid regions, wetlands support more species than other ecosystems[54], and many of these are provincially red- or blue- listed due to historic and impending threats (e.g. Tiger Salamander and Great Basin Spadefoot [55]). Temporary or small wetlands, which may be most at risk of drying or alteration, contribute disproportionately to biodiversity[56].

[49] BC Commission on Resources and the Environment 1994
[50] Sarell 1990
[51] Lea 2008
[52] Sorenson et al 1998
[53] Compass Resource Management 2007
[54] Brinson et al 2008
[55] BC Ministry of Water, Land and Air Protection 2004
[56] Semlitsch and Bodie 1998

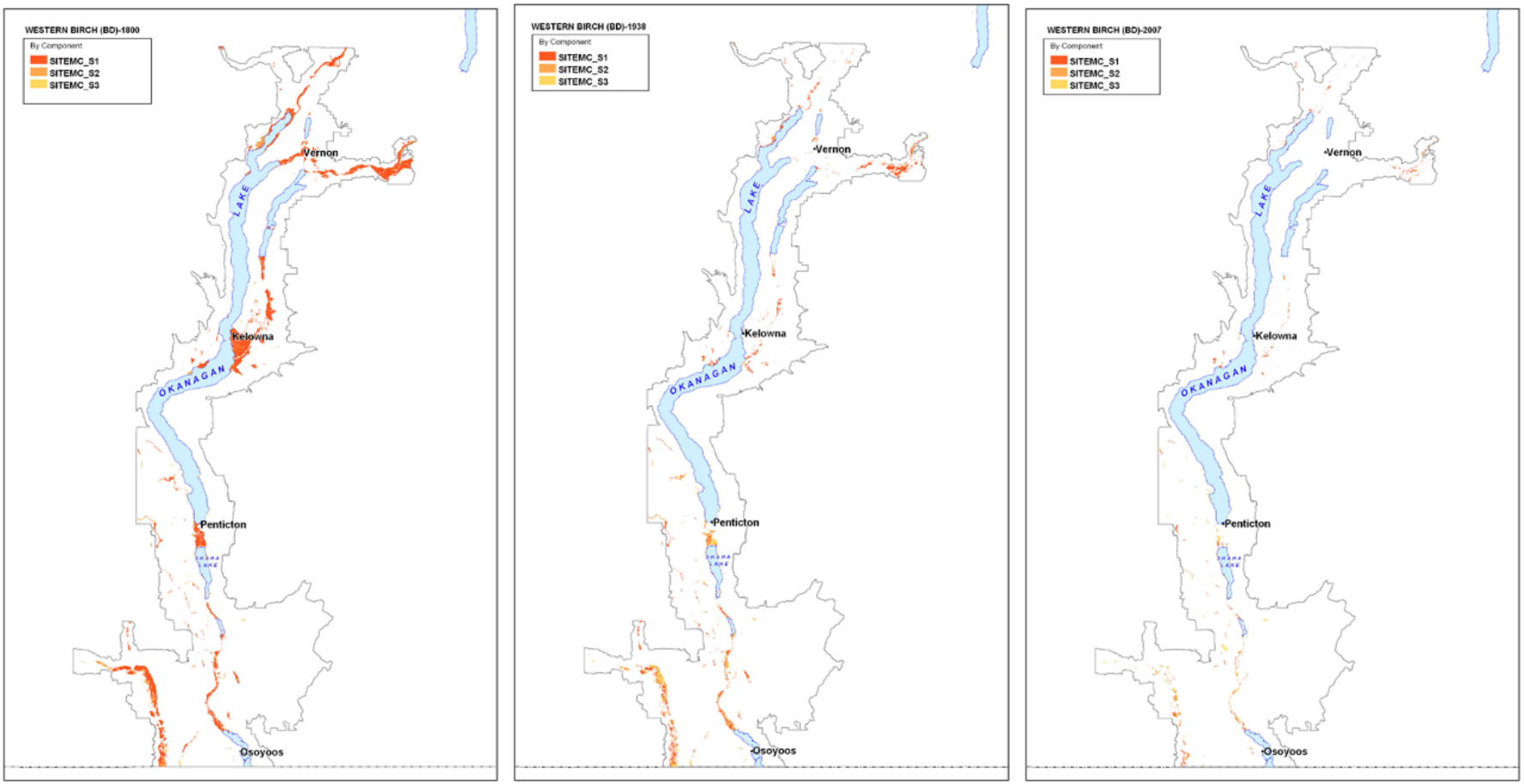

Figure 11: Wetland trends in the Okanagan. Maps showing changes in the water birch – red-osier dogwood riparian shrub swamp wetland (BD) ecosystem between 1800 and 2005. (Source: Lea 2008)

Conservation Areas Database

The high biological value and increasing vulnerability of the Canadian Intermountain has long been recognized. Many organizations, working alone and in partnerships, have invested significant resources and energies in conservation efforts in the region. Conservation achievements include a range of habitat acquisitions, protection and stewardship programs, development and implementation of strategies and tools to guide conservation efforts and successful communication and outreach programs.

To track and coordinate their efforts in securing lands for conservation, CIJV partners (in coordination with the PCJV) developed a new province-wide database consisting of spatial boundaries and attributes of all conservation lands to complement existing datasets of provincial and federal parks and protected areas. This "Conservation Areas Database" improves the precision and accuracy of tracking conservation lands and improves the efficiency of data management. The conservation estate (Table 9) includes lands from non-government organizations, national wildlife areas, regional district parks, provincial protected areas (parks, conservancies, wildlife management areas) and national parks. There are plans to add municipal parks, marine protected areas and protected portions of First Nation lands. Conservation areas were mapped and described in a standardized way (e.g. by IUCN protection level) and at a very fine scale (cadastral). The CAD was web-enabled in 2009. The team has also mapped habitat types within these conservation lands, as shown in Appendix 3.

Table 9: Conservation lands in CIJV by ecoprovince (BC and AB portions)

Tenure	Entire CIJV			Ecoprovince				
				Sub-Boreal Interior	Central Interior	Southern Interior	Southern Interior Mtns	North-western Forested Mtns
	# Parcels	*Area Conserved (ha)*	*% of Total Area*	*Area Conserved (ha)*				
Provincial Protected Areas	681	6,191,106	12.4	905,713	1,638,979	510,508	2,030,839	1,105,067
Federal Parks	7	2,284,436	4.6				429,728	1,854,708
National Wildlife Areas (CWS)	29	1,211	<0.1			753	458	
Non Government Organizations	1,795	453,366	0.9	9,246	62,366	44,719	333,589	3,446
Regional District Parks	133	2,600	<0.1	320	604	1,246	430	
Total	**2,645**	**8,932,719**	**17.9**	**915,279**	**1,701,949**	**557,226**	**2,795,043**	**2,963,221**

Waterfowl Decision Support System

The Waterfowl DSS multi-species breeding habitat model[57] is the primary tool used to plan CIJV wetland conservation actions. This model spatially ranks and predicts waterfowl breeding use of wetlands across the CIJV area, except the Alberta portion which is largely forested and mountainous. It is based on waterfowl HS breeding models combined with wetland abundance as generated from a GIS query of the BC Freshwater Atlas. The model also considers the productivity of each wetland as determined by the Canada Land Inventory (CLI) Waterfowl Capability Maps[24]. Wetlands are weighted by CLI ranking, to illustrate the superior waterfowl productivity value of a high CLI- ranking wetland. The result is a spatially-explicit model of waterfowl distribution and abundance for the entire CIJV which can be used to guide conservation efforts (e.g. compare predicted waterfowl use at two competing sites, identify priority areas for securement). A map output of the model is shown in Figure 12, in which all waterfowl were combined to derive habitat importance. A new model for only the current priority waterfowl species is in development.

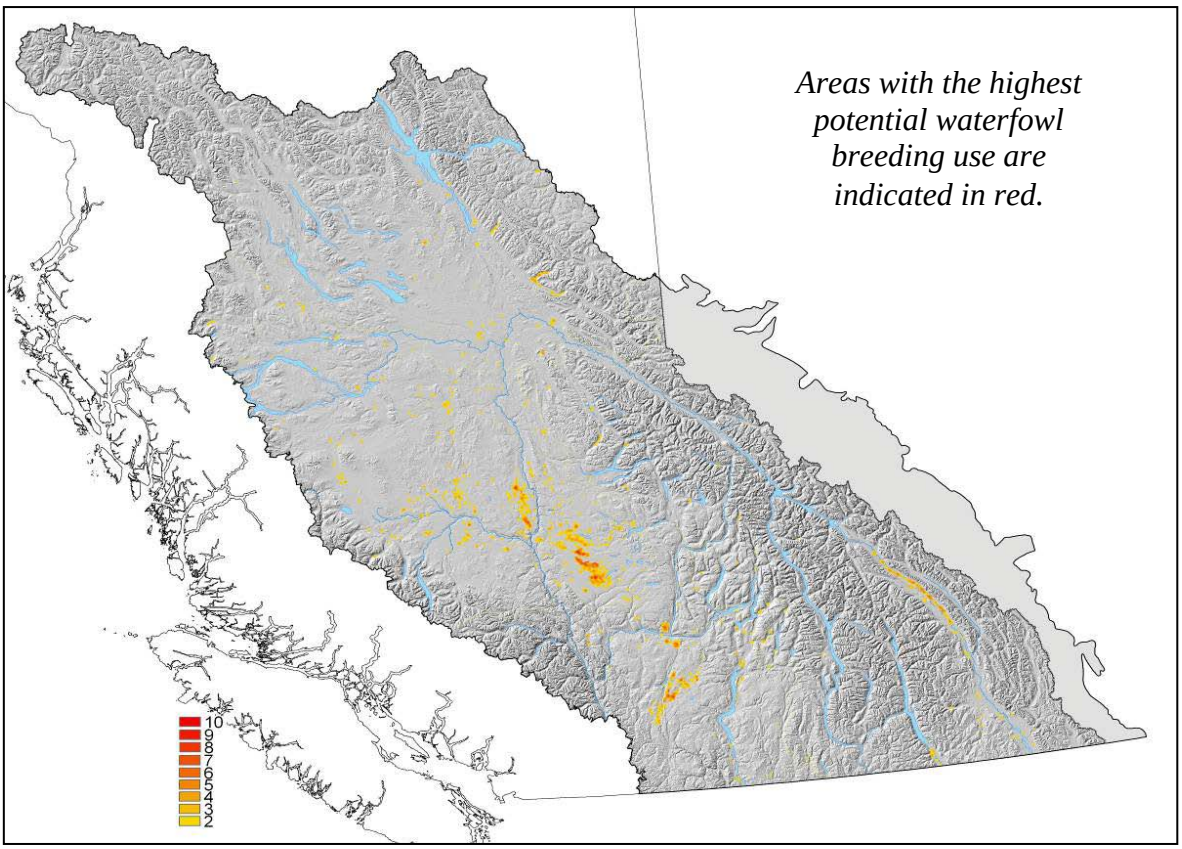

Figure 12: Waterfowl DSS modelling output. Colours indicate an "importance scale" of 1-10 (no units) where 1 is of lowest potential habitat value and is transparent.

[57] Kroeker and Renner 2002

DUC's Waterfowl Priority Areas

Priority Areas were established to enable the focussing of waterfowl-related resources toward areas with the highest need and where activities will benefit the most birds. Two waterfowl Priority Areas were selected in the CIJV based in part on the results of the Waterfowl DSS: the Cariboo-Chilcotin and the Okanagan Valley (Figure 13). Other factors considered in setting Priority Areas were wetland density, risk and/or degree of habitat loss, and partnership opportunity. For the Okanagan Valley, the latter two factors outweighed the DSS in its selection as a priority area (e.g. wetlands are at high risk due to development pressures, but dozens of conservation groups are active and there is potential to combine resources for greater gains). DUC has prepared comprehensive landscape plans for each Priority Area[58,59] which identify habitat threats, set habitat objectives and outline a conservation program for meeting objectives.

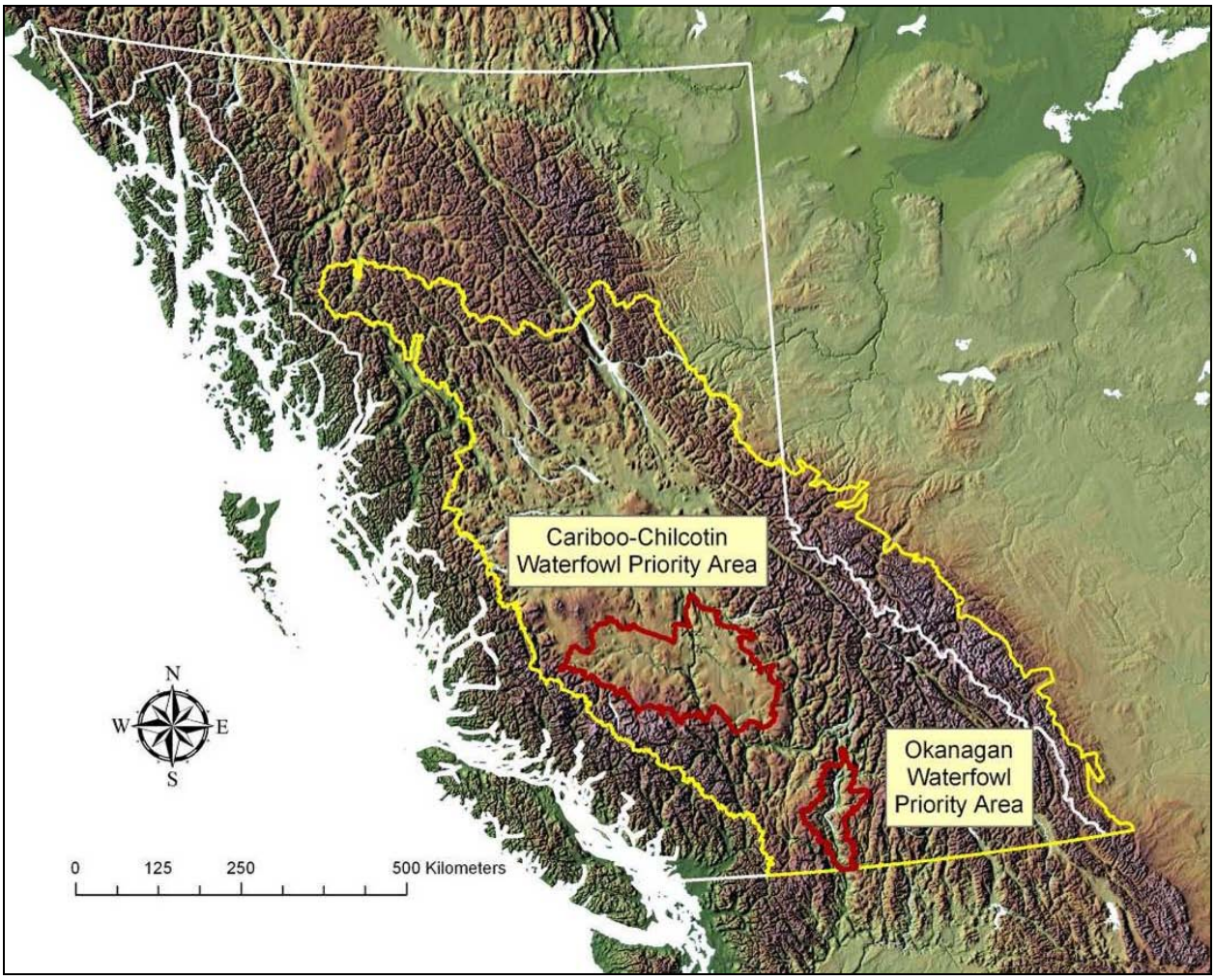

Figure 13: Waterfowl Priority Areas within the CIJV

[58] Ducks Unlimited Canada 2008
[59] Ducks Unlimited Canada 2005

Within Priority Areas, programs are targeted towards areas where there is a strong overlap of high waterfowl values and high risk of habitat degradation due to the above factors. Specific "delivery watersheds" are then selected after consideration is given to public profile, landowner receptiveness and concurrent partner stewardship programs.

Nature Conservancy of Canada's Conservation Planning System

The Nature Conservancy of Canada (NCC) uses a three phase conservation planning system to represent three scales on the landscape: Ecoregion, Natural Area, and Property. Each phase is a systematic conservation assessment that identifies spatial priorities for conservation action. The strategy for implementation refines goals, specifies actions and timelines, assigns responsibilities and establishes accountability, at an increasing level of detail.

The Ecoregional Assessment (ERA, also known as a conservation blueprint) identifies a suite of conservation sites that could contribute to the long-term survival of all viable plant and animal species and natural communities in an Ecoregion, including wetlands, and follows a methodology of portfolio design described in *Designing a Geography of Hope*[60]. Its first step is to identify conservation targets that represent a full range of local biodiversity, with the overall goal of achieving long-term viability of those targets. Spatial distribution data for each target is compiled using best available knowledge. Data on suitability, based on road density, land conversion and other key threats, is used to assess quality of each planning unit in the Ecoregion. An optimization algorithm assists in creating a portfolio of sites that accomplishes conservation goals and minimizes costs. One of the outcomes is a spatial matrix of biodiversity value versus threats/urgency for conservation action[61]. These Ecoregional plans cross political boundaries, and are now in place for the whole of the CIJV.

At the next planning level, the portfolio of sites is used to geographically focus efforts in Natural Areas with higher biodiversity values and lower costs (e.g. lower threats and thus higher suitabilities). Following a standardized template, NCC prepares Natural Area Conservation Plans (NACPs) to achieve biodiversity targets via specific conservation actions. Actions may include securement, stewardship, education, communication, and policy development. At least 80% of NCC's work is focused within a Natural Area. It has defined 6 Natural Areas within the CIJV, 4 of which have conservation plans as of March 2010. The South Cariboo Ranchlands Natural Area is of particular note due to its key wetland and waterfowl habitats, and it will soon have a conservation plan in place.

One of the major areas of conservation action is protection of key properties that capture the conservation (biodiversity) targets and help alleviate defined threats (e.g., acquisition of a range-dominated property might remove the threat overgrazing). For each property secured, NCC creates a Management Plan that links goals, a smaller set of targets (usually a subset of the NACP targets, threat analysis, and a set of conservation actions to alleviate major threats.

[60] Groves et al 2000
[61] Margules and Pressey 2000

At all planning levels, threats and conservation actions are defined according to the standardized classification developed by IUCN-CMP[62], and conservation targets have been defined for wetland habitats (along with individual bird species at risk or bird groups such as waterfowl).

Other Tools

- The BC Conservation Framework (CF)[63] is a recent approach by the provincial government towards biodiversity conservation, including wetlands. The CF "provides a set of science-based tools and actions for conserving species and ecosystems in BC". The CF was also designed to enable collaboration between government and non-government resource managers and practitioners. The approach involves a "Prioritization Tool" for species and ecosystems (based on factors such as global contribution, prevention from becoming at-risk, and maintenance of native diversity), and an "Action Sorting Tool" to determine which conservation actions are most appropriate and effective.
- The BC Trust for Public Lands was a five-year partnership between federal, provincial and local governments and conservation NGOs established in 2004. The Trust was given a conservation mandate to help secure and improve the management of private and public lands, as well as to develop a comprehensive, science-based biodiversity strategy for BC. While this strategy was eventually superseded by the CF, the partnership did produce two significant peer-reviewed reports related to biodiversity: *Taking Nature's Pulse* [64], a comprehensive examination of the condition of the BC's natural environment and the stresses and threats affecting it, and the companion *Biodiversity Atlas of BC* [65].
- Sensitive Ecosystems Inventory mapping has been completed for the Okanagan Valley from Vernon to Osoyoos, and local governments are using this mapping of remaining sensitive habitats to guide their land use planning and decision making. In addition, a Biodiversity Conservation Strategy for the South Okanagan is in development, with active participation by provincial, federal and local governments, First Nations, and non-government organizations. Wetlands have been identified as a priority ecosystem in the spatial framework that will inform the development of the Strategy.
- The Important Bird Areas (IBA) Program[66] is a science-based program which identifies and monitors sites providing significant habitat for Canada's bird populations. The Canadian co-coordinators for the IBA Program are Bird Studies Canada and Nature Canada. IBAs typically support threatened birds, large groups of birds, and birds restricted by range or habitat, and can range in size from tiny patches to large tracts of land or water. Many IBAs incorporate wetlands due to their relative importance for concentrations of species. In the CIJV, there are 15 IBAs which together comprise 330,000 hectares. Notable IBAs include Fraser Lake, Chilcotin Junction and Vaseux Lake.

[62] International Union for Conservation of Nature – Conservation Measures Partnership 2006a and 2006b
[63] http://www.env.gov.bc.ca/conservationframework/index.html
[64] Austin et al 2008
[65] Austin and Eriksson 2009
[66] http://www.ibacanada.ca

Habitat Objectives

The CIJV has set habitat objectives at smaller scales, but deficiencies in JV-wide data on habitat conditions have made it difficult to set quantitative objectives for the entire area. For example, there is no reliable quantitative estimate of wetland occurrence in the 1970s to use as a "reference condition", and while we believe that habitat losses are ongoing in some areas, we are unable to quantify the losses at present. Linking habitat objectives to population trends is also problematic: there is little long-term (1970s to present) data on populations and the objective of maintaining current levels" is somewhat of a default position. Addressing this lack of monitoring data is a major program need for the CIJV, and is discussed in Section 5.

Prior to setting JV-wide objectives, the CIJV took the approach of setting waterfowl-focussed wetland habitat objectives for the two waterfowl Priority Areas (Cariboo-Chilcotin and Okanagan). DUC played the lead role in this process and used a relatively straightforward approach. For example, in the Cariboo-Chilcotin[58], habitat conservation efforts are directed toward retaining key existing habitats, with some restoration or enhancement to compensate for lost habitat and projected future losses. Outright wetland loss has not been a major issue to date[48], and this low rate helps to explain why populations did not decrease demonstrably during the last 30 years.

The process involved focussing on those areas identified as "target habitat" in the Waterfowl DSS which had not yet been conserved. Table 10 identifies the amounts of target habitat found in each of the 5 main land cover types in the Cariboo-Chilcotin. Habitat objectives were extracted from DUC's 5-year Business Plan[67] and distributed among the land cover types in proportion to the amount of target habitat in each cover type. Note that objectives within a land cover type (e.g. forestlands) are focussed on wetlands within that cover type, rather than the dominant feature of the cover type (e.g. trees). However, objectives normally include some upland areas associated with wetlands due to their importance for waterfowl nesting, wetland buffering, etc. We also recognize that upland context plays a role in the value of a wetland for waterfowl, and we are working to add upland-related parameters to our Habitat-Species models (p.50) for insight into how to better distribute objectives among land cover types.

Once objectives were established for the two waterfowl Priority Areas, the team established some preliminary objectives for the "remainder of the CIJV", so that a total could be reached for the joint venture (Table 11). Habitat objectives are expected to be achieved through three types of program (direct, stewardship and policy; see Section 4). The objectives for the "remainder of the CIJV" should be considered a preliminary and conservative starting point. The team believed this was a necessary step in setting a JV-wide goal to help drive us forward in achieving on-the-ground habitat benefits. We will continue to fine-tune the numbers (see Section 5), particularly in important wetland areas such as the Creston Valley and the Columbia Wetlands.

[67] Ducks Unlimited Canada 2007

Table 10: 5-Year habitat objectives for Cariboo-Chilcotin Priority Area

Broad Land Cover [a]	Total Lands		Target Habitat (DSS>1 [b], minus conserved areas)		5-Year Objectives [c]
	ha	% of total	ha	% of total	ha
Entire Landscape	**3,456,400**	**100**	**291,000**	**100**	**9,180**
Grass-covered rangelands	237,900	7	27,000	9	800
Cultivated lands	84,000	2	6,000	2	200
Forestlands	3,070,400	89	257,500	88	8,000
Urban/interface lands	12,200	<1	500	<1	180
Not habitat	51,900	1	0	0	0

[a] Areas covered by wetlands and lakes are included in each of the four land cover types.
[b] Lands were rated on an "importance scale" of 1-10 (no units) in the Waterfowl DSS, where 1 represents the lowest potential habitat value.
[c] Objectives include both wetlands and uplands, since DUC's habitat program includes both categories of habitat, and since the Waterfowl DSS does not distinguish between the two when identifying target lands.

Table 11: 5-Year habitat objectives for CIJV

Program	5-Year Habitat Objectives [a]			
	Cariboo-Chilcotin Priority Area	Okanagan Priority Area [b]	Remainder of CIJV	CIJV Total
Direct	4,000	1,030		5,030
Stewardship	2,080		2,500	4,580
Policy	3,100	6,700	2,500	12,300
Total	**9,180**	**7,730**	**5,000**	**21,910**

[a] Objectives are based on waterfowl habitat needs and represent both wetlands and associated uplands.
[b] For the Okanagan Priority Area, stewardship objectives were included within the Policy program.

The BCR Planning Process also proposes a future approach for setting conservation objectives:

1. ***Develop measurable conservation objectives for supporting priority species/groups.***
   Identify the desired results that support bird conservation by integrating the needs of appropriate groups of priority species. Conservation objectives will support identified population objectives and address limiting factors and will serve as performance measures.
2. ***Identify recommended actions and their relative priority.***

   Identify suites of "on the ground" actions that will support the measurable conservation objectives. The relative priority of these actions will help target efforts for maximum benefit.
3. ***Identify and assign priority to areas and/or habitat types where conservation actions would be most effective.***
   Provide biological guidance as to the areas where conservation effort could be concentrated for maximum benefit to bird populations both now and based on future impacts.

Within NCC's Conservation Planning System, wetlands are identified as a biodiversity target (with waterfowl as a nested target therein) and included in securement acre goals, but there are no separate wetland goals. NCC's approach is to contribute to the Waterfowl Priority Area habitat objectives through its actions in land securement, rather than setting its own specific wetland habitat objectives.

Improving the CIJV Objectives

Although habitat objectives were derived in part from the waterfowl DSS, neither set of Priority Area objectives was explicitly derived from waterfowl HS models. There is no satisfactory HS model for the Okanagan, which is not part of the annual helicopter survey area, and we were unable to develop a satisfactory process for using HS models to set objectives for the Cariboo-Chilcotin. The Cariboo-Chilcotin is mostly a "retention landscape", where populations are believed to have been stable for several decades, and where outright wetland losses have been minimal. We had no reference population level (other than status quo) to strive towards, and HS models would not easily inform this type of "retain historic levels" objective-setting process.

Our approach in the Cariboo-Chilcotin is primarily to secure wetlands of high value to waterfowl and other birds. However, we believe wetland impacts in this landscape are ongoing and likely to worsen, and retaining historic levels of waterfowl will necessarily involve some restoration to offset losses. Specifically, wetlands are most threatened by 1) degradation due to poor grazing practices, and 2) ongoing and future wetland loss or dewatering due to climate change. Habitat objectives must reflect the need to increase the carrying capacity of remaining habitats to mitigate these influences. Because it is difficult to estimate livestock degradation and predict climate change effects, acre goals based on these factors are still somewhat arbitrary, although we are working to correct this. For example,

- DUC is currently reporting on a 3-year study (with Thompson Rivers University) of the effects of cattle grazing on various wetland parameters, including waterfowl, and we expect the results to improve our understanding of how grazing affects waterfowl values (p.52).

- The partners are not able to project wetland and waterfowl losses due to climate change effects. Despite the availability of various climate change scenarios and predictions, no modeling data is currently available for wetlands. Consequently, DUC and CWS initiated a study to model the effects of climate change on Interior wetlands (p.48).
- Nor is there any assessment of ongoing wetland trends at a sufficiently large scale, although JV partners are also currently planning a project to monitor wetland changes (p.48).

We will continue to adapt and evolve our objectives as information becomes available. Formal reassessments will be made at 3-5 year intervals, as part of the IP updating process. DUC also reviews its waterfowl Priority Area objectives annually.

Integration among Species and Treatments

Priority Area objectives were developed primarily in consideration of waterfowl habitat needs. Other water-associated birds use the same habitats in most cases and are expected to benefit from waterfowl habitat conservation efforts. However, it is recognized that the needs of certain species may not be sufficiently captured. The CIJV is still working to develop habitat needs and population objectives for other priority wetland-associated species.

It is expected that habitat objectives will be accomplished primarily via three program types: direct, stewardship and policy, by all partners. Refer to p.38 for a discussion of program types and apportioning of resources. Within programs, the process of deciding which conservation actions will be used to achieve habitat objectives is still ongoing, although DUC has described an approach in both of its Priority Area plans.

Progress Towards Objectives

Each partner has historically tracked its own accomplishments internally and contributed to a common National Tracking System (NTS), but inter-agency differences in tracking protocols made it difficult to combine wetland-specific accomplishments, and data from the NTS are not specific to wetlands. The development of the Conservation Areas Database (CAD) represents a good opportunity to standardize what we track.

However, because conservation activities were underway in the province long before the CIJV was formally established in 2003, we lack the ability to distinguish between pre- and post-2003 accomplishments. The CAD currently lacks some information on dates of property securement, but work is underway to separate habitat land accomplishments into discrete time periods, which will enable us to account more accurately for our progress since 2003.

4. HABITAT DELIVERY

Conservation Programs

Direct

Direct programs focus on securing key natural breeding habitats that are at high risk of loss or degradation. With competition for water coming from agriculture, fisheries and increasingly from urban areas, it is critical to ensure that wetland habitats remain for waterfowl. Methods of securement include acquisition through fee simple purchase or donation, permanent conservation covenants and/or long term (10+ years) landowner or Crown agreements. In general, the level of securement declines with its cost, and use of these securement tools is typically balanced according to biologic value of the wetlands, available resources and landowner willingness.

Partners also restore habitat on lands that have been degraded where it is efficient and effective to do so. DUC occasionally restores very high-value wetlands through its traditional wetland program involving an engineered structure or minor earth-fill "ditch plugs" to control the hydrologic regime of a basin for the benefit of waterfowl and other wildlife. More often, partners now work with the agriculture industry to improve wetlands and associated habitats within agricultural zones via activities such as exclusion fencing, rotational grazing to provide wetland-associated nesting cover, alternative stock watering and reductions in water extraction, among others.

Although breeding habitats are the focus, wetland complexes that offer regionally significant moulting, staging and over-wintering values may also be a priority for protection and restoration when at risk of being lost or significantly altered.

Stewardship

Stewardship programs are focused on changing broad land use for the benefit of wetlands, and can affect larger areas than direct programs. In the CIJV, this often involves promoting the voluntary adoption of agricultural practices which are better for wetlands, without a long-term (10+ years) agreement. For example, producers are encouraged to maintain large, well-managed and mostly-natural properties, where wetlands generally fare better than under the alternative scenario, in which large rangelands are increasingly subdivided into intensively managed recreational properties. To date, we have had success using a variety of tools such as environmental farm planning, demonstration projects, extension materials, biodiversity assessments and range schools to influence livestock producers. In zones of more intensive agriculture (e.g. the Okanagan), producers are also encouraged to limit water extraction and use for irrigation.

Forested landscapes are the most common cover type in the CIJV, but to date the partners have had less influence on forest stewardship than on agricultural practices. We need to place greater emphasis on using influence programs to reduce forestry-related risks to wetlands, particularly

during pine beetle salvage operations. Impacts might be mitigated (for example) by retaining natural drainage patterns and managing cattle access to cutblock wetlands. The provincial Ministry of Forests and Range is heavily engaged in the pine beetle issue and we should seek opportunities to influence government range planning. Partners could also work with forest companies to implement forest Best Management Practices (BMPs) for wetlands.

On the urban fringe, landowners are encouraged to limit development in areas with natural wildlife features and maintain wildlife-friendly activities on their property. In urban areas we find it more effective to work via policy programs.

A number of federal funding programs (e.g. Habitat Stewardship Program, EcoAction) support habitat stewardship, community capacity building, and the implementation of the Species at Risk Act. On a broader level, the multi-agency Wetland Stewardship Partnership has produced several stewardship publications such as the *Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure*[68], *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia*[69], and *Wetlands in British Columbia: A Primer for Local Governments*[70]. The Stewardship Centre of BC also provides support and technical resources to promote habitat stewardship.

Stewardship necessarily involves an education component. We will focus on educating rural residential landowners, agricultural producers and foresters, who have the greatest ability to affect wetland and waterfowl values on the landscape. Informing the public with demonstration projects, workshops and marketing is important to changing attitudes about the value of wetlands, with the assumption that this will also help achieve wetland-friendly policy goals.

Policy

CIJV policy activities are coordinated through the Wetland Stewardship Partnership (WSP), a collaborative association of three levels of government (federal, provincial and municipal), industry, and several key environmental non-governmental organizations with the goal of conserving, restoring and managing wetland ecosystems throughout BC[71].

Policy activities are non-confrontational and informed by science. Activities focus on encouraging governments to favour wetlands and other sensitive ecosystems via a variety of strategies, including influencing legislation/regulation, supporting incentives such as mitigation, providing awareness/education, Integrated Watershed Management Planning (IWMP) and inventory, measurement and tracking.

[68] Wetland Stewardship Partnership 2007
[69] Wetland Stewardship Partnership 2009
[70] Wetland Stewardship Partnership 2010a
[71] Wetland Stewardship Partnership 2010b

Ongoing major policy initiatives of the WSP include:

- Supporting the BC provincial government in its efforts to develop a comprehensive water strategy which incorporates wetland protection according to integrated watershed management principles.
- Beginning implementation of a comprehensive *Wetland Action Plan for British Columbia*[71] which builds on existing initiatives and coordinates the efforts of public agencies and private-sector bodies to fulfill a variety of needs around wetlands, including conservation, legal protection, research, monitoring and communication.
- Working with the province to develop a mitigation strategy for addressing development-related impacts to wetlands.
- Promoting sector-specific wetland BMPs[69] for various industries and other sector groups to avoid and minimize impacts on wetlands.
- Distributing and promoting the use of the *Green Bylaws Toolkit*[68] to provide options for local governments to maintain wetlands and associated habitats in their Official Community Plans and Regional Growth Strategies, and to incorporate sustainable strategies into Regional Economic Development Plans.
- Promoting the value of the ecological goods and services provided by functioning wetlands for the benefit of our health, social, cultural, and economic needs.
- Developing standards for assessing wetland function.
- Working with the BC Ministry of Agriculture and Lands and the BC Ministry of Environment to designate priority Crown Lands for conservation purposes, or give conservation groups first right of refusal for land purchases or conservation covenants.

Management

The partners continue to look for new ways of operating and managing existing habitat projects in a cost efficient manner.

DUC has a significant project infrastructure across the CIJV (more than 350 projects consisting of >800 water controls), and has created a “project evaluation matrix” database to identify the priority sites for reconstruction, repair or decommissioning. The matrix evaluates each project according to required repair/replacement cost, risk of breach, waterfowl values, agricultural responsibilities, land ownership and other criteria, and assigns it a priority rank. Repairs and replacements are conducted according to these ranks.

Costs are balanced against habitat function to derive the most benefit for the least expense, consistent with the concept of “minimal ecological management”. Furthermore, when projects are rebuilt, project design is reviewed to determine approaches to reduce rebuild and operational costs. When projects are renegotiated with landowners, operation and management is turned over to the landowner wherever possible to minimize future obligations.

Science and Evaluation

Science is essential to adaptive management, wherein it plays an integral part in the cyclical processes of planning, implementation and evaluation, and helps ensure we achieve our population and habitat goals in a cost-effective fashion. These activities are undertaken for a number of reasons, including:

- To advance our level of knowledge of wetlands and water-associated birds in BC.
- To improve our understanding of waterfowl species distribution, species-habitat relationships and landscape trends in habitat availability and condition.
- To inform planning processes and priorities.
- To test fundamental assumptions of our models and conservation programs.
- To measure progress towards our goals.

The CIJV Technical Committee, with representatives from the major government and ENGO partners, is responsible for designing, implementing and evaluating individual and collaborative science programs. Current and planned science initiatives are detailed in Sections 5 and 6.

Communications and Outreach

Communications are generally undertaken by each of the CIJV partners according to their level of involvement. An exception is the WSP, which undertakes joint communication tasks under the direction of the WSP coordinator, currently held by a representative from DUC.

In general, partners communicate to inform and educate the public (and the various CIJV partners), to demonstrate leadership on issues which relate to government or industry policies, and to encourage new partnerships and funding opportunities. Partners use multiple formats to ensure the appropriate information reaches each of our audiences (e.g. mass media publications, technical reports, conference presentations, peer reviewed journal articles).

Coordination and Partnership

CIJV activities are coordinated by a Board which includes representatives from its major active partners. The CIJV Board is currently chaired by a representative from Environment Canada, which also supports the partnership by providing a CIJV Coordinator to assist in optimizing the activities of the fourteen various partners (Appendix 4). Partners are ultimately responsible for participating in the various conservation programs according to their resources and mandates.

Activities are often dependent on funding from individual partners or external sources. Currently, two of the partners (DUC and NCC) are the recipients of grants under the North American Wetlands Conservation Act (NAWCA). The use of NAWCA funding is dictated

solely by the individual Grantees and used for the benefit of wetlands and waterfowl according to the terms of the grant agreements.

Partnerships with other like-minded organizations and agencies will continue to be a key part of CIJV programs. Partnerships build on the strengths of each agency to coordinate activities and use cost-effective approaches for the best use of limited staff, expertise and financial resources. However, delivery capacity continues to be a barrier to achieving JV goals, particularly since most partners are not focussed exclusively on joint venture activities.

One approach used by partners in "conserving cost-effectively" has been to participate in multi-organization formal partnerships such as the South Okanagan Similkameen Conservation Program which gather a broad array of expertise and funding, and include conservation agencies, regulators, industry, academic institutions, and resource companies. This local-level coordination (at a smaller scale than the CIJV) can bring about significant benefits while minimizing the costs to individual partners.

The CIJV has one of the most diverse partnerships among the Canadian joint ventures. Partners include representatives from industries which have large impacts on the land base, and consequently we have opportunities to work cooperatively with industry to develop creative solutions to conservation challenges. Partnerships with industry, landowners and other land users also create opportunities to work on lands which partners would not otherwise be able to access or influence at a meaningful geographic scale. For example, partnerships with organizations such as the BC Cattlemen's Association are essential to build trust with agricultural producers, and allow partners to implement direct or stewardship programs in rangeland areas.

Despite these successes, the CIJV recognizes a need for new types of partnerships to improve program delivery. Specifically, science programs would benefit from an expansion of research partnerships; recent partnerships with Thompson Rivers University (p.52) and the University of British Columbia (p.48) are starting to "bear fruit" in terms of filling research gaps. Also, greater short-term cross-over of staff with neighbouring JVs, such as the Intermountain West Joint Venture, would help provide insight into shared or similar technical challenges.

Program Objectives

The process of setting habitat objectives necessarily includes consideration of how those objectives might be achieved. Consideration should include all program types, not just direct conservation treatments such as securement, and resources should be apportioned to the different program types based on their demonstrated cost and effectiveness in achieving habitat goals. At some point in the planning process, habitat objectives must be set before a suite of programs can be prescribed.

Currently, CIJV partners have not developed a common (multi-agency) approach for linking wetland habitat objectives to conservation programs, but there have been attempts to prioritize programs and apportion resources. For example, in the Cariboo-Chilcotin Priority Area, DUC apportioned the acre objectives among its program types according to several criteria, including:

- Nature of primary wetland threats/drivers and whether a program was considered effective in addressing those threats.
- Historic success of that program in conserving wetlands.
- Anticipated likelihood of future success.
- Estimated cost and available partner resources.
- Additional partnership opportunities associated with a program.

Partners recognize that lower-cost and broader-scale stewardship and policy activities are a more cost effective way to impact waterfowl populations at a JV scale. There will always be a need for direct conservation interventions on key, high value sites (e.g. acquisitions and covenants are still the best security for wetlands under current provincial legislation) but rising costs and declining budgets dictate a move towards activities aimed at influencing decision makers.

The prospect of CIJV-wide climate change necessitates a re-thinking of traditional programs. Given our current level of understanding, our approach to the threats posed by climate change is to continue to work towards retaining as much water on the landscape as possible. This is a consistent thread running throughout our conservation programs, as we believe wetlands will be conserved via our involvement in range stewardship (e.g. wetland protection is the goal of several farm practices supported in Environmental Farm Plans), via our efforts to influence governments (e.g. we are encouraging the province to inventory and legislatively protect wetlands in BC), via partnerships with the forest industry (e.g. to manage with consideration for climate change and its effects on landscape hydrology), and lastly via our targeted acquisitions and agreements. Where cost-effective, we will also pursue opportunities to more actively address the anticipated *indirect* effects of climate change, such as more concentrated cattle impacts and water extraction as natural wetlands decrease in number.

Conservation Actions

The CIJV partners use a wide range of tools to protect and restore habitat (Table 12), as is necessary in an area with very diverse habitat types under multiple categories of land tenure. Actions also enable partners to operate at multiple spatial scales, from the individual level to government/industry with large landholdings.

Table 12: Typical wetland conservation actions undertaken by CIJV partners

Program	Conservation Action	Commonly used in: Rural Environments	Commonly used in: Urban Environments
Direct	*Securement*		
	Acquisition - purchase	X	
	Acquisition – donation	X	
	Conservation covenant	X	
	Conservation agreement (minimum 10 years)	X	X
	Crown designation / transfer	X	
	Restoration		
	Water control	X	
	Fencing	X	
	Off-site livestock watering	X	
	Reduction in water extraction	X	
	Riparian planting / bioengineering	X	X
Stewardship	Environmental farm planning	X	
	Demonstration projects	X	
	Range schools	X	
	Biodiversity assessments	X	
	Education	X	X
Policy	Wetland BMPs	X	X
	Provincial Water Strategy	X	X
	Wetland mitigation	X	
	“Green Bylaws”		X

From a waterfowl perspective, conservation treatments are aimed at improving breeding conditions and reproductive rates in particular, generally via the retention of nesting cover, the removal of disturbances, the prevention of nutrient inputs and the retention of water on the landscape.

Expenditure Forecast

Table 13 shows the total estimated 5-year cost for the CIJV conservation programs. Expenditures are for actions taken primarily to benefit wetlands as waterfowl habitat, and consequently they underestimate what is required to benefit all of the birds and bird habitat targeted by the CIJV. Once the habitat needs of other species are factored in, the required expenditures are expected to grow significantly, and the partners will need to identify new ways to leverage costs. Cost estimates may also change as habitat objectives evolve in response to new information we expect in the next few years (e.g. better understanding of cattle degradation effects, climate change projections).

Table 13: 5-Year expenditure forecast by program

	5-Year Cost Estimate		
Program	**Direct**	**Indirect [a]**	**Total**
Direct	$ 2,800,000	$ 1,300,000	$ 4,100,000
Stewardship	$ 150,000	$ 550,000	$ 700,000
Policy	$ 150,000	$ 1,050,000	$ 1,200,000
Subtotal	*$ 3,100,000*	*$ 2,900,000*	*$ 6,000,000*
Management	$ 2,000,000	$ 1,250,000	$ 3,250,000
Science and Evaluation	$ 750,000	$ 600,000	$ 1,350,000
Communication and Outreach	$ 100,000	$ 200,000	$ 300,000
Coordination and Partnership	$ 100,000	$ 600,000	$ 700,000
Subtotal	*$ 2,950,000*	*$ 2,650,000*	*$ 5,600,000*
Total	$ **6,050,000**	$ **5,550,000**	$ **11,600,000**

[a] Indirect expenditures are based on staff-associated costs from a representative partner (Ducks Unlimited Canada).

Appendix 5 shows how estimated 5-year costs are apportioned among waterfowl Priority Areas.

5. MONITORING

Conservation Tracking

The partnership has been tracking conservation actions via the Canadian National Tracking System. However, because the NTS is very coarse-scale and not spatially explicit, it has not been used to inform conservation decisions and planning. We believe that the Conservation Areas Database will be more useful in making the link between conservation actions and progress toward objectives. The single database will improve spatial precision and accuracy and standardized reporting will reduce the multiple inter-organization requests for project accomplishments. Currently, the CAD is administered by two organizations (The Nature Trust of BC and Ducks Unlimited Canada), but all CIJV partners contribute updates on a yearly basis.

The NTS will still be used to track partner financial contribution and expenditures. DUC maintains the NTS and periodically enters its own data into the NTS. Other partner accomplishments will be added concurrently with an annual request for updating of the CAD.

Although the CAD will enable improved tracking of conservation actions, some of these actions are difficult to describe in terms of biological accomplishments. We have quantified the benefits for some restoration treatments (e.g. DUC has numerous studies on the benefits of water control-type projects for waterfowl pair and brood abundance), but still need to learn more about how range management activities such as fencing and off-site watering benefit waterfowl breeding use of wetlands (and likely productivity). For wetland retention projects the benefits derive from preventing future losses, and it is proving difficult to reconcile these with habitat objectives which typically imply additive benefits based on habitat improvements. Section 6 discusses treatment assumptions and related priorities for research.

Stewardship projects often do not involve long-term securement, and such projects are not captured by the CAD. Policy activities are tracked internally by the individual partners, but they are also not yet in the CAD.

Habitat Inventory & Monitoring Programs

CIJV monitoring programs are focussed on addressing the habitat drivers, limiting factors and information needs identified in previous sections, even if this requires making certain assumptions. For example, monitoring land cover enables the JV partnership to estimate the types and amounts of habitat secured over time in a spatially explicit and objective approach. Monitoring wetland occurrence improves the accuracy and applicability of HS models in estimating population sizes and distributions.

However, partners have historically lacked the resources to undertake a comprehensive, wetland-specific monitoring program under the CIJV umbrella. Rather, our approach to date has (mostly) been to compile datasets from various regional, provincial and national programs and integrate

them into our own systems. Datasets which pertain to wetland occurrence on the landscape are presented in Appendix 6.

Most of the habitat mapping datasets are static and lack specific plans for updates. For example, a modified version of Earth Observation for Sustainable Development (EOSD) was used for the general land cover of the Joint Venture and for basic statistics on the habitats within conservation areas as discussed in Section 3 Conservation Design. However this dataset is current to 2000 with no plans for updates by the Canadian Forest Service (the source of the dataset).

Trend statistics are available at a broad scale for two significant cover types in the CIJV – forests and agricultural land, and information can be related to some bird population trends, but for wetlands, which occupy a much smaller percentage of the CIJV area, there is no such systematic reporting. In addition, these habitats often experience changes that can only be detected at a fine scale. Fine-scale habitat mapping is available for only a few areas, and regular updates are not routinely available. As a result, the CIJV is prioritizing those locations that require fine-scale base habitat mapping and where updates for trend statistics are warranted. These mapping priorities will need to consider several factors:

- A sampling design so that CIJV-funded mapping can relate to changes in the broader landscape.
- Technology that is appropriate to detect small changes in habitat.
- Locations with conservation priorities, and/or which are subject to significant habitat pressures (i.e. urbanization, over-grazing).

For instance, mapping of wetlands in part of the Okanagan Priority Area was completed in 1989 using Sensitive Ecosystems Inventory (SEI). This was reassessed again in 1999 and it was determined that one in five wetlands had been affected by encroachment over this ten year period. One-quarter experienced a 5-15% loss in wetland area. About 41% of the lost wetland area was to agricultural development, and the remainder was to urban expansion such as golf courses and highway widening. This mapping is being updated again for the 2009 period. These trends are used by the Joint Venture to help set priorities for conservation, identify industry groups that require education about wetland mitigation, and flag local governments that could benefit from new policy tools such as the Green Bylaws Toolkit.

There have been several other partner-led projects (some of them on-going) with relevance to wetland monitoring.

- Environment Canada conducted a pilot assessment in several areas in preparation for a Canadian Wetland Inventory, but this project encountered some obstacles in terms of cost and methodological issues, and is more likely to be implemented on a region by region basis across the country rather than nationwide.
- As mentioned previously, the CIJV partners have mapped EOSD habitat types within all lands captured in the Conservation Areas Database, and will continue to update these as new areas are added. EOSD represents the current best estimate of habitat structure and condition at the JV scale.

- DUC and CWS have recently begun initial work on a project to track trends in wetland distribution and spatial attributes at the landscape level in the BC Interior. This project is still at the scoping level, but will likely involve a mix of aerial photography, remote sensing and ground-based measurements at multiple scales and time periods. Repeated monitoring of landscape composition is critical to knowing what net landscape changes are occurring.
- Beginning in 2008, DUC, CWS and UBC have been working on a project to model the effects of climate change on wetlands in the BC Interior under various scenarios involving temperature, precipitation and composite heat/moisture indices.
    - Phase 1 of the project created a "vulnerability map" predicting the likelihood of wetland losses in the Central Interior due to climate change. Wetlands will decline in area and number due to declining snowfall and greater summer drying in the future. Expected significant drying of small or shallow wetlands could impact waterfowl populations, because small wetlands provide some of the most productive waterfowl habitat. Examination of the spatial distribution of drying trends suggests that low elevation wetlands in the south and northwest will lose the most moisture.
    - Phase 2 of the project expanded this modelling to the Southern Interior and assessing how waterfowl and other wetland-dependent species might be affected by wetland response to the various climate change scenarios. Results are consistent with the Central Interior, and patterns are similarly troubling, since the smallest wetlands, which comprise 68% of all wetlands, are the most vulnerable.

Population Monitoring Programs

Waterfowl Surveys

Waterfowl are monitored in the course of three different survey programs. In all cases, CWS and DUC are the leading partner agencies.

- **Helicopter Surveys:** The *Waterfowl Breeding Population Survey of the Central Interior Plateau* is an annual sample in May of over four thousand different streams, rivers, and wetlands across eight ecosections in the Central Interior Ecoprovince. Geo-referenced data are acquired during a series of 400m-wide strip transects spaced 10 miles apart. The results inform the HS and DSS models and provide extrapolated estimates of regional breeding populations. Refer to p.15 for an example of model output. Reporting will likely be synchronized with the Mid-Continent Surveys in 2011. The data are also used by the third major program partner, the US Fish and Wildlife Service, to inform Adaptive Harvest Management.
- **Cooperative Ground Surveys (1987-2009; on-hold indefinitely):** An annual census of over 100 wetlands in Central Interior, Southern Interior and Southern Interior Mountains Ecoprovinces. Geo-referenced data were collected from full-wetland ground surveys. This program originally focussed on high-value grassland-associated wetlands, then was

modified to assess conservation lands. Ground surveys were used to develop an earlier set of HS and DSS models, but have been replaced in this function by the helicopter surveys.

- **Duck Banding Station:** Located in the Merritt area of the Southern Interior, dabbling ducks are captured and banded annually for 2-4 weeks in late summer. Information is used to identify harvest rates of Mallards and a few other species, to identify links with other regions, to estimate harvest pressure, and to research avian influenza.

For waterfowl, our ability/commitment to track landscape-level changes in populations is mostly limited by the nature and availability of landscape-level biophysical data to interpret and model habitat use, not by monitoring programs.

Surveys of Other Wetland Birds

- Larger-bodied water-associated birds are surveyed to some extent during the helicopter and ground-based surveys, although their focus is on waterfowl.
- Breeding Bird Surveys (BBS), conducted annually by volunteers as part of the North American BBS, and coordinated in BC by the CWS, collect long-term data on the population status and trends of breeding birds. By design, these surveys tend to focus on landbirds, but they also detect some wetland-associated species.
- The BC Breeding Bird Atlas (BCBBA), coordinated by Bird Studies Canada, is a seven year project (running from 2008 to 2014) to determine the distribution and relative abundance of birds across the province. Atlas data will include birds from all habitats and will therefore provide baseline distribution data for many waterbird species, which was previously lacking. Once completed the BCBBA will not be repeated for 20 years.

6. RESEARCH

The preceding section addressed information needs for CIJV monitoring programs. The current section deals with research needs for other planning and program elements such as HS models and conservation treatments. The focus is mainly on improving the biological foundation for waterfowl at present, but other water-associated birds will be addressed in greater detail as the BCR Planning process continues. Major issues with the potential to impact wetlands at the broad scale, such as climate change, are discussed in more detail in the preceding section.

Habitat/Species Models

Assumptions

- Existing helicopter-based breeding surveys generate an unbiased estimate of population abundance, species distribution, diversity and habitat use for the entire CIJV study area. These data are sufficient to produce scalable population goals (e.g. population goals that vary depending on overall habitat conditions).
- Indicated Breeding Pair (IBP) densities are an accurate predictor of the value of a wetland to waterfowl, and are the best measure available to the CIJV at most scales. This assumes IBP values are directly related to waterfowl recruitment, and the prevalence of "ecological traps" (e.g. high pair density but low productivity due to a concentration of predators) is minor.
- Wetland characteristics are more limiting to waterfowl production than upland context, and productivity does not differ among wetland classes (which we are unable to characterize at the landscape scale). Research from DUC's Institute of Wetland and Wildlife Research (IWWR) has shown that in Prairie Canada, duck density is primarily a function of wetland density.
- The helicopter-derived waterfowl models assume that breeding waterfowl are limited to wetlands below 4,000 feet (1220 metres). This is conservative, since we have observed breeding pairs above that elevation (although their productivity is unknown). However, the number of breeding pairs above 4,000 feet is relatively small.
- The distribution of wetlands, rivers and streams in available GIS datasets is representative of the habitats that are available for bird use in an average year. Waterfowl HS models do not currently address environmental stochasticity or the potential effects of climate change (e.g. reductions in wetland area and depth).

Addressing Model Assumptions

Waterfowl HS models do not yet incorporate information on upland habitat features. CIJV Technical Committee members are collaborating to explore possibilities for expanding the models to include upland variables such as forest cover and forest type, at least at a coarse scale.

This will make the models more directly applicable to forest management programs, and should strengthen our extension and policy-type activities in forest-dominated environments.

HS models also lack a covariate related to water availability in the landscape in any given year. The team recently completed a retrospective analysis of the first 3 years of results from the Central Interior helicopter survey program, and found that interannual variation was considerable. The inclusion of a moisture index using historic weather data would make the models more representative of stochastic environmental conditions and give insight into the relative effect of moisture conditions (and climate change) on wetlands and waterfowl populations.

Climate change elements have not been yet integrated into the HS models. Models can however handle climate change considerations by generating predictions for various landscapes associated with climate change scenarios (i.e. decreased wetland abundance, wetland productivity etc.).

Conservation Actions

Assumptions

- Conserving and restoring priority waterfowl habitats via CIJV programs will have a positive effect on vital rates for most waterfowl and other water-associated birds, and on carrying capacity at the landscape scale, at a measureable level. Specifically, we expect programs to increase nesting propensity, nesting success and brood survival via activities which retain nesting cover, remove disturbances, and secure/restore healthy wetlands. However, we still lack baseline knowledge of vital rates specific to the CIJV for most species, and our knowledge of population dynamics and resource utilization through the annual cycle is mostly derived from information collected outside the CIJV. As in the prairies, we assume that density dependence is not a major factor.
- Waterfowl productivity in the CIJV is better served by focusing on activities that result in increased “reproductive rates” (e.g. nest success, re-nesting probability) in priority habitats, rather than activities that directly impact “survival rates” (e.g. duckling survival, hen survival). Research from the prairies indicates that population dynamics are most responsive to changes in nesting success.
- Concomitant with the assumption that populations are limited more by wetlands (p.50), activities which improve wetland and riparian conditions will benefit waterfowl more than those which improve uplands, primarily via increases to pair density, overwater nesting density and success, and brood survival. Nevertheless, upland cover is important to dabbler nesting.
- High waterfowl values are compatible with sustainable agriculture. Cattle management (specifically, excluding or limiting cattle access to wetlands and riparian areas, particularly in the spring) improves habitat conditions for waterfowl.

- CIJV wetlands are more at risk of loss via climate change effects rather than drainage. Climate change will have mostly negative effects on CIJV wetlands, and therefore retaining water on the landscape will counteract this and provide benefits for breeding waterfowl over the long term.

Addressing Treatment Assumptions

We lack information on limiting factors, and whether we are addressing these with current programs. For example, the issue of cattle management is central to many contemporary JV habitat management programs in agricultural landscapes, but it is still unclear to what extent waterfowl populations benefit from cattle exclusion or rotational grazing. Specifically, we need to quantify the benefits (and/or detriments) of limiting cow access to wetlands, riparian areas and uplands. The CIJV has no productivity model to measure the effects of its upland management programs, due to a lack of IWWR Assessment-type research to test the parameters and assumptions necessary in such a model.

The recent DUC/Thompson Rivers University study into the effects of cattle grazing on various wetland parameters found that excluding or limiting cattle access to wetlands can benefit waterfowl breeding use of those wetlands. This research also demonstrated that other factors such as hydrology and water chemistry may be equally important in determining waterfowl presence. However, the design did not allow for a more direct examination of waterfowl productivity, and it assumed that "within-wetland" grazing pressure was indicative of upland grazing pressure.

To build on that research, DUC and CWS are currently researching the feasibility of a waterfowl nesting study to determine reproductive vital rates under different cattle management scenarios. Nesting rates have been well studied for some cavity nesting ducks in Riske Creek in the Cariboo-Chilcotin (e.g. studies of Barrow's Goldeneyes and Buffleheads in Central BC[72]), but vital rate information is lacking for almost all other species, including over-water and upland nesters. For most species, collecting this information directly is likely cost-prohibitive, and the team is considering ways of making inferences from alternative data sources. Our top vital rate information needs include data on nesting propensity, nesting success and brood survival.

The CIJV Technical Committee is also exploring ways to use survey datasets and project files to compare the value of conserved lands versus unconserved lands. The process is still developing, but we expect it will help us to quantify the "value of conservation".

[72] Evans 2003

Sensitivity Analyses

Although we have little baseline information for the key vital rate parameters most likely to influence waterfowl population measures such as productivity, we assume that in the CIJV, as in Prairie Canada, "reproductive rates" have more influence on duck productivity than "survival rates". In the Prairies, IWWR found that nest success is the primary determinant of annual waterfowl recruitment, although breeding season survival rates are also important. Without a more fundamental knowledge of how vital rates are expressed here, we assume the CIJV exhibits a similar pattern.

From a habitat perspective, in accordance with the assumed main factors limiting waterfowl (wetland availability and wetland quality), our ability to achieve objectives will depend most upon addressing two main habitat drivers: i) wetland loss due to environmental factors such as long-term drought and climate change, and ii) wetland degradation such as that caused by unmanaged agricultural grazing. The relative importance of these factors will become clearer as we improve our understanding of wetland trends and cattle grazing effects.

Spatial Data

The CIJV believes its conservation planning may be limited by the following aspects of the spatial databases currently available.

1. The static nature of available datasets limits our ability to track trends in wetland distribution.
2. There is a lack of fine scale coverage (e.g. SEI mapping) for most of the Joint Venture.
3. Our predictive capability for modelling the effects of climate change on wetlands is still developing.
4. The condition of habitats on conservation lands is not well known due to limitations in our capacity to monitor site-specific conditions. For example, only a small fraction of DUC's 350 Interior projects is inspected by a biologist annually.
5. Wetland condition is not specifically addressed by any of the available datasets, although inferences may be drawn from some of the sources (e.g. CAD).
6. Small and ephemeral wetlands are still not well-inventoried, even by fine-scale SEI.
7. Biologically-based wetland classification (e.g. according to the Canadian Wetland Classification System) cannot be reliably derived yet from any of the datasets. It is expected that this information would significantly improve the performance of HS models.

As discussed in Section 5 Monitoring, the CIJV partners are actively working to address the first four of these limitations.

7. CRITICAL CHALLENGES

The process of developing this Implementation Plan revealed a number of knowledge and/or program gaps which we have been able to group into six "critical challenges" with consistent themes relating to NAWMP priorities. Each challenge might include several gaps, and we believe it is more effective to deal with them collectively to move the CIJV forward in meeting the *NAWMP Desired Characteristics*. The six challenges represent a range of program elements.

Tracking Populations of Priority Wetland Birds

A better understanding of population trends of wetland-associated birds would enable us to focus on declining species or those most at risk from habitat drivers. This will require better modelling for a wider range of species. Tracking all priority birds will be difficult to achieve with sufficient precision, and partners need to be opportunistic about acquiring new datasets.

Understanding Limiting Factors

We need to evaluate whether our conservation actions address the wetland habitat functions which most limit the productivity of wetland-associated birds. Fine-tuning our efforts in this way would achieve greater gains for fewer dollars. Baseline knowledge of vital rates would greatly inform this issue, but would require a major investment of resources to collect data. Alternative approaches involving more readily-available information will be considered.

Improving Habitat Objectives

Habitat objectives should reflect current and future risk of wetland loss, and be based on biological relationships such as HS models or on historical information. Quantifying the benefits of conservation treatments (and the consequences of inaction) should play a role.

Tracking Changes in Wetland Habitats

The CIJV must improve its ability to monitor wetlands and predict future conditions based upon expected major drivers such as climate change.

Increasing and Validating the Effectiveness of Stewardship and Policy

These programs may influence a larger land base and accomplish landscape change more cost-effectively than direct programs. Accordingly, as we shift towards these types of activities we must set biologically-based objectives, target them where they will have the most effect, and evaluate whether they are achieving the objectives. Quantifying the ability of natural habitats to provide ecological goods and services would support these activities.

Increasing Funding and Capacity

Our ability to deliver on all aspects of conservation programs, and on science and project management in particular, is limited by a lack of resources. Building on existing partner initiatives and expanding to new partners with such resources is critical to our success.

The CIJV Technical Committee intends to use this list to develop cooperative work plans for the medium- and long-term, and the next stage will necessarily involve more detailed prioritization, timelines and costs. There are a number of information needs and program gaps which don't fall within these six categories; these are lower priority and will be addressed as convenient.

8. LITERATURE CITED

Austin, M.A. and A. Eriksson. 2009. The biodiversity atlas of British Columbia. 135p. Available at: www.biodiversitybc.org.

Austin, M.A., D.A. Buffett, D.J. Nicolson, G.G.E. Scudder and V. Stevens (eds.). 2008. Taking nature's pulse: The status of biodiversity in British Columbia. Biodiversity BC, Victoria, BC. 268p. Available at: www.biodiversitybc.org.

BC Assessment Authority. 2010. Land Title and Survey Authority. http://www.ltsa.ca/resources/fast-facts.

BC Commission on Resources and the Environment. 1994. West Kootenay-Boundary land use plan. Government of British Columbia. Victoria, BC. 26p.

BC Ministry of Sustainable Resource Management. 2002a. Baseline Thematic Mapping dataset http://home.gdbc.bc.ca/products/btm.htm.

BC Ministry of Sustainable Resource Management. 2002b. Broad Ecosystem Inventory. http://srmwww.gov.bc.ca/rib/wis/bei.

BC Ministry of Water, Land and Air Protection. 2002. Environmental trends in British Columbia 2002. State of Environment Reporting: 15-22.

BC Ministry of Water, Land and Air Protection. 2004. Wetlands of the Southern Interior valleys. Victoria.

British Columbia Waterfowl Technical Committee. 1989. Cooperative waterfowl management plan for British Columbia. Canadian Wildlife Service, BC Ministry of Environment and Parks, Ducks Unlimited Canada.

Biological Services Group. 1990. Cariboo Parklands, British Columbia (Completed project evaluation appendix to Biological Techniques manual). Ducks Unlimited Canada. 89p.

Bird Studies Canada. 2002. North American Bird Conservation Initiative. http://www.bsc-eoc.org/nabci.html.

Breault, A. 2007. Wetland Bird Biologist (Pacific Wildlife Research Centre). Canadian Wildlife Service, Environment Canada. Personal communication.

Brinson, M. M., B.E. Bedford, B. Middleton and J.T.A. Verhoeven. 2008. Temperate freshwater wetlands: response to gradients in moisture regime, human alterations and economic status. Aquatic ecosystems: trends and global prospects. N.V.C. Polunin, New York, Cambridge Univ. Press. 482p.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, M.C.E. McNall. 1990. The birds of British Columbia. Volume 1. Nonpasserines: Introduction, loons through waterfowl. Royal British Columbia Museum, Victoria, BC. 514p.

Canadian Intermountain Joint Venture. 2003. Biological foundation and prospectus. 73p.

Canadian Landbird Conservation Working Group. 1995. Framework for landbird conservation in Canada. Partners in Flight Canada. Environment Canada, Ottawa. 24p.

Canadian Wildlife Service and Ducks Unlimited Canada. 2002. Preliminary proposal for delivering the waterfowl component of the Canadian Intermountain Joint Venture. 28p.

Cannings, R.J. 1998. Assessment of species diversity in the Montane Cordillera Ecozone. *in* Smith, I.M. and G.G. E. Scudder. Assessment of species diversity in the Montane Cordillera Ecozone. Burlington: Ecologic Assessment Network, 1998.

Cannings, R.A., R.J. Cannings, and S.G. Cannings. 1987. Birds of the Okanagan Valley, BC. Royal British Columbia Museum, Victoria, BC.

Committee on the Status of Endangered Wildlife in Canada. 2007. Canadian Species at Risk (as of August 2009). http://www.cosewic.gc.ca/eng/sct0/rpt/dsp_booklet_e.htm.

Compass Resource Management. 2007. An assessment of climate change impacts on biodiversity management in BC. Biodiversity BC Technical Subcommittee Component Report. 41p.

Dawson, R. J., A.T. Werner, T.Q. Murdock. 2008. Preliminary analysis of climate change in the Cariboo-Chilcotin area of British Columbia. University of Victoria Pacific Climate Impacts Consortium. 49p.

Demarchi, Dennis A. 1996. An introduction to the Ecoregions of British Columbia. January, 1996. Wildlife Branch. Ministry of Environment, Lands and Parks. Victoria, British Columbia.

Donaldson, G.M., C. Hyslop, R.I.G. Morrison, H.L. Dickson, I. Davidson. 2000. Canadian shorebird conservation plan. Canadian Wildlife Service, Ottawa, Ontario, Canada. 27p.

Ducks Unlimited Canada. 2005. Proposal for waterfowl habitat conservation in the Okanagan Valley of the Canadian Intermountain. Kamloops, British Columbia. 22p.

Ducks Unlimited Canada. 2007. Pacific Region five year business plan, fiscal years 2007-2011. Kamloops, British Columbia. 26p.

Ducks Unlimited Canada. 2008. Waterfowl habitat conservation plan for the Cariboo-Chilcotin landscape of the Canadian Intermountain. Kamloops, British Columbia. 52p.

Dunn, E.H. 1997. Setting priorities for conservation, research and monitoring of Canada's landbirds. Technical Report Series No. 293. Canadian Wildlife Service, Ottawa, Ontario.

Eng, M.A. 2004. Forest stewardship in the context of large-scale salvage operations: An interpretation paper. BC Ministry of Forests Forest Science Program, Technical Report 019. Victoria.

Environment Canada. 1981. Land capability for waterfowl. Land Resources and Data Systems Branch, Lands Directorate. Ottawa. http://geogratis.cgdi.gc.ca/CLI/index_waterfowl.html.

Evans, M.R. 2003. Breeding habitat selection by Barrow's Goldeneye and Bufflehead in the Cariboo-Chilcotin region of British Columbia: nest sites, brood-rearing habitat, and competition. PhD thesis. Simon Fraser University.

Federation of Alberta Naturalists. 2007. The Atlas of breeding birds of Alberta: A second look. Federation of Alberta Naturalists, Edmonton, AB. 625p.

Groves C., et al. 2000. Geography of hope, Second Edition. Volume 1. The Nature

Conservancy, Arlington, Virginia. http://conserveonline.org/docs/2000/11/GOH2-v1.pdf.

Gunnarsson, G., J. Elmberg, K. Sjöberg, H. Pöysä and P. Nummi. 2004. Why are there so many empty lakes? Food limits survival of mallard ducklings. Canadian Journal of Zoology 82: 1698–1703.

International Union for Conservation of Nature – Conservation measures partnership. 2006a. Unified classification of conservation actions, version 1.0 http://www.iucn.org/themes/ssc/sis/classification.htm.

International Union for Conservation of Nature – Conservation Measures Partnership. 2006b. Unified classification of direct threats, version 1.0 http://www.iucn.org/themes/ssc/sis/classification.htm.

Kroeker, D. and J. Renner. 2002. DSS: A decision support system to optimize benefits of the Intermountain Wetland Conservation Program to breeding waterfowl. 6p.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, I. Davidson, L. Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J. E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, K. Whol. 2002. Waterbird conservation for the Americas: The North American waterbird Conservation plan, version 1. Waterbird Conservation for the Americas, Washington, DC, U.S.A.

Lea, T. 2008. Historical (pre-settlement) ecosystems of the Okanagan Valley and Lower Similkameen Valley of British Columbia - pre-European contact to the present. Davidsonia 19(1): 3-36.

Leith, R.M. and P.H. Whitfield. 1998. Evidence of climate change effects on the hydrology of streams in south-central BC. Canadian Water Resources Journal 23: 219-230.

Machmer, M. 2004. Small wetland literature review and mapping. Prepared for Columbia Basin Fish and Wildlife Compensation Program. 92p.

Margules, C.R. and R.L. Pressey. 2000. Systematic conservation planning. Nature 405: 243-253.

Marty, J.T. 2005. Effects of cattle grazing on diversity in ephemeral wetlands. Conservation Biology 19: 1626–1632.

McKelvey, R. and W. Munro. 1983. Cooperative waterfowl management plan for British Columbia. Regional report, Canadian Wildlife Service, Pacific and Yukon Region, Delta, British Columbia and British Columbia Fish and Wildlife Branch, Victoria, British Columbia, Canada.

McKenzie, E. 1983. Preliminary assessment of wetland alienation in the Cariboo-Chilcotin Area, B.C. Pacific and Yukon Region of Canadian Wildlife Service. Delta, BC. 66p.

Milko, R., L. Dickson, R. Elliot and G. Donaldson. 2003. Wings over water: Canada's waterbird conservation plan. Canadian Wildlife Service, Ottawa, ON.

Murdock, T. Q., J. Fraser and C. Pearce. Editors. 2007. Preliminary analysis of climate variability and change in the Canadian Columbia River Basin: Focus on water resources 2006. University of Victoria Pacific Climate Impacts Consortium. 57p.

North American Waterfowl Management Plan. 2004. North American Waterfowl Management Plan implementation framework: Strengthening the biological foundation. 105p.

Panjabi, A., C. Beardmore, P. Blancher, G. Butcher, M. Carter, D. Demarest, E. Dunn, C. Hunter, D. Pashley, K. Rosenberg, T. Rich, T. Will. 2001. The Partners in Flight handbook on species assessment and prioritization. Version 1.1. http://www.rmbo.org/pif/pifdb.html.

Panjabi, A. O., E. H. Dunn, P. J. Blancher, W. C. Hunter, B. Altman, J. Bart, C. J. Beardmore, H. Berlanga, G. S. Butcher, S. K. Davis, D. W. Demarest, R. Dettmers, W. Easton, H. Gomez de Silva Garza, E. E. Iñigo-Elias, D. N. Pashley, C. J. Ralph, T. D. Rich, K. V. Rosenberg, C. M. Rustay, J. M. Ruth, J. S. Wendt, and T. C. Will. 2005. The Partners in Flight handbook on species assessment. Version 2005. Partners in Flight Technical Series No. 3. Rocky Mountain Bird Observatory website: http://www.rmbo.org/pubs/downloads/Handbook2005.pdf

Paquette, G.A. and C.D. Ankney. 1996. Wetland selection by American Green-winged Teal breeding in British Columbia. Condor 98: 27-33.

Province of British Columbia. 2010. Facts about B.C.'s Mountain Pine Beetle. Factsheet updated March 2010. 2p.

Redding, T., R. Winkler, P. Teti, D. Spittlehouse, S. Boon, J. Rex, S. Dube, R.D. Moore, A. Wei, M. Carver, M. Schnorbus, L. Reese-Hansen, and S. Chatwin. 2008. Mountain pine beetle and watershed hydrology. BC Journal of Ecosystems and Management 9(3): 33-50.

Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American landbird conservation plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website: http://www.partnersinflight.org/cont_plan/ (Version: March 2005).

Rodenhuis, D. R., K.E. Bennett, , A.T. Werner, T.Q. Murdock, D. Bronaugh. 2007. Hydro-climatology and future climate impacts in British Columbia. University of Victoria Pacific Climate Impacts Consortium. 132p.

Salafsky, N., D. Salzer, J. Ervin, T. Boucher, W. Ostlie. 2003. Conventions for defining, naming, measuring, combining and mapping threats in conservation. An initial proposal for a standard system. Available online at http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_pl_w7000_1187a/media/Conventions_for_Threats_in_Conservation.pdf. 33p.

Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, D. Wilkie. 2008. A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. Conservation Biology 22: 897-911. Species at Risk Act Registry online www.sararegistry.gc.ca/sar/recovery/recovery_e.cfm.

Sarell, M.J. 1990. Survey of relatively natural wetlands in the South Okanagan. Unpublished Working Report, Ministry of Environment, Lands and Parks. Penticton. 6p.

Savard, J-P.L. 1986. Territorial behaviour, nesting success and brood survival in Barrow's Goldeneye and its congeners. PhD Thesis. University of British Columbia.

Semlitsch, R. D. and R. Bodie. 1998. Are small, isolated wetlands expendable? Conservation Biology 12(5): 1129-1133.

Sorenson, L. G., R. Goldberg, T.L. Root and M.G. Anderson. 1998. Potential effects of global warming on waterfowl populations breeding in the northern great plains. Climatic Change 40: 343-369.

Spittlehouse, D. L. 2008. Climate change, impacts, and adaptation scenarios: Climate change and forest and range management in British Columbia. BC Ministry of Forests and Range. 38p.

Uunila, L., B. Guy, and R. Pike. 2006. Hydrologic effects of mountain pine beetle in the interior pine forests of British Columbia: Key questions and current knowledge. BC Journal of Ecosystems and Management 7(2): 37-39.

Veridian Ecological Consulting, Ltd. 2003. Provincial and regional threats to wetlands in BC, a compilation of information from "Biodiversity conservation in BC: An assessment of threats and gaps". 18p.

Wetland Stewardship Partnership. 2007. Green bylaws toolkit for conserving sensitive ecosystems and green infrastructure. Environmental Law Clinic, Univ. of Victoria Faculty of Law, and Deborah Curran & Company. Available at http://www.greenbylaws.ca/images/greenbylaws_web1207.pdf. 255p.

Wetland Stewardship Partnership. 2009. Wetland ways: Interim guidelines for wetland protection and conservation in British Columbia. Available at http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html.

Wetland Stewardship Partnership. 2010a. Wetlands in British Columbia: A primer for local governments. 23p.

Wetland Stewardship Partnership. 2010b. A wetland action plan for British Columbia. Draft January 4, 2010. 75p.

Wilson, S. J. and R.J. Hebda. 2008. Mitigating and adapting to climate change through the conservation of nature. The Land Trust Alliance of British Columbia. 60p.

Winkler, R. D., J. F. Rex, P. Teti, D.A. Maloney and T. Redding. 2008. Mountain pine beetle, forest practices and watershed management. BC Ministry of Forests and Range. Victoria. Extens. Note 88.

Zhang, X., L.A. Vincent, W.D. Hogg and A. Niitsoo. 2000. Temperature and precipitation trends in Canada during the 20th century. Atmospher-Ocean 38(3): 395-429.

APPENDIX 1: STATUS OF SELECTED SPECIES IN NAWMP AND BC CONSERVATION FRAMEWORK

Species (Regional Population)	NAWMP 2004 – BCRs 9 & 10			BC Conservation Framework [b, c]		
	Contin. Priority	Breed. Import.	Breed. Need [a]	Goal 1	Goal 2	Goal 3
Waterfowl						
American Wigeon	Mod High	Mod High	Mod High	6	6	6
Barrow's Goldeneye	Moderate	High	High	4	1	3
Bufflehead	Moderate	High	High	6	6	6
Cinnamon Teal	Mod High	Mod High	Mod High	6	2	4
Gadwall	Moderate	Mod High	Mod High	6	6	6
Green-Winged Teal	Moderate	Mod High	Mod Low	6	6	5
Hooded Merganser	Mod Low	Mod High	Moderate	6	6	6
Lesser Scaup	High	Mod High	High	6	2	4
Mallard	High	Mod Low	Moderate	6	6	5
Redhead	Mod High	Mod High	Mod High	6	2	4
Ring-necked Duck	Moderate	Mod High	Mod High	6	6	6
Ruddy Duck	Mod Low	Mod High	Moderate	6	6	6
Trumpeter Swan (Rocky Mtn Pop)	High	Mod High	High	5	6	5
White-winged Scoter	Mod High	Mod High	Mod High	6	6	5
Other Water-Associated Birds						
American Avocet				4	6	2
American Bittern				5	2	3
American White Pelican				5	6	1
Black Tern				3	6	5
California Gull				6	6	4
Caspian Tern				6	2	3
Clark's Grebe				6	6	2
Common Loon				6	6	6
Double-crested Cormorant				6	2	3
Franklin's Gull				5	4	5
Forster's Tern				6	6	2
Great Blue Heron				6	2	3
Horned Grebe				4	4	5
Northern Harrier				4	2	4
Peregrine Falcon				5	4	4
Red-necked Phalarope				5	4	4
Sanderling				6	2	4
Short-billed Dowitcher				6	6	3
Virginia Rail				6	2	4
Western Grebe				6	6	1
Wilson's Phalarope				4	2	4

[a] Need for conservation and/or need for monitoring

[b] Numbers refer to priority where 1 is highest and 6 is lowest; pink shading denotes greater concern (1-3)

[c] Goal 1 - Contribute to global efforts for species and ecosystem conservation; Goal 2 - Prevent species and ecosystems from becoming at risk; Goal 3 - Maintain the diversity of native species and ecosystems; ratings current as of March 24, 2010

APPENDIX 2: ESTIMATED WATERFOWL POPULATIONS IN CIJV

Species	BCR Totals [a]		CIJV Total
	Great Basin (9)	N. Rockies (10)	
Ducks			
American Wigeon	11,200	130,000	141,200
Barrow's Goldeneye [b]	5,000	55,000	60,000
Blue-winged Teal	4,000	60,000	64,000
Bufflehead	6,000	180,000	186,000
Canvasback	2,000	14,000	16,000
Cinnamon Teal	8,000	22,000	30,000
Common Goldeneye	200	12,000	12,200
Common Merganser	600	40,000	40,600
Eurasian Wigeon	Incidental	200	200
Gadwall	4,000	50,000	54,000
Green-winged Teal	8,000	100,000	108,000
Harlequin Duck	2,000	12,000	14,000
Hooded Merganser	600	80,000	80,600
Lesser Scaup	8,000	60,000	68,000
Mallard [b]	15,000	185,000	200,000
Northern Pintail	2,000	12,000	14,000
Northern Shoveler	10,000	28,000	38,000
Redhead	5,000	100,000	105,000
Ring-necked Duck [b]	6,000	94,000	100,000
Ruddy Duck	4,000	50,000	54,000
Wood Duck	400	7,000	7,400
White-winged Scoter	0	7,000	7,000
Geese and Swans			
Canada Goose	2,000	50,000	52,000
Trumpeter Swan	0	Incidental	Incidental
Total	**104,000**	**1,348,200**	**1,452,200**

[a] From BC May Cooperative Ground Surveys, BC Waterfowl Breeding Population Survey of the Central Interior Plateau (helicopter), and Campbell et al. 1990.

[b] Estimates for these species have been revised since the CIJV Prospectus based on helicopter survey results and are meant to supersede previously-published population goals.

APPENDIX 3: HABITAT TYPES PROTECTED WITHIN CIJV CONSERVATION LANDS

Cover Type	Entire CIJV		Ecoprovince									
			Sub-Boreal Interior		Central Interior		Southern Interior		Southern Interior Mtns		North-western Forested Mtns	
	Area of Conserved Lands (ha)	*% of Total Area*	Area of Conserved Lands (ha)	*% of Total Area*	Area of Conserved Lands (ha)	*% of Total Area*	Area of Conserved Lands (ha)	*% of Total Area*	Area of Conserved Lands (ha)	*% of Total Area*	Area of Conserved Lands (ha)	*% of Total Area*
Agriculture [a,b]	11,341	2.5%	937	0.2%	2,752	0.6%	4,915	1.1%	2,738	0.6%	0	0.0%
Alpine [a,b]	671,752	25.2%	107,799	4.0%	208,862	7.8%	50,011	1.9%	304,060	11.4%	1,020	0.0%
Barren land [a]	187,798	13.1%	14,252	1.0%	50,685	3.5%	9,217	0.6%	110,566	7.7%	3,077	0.2%
Broadleaf [a]	244,811	10.4%	62,999	2.7%	25,183	1.1%	12,622	0.5%	75,419	3.2%	68,587	2.9%
Coniferous [a]	4,296,886	15.5%	521,434	1.9%	953,774	3.4%	325,038	1.2%	1,383,244	5.0%	1,113,397	4.0%
Grasslands [a,b]	55,190	15.0%	97	0.0%	21,639	5.9%	29,237	7.9%	4,217	1.1%	0	0.0%
Herbs [a]	384,827	14.7%	12,098	0.5%	43,404	1.7%	20,957	0.8%	55,054	2.1%	253,315	9.6%
Ice/Snow [a,b]	297,575	27.2%	24,514	2.2%	55,225	5.0%	3,746	0.3%	116,558	10.6%	97,533	8.9%
Mixedwoods [a]	119,916	9.6%	26,361	2.1%	21,771	1.7%	4,271	0.3%	55,974	4.5%	11,539	0.9%
No Data [a]	409,596	29.3%	17,633	1.3%	26,475	1.9%	15,799	1.1%	159,075	11.4%	190,614	13.6%
Rock/Rubble [a]	1,092,246	60.7%	14,729	0.8%	4,418	0.2%	456	0.0%	182,212	10.1%	890,430	49.5%
Shrubs/SparseTree [a]	741,700	18.3%	58,675	1.4%	129,768	3.2%	61,965	1.5%	228,697	5.6%	262,595	6.5%
Urban [a,b]	984	1.4%	51	0.1%	221	0.3%	273	0.4%	439	0.6%	0	0.0%
Water/Lakes) [a]	245,886	15.4%	32,223	2.0%	99,331	6.2%	10,507	0.7%	69,653	4.4%	34,172	2.1%
Wetlands [c]	158,764	15.5%	21,120	2.1%	56,715	5.5%	5,328	0.5%	36,654	3.6%	38,947	3.8%
Total	**8,919,271**	**17.9%**	**914,922**	**1.8%**	**1,700,223**	**3.4%**	**554,341**	**1.1%**	**2,784,560**	**5.6%**	**2,965,225**	**5.9%**

[a] Source: Earth Observation for Sustainable Development
[b] Source: BC Baseline Thematic Mapping
[c] Source: BC Freshwater Atlas

APPENDIX 4: CIJV PARTNERS

Canadian Intermountain Joint Venture Partners

1	BC Cattlemen's Association
2	BC Field Ornithologists
3	BC Hydro
4	BC Ministry of Environment
5	City of Kelowna
6	Ducks Unlimited Canada
7	East Kootenay Conservation Program
8	Environment Canada (Canadian Wildlife Service)
9	Grasslands Conservation Council of BC
10	The Land Conservancy of BC
11	The Nature Conservancy of Canada
12	The Nature Trust of BC
13	Teck Resources Ltd.
14	UBC Centre for Applied Conservation Research

APPENDIX 5: 5-YEAR HABITAT OBJECTIVES AND EXPENDITURES FORECAST FOR WATERFOWL PRIORITY AREAS

Program	5-Year Objectives (Hectares) [a]				5-Year Expenditure Forecast			
	Cariboo-Chilcotin Priority Area	Okanagan Priority Area [b]	Remainder of CIJV	CIJV Total	Cariboo-Chilcotin Priority Area	Okanagan Priority Area [b]	Remainder of CIJV	CIJV Total
Direct	4,000	1,030		5,030	1,550,000	2,550,000		4,100,000
Stewardship	2,080		2,500	4,580	350,000		350,000	700,000
Policy	3,100	6,700	2,500	12,300	350,000	500,000	350,000	1,200,000
Subtotal	**9,180**	**7,730**	**5,000**	**21,910**	**2,250,000**	**3,050,000**	**700,000**	**6,000,000**
Management								3,250,000
Science and Evaluation								1,350,000
Communication and Outreach								300,000
Coordination and Partnership								700,000
Total								**11,600,000**

[a] Objective areas are based on waterfowl habitat needs and represent both wetlands and associated uplands.
[b] For the Okanagan Priority Area, stewardship objectives and expenditures were included within the policy program.

APPENDIX 6: SPATIAL DATABASES WHICH INCLUDE WETLANDS IN THE CIJV

Dataset	Scale	Scope	Source	Date Collected	Description	Frequency of Updates
BC Watershed Atlas	1:50,000	Provincial	Air Photos	1980s	Freshwater wetlands, rivers, streams and lakes from 1:50,000 NTS base maps	None
Baseline Thematic Mapping	1:250,000	Provincial	Satellite and digital NTS base maps	Mid 1990s	12 classes	None
Canada Land Inventory Capability for Waterfowl	1:250,000	National	Air photos	Early 1970s	8 classes, numerous subclasses	None
Census of Agriculture	Regional Districts or Municipalities	National	Statistics Canada	1980s	General agricultural trends	5 years
Conservation Areas Database	1:20,000	Provincial	Cadastral mapping	2008 to present	NGO conservation areas, National Wildlife Areas, Provincial Parks, National Parks, Ecological Reserves, Wildlife Management Areas, Regional Parks	Annually
BC Freshwater Atlas	1:20,000	Provincial	Air photos	Early 1990s	Freshwater wetlands, rivers and lakes from TRIM 1:20,000 base maps	Some updates (TRIM 2)
Earth Observation for Sustainable Development (EOSD)	1:70,000	National	Satellite	2000	General land cover, 25m pixels	None
Grasslands	1:20,000	Provincial	Forest cover, TEM	1970s to 2000s	Mainly grasslands and meadows	None
National Land and Water Information Service (Agriculture Canada)	1:70,000	National	Satellite	2000	Agricultural land cover	None
Sensitive Ecosystems Inventory	1:15,000	Regional	Air photos	2000s	9 classes	Some
Terrestrial Ecosystem Mapping	1:15,000	Regional	Air photos	Late 1990s, 2000s	Numerous vegetation communities	None
Terrain Resource Inventory Mapping	1:20,000	Provincial	Air photos	TRIM 1 (early 1990s); TRIM 2 (2002 to present)	TRIM 1 is a standard 1:20,000 base map, TRIM 2 is a 1:10,000 base map	Some updates (TRIM 2)
Vegetation Resource Inventory	1:20,000	Regional	Air photos	2000s	Numerous vegetation communities	Expected