Ducks Unlimited's International Conservation Plan

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Introduction

For over six decades, Ducks Unlimited (DU) has maintained a singleness of purpose that has guided the organization to become the leading waterfowl and wetlands conservation entity in North America. Dynamic and responsive leadership by staff and volunteers, working together, has assured that DU's work evolved in response to the ever-changing pressures on waterfowl and the habitats upon which they depend throughout their annual cycle.

From time-to-time, DU has re-evaluated its future path to make sure it is in tune with the needs of waterfowl and wetlands conservation. This strategic plan represents the most recent iteration of such a self-assessment conducted by staff and volunteers to assure that the organization is effectively in pursuit of its mission. DU believes that solutions to fundamental problems must be anchored in the most up-to-date scientific understanding of waterfowl and the habitat resources to which they are intimately tied. Thus, this plan has been guided by a thorough review of our current knowledge of the biological issues affecting the birds and their habitats.

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Part 1: Mission Statement, Vision, and Principles

Mission Statement

Ducks Unlimited conserves, restores, and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people.

June 3, 2004 – Original three Mission Statements replaced by single International Mission Statement.

Waterfowl, like all organisms, are intimately linked to the ecosystems in which they evolved. Understanding these relationships and assuring environmental conditions that support each species are crucial to successful waterfowl conservation. This is the fundamental business of Ducks Unlimited.

Ducks Unlimited is the leader in the conservation of habitats that are essential to North America's waterfowl and countless other species of plants and animals. Because they cross an enormous scope of geography, waterfowl and other migratory species have especially complex needs. The continent's 36 species of ducks, 10 species of geese, and 2 species of swans depend on a broad array of wetland and upland habitats at each phase of their annual cycle.

The broad approaches that exemplify DU's work greatly improve the overall environment. Soil and water conservation are core benefits. DU's waterfowl conservation work also leads to major improvements in water quality and flood control. In short, waterfowl conservation is at the heart of the most effective natural resource conservation movement in history.

DU works with a broad array of public and private partners. The organization's approach to habitat conservation recognizes the paramount need to find cooperative, common sense solutions to increasingly complex problems. DU avoids confrontation and litigation. Public policy issues are addressed only when they have a direct and substantial impact on the fulfillment of DU's mission.

DU's unique legacy has been driven by the unequalled commitment of millions of individual members and a history of successful conservation since 1937. Combined with the strong leadership of exceptional staff in the U.S., Canada, and Mexico, these conservationists have been directly responsible for the restoration and protection of millions of acres of habitat. Many acres have been conserved because of the organization's effective public policy work. Still more acres have been conserved because of individual members who conserve habitat on their own land and support public land conservation programs locally and across the continent.

Wildlife habitats are under constant and increasing pressure. Factors as diverse as agricultural development, commodity markets, climate change, disease, pollution, and harmful public policies all have serious ramifications. Identifying these issues, designing effective counter measures, securing resources and partners, and delivering conservation on the ground all present enormous challenges. DU's decision-makers must approach these challenges with a comprehensive plan of action that identifies and pursues the most important needs. It is equally important to avoid wasting time and resources through ineffective programs.

DU's focus is on efficiently addressing imperative waterfowl habitat conservation issues. Based on strong science, DU's programs are dynamic, allowing the organization to mature, grow, and change as goals are reached, new information is developed, and new challenges arise. This document is a product of this process of re-evaluation and renewal. It reviews current environmental issues affecting waterfowl, highlights what the organization is doing now, and charts a course for the future.

DU's Conservation Vision

Functionally integrated landscapes capable of perpetually sustaining healthy populations of waterfowl and other wildlife through the retention and restoration of their ecological integrity.

Landscapes are distinct geographic planning units that encompass all biophysical upland and wetland features. DU believes we must maintain, restore, create, and protect landscapes with the physical and cultural features that can sustain waterfowl populations. Such landscapes will benefit waterfowl, a broad variety of other species, and humans.

Functional integration addresses the interconnected nature of the various areas in which DU works. Waterfowl depend on many different habitats throughout the year. It does not suffice to focus narrowly on landscapes that only provide a portion of the birds' needs, as they may ultimately be limited by events or conditions that occur at other times and places.

Ecological integrity means the condition in which the natural processes in landscapes interact dynamically with minimal management intervention. The restoration and retention of ecological integrity means preserving intact native systems, and restoring natural features and processes to damaged systems by working with naturally evolved processes. On working landscapes, such as farms, ranches, and timberlands, DU prioritizes management practices that assure the integrity of soil, water, and wildlife resources and sustain the enterprise.

DU has developed long-term strategic plans for regional conservation that span one or more generations. These conservation plans have been implemented with shorter-term operational plans (5 years). Ecological regions will guide regional planning, and implementation will occur via DU's regional offices. Conservation plans will vary geographically, but the following

principles will serve as guidance for all of DU's efforts. These reaffirm and clarify DU's approach to conservation and support our fundamental culture.

Conservation Plan Principles

Principle 1: Focus on Essential Waterfowl Habitat

DU's conservation efforts will continue to focus on efforts that sustain or improve the production and survival of waterfowl. These programs simultaneously provide broad benefits to countless organisms, including many endangered species, and to the conservation of biodiversity in general.

DU's resources will be invested in programs that are most likely to provide cost-effective benefits for waterfowl in the long-term. Critical and threatened landscapes will be the highest priority. DU will be active in a diversity of other habitats, taking advantage of opportunities to achieve beneficial conservation works and to maintain a strong constituency that supports the organization's objectives.

DU has adopted the goal of assuring the habitat base needed to support the waterfowl population goals defined in the North American Waterfowl Management Plan (NAWMP). Therefore, the habitats designated by the NAWMP for focused conservation work will naturally be where DU does much of its on-the-ground work.

DU will deliver conservation programs in regions beyond North America where significant portions of the continent's waterfowl species are found for some portion of the annual cycle, and where there may be issues that would benefit from DU's involvement.

Principle 2: Use Ecosystem Management

Maintenance of native plant and animal communities, and restoration of altered ecosystems, is integral to DU's initiatives. DU designs its programs to maintain or restore the natural functions of wetland and upland ecosystems with the attendant benefits to biological diversity.

DU is a global leader in ecosystem management principles. Planning units are normally landscapes upon which missing or threatened habitat components are targeted for restoration, management, and protection. This approach to waterfowl conservation assures that habitat projects will benefit all biological resources on the landscapes on which DU works. It also assures an abundance of partners as DU pursues objectives shared by a broad cross-section of public and private interests.

Principle 3: Conserve Existing Habitat

Securing existing habitat will often be the first step in a comprehensive landscape effort, especially where there are clear threats. This approach helps minimize the need for future restoration and ensures that many basic landscape features important to DU's objectives are sustained. Because restoration costs are usually high, protection will often be the most cost-effective way to assure long-term benefits to wildlife. Further, since it is often not possible to fully restore the quality of damaged landscapes, it is only sensible to secure what is already in existence, especially remnant native habitats that may otherwise disappear. DU will secure habitat to assure traditional uses continue where they are compatible with wildlife conservation.

Tools such as easements and fee title purchase will be used. Regulatory measures will be avoided.

Principle 4: Use Appropriate Levels of Management Intervention

DU's restoration and management activities will follow the guideline of *minimum ecological management* by using the minimum resources necessary to optimize the productive capacity of the land for wildlife. Intensive management actions that require continual inputs of resources usually will be foregone in favor of restoring natural ecological functions. DU will generally not impose new functions, or convert existing functions, on wetland or upland systems that were not part of original landscape and climactic features. This might be thought of as "working with Nature" as opposed to "fighting Nature."

However, minimum ecological management does not mean no management. Human activities have greatly altered natural ecosystems in most regions of North America. In many instances, the restoration of landscapes to some semblance of their natural function will require extensive and expensive work.

Principle 5: Integrate Adaptive Resource Management

DU's biological staff will design research and monitoring programs to help direct and support conservation programs, and be responsive to new information developed by internal and external sources. DU must identify the most important biological assumptions underlying its conservation programs and, where warranted, test their validity. An iterative and candid process of planning/implementation/evaluation will provide DU with vital information to assist in making the best program management decisions. This *Adaptive Resource Management* approach to the delivery of conservation programs will ensure that DU focuses its resources in an efficient and cost-effective manner.

Principle 6: Expand Extension Initiatives

Social and economic factors at local, national, and international levels impact DU's delivery capability. These are critical issues on the lands of the partners with whom we work. DU will search for conservation opportunities that will help meet local needs while furthering conservation objectives. In some carefully targeted instances, DU will employ the extension process to work with private landowners to provide both economic and ecological sustainability.

Extension is a process of education that works with people, not for them; which helps people become self-reliant, not dependent on others; and which makes people central participants in the process. While many opportunities exist for DU to use the extension process, targeting and monitoring of extension efforts are crucial since they can result in a high level of activity and expense but limited real accomplishments against conservation goals.

Principle 7: Increase Public Policy Initiatives

On occasion, the judicious application of resources to public policy initiatives can result in tremendous positive returns for wildlife. DU will maintain an active, leadership role in certain public policy issues. Furthermore, with ever-increasing pressures on natural habitat, an expansion of DU's involvement can be anticipated. That involvement will continue to be extremely focused and carefully controlled.

In general, the following principles will govern: Public policy initiatives will be pursued only when they have the potential to contribute to DU's core conservation goals. Input to public policy issues by DU will be substantive and based on the best available science. Involvement will be limited to situations where we are likely to influence the outcome. Under no circumstances will DU's credibility or integrity be compromised. In addition, public policy actions should consider the ramifications to our members, programs, and partners.

DU's approach to public policy recognizes the fundamental distinction between controversy, which cannot always be avoided, and confrontation or partisanship, which DU does avoid. While the regulation of many activities is essential to the protection of the environment, DU will focus its efforts on legislative incentives rather than disincentives, particularly in the area of land use. DU typically avoids litigation, unless compelled by exceptional circumstances or the need to enforce a conservation agreement to which DU is a party.

Principle 8: Communicate Effectively

DU's conservation programs depend on continued, widespread support. That support takes many forms--financial, political, and philosophical. It also comes from many sources and represents a broad diversity of interests. It is critical that DU's message is clear and consistent across all communication vehicles.

Effective communication will continue to be an integral part of DU's conservation programs. This communication effort will be designed to publicize the benefits, both natural and socioeconomic for wildlife and humans, provided by our landscape initiatives, and will be targeted to broaden and expand our support base. Water-related benefits, including improved quality, groundwater recharge, flood control, soil moisture stabilization, waste product decomposition, and recreation, will receive greater emphasis in the future. DU's role in improving conditions for timber products, reducing agricultural chemical use, and reducing atmospheric carbon also provide new messages that will enhance DU's success.

Realizing the Vision

DU is eminently positioned to expand its legacy of accomplishments and to help ensure the long-term integrity of waterfowl populations. A very strong staff works closely with volunteers and partners to deliver a broad array of effective, landscape-scale programs across North America and in other areas where North American waterfowl travel.

This strategic plan provides the biological underpinnings for the continued growth and maturation of these dynamic programs. All elements of DU's organization will be involved in successfully addressing the waterfowl and wetlands conservation goals that are identified.

Partnerships with other organizations and agencies are also key elements of this plan. Combining complementary resources will allow the conservation cause to achieve success where, working alone, the goals would be more daunting and less efficiently attained. DU will develop partnerships that are built on common goals, mutual respect, and understanding. These relationships are durable and have the greatest chance of long-term success.

DU's strong traditions and focus will be maintained. Programs evolve, as demonstrated by the expanded scope of our work and influence, but the focus on DU's mission remains the same.

Part 2: Important Habitat Priority Areas

In preparing these regional reports, we have adopted the basic map (Appendix I) provided by the North American Bird Conservation Initiative (NABCI) (Anonymous 1997). This initiative provides a framework for planning and implementing conservation efforts on behalf of all birds in North America. Most of the regions are coincident with planning and program delivery regions already recognized by DU. Throughout this report, the boundaries of each DU region are illustrated based on the modified NABCI map (Appendix II).

Western Alaska / Aleutian - Bering Sea Islands[1]

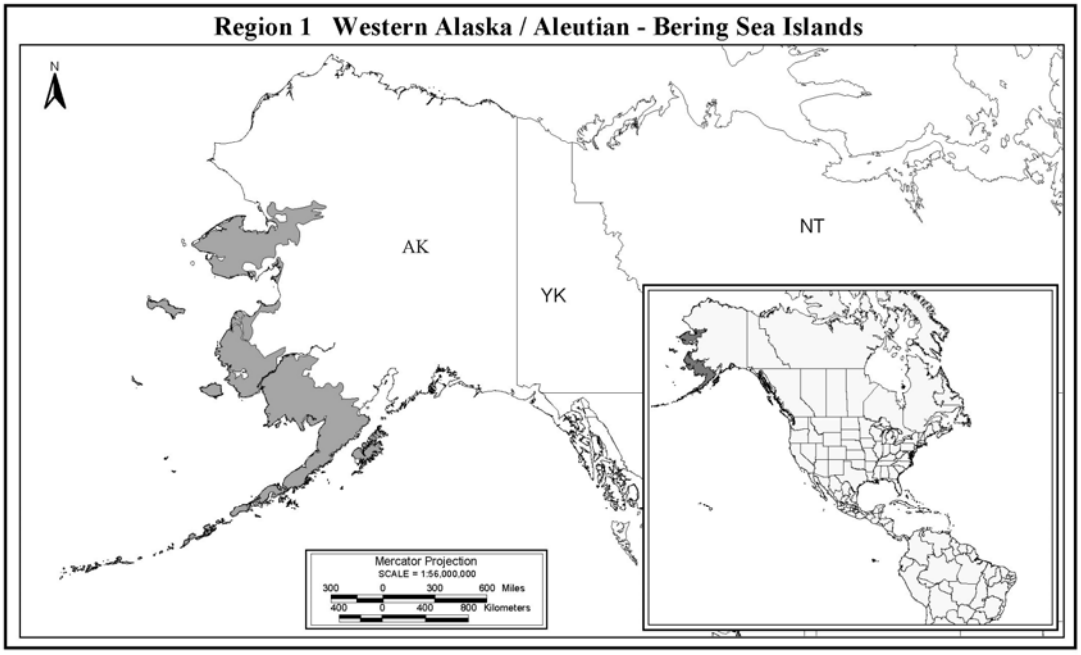
Western Alaska consists of the Subarctic Coastal Plain from Kotzebue Sound and Seward Peninsula to the Bristol Bay lowlands. The coastline includes the Norton Sound, Bering Sea islands, Bristol Bay, and the Yukon-Kuskokwim Delta which is the largest riverine delta in western North America. The Norton Sound contains 16 lagoons (over 88,000 ha), 2 large tidal river mouths (over 2,100 ha), 49 rivers, and 386 streams. The four Bering Sea islands (St. Lawrence, Nunivak, St. Matthew and the Pribilofs) contain 37 lagoons (over 37,000 ha), 40 rivers, and nearly 400 streams. Bristol Bay (including the Alaska Peninsula) contains 31 lagoons (over 206,000 ha), 3 large tidal river mouths (nearly 16,000 ha), 56 rivers, and 749 streams. The Yukon-Kuskokwim Delta contains 13 lagoons (over 103,000 ha), 22 large tidal river mouths (over 141,000 ha), 171 rivers, and nearly 2,100 streams. Overall, this region contains over 9.7 million ha of salt water less than 18 m in depth, 10,881 km of shoreline, 97 lagoons with an area greater than 435,000 ha, 27 large tidal river mouths with an area nearly 160,000 ha, some 534,000 ha of unvegetated intertidal zone, over 1 million ha of vegetated intertidal zone, 316 rivers, and over 3,600 streams (King and Dau 1981). The wet and moist tundra of the Subarctic Coastal Plain is dominated by sedges, grasses, and mosses, with numerous lakes and ponds.

The Yukon-Kuskokwim Delta is one of the most important waterbird areas on the continent. Within 60 km of the coast this area is directly impacted by tidal action, but annual precipitation, river action, and permafrost play significant roles in wetland function. Wet meadows and sedge marshes are interspersed throughout the volcanic Aleutian Islands. The Alaska Peninsula is a 48,000 km^2 area extending from Becharof Lake to Dutch Harbor and is dominated by dwarf scrub, moss/lichen, tall riparian, and sedge wetlands. The peninsula has a coastline longer than that of the conterminous United States, and includes Izembek Lagoon which contains 34,000 ha of eelgrass (one of the largest eelgrass beds in the world).

Importance to Waterfowl

Yukon-Kuskokwim Delta, Bristol Bay lowlands, Kotzebue Sound, Izembek Lagoon, and the Aleutian and Bering Sea Islands are the most important waterfowl areas of this region. The Yukon Delta has an estimated breeding population of 1.3-1.7 million ducks, nearly the entire population of emperor and cackling Canada geese, and nearly 70% of the continental population of black brant (King and Lensink 1971). Density of ducks (1989-91) in subarctic tundra (20.5 pairs/mi^2) is lower than encountered in boreal forest (24.5 pairs/mi^2) or arctic tundra (33.1 pairs/mi^2) regions (Conant and Dau 1991). Dominant breeding species in the Bristol Bay according to U.S. Fish and Wildlife Service (USFWS) surveys include scaup (nearly 130,000), scoter (>75,000), mallard (69,000), green-winged teal (>61,000), northern pintail (>59,000), and American wigeon (>46,000). Dominant species in the Yukon Delta include northern pintail (>362,000), green-winged teal (> 263,000), scaup (>254,000), northern shoveler (>181,000), mallard (>157,000), and tundra swan (>116,000). Dominant species in the Seward Peninsula include northern pintail (>131,000), northern shoveler (>53,000), American wigeon (>41,000), and scaup (>33,000). Dominant species in the Kotzebue Sound include American wigeon (>147,000), northern shoveler (>142,000), northern pintail (>112,000), mallard (nearly 93,000), and scaup (>80,000).

[1] NABCI Bird Conservation Regions 1 & 2



Sea ducks (primarily eiders, long-tailed ducks, and scoters) winter in large assemblages along the Alaska Peninsula, Aleutian, Bering Sea, and Kodiak Islands. Single flocks may reach several 100,000 birds, and several million sea ducks winter in this region. This region, combined with the shore of the Arctic Coastal Plain, is the most important area for sea ducks in North America. More than nine million waterfowl are heavily dependent on Bering Sea habitats during their annual cycle, which accounts for approximately 11% of the continental populations (King and Dau 1981). Six species including cackling Canada goose, emperor goose, and Aleutian Canada goose use these areas exclusively (King and Dau 1981). The 15,720 km^2 of intertidal habitat found on the eastern Bering Sea coast is probably not duplicated elsewhere on the continent in an area of comparable size. It is not uncommon to find densities of nesting waterfowl, primarily geese, in excess of 57/km^2 in the intertidal habitat of the Yukon Delta (King and Dau 1981). The Aleutian Islands contain habitat for the only North American population of European common teal, and Eurasian wigeon breed in the coastal Yukon Delta.

Importance to Other Birds

Even without its large populations of waterfowl, the Yukon Delta would be unique for its large populations of waterbirds (King and Lensink 1971). Arctic and red-throated loons are common breeders, as are bar-tailed godwits, dunlins, western sandpipers, northern and red phalaropes, and black and ruddy turnstones. Coastal habitats provide key staging areas for bristle-thighed curlews and whimbrels during late summer (King and Lensink 1971). Colonies of sea birds have been described at 135 locations in the Gulf of Alaska and the Bering Sea, exclusive of the Aleutian Islands (King and Lensink 1971). At least 26 colonies contain more than 100,000 breeding birds and several contain more than a million. Dominant sea bird species include red-faced and pelagic cormorants, red-legged and black-legged kittiwakes, Aleutian terns, Kittlitz's murrelets, horned puffins, and least and whiskered auklets. This region is the most important area for alcids and kittiwakes in western North America.

Environmental Risks

The principal risk in this area is contamination of near shore waters. Petroleum exploration has been stopped in recent years by a drilling moratorium. There are numerous offshore wells in the Bering Sea, but the greatest risk is from maritime shipping, especially international ships that are not kept to the same standard as U.S. or Canadian vessels. Floating petroleum in the near shore waters or the principal lagoons of the Bering Sea could destroy large numbers of geese and sea ducks (King and Dau 1981). Similarly, oil cast by storm tides into the nesting habitats of the Yukon Delta could cause considerable waterfowl mortality (King and Dau 1981). Marine terminals for oil storage have been proposed for western Alaska, even at Izembek Lagoon. Digital landcover maps of this region are critical for resource managers to make sound management decisions. Existing landcover maps will facilitate planning or execution of hazardous material containment. Through pro-active delivery of landcover scenes, change detection is feasible if significant spill occurs.

Current Conservation Programs

Ducks Unlimited has digitally mapped wetlands and associated uplands through remote sensing of the Lake Iliamna region at the base of the Alaska Peninsula and near coastal areas of Norton Sound. Little digital landcover data exists for the vast majority of this region. Partnerships with the Alaska Science Center, USFWS, and University of Alaska have resulted in research efforts on brant, cackling Canada goose, emperor goose, greater scaup, and spectacled eider.

Goals

- To complete wetland habitat mapping on at least 10,121,000 ha. Areas of importance include Selawik, Yukon Delta (over 7,692,000 ha), Togiak, Alaska Peninsula, Kodiak, and Izembek National Wildlife Refuges (NWRs); Bering and Aleutian Islands (especially St. Lawrence Island); Bering Land Bridge and Katmai National Park (NP).

- To complete analyses of waterbird associations with landcover, especially in core areas such as Yukon Delta. To aid in risk assessment of potential oil damage in core lagoons.

- To assist in research on coastal tundra ecology, sea duck, brant, and emperor goose ecology, and habitat use by northern pintail and scaup.

- To aid resource managers, principally USFWS and First Nation, in positive management decisions.

Assumptions

- Dramatic population declines for several species of sea ducks have been observed, but causes are unknown.
- This vast region has specific core areas that are important for waterbirds, but many of the specific locations are poorly known or understood.

- Changes in population structure may be due to conditions on wintering or migration areas.

- Reduction in subsistence harvest (Hooper Bay agreement) has had a substantial influence on the recovery of several goose populations.

Strategies

- Expand partnerships with developed image classification protocol and technology of waterbird habitat use and relationship to fire histories with USFWS, Alaska Science Center, Alaska Fire Service, and First Nations on the Yukon Delta and Alaska Peninsula regions.

- Pursue research projects with Alaska Science Center and Universities on tundra ecology, northern pintail, greater scaup, sea duck, and emperor goose ecology, and the relationship that Bering Sea marine environments play to western Alaska waterbird habitats.

- Focus on gaining critical resource information that can be used for risk assessment of potential degradation.

Arctic Plains and Mountains - Alaska[2]

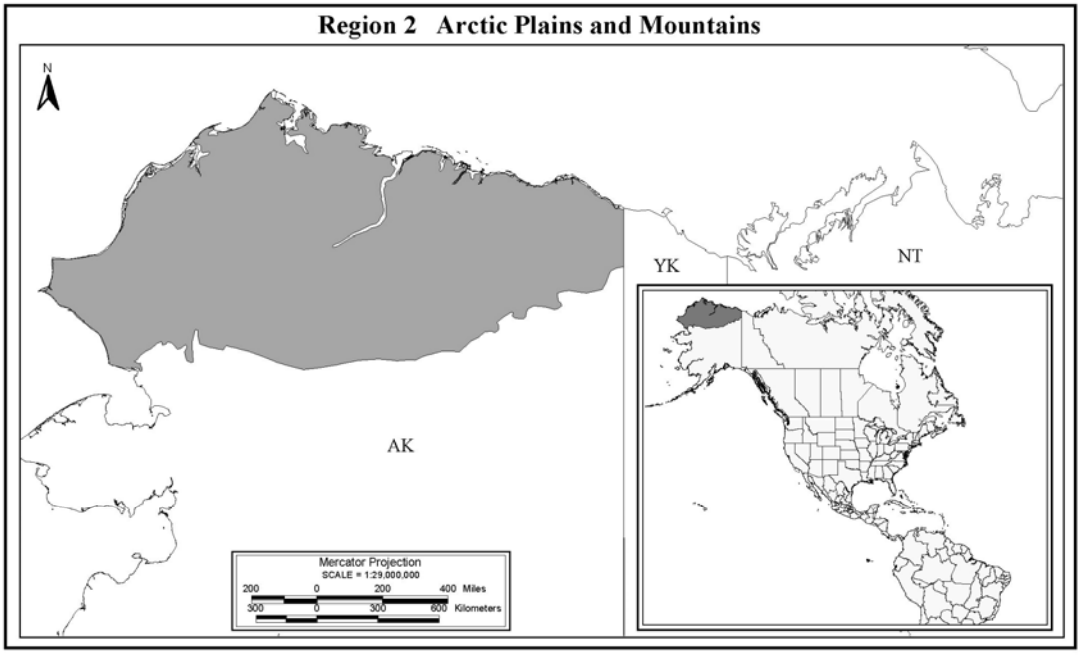
The Arctic Coastal Plain of Alaska is a 60,000 km^2 area bounded on the north and west by the Arctic Ocean and stretching eastward to the international boundary with the Yukon Territory (Gallant et al. 1995). This poorly drained, treeless coastal plain rises gradually from sea level to the adjacent foothills and then abruptly into the glaciated Brooks Mountain Range. These regions have an arctic climate and are underlain by permafrost. The poor surface drainage results in wet tundra habitats that are dominated by mosses and herbaceous sedges and grasses on the coastal plain, and numerous thaw lakes and wetlands are present. A high density of wetlands characterizes the Arctic Coastal Plain. Between Barrow and Prudhoe Bay some 42 to 86% of several areas were covered by water (Derksen et al. 1981), and lake and marsh coverage has been estimated as 50% (Hussey and Michelson 1966). Many of the shallow thaw-lake wetlands that are of greatest value to breeding waterfowl are most abundant near the Beaufort Sea coast (Derksen et al. 1981) and pond density declines east of Prudhoe Bay.

The Arctic Coastal Plain contains one of the largest and most stable collections of wetlands in North America (Wellein and Lumsden 1964). In spring, water from rapidly melting snow flows over frozen surfaces and fills the numerous shallow thaw lakes and ponds, streams, and rivers (Irving 1972). Alternating processes of freezing, thawing, and water movement enlarge and deepen the basins. As the basins enlarge, breaching of shorelines occurs, resulting in fusion or drainage (Bergman et al. 1977). The distribution of vegetation communities is strongly related to microtopographic features that affect soil drainage. Tussock tundra and beaded streams dominate the foothills of the Brooks Range. Alpine communities dominate vegetation in the mountains.

Importance to Waterfowl

Intensive fieldwork at Storkersen Point, near Prudhoe Bay, revealed 18 species of waterfowl, including seven species that nested (Bergman et al. 1977). In a broader study of the National Petroleum Reserve Area (NPR-A), 19 species of swans, geese, and ducks were identified, including 11 breeding species (Derksen et al. 1981) which included tundra swan, black brant, white-fronted goose, lesser snow goose, northern pintail, green-winged teal, greater scaup, king eider, spectacled eider, long-tailed duck, and white-winged scoter. Avifaunal records of the Beaufort Sea area for both Alaska and Canada reveal some 37 swan, goose, and duck species (Johnson and Herter 1989). King (1990) estimated over 1 million waterfowl on the Arctic Coastal Plain, including over 400,000 dabbling ducks, over 60,000 scaup, over 540,000 sea ducks, over 160,000 geese, and over 10,000 tundra swans. The dominant species included long-tailed ducks (>495,000), northern pintails (>390,000), and white-fronted geese (>145,000). The highest density of breeding pairs in 1989-91 (Conant and Dau 1991) included northern pintails at 10.4 pairs/mi^2, canvasback (6.9), American wigeon (4.9), and long-tailed duck (3.8).

[2] NABCI Bird Conservation Region 3. This report covers Alaska only as DU has been engaged only minimally in conservation work in Canada's high Arctic. For the time horizon of this plan, DU's work in the region will consist only of activities in support of the Arctic Goose Joint Venture or the Sea Duck Joint Venture of the North American Waterfowl Management Plan.



The Arctic Coastal Plain is also a critically important area for migration and molting. Periodic drought displacement of northern pintail to this region is dramatic, where density of birds may reach over 45/km^2, and as much as 15% of the continental population may be found in the Arctic Coastal Plain (Derksen and Eldridge 1980). Although pintails are abundant on the coastal plain, especially associated with shallow *Arctophila* wetlands, sex ratios are heavily skewed toward males, and most are probably nonbreeders. The king eider migration alone has been estimated at over one million birds passing Point Barrow (King and Lensink 1971). This area has a significant, but declining population of spectacled and Steller's eiders, both federally threatened species. This region, combined with western Alaska, the Alaska Peninsula, Kodiak Island, and the Aleutians, represents the most important area for sea ducks in the world. Molting geese regularly use the approximately 100 lakes around Teshekpuk Lake. In 1990 there were 23,395 brant, 12,233 Canada geese, 6,619 white-fronted geese, and 154 lesser snow geese, not including young (King 1990).

Importance to Other Birds

In addition to waterfowl, the interspersed tundra habitats are used by caribou, brown bear, polar bear, foxes, lemmings, ptarmigan, passerines, raptors, and shorebirds. Four loon species (common, arctic, yellow-billed and red-throated) use this arctic wetland assemblage, and more than 30 shorebird species have been recorded. Among the most common breeding shorebirds are red and northern phalaropes, pectoral sandpiper, and dunlin (Derksen et al. 1981). All three jaeger species are present, as are Sabine's gull and arctic tern. The most common passerine breeder is lapland longspur. In the Brooks Range, foothill areas are important for all scoters, especially black scoters, while riparian associated shorebird species include wandering tattler, semipalmated sandpiper, and spotted sandpiper. The Arctic Coastal Plain is far more important to continental waterbird populations than is the Brooks Range.

The vast majority of the Arctic Coastal Plain is in public ownership. The NPR-A includes over 9,474,000 ha and is managed by the Bureau of Land Management, while the 607,000 ha of eastern plain is known as the "1002 Lands" and is managed by the USFWS as part of the Arctic NWR. The Prudhoe Bay/Deadhorse area is privately owned and has undergone considerable development. Most of the Brooks Range is in protected status under the National Park System (NPS) and includes Noatak NP, Gates of the Arctic NP and Kobuk Valley NP.

Wetland degradation in these regions is principally from petroleum development of the North Slope, transportation systems (roads, pipelines, airports), and urban development. More than 800 exploratory oil and gas wells have been drilled on the Arctic Coastal Plain. Approximately 8,100 ha of wetlands have been directly degraded through petroleum development and secondary effects, such as flooding and thermal erosion of permafrost has had additional impacts. Petroleum development on the Arctic Coastal Plain results in much more extensive disturbance of wetlands than in more southerly locations, because it requires fill material, over permafrost, to construct infrastructure. This infrastructure, which consists of drill pads, storage areas, transportation facilities, gravel mines, and housing, alters terrain, disrupts natural drainage patterns, and may modify fish and wildlife habitat. The existing infrastructure for oil and gas operations in the Prudhoe Bay – Kuparuk complex is spread over more than 1,287 ha^2 of tundra. Nevertheless, the amount of wetland area affected is relatively small. Winter activity will reduce human disturbance impacts on waterbirds; however, certain key areas (e.g., Teshekpuk Lake region) may need refuge status.

Current Conservation Programs

In partnership with the Bureau of Land Management (BLM), USFWS, and North Slope Borough, DU completed a digital landcover map of the entire 9.4 million ha of the NPR-A (Kempka et al. 1995). Because of the immense size of the project area and limited field access, this effort was phased over three field seasons. The products from this effort have been used extensively in planning potential petroleum leases for the future. In addition to the landcover classification, correlations among mapped landcover classes and point locations for seven waterfowl species was conducted (Morton et al. 1998). Results from logistic regression model development suggest that the distribution of spectacled eider seem to coincide with high concentrations of Flooded Tundra, (*Carex aquatilis*), (*Arctophila fulva*) and smaller water bodies, and to be negatively associated with concentrations of Tussock Tundra, Dwarf Shrub, Ice, and large water bodies.

Goals

- To complete 3,239,000 ha of mapping on the Arctic Coastal Plain.
- To complete inventory of coastal and near shore habitats, which are critical for sea ducks.
- To complete analyses of waterbird associations with landcover, especially in core areas such as Teshekpuk Lake and the Meade River.
- To assist in research on arctic wetland ecology, sea duck ecology, and use of habitat by northern pintail.
- To aid resource managers from BLM, USFWS, NPS, First Nations, and petroleum firms in positive management decisions.

Assumptions

- As the Arctic Coastal Plain holds one of the largest known oil and gas reserves in the continent, development will expand rapidly in the next twenty years.

- Oil spills as well as petroleum industry infrastructure and surface disturbance can impact waterbird use patterns.

- There is an immediate need to understand where critical wetland complexes for waterbirds exist.

Strategies

- Coordinate further resource selection analyses by waterbirds with USFWS, BLM, and Alaska Science Center.

- Expand partnerships with USFWS, especially Arctic NWR, and with Native Alaskans and petroleum firms.

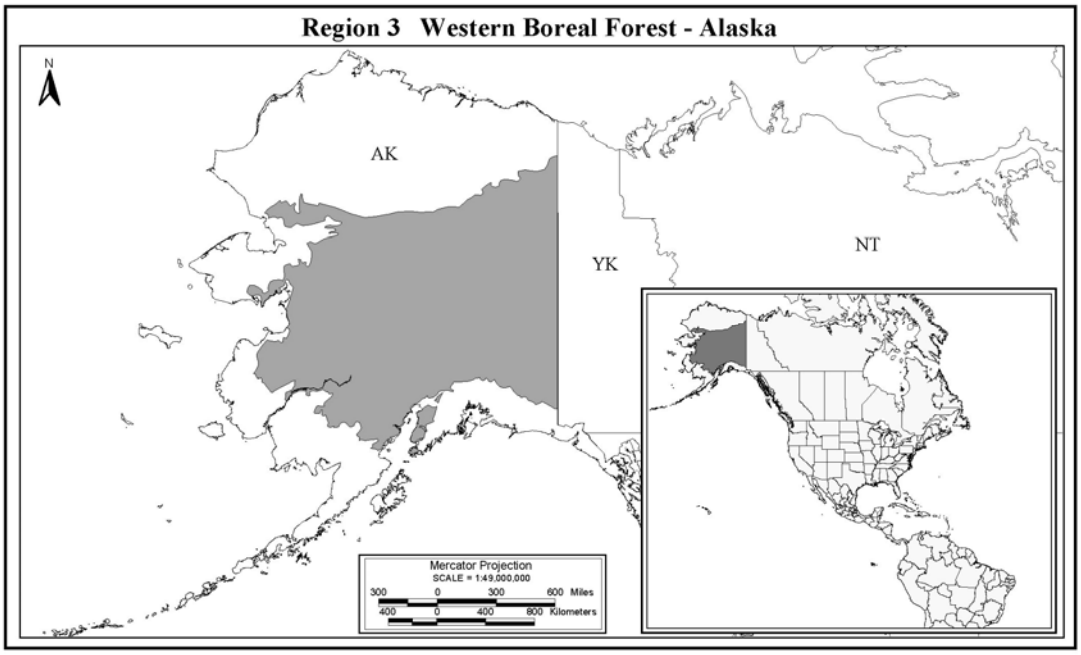
- Make digital land cover maps available to all resource managers, so that informed decisions can be reached.

- Coordinate research efforts with Alaska Science Center, BLM, USFWS, Universities, North Slope Borough, and petroleum firms.

- Take a leadership role in landcover mapping coordination for the Arctic Coastal Plain and coordinate efforts with DU Canada (DUC) into the MacKenzie River Delta.

Western Boreal Forest - Alaska[3]

The state of Alaska encompasses more than 163,158,000 ha. Wetlands make up more than 50 percent of the surface area. Palustrine scrub/shrub wetlands are extensive and make up almost two-thirds of Alaska's wetlands. The interior of Alaska is hydrologically driven by riverine systems and the floral region is dominated by boreal forest. High quality waterfowl habitat within Alaska's interior exceeds 8,907,000 ha and produces a fall flight that probably exceeds 4.6 million ducks and 100,000 geese (King and Lensink 1971). The boreal forest extends from the western lowlands northward to the mouth of the Mackenzie, dominated chiefly by white spruce mixed with paper birch. In the muskeg, black spruce is common, while balsam poplar, alder, and willow dominate riparian areas. Larch is most common in the middle and lower Tanana valley, but penetrates westward to the 160th meridian. Alpine fir and lodgepole pine extend into the Yukon.



Alaska's boreal forest is framed by the Brooks Mountain Range to the north the lowland tundra of the Yukon-Kuskokwim Delta to the southwest and an irregular boundary of the Kuskokwim, Alaska, and Chugach Mountains to the south. The dominant rivers that have carved this forested system include the Yukon, Kuskokwim, Innoko, Koyukuk, Kanuti, Porcupine, Black, Charley, Tanana and upper reaches of the Suisitna and Copper River systems. Most lakes and wetlands in the boreal forest were formed by hydrological processes associated with rivers, and have resulted in shallow water bodies with relatively flat bathometry. These systems contain vast areas suitable for emergent or submergent vegetation. Flooding occurs along the major rivers in interior Alaska associated with two types of events, a heavy snow pack in spring or a late and rapid breakup. Either of these hydrologic events produces extensive floodplain inundation. Other than flooding, fires have historically driven the succession of these boreal systems. Fire modifies

[3] NABCI Bird Conservation Region 4 (Alaska only – Region 4 for Yukon and SE Alaska is covered in Western Boreal Forest, Bird Conservation Region 6.)

upland vegetation, pulses wetlands with nutrients, and may change the predator base. Critical waterbird habitat is found in the lowlands of the Yukon and Minto Flats, Kanuti, Nowitna, Innoko, Khotol, Iditorod, and Koyukuk River floodplains.

Importance to Waterfowl

The diversity of waterfowl species in the western boreal forests of Alaska rivals that of the prairie/pothole region. Densities of scaup (1.95 pairs/km^2), northern pintail (1.79 pairs/km^2) and American wigeon (1.73 pairs/km^2) dominate duck breeding pairs (Conant and Dau 1991). Green-winged teal (1.05 pairs/km^2), mallard (0.95 pairs/km^2), and northern shoveler (0.89 pairs/km^2) are also present in significant numbers. Canvasback, goldeneye, bufflehead, ring-necked duck, and scoters are also present throughout wetlands of the boreal forest. Tundra swans, trumpeter swans, white-fronted geese, and interior Canada geese have all increased in recent years. Several sea duck populations (including Steller's eider, spectacled eider, oldsquaw, and all three species of scoter) have declined in recent years. These species use a mix of boreal, tundra and marine environments.

Importance to Other Birds

Common and Pacific loons or horned and red-necked grebes dominate deep wetland areas, while yellowlegs, spotted sandpiper, red-necked phalarope, and common snipe dominate shallow flooded areas. Mew gull and arctic tern are common throughout interior Alaska. Neotropical songbirds dominate forested stands, while several species of thrush and waterthrush are common in riparian habitats. Great gray and boreal owls hunt on wetland margins.

Over 88% of Alaska wetlands are under public ownership, with the principle agencies in the boreal forest being the USFWS, BLM, and Alaska Department of Fish and Game. First Nation land holdings are also critical. The Doyan Corporation holds some 5,061,000 ha of land in the Alaskan boreal and is the single largest private landowner in the United States.

Challenges to the western boreal forest of Alaska come in the form of projected development. In 1999, more hydropower projects are proposed for Alaska than all other states combined. The proposed (but defeated) Rampart Canyon Dam would have caused the inundation of nearly 26,900 km^2 of the Yukon flats and the loss of 1.5 million ducks from the fall flight (Bartonek et al. 1971). Currently, pulp and paper operations are small for interior Alaska, but demand is expected to rise. Mineral extraction, especially gold and tungsten, has altered wetlands and destroyed some salmon streams. Petroleum and gas production will need expanded pipeline development through the boreal forest. Increasing human growth and tourism will demand increased road access to Alaska's interior, which will result in altered hydrology, fragmentation of forests, and accelerated development. As human demands on the natural resources of the north expand, viable landcover and waterbird surveys are critical.

Current Conservation Programs

Beginning in 1989, DU has worked with key agency partners to delineate landcover types across interior Alaska. Initial work was cooperative with the BLM and centered in the Gulkana and Iliamna Basins, as well as the Black and Innoko River watersheds. Ducks Unlimited and the BLM have developed a sampling protocol that is now accepted as an Alaska-statewide earth cover procedure. This protocol utilizes extensive field verification with helicopters to increase accuracy assessment of final products. Partnerships with the NPS, the U.S. Air Force, the Alaska Fire Service, the USFWS will have helped map over 40,486,000 ha of landcover in Alaska by

2000. All of the landcover areas have digital map products and ten manuscripts (which describe boreal landscapes and waterbird usage) have been published in the last six years.

Geographic Information Systems (GIS) have been developed for a number of western boreal landcover data sets. A demonstration CD has been prepared for the Western Boreal Forest and used for resource training. Various spatial data have been analyzed with landcover type and include: (1) boreal fire history with landcover type; (2) hydrography; (3) change detection; (4) macro-habitat selection by various waterfowl species; (5) carrying capacity and landcover selection by moose and caribou, and; (6) successional vegetation modeling. Specific research projects to date have focused on breeding ecology of lesser scaup and Barrow's goldeneye.

Coordination with efforts in western boreal Canada includes cross training of U.S. and Canadian resource managers. DUC biologists will oversee all field efforts in Canada with a DU remote-sensing analyst. DUC will not duplicate a boreal GIS staff. Products will have similar protocols across borders and the western boreal initiative can truly be a linked international effort.

Goals

- Expand understanding of wetland and waterbird ecology in the boreal forest.
- Map 520,243,000 ha of landcover in Alaska within the next 20 years.

Assumptions

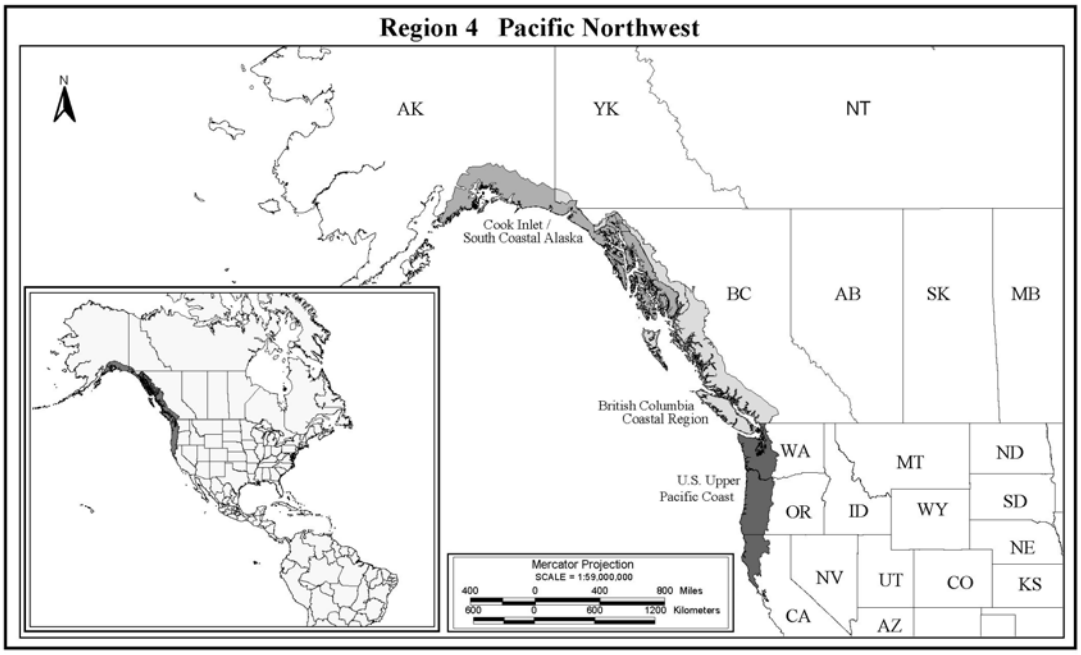
- Digital remote-sensed data, combined with GIS analyses, will allow land managers to make reasonable land use decisions.
- Knowledge gained in northern boreal habitats will aid in our understanding of disturbed systems in the southern (Canadian) boreal habitats.

Strategies

- Expand partnership efforts with major agencies, Native Alaskans, and resource-minded industry.
- Identify major wetland complexes important to waterbirds.
- Coordinate with DUC to develop digital landcover mapping of key wetland complexes.
- Develop GIS analyses of waterbird distribution and landcover relationships.
- Conduct basic ecological investigations to improve understanding of waterfowl use in boreal habitats of Alaska.

Pacific Northwest[4]

This region extends from Cook Inlet on the south coast of Alaska through coastal Alaska, British Columbia (BC), Washington and Oregon to northern California. The important waterfowl habitats tend to be similar estuarine, riverine and forested wetland landforms throughout. However, the intensity of land use and future threats to waterfowl conservation are extremely different between, for example, the wilderness of Alaska and the urbanized Fraser River Delta. Strategic plans for this region have been prepared in three sections: Alaska, British Columbia and the Pacific Northwest of the U.S.



Pacific Northwest - Cook Inlet / South Coastal Alaska

Cook Inlet (28,000 km^2) composed of the lower Matanuska-Susitna River valley into the Inlet and the coastal southeast panhandle of Alaska (61,000 km^2) make up the 1,600 km arc of these regions. Both regions are characterized by high annual precipitation in a maritime climate. One-half of Alaska's human population lives in the Cook Inlet-Anchorage bowl, with an additional 15% of the population living in the Southeast. The regions are heavily forested, with black, white, and sitka spruce and western hemlock as the climax needleleaf communities. Broadleaf forests are found along floodplain river and riparian drainages. More than half of the wetlands are forested or bog communities. Lakes in the upland areas cover some 10% of the terrain. Scrub and bog wetlands and wet forb and sedge vegetation dominate open areas. Thousands of small coastal wetland marshes occur along the shoreline and large wetland expanses exist at the Susitna Flats, Copper and Stikine Deltas, and the Yakutat forelands. Periodic tectonic uplift has altered the sub-tidal mudflats to marsh and mixed forests. Glaciation has been the major force in creating present-day landforms in the Copper and Stikine basins. The Copper River basin is the sixth largest basin in Alaska with an area of 62,000 km^2. These regions include more than 40,000 km of tidal shoreline.

[4] NABCI Bird Conservation Region 5 (Northern Pacific Rainforest)

These regions provide nesting and molting habitat for the world's population of dusky Canada and tule white-fronted geese, most Vancouver Canada geese, more than 40% of all trumpeter swans, and substantial numbers of mallards, mergansers, and other ducks. Large rafts of sea ducks (scoters, mergansers, harlequin ducks) and mallards and Vancouver Canada geese winter in bays or estuaries of the regions. Over 10 million waterfowl and 10 million shorebirds utilize the Yakutat, Stikine, Tsiu, Copper and Susitna Flats in spring migration. The breeding area of the tule white-fronted goose was destroyed by the volcanic eruption of Mt. Redoubt. Dusky Canada goose habitat was modified by an earthquake in 1964 that shifted the hydrology and plant succession within the Copper River Delta.

Large tracts of these regions are in public ownership. The two largest National Forests (NF) in the U.S. are found here in the Tongass (6,883,000 ha) and the Chugach (5,263,160 ha) NF, which includes the 283,400 ha Copper River Delta. Other protected areas include Kenai NWR, Glacier Bay and Kenai Fjord NPs, and BLM's forelands of the Bering Glacier. Alaska Department of Fish and Game is responsible for large tracts of land in the southeast, including Susitna Flats, Palmer Hay Flats, Potter's Marsh, and Tsiu Flats.

Some 80% of the people of Alaska live within the coastal arc of Anchorage to Ketchikan. Industry in the region consists of oil and gas production, commercial fishing, logging, mining, and minor agriculture. The only extensive threat to waterfowl would come from contamination of the estuarine habitat. There have been waterfowl kills from the grounding of the Exxon Valdez, oil pollution in Cook Inlet, and pulp mill effluent in Sitka and Ketchikan. By 1986, over 133,600 ha had been logged on the Tongass NF. This resulted in some 5,600 km of roads, of which 2,703 km impacted wetlands, for a direct degradation of 810 ha (USFWS). Protection and riparian restoration in existing harvested areas is critical in the Copper, Susitna, Tsiu, and Stikine Deltas. The Exxon Valdez spill in Prince William Sound demonstrated the impact of one serious marine accident. If coastal storms or tides bring the toxins into the estuaries, a major portion of our continent's waterbirds could be threatened.

Importance to Waterbirds

In 1998, the Kenai-Susitna USFWS strata averaged 11.5 ducks/km^2, whereas, the Copper Delta USFWS strata averaged 32.5 ducks/mi^2. These systems have traditionally been used as spring staging areas. Cook Inlet and the Copper River Delta are among the most important wetlands to the world's populations of western sandpiper and dunlin. The Stikine is also a traditional fall staging area for Wrangel Island snow geese. Common wintering shorebirds include black oystercatchers, rock sandpipers, black turnstones, and surfbirds. Seabirds (murres, murrelets, auklets) are common breeders throughout Prince William Sound. Southeastern Alaska has over 2,800 important anadromous fish streams, and over 15,000 bald eagles use this habitat.

Current Conservation Programs

Initial efforts in Southeast Alaska have concentrated on education and landscape planning. Partnerships with the USFS (USFS), BLM, USFWS, Alaska Science Center, and Alaska Department of Fish and Game have resulted in remote sensing products for the Copper River Delta, Kenai Peninsula, and Bering Glacier forelands. Fieldwork has been completed for GIS work at Susitna Flats. Extensive conservation planning has occurred through the development of the Copper River Delta GIS product. Current efforts include modeling of vegetation successional changes, which will have significant impact on dusky Canada goose, trumpeter swan, and northern pintail use of the Delta. More recently, efforts have been initiated

to restore and enhance wetland habitats that have been dramatically altered by construction of towns, roads, railroads and other developments. Significant wetland enhancement opportunities exist in Southeast Alaska; primarily altered estuarine habitats in close proximity to coastal communities.

Goals

- Complete remote sensing and GIS products for Cook Inlet (which includes Susitna, Redoubt and Palmer Hay Flats) and Stikine Flats.

- Complete successional vegetation modeling for the Copper River Delta and analyze pond succession related to beaver activity.

- Coordinate research efforts related to limnology and hydrology of Copper River Delta wetlands, and the ecology of Prince William Sound, sea ducks, dusky and Vancouver Canada geese, tule white-fronted geese, dunlin, and western sandpipers.

- Enhance 500 ha of estuarine habitats, primarily by restoring natural tidal processes in altered coastal wetlands.

Assumptions

- GIS products will be used by government and industry to protect and restore habitat values in association with the development of resource extraction activities.

- Although current demand for Alaskan lumber is down from Asian markets, interest in the pulp and paper potential remains high. The timber of Southeast Alaska has the easiest transport potential.

- Petroleum terminals in Cook Inlet and Valdez, plus the maritime shipping, provide potential contamination risk for large number of North American waterbirds.

- Vegetation succession on the Copper River Delta is characteristic of processes throughout the Southeast Arc.

- Successional modeling for the Copper River Delta will allow for management projections for the last forty years and the next fifty years.

- Additional opportunities and interest in wetland restoration projects will be identified.

Strategies

- Continue current partnerships, and develop new ones, with public agencies, the private sector, and university-based research specialists to identify program priorities and to secure funding to allow the work to be accomplished.

- Work with the Pacific Coast Joint Venture to develop a Joint Venture Coordinator position for Alaska. This position will assist in efforts to identify projects and secure financial support to complete those projects.

Pacific Northwest – United States Upper Pacific Coast

Important waterfowl habitats in the Upper Pacific Coast region in the U.S. include estuaries, riverine wetlands, marine habitats, floodplain marshes, wet prairies and isolated potholes of coastal Washington, Oregon, and northwest California. Critically important wetland complexes in this region include Samish Bay, Skagit River Delta, Snohomish River estuary, Puget Sound, Hood Canal, Grays Harbor, Chehalis River floodplain, Willapa Bay, Columbia River estuary, Willamette Valley, Tillamook Bay, Coos Bay/South Slough, Coquille Valley, Klamath and Eel Rivers, and Humboldt Bay.

The Pacific Northwest is a high rainfall zone with annual precipitation exceeding 250 cm in some locations. The diverse topography in the region, combined with high precipitation, has resulted in a rich and diverse mix of wetland habitats within this ecosystem.

Major rivers in the region have carved out extensive freshwater floodplain habitats and created large estuarine systems, both of which are used by hundreds of thousands of waterfowl. Prior to settlement by Europeans, some areas in the region contained extensive freshwater wetland habitats, including a huge complex of wet prairie wetlands in the Willamette Valley.

Pacific coast wetlands have been degraded by human expansion. Large-scale timber harvest and development of agricultural lands have resulted in direct wetland loss, sedimentation of bays and degradation of water quality and submergent plant beds. Extensive urbanization and industrialization has eliminated entire wetlands and reduced the value of other coastal wetlands to waterbirds. Many of the estuaries along the Pacific coast have been diked and drained, primarily for agricultural development. For example, approximately 95% of the Skagit River estuary has been drained. Expanding urbanization eliminates connections among wetlands, disrupts natural hydrologic flow patterns, and results in few areas that are without human disturbance.

Marine, estuarine and freshwater habitats along the Pacific Coast are complex. Migratory waterfowl, particularly puddle ducks, depend on tidal estuaries, freshwater floodplain marshes, riverine habitats, isolated freshwater wetlands and flooded agricultural lands in this region. Diving ducks primarily forage in riverine, estuarine and coastal marine wetlands. The coastal zone is a critical migration and wintering area for sea ducks. Aquatic beds of eelgrass are present in many of the region's bays and are heavily used by Pacific brant, wigeon, diving ducks, and many other waterbirds (alcids, loons, cormorants, and grebes). Many of these beds have been destroyed or reduced because of shellfish mariculture, wetland drainage and water quality problems.

The Upper Pacific Coast of the Lower 48 of the U.S. is divided into six subregions: Puget Sound, Washington Coast, Lower Columbia River, Oregon Coast, Willamette Valley, and Upper California Coast.

Puget Sound

Puget Sound and the Strait of Georgia stretch 290 km south from the Canadian border to Olympia, WA. Tidal variations provide expansive intertidal habitats for shorebirds and waterfowl. Large bays and estuaries characterize the northern Puget Sound. The principal rivers (Nooksack, Samish, Skagit, Stillaguamish, Nisqually and Snohomish) formed extensive floodplains that support palustrine marshes, riparian corridors, and expansive agricultural zones. Principal crops grown in the region include barley, cold leaf crops, carrots, potatoes, and hay. Fallow fields are utilized heavily by staging and wintering waterfowl. In the northern Puget

Sound, eelgrass beds are extensive in Skagit, Padilla, and Samish Bays, while Port Susan, Bellingham and Lummi Bays support tidal marshes with less eelgrass. The "upper intertidal zone" in all of these areas has been largely lost due to diking and draining activities, primarily to convert these areas to agricultural fields. The middle reach of Puget Sound is heavily altered. The Seattle-Tacoma Metropolitan area has a population approaching 8 million people. The Puget Sound has one of the highest population growth rates in the country. The Hood Canal and Nisqually River Valley are the primary wetland habitats in the southern Puget Sound.

State protected wildlife areas include Washington Department of Fish and Wildlife lands at Skagit, Lake Terrell, Nisqually, Sequim, and Snoqualmie. Federally protected lands include Nisqually River Estuary, Dungeness Spit, and Padilla Bay. The northern bays of Puget Sound support nearly 80% of western Washington's wintering waterfowl. The loss of freshwater and estuarine wetland habitat in the region has shifted waterfowl habitat dependency to agricultural lands in the past 100 years, particularly in the Skagit Delta. Mallard, wigeon, and northern pintail make up nearly 90% of the total puddle ducks wintering in the region. The heaviest concentrations occur in Port Susan, Skagit, and Padilla bays. Marine habitats in the Puget Sound, along with similar habitats in coastal Washington, account for 46% of the goldeneyes and 49% of the buffleheads wintering in the Pacific Flyway. Urbanization, with its associated loss of wetlands and agricultural lands, degradation of existing wetlands, and lowered water quality, will be the greatest threat to these waterfowl populations.

Importance to Waterbirds

The Skagit River Delta and Samish Bay support over 30,000 Wrangel Island snow geese and hundreds of thousands of ducks during the migration and wintering periods. Waterfowl counts exceeding one million birds have become increasingly common in the Skagit and Samish bays. Padilla Bay winters over 10,000 Pacific brant, the largest wintering population of this species north of Mexico (Ball et al. 1989). The Skagit Delta is also an important region for more than 700 wintering trumpeter swans. These swans, along with 1,500 tundra swans, forage in grain fields, fallow potato fields, and tidal estuaries. The Olympic Mountains and rough coastal areas of the Outer Sound support the densest U.S. breeding population of harlequin ducks. Hydroelectric dams, deforestation, and development have threatened this Mergini species through much of its nesting range in the Cascade and Sierra Nevada Mountains. The Hood Canal supports numerous Barrow's and common goldeneye, in addition to wintering white-winged and surf scoters.

Washington Coast

Washington's Pacific Coast (not including Puget Sound) is a sloping beachfront cut by Grays Harbor and Willapa Bay. Willapa Bay constitutes one of the largest and most pristine estuaries in the U.S. Its shallow contours make it unusable as a deep-water port and the Bay supports the state's largest commercial shellfish beds. A threat to this habitat is the introduction of smooth cordgrass. This invasive weed is choking out important mudflats and aquatic beds. Efforts are underway to assist the U.S. Fish and Wildlife Service and the Washington Department of Fish and Wildlife to control smooth cordgrass in Willapa Bay and other coastal habitats. Grays Harbor is fed by several lentic systems including the Chehalis River, which has a large expanse of bottomland habitats.

Importance to Waterbirds

Waterfowl utilize Washington's coastal bays primarily during migration. American wigeon compose some 80% of these migrants, which may reach 50,000 birds per fall. Some

90,000 scoters are counted annually during midwinter surveys with over half occurring in western Washington (Ball et al. 1989). Large numbers of pintails migrate through these habitats. Canada geese are most numerous along Willapa Bay with a resident population of about 1,000 birds. Willapa Bay also holds between 800-1,500 Pacific brant in winter, with larger numbers staging in spring.

Lower Columbia River

The Lower Columbia River area includes both the Oregon and Washington shores of the river from Bonneville Dam to the mouth. The Columbia River Estuary encompasses over 40,000 ha. Although there are no dams on the Columbia River below Bonneville, the system has been dramatically altered through dredging, ditching, and construction of flood control levees. In addition, an extensive dam system on the lower tributaries to the Columbia River have dramatically altered natural hydrology, affecting the natural processes that form and maintain wetland habitats. The heavily developed Portland-Vancouver Metropolitan Area has degraded the river system by extensive levee construction and drainage of floodplain wetlands. Much of the flat alluvial plains of the Columbia are currently managed as pastures, with some areas planted to annual and perennial crops. . Recently, the conversion of many of these areas to cottonwood tree farms has degraded prime waterfowl foraging areas. The extensive loss and conversion of floodplain habitats in the lower Columbia River has not only affected waterfowl habitat, but is one of the leading factors in the decline of other species, including 12 stocks of salmonids listed under the Endangered Species Act.

Important wetlands managed by public entities in the region include: Ridgefield, Steigerwald, Pierce and Julia Butler Hanson National Wildlife Refuges managed by the U.S. Fish and Wildlife Service; Shillapoo, Vancouver and Chinook River Wildlife Areas managed by the Washington Department of Fish and Wildlife; Oregon's Sauvie Island and Burlington Bottoms Wildlife Areas; Smith and Bybee Lakes, and Multnomah Channel habitats managed by Metro (the regional government entity for the metropolitan area of Portland); and the Sandy River Delta and other Columbia River gorge habitats managed by the U.S. Forest Service. The Columbia Land Trust, a local non-profit conservation organization, has developed a significant land protection program and has secured extensive wetland habitats in the lower Columbia River, especially in the Grays River estuary near the mouth of the Columbia River.

Importance to Waterbirds

Over 150,000 ducks and geese use Sauvie Island and nearby wetland areas during peak migration. Over 250 avian species have been recorded there. Mallard, northern shoveler, American wigeon, northern pintail, and green-winged teal are the principle dabbling ducks, whereas, canvasback, ring-necked duck, and scaup are the principle diving ducks. Scaup and ring-necked ducks occur primarily in the Columbia River estuary. Aleutian and cackling Canada geese are migrants that pass through this region, and some 76,000 Canada geese winter in the Lower Columbia and Willamette Valley (Jarvis and Cornely 1988). Significant numbers of dusky Canada geese winter in this region. The Lower Columbia also supports the majority of the 8,000 tundra swans wintering in the Pacific Northwest (Ball et al. 1989). Wetland restoration projects in the region have also resulted in significant increases in numbers of locally breeding waterfowl, an important component of the local waterfowl harvest, particularly early in the season.

Oregon Coast

The Oregon Coast is characterized by a rugged coastline that is dissected by large rivers originating from the Cascade Mountains and coastal range. These rivers have created significant floodplain and estuarine wetlands. Along the coast, sand dunes trap freshwater and create coastal lakes, ponds, and palustrine marshes. Important river systems include Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, Coquille, Rouge, and New. In addition to providing important waterfowl habitat, Oregon's estuaries provide critical rearing habitats for anadromous fish. Losses of 50-80% of intertidal marsh habitat in Oregon's estuaries have resulted from diking for farmland conversion (Thomas 1983). Several small refuges, including Siletz Bay and Bandon Marsh NWRs, protect critical tidal wetlands, but no large public wetland complex exists.

Importance to Waterbirds

The Coquille Valley supports the highest concentration of puddle ducks (dominated by mallard, pintail, wigeon, and green-winged teal) wintering along Oregon's coast. During harsh winters in the Great Basin, coastal Oregon experiences a 100-200% increase in bird use. Scoters are common wintering birds off several estuaries. Nestucca Bay supports the only coastal wintering population of dusky Canada geese (500 birds). Netarts, Yaquina, and Tillamook Bays all support wintering brant in small numbers. Aleutian Canada geese (over 10,000 birds) stage on pastures along the New River and Nestucca Bay.

Willamette Valley

This interior valley is approximately 49 km long and about 60 km at its widest point. It was created by one of the major tributaries of the Columbia, the Willamette River. Prior to settlement, this valley contained extensive systems of floodplain and wet prairie wetland habitats. It is believed that between 120,000 and 160,000 ha of wetland prairie existed in 1850. Today, less than 400 ha remain (Guard 1995). Public refuges exist at Slough, Ankeny, and Finley NWRs and Fern Ridge and E.E. Wilson WAs. The greatest threats to waterfowl habitat are expanding urban sprawl, intensive agriculture and degradation of existing wetland habitats.

Importance to Waterbirds

The Willamette Valley winters large number of ducks, including more than 50,000 mallard and 30,000 American wigeon. Green-winged teal, pintail, and ring-necked duck are common migrants and wintering birds. Five different races of Canada geese winter in the valley, including virtually the entire population of dusky Canada geese and recently, most of the population of cackling Canada geese. Total numbers of wintering Canada geese have grown from 20,000 to over 250,000 birds in the last two decades.

Upper California Coast

From the border of Oregon, important waterfowl habitats in northwestern California include the 18,225 ha Smith River floodplain, the coastal lagoons of Lake Earl and Lake Talawa; deltas of the Klamath, Redwood, and Little Rivers, and the estuarine complex of Humboldt Bay, Mad River Estuary, and the Eel River Delta. This latter wetland complex is second only to San Francisco Bay in size or importance for waterfowl in coastal California. It provides at least 8,000 ha of low-lying seasonal wetland, 8,000 ha of tidal marsh or mudflat, and 1,800 ha of sloughs and deep-water estuarine habitats, plus 400 ha of rare floodplain riparian forest. Expanding human populations is the greatest threat, and urbanization results in direct loss of habitat and also greater

disturbance of birds, nonpoint pollution, modification of hydrologic regimes, and diversion of water.

Current Conservation Program

Significant wetland conservation efforts in this region have been completed in the past five years. Additional wetland conservation projects are currently underway or planned for the future. Wetland conservation activities in the Lower Columbia Ecosystem have centered around four NAWCA grants. Two NAWCA grants in Willapa Bay and five grants in the Puget Sound have provided significant partnerships and financial resources for wetland conservation activities. The U.S. Natural Resources Conservation Service has become a significant partner in wetland conservation activities in the region through the Wetland Reserve Program. Salmon recovery efforts have brought millions of dollars to the region to restore and protect important wetlands and riparian areas. Ducks Unlimited has capitalized on these efforts by securing millions of dollars from the Oregon Watershed Enhancement Board and the Salmon Recovery Funding Board of Washington. Most of the wetland conservation projects completed by DU in this region provide significant benefits to salmon, particularly by providing rearing habitat to juvenile coho and Chinook salmon.

As extensive wetland restoration projects are completed in the Lower Columbia River and additional opportunities become less common, focus is shifting to other areas, primarily the Puget Sound region. Opportunities for restoration of floodplain and estuarine wetlands in the Puget Sound are significant, primarily in the Snohomish River watershed. A major estuary restoration project will also be completed at Nisqually NWR. Additional projects are being pursued in all of these regions. One of the most significant issues facing ongoing management of floodplain freshwater habitats is reed canarygrass. This species is very competitive and routinely becomes the dominant plant species in freshwater, seasonal wetlands. Reed canarygrass provides little value to waterfowl or other wildlife. If left unchecked, freshwater wetlands can become virtually worthless to waterfowl as reed canarygrass eliminates other plant species. The installation of appropriate water management facilities and on-going, intensive management of seasonal wetlands is essential to maintaining diverse, productive wetland habitats that provide the nutritional requirements of wintering and migrating waterfowl.

Goals (2005-2009)

- Protect an additional 1,000 ha of existing waterbird habitat.
- Restore and protect 4,000 ha of wetlands.
- Enhance approximately 1,000 ha of existing wetlands each year by replacing dilapidated wetland management infrastructure and assisting with efforts to reduce reed canarygrass and promote early successional, diverse wetland plant communities in managed wetlands.
- Provide technical assistance to public and private land managers.
- Develop new partnerships, both public and private, to secure additional income sources to support DU’s conservation programs.

Assumptions

- Replicating a more natural hydrologic pattern favors native and diverse vegetation and viable habitat.

- The restoration and protection of wetland-dominated habitats is more likely to meet the long-term needs of waterfowl that continuing to rely primarily on the maintenance of agricultural lands.

- Wetland and riparian restoration and enhancement efforts will produce viable habitats for both waterbirds and salmonids.

- Protection or restoration actions should consider the risk posed by contaminants.

Strategies

- Facilitate easement and fee acquisition efforts or land donations on key private lands.
- Restore floodplain and other freshwater wetlands primarily by utilizing techniques that attempt to replicate natural hydrological cycles through water control.

- Continue to investigate and refine wetland restoration and management strategies that successfully control reed canarygrass and promote diverse wetland plant communities.

- Assist in efforts to intensively manage seasonal wetland habitats where appropriate, primarily on publicly managed areas and certain privately owned parcels managed primarily for waterfowl.

- Restore estuarine habitats throughout the Pacific Coast region.

- Prioritize projects that provide benefits to both salmon and waterfowl because those types of projects are more easily funded and permitted.

- Provide technical assistance to private landowners, especially in the Puget Sound, Lower Columbia River and Willamette Valley regions.

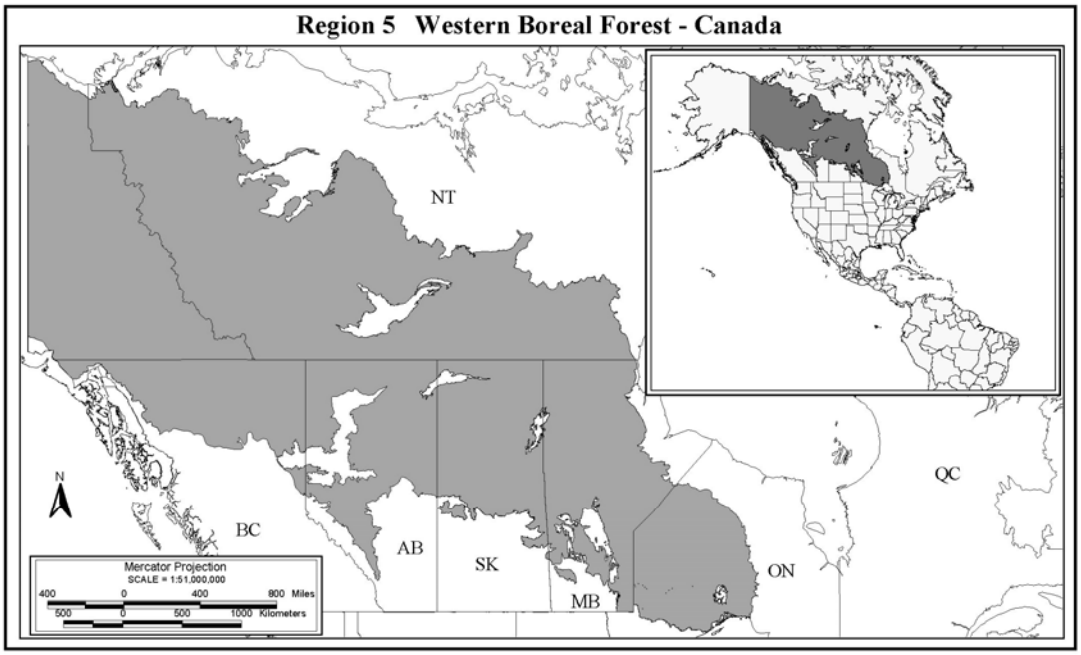
- Continue to investigate and monitor salmonid use of restored and enhanced wetland habitats in order to: refine wetland restoration and management techniques, generate support and acceptance of these techniques, and assist in fundraising efforts.

February 1, 2005 – Region 4

General editing and minor improvements through out the text

Western Boreal Forest - Canada[5]

Western Canada and Central Alaska are part of one of the largest forested regions in the world. A particularly important and distinctive portion, hereafter referred to as the Western Boreal Forest (WBF) is at the heart of this ecosystem and covers >3 million km^2. In addition to vast timber reserves, this region encompasses thousands of km^2 of lakes and wetlands providing critical breeding, staging and molting habitats for North American waterfowl and waterbirds.



The eight ecozones that comprise the WBF contain a mosaic of wetland complexes, meandering river valley flood plains and some of the largest inland river deltas in the world. Spruce, pine and fir dominate much of the uplands along with mixed-wood forests of aspen, birch and poplar. Forest fire historically has been the dominant rejuvenating force influencing upland and wetland vegetation structure. Beavers also influence wetland abundance and function.

The WBF annually supports breeding populations of 12-14 million ducks (Table 1). Scaup, mallard, American wigeon, green-winged teal and scoters each have breeding populations between 1 and 4 million birds. Boreal lakes, fens and bogs also are primary breeding areas for common loons, sandhill cranes and red-necked grebes. Several species of shorebirds, including greater and lesser yellowlegs, short-billed dowitchers, spotted and solitary sandpipers and Wilson's phalaropes, use boreal wetlands for breeding. At least two bird species of special interest, the trumpeter swan and whooping crane depend almost exclusively upon boreal wetlands for breeding. Riparian and wetland habitats also are important for nesting and foraging for many passerine species.

[5] NABCI Bird Conservation Region 6 (Boreal Taiga Plains). For DU planning purposes, this region overlaps with Region 4 in the Yukon and Region 4 in part of Alaska.

Table 1. Population Indices for Western Boreal Forest Waterfowl Species, 1960 – 1998, USFWS/CWS Surveys Data for Strata 1-7, 12-18, 20-25, 50 and 77.

DUCKS	MEAN 90s	MEAN 80s	MEAN 70s*	MEAN 60s
Scaup	2,860,100	3,904,026	4,407,872	3,551,789
Mallard	2,055,942	2,101,015	2,298,789	2,079,660
American Wigeon	1,300,241	1,467,630	1,394,384	1,308,455
American Green-winged Teal	1,091,125	1,162,401	808,635	861,648
Ring-necked Duck	763,975	530,646	410,397	363,763
Scoter	729,080	1,291,680	1,212,484	1,158,120
Mergansers	578,430	469,236	373,037	310,619
Bufflehead	554,958	529,253	528,835	334,701
Goldeneyes	490,538	425,683	374,711	356,122
Northern Pintail	447,705	711,491	685,748	835,667
Northern Shoveler	433,232	405,910	227,560	271,989
Blue-winged Teal	375,073	582,644	415,202	451,929
Canvasback	220,428	189,735	146,387	223,072
Oldsquaw	93,514	298,742	277,525	382,501
Gadwall	66,610	58,064	40,268	45,035
Ruddy Duck	50,675	60,204	18,608	34,654
Redhead	39,496	45,195	36,099	70,525
American Black Duck	30,843	22,763	29,829	32,477
Eider	0	2,862	322	0
TOTAL	12,182,055	14,259,260	13,686,762	12,672,786
GEESE				
Canada Goose	22,137	64,810	36,396	25,223
Greater White-fronted Goose	393,982	380,156	287,543	366,776
TOTAL	416,119	444,966	323,939	391,999
COOTS & SWANS				
Coots	93,675	365,406	124,386	139,771
Tundra Swans	58,453	78,866	38,562	17

*Waterfowl population goals for the WBF (goals are for ducks and geese only).

The permanent water provided by boreal wetlands and lakes is important to millions of molting waterfowl from the parklands and prairies to the south. During spring and fall migration, northern-breeding waterfowl also congregate on these lakes.

Boreal wetlands have been considered stable and largely undisturbed because of their remoteness, and thus management of boreal wetlands has been viewed as expensive and unnecessary. This situation is changing. The WBF, though vast and difficult to access, is undergoing rapid transformation from undisturbed wilderness to a resource-rich, commercially exploited region. Wetlands systems are being impacted by forest cover removal, climate change and extensive linear developments (e.g., roads, seismic lines). Five environmental pressures predominate:

Forest Management - Since the glaciers receded, fire has been the most dominant recurring event affecting natural processes in the boreal forest. In this region, the effects of fires on aquatic

systems are not well understood, but are likely to be important. Intensive fire suppression and forest harvesting are changing historical disturbance regimes.

In the last 30 years, commercial forestry has increased dramatically in the WBF. Governments have encouraged development by granting cutting rights to vast areas of forest. Forest Management Agreements and other licenses provide exclusive access to Crown Lands for large forestry companies, typically for tenures of 10 to 20 years in Canada, and up to 50 years in Alaska. Recent technological improvements in harvesting methods, road building, and the use of aspen for pulp production have enabled timber harvest to increase dramatically. The vast majority of the commercially valuable timberland in the central WBF has been allocated and scheduled for harvest over the next 40 years.

Oil, Gas and Mineral Extraction - Extraction of petroleum resources is the primary threat to boreal habitats where little marketable timber is present. The fourth largest oil field in Canada is located at the heart of the taiga plain at Norman Wells, NT. Alberta, however, possesses the bulk of the region's oil and gas fields. There are over 88,000 well sites located in Alberta's portion of the boreal forest alone, and >885 km^2 have been cleared for those well sites. Between 1986 and 1995, approximately 500,000 km of seismic lines were approved to be cleared in Alberta, and by 1998, more hectares of land were cleared each year for oil and gas pipelines, seismic lines, roads and well sites than were cleared by forest logging. Although most of this activity is in the south central portion of the WBF, these combined impacts illustrate the level of fragmentation that can occur in more remote regions if they contain extractable minerals. In addition to land clearing, petroleum production and oil sands mining promote a high degree of habitat fragmentation, hydrologic interruption, and air and water pollution.

Agriculture - Land clearing, followed by wetland loss, has been especially rapid in the forest's southernmost region as a result of agricultural expansion. The aspen parkland transition zone and the Peace Parklands have been hardest hit, and present-day conversion rates are likely to increase with growing human populations and a warming climate. In the Alberta parklands, some 200 km^2 per year were converted from forest cover to agriculture from 1949 to1995, mostly for small grain crops and improved pasture. Government-owned forestland located on soils suitable for agriculture continues to be sold to farmers for conversion, and the agricultural industry has targeted the WBF for accelerated expansion.

Climate Change - The character of the boreal zone is partly determined by long, cold winters and short summers. Temperatures in central Canada already have warmed at a higher rate than in most of North America. With a doubling of atmospheric CO_2 in the next century, average temperatures in the WBF may increase by as much as 4.2^0 C. This is expected to result in drier average conditions, greater annual climatic variation, melting permafrost, altered surficial hydrology and higher rates of wildfires. Vegetation zones are likely to shift slowly northward and up to 16 million ha of new ground may become suitable for agricultural production. Significant changes in wetland ecology, including food webs that support duck populations, are likely but cannot be predicted with certainty.

Hydroelectric Development – Dams for power projects already have altered the hydrology of major boreal wetland systems, most notably the Peace-Athabasca Delta near the Alberta/NT border and the Saskatchewan River Delta on the Manitoba/Saskatchewan border. Many other projects are on the drawing boards. Today, more hydropower projects are proposed for Alaska than for all other states combined. The proposed Rampart Canyon Dam (now on hold) would have caused the inundation of nearly 27,000 km^2 of the Yukon Flats.

Current Conservation Programs

With the exception of a number of isolated studies, very little is known regarding the ecology of wetlands and waterbirds in the WBF. High priority information needs include the identification and description of key habitats, the relative value of these habitats to continental waterbird populations, and the ecological processes affecting habitat productivity. DU's current activities are focused on land cover inventory and mapping, waterbird surveys and wetland productivity research, all of which need to be expanded in the future. DU's actions over the past 2 years have stimulated partnership opportunities with industry, government agencies, universities, and aboriginal groups and greatly enhanced the understanding and concern for wetland systems in the WBF.

Over the next 20 years DUC will work to maintain the WBF as a landscape including wetlands and adjacent uplands capable of supporting waterfowl populations at levels comparable to the 1970s. By initiating actions to preserve the ecological integrity of wetlands and critical uplands, DU will be viewed as a leader in the conservation of habitat for waterfowl and other wetland wildlife in the WBF. Although the primary focus of DU activities will be the protection of intact wetland systems that support waterfowl and other wetland wildlife, restoration of damaged systems will be undertaken through innovative policies, land use practices, and partnership developments.

Future land use activities in the WBF will respect the functions and values of wetlands in the sustainable development of the region. By working with industry, government, and aboriginal partners with interests in the WBF, we will significantly increase our understanding of WBF wetlands, their values for waterfowl and other wildlife and the impacts of various industrial activities on the productivity of these wetlands. This information will be used to increase societal awareness of the values of the WBF to wildlife and to promote sustainable land use policies and practices that will maintain the ecological integrity of the region. As a result of DU's efforts, the WBF will continue to play a significant role for North American waterfowl.

Goals

- Sustain waterfowl breeding population of the 1970s (± 1 SD), that is, 13.7 million breeding ducks and 0.3 million breeding geese of the 23 species that occupy the region (Table 1).
- Maintain habitat adequate to sustain waterfowl populations at goal levels.
- Develop techniques and gather information necessary to ensure that we can establish more specific habitat goals within 5 years.

Assumptions

- Waterfowl use of the boreal ecosystem is adequately represented by USFWS/Canadian Wildlife Service (CWS) survey data.
- Sustainable forest management strategies that help to maintain wetland ecosystem functions and waterfowl populations in the WBF will be adopted.
- Impacts on WBF uplands are not currently limiting waterfowl production.

- The current rate of ecosystem impairment will not compromise our ability to achieve stated population goals as we work toward addressing existing information gaps.

Strategies

- Prioritize ecoregions for program delivery based on importance to continental water-bird populations, the vulnerability of the area to natural and anthropogenic impacts, and funding/partnership opportunities.

- Develop and test landscape/waterbird-use models for use with digital land cover data as a means of identifying all the major wetlands in the WBF of high importance to migratory waterbirds.

- Address high priority information needs within each ecoregion to expand our understanding of wetland and waterbird ecology in the WBF.

- Conduct research on species of concern in the WBF (e.g., scaup, scoters, American wigeon, loons).

- In areas where intensive resource development is occurring, conduct research on the effects of various land use practices on the integrity of boreal wetland systems.

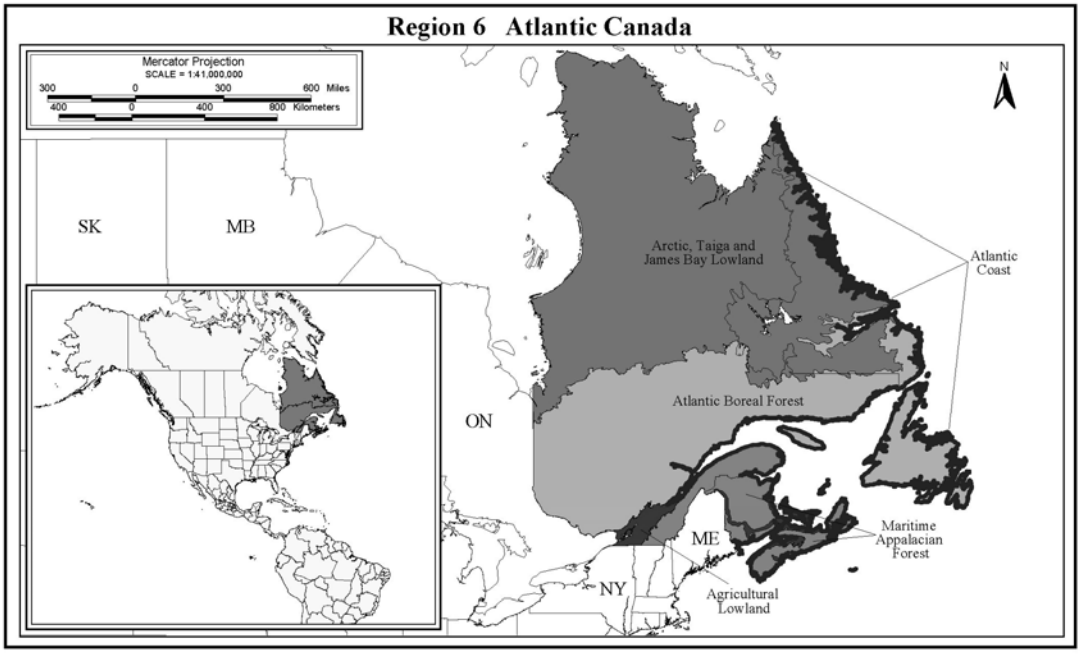
- Focus GIS applications on the temporal and spatial relationships between waterbirds and land cover, succession related to boreal fires, forest harvest, hydrological patterns, vegetation communities and human development activities.

- Increase awareness of WBF issues to ensure that wetlands are recognized as an integral component of healthy boreal landscapes and to assist in the development of helpful public policies.

Atlantic Canada[6]

The Atlantic Region of Canada includes 5 provinces (Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland – Labrador) with a total area of 2.3 million km^2. It also includes 824,000 km^2 of the Ontario sections of the Eastern Boreal Forest and Arctic, Taiga and James/Hudson Bay Lowland landscapes. The region contains a wide diversity of habitats, waterfowl and wildlife communities. Major river systems, such as the St. Lawrence and St. John Rivers, along with coastal habitats play a crucial role for waterfowl populations in the Atlantic flyway.

Human populations have been established mainly on the coast and along major river systems. There are currently 9.6 million people in the region with relatively high population densities in the Maritimes (PEI 24/km^2, NS 16.8/km^2, and NB 10/km^2). In Quebec, about 97% of the population live within the St. Lawrence River's watershed, with 69.5% of the population within 10 km of the river.



Loss of wetlands or wetland functions began in the 1600s and has continued because of land use activities such as agricultural and urban expansion. Wetland losses have contributed to declines in waterfowl numbers. This prompted the development of landscape visions to provide a clear picture of the habitat base as well as the waterfowl and wildlife benefits accruing from this habitat. A total of seven landscapes make up the Atlantic region, including 6 terrestrial ecozones and one coastal landscape. The coastal and agricultural landscapes are intimately linked with waterfowl moving freely between landscapes often on a daily basis.

The region supports a diverse waterfowl community of more than 30 species. There are important breeding, staging (spring and fall), molting and wintering habitats. The area supports

[6] NABCI Bird Conservation Regions 7, 8, 12, 13 and 14 (in Canada).

significant waterfowl numbers (1.33 million breeding pairs, 2.12 million staging, 152,600 molting and 647,000 wintering birds). The region produces birds important to the Atlantic flyway such as American black ducks (black duck), green-winged teal, ringed-necked ducks, mergansers, goldeneyes, Canada and greater snow geese, scoters and eiders. The annual fall flight is estimated at 7.8 million birds.

Declines from historic levels have occurred for some species (black ducks, goldeneyes, eiders, scoters and the North Atlantic population of Canada geese) over the past decades. However, over the past 10 years, waterfowl populations are generally stable or increasing with the exception of goldeneye, mergansers and sea ducks. Most of the endangered eastern harlequin ducks are in this region. Some species such as mallards and wood ducks are increasing. There has also been a spectacular increase in greater snow goose numbers with spring estimates of 800,000 birds.

Strategic Planning for this diverse region of Canada has departed somewhat from the delineation of Bird Conservation Regions recognized for NABCI. DU staff in Canada felt it was more germane to their planning needs to recognize five distinct landscapes: Coastal, Forested, Agricultural Lowland, Maritime Appalachian Forest, Boreal Forest and Arctic, Taiga and James Bay Lowland. These generally apply to Bird Conservation Regions: 7 (Taiga Shield and Hudson Plains in Quebec and Labrador), 8 (Boreal Softwood Shield in Quebec, Labrador and Newfoundland), 12 (Boreal Hardwood Transition in Quebec), 13 (Lower Great Lakes/St Lawrence Plain in Quebec) and 14 (Atlantic Northern Forest in Nova Scotia, New Brunswick and Prince Edward Island).

Coastal Landscape

Length of coastline	Atlantic region 31,800 km
Wetland area	Atlantic region 457,100 ha salt marsh, estuarine flats, saline ponds and islands
DU managed wetlands	Maritimes 1,466 ha, 5,700 eider nest shelters
Waterfowl Numbers	Atlantic region 130,000 breeding pairs of eiders
Moulting numbers	Labrador 62,000 scoters and 600 harlequins, NS 40,000 eiders, St. Lawrence: 50,000 scoter,
Staging numbers	Atlantic Provinces 100,000 geese, 100,000 ducks, QC 220,000 ducks and geese, 200,000 scoter
Wintering numbers	Maritimes 167,000, NF and LAB 230,000, Quebec 200,000
Other species	Millions of seabirds, 4.8 million shorebirds during fall migration.
Waterfowl goals	Could support increased breeding and non-breeding populations

The coastal landscape is a complex mix of salt marshes, estuaries, tidal mud flats, islands, saline ponds, rock and beach shoreline as well as offshore areas. Habitats depend on the varying tidal regimes and climatic conditions. Waterfowl use is mainly in the form of staging and wintering, although common eiders use coastal islands for nesting.

The vast majority of human settlement has occurred on the coasts of this region. Significant wetland loss has occurred with an estimated 65% of the salt marsh in the Bay of Fundy having been dyked with 27,300 ha remaining. In addition, 5,000 ha of salt marsh remain

in the St. Lawrence estuary. Urban, recreational, and industrial developments have impacted coastal habitats to varying degrees, however, urban expansion continues to impact all coastal systems. Intensification and diversification of resource extraction (i.e. aqua-culture, inter-tidal harvest, marine traffic) is placing additional stress on the environment and increasing interactions between waterfowl and humans. Human activities result in considerable direct mortality of waterfowl and seabirds in this landscape with significant losses being attributed to oiling, gill nets, and harvest. Depredation of ducklings by great black-backed gulls is also a significant source of mortality.

The coastal landscape supports a diverse waterfowl community including dabbling, diving and sea ducks as well as geese. Waterfowl use this area throughout the year, with significant numbers of staging, breeding and wintering waterfowl. This landscape supports the majority of breeding common eiders. In addition, as a significant proportion of the continental scoter and eider population stage, molt and winter in this area. There are also millions of seabirds that use this area throughout the year. In addition, an estimated 4.8 million shorebirds migrate through the Atlantic Provinces every fall and rely on the coastal habitat during their stay.

The coastal landscape is the keystone habitat in Atlantic Canada. Sufficient coastal habitat exists to support current waterfowl populations, although habitat loss continues and threats are increasing. Complex interrelationships occur among the various coastal habitats and adjacent uplands that make some coastal regions more important to waterfowl than others. There will be an increased demand for property adjacent to the coast. Current legislation does not fully protect these habitats.

Goals

- Develop initiatives that will conserve coastal habitats in the face of growing urban expansion.
- Identify and protect the remaining 32,300 ha of salt marsh in the Bay of Fundy and in the St. Lawrence estuary and, where possible, restore degraded salt marsh habitat.
- Identify and protect critical breeding islands for eiders.
- Identify and conserve critical areas of coastal shoreline to protect molting, staging and wintering habitat.
- Develop new initiatives that address problems of survival and recruitment of sea ducks.

Strategies

- Focus DU’s conservation programs on important coastal areas.
- Employ public policy, free easements and extensive programs to accomplish goals.
- Evaluate salt marsh restoration in the local context, before being attempted on a large scale.

Agricultural Lowland Landscape

Landscape Area	Atlantic region 64,572 km^2, Maritimes 20,000 km^2 (9,000 in small wood lots), Quebec 44,572 km^2
Proportion of land-base	Atlantic Region 3%, Maritimes 15%, Quebec 2.6%
Wetland area	Atlantic region 491,700 ha, Maritimes 46,000 ha (mean 2.3 ha/km^2, range 0.3 – 8.8), Quebec 445,700 ha (mean 10 ha/km^2, range 5-24)
DU managed wetlands	Atlantic region 30,000 ha, Maritimes 14,000 ha, Quebec 16,000 ha
Breeding pairs of waterfowl	Atlantic region 201,600, Maritimes 10,000, Quebec 191,600
Staging Waterfowl	Atlantic region 1,500,000, Maritimes 150,000 ducks and 100,000 geese, Quebec 250,000 ducks and 1,000,000 geese
Wintering waterfowl	St. Lawrence 50,000 ducks and geese
Waterfowl goal	Maritimes 20,000 breeding pairs, Quebec 256,000 breeding pairs and 1.5 million staging birds.

The agricultural landscape ranges from intensive corn and grain cultivation to a mosaic of farmed land, small woodlots, rough cover and urban development. Major rivers and the surrounding valley (i.e. St. Lawrence River and estuary and St. John River), Bay of Fundy dyked land, and the Northumberland Plain are included in the landscape. In Quebec, agriculture continues to intensify with 26% of the land base being farmed. However, in some areas up to 60% of the land is farmed. Corn, cereal, dairy, and beef make up most of the active farm practices. In the Maritimes, agricultural activity peaked in the early 1900s when 30% of the total Maritime land base was actively farmed. Today, farming occurs on 15% of the land base, but at greater intensity. Potato, dairy, beef, hogs, sheep as well as vegetables and fruit make up most of the active farming practices. More than 70% of the Atlantic population lives in this area. Consequently the land is primarily privately owned. Urban expansion is steadily increasing and changing this landscape.

Wetland loss in this landscape is difficult to determine since most of the loss occurred prior to aerial photography. In addition, there are no wetland inventories in Quebec. We do know that wetland loss did occur on a fairly large scale in some regions. Upgrading and maintenance of land drainage continues to reduce the extent of wetland areas. In the Maritimes, DU has played a key role by conserving 30% of the wetlands in the landscape through restoration and enhancement. DU's program has focused on the best quality-breeding habitat. Beaver ponds are important habitats but have fluctuated greatly in numbers over time. Wetland loss continues through small-scale drainage and in filling. Slower and less obvious actions such as sedimentation and eutrophication decrease the functional value of wetlands to waterfowl, other wildlife and people.

Agricultural lands support a rich diversity of waterfowl species during both the breeding and staging period. The productive wetlands in this landscape result in the greatest breeding densities of all the landscapes in Atlantic Canada. Waterfowl estimates however, are limited by the lack of good survey information and population estimates are likely conservative. While loss of wetlands has resulted in a reduction of the waterfowl carrying capacity for breeding birds, the availability of nutrient rich food, both in the form of waste grain, and green forage has greatly

improved the value of this landscape for staging waterfowl. DU has been successful in securing and managing many of the highest quality wetlands in this landscape.

The vision that DU has set for this landscape is to protect the existing habitat base and increase waterfowl numbers through habitat protection and restoration.

Goals

- Double the waterfowl breeding population to 20,000 pairs, by increasing the average wetland density in the Maritimes from the current level of 2.3 ha/km^2 to 4 ha/km^2 through the protection and restoration of quality wetlands.

- Protect and restore wetlands and uplands within the St. Lawrence lowlands to provide habitat for 256,000 breeding pairs.

- Protect and restore 5,000 ha of nesting cover on critical nesting islands in the St. Lawrence River and estuary to enhance local production.

- Maintain the current quality DU projects and improve their management for waterfowl and other wildlife species towards the goal of 20,000 breeding pairs in the Maritimes.

Assumptions

- Physical and functional wetland loss has occurred and the potential for future expansion of both agriculture and urbanization exists.

- Quality, nutrient rich brood habitat is the major factor limiting waterfowl numbers.

- Nesting cover is usually not limiting, however, in areas of intensive agricultural activity, nesting cover and direct mortality factors such as predation and loss to farm equipment may be limiting waterfowl numbers.

- Recreational activities often cause significant disturbance to breeding waterfowl.

- Restoration of degraded wetlands will result in increased waterfowl populations providing that existing wetlands are not further degraded or lost.

- Maintain quality habitat for the 1.5 million staging waterfowl.

Strategies

- Develop a decision support system to focus conservation efforts in the most important and most at risk parts of this large and diverse landscape.

- Employ direct intervention to protect and restore wetlands.

- Use extension, easements and promote beneficial public policies to protect wetlands by focusing on wildlife friendly farming practices and upland threats such as soil erosion, wastewater management, non-native plant invasions and urban expansion.

- Monitor land use and social changes as well as waterfowl and wetland numbers to guide program adjustments.

Maritime Appalachian Forest Landscape

Landscape size	Atlantic region 204,625 km^2, Maritimes 110,500 km^2, Quebec 94,125 km^2
Proportion of the land-base	Atlantic region 9%, Maritimes 85%, Quebec 6%
Wetland area	Atlantic region 538,000 ha, Maritimes 350,000 ha, Quebec 188,000 ha
DU managed wetlands	Atlantic region 13,500 ha, Maritimes 11,500 ha, Quebec 2,000 ha
Breeding pairs of waterfowl	Atlantic region > 50,000, Maritimes 50,000, Quebec No Data.
Waterfowl goals	50,000 breeding pairs in the Maritimes

Overview

The Appalachian forest is the transition zone between the southern deciduous forest zone and the boreal coniferous region found further north. It contains mixed hardwoods and softwoods and is generally divided into highland and lowland regions. Sustainable or below sustainable levels of forest harvest is occurring in this landscape. Most of the land is privately owned (PEI 90%, NS 70%, NB 50% and QC 95%). Silvicultural activities are increasing to bolster long-term wood supplies. However, reduced wood supplies will push companies to harvest areas that are currently not economically feasible.

The wetlands in this region are generally nutrient poor, with many bogs. However, there are areas of quality wetlands. In the Maritimes, DU currently manages the majority of the productive wetlands in this landscape. Waterfowl breeding densities are typically low yet the landscape produces a significant number of waterfowl because of its size. Black ducks, green-winged teal, ring-necked ducks, goldeneyes and mergansers are the most common ducks. Significant beaver populations are maintaining a large number of ponds in this landscape.

Goals

- Maintain the existing wetland base to support the current breeding waterfowl numbers of 50,000 pairs.

- In the Maritimes, maintain the current quality DU projects and improvement management for waterfowl and other wildlife species.

Assumptions

- Wetland quantity is generally not limiting, but due to low inherent nutrient levels, the quality is.

- Waterfowl populations are stable.

- Current wetland densities are adequate to support existing populations.

- Beaver pond numbers will continue to fluctuate.
- Increased forestry practices and recreational activities will have negative impacts on habitat quality.
- Long-range air pollution has and is degrading water quality in poorly buffered systems.

Strategies

- Focus on the most important and threatened parts of this large and diverse landscape.
- Conduct research on the impacts of intensive forestry practices to help develop a better understanding of what strategies will be most applicable to achieving the goals.
- The need for forestry companies to achieve global environmental certification represents an opportunity for DU.
- Extensive rather than intensive conservation programs are most suitable for this landscape.

Eastern Boreal Forest Landscape

Landscape size	Atlantic region 715,446 km^2, NF 107,120 km^2, Quebec 608,326 km^2, Ontario 560,000 km^2
Proportion of total Land-base	Atlantic Region 32%, NF and Lab 29%, Quebec 36%, Ontario 57%
Wetland area	Atlantic region 3,086,000 ha, NF 686,500 ha, Quebec 2,400,000 ha
DU managed wetlands	Atlantic region 6,071 ha, NF 1,071 ha, Quebec 5,000 ha, Ontario 32,239 ha
Breeding pairs of waterfowl	Atlantic region 277,850, NF 32,100 ducks, 15,750 Canada geese, Quebec 230,000 ducks and geese, Ontario 450,000
Waterfowl goals	727,850 breeding pairs

The boreal forest zone encompasses 32% of the Atlantic Canada Region and more then 57% of Ontario. The boreal is basically a coniferous forest with some hardwood mix in southern latitudes. Half the boreal forest in NF is considered unproductive forest, which means it, cannot be sustainably harvested. Intensive forest harvesting is occurring close to NF pulp mills and expansion into Labrador is a real possibility. Ninety-nine percent of the forests in NF are Crown owned. Commercial forests cover 46% of Quebec and are Crown owned. In Ontario, over 90% of the land is Crown owned and 75% is considered productive commercial forest.

Wetlands are numerous, generally low in productivity, with more productive “pockets” occurring. Waterfowl are dispersed at low densities, yet the large land mass results in a significant proportions of the total Atlantic region’s black duck, green-winged teal, goldeneye, scoter and Canada goose production coming from the boreal forest. Beaver populations have

recovered from low levels in the 1940s and have created innumerable ponds. In Ontario, the vast size of the boreal forest results in a fall flight of more then 3.5 million waterfowl.

Forestry, hydroelectric development and acid rain have the most significant impact on this landscape. Forestry remains the primary land use. Current projections are for a wood shortfall over the next 20 – 30 years. There has been a significant increase in silviculture; however, it remains unclear if this will offset the shortfall. This shortfall will force forestry operations in areas currently considered unprofitable, thereby increasing human access. The most significant influence of forestry is likely the development of the road system allowing access to previously remote areas.

Goals

- Maintain the existing diverse habitat quality and quantity needed to sustain current breeding waterfowl numbers.

- Increase the availability of nesting cavities for declining goldeneye populations.

Assumptions

- Wetland quantity is generally not limiting, but due to low naturally occurring nutrient levels, the quality is.

- There have been significant historic declines in black duck, goldeneye and scoter populations. However, in the past 10 years, waterfowl populations including black ducks have been stable.

- Current wetland densities are adequate to support the existing populations.

- Removal of large snags is limiting nest sites for declining goldeneye populations.

- Beaver pond numbers fluctuate.

- Increased forestry practices and recreational activities will have negative impacts on habitat quality.

Strategies

- Acquire wetland inventories and more complete waterfowl surveys to focus conservation programs.

- Conduct research on the impacts of intensive forestry practices to help develop a better understanding of what strategies will be most applicable to achieving the goals.

- The need for forestry companies to achieve global environmental certification represents an opportunity for DU.

- Extensive rather than intensive conservation programs are most suitable for this landscape.

Arctic, Taiga and James/Hudson Bay Lowland Landscape

Landscape size	Atlantic region 1,329,795 km^2, Ontario 264,000 km^2
Proportion of the land-base	Atlantic region 60%, Ontario 27%
Wetland area	Atlantic region 22,796,900 ha, Arctic 2,070,000 ha, Taiga 18,300,000 ha, James Bay Lowlands 2,426,900 ha
Waterfowl breeding pairs	Atlantic region 674,350, Lab 65,200 ducks, 29,150 Canada geese, Quebec 580,000 ducks and geese, Ontario 657,000
Waterfowl goals	1,331,350 breeding pairs

This landscape encompasses 60% of the Atlantic region and includes tundra and lowland habitat as well as taiga that represent a transition zone between the boreal forest and tundra. In Ontario, this region represents 27% of the total land base, and contains the most extensive continuous wetland ecosystem in the world. There is limited human activity in this area. Wetlands are abundant but of limited productivity, with the exception of the relatively productive James Bay Lowlands. The land is owned either by the crown or aboriginal people.

Breeding waterfowl typically occur at low densities. However, significant areas of greater density occur adjacent to the coast and on the Ungava peninsula. Critical staging and breeding habitats occur within a 100 km band along the James and Hudson Bay. Common species include black ducks, Canada geese and scoters. Waterfowl production from this area makes a significant contribution to the Atlantic and Mississippi Flyways. Canada Geese of the Southern James Bay population have experienced significant population decline since the late 1980s. Breeding snow geese in the region have shown remarkable growth during the same period, resulting in concerns for breeding ground integrity and the future of the breeding populations. Low human activity results in little direct threat to wetlands or waterfowl. However, activities in this area are typically at a large scale and can potentially have significant consequences for waterfowl and wildlife. In addition, climate change may result in extreme long-term impacts.

Goal

- Maintain the existing diverse habitat quality and quantity needed to sustain the current waterfowl numbers.

Assumptions

- Wetland quantity is generally not limiting, but due to low naturally occurring nutrient levels, the quality is.
- Waterfowl populations have been stable.
- Current wetland densities are adequate to support the existing population level.

Strategy

- Monitor human activities and waterfowl and wildlife population trends.

Great Basin[7]

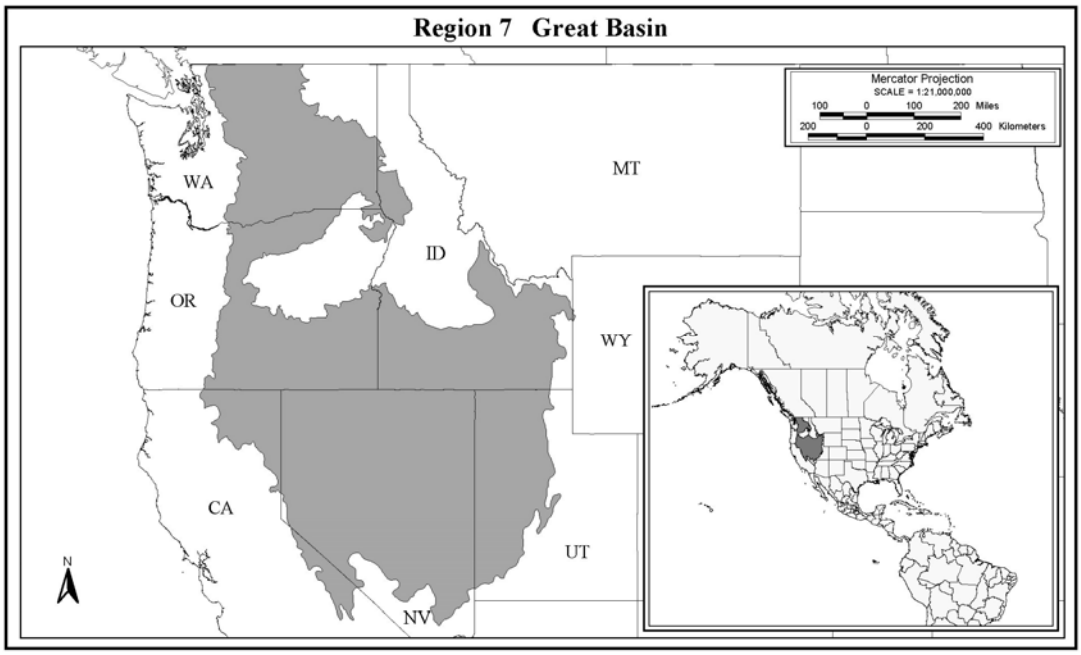
There are some 1.6 million ha of waterfowl habitat in the Intermountain West – Great Basin region of the U.S. (Sanderson 1980). There are two major subregions west of the Colorado Plateau and east of the Sierra/Cascade crest: (1) Columbia Basin/Snake River Plains and (2) Great Basin (Kadlec and Smith 1989). Precipitation varies widely in this region from >130 cm/yr on the western slope to <5 cm/yr in some parts of the desert. Higher elevations are interspersed with lakes, wet meadows, and streams. Lower elevations in the Great Basin are dominated by rivers with broad, meandering floodplains that typically flow into terminal basins. Springs and/or snowmelt feed most streams. Streams and rivers featuring extensive floodplain habitats that eventually flow into the Columbia River dominate the Columbia Basin, including the Snake River.

Important wetland regions in the Columbia Basin/Snake River Plains include: the channeled scablands and potholes region in eastern Washington, Yakima River floodplain, wetlands created and enhanced by the huge Columbia Basin irrigation project, mid-Snake River region, the mid-Columbia River region on the Oregon/Washington border, and the extensive marshes and floodplains in the upper Snake River basin in eastern Idaho, including the Henry's Fork watershed.

The Great Basin subregion is made up of many unique, expansive watersheds, most of which have no drainage to the sea. Most of the watersheds in this region end in terminal basins. Wetlands in the Great Basin are generally associated with rivers, lakes, or springs, or are formed as terminal basins. Some 45 significant terminal basin lakes exist today in the Great Basin, covering about 1,012,000 ha, of which almost half is the Great Salt Lake and associated wetlands found along the Bear, Jordan and Weber Rivers. Other important wetland habitats for waterfowl in this region include: Ruby Lake and Stillwater/Carson Sink in Nevada; Malheur-Harney Lakes, Upper and Lower Chewaucan Valleys, Warner Valley, Lake Abert and Summer Lake in Oregon; and the Klamath Basin marshes and Goose Lake found along the Oregon-California border.

Water quality and quantity are the chief concerns for Intermountain West and Great Basin wetlands. Competition for water from municipal, agricultural, and industrial uses continues to alter hydrologic functions of western wetlands. Population levels in several areas of the Great Basin are growing at a rate well above the national average. Certain areas in Idaho, Utah, Nevada and eastern Washington are experiencing rapid growth. Human populations in some of these areas have doubled in the last 10 years. This growth has increased the demand for urban water in these areas, often at the expense of both agriculture and wildlife. Competition for water will become more intense as population levels continue to increase. In the Great Basin, both Owens and Winnemucca Lakes had been totally dried by water diversions prior to 1950. Bottoroff (1989) states that 85 to 90% of Klamath Basin wetlands have been lost. A review of the biological, limnological, and historical changes (primarily induced by humans) in eight of the most important saline and alkaline Great Basin lakes describes how these changes may have affected the lakes' ability to support breeding and migratory birds during the past 150 years (Jehl 1994). Based on this review, Jehl (1994) concluded that only Mono Lake, Pyramid Lake and perhaps the Great Salt Lake will likely remain largely unchanged in their ability to support current population levels of migratory birds well into the next century. Surface modifications to intercept precipitation and snowmelt runoff have resulted in the single greatest impact on Great Basin wetlands (Engilis and

[7] NABCI Bird Conservation Region 9 (U.S. only – Canada Great Basin is covered in British Columbia Intermountain Region (BCR 9 and 10.)



Reid 1997). Trans-basin water diversions will only increase degradation to Great Basin wetland complexes and aquifers.

Avian botulism is a common and long-standing disease that kills thousands of waterfowl and other waterbirds in the Great Basin annually. Botulism is most common from August through October when waters are hot, stagnant, and of low oxygen content. Consequently, the effects of botulism are most dramatic on breeding, molting, or staging birds. Livestock grazing is a common land use in the Great Basin. Livestock, particularly cattle, can cause a variety of problems for wetlands and waterfowl including degradation of water quality and nesting habitat (Ratti and Kadlec 1992). Solar evaporation operations, primarily for magnesium and potassium, on the east and south end of the Great Salt Lake and other saline basins are having an adverse impact on both hydrology and plant and animal life. The evaporation ponds interrupt the water flows and the elevated mineral levels displace organisms such as brine shrimp, which has an impact on bird use.

Other impacts to waterfowl habitat have occurred as the result of introduced species, such as the common carp introduced from Europe. Historical records from the U.S. Fish and Wildlife Service indicate that Malheur Lake produced 50,000 fledged mallards each year as recently as the 1950's. The lake was also once the most important staging area for canvasbacks in the intermountain west. A dramatic increase in carp numbers in the lake has virtually eliminated vast expanses of sago pondweed and other emergent and submergent aquatic plants. Today, only a handful of waterfowl are produced in Malheur Lake itself and canvasbacks are only seen in very small numbers during migration periods.

Importance to Waterfowl

The importance of the Great Basin and the Columbia/Snake Basin to waterfowl is perhaps best captured by Kadlec and Smith (1989:451) who state: "In contrast to the perception that the Great Basin is a 'desert' of little value to waterfowl, the reality is that the marshes and wetlands are of higher value to waterfowl than are many areas in wetter regions. In fact, the very rarity of marshes in a dry region adds to their value." Because of limited numbers of wetland

stopovers in the Great Basin, large and spectacular concentrations of migrating waterfowl often are found on suitable areas (Chattin 1964, Smith and Kadlec 1986). Prior to transbasin water diversions, both Owens and Mono Lakes held over 1 million ducks at one time in fall migration (Reid et al. 1997), and the Great Salt Lake marshes have recorded similar fall usage. Waterfowl population estimates on Mono Lake in 1948 indicated peak migrant numbers "well over a million ducks" by 1 November, principally northern shovelers and ruddy ducks. Recent estimates during the 1980s-90s indicate that no more than 15,000 ducks use the Mono Basin annually (Reid et al. 1997). The Klamath Basin has attracted greater than 5 million waterfowl during migration, and prior to water diversions and habitat degradation was considered the single most important waterfowl habitat in the U.S. (Gilmer et al. 1982). Great Basin wetlands provide important waterfowl breeding grounds, primarily for mallard, northern shoveler, cinnamon teal, gadwall, and redhead.

From 1966-90, the ten-year average for total ducks produced in the Columbia Basin alone was over 535,000 birds. Other divers with significant breeding populations include ruddy duck and canvasback. Some 18 species of waterfowl nest at Malheur, Klamath, Great Salt Lake, Carson Sink, and Ruby Lake. Many of these sites are also critical staging areas for ducks, especially northern pintail and northern shoveler. In addition to waterfowl, millions of shorebirds use these lakes during breeding and migration periods. Great Basin marshes are critical to sandhill cranes, eared grebes, white-faced ibis, American avocet, phalaropes, black-necked stilts, snowy plover, white pelican, California gull, and black tern. Wintering populations of bald eagles are some of the highest in the contiguous 48 states. The Klamath Basin winters 2,000 bald eagles while marshes on the east side of the Great Salt Lake winter 1,000 birds. Golden eagles, peregrine falcons and a host of other raptors forage in Great Basin wetlands throughout the year. These birds regularly nest on cliffs adjacent to the wetlands. The basin and range makeup of the area provides migration corridors for a host of neo-tropical species.

Few areas in the world have more spectacular concentrations of fall migrants than does the Great Basin. Estimates of migrants through the Great Basin include 2 million northern pintail and 1.5 million mallard (Kadlec and Smith 1989). Estimates of American wigeon are 0.7 million and both green-winged teal and northern shoveler are at 0.5 million. The Snake River and Columbia Basin may winter some 32,000 Canada geese and 1.1 million mallards. The entire Rocky Mountain trumpeter swan population winters in the tri-state area, south to Great Salt Lake.

Current Conservation Programs

Currently, DU is assisting a variety of cooperators in the delivery of more than 100 wetland projects in the Great Basin on both private and public lands. These projects will enhance or protect upland and wetland habitats on more than 30,000 ha. Total costs for these efforts will exceed $10 million. Included in this restoration work are several NAWCA funded projects in such widely diverse areas as the Lower Colorado River, Goose Lake Basin in Oregon, Malheur/Harney Lakes Basin, Bear Lake in Idaho, Channeled Scablands of Washington, Henry's Fork in Idaho, and the Great Salt Lake. The Malheur Lake project includes enhancing 4,050 ha of wetlands by excluding carp. The Lower Colorado River project will protect over 1,000 ha of floodplain wetlands and 175 ha of riparian forest. These habitat improvements will directly benefit waterfowl, Yuma clapper rail, willow flycatcher, and several species of indigenous fish. The Great Salt and Bear Lake projects will protect and enhance threatened wetland and upland habitat in southeastern Idaho and northern Utah. The projects will protect and enhance more than 6,400 ha of threatened wetlands and provide habitat for nesting and migrating waterfowl, as well as bald eagles, peregrine falcons, ospreys, and trumpeter swans. The projects in the Channeled Scablands of eastern Washington will restore and enhance several thousand acres of waterfowl

breeding habitat. The Goose Lake project in Oregon will protect the largest remnant bulrush marsh in the Goose Lake basin, protecting the nesting habitat for over 9,000 white-faced ibis.

Goals (2005-2009)

- Protect and restore/enhance 4,050 ha of private land utilizing a variety of private, state and Federal partnerships.

- Restore or enhance 10,100 ha of public land in cooperation with state and federal agencies.

- Establish and expand technical assistance efforts to encourage proper land management on private lands.

- Develop new partnerships, both public and private, to secure additional income sources to support DU's conservation programs.

- Provide technical assistance to public and private land managers.

Assumptions

- The scarcity of wetlands throughout the Great Basin makes them extremely valuable to waterfowl, other waterbirds and wetland dependent wildlife for breeding, migration and molting waterbirds.

- Artificial and naturally occurring concentrations of heavy metal contaminants, primarily selenium, may result in avian mortality or reduction in egg viability.

- Urbanization and water diversions for municipal and agricultural use will continue to negatively impact wetlands.

- Livestock grazing and other agricultural practices can be managed to lessen negative impacts to wetlands and waterfowl.

- Botulism will continue to be a chronic source of waterfowl/water bird mortality in the Great Basin.

Strategies

- Prioritize wetland restoration and protection projects in areas that provide important breeding and migration habitat for waterfowl.

- Develop wetland restoration and protection programs geared towards private landowners in key areas throughout the region, including the Channeled Scablands and potholes region of eastern Washington, the Silvies River floodplain in the Malheur Lake basin, the Klamath Basin, and the upper Snake River region.

- Recognize that operations and maintenance costs are a reality for many of the private and public wetland managers in the region, and provide assistance to those landowners wherever possible in order to maintain high quality wetland habitat that provides long-term benefits to waterfowl.

- Develop and implement a land protection program that emphasizes conservation easements to protect and restore key landscapes and water rights.

- Implement carp control projects in basins that have been decimated by the proliferation of this species.

- Promote helpful public policies for general land use and water management, particularly those that provide recognition to the fact water delegated to wildlife is a beneficial use of the resource.

- Assist in efforts to intensively manage seasonal wetland habitats where appropriate, primarily on publicly managed areas and certain privately owned parcels managed primarily for waterfowl.

February 1, 2005 – Region 7

General editing and minor improvements throughout the text

British Columbia Intermountain[8]

The Intermountain Ecological Region (Intermountain) of British Columbia includes the Canadian portion of the NABCI Great Basin and the majority of the Canadian portion of the Northern Rockies Bird Conservation Regions. It occupies approximately the southern half of the province. The region is delineated by the crest of the Coast Mountains on the west, the crest of the Rocky Mountains on the east, the southern extent of the boreal forest to the north, and the boundary with the United States on the south. The region covers 320,000 km^2, over 34% of the area of BC, and supports a breeding waterfowl population of approximately 1.1 million birds. Four percent of this area (12,300 km^2) is lakes and wetlands. The Intermountain contains 4 ecoprovinces, including 10 ecoregions and 37 ecosections. Elevation ranges from 200 meters to over 3,000 meters above sea level. Within the Intermountain, the habitats most important to waterfowl occur in the valleys and on mid-elevation plateaus.

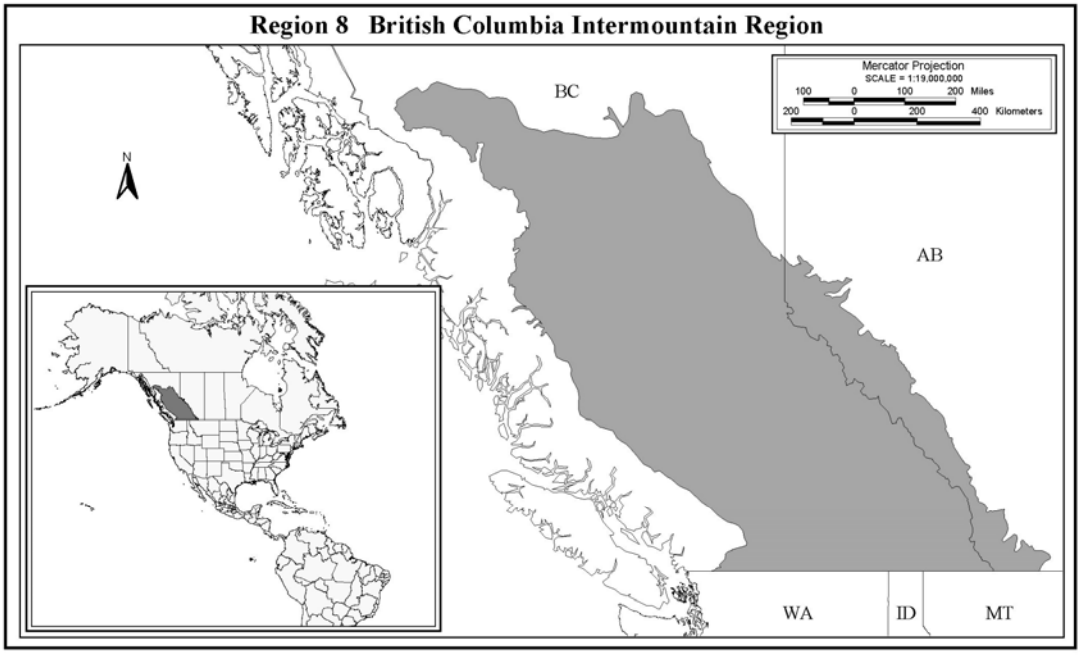
Ninety-two percent of BC is publicly owned provincial Crown land with the remainder privately owned, First Nations reserves, or parks. The majority of wetland drainage has taken place on private land in valley bottoms where up to 80% of wetlands have been drained. While the few wetlands remaining on private land are highly productive, by far the majority of remaining waterfowl habitat exists on Crown land. Crown land is available to the public and its regulation is defined by public policy and legislation.

Importance to Waterfowl

The Intermountain contains important breeding habitat for 26 species of ducks as well as Canada geese. Two conservative provincial estimates of breeding waterfowl populations suggest about 1.7 million ducks breed in BC or approximately 4% of the breeding waterfowl population in Canada. It is particularly important to Barrow's goldeneyes and provides breeding habitat for more than 60% of the world's population of this species. A recent effort to calculate the number of waterfowl breeding in the interior alone suggests 1.1 million ducks or 65% of the total provincial waterfowl population breed in the Intermountain. Density of breeding waterfowl in the Intermountain ranges as high as 36.3 pairs/km^2 (94 pairs/mi^2) in some locations.

Population data from 1967-69 and 1987-98 suggest that mallards, northern pintails, blue-winged teal, common goldeneyes, ruddy ducks, harlequin ducks, common mergansers, and red-breasted mergansers have markedly declined in abundance in BC during the last 30 years. More recent trend estimates also suggest that Barrow's goldeneyes and lesser scaup are declining throughout the Intermountain. Although it is unclear what factors may have contributed to these declines, it is likely that wetland loss and rangeland degradation have been key factors contributing to the decline of dabbling ducks. Intensified logging activities, and its accompanying negative effects on wetland and riverine habitats, have likely contributed to declines in several species of diving ducks.

[8] NABCI Bird Conservation Regions 9 & 10 for the Canadian Intermountain only



In addition to providing important breeding habitat for waterfowl, the Intermountain is used extensively by migrating and wintering waterfowl. The strategic location of the Intermountain between significant breeding areas in Alaska and key wintering areas in California and western Mexico contribute to heavy use of this region by migrating waterfowl. Up to 8 million waterfowl comprised of 38 different species migrate through the interior of BC. Also, growing numbers of waterfowl winter on the rivers and large lakes in the Intermountain. Notably, more than 2,000 of the world's remaining 19,000 trumpeter swans currently winter in the Intermountain.

Importance to Other Wildlife

In addition to being important to waterfowl, the habitats in the Intermountain are valuable to other species as well. British Columbia is one of the most biologically diverse regions in North America and certainly the most biologically diverse province in Canada. Excluding marine fish, BC contains 732 species of vertebrates including 467 species of birds, 143 species of mammals, 19 species of reptiles, 20 species of amphibians, and 83 species of freshwater fish, many of which rely on habitats in the Intermountain. Nearly 300 species of birds breed in the province, 40 of which breed nowhere else in Canada. Furthermore, the province has 2,073 species of native plants of which nearly 20% are currently considered at risk. Most of the province's threatened and endangered wildlife and plants are found in the grassland districts of the southern Intermountain.

Habitat Characteristics, Impacts and Limitations

Although topography contributes to habitat diversity, we define 4 landscapes based on major land uses within the past 150 years, namely ranching, forestry, crop-based agriculture, and urbanization. These uses loosely define the following landscapes: Rangeland, Forestland,

Agriculture/Forest Fringe, and Urban and Urban Fringe. Because land uses are not necessarily confined to specific areas, the defined landscapes overlap each other to varying degrees.

Rangeland includes 5 million ha of natural grasslands, open forests, and aspen parklands, as well as 250,000 ha of lakes and wetlands, making up 16% of the Intermountain. Lower elevation grasslands and open forests are generally privately owned while higher elevation grasslands and forested rangelands are Crown land. Rangeland wetlands are some of the more productive habitats in the Intermountain, supporting at least 300,000 breeding ducks. While breeding pair densities as high as 7 pairs/ha have been documented on individual wetlands, 2.5 pairs/ha is more typical of average waterfowl habitat. Over 100 years of unmanaged livestock grazing have depleted the vegetation in and around many wetlands, reducing nesting and brood-rearing cover. While range management practices have improved since the 1950s, degraded wetland and upland conditions continue to limit waterfowl productivity.

Forestland makes up 80% of the Intermountain, containing 1,000,000 ha of lakes and wetlands, and supporting approximately 800,000 breeding waterfowl. Although grazing occurs in part of the forestland, timber harvest and management practices affect the majority of the landscape. Impacts include altered water regimes with faster freshets, increased erosion and sedimentation, increased downstream nutrient loading, blowdown along cutblock edges and riparian areas, reduced beaver populations, loss of wildlife trees, and suppression of natural deciduous regrowth following logging. While loss of wildlife trees is obviously detrimental to cavity-nesting waterfowl, other alterations may have a more subtle effect on waterfowl populations and species. There are some private woodlots, but the majority of Forestland is publicly owned Crown land.

The Agriculture/Forest Fringe landscape is defined by the area currently in crop-based agriculture (hay, tame pasture, cereal grains), as well as the adjacent forest fringe into which it will expand in the future. While agriculture occurs in valley bottoms throughout the Intermountain, the projected area of expansion into the forest fringe is primarily focused in the Nechako Valley in the northern part of the region. Approximately 500,000 ha of Crown Forestland are suitable for crop production and approximately 7,500 ha are logged, drained and converted to privately owned agricultural land each year. The Agriculture/Forest Fringe landscape makes up only 4% of the Intermountain, but together with the urban landscape, contains the majority of drained wetlands. A minimum of 20,000 ha of wetlands has been drained to accommodate agriculture. Forty-five thousand ha of wetlands remain in this landscape, supporting approximately 70,000 breeding waterfowl. Given the high productivity of agricultural habitats, this drainage could have resulted in the loss of 140,000 breeding pairs.

The Urban and Urban Fringe landscape is made up of the populated urban areas together with the surrounding habitats into which expanding populations are expected to grow. The current Intermountain population of 900,000 people is expected to increase by 38% in the next 20 years. Towns have a history of draining, filling and building on wetlands as they grow. Present urban area covers 150,000 ha but nearly 9,000,000 ha of Agriculture/Forest Fringe, Rangeland and Forestland falls within 10 km of these areas and is particularly susceptible to impacts from urban expansion, hobby farms, and increased recreational activities. Over 400,000 ha of lakes and wetlands fall within the Urban and Urban Fringe landscape, supporting approximately 400,000 breeding waterfowl.

Current Conservation Programs in the Intermountain

Waterfowl conservation programs began in earnest in the Intermountain in 1968, when at the invitation of the provincial government, Ducks Unlimited moved to BC and opened an office in Creston. Since then, DU has expanded activities throughout the Intermountain with key focus areas in the Kootenay and Columbia River valley's, the grasslands of the Thompson Okanagan River valleys, the vast Cariboo-Chilcotin plateaus and the Nechako River valley.

The primary emphasis in the Intermountain until the late 1980s was to provide adequate water for waterfowl breeding habitat to the arid wetland landscapes. This resulted in the construction of over 550 water control projects, in cooperation with other partners, covering more than 50,607 ha at a cost of approximately $30 million. A major shift in DU's approach to waterfowl conservation programs began in the late 1980s when funding partners were actively recruited to help deliver broader, landscape projects extending beyond water management to include uplands. In 1992, Ducks Unlimited and the Canadian Wildlife Service (CWS) embarked on the Interior Wetlands Program (IWP) to encourage new approaches to land use and management that would benefit waterfowl, other wildlife, fisheries resources and agriculture. The main objectives were to promote land use practices that would result in healthy wetland and upland vegetation for food, nesting and escape cover for waterfowl and other wildlife, maintained or improved water quality and quantity and sustainable agriculture. The six year, $4.2 million program delivered by DU secured 10,121 ha of high quality habitat and involved over 100 partners and cooperators who provided time, resources and expertise. Each of the 31 projects contained an extension component whereby information was shared with many other landowners to protect high quality habitat from incompatible use. Projects were evaluated to ensure that future waterfowl needs could be more accurately addressed.

The final report of the IWP was completed in 1998 and recommended that future programs would include the entire Intermountain, increase partnerships, expand extension activities, and continue program evaluation. Although the program created an awareness of the overall functioning of wetland landscapes, surveys indicated that the job had just begun. As a result, DU and CWS, together with other potential partners, developed the Intermountain Wetland Conservation Program (IWCP). The IWCP became a partnership of 12 organizations with a mission to maintain, enhance, restore or manage BS's intermountain wetland landscapes. Delivery of the IWCP will commence in the year 2000.

Goals and Strategic Directions for BC Intermountain Landscapes

Rangeland

Goals

- To increase waterfowl populations and recruitment to levels that may have been experienced prior to the destructive grazing practices which began in the 1850s.

- To increase average pair density on approximately 55,000 ha of productive wetlands (0 to 20 ha in size) by 2.5 pairs/ha. This would double the duck population to 575,000 breeding birds.

- To increase production to 2 broods/ha.

Assumptions

- Waterfowl populations are below historical levels due to habitat impacts.
- Improving habitat conditions will increase breeding populations.

Strategies

- Maintain and enhance the regulations, legislation and policies that improve habitat quality.
- Increase public and land user awareness of the importance of wetlands and beneficial range management practices.
- Minimize or eliminate practices that destroy or degrade waterfowl habitat.
- Identify key research on waterfowl ecology to identify limiting factors.

Forestland

Goal

- Maintain current waterfowl populations and species composition.

Assumptions

- Waterfowl populations have not changed in 30 years.
- Impacts of forestry practices on waterfowl are poorly understood. Natural ecological processes maintain waterfowl habitat and populations.

Strategies

- Encourage forestry practices that emulate natural ecological processes.
- Maintain wetland habitat quantity and quality.
- Retain and enhance policies and legislation that result in the conservation of wetland habitat and provide appropriate mitigation or enhancement measures where habitat degradation has occurred.
- Encourage more research to identify factors that limit waterfowl abundance.
- Discourage single species management, such as fish introductions or monocultural reforestation.

Agriculture/Forest Fringe

Goals

- To restore 9,000 ha of the most productive wetlands in the agriculture area while maintaining the proportion of wetlands in the forest fringe at 5% by preventing further agricultural encroachment on wetlands.

- To increase waterfowl populations by approximately 45,000 ducks by supporting breeding pair densities of at least 2.5 pairs/ha.

Assumptions

- Waterfowl populations have declined due to wetland drainage, clearing and agricultural development.

- Restored wetlands will be used by breeding waterfowl and will result in increased populations

Strategies

- Improve landowner attitudes towards wetland and upland values.

- Identify and restore drained wetlands.

- Revise legislation that promotes wetland drainage and impacts.

Urban and Urban Fringe

Goals

- To achieve no net loss of wetlands due to urban expansion and see degraded and drained wetlands restored to mitigate lost wetlands.

- To maintain wetland habitats in a productive natural state.

- To maintain current waterfowl populations and recruitment rates in urban areas.

- To maintain or increase waterfowl populations and recruitment rates in urban fringe areas.

Assumption

- Net wetland loss can be stopped.

Strategies

- Use urban wetlands to provide venues for education, extension and fundraising activities.

- Maintain and influence planning processes and land use policies that will affect wetland conservation.

- Encourage mitigation for lost habitat.

Northern Rockies and Southern Rockies / Colorado Plateau[9]

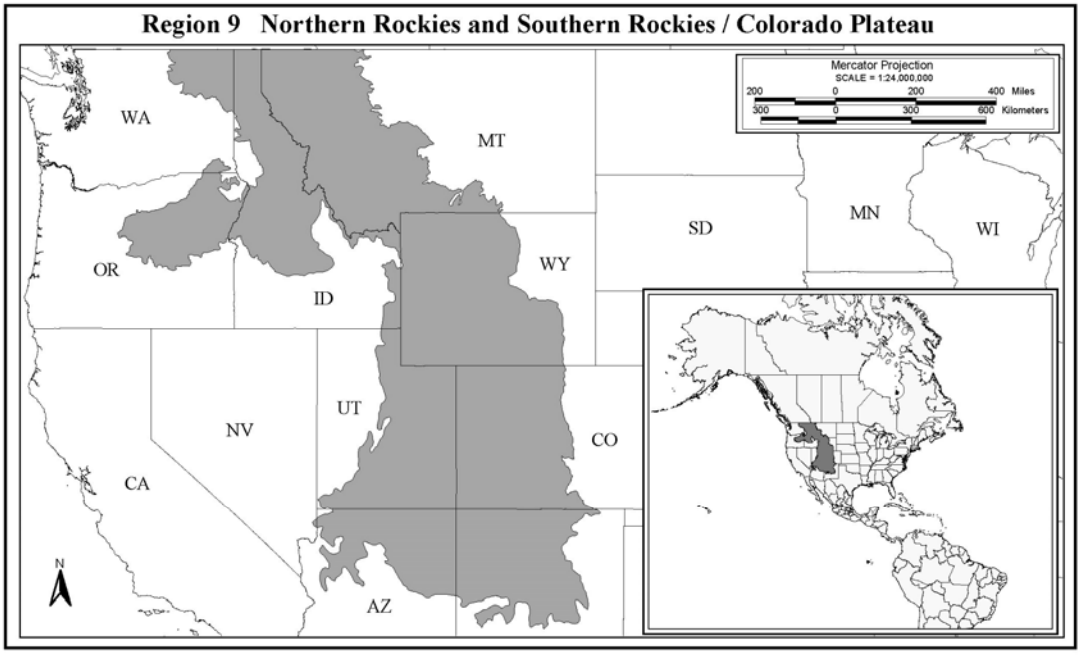
The Northern Rockies and Southern Rockies / Colorado Plateau Regions (RCP) include several ecosystems ranging from alpine tundra to sagebrush flats. Much of the diversity of the RCP is attributable to its topographic relief, which ranges from 1,000 to 4,300 m. Elevation changes result in ecosystem regions or "life zones" characterized by differences in precipitation, humidity, temperature, growing season, wind, exposure, and soil conditions. The four life zones recognized in the Rocky Mountains -- Lower Montane, Upper Montane, Subalpine, and Alpine -- possess unique flora and fauna. The Alpine has few woody species (mostly willows), but contains abundant grasses and forbs characteristic of vegetation at much higher latitudes. Subalpine areas contain Englemann spruce and subalpine fir. Upper Montane habitats are somewhat drier, and are dominated by blue spruce, Douglas fir, and several other coniferous species. Lodgepole pine and aspen are the most common species in Lower Montane areas. Depending on the latitude, sagebrush, rabbitbrush, and black greasewood are the dominant species in the intermountain basins.

Waterfowl habitats in the RCP have several attributes that set them apart from their prairie counterparts. First, montane wetland communities are relatively intact compared with the widespread wetland degradation typical of the northern Great Plains. This more nearly pristine condition reflects the rugged topography and generally poor soils of the region, which favors ranching, timber harvest, and mining over farming. Additionally, many areas are afforded some degree of natural resource protection by virtue of their inclusion in the National Forest System or as BLM holdings. The most secure areas are lands set aside as wilderness areas or research natural areas. Second, except where locally affected by mining operations and ski areas, for example, upland plant communities are still dominated by native plant species. Third, although the magnitude of the snowpack and rainfall varies annually, precipitation is almost always sufficient to provide adequate water for ducks and geese. Thus, waterfowl habitats in the RCP is relatively stable compared with those in the prairies.

The geology and topography of the RCP create a greater diversity of wetland types than are found in the prairies. Annual primary production decreases with elevation, so wetland succession proceeds much more slowly in montane wetlands than in low elevation ponds. Most high elevation wetlands are slightly acidic to circumneutral and contain relatively small amounts of dissolved nutrients compared to a typical prairie wetland. Accordingly, only some wetland communities -- intermountain basin wetlands, beaver ponds, glacial ponds, and riparian corridors -- are heavily used by waterfowl. Understanding the nature of these wetland communities is important to the success of any waterfowl management initiative in the RCP.

The intermountain basins or "parks" of the RCP contain the most important waterfowl habitats in the region. The flat or rolling topography typical of mountain parks, which originated from tectonic and volcanic events during the formation of mountain ranges, is underlain by deep layers of alluvial material eroded from the surrounding mountains. Although relatively few in number -- 33 parks have been identified in the RCP -- intermountain basins are often several hundred square kilometers in size. Many parks are considered cool deserts because of the low precipitation created by the rain shadow of surrounding mountains. The average frost-free period may be <2 months. Despite low seasonal temperatures, ratios of precipitation to evaporation are

[9] NABCI Bird Conservation Regions 10 & 16. Region 10 in Canada is covered in above section.



usually <1, causing the development of pedocal soils. Where alkali deposits occur in poorly drained areas, salt-tolerant plants such as black greasewood and saltgrasses are common. Less saline areas typically contain wheatgrasses, bluegrasses, sedges and rushes, or shrubs such as sagebrush and rabbitbrush. Ranching and haying are the most common land use, but some grain crops and cold-weather vegetables are grown in more temperate parks. Many intermountain basins contain relatively few wet areas, but some -- such as the 13,000 km^2 San Luis Valley in south-central Colorado -- possess abundant wetlands. Wetlands are formed by spring runoff, which creates shallow water areas and recharges the persistently high water tables, and by artesian flows and impoundments. Lakes and reservoirs provide important migratory staging and molting habitats, and lake margins attract breeding waterfowl. High densities of aquatic invertebrates such as freshwater shrimp and the larvae of dragonflies, midges, flies, and mosquitoes abound in these wetlands, providing abundant food for waterfowl.

Beaver ponds most commonly occur in mid-elevation, montane valleys where the slope is <15%. Because beaver ponds are often clustered in "flowages" along suitable lengths of streams and rivers, they provide a valuable wetland community well suited to the needs of breeding waterfowl. Densities of 5 to 10 ponds/km of stream are common, increasing to as many as 42 ponds/km in excellent habitat with high beaver populations. Wetlands created by beaver possess relatively stable water levels maintained by precipitation and runoff. However, beaver flowages themselves may be somewhat ephemeral in nature, and usually are abandoned within 10-30 years, after beaver deplete their food resources. Beaver ponds act as nutrient sinks by trapping sediments and organic matter that otherwise would be carried downstream. This function enhances wetland fertility and the plant and aquatic invertebrate communities exploited by waterfowl. Invertebrates typical of running water systems are replaced by pond organisms such as snails, freshwater shrimp, and the larvae and immature stages of caddisflies, dragonflies, flies, and mosquitoes. Structural cover provided by flooded willows, alders, sedges, burreeds, and other emergents affords ideal habitat for waterfowl breeding pairs and broods.

Glacial ponds include both small wetlands formed behind lateral and terminal moraines of glaciers, and "kettle ponds" created by the same glacial process that formed the prairie "potholes" -- ice embedded in glacial till melted after glaciers retreated, forming depressions that later filled with water. Glacial wetlands most commonly occur in mountainous terrain. Often, these ponds are dependent solely on spring runoff and summer precipitation for water. Therefore, water levels recede during summer, while density and abundance of herbaceous, emergent vegetation increases. Despite dynamic water levels, natural succession is slow. Peat accumulations indicate that some glacial ponds have persisted as wetlands for >7,000 years. Northern mannagrass, sedges, and reedgrasses are common emergent plants in these wetlands, as are submerged species such as pondweeds, watermilfoils, and cowlilies. Often, the size and physical setting of glacial ponds restrict waterfowl use to dabbling ducks, which can land and takeoff in confined areas. The shallow water of these ponds is unsuitable for sustaining fish populations, which might otherwise compete with waterfowl for aquatic invertebrate foods. The abundant plant and animal foods in glacial ponds make these wetlands very attractive to waterfowl.

The headwaters of many major river systems begin in the RCP. At high and mid-elevations, these streams and rivers often flow unrestricted by major dams and diversions. Accordingly, overbank-flooding wetlands develop along riparian corridors during spring runoff, creating potential habitat for waterfowl. Unfortunately, the timing of runoff, from late April and May in Lower and Upper Montane Zones to June and early July in Subalpine areas, may actually be detrimental to waterfowl nesting along river margins or on islands in the main channel. It is not unusual for nests of ducks and geese to be flooded by runoff. Nonetheless, the backwaters, sloughs, and old oxbows associated with western riparian areas provide important benefits to waterfowl during spring and fall migration, and for waterfowl that select nesting sites on higher ground away from flood-prone areas.

Other riverine systems in this region have been negatively impacted by significant man-made alterations, including dams and flood control levees. Most of this alteration was implemented to improve agricultural viability within the region by storing water for irrigation and preventing flooding of croplands and haylands. While these alterations to natural hydrology have negatively impacted waterfowl habitat, many of these systems continue to provide important resources to waterfowl and offer ideal locations to focus habitat conservation activities. The Baker Valley and Lower Powder River Valley in Baker County, Oregon provide significant resources to spring migrating waterfowl and have been the focus of several conservation projects. The Grande Ronde Valley in northeast Oregon is the home of the Ladd Marsh Wildlife Area. Several projects have been completed, or are underway, in this area. Combined, these projects will restore approximately 506 ha of wetland habitat, providing significant benefits to both migrating and locally breeding waterfowl. The Kootenai River valley in the Idaho panhandle is another floodplain system that has been extensively altered by levee construction. Several projects have been completed to restore over 405 ha of wetland habitat in this area.

Waterfowl Resources

Waterfowl populations in the RCP have not been well studied. Most research has been conducted in mid-latitude habitats between 2,100-3,000 m elevation. Surprisingly, waterfowl are common in these areas. Generally, peak waterfowl populations occur during spring and fall migration periods, particularly in the intermountain basins and riparian corridors. In beaver ponds and glacial wetland habitats, numbers of waterfowl decline as females proceed with incubation and males seek larger wetlands for the molt. Often, a molt migration occurs from higher elevation forested habitats to large lakes and reservoirs in intermountain basins. During fall, post-fledging

young birds also move toward lower-elevation staging areas in mountain parks. Most mid-latitude montane wetlands freeze during October, greatly reducing the amount of available wetland habitat. Some wetland areas, however, such as the San Luis Valley in Colorado, retain open water areas as a result of warm water flowing from springs and artesian wells. Major river systems also afford winter habitat, particularly if cereal grain crops or other foods are located nearby.

Species composition of the waterfowl in the RCP varies seasonally and in relation to the wetland community (Table 2). Mallards and green-winged teal are usually the most common species in both intermountain parks and high elevation Montane and Subalpine zones. Gadwalls, northern pintails, American wigeon, cinnamon teal, northern shoveler, redheads, lesser scaup, and Canada geese are other common breeders in the intermountain basins. Trumpeter swans are important year-round residents in the northern RCP in and around Yellowstone NP. In beaver and glacial ponds of the Upper Montane and Subalpine zones, ring-necked ducks, Barrow's goldeneyes, buffleheads, and gadwalls are common. The peak of nest initiation for early-nesting ducks (mallards and green-winged teal) varies from early May to early June, depending on snow conditions and wetland availability. Late-nesting species such as ring-necked ducks begin nesting nearly a month later than early-nesting species.

Table 2. Relative species abundance of waterfowl in different RCP wetland types during spring and fall migration (M or m), breeding (B or b), and wintering (W or b) periods. Uppercase letters denote greater relative abundance than lowercase letters (from Ringelman 1992).

Species	Intermountain basin wetlands	Beaver ponds	Glacial ponds
American wigeon	M,B	b	b
Barrow's goldeneye	m	m,b	m,b
Blue-winged teal	m,b	--	--
Bufflehead	m,b	m,b	m,b
Canada goose	M,B,w	b	--
Cinnamon teal	m,B	--	--
Common merganser	m	m,b	m,b
Gadwall	M,B	b	b
Green-winged teal	M,B,w	m,B	m,b
Lesser scaup	M,B	--	--
Mallard	M,B,w	m,B	m,B
Northern pintail	M,B,w	--	--
Northern shoveler	M,B	--	--
Redhead	M,B	--	--
Ring-necked duck	m,b	M,B	M,B
Ruddy duck	m,b	--	--
Trumpeter swan	b,w		
Tundra swan	M,w	--	--

The waterfowl population in the RCP is not known, although it is recognized that breeding densities of waterfowl vary greatly within the region (Table 3). This variation is largely attributed to wetland density and the availability of open water to attract and hold spring migrants. Wetlands larger than 0.4 ha receive most of the use by breeding ducks, although much smaller wetlands are also frequented. Considerably larger wetlands are needed to attract molting

birds and fall migrants. Some intensively managed habitats achieve remarkable high breeding densities. For example, the 57 km^2 Monte Vista National Wildlife Refuge (MVNWR) in Colorado's San Luis Valley averaged 107 duck nests/km^2 over a 27-year period, and some individual wetland units exceeded 1,158 nests/km^2 in some years (Gilbert et al. 1996). This compares favorably to nesting densities in the best prairie habitat. Moreover, at MVNWR the Mayfield duck nest success is estimated at 26-29%. The relatively unfragmented habitat and indigenous predator community typical of many areas of the RCP undoubtedly contributes to this high nest success. The combination of high nest success and potentially high breeding densities underscores the management potential of some portions of the RCP.

Table 3. Waterfowl breeding pair densities in portions of the RCP (from Ringelman 1992).

Waterfowl density (pairs/km^2)	Area sample (km^2)	Elevation (m)	Location (habitat type)
0.62	93	2,285-3,047	Uinta Mountains, Utah (Upper Montane)
0.62	47	2,742-3,047	White River Plateau, Colorado (Upper Montane)
1.58	1,774	2,437-3,047	San Juan Mountains, Colorado (Upper Montane)
8.42	18	2,590-2,894	Park Range, Colorado (Upper Montane)
0.19	2,331	2,559-3,016	South Park, Colorado (Intermountain Basin)
2.01	12,950	2,255-2,437	San Luis Valley, Colorado (Intermountain Basin)
10.50	1,549	2,437-3,047	North Park, Colorado (Intermountain Basin)

A few waterfowl populations depend heavily on the resources provided in the RCP. The mid-continent trumpeter swan population is centered in the region, and is heavily dependent on the submergent vegetation that develops in the wetlands and river systems of northwestern Wyoming and northeastern Idaho. Despite the many problems these birds encounter when trying to over-winter in this area, many individuals persist in being non-migratory. This poses special management problems. In addition to swans, the entire Rocky Mountain population of greater sandhill cranes is largely confined to the RCP, from their primary wintering grounds in New Mexico to their breeding habitats in Idaho and Montana. During both spring and fall migration, the entire population migrates through the San Luis Valley, Colorado. Cranes feed heavily on waste barley and other agricultural and natural foods during their stay in the Valley, during which they acquire important nutrient reserves. Wetlands of the San Luis Valley are vital as loafing and roosting sites for these cranes.

Other Wetland- and Grassland-Dependent Wildlife in the RCP Region

Elevational guilds of other birds species have been noted for the RCP. In the Alpine Zone, the brown-capped rosy finch and white-tailed ptarmigan are important species. The Williamson's sapsucker, Virginia's warbler, and Lewis' woodpecker are found in mid-elevation sites, along with blue grouse and the black swift. Most of the world's breeding gray vireos occur in the pinion pine-juniper ecosystem. Lowlands support sage grouse and provide critical breeding areas for mountain plovers.

Impacts to Habitat in the RCP

It is difficult to generalize about the human impacts on wetlands and upland habitat in the RCP because the region is so vast and diverse. Habitat degradation tends to decrease with increasing elevation, partially because high elevation habitats tend to be remote, in public stewardship, and have topography and soils that are not conductive to landscape-level impacts. Nevertheless, localized effects are apparent even in these high elevation ecosystems. In some areas, logging activities on both public and private land have degraded wetland basins through sedimentation and physical disturbance. Some diversion ditches reach even the highest headwater streams, altering the hydrology of downstream wetlands during times of irrigation demand. Livestock often concentrate around wetlands, particularly during dry summer periods, with localized effects on wetland aquatic vegetation and substrate.

Before the arrival of Europeans, 60-400 million beaver occupied North America. The RCP region was particularly rich in beaver. However, by 1900 beaver populations had been so heavily exploited that some state wildlife agencies considered them on the brink of extinction. In most portions of the RCP beaver did not regain significant populations until the 1950s, and some areas have still not recolonized. Although the number of ponds created and maintained by beaver during pre-settlement times will never be known, it is certain that these wetlands provided extensive waterfowl habitat that no longer exists in the region (Ringelman 1991).

In lower elevation systems, extensive alteration to natural hydrology has been implemented, most often associated with development of agricultural activities. Dam construction and flood control levees have effectively drained many floodplain marshes, reducing waterfowl habitat. Farming activities in these floodplains often provides suitable foraging habitat for many waterfowl species, primarily during migration periods. However, the loss of wetland habitat has significantly reduced the value of these areas for locally breeding waterfowl. Examples of this type of loss can be seen in the Baker Valley, Powder River Valley and Grande Ronde Valleys of Oregon and the Kootenai River Valley in the Idaho panhandle.

The newest threats to wetlands stem from the pressures imposed by human population growth and affluence. Condominiums and retirement homes are sprouting in mountain valleys, directly and indirectly impacting wet meadow habitats. Water to serve the domestic needs of the new residents and to make artificial snow on ski slopes has depleted streamflows. Farther downstream, water is diverted into reservoirs for storage and flood control, and groundwater is pumped to irrigate cropland. As surface and groundwater hydrology is altered, so too are the hydrologic regimes of shallow wetlands. However, not all water diversion has been detrimental to waterfowl. Irrigated hayland provides shallow, flooded habitat that is attractive to breeding pairs, and small to moderate-sized impoundments provide new wetland habitat along the margins and inlet. In places, small grains and legumes are cultivated, and waterfowl feed heavily on the waste that remains after harvest.

Conservation Programs in the RCP

The eastern half of the Intermountain West Joint Venture (IWJV) of the NAWMP includes the RCP region. Because the area is so vast, the IWJV has identified focus areas in which program delivery will be concentrated. Within the RCP there are about 50 focus areas of the IWJV. This joint venture has an objective of protecting 607,300 ha, restoring 202,430 ha, and enhancing 202,430 ha of waterfowl habitat. Unlike other regions of the country, much of the land in the RCP is publicly owned. Many state and federal agencies have programs to manage and

protect wetland and wildlife habitat in the region. In Colorado, the partnership to protect wetlands has been particularly strong, involving the Colorado Division of Wildlife, the USFWS, and the Great Outdoors Colorado Trust. In Oregon, two NAWCA grants have focused wetland conservation actions in the Blue Mountains Focus Area while another NAWCA grant was centered on the Kootenai River valley in the Idaho panhandle.

Ducks Unlimited's "High Country Wetlands" initiative prioritizes 18 focus areas within the RCP. In Montana, these focus areas are the Flathead Valley, Bitterroot Valley, Blackfoot Valley, Clark Fork Valley, Beaverhead Valley, and the Centennial Valley. Focus areas in Wyoming include the Bighorn Valley, Green River Valley, Upper North Platte Basin, Bear River Valley, Wind River Basin, and the Laramie Basin. Colorado focus areas are in the Yampa Valley, North Park, Middle Park, South Park, Colorado-Gunnison Valley, and the San Luis Valley. Principal complexes where work will occur based out of DU's Western Regional Office include Pend 'Oreille (ID), Kootenai (ID), Okanagon (WA), Scabland (WA), Blue Mountains (OR), Green River (UT), and the Middle Rio Grande (NM). These rich wetland communities, many of which lie along riparian areas or within intermountain basins, contain outstanding waterfowl habitat but face threats from human development and water depletions. Accordingly, DU will concentrate our conservation programs in these areas.

Goals (2005-2009)

- Maintain no net loss of wetlands and associated uplands within DU focus areas.
- Protect 1,000 ha of critical wetlands and wetland complexes in portions of the RCP outside of DU focus areas.
- Restore and create 1,500 ha of wetlands to restore values formerly provided by beaver pond complexes and glacial ponds in Lower and Upper Montane zones within DU focus areas.
- Restore and protect 3,000 ha of wetlands to restore values formerly provided by floodplain wetlands along rivers and streams.
- Maintain the hydrologic integrity of naturally occurring wetlands by securing conservation easements.
- Maintain the habitat value of 1,000 ha of managed wetlands by implementing projects that replace dilapidated water management systems and control undesirable vegetative communities.

Assumptions

- Human population growth in the RCP will continue at the rapid rate experienced in the 1990s, and therefore investments in habitat protection are needed to sustain current waterfowl population levels.
- Emulating natural events like fires, floods and drought will enable us to sustain the functions and values of wetlands we seek to restore, protect and manage, thereby allowing us to achieve waterfowl population objectives.

- We know where to locate and manage wetland complexes in a landscape to mimic the values provided to waterfowl by beaver pond complexes and glacial potholes.

- We know how to mimic the hydrology associated with overbank-flooding events to promote the development of plant and invertebrate communities in seasonal floodplain wetlands.

Strategies

- Employ GIS to target areas of the RCP for land protection and wetland restoration.

- Use donated and purchased conservation easements, along with revolving land purchases, as the principal mechanisms to protect land.

- Restore wetland complexes or large marshes using established engineering approaches, being careful to provide only the water management capabilities that will be utilized and are cost-effective.

- Purchase/secure water rights to guarantee the hydrologic integrity of naturally occurring and managed wetlands.

- Maintain relationships with traditional cooperators and develop new partnerships for conservation, particularly with agencies that have jurisdiction over much of the landmass in the RCP.

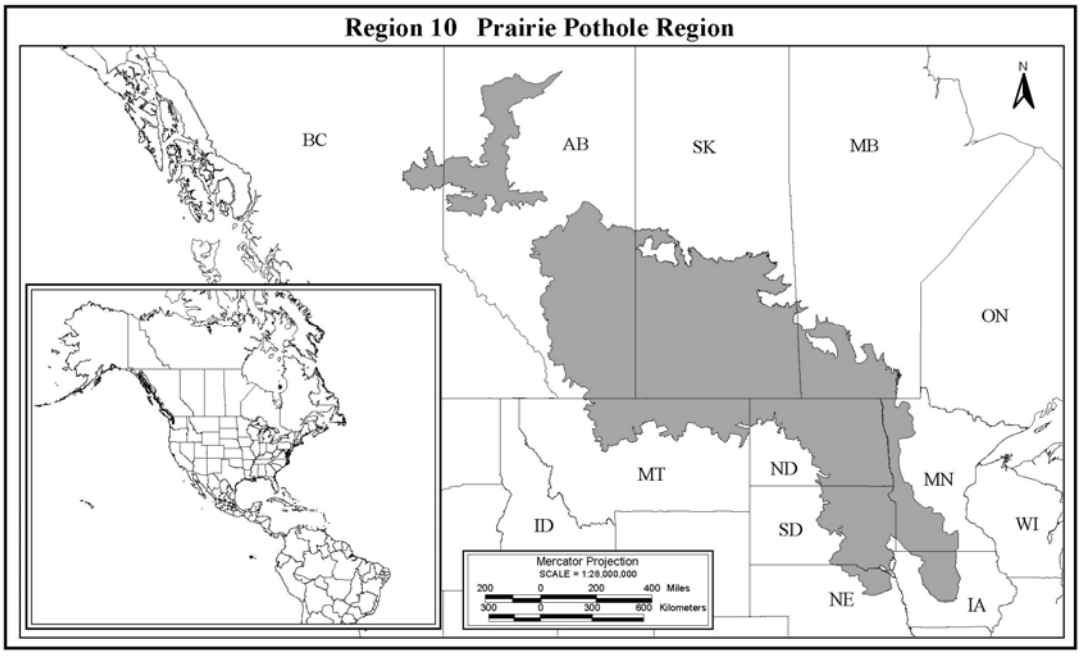
- Recognize that operations and maintenance costs are a reality for many of the private and public wetland managers in the region, and provide assistance to those landowners wherever possible in order to maintain high quality wetland habitat that provides long-term benefits to waterfowl.

- Assist in efforts to intensively manage seasonal wetland habitats where appropriate, primarily on publicly managed areas and certain privately owned parcels managed primarily for waterfowl.

January 5, 2005 – Region 9
Minor updates and corrections
February 1, 2005 – Region 9
General editing and minor improvements throughout the text

Prairie Pothole Region[10]

The Prairie Pothole Region (PPR) forms the core of what was formerly the largest expanse of grassland in the world – the Great Plains of North America. It encompasses some 700,000 km^2, stretching from the Peace Lowlands of northwestern Alberta and northeastern BC, southeast to the Tall Grass Prairie of Iowa. When the glaciers from the last ice age receded across this landscape about 10,000 years ago, they left behind millions of shallow depressions that are now wetlands known as prairie potholes. Since that time, these pothole complexes, rich in plant and aquatic invertebrate life, have supported populations of breeding waterfowl unmatched anywhere in the world. In some portions of the region, potholes occur in densities exceeding 70 ponds/km^2, creating a wetland community that supports up to 50 breeding duck pairs/km^2. Despite wetland drainage and conversion of grasslands, the PPR remains the most important habitat for breeding waterfowl in the world.



The last 125 years have seen a dramatic change in this landscape's ability to support breeding waterfowl. Settlement by Europeans has brought with it significant impacts on the ecological function of the PPR. The nutrient-rich soils have proven to be highly productive for growing annual crops, and the vast grasslands supported the introduction of millions of grazing livestock. To facilitate agricultural development, pothole wetlands have been subjected to considerable drainage and consolidation. Though variable across the PPR, estimates suggest that on a localized basis anywhere from 50 – 90% of these potholes have been lost or severely degraded, and this trend continues today. But drainage has not been the only impact on PPR wetlands. Years of cultivation and soil erosion have also resulted in many more potholes being filled, and the cumulative effect of agricultural chemicals have impacted the survival and composition of aquatic plant and invertebrate communities.

[10] NABCI Bird Conservation Region 11 with Peace River Parklands added.

In many areas across the PPR, upland habitats have been under even greater siege than the wetlands. Native prairie has been cultivated, and today annual crops dominate much of the region. Recent analysis has revealed that some parts of the PPR have suffered losses of native habitat in excess of 70%. In the PPR of Canada, the cropland base has increased by 30% in the last 25 years alone. This alarming rate of native habitat loss shows no signs of abating. Up to 3% of the remaining native uplands continue to be converted to cultivated lands on an annual basis in some areas of the PPR. Conversion of these upland habitats is not the only threat to the integrity of the habitat for breeding waterfowl. Poor range use and management practices, and increased stocking rates of grazing livestock, have resulted in much of the remaining native grasslands being severely degraded. In addition, fragmentation of critical upland habitats has been shown to have negative impacts on waterfowl production. These changes in the landscape have also had an impact on the predator community to the detriment of breeding waterfowl. In some areas of the PPR, recruitment of waterfowl on an annual basis is unable to keep pace with the mortality caused by predation.

With only remnant patches of grassland remaining in many areas, ducks are forced to lay their eggs in fragments of prairie that have escaped cultivation. Predators, in particular red foxes, skunks, raccoons, badgers, and coyotes, can more easily encounter nests in these small patches. Moreover, changes in the landscape that accompanied European settlement -- extirpation of wolves and other large carnivores, farmsteads and culverts that provide den sites, and agricultural foods that better enable mammals to survive through the winter -- have also transformed the predator community in the PPR. Without wolves and coyotes to suppress their numbers, foxes are much more abundant than they were before settlement, as are skunks and raccoons. The dual effects of grassland fragmentation and alteration of the predator community have resulted in very low duck nest success rates and high mortality of nesting hens. Of all the demographic parameters that are responsible for change in mid-continent mallard populations, nest success and hen mortality during breeding are clearly of greatest importance (Steve Hockman et al. IWWR, unpubl. manuscript). There is strong evidence that these same parameters are driving other mid-continent dabbling duck populations as well as many other grassland bird species.

Although wetlands occur throughout most of the region, their density varies according to surface form patterns, relief, composition of glacial materials and human activities. About 40% of the PPR consists of ground or hummocky moraines, which produce landscapes pitted with numerous depressions of varying size. Wetland densities can vary from 0 to 74 ponds/km^2. The flatter landscapes (60% of the region) are comprised of mainly lacustrine and fluvial material and wetland density averages <5/km^2. In total, the U.S. portion of the PPR is estimated to contain 1,688,000 ha of wetlands (Prairie Pothole Joint Venture Concept Plan). In Canada there are estimated to be between 2 - 7 million wetlands, depending on weather conditions, and in wet years the area occupied by these basins can exceed 30 million ha (DUC wetland inventory).

The PPR has a continental climate, with extremes in both temperature and annual precipitation. Because prairie potholes are dependent on snowmelt, surface runoff, and direct precipitation as sources of water, the abundance of wetlands varies both seasonally and annually. Some larger PPR wetlands may be hydrologically connected to groundwater, but smaller wetlands are often perched above the water table. These small potholes are often linked hydrologically and thereby supply, obtain, or pass water to other, adjacent potholes. During springtime, ephemeral, temporary, and seasonal wetlands typically contain water for only days, weeks, or 1-2 months, respectively. Wetlands with longer hydroperiods, classified as semi-permanent or permanent wetlands, usually retain water throughout the growing season, although their water levels also decline due to evaporation, transpiration, and seepage. Under extreme drought conditions, entire wetland communities may dry up. More commonly, however, wetland

densities vary from 0.8 potholes/km^2 during a severe drought to 4.4 potholes/km^2 during near average water conditions (Cowardin et al. 1995). This wet-dry cycle rejuvenates prairie potholes by exposing organic matter to aerobic decay, thereby making nutrients more available when the next wet period returns. Dry periods also allow the germination of aquatic plant seeds and set back wetland succession. The dynamic nature of wetlands in the PPR, combined with the high density of diverse wetland types, makes wetland communities of the PPR among the most productive systems on earth and ideal waterfowl breeding habitats. Wetlands are the magnets that attract waterfowl to the PPR.

The PPR is a large landscape, and in any given year weather conditions are not uniform across the region. Waterfowl respond to habitat conditions within the region, settling in areas with the best wetland and upland conditions. Although DU can not control annual precipitation, we can work towards conservation of wetland and uplands so that in wet years habitat in the PPR is in the best condition for maximum waterfowl response.

Importance to Waterfowl

Despite the habitat degradation that has occurred across the PPR in the last century, this region continues to be the most important to breeding waterfowl in North America. In wet years, 70% or more of the continent's duck production originates in the PPR (Fig. 1). It is especially important on a continental basis to breeding northern pintails, mallards, canvasbacks, redheads, gadwall, blue-winged teal and northern shovelers. Although populations across the Canadian prairie and parkland have not responded to the levels expected, the relatively wet years experienced during the 1990s have resulted in most of these species reaching and surpassing the regional population goals as established by the NAWMP. One exception has been the northern pintail. This grassland-dependant duck has struggled despite the generally favorable water conditions in the last decade. Studies show that breeding pintail populations have decreased in excess of 50% in the last 20 years, with no significant improvement to the trend. The shallow, nutrient-rich wetlands and fragile grasslands on which these birds rely have been impacted particularly hard despite recent improved moisture conditions.

Lesser scaup are another species that has historically relied on the PPR for breeding habitat, particularly in the northern portion of the region where the prairie/parkland transitions to the mixed-wood boreal forest. Again, despite the favorable moisture conditions experienced in the last decade, scaup have not responded with improved breeding success. As a result, scaup are hovering at population levels below those established under the NAWMP as plan goals.

Several million ducks and geese pass through the region each spring. Even in regions that have experienced substantial wetland losses, such as Iowa, valuable migration habitat is often available in early spring when the ground is still frozen and drainage ditches are not yet flowing. In autumn, an estimated 8 - 10 million ducks and 0.5 - 1 million geese migrate south through Iowa, en route to warmer climates. A few, including an average 106,000 ducks and 138,000 geese, remain during winter in the PPR or adjacent areas. However, the PPR is most critical for breeding waterfowl.

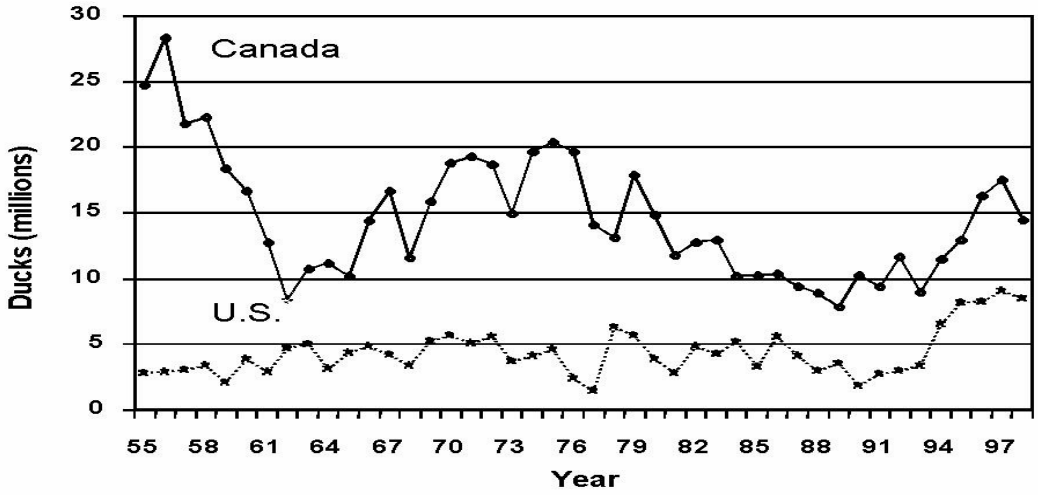


Fig. 1. Total ducks observed in the May survey in the Prairie Pothole Region.

Recruitment rates, defined as the number of young female ducks that enter the fall population per the number of adult females in the spring population, are highly variable within the PPR. However, there is a strong relationship between recruitment and the quality and amount of upland cover. In recent years recruitment rates and brood production in the U.S. portion of the PPR have exceeded those in Canada (Fig. 2). This change from historic patterns is thought to be a result of exceptional precipitation and excellent upland conditions in the U.S., primarily due to an initiative called the Conservation Reserve Program (CRP). In the U.S. PPR, recruitment rates have been estimated for each of the USFWSs Wetland Management Districts. Those simulations, made as part of the Multi-Agency Approach to Planning and Evaluation, revealed that 9 of the 14 Districts had recruitment rates above the maintenance level of 0.5 needed to sustain or increase duck populations. These simulations were made assuming the current distribution of CRP land.

As the percentage of grassland in a landscape increases, so does the success of duck nests (Reynolds et al. 2000). This relationship, while accounting for a relatively small percentage of the total variation in nest success, is nonetheless statistically significant for five duck species in the PPR. However, as with wetlands, the distribution of grassland is not uniform within the PPR. Because most soils in the Missouri and Prairie Coteau are rocky and the topography is rolling, much of this physiographic region is devoted to livestock production (pasture and hayland), and significant areas of native grassland remain. Consistent with the relationship between grassland area and nest success, duck nest success in the Coteau appears to be relatively high. In contrast, prior to 1985 the Drift Plain of the Dakotas, like most of Minnesota and Iowa, was dominated by cropland and contained very little grassland. Duck nest success in many places was distressingly low -- below the threshold necessary to sustain duck populations. That changed with the 1985 Farm Bill and the CRP.

CRP was authorized as a program to reduce soil loss on highly erodible land, reduce crop surpluses, and improve wildlife habitat. Under the program, farmers could apply for enrollment in CRP and, if accepted, were obligated to plant perennial cover in exchange for an annual payment. Most contracts were for 10 years. By 1985, it was widely recognized that inadequate grassland habitat was responsible for low duck nest success. Because of the potential for CRP to restore grasslands in the PPR, conservationists worked to persuade the U.S. Department of Agriculture to designate the entire PPR as a Conservation Priority Area due to its wildlife, and particularly,

waterfowl values. This designation made nearly all previously cropped land in the PPR eligible for CRP, regardless of soil erodibility. Subsequent modifications to the implementation rules and scoring of CRP afforded advantages to farmers who were willing to restore wetlands and plant cover that was beneficial to wildlife.

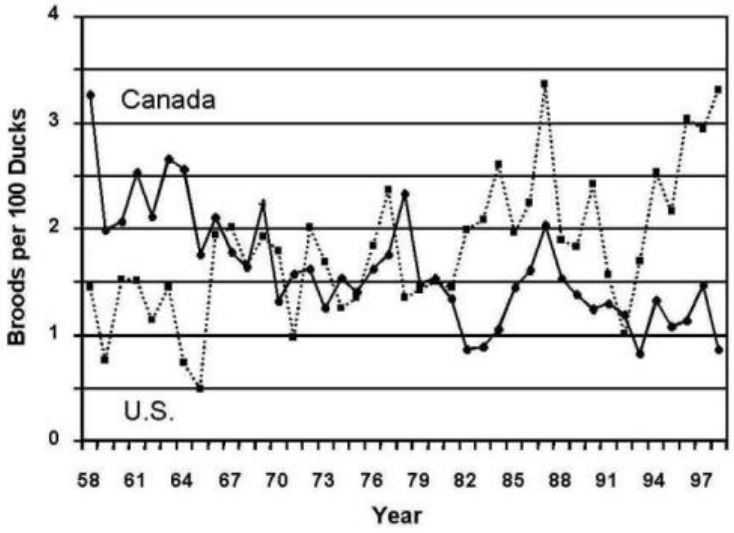


Fig. 2. Duck productivity, expressed as July broods/100 ducks observed in the May survey.

By any measure, CRP was a huge success for waterfowl conservation. About 1.9 million ha of former cropland, 7% of the land base in the U.S. PPR, was enrolled in CRP. When water returned to the region in 1993, ducks responded. Duck nest success in CRP exceeded rates reported in earlier studies, and CRP had the added benefit of increasing the nest success in nearby Waterfowl Production Areas (Reynolds et al. 2000). Research on the effects of CRP concluded that duck nest success increased 46% as a result of CRP, and that CRP resulted in an additional 10.5 million ducks recruited into the fall population during 1992-97 (Reynolds et al. 2000). The weight of the evidence indicates that ducks will readily accept planted cover in which to nest and, given an adequate amount of cover in the landscape, can achieve nest success rates adequate to increase duck populations.

Clearly a focus of our conservation efforts must be the maintenance and expansion of cover programs such as CRP in the U.S. Unfortunately Canada does not have a similar program and much of the Canadian PPR, particularly in Saskatchewan, remains intensively cropped. Therefore the implementation of a similar, aggressive, extensive cover program in Canada is needed.

The NAWMP uses the period 1970-79 as a benchmark against which to measure current waterfowl populations. Most Joint Ventures (JV's) under the NAWMP have adopted species population goals equal to the average of the 1970s. In recent years most species have reached or exceeded the numeric NAWMP goals in the PPR, with the notable exceptions of pintails and scaup (Table 4). However even for the species that have apparently achieved target goals, the population response has not been as great as expected based on historical patterns between ducks and precipitation. There is clearly a need for enhanced habitat conservation efforts if target populations are to be sustained.

Table 4. Breeding duck population status and goals for the 10 most common species in the PPR (as stated in the 1998 plan update).

Species	1999 Population x 1000	NAWMP goal x 1000
Mallard	10,806	8,200
Northern Pintail	3,058	5,600
Gadwall	3,236	1,500
American wigeon	2,920	3,000
Green-winged teal	2,631	1,900
Blue-winged teal	7,950	4,700
Northern shoveler	3,890	2,000
Redhead	973	640
Canvasback	716	376
Scaup	5,384	6,300

Importance to Other Species

The same complexes of wetlands and grasslands that make the PPR the core breeding area for North America's waterfowl also make the region extremely attractive to other migratory species. Besides ducks, geese, and swans, 225 other migratory bird species can be found in the PPR. Recent studies have shown that populations of many of these birds are diminishing at an alarming rate. These include numerous species of shorebirds, wading birds, and grassland songbirds. Included among these are priority species such as whooping cranes, Franklin's gulls, yellow rails, burrowing owls and piping plovers. During spring migration, wetlands are used by Hudsonian godwits, American golden plovers, white-rumped sandpipers, and buff-breasted sandpipers. Shorebirds such as Wilson's phalaropes, marbled godwits, and American avocets are common breeders in prairie pothole wetlands. In areas where large tracts of grassland still exist, priority species such as Baird's sparrows and Sprague's pipits are common.

Conservation Programs in the Prairie Pothole Region

The habitat programs within the PPR which are being delivered by DU, other NAWMP partners and a variety of other government and non-government wildlife agencies, are among the most aggressive on the continent. In excess of 1.6 million ha of critical wildlife habitat have been influenced through our conservation programs in Canada. These programs vary widely in terms of both security and impact, ranging from perpetual protection of critical native habitats through legislation or ownership, to conversion of land use to functions more favorable to wildlife, to stewardship programs that are little more than recognition of landowners who have decided not to alter key wildlife habitat components within their land holdings. In the U.S. PPR, 140,000 ha have been protected or restored by DU. Although wetland restorations, upland management, and intensive techniques like nesting islands and predator exclosures form the majority of U.S. projects, increasing attention is being devoted to protecting intact habitats through conservation easements. Unfortunately, despite the magnitude of these efforts, critical habitats continue to be lost and degraded at a level that surpasses the restoration and protection capacity of our current conservation programs.

A wide array of partners and programs are at work in the PPR. In the U.S., the backbone of habitat secured for waterfowl is provided by the USFWS, which owns about 366,000 ha of

land in NWRs and Waterfowl Production Areas. State agencies own another 192,000 ha of public Wildlife Areas. A growing component of land protection is wetland and grassland easements, obtained and held mostly by the USFWS. Through 1999, nearly 140,000 ha were protected under grassland easements in North and South Dakota. Quasi-governmental organizations such as the North Dakota Wetlands Trust are actively cost-sharing habitat restoration projects. National and local non-profit conservation organizations are securing important parcels of habitat, although at nowhere near the scale of the agencies. DU works in collaboration with these agencies and organizations under the umbrella of the NAWMP joint ventures, in this case the Prairie Pothole Joint Venture (PPJV). As of 1999, the PPJV has protected 226,081 ha, restored 90,327 ha, and enhanced 230,104 ha in the U.S. PPR.

Agricultural programs continue to shape the landscape of the PPR. In addition to CRP, the Wetlands Reserve Program (WRP) has facilitated the protection and restoration of many wetland habitats in Minnesota and Iowa. The opportunity exists to expand WRP in these states. After leveraging with other state funding sources like *Re-invest In Minnesota*, the state was able to convert short-term WRP easements to perpetual easements, allowing the permanent protection of wetlands. There is a need to develop similar programs in the Canadian prairie.

In Canada, conservation partnerships are equally important. Through partnerships such as NAWMP, DU has secured over 490,000 ha of wetland and uplands. Provincial wildlife agencies and other non-governmental organizations (NGO's) currently control an additional 830,000 ha.

The Prairie Pothole Region has been the focus of more waterfowl conservation work by DU, and others, than any other region of the world. It is also one of the most important agricultural regions in North America and has therefore been the target of many land use, agricultural and wildlife conservation regulations and public policies in Canada and the U.S. These have been directed under different social, climactic, political and economic realities and now have an overwhelming influence on how waterfowl conservation can be accomplished in each country. Thus, DU's conservation plan, while understanding that the waterfowl don't recognize political boundaries, must address the realities in each country if realistic waterfowl conservation programs are to be developed.

In 1999, the staff from DU in both the U.S. and Canada joined forces to develop a Conservation Vision for the PPR. The document sets forth a vision and underlying principles for DU's conservation programs in the entire PPR, quantifies population objectives, and sets forth wetland and upland habitat goals.

Our vision: "A mosaic of natural, restored and managed landscapes capable of perpetually sustaining populations of waterfowl and other wildlife"

Goals

- Achieve waterfowl population goals in the NAWMP stepped down to the PPR level.

- Stop the loss of wetlands, with a priority on protecting and restoring landscapes that contain a high proportion (> 40%) of cover suitable for nesting waterfowl.

- Restore wetland complexes in areas with cover suitable for nesting waterfowl where the risk of loss or degradation of this upland cover is minimal.

- Prevent further loss of native or naturalized cover, particularly in areas with high wetland densities that attract over 12 duck pairs/km^2 and contain a high proportion of cover suitable for nesting waterfowl.

- Increase the proportion of perennial cover in areas with more than the median density of wetlands and between 30% and 70% perennial cover.

- Increase annual cover suitable for nesting waterfowl (e.g., winter cereals) on landscapes with high wetland densities that attract over 12 duck pairs/km^2 where opportunities for establishing perennial cover are limited.

Assumptions

- The PPR cannot be "drought-proofed", therefore the best conservation strategy is to protect and restore wetlands and uplands so that when wet conditions exist in the region, all of the elements needed to quickly re-build duck populations will be in place.

- Because the destruction of grasslands and wetlands will accelerate as world demands for food and fiber grow, investments in land protection now will reduce the cost of conservation to future generations.

- Native/natural habitats are as good or better than restored or created habitats for improving waterfowl production.

- Protecting and restoring land is not an "either-or" proposition, and there will be appropriate times and locations to do both.

- Easements and other protection tools that do not require DU to hold title to land are the preferred approaches to land protection, given the relatively higher costs of fee title acquisitions, ongoing costs associated with fee title holdings, and political obstacles to owning land for conservation.

- Nest success and hen survival are limiting duck population growth.

- Duck nest success increases as the percentage of perennial cover in a landscape increases.

- Recruitment rates and thresholds for population stability can be accurately identified through simulation models, hence we will correctly target landscapes.

Strategies

- Expand our programs from direct, site-specific intervention to include indirect approaches that target government and corporate policy, human attitudes through education and human action through extension.

- Focus more direct intervention on the retention of targeted wetlands and tracts of native/natural uplands as the basis for having the greatest effect on waterfowl populations.

- Develop a mechanism for continually testing the assumptions on which our vision and underling strategies are based.

- Maintain a conservation program for the PPR that is dynamic and responsive to changing forces on the landscape.

- Continually refine our ability to target areas of the PPR for land protection, wetland restoration, and grassland restoration / intensive management that will realize the maximum benefit to waterfowl.

- Use donated conservation easements, purchased grassland easements, and revolving land purchases as the principal mechanisms to protect land with the goal of 800,000 ha protected in North and South Dakota

- Restore wetland complexes or large marshes using traditional engineering approaches, being careful to provide only the water management capabilities that will be utilized and are cost-effective.

- Continue to use intensive management practices like predator fences and nesting islands when they are the only options available.

- Implement agricultural programs such as fall-seeded crops that provide suitable nesting cover while at the same time benefiting the farmer and conservation of soils and water.

- Work to promote agricultural policies and programs that contain conservation provisions beneficial to waterfowl. When appropriate, assist with implementation of programs such as small wetland restorations in CRP.

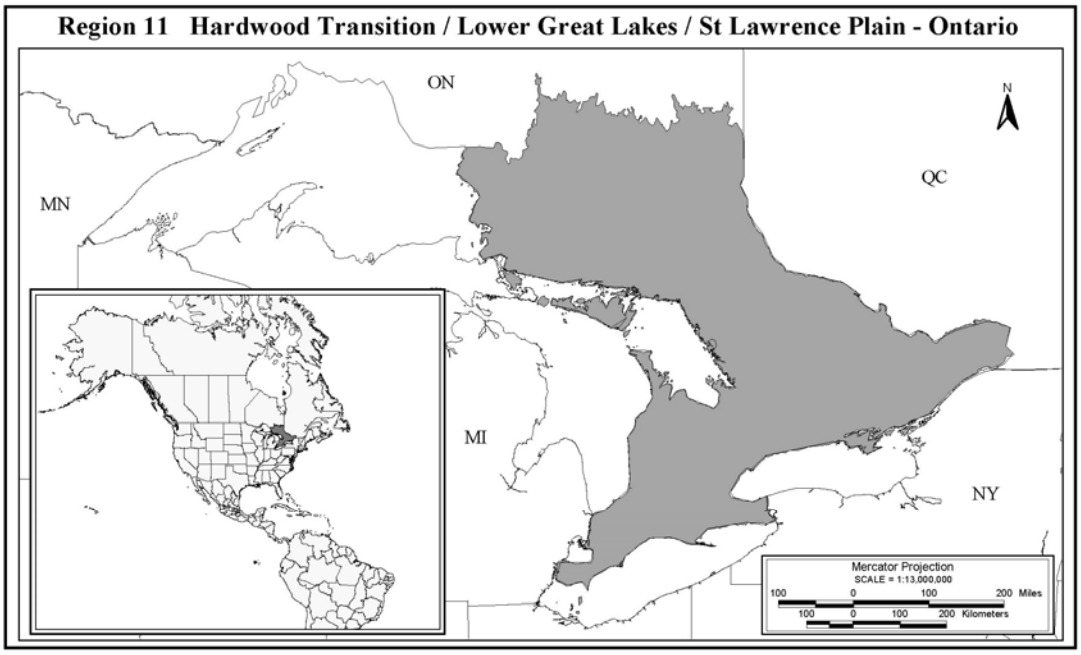
- Continue to build effective conservation partnerships.

Hardwood Transition/ Lower Great Lakes/St Lawrence Plain - Ontario[11]

The Great Lakes-St. Lawrence (GLSL) biome of Canada includes southern parts of Ontario and Quebec plus a small part of northwestern New Brunswick. Within Ontario, the GLSL encompasses all of the Lower Great Lakes/St. Lawrence Plain and the southern half of the Boreal Hardwood Transition NABCI Regions. Within the GLSL of Ontario, three unique landscapes (Mixed Woodland Plain, Shield and Coastal) have been identified. Although there is considerable diversity within each of these areas, there is sufficient homogeneity within to allow effective development of habitat conservation programs for each. Each of these areas is important to waterfowl in its own right, however, each plays a different role in the biology of Ontario waterfowl.

Current Habitat Programs

A comprehensive set of programs and initiatives developed specifically to address habitat limitations and encourage growth in duck populations are currently being delivered in priority areas within the various landscapes of the GLSL. These include wetland securement/restoration, Ontario Land CARE (OLC) and grassland restoration initiatives in agricultural landscapes and Beaver Pond Management in forested landscapes.



Wetland Securement and Restoration - Securement involves the legal protection of critical breeding and migration habitat through conservation easements, agreements or leases, and purchases. Recent legislation provides the ability to negotiate perpetual conservation easements, and this technique is used where possible as a cost efficient alternative to the purchase of critically important habitats. Provincial Crown land dedication occurs on public lands associated

[11] Within NABCI Bird Conservation Regions 12 and 13 for Ontario only.

with key breeding areas. Conservation agreements on wetland restoration, enhancement and agricultural initiatives secure valuable waterfowl habitats on private lands within southern Ontario. Wetland restoration is used restore hydrologic function in degraded habitats. This technique requires the co-operation and partnership of many groups (e.g. Federal and Provincial Crown, Conservation Authorities, and a large number of private landowners). Wetland securement and restoration is focused within the Mixed Woodland Plain and Coastal regions of the GLSL.

Ontario Land CARE - Upland initiatives delivered under the OLC program in agricultural landscapes of the Mixed Woodland Plain region to improve the breeding waterfowl value of wetland and associated habitats. The intent of OLC is to conserve wetlands and promote long term, sustainable land use changes in the agricultural landscape. Programs directed at modifying existing agricultural practices have a two-fold purpose. The first is the long-term securement (minimum 25 years) of the existing wetland habitat and where possible, rehabilitation and creation of new wetland areas. The second purpose is to positively affect adjoining upland areas by promoting changes in agricultural practices that not only benefit waterfowl and other wildlife, but are also economically attractive and thus sustainable from an agricultural standpoint. Direct program techniques employed include modified grazing systems, conversion of cultivated lands to forages, cover establishment on fragile or marginal lands, conservation tillage demonstrations and making flushing bars available for use during hay harvesting. This program also involves a co-operative approach with private landowners and many partnerships.

Grassland Restoration - Native grasses and forbs provide long-term benefits as upland cover for nesting waterfowl and a wide range of birds and mammals. This technique is used in agricultural landscapes within the Mixed Woodland Plain and Coastal regions to promote permanent retirement of marginal and fragile lands. The native grass program is strategically implemented around critical coastal and inland wetlands providing an important buffer to disturbance, improving runoff water quality and providing important nesting habitat.

Beaver Pond Management - The Beaver Pond Management program is implemented on large blocks of Crown and private land ranging up to 20,243 ha in area and encompassing complexes of 200-500 beaver ponds in various stages of succession. Beaver ponds are considered the most important waterfowl-breeding habitat in Ontario and are greatly influenced by forest management and fire suppression practices. Partnerships and cooperative efforts with Forestry Companies and the Ministry of Natural Resources will focus on modifying current forest management practices, policies and guidelines for the benefit of beaver populations, which in turn benefit wetlands and waterfowl. Small changes in current forestry management activities will have large-scale, significant and sustainable benefits to waterfowl and other wetland dependant wildlife. Direct program techniques under the Beaver Pond Management program will center on addressing waterfowl breeding limitations through nest box placement and upland management.

Mixed Woodland Plain Landscape

The Mixed Woodland Plain landscape is located from the southern extent of Ontario northward up to the Precambrian Shield Region of central Ontario. This landscape is tremendously diverse and includes physiographic features such as sand, clay, limestone and till plains, which are interspersed with moraine and drumlin features. Prior to European settlement this region had large areas of seasonally flooded swamps in the southwest and expanses of aak savannah interspersed with tall grass prairie through the southern and central regions. While much of the eastern and central regions were covered by mixed deciduous/coniferous forests. Land use activities with major influences in this region have been agriculture, forestry and urban

expansion. There is no doubt that agriculture has had the greatest influence to date, impacting over 3 million ha within the Mixed Woodland Plain. The amount of land in agricultural production varies from 80-90% of the land area in the southwest and east to as little as 5-10% in central and northern portions.

In the past, wetlands in the GLSL have been viewed as wastelands and a hindrance to human progress. Large-scale drainage of the Mixed Woodland Plain landscape began as early as the 1880s with passage of the Ontario Drainage Act that offered farmers financial assistance to drain their lands. Urban development, including transportation and service (hydro, gas/oil) corridors, has also been responsible for high wetland loss and by 1967 over half of the original 2.4 million ha of southern Ontario's wetlands had been lost (Snell 1987). Loss in areas of the southwest and east has reached 90% and is among the highest loss rates observed in Canada.

Throughout the Mixed Woodland Plain, many of the wetlands that remain have been degraded and are of reduced value to waterfowl. However, despite extensive loss of wetlands within the region, quality wetlands and wetland complexes that support relatively high densities of breeding waterfowl still exist (Gabor et al. 1999). These are typically associated with low to moderate agricultural intensity, a result of currently unfavourable "land improvement" conditions. Since the mid 1900s beaver populations have recovered from previous over trapping thus helping to mitigate extensive wetland loss through their wetland creation activities.

The Mixed Woodland Plain is particularly valuable as breeding habitat to mallard, wood duck, blue-winged teal, green-winged teal, black duck, hooded merganser and Canada geese. Of these, mallard, wood duck and Canada geese make up a large percentage although in the recent past blue-winged teal were an important component of the breeding waterfowl population. Since mallards have expanded in the region, black ducks have correspondingly declined. Breeding mallard numbers began to rise in Ontario after 1950 and have grown to be the most common breeding duck in the region. CWS data shows the most abrupt increase in the number of mallards observed during surveys through the 1970s – 1980s. Since that time the number of mallards counted during ground surveys have leveled off in southern Ontario suggesting that mallards have saturated this landscape and are now limited by habitat (CWS Unpublished).

Human threats (i.e. urban expansion, agricultural activities) to much of the remaining waterfowl habitats of this region remain high. Fortunately southern Ontario society is beginning to see wetlands in a new light and acknowledge the value of this diminishing resource. There is tremendous opportunity to revive the expansion of waterfowl populations in the GLSL. Highly productive soils, historic wetland density and the conducive climate of this region affirm that the Mixed Woodland Plains is capable of supporting much greater densities of breeding waterfowl. The rapid increase in breeding populations of mallard, wood duck and Canada geese attest to the productivity of this region for breeding waterfowl.

Goals

- Sustain breeding waterfowl populations to a mean of 10 breeding waterfowl pairs/km^2.
- Secure an average of 8-10 wetlands/km^2 in a combination of habitats ranging from ephemeral to permanent to support the waterfowl breeding pair goal.
- Secure a minimum of 1 permanent wetland/km^2 as suitable habitat for brood rearing.

- Secure 30-40% upland nesting cover of which 5-10% is forested to meet cavity-nesting requirements.

Assumptions

- The waterfowl population goal of 10 breeding waterfowl pairs/km^2 is achievable working within the confines of current land use activities (agriculture, forestry and urban expansion).

- The size of breeding waterfowl populations are limited by the amount and quality of habitat which in turn has been affected by wetland and upland loss and degradation.

- Waterfowl capabilities or carrying capacities are not equal across all landscapes within the Mixed Woodland Plain landscape.

- Wetland density, type and distribution limit the density of waterfowl breeding pairs in the GLSL.

- Lack of adequate brood rearing habitat in some areas limit population growth because of low brood and duckling survival due to predation.

- Mallard and wood duck breeding habitat needs represent the general habitat needs for other upland and cavity nesting waterfowl species, respectively.

- The amount of nesting cover limits waterfowl population growth in areas with <30-40% cover because of low hen success due to predation.

- Availability of nesting cavities in close proximity to wetlands limits cavity-nesting waterfowl breeding pairs densities.

Strategies

- Ensure that functional wetlands are conserved in the face of the inevitable developments that will accommodate the increasing population.

- Work with agriculture to ensure that current and future agricultural activities incorporate wildlife habitat conservation.

- Support public policies that affect wetlands and associated habitats.

- Motivate the public (both general and targeted publics) to take actions in support of wetland habitat conservation.

Shield Landscape

The Shield landscape is located between the Boreal Forest of northern Ontario and the Mixed Woodland Plain to the south. The area is underlain by Precambrian granite bedrock, with a shallow soil layer. Climate and natural disturbances such as fire, insects and disease have played key roles in the development of forest communities found throughout this 5 million ha area. This landscape once consisted of large, contiguous mature mixed coniferous and deciduous forests interspersed with a patchwork of wetlands, rivers and lakes and areas that had been disturbed by

fire, windthrow and disease. Since European settlement, forestry, hydroelectric, industrial and recreational activities have modified this landscape. Land tenure is approximately 50% private and 50% public land, however there tends to be more privately held land in the southern portions of the Shield and higher proportions of public land in the northern half of the Shield. The loss and degradation of wetlands and uplands is relatively low compared to southern Ontario and, although this landscape is by no means pristine, it appears to be a relatively intact ecosystem.

Wetland ecosystems and their maintenance (particularly the beaver pond complexes) are key to the waterfowl resource in this landscape. The most significant feature of the Shield ecosystem is that it is driven by a combination of repeated natural and human induced, cataclysmic, cyclic disturbances caused by fire, insect outbreak, wind damage or forestry activities. Historic large-scale natural disturbances such as fire and disease have provided the conditions necessary for the establishment and regeneration of shade intolerant species such as poplar and birch which are crucial food supplies to sustain beaver populations and in turn create wetland habitats.

Natural fire disturbances within the riparian zones throughout the 1920s, 30s and early 40s combined with recovery of beaver populations from over trapping caused a rapid expansion of beavers and hence wetland habitats that continue today. Unfortunately provincial fire suppression policies changed to aggressively suppress fire disturbance within the landscape partly in response to increasing human population. Concurrently forest policies and management practices have “protected” the riparian areas from virtually all forest harvesting disturbances. In much of the Shield area, a wide buffer must be left along all riparian areas to address soil erosion and fisheries values issues. These two factors combined with silvicultural activities that discourage aspen have created riparian habitat conditions that promote shade tolerant trees and severely limit tree species necessary for beaver colonies to sustain themselves.

This landscape functions primarily as breeding habitat for waterfowl, and contributes significantly to the GLSL waterfowl breeding population. More than half of the breeding population consists of mallard and wood duck with a significant portion of the world’s hooded mergansers also being produced in this landscape. Other significant breeding species include black duck, ring-necked duck, common goldeneye, Canada geese, and common and red-breasted mergansers. Breeding waterfowl densities vary greatly across the region primarily due to variations in relative fertility and wetland density found throughout the Shield.

The most threatening impact on the waterfowl resource throughout this landscape are the current fire suppression and forest management policies/guidelines which precludes disturbance in the riparian zone over large areas of the shield. In fact, suppression of forest fires has resulted in an overall decrease of disturbance by fifteen fold (Donnely and Harington 1978). Should these policies continue, beaver populations will decline resulting in a significant reduction in wetland habitats and breeding waterfowl capabilities throughout this landscape. Increased cottage development, hydroelectric, mining impacts and transportation corridors also present significant threat to the aquatic ecosystems.

Goals

- Maintain and average of 3 breeding waterfowl pairs/km^2.

- Maintain a disturbance regime which mimics historic natural disturbance frequencies in riparian areas in order to create and maintain a mosaic of wetland and upland habitats necessary to sustain the waterfowl goal

Assumptions

- A recovery of beaver populations has resulted in colonization of most lowland basins. In recent times, this has resulted in near maximum waterfowl production in this landscape.

- Waterfowl capabilities or carrying capacities are not equal across all of the Shield landscape.

- Disturbances such as fire and disease are much less frequent and effect smaller areas now than occurred historically.

- An average annual disturbance of 2% of the total riparian zone within the Shield landscape will simulate historical disturbance frequency and sustain current beaver populations.

- Appropriate forest management activities within riparian zones can mimic natural disturbances.

- Forest management practices such as those that support pileated woodpecker will create conditions that will benefit cavity-nesting waterfowl.

Strategies

- Mimic natural forest succession, especially in the riparian areas and areas immediately adjacent to beaver pond habitats by working closely with the forest industry, provincial government policy makers and planners and by working with the public that will play an increasing role in forest management planning.

- Identify research and evaluation needs to support this approach.

Coastal Landscape

The Coastal landscape exists along the shores of the Great Lakes and St. Lawrence lowlands. These coastal wetlands are associated with the largest freshwater system in the world being comprised of 5 lakes with an associated shoreline of more than 15,000 km, and an area of 246,568 km^2. The Great Lakes-St. Lawrence system is highly dynamic with its own set of coastal processes, functions and features. Water levels within Great Lakes basins are regulated through a variety of human interventions. There are seasonal fluctuations, annual variations, and long-term cyclic fluctuations. The Great Lakes are also subject to temporary seiches that commonly occur on Lake Erie and Lake St. Clair causing water levels to be altered by up to 2.6m. The GLSL coastal habitats are diverse in nature being based largely on the shoreline morphology, water depths and their associated vegetation communities.

These coastal areas proved historically attractive to early European settlers and their affects on the system date back to the late 18^{th} century. Human impacts on wetland and wildlife habitat in many areas of the Great Lakes ranks with the highest on the continent. Losses of more than 90% of the wetland habitat base have been recorded in some areas. Outright loss has been extensive and remaining habitats face continuing threat from urbanization and intensive agricultural land uses. Impacts range from the indirect regulation of water regimes and introduction of exotic invasive species throughout the system, to the more direct drainage and degradation for agriculture, industry and urbanization. Shoreline hardening and dyking associated

with urbanization and agriculture, in conjunction with water level regulation, has restricted the dynamic movement of the shoreline wetland habitat thereby limiting its abundance and quality. Recreational uses also impact both wetland and wildlife through marina development in wetlands and disturbance.

GLSL coastal wetlands are of greatest importance in terms of their value to waterfowl during spring and fall migrations and of relatively minor importance to waterfowl production in comparison. The spring and fall migrations consist of large numbers of diving ducks, sea ducks, dabbling ducks, Canada geese, tundra swans, and coots. A conservative estimate of 2M dabbling ducks migrate through the GLSL most of which are mallards, blue and green winged teal, wood ducks, black ducks, and American wigeon. The Great Lakes and St. Lawrence River are also important to many species of diving ducks during migration. This results from the region's fertility and a mild climate paired with strong water currents, which promotes an unusually long ice-free period. These conditions commonly favor an extended staging period with some species actually over wintering on the Great Lakes. Continentally significant numbers of canvasback, redhead, scaup and ring necked ducks also utilize the Basin enroute along the Atlantic and Mississippi flyways. Dennis et al. (1987) and Ross (1989) collected the most comprehensive data on fall and spring migration for the CWS. Prince et al. (1992) compiled and reported waterfowl migration values for the Great Lakes basin in terms of waterfowl use days. Based on CWS survey data, key migration habitats include the Lake Erie Long Point marshes, Lake St. Clair marshes, Prince Edward County marshes and wetland habitats along the St. Lawrence and Ottawa Rivers. Other significant coastal and inland staging habitats may exist, but currently little or no waterfowl information has been collected. Likewise, data on the importance of coastal habitats to other wetland dependent wildlife, although acknowledged as being significant, is poorly understood.

Goals

- Meet the nutritional, social and time requirements of diving duck species, at NAWMP population goal levels, on coastal habitats in fall and spring.

- Maintain the existing quantity and quality of coastal wetland habitats traditionally relied on by diving ducks in Ontario's coastal landscape.

- Meet the nutritional, social and time requirements of dabbling duck species, at NAWMP population goal levels, and at anticipated increases in breeding dabbling duck populations within Ontario.

- Maintain the quantity and quality of wetland and associated agricultural habitats now available to migrating dabbling ducks.

- Increase the amount of spring migration habitat to a level that supports increased breeding population objectives in Ontario.

Assumptions

- Diving ducks that use these staging habitats rely on them to maintain favorable body condition for breeding and annual survival.

- Diving duck population size using the GLSL varies in response to conditions on the breeding grounds.

- Most diving ducks species (excluding scaup) using the GLSL coastal habitats are at NAWMP goals and the current quantity and quality of migration habitat in Ontario is sufficient.

- Dabbling ducks must be able to exploit adequate staging habitats to maintain favorable body condition for breeding and annual survival.

- Programs developed to meet the waterfowl goals in the mixed woodland landscape will result in increases in dabbling duck populations and thus staging habitat requirements.

- Fall migration habitat is currently sufficient to meet the nutritional, social and time requirements of dabbling ducks migrating through Ontario when populations of these ducks are at NAWMP goals and when breeding population objectives for Ontario have been met.

- Mitigation due to losses of existing wetland areas may be necessary.

- The availability of spring migration habitat has the potential to be limiting.

Strategies

- Ensure that functional wetlands are conserved in the face of the inevitable developments that will accommodate the increasing population.

- Work with agriculture to ensure that current and future agricultural activities incorporate wildlife habitat conservation.

- Support public policies that affect wetlands and associated habitats.

- Motivate the public (both general and targeted publics) to take actions in support of wetland habitat conservation.

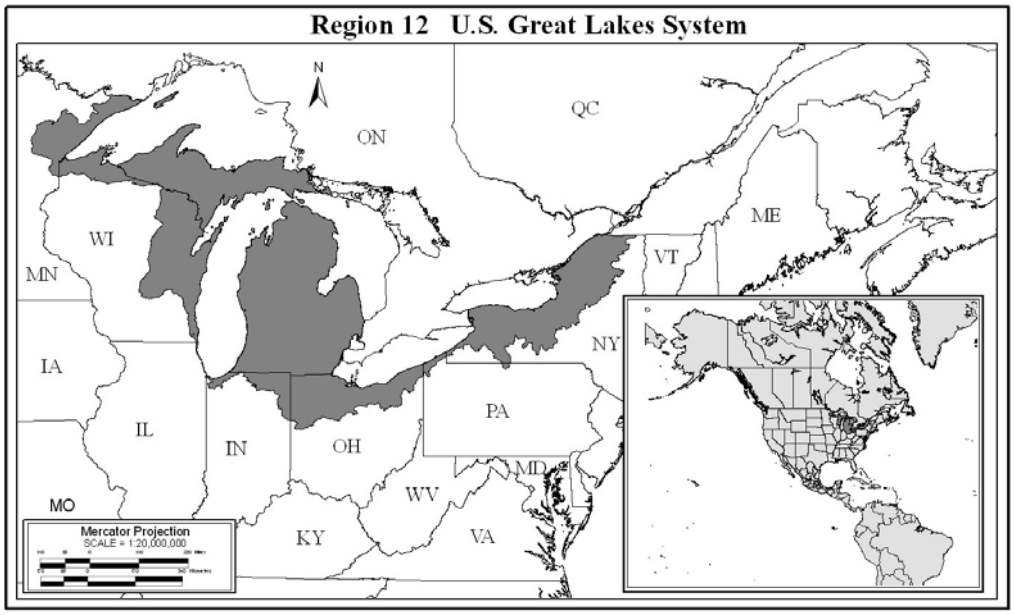
- Participate in international ventures that influence the management of the Great Lakes habitats and water levels.

Summary

Common and unique trends are occurring among the three landscapes within the GLSL of Ontario. Subsequently, some common and unique strategies are required to address these trends. Using landscape goals to strategically focus programs and resources within and among the three landscapes of the GLSL will ensure a maximized return for resources invested. As well, integration of current and future habitat conservation activities within of the GLSL will ensure efficient use of available resources.

U.S. Great Lakes System[12]

The U.S. Great Lakes System Waterfowl Conservation Region is comprised of five ecoregions designated by the Commission for Environmental Cooperation (IAFWA 1998).



The Prairie Hardwood Transition, Eastern Tallgrass Prairie and the Central Hardwoods Regions include the southern portions of Wisconsin and Michigan, and Northern Illinois, Indiana and western Ohio, was historically a transitional zone between prairie and eastern woodlands, and the primary focus of conservation work within this Conservation Region. Glaciation created numerous pothole type wetlands, shallow lakes, coastal estuaries and river flowages. The Central Hardwoods contains some of the largest and most historically significant wetlands, or remnant wetlands, in the lower 48 states. The area surrounding of Horicon Marsh is remnant glacial habitat and contains numerous pothole-type wetlands. Also important is the Winnebago watershed, consisting of Lake Winnebago and three upstream lakes (Buttes des Mortes, Winneconne, and Poygan). The Prairie Hardwood Transition includes the 12-county area around Chicago, which contains about 60,729 ha of palustrine wetlands, 12,955 ha of lakes, and several resource rich areas as identified by the Illinois Department of Natural Resources (Suloway et al. 1996).

Also within the Prairie Hardwood Transition is the historic Great Black Swamp, which once covered approximately 580 km^2 and reached from Sandusky Bay south and west to Fort Wayne, Indiana and north and east to Detroit, Michigan. This system formed on ancient glacial lake plain and was dominated by forested wetlands, with isolated wet prairies and oak savannas interspersed within the swamp and coastal marshes along the Lake Erie shoreline. The Great Black Swamp was decimated in a matter of decades by agricultural drainage and logging efforts and today only fragmented remnants remain (Herdendorf 1987).

[12] NABCI Bird Conservation Regions 12, 13, 22, 23 & 24 Lower Great Lakes / St. Lawrence Plain, Boreal Hardwood Transition, Central Hardwoods, Eastern Tallgrass Prairie, Prairie Hardwood Transition

The Lake Ontario Basin, in the Lower Great Lakes/St. Lawrence Plain is the lowest in the Great Lakes drainage system, has the highest relief of all the Great Lakes, and is also a primary focus within this Conservation Region. The level plain around the edge of the lake gives way to rolling glaciated topography. Plateaus or glaciated hills with steep slopes comprise the uplands. Streams near the headwaters are fast moving and cold, with high water quality. Bays, river mouths shoreline estuaries, and islands of the St. Lawrence River contain some of the best potential for wetland development in the Great Lakes Region.

The Boreal Hardwood Transition Region includes the northern half of Michigan, Wisconsin and Minnesota, and is characterized by coniferous and northern hardwood forests, numerous clear lakes, bogs, river flowages and nutrient-poor soils. This area includes portions of the Canadian Shield, which encompasses Lake Superior and significant portions of Lakes Michigan and Huron. Over 9,717 ha of coastal wetland, consisting of forested, scrub-shrub, and emergent types, are associated with Wisconsin's Green Bay and the Door Peninsula (Prince et al. 1992), and are considered some of Lake Michigan's most important marshes (Bookhout et al. 1989).

Another notable area of importance in the Boreal Hardwood Transition Ecoregion is the coastal marsh and lake plain region surrounding the Saginaw Bay in Michigan. The 7,287 ha of productive coastal wetlands surrounding Saginaw Bay make up one of the largest remaining freshwater coastal systems in the nation. More than 30 plant and animal species on the federal threatened and endangered list make their home in the 22-county watershed. The area is important for commercial fishing, tourism and recreation as well as being a major agricultural and industrial area.

Wetland Status and Trends

Wetland loss throughout the Prairie Hardwood Transition and Central Hardwoods has been extremely high with most states losing over 75% of their original wetlands (Dahl 1990). Much of the remaining wetland and prairie habitat has been seriously degraded. Threats to wetland habitats of these two regions include water quality, urbanization, recreational development, agricultural drainage, pollution, surface mining, forestry, barge fleeting and high Great Lakes water levels.

Hydrological modification is the key term when characterizing the Prairie Hardwood Transition and Central Hardwoods. Agricultural development has resulted in the conversion of countless small inland wetlands as a result of drainage with millions of kilometers of drain tiles and ditches. Agricultural development has also led to the diking and drainage of Great Lakes coastal marshes, especially along the southern half of Lake Michigan, Western Lake Erie, and Lake St. Clair. "Hardening" of the lakeshore in the late 1880s and early 1900s for agriculture and development do not allow coastal marshes to "migrate" inland in response to high Great Lakes water levels (Herdendorf 1987). In many areas, the only remaining coastal marshes are those retained by waterfowl hunting interests or those located on government-owned wetland management areas. Paradoxically, these existing marshes must be protected and their productivity maintained by dikes and pumps due to the destructive actions of high lake levels, storm events and exotics such as carp, purple loosestrife and phragmites (Kroll and Gottgens 1997).

Almost equally important as hydrological modification, especially along the shore of lower Lake Michigan, the west shore of Lake St. Clair and western Lake Erie, is urban sprawl associated with the cities of Chicago, Detroit and Toledo (Fuller et al. 1995). In many coastal

areas, residential and industrial development is so pronounced that wetland restoration on a broad scale is not possible. Small remnant wetlands and isolate “islands” of habitat can be protected and restored, although the overall value for waterfowl is limited. These wetlands can serve as ideal locations for education and public use. Additionally, industrial activity has introduced contaminants into the ecosystem, compounding restoration efforts and presenting a serious issue that must be considered with restoration activities in many areas of this region. Active management of remaining wetlands is especially important because a high level of productivity is necessary to compensate for irreversible wetland losses.

The coastal marshes of the Great Black Swamp are primarily intensively managed marshes due to the hydrological alterations since settlement. Of the 12,146 ha of wetlands remaining, about half are in public ownership and half are owned by private duck hunting clubs (Bookhout et al.1989). Other coastal habitats along the shores of Lake Erie and Ontario have been lost or seriously altered for residential, commercial and recreational development. In addition to this direct loss of habitat, various toxic chemicals from agricultural and industrial sources degrade remaining wetlands. It is expected that coastal shoreline development will increase from 10-30% in many areas in the next 20-50 years.

In the St. Lawrence Valley, dairy farms are the primary industry and the landscape is comprised of an abundance of grassland habitat. However, soils here are low to moderate in productivity and extensive farm abandonment has occurred. Reverting farmland has produced ideal habitat for beaver allowing their populations to expand, creating thousands of acres of wetland habitat. The combination of many wetlands in close proximity to pasture land accounts for relatively significant breeding waterfowl densities. Ironically, the continuing decline in dairy farming in the Valley may present the greatest threat to maintaining and expanding waterfowl production.

An exotic plant, purple loosestrife, is scattered throughout the region. Significant areas of concentration occur at the Montezuma Wetland Complex (MWC), and Tonawanda-Iroquois-Oak Orchard (TIO) wetlands. An intensive biological control program, involving the release of several species of beetles from Europe, has been ongoing on MWC and TIO since about 1995. Results have been very positive and plans are now being made to use beetle populations from these sites to populate other loosestrife-infested areas throughout the region.

In general, wetland loss throughout most of the Boreal Hardwood Transition Ecoregion has been moderate; less than 25% of the pre-settlement wetlands have been lost in the Michigan portion, with similar losses in Wisconsin (Dahl 1990). Although sparsely populated, wetland habitats in this region face numerous human influences including recreational development, urbanization, agricultural drainage, pollution, cranberry operations, peat harvesting and high Great Lakes water levels. Wetland loss in the Saginaw Bay watershed of Michigan, however, has been extreme. Settlement and intensive farming led to the loss and degradation of more than 50% of these wetlands (Comer 1996). Intense agricultural and industrial practices throughout the watershed have seriously degraded the water quality in Saginaw Bay. Similar losses have occurred in the Green Bay and Lake Winnebago areas of Wisconsin.

Waterfowl Characteristics

Breeding Habitat - Mallards, wood ducks, blue-winged teal, ring-necked ducks, mergansers and Canada geese are common breeding species in the U.S. Great Lakes Waterfowl Conservation Region. Nesting by American black ducks, green-winged teal, northern shoveler, gadwall, canvasbacks, redheads and American wigeon also occurs on a limited basis within the region

(USFWS 1979). Historically, high numbers of black ducks nested in the Boreal Hardwood Transition region (Pirnie 1935). Mallards are the most common waterfowl species found breeding throughout the entire region. Areas with relatively high populations of breeding mallards occur throughout southeastern Wisconsin, southeastern Michigan, fringes of northern Illinois, Indiana and Ohio, and the St. Lawrence Valley in New York. Survey data taken in New York show that the St. Lawrence Valley has the greatest density of breeding mallard pairs (5\km^2) in the entire Northeast portion of the U.S. The wood duck is the second most abundant breeding waterfowl species, and nests throughout the region. Blue winged-teal can also be found nesting where mallards are abundant, but the highest concentrations are in southeast Wisconsin.

The Prairie Hardwood Transition and Central Hardwoods are second only to the prairies to the west in terms of waterfowl production **(**IAFWA 1998). Glacial pothole wetlands and small inland lakes in the north and forested bottomlands along river corridors provide breeding habitat for dabbling ducks including mallards, wood ducks and blue-winged teal. In Northeast Illinois, mallard breeding pair surveys estimated mallard breeding pair density in a 287,044 ha study area to be 3.38 pairs/km^2. Breeding waterfowl densities for all species was approximately 4.6 pairs/sq. km, which compared favorably with areas of secondary importance in the PPR (USFWS 1998). Managed marshes adjacent to vegetated littoral areas of the Great Lakes provide limited nesting habitat for canvasbacks, scaup, mallards, black ducks and red-breasted mergansers (USFWS 1979).

Migration and Wintering Habitat - More than 3 million ducks, primarily mallards, black ducks, lesser and greater scaup, canvasbacks, and redheads are estimated to migrate annually through the Great Lakes region. Many cross the Boreal Hardwood Transition, Central Hardwoods, Prairie Hardwood Transition and the Eastern Tallgrass Prairie as they make their passage between breeding and wintering areas (Bookhout et al. 1989). Important habitats in these regions include portions of the sheltered, vegetated littoral zone of the Great Lakes, coastal marshes, and riverine and palustrine marshes, and adjacent upland habitats of low-gradient river tributaries that empty into the lakes.

Lack of suitable migration habitat, especially for spring migrants, in this Waterfowl Conservation Region may be a factor in population declines of black ducks, canvasbacks, scaup and redheads. Diving ducks, including greater and lesser scaup, canvasback, redhead, bufflehead and common goldeneye generally use open water and emergent marshes associated with coastal wetlands of the upper Great Lakes, Saginaw Bay and Green Bay. Habitat loss and degradation on historic canvasback staging areas, such as the Winnebago System, other large inland lakes, and Green Bay, has caused migrating canvasbacks to utilize the Upper Mississippi River in greater numbers (Bellrose 1976). The Lake St. Clair, Detroit River and southwest Lake Erie marshes are considered to be the most important wetlands in the Great Lakes (Fuller et al. 1995). In recent years, 150,000 canvasbacks have been surveyed in Lake St. Clair (MI DNR unpublished report). The Lake Erie marshes annually host hundreds of thousands of waterfowl in spring and fall, and are the most concentrated staging areas for black ducks in North America (average peak 51,500 black ducks) (Tori et al. 1990).

The Mississippi Valley Population (MVP) of Canada geese, use migration sites in the western Upper Peninsula and eastern Wisconsin. Notably, Horicon marsh in eastern Wisconsin is a significant staging and wintering area for the majority of the MVP geese as they pass through the area. The Saginaw Bay area is a key migration area for the Southern James Bay Population (SJBP) of Canada geese, as it is the first major stop after the birds leave James Bay. It is estimated that during peak fall migration, 13,680 Southern James Bay Canada geese occur annually at Shiawassee National Wildlife Refuge (estimates based on 10-year average). One of

the limiting factors for wintering SJBP and other waterfowl in the Saginaw Bay is the lack of an adequate energy source. The Eastern Great Lakes Lowlands is also an important region for the SJBP.

Other Wildlife

This region provides breeding and migration habitat for a diverse group of wildlife including song, shore and upland birds, mammals, fish, amphibians, and reptiles. Species of concern include Forster's, common and black tern, snowy egret; state listed osprey, federally threatened bald eagle and federally endangered piping plover and peregrine falcon. Restoration of wetlands, native grassland complexes, and forested and scrub-shrub habitats will improve breeding and stopover conditions for many birds. Involvement with many 'all-bird' initiatives associated with the Joint Venture provides additional opportunities to participate in habitat conservation, management and research to improve populations of avian species in North America and the Neotropics. Amphibians use wetlands during part of their life cycle, and while reptiles are often less dependent on wet areas, there are many that require the habitat characteristics provided by wetlands. Wetland-dependent amphibian and reptilian species occurring in the Great Lakes Basin and expected to benefit from wetland restoration include such species of concern as Blanchard's cricket frog, copperbelly rattlesnake, eastern massasauga rattlesnake and Blanding's turtle.

Current Habitat Conservation Programs

This region bridges two Joint Ventures of the NAWMP; the Boreal Hardwood Transition, Central Hardwoods, Prairie Hardwood Transition, Eastern Tallgrass Prairie and the Ohio portion of the Lower Great Lakes/St. Lawrence Plain being associated with the Upper Mississippi River and Great Lakes Region Joint Venture (UMR/GLRJV). Portions of New York and Pennsylvania are in the Atlantic Coast Joint Venture.

In Wisconsin, DU's program is focused in southeastern Wisconsin, which is important for both breeding and migratory waterfowl. Southeast Wisconsin spans an area historically characterized by a glaciated mosaic of wetlands surrounded by tall grass prairie and oak savanna. Agriculture and development are the dominant features resulting in substantial losses of small isolated prairie-like wetlands and the original prairie that covered most of the area prior to settlement. Much of the current landscape is composed of row crops, hayfields, and pasture. Development associated with urban sprawl is currently the greatest threat to grassland and wetland habitat. The protection and restoration of grass and wetland complexes on private land will increase breeding propensity as well as improve production. Coastal habitat restoration and acquisition on large public property is primarily for spring and fall migratory waterfowl, although breeding birds will also benefit from small restoration projects.

Three DU programs cover a significant portion of Lower Michigan: Saginaw Bay, Lake St. Clair/ Lake Erie, and Southeast Lake Michigan including the Grand River. The Saginaw Bay watershed falls mostly within the Boreal Hardwood Transition region. Saginaw Bay is one of largest remaining freshwater coastal systems in the nation. The Saginaw Bay watershed historically contained some of Michigan's most extensive wetlands, providing spring and fall stopover points for tremendous flocks of migrating birds and nesting habitat for large numbers of waterfowl. Settlement and intensive farming led to the loss and degradation of more than 50% of these wetlands. Degradation of remaining habitat has occurred as intense agricultural and industrial practices throughout the watershed have seriously degraded water quality. Conservation work in this area will concentrate on production and migration habitat through the

protection and restoration of Great Lakes coastal marshes and their associated habitats, expansion of existing state and federal wildlife areas with the restoration of newly acquired lands, and restoration and enhancement of small wetlands and associated uplands important for waterfowl production on private lands. To date, several NAWCA grants and several large foundation donations have been secured to fund the partnership project in Saginaw Bay.

The St. Clair-Detroit waterway his heavily impacted with over 90% of the U.S. shoreline filled and bulk-headed, that resulted in wetlands being replaced by hardened shoreline. Over 5 million people live within one hour of the area. Despite these impacts, existing marshes in the lower river have high waterfowl use, primarily diving ducks during spring and fall migration as well as wading and shorebirds. The coastal marshes in this area provide habitat for some of the highest concentration of staging American black duck and canvasbacks in North America as well as 27 other species of waterfowl. Because the area still has extensive beds of wild celery, it remains one of the largest and most productive duck feeding and fish spawning grounds in the Midwest. The Western Hemisphere Shorebird Reserve Network as a Regional Shorebird Reserve designated this area. Given the continued threat from sprawl and development, programs in this area will be focused on the long-term protection of important and threatened wetland habitat, primarily for migratory birds.

The southeast Lake Michigan watershed, which includes parts of Indiana, is one of the fastest growing and most urbanized regions in the Great Lakes Basin. This area also supports some of the highest breeding densities of mallards and wood ducks in Michigan. Agriculture and urban development dominate the landscape and have resulted in drained wetlands, fragmented forests, and increased sedimentation and nutrient loading in lakes and streams. Habitat fragmentation, initially for agriculture and more recently for urban development, has hindered attempts to restore large blocks of habitat within this watershed. Wetland losses within the Grand River watershed since 1800 are estimated to be more than 229,000 acres, with some counties exceeding 40-60%. In Indiana, the current landscape contains a disproportionate amount of grass and hence the potential for wetland restoration on private lands is high. The primary life cycle need within this focus area is for breeding habitat, targeted at mallards, and spring migration habitat for a variety of species

DU Programs in the Lake Erie Watershed are focused on southwest Lake Erie marshes in Ohio. Alterations in hydrology are the primary influence on quantity and quality of waterfowl habitat. Sediment from agricultural practices and industrial runoff has created serious water quality problems. The open water bays and coastal wetlands of northwest Ohio are used extensively for feeding and resting by migrating and wintering waterfowl and other wildlife. Remnants of the Great Black Swamp, including inland forested, riverine, emergent and depress ional wetlands and associated uplands, provide valuable habitat for breeding waterfowl. The conservation focus in southwest Lake Erie is restore and preserve forested, inland, and coastal wetlands for breeding, wintering and migratory waterfowl.

Two areas of concentration in the Lower Great Lakes/St. Lawrence Plain of the Lake Ontario watershed include Montezuma and the St. Lawrence Valley. Historically this area was dominated by a forested ecosystem, with extensive coastal marshes. The area has lost approximately 70% of its wetland base primarily due to agriculture and urbanization. The Montezuma Wetland Complex is known as an important stating area within the Atlantic Flyway, attracting as many as 1 million ducks and geese during spring and fall migration. The focus is to restore and protect those areas containing muck land soils that were previously drained for agricultural production. . Three NAWCA grants have been awarded for habitat work in the complex. The St. Lawrence area contains abundant freshwater wetlands interspersed with

extensive agricultural grasslands. Although grasslands in this are represent the largest contiguous block of grassed landscape in the northeast U.S., they are currently threatened by farm abandonment which results in natural succession to woody habitat, further fragmentation, and an overall decline in agricultural grasses. This area is an important breeding area for mallards, blue-winged teal, blacks ducks, and Canada geese. Because of the abundance of grasslands, this area supports some of the largest populations of grassland and early success ional bird species in the northeastern U.S. DU has taken the delivery role in 'All-bird' partnerships in the St. Lawrence. The approach is to develop or protect habitat in a complex of grass and wetlands to meeting multiple lifecycle needs, especially in areas where protected lands already exist so that buffers can be built around these areas.

Goals

To provide habitat in sufficient quantity and quality to meet the needs of breeding, wintering and migratory waterfowl, concentrating in areas of highest priority

- Increase production of key breeding species, namely mallards, in targeted areas by incorporating recent research findings and GIS applications into conservation programs.

- Improve water quality in coastal areas, hence food resources, via watershed-based wetland and upland restoration activities.

- Distribute a variety of outreach and communication collateral to increase general awareness and promote DU's conservation work.

- Develop GIS targeting tools and the research needed to address current uncertainty in the life cycle needs and limitations of key waterfowl species within the Great Lakes Watershed.

Assumptions

- Wetland and grassland restorations provide all the habitat elements necessary for successful reproduction and provide sustainable benefits.

- Wetland restorations for breeding birds will also benefit spring migratory waterfowl

- Restoration designed for fall migratory waterfowl will also benefit spring migratory waterfowl

- Wetland restoration design and delivery will improve water quality, and hence food resources for waterfowl.

- Active management will minimize impacts of exotics such as carp, purple loosestrife and *Phragmites*.

Strategies

- Restore wetland complexes, including small pair wetlands and larger wetlands for brood-rearing areas, and associated grasslands on public and private lands.

- Promote intensive management practices to compensate for past wetland loss in the hydrologic ally modified environments of Saginaw Bay, Lake St. Clair, Detroit River and southwestern Lake Erie.

- Provide food, cover and brood-rearing habitat for wood ducks, ring-necked ducks, black ducks and others, through the restoration of shallow water, forested and scrub-shrub wetlands.

- Protect, restore and improve the water quality of coastal wetlands to benefit degraded food resources, especially wild celery, which is important to diving ducks.

- Restore wetlands and associated grasslands on private land, utilizing Farm Bill Programs such as WRP, CRP and Conservation Reserve Enhancement Program (CREP), DU Private Lands Programs and NAWCA in partnership with the state and federal agencies.

- Develop hydrological restoration and management systems that emulate natural conditions.

- Protect important habitats that are vulnerable to loss through acquisition, conservation easement or long-term management agreements through cooperative land protection programs.

- Increase public awareness of DU's programs through targeted public relations programs.

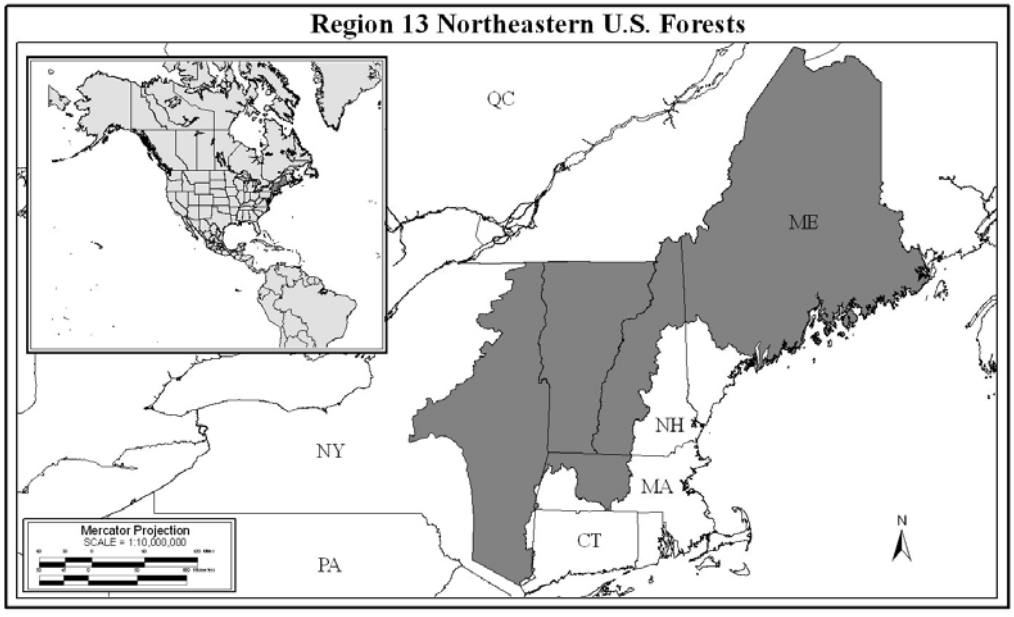
- Continue to develop GIS tools to target and improve benefits of habitat programs.

January 17, 2005 – Region 12
Major revision and update of all sections

Northeastern U.S. Forests[13]

The Northeastern U.S. Forests Waterfowl Conservation Region overlaps almost exclusively with the Atlantic Northern Forest Ecoregion of the Commission for Environmental Cooperation (IAFWA 1998), except for a narrow band representing the Lower Great Lakes/St. Lawrence Plain that transverses the North-South border between New York and Vermont. It includes the non-coastal regions of northern Maine, New Hampshire, Vermont and northeast New York. This region is included in its entirety in the Atlantic Coast Joint Venture (ACJV) of the NAWMP. This region is within the Laurentian Mixed-Forest Province and is characterized by low relief, low hills and low mountains. Marshes, rivers, lakes, poorly drained depressions, moraines, eskers, out-wash plains, and other glacial features compose most of the wetlands in the area. Vegetation is transitional between the deciduous forests to the south and the boreal forest to the north. Soils vary greatly but are generally poor and relatively infertile in the Atlantic Northern Forests; however, they are more fertile in the Eastern Great Lakes Lowlands. Soils vary greatly including combinations of peat, muck, marl, clay, silt, sand, gravel and boulders.

Approximately 85% of the 260,000 ha of forest within the Northeastern U.S. Forests region are in private ownership (Harper et al. 1990). Historically, the vast majority of land has been owned by timber companies and thus managed for forest products. The character of this region has changed relatively little over time, compared to other regions of New England where



extensive land use changes have occurred due to a strong economy and population growth. Concerned about future change, a 1990 USFS and Governors Task Force on Northern Forest Lands warned that changes in land ownership from the timber industry to recreational property here would likely have an adverse impact on open space, forestry, farming and recreational uses on private lands (Harper et al. 1990). In the last decade a downturn in the economy of the forests industry has led to millions of acres of timber company lands being put up for sale. At the same

[13] NABCI Bird Conservation Region 13 & 14 – U.S. only.(Atlantic Northern Forest, Lower Great Lakes/St. Lawrence Plain)

time, a strong regional economy has put much of this land at risk to land developers and prospectors interested in recreational developments. Fortunately, most of this land is being protected through fee title acquisition and conservation easements, by a coalition of state and federal wildlife agencies and private, non-profit conservation agencies. This is occurring throughout the region and most of this area is going into public ownership of State Wildlife Management Areas and NWRs.

Waterfowl Characteristics

The most significant waterfowl characteristic in the Atlantic Northern Forest is the contribution of this region to the breeding habitat of the black duck. Common mergansers, common goldeneye, wood ducks and ring-necked duck, also breed in relatively significant numbers in the forested zone. Since surveys of breeding ducks began in the U.S. in 1966, most states have seen a decline in numbers of black ducks. Maine, New Hampshire and Vermont are the exception in that black duck numbers have not changed much in the past 30 years. Breeding black ducks are linked to forests in general and beavers in particular (Petrie pers. com.). Growth in beaver populations throughout northeastern forests has provided an increase in the quantity and quality of breeding habitat for black ducks.

In addition to black ducks, mallards, wood ducks and green-winged teal are common breeding waterfowl in the Lower Great Lakes/St. Lawrence Plain of Northeast New York. Soils are more fertile and suitable for agriculture, lending them beneficial for breeding habitat. The quality of habitat in both the Atlantic Northern Forest and Lower Great Lakes/St. Lawrence Plain can be considered questionable. Acid rain and other pollutants may be affecting waterfowl use and productivity, but that has yet to be determined. The Connecticut and Hudson Rivers provide an important migration corridor for ducks and geese as they make their way down to the New York Bight and the Atlantic Coast.

Significance to Other Wildlife

The Northeast Forest region provides a unique forest habitat not found elsewhere in the U.S. and, consequently, supports a varied community of plant and animal species. It is reported that 225 bird species use this area during migration and breeding periods (U.S. Forest Service 1979) and virtually the entire worlds Bicknell's thrush breed on mountaintops in this region. Other important forest birds include the Canada warbler and bay-breasted warbler (IAFWA 1998). This region is also critical habitat to mammals, such as moose and black bear, which require vast areas of wilderness for survival. Lakes, rivers and streams throughout this region provide important habitats for a wide variety of cold and warm water fish, amphibians and reptiles.

Current Habitat Conservation Programs

American black ducks represent an important breeding population in northeastern states, particularly Maine. Black duck populations have declined and not recovered to the goals of the North American Waterfowl Management Plan. The current approach for black ducks is to protect large blocks of relatively undisturbed breeding habitat in the northeast US forest. Partnerships with state and federal wildlife agencies are being expanded and new partnerships with corporate timber industry are being established to protect and enhance breeding habitat.

Goals

- Work with partners to enhance and protect migration habitat and black duck breeding habitat.
- Establish habitat protection, GIS planning and outreach programs with the timber industry.
- Identify and prioritize key research and evaluation needs.

Assumptions

- Black ducks nest in relatively low densities and prefer large expanses of forested wetlands, especially beaver ponds, for breeding.
- The northeast forests region remains a stronghold for the black duck.

Strategies

- Protect shallow forested and shrub-shrub wetlands and ensure habitat management to promote continued growth of beaver populations, which will result in food production and optimal brood-rearing habitat for waterfowl such as wood ducks, ring-necked ducks, and black ducks.
- Develop partnerships and management agreements with the forestry and other large private landowners to provide technical and financial assistance for wetland protection, enhancement and management that will benefit breeding black ducks and other waterfowl.
- Emphasize timber harvest practices that benefit nest site selection (e.g. slash for cover) and provide forest regeneration that allows an adequate beaver occupancy rate throughout major watersheds.
- Protect important habitats that are vulnerable to loss through acquisition, conservation easement or long-term management agreements through cooperative land protection programs.
- Increase public awareness of DU's programs and their benefits to wetlands and wildlife.

January 17, 2005 – Region 13
General edits and minor revisions to all sections

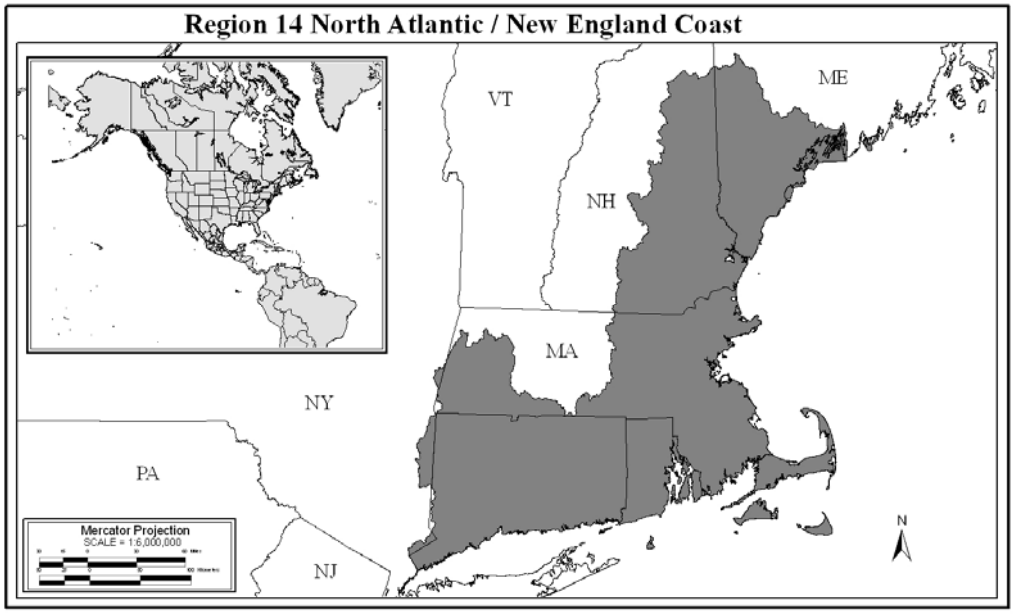
North Atlantic / New England Coast[14]

The North Atlantic Coast Waterfowl Conservation Region includes the portions of the Atlantic Northern Forest and the New England/Mid-Atlantic Coast Ecoregions identified by the Commission for Environmental Cooperation (IAFWA 1998). A chain of extensive estuarine embayments characterizes the North Atlantic Coast, stretching from Long Island Sound, to Scarborough Bay in Maine. The complex geology and geography of the Atlantic coast creates a remarkable diversity of highly productive shallow water and adjacent upland habitats including barrier beach and dune, submerged aquatic vegetation (SAV) beds, intertidal sand and mudflats, salt marsh islands, fringing tidal salt marshes, freshwater tidal marsh, and maritime forest. Major river systems drain into estuaries, merging into a network of tidal channels and bays, before ultimately flowing into the Atlantic Ocean. Inland habitats include coastal plain intermittent ponds, hardwood and Atlantic white cedar swamps, upland forests, and agricultural areas.

Coastal and inland wetlands along the Atlantic coast have been recognized as an important ecological resource, not only for waterfowl, but wading birds, shorebirds and other aquatic species that depend upon coastal marshes during their lifetime. Within the mid-Atlantic region, a substantial number of salt marshes have been lost over the past 200 years. Between 1954 and 1978, loss rates were extremely high primarily due to urban and industrial development. However, since the passage of protective legislation, loss rates have declined dramatically. Remaining tidal marsh is fairly well protected, but is severely degraded due to past grid-ditching activities. This practice resulted in altered hydrological patterns, lowered water tables, and invasion of exotic species such as common reed and purple loosestrife. Although coastal wetlands are under protection, protection of inland wetlands is not as effective. Pressure on inland wetlands and adjacent uplands continues to grow due to increases in human populations desiring proximity to coastal areas. The Atlantic coast is the most populated and heavily industrialized coastal area in the world. Industrial and agricultural runoff from major river systems continues to pose a threat to coastal waters and tidal marshes. This development trend continues today with grave consequences for coastal habitats and the wildlife that depend upon those systems.

Atlantic estuaries are a major link in the migratory chain that stretches from South America to Canada. The significance of this complex of habitats relates to its geographic location, which acts to concentrate migratory marine and estuarine species along the coastlines in both directions. The majority of Atlantic flyway populations of brant, greater scaup, black ducks, and bufflehead winter in southern New England and the New York Bight. About 1/3 of the entire Atlantic flyway population of wintering black ducks can be found in the New York Bight. Further, 80% of the wintering population of Atlantic brant are found in New Jersey and Long Island. The most common nesting species in this initiative are mallards, black ducks, and Canada geese. Conservation efforts in along the North Atlantic coast focus on migratory and wintering waterfowl needs, as well as breeding objectives for mallards and black ducks.

[14] NABCI Bird Conservation Regions 14 & 30 (Atlantic Northern Forest, New England/mid-Atlantic Coast)



Importance to Waterfowl

Expansive estuarine and near-shore habitats along the Atlantic coast historically provided abundant SAV and animal foods (including clams, snails and other invertebrates) used by waterfowl (Peterson and Peterson 1979). Tidal and riverine freshwater and brackish emergent marshes provide sheltered resting areas for wintering ducks and geese (Gordon et al. 1989).

Areas of historical importance to waterfowl in the North Atlantic coast include significant habitats found along the Connecticut River, in Narragansett Bay in Rhode Island, along the Merrimack River and Plum Island Sound in Massachusetts, the Great Bay estuary in New Hampshire, and Merrymeeting and Cobscook Bays in Maine.

Waterfowl migrate in substantial numbers down the Hudson and Connecticut Rivers and/or along the Atlantic Coast, stopping to rest and feed in coastal bays and wetlands. For several species, such as brant, greater scaup, black duck, and bufflehead, the mid-winter populations occurring in the southern New England - New York Bight account for a major part of their total Atlantic flyway populations. The New York Bight accounts for about one-quarter of the Atlantic flyway wintering population of buffleheads (USFWS 1997). Coastal wetlands in Maine are used extensively by black ducks, sea ducks and geese during winter and migration, especially Merrymeeting and Cobscook Bays. In addition, large concentrations of scoters raft off the shoals of Nantucket and Cape Cod in Massachusetts (Bellrose 1980).

During 1986-1990, 72% of all black ducks wintered in the Atlantic Flyway. About one-third of the total Atlantic flyway population of black ducks winters in the New York Bight. Wintering black ducks are found in bays, marshes, and flats along the Hudson River, New York Harbor.

Importance to Other Wildlife

The wetlands of North Atlantic estuaries, and the riverine wetlands of tributary streams and creeks, provide spawning, nursery, and feeding sites for a multitude of fish and shellfish species. The lower Hudson River Estuary is a major nursery area for striped bass, white perch, and tomcod that spawn elsewhere in the Hudson River system. In addition, the river is a wintering area for the federally listed endangered shortnose sturgeon.

Coastal and inland wetlands provide critical habitats for waterfowl, wading birds, and shorebirds, as well as other wildlife. Every spring and fall, wetlands and beaches of the estuary host massive migrations of shorebirds, waterfowl, raptors and songbirds. All types of natural habitats, including marshes, fields, successional habitat, and woods, are used by fall migrants, although woodlands adjacent to salt marshes seem to be particularly important. Black Guillemots breed in Maine's coastal habitat, while Leach's storm petrels, gulls, terns, and the southernmost population of breeding alcids nest on off shore islands.

Threats and Special Problems

The New England- Coast is one of the most populous and heavily industrialized coastal areas in the world. Much of the upland and wetland shoreline of the major Atlantic bays and their watersheds have been developed, impaired, or degraded by industrial, commercial, and residential uses. Wetland losses have resulted from coastal impoundment and filling, dredging projects, and natural sea level rise. Urban development has resulted in substantial wetland loss and has accelerated the rates of erosion along shorelines that have been stripped of vegetation. Remaining coastal wetlands are subject to extreme social and economic pressures. Ecological impacts from urban and suburban development include point and nonpoint source pollution, oil and chemical spills, recreational overcrowding, floatable materials, atmospheric fallout of pollutants, dredging and dredged material deposition, over harvesting of fishery resources, competition from exotic and invasive species, and destruction of essential natural habitats (USFWS 1997).

In addition, significant wetland losses are attributable to conversion of nontidal, forested wetlands to agriculture (USFWS 1988). All of the Atlantic states have enacted laws and regulations to protect coastal wetlands. However, protection of inland wetlands has not been as effective. In addition, pressures on adjacent uplands continue to grow with increases in human populations seeking proximity to the coast.

Current Habitat Conservation Programs

The focus of conservation programs in the North Atlantic is on meeting the needs of migratory and wintering waterfowl by restoring and conserving coastal watersheds. The primary goal is to restore hydrologic function to degraded coastal wetlands by addressing invasive species, removing tide gates, replacing undersized culverts, removal of roadbeds and dikes, and removal of dredge spoil or fill material. Efforts to restore wetlands and associated habitats will be focused in the coastal areas.

Goals

- Restore and protect ecological functions and values of coastal watersheds.

- Protect and maintain grass, tree and shrub buffers around the existing marshes.

- Gain a better understanding of the geographic distribution of waterfowl needs.
- Target areas where complexes can be built on existing and/or protected habitat.
- Establish public education programs on the importance of wetland values and a healthy environment.

Assumptions

- Restoring tidal hydrology, via ditch plugging, restores function and habitat value to coastal marshes
- Restoration work in the headwaters will improve habitat by improving water quality in the coastal marshes
- Restoration of coastal habitat will improve survival of wintering waterfowl or increase carrying capacity
- Coastal restoration activities designed for migratory or wintering waterfowl will also benefit breeding waterfowl
- A working assumption is that fall and spring coastal habitat for waterfowl is not different

Strategies

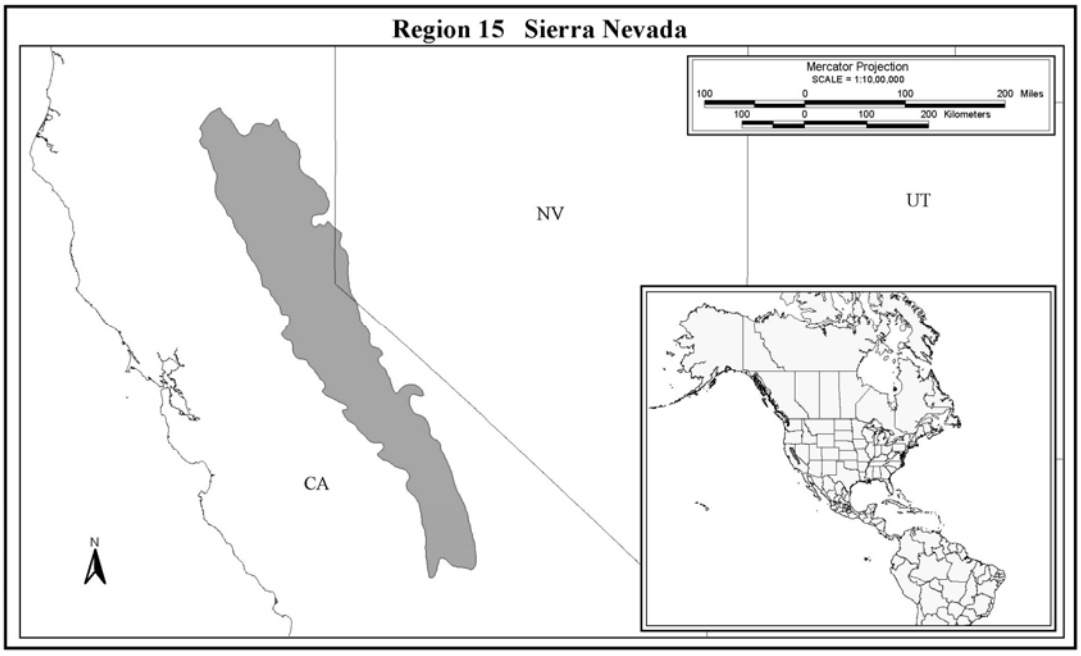
- Protect and enhance coastal and riverine marshes, shallow bays and adjacent upland areas along the New England using a. 'complex concept': restoration of wetland, upland, and riparian habitats located in or near permanently protected habitats.
- Re-create open water habitat, such as deeper pools and shallow pannes, to provide protective and productive foraging areas for waterfowl, game fish, baitfish, and migrating shorebirds and wading birds
- Restoration should focus on restoring tidal hydrology to wetlands that have been altered by roadways, railway lines and historic grid ditching.
- Focus on restoring buffers adjacent to the marshes to improve water quality that negatively affects the salt marsh system.
- Continue cost-sharing the long-term control of invasive species, such as common reed and purple loosestrife.
- Partner with other groups and agencies to promote wetland conservation, management and protection.

January 17, 2005 – Region 14
Region was renamed
Major revisions to most sections

Sierra Nevada[15]

A gentle western slope demarks the Sierra Nevada, rising out of the Central Valley, forming jagged peaks, and a steep eastern face that slopes into the Great Basin. From 100 to 1,000 m the vegetation is dominated by grassland or oak chaparral. Above 800 m pines begin to dominate, until alpine habitats are reached near the summit. The most important wetland habitats are associated with the major tributaries of the Sacramento and San Joaquin Rivers. Lacustrine marshes also existed around Lake Tahoe, but several have been degraded for home development. Grass Valley and Sierra Valley are perhaps the best palustrine wetland complexes in this region. Over 90% of the riparian corridors in California have been destroyed or modified (Gilmer et al. 1982). Urban expansion in the next 10-40 years will concentrate on the Valley and its foothills. The human population in California is expected to double in the next forty years.

This forested region is very important for neotropical songbirds, but is far less important for waterbirds. Mallard, wood duck, Canada goose, and hooded merganser nest to 1,000 m, while bufflehead and common merganser nest at higher elevations. Foothill riparian wetlands are used during late winter and early spring, especially in wet winters. It is important to protect water quality, hydrologic flow patterns, and riparian corridors for watershed impacts within the Central Valley, but the Sierra Nevada region is of minor importance to the conservation efforts of DU.

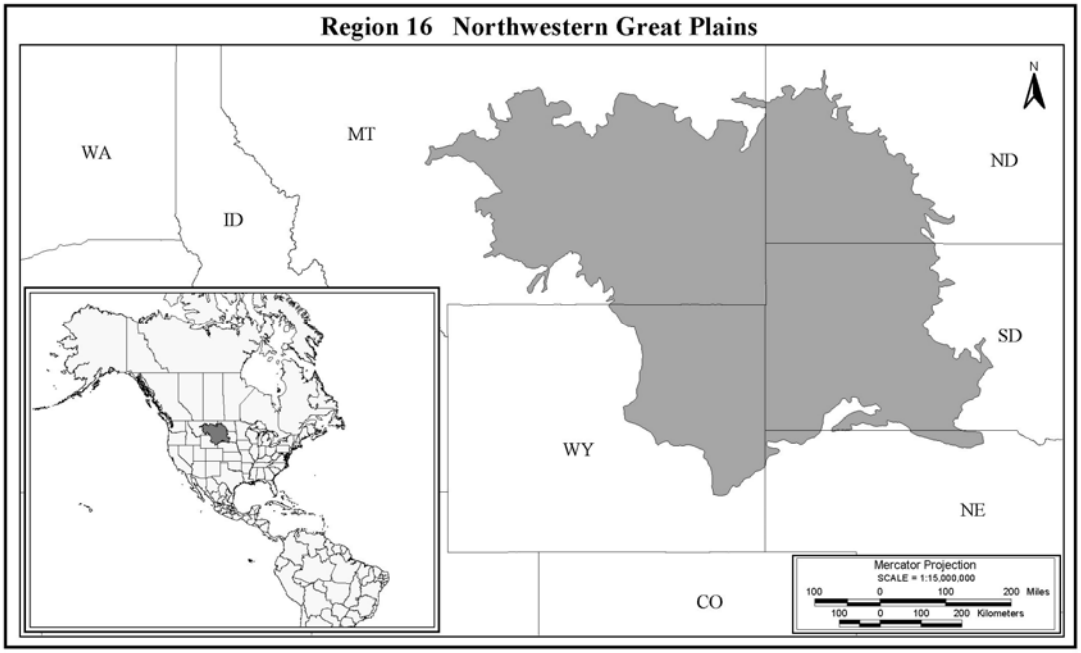


[15] NABCI Bird Conservation Region 15

Northwestern Great Plains[16]

The Northwestern Great Plains Waterfowl Conservation Region (NGP) is an arid to semi-arid landscape that lies west and south of the PPR, east of the Rocky Mountains, and north of the Southern Great Plains Region. Unlike the PPR, most of the NGP was unglaciated, therefore drainage patterns are well developed. The region is flat to moderately rolling except for the badlands of western North and South Dakota, which feature sharp topographic relief. Outside of riparian areas and shelterbelts, the area is a vast, treeless prairie dominated by vegetation typical of mid-grass and short-grass ecosystems.

Land use in the NGP is predominately devoted to livestock production. In most areas, only 5-15% of the land base has been cultivated, although the rate of cultivation is increasing. New, drought-resistant varieties of soybeans, wheat, and canola are becomingly increasingly common. Shallow aquifers occur under a significant portion of the eastern edge of the region, and there is momentum to use this groundwater, along with Missouri River water stored in mainstem reservoirs, for irrigated agriculture. Profitable, irrigated crops like potatoes and other root vegetables thrive in the soils and cool growing climate of the NGP.



Compared to the PPR, relatively few natural wetlands exist in the NGP. However, numerous manmade wetlands have been created for livestock and wildlife. These created wetlands have resulted in a net increase in wetlands since European settlement. "Stock ponds" are usually small (~1 to 5 ha) wetlands that are created by impounding seasonal streams or runoff from shallow basins. "Dugouts" are excavated wetlands under 1 ha in size that are created to water livestock. Together with natural marshes and wetlands that occur along riparian corridors, stockponds and dugouts provide surprisingly productive habitat for waterfowl. In many parts of the NGP, wetlands densities equal or exceed 1 pond/km^2, with an average wetland size of about 1

[16] NABCI Bird Conservation Region 17 (Badlands and Prairies)

ha. Nevertheless, the NGP remains a dry environment, and the number of wetlands is believed to limit the abundance of waterfowl in the region.

Waterfowl in the NGP

Although the NGP provides important spring and fall migration habitat for waterfowl, it is most important as a duck production area. The relationships among wetlands, grasslands, predators, and duck nesting success described earlier for the Prairie Pothole Waterfowl Conservation Region also apply to the NGP. The vast, unfragmented grasslands of the region enable ducks to disperse their nests, presumably making them less vulnerable to predators. Moreover, the predator community in the NGP is dominated by coyotes. Red foxes, raccoons and skunks, the important duck predators in the PPR, are far less abundant in the NGP. Consequently, duck nesting success and waterfowl production per wetland area is greater than in the PPR.

Collectively, breeding waterfowl in the NGP are a significant component of the continental population. Brewster et al. (1976) found that the NGP portion of South Dakota accounted for 21% and 31% of the state's breeding duck pairs in 1973 and 1974, respectively. Stewart and Kantrud (1974) suggested that 16% of the breeding ducks in North Dakota in 1967 were in the NGP portion of the state. During 1989-98, the number of breeding ducks in the NGP (derived from the May aerial survey) averaged 21% of the total ducks in the U.S. survey area. In 1990-93, when the PPR was dry, the NGP held a higher proportion of the breeding birds than when the PPR was wet during 1994-98 (Fig. 1). This reinforces the belief that the relatively stable water levels of NGP wetlands provide ducks a refuge during drought.

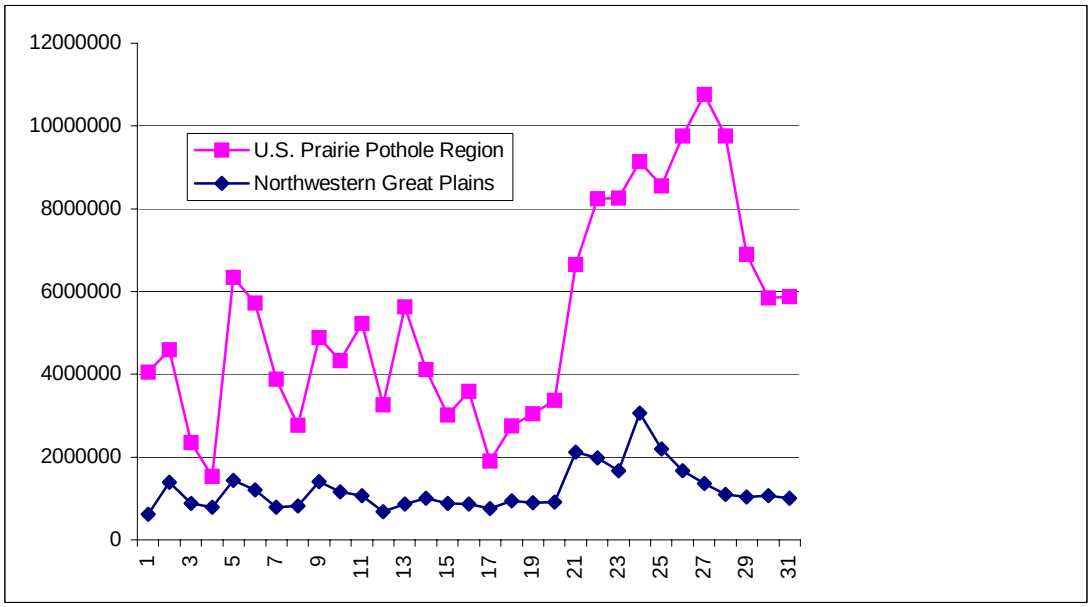


Figure 1. Breeding duck populations estimates for the Northwestern Great Plains and the U.S. Prairie Pothole Region based on May aerial surveys, 1974-2004. Northeastern Wyoming is not included in the NGP data.

In north central Montana, an area very similar to and just north of the NGP region, Ball et al. (1995) observed 6.9 breeding pairs/km^2, or 7.7 pairs/ha of water. However, most waterfowl recruitment studies in the NGP have relied on brood surveys to index recruitment. Lokemoen (1973) found 32 broods/100 wetland ha in western North Dakota, which was less than the 61

broods/100 wetland ha observed on stock ponds by Bue et al. (1952) in western South Dakota. Since 1986, DU biologists have surveyed broods on NGP stock ponds created in cooperation with ranchers, the USFS (National Grasslands), and other partners. DU survey data on 31 wetland creation projects revealed an average of 20 broods/100 wetland ha (range of 0-170), with a mean brood size of 5.5 ducklings. In general, brood densities in the NGP equal or exceed those found in the PPR. Although recruitment rates (number of fledged females per adult female in the spring population) are not known with certainty, Ball et al. (1995) observed 48.1 broods/100 breeding pairs of dabbling ducks, suggesting a hen success rate (percent of hens that successfully hatch at least one egg) of over 48%. This is considerably higher than hen success for mallards in the PPR, and greater than reported broods/pair ratios in the Canadian portion of the PPR (e.g., 10 broods/100 pairs; Hochbaum et al. 1987).

Species composition of breeding ducks is similar to that found in the PPR. Research on DU projects in the NGP region reveals that blue-winged teal were the most common species (28% of broods observed), followed by mallards (22%), gadwall (19%), other or unknown (10%), pintail (8%), wigeon (7%), and shoveler (6%). Canada geese made up <1% of waterfowl observed. Breeding ducks populations in Lokemoen's (1973) study areas in western North Dakota were dominated by mallards (50%), followed by wigeon (15%), pintails (13%), and blue-winged teal (12%).

Other Wetland- and Grassland-Dependent Wildlife

The large, unfragmented grasslands of the NGP provide important habitat for many grassland songbirds, particularly "area-sensitive" species. Baird's sparrows, Sprague's pipits, McCowan's longspurs, and mountain plovers are among the high priority species. Over a dozen different shorebird species have also been observed on created wetlands in the NGP, including Wilson's phalaropes and long-billed curlews.

Conservation Programs in the Northwestern Great Plains Region

The NGP is designated a secondary emphasis area for DU’s "Grasslands for Tomorrow" Initiative. Under the umbrella of Grasslands for Tomorrow, DU works with the USFS (National Grasslands), the BLM, the USFWS (Partners for Fish and Wildlife Program), and private landowners to create and enhance wetlands in the region. Most projects are designed to provide waterfowl benefits as well as water for livestock. These projects have been very popular with landowners in the region. Since 1984, DU has completed about 185 such projects in the NGP.

The Northern Great Plains Joint Venture was recently formed which encompasses the entire Northwestern Great Plains Region. The Joint Venture Management Board has only recently been formed and the Technical Committee is currently being assembled. Once up and running, maintaining and protecting existing wetlands and grasslands, as well as creation and enhancement of wetlands will be a major focus for the NGPJV.

Goals

- Maintain the integrity of existing wetlands projects in the NGP region.
- Create and enhance an additional 100 ha of wetlands in the NGP.
- Work with other non-profit organizations and agencies to protect existing grassland from cultivation in areas of the NGP with high wetland densities.

Assumptions

- The number of wetlands in the NGP limits the abundance of waterfowl.
- Unfragmented grasslands of the NGP enable ducks to disperse their nests, making them less vulnerable to predators.
- Nesting success rates are higher in the NGP than in the PPR, because of differences in the mammalian predator community and the dispersal of duck nests in a largely unfragmented landscape.
- Observational studies of duck recruitment in the NGP correctly reflect true recruitment rates, and therefore projects are cost-justified.
- Private landowners and agency partners will continue to share our interest in wetlands creation in the NGP.

Strategies

- Create and enhance wetlands in season watercourses and drainages using conventional engineering approaches, being careful to provide only the water control capabilities that are needed and will be used by landowners or agency personnel.
- Work with agencies and other organizations to protect large tracts of grasslands in areas with high wetland densities.
- Provide information to partners on the wildlife benefits and cost-effectiveness of created wetlands in the NGP in order to improve the prospects for further collaborative work in the region.
- Use donated conservation easements, purchased grassland easements, and revolving land purchases as the principal mechanisms to protect land.

January 5, 2005 – Region 16
Minor updates and corrections

Southern Great Plains[17]

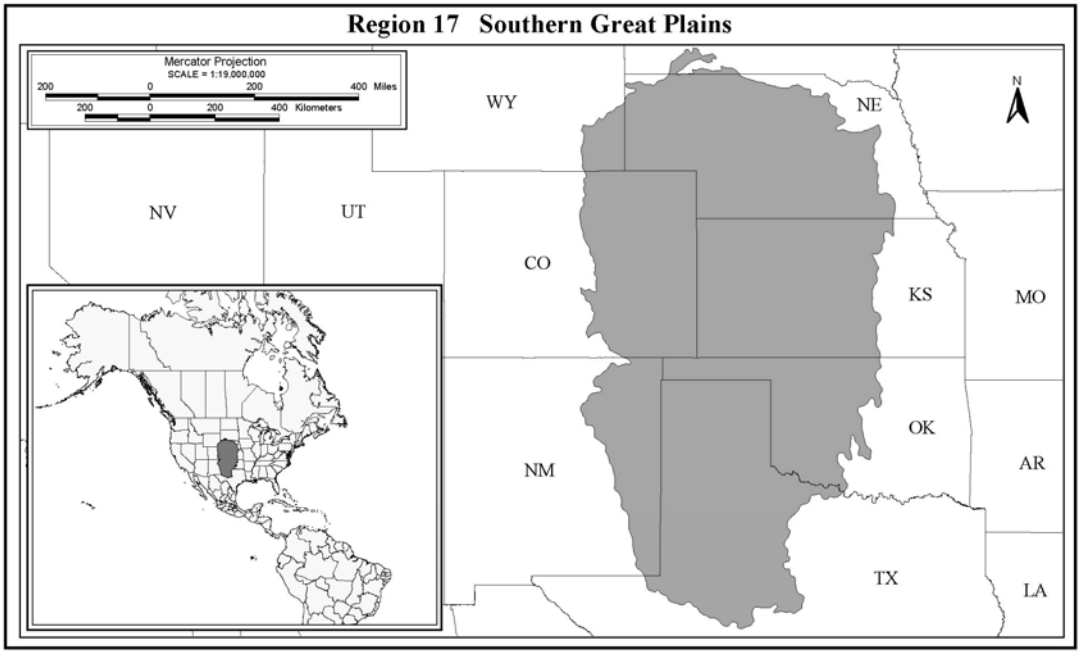
The Southern Great Plains (SGP) conservation region encompasses a large area extending from southeastern Wyoming and west-central Nebraska, south through eastern Colorado and west-central Kansas and Oklahoma, to eastern New Mexico and west-central Texas. Most of the region once consisted of semi-arid prairie interrupted by riparian corridors along major rivers (e.g., Platte River), with interspersed, continentally significant wetland complexes including the Rainwater Basin, Cheyenne Bottoms, McPherson Valley Wetlands, Hackberry Flat, isolated saline wetland complexes, and playa lakes. Collectively these wetlands are core of the Central Flyway migration corridor. The majority of wetlands in this conservation region are in private ownership, notable exceptions being Valentine NWR, NE (USFWS) Cheyenne Bottoms, KS (KDWP and USFWS) Hackberry Flat, OK (ODWC), and parts of the McPherson Valley Wetlands, KS (KDWP).

As with many other regions, wetland drainage and/or alteration of wetland hydrology have been substantial, with most drainage or alterations attributable to agricultural practices. For example, 91% of the original wetlands in the Rainwater Basin have been drained and converted to agricultural production (Tiner 1984). Approximately 70% of 589 playas >4 ha (or 33% of all playas) have been modified via construction of pits to concentrate runoff for use in irrigation of crops (Guthery and Bryant 1982). While these playas are not lost, their hydrology is altered in a manner that reduces their value to ducks via reducing the area available for growth of emergent vegetation and as foraging habitat (Gray 1986). This may be an important factor in that much of the food resource for migrating and wintering waterfowl is agricultural crop residue. Agricultural grains must be supplemented by natural foods so that birds are able to obtain the full range of nutrients for annual cycle events that occur in winter, particularly molt. Many remaining wetlands in this region have been altered, some positively and others negatively, by grazing and farming practices, siltation, and other factors (Guthery et al. 1982, Guthery and Stormer 1984).

An underlying conservation issue that affects wetlands and may have potentially serious implications for waterfowl in the SGP is allocation and use of water. Surface and ground water are used for irrigation to produce cereal grain, particularly corn (Bolen et al. 1989, Guthery et al. 1984). Waste grain provides an important source of energy for migrating and wintering waterfowl in the SGP, and probably has increased the carrying capacity (as determined by available food) of this conservation region (Baldassarre and Bolen 1984, Baldassarre et al. 1983).

Extensive use of water for irrigation has had contrasting effects on waterfowl populations. On one hand, much of the corn could not be grown in this region were it not for irrigation, and irrigation tail water can create favorable conditions for moist soil plant production in playa basins (Bolen and Guthery 1982, Guthery et al. 1982). Hence, irrigation can and probably has increased available food resources. Alternatively, many wetland basins have been drained or extensively altered by agricultural practices or to store irrigation water. The net effect likely has been an increase in agricultural foods (waste grain) and a decrease in available wetlands and associated moist soil habitat. Loss and degradation of natural wetlands may have reduced the amount of natural foods (moist soil plants, invertebrates) wherein birds cannot easily acquire essential nutrients that are not available in agricultural grains (Baldassarre and Bolen 1984).

[17] NABCI Bird Conservation Regions 18 (Shortgrass Prairie) & 19 (Central Mixed Grass Prairie)



Further, reduced number and area of wetlands may concentrate birds, making them susceptible to disease outbreaks, particularly avian cholera (Bolen et al. 1989, Friend 1987). In many years playas and wetlands in the Rainwater Basin are dry or greatly reduced in area and number by dry conditions. This further concentrates birds and increases the risk of mortality related to disease (Bolen et al. 1989, Friend 1987).

Another feature of this region that influences both the carrying capacity and distribution of migrating and wintering waterfowl is the presence of reservoirs (Ringelman et al. 1989). The semi-arid nature of this conservation region has stimulated construction of many reservoirs to hold water for irrigation and municipal water supply, with flood control, power generation, navigation, and recreation also driving construction. Ringelman et al. (1989) discussed the importance and relationship of reservoirs in this region to migrating and wintering waterfowl. They summarized information from the USFWS that indicate that there are 1,163 reservoirs encompassing 269,974 ha that are of high value to waterfowl, while another 571 encompassing 52,221 ha were available but considered of low value (Ringelman et al. 1989).

Overall, the wetlands of the SGP are of primary importance as migration habitat and they provide significant winter habitat for some species. Wetlands in this conservation region also serve as production habitat, though the number of birds produced is not well documented. The limiting factor in terms of waterfowl using the region is availability of flooded habitat.

Importance to Waterfowl

Numbers of waterfowl wintering in the SGP region probably have increased with conversion of grassland to production of cereal crops, particularly with the advent of irrigation that permits corn production in the region, though no historical estimates are available (Bolen et al. 1989). The SGP conservation region is the primary migration corridor for several million

ducks and geese in the Central Flyway. Additionally, depending on winter weather severity and wetland conditions, 500,000 to 4 million ducks and 250,000-1 million geese over-winter in this region (Bolen et al. 1989, Ringelman et al. 1989). The playa lakes alone are second in importance only to the Gulf Coast as winter habitat for waterfowl in the Central Flyway (Curtis and Beierman 1980), with estimates of waterfowl ranging from 500,000 to 2.8 million ducks and as many as 750,000 geese (Bolen et al. 1989). Mallards, pintails, green-winged teal and Canada geese are the most common winter residents.

While spring migrants make use of nearly all available habitats in this semi-arid region, the Rainwater Basin wetlands stand out in terms of concentrations of waterfowl. The wetlands in the Rainwater are particularly important spring staging habitat for pintails, mallards, white-fronted geese, Canada geese and snow geese. For many species of ducks, this is the final staging area prior to arrival on prairie nesting areas.

Some waterfowl production occurs on wetlands in the SGP conservation region. Mallards, redheads, blue-winged teal and cinnamon teal are known to successfully nest in playa wetlands, with as many as 25,000 ducks (mostly blue-winged teal and mallards) fledged in some years (Rhodes and Garcia 1981, Simpson et al. 1981). Total waterfowl production in the SGP conservation region has not been well studied.

Non-hunting mortality is the major factor affecting migratory birds in the SGP. Avian diseases, primarily avian cholera and botulism, are the primary source of mortality. Disease outbreaks are related to over-crowding on the limited wetland base in the SGP. Severe disease outbreaks occur in winter and spring when conditions are dry and severe winter weather persists for several days, concentrating birds on smaller areas of open water. However, it also has been suggested that there is a chronic low to moderate rate of disease-related mortality each year in this conservation region. Other factors, including contaminated water, uncovered waste oil pits, and pesticide pollution also contribute to total non-hunting mortality. Wetlands in the region are threatened by sedimentation, pit excavation, overgrazing, land leveling, and other factors. Water availability is a limiting factor in many years. Bolen et al. (1989) summarized disease and other mortality factors that affect birds in this region.

Other Wildlife

Within the SGP, the playa lakes winter over 90% of the mid-continent population of lesser sandhill cranes (Iverson et al. 1985, Tacha et al. 1994). Endangered whooping cranes migrate directly through the SGP region and occasionally stop to rest and forage, while wetlands throughout the SGP are heavily used by spring and fall migrant shorebirds (Bolen et al. 1989, Fischer et al. 1982). Playas, Hackberry Flat, and Cheyenne Bottoms are important stopover sites for and undetermined but large number of American avocets, Wilson's phalaropes, Baird's, buff-breasted, and semipalmated sandpipers and other species. Avocets, Wilson's phalaropes, snowy plovers, long-billed curlews and mountain plovers breed in this region. Grasslands in this region offer some of the better remaining habitat for greater prairie chickens and Henslow's sparrows. This region provides breeding habitat for most of the endangered interior least tern population in North America.

Conservation Programs

The SGPs conservation region takes in two NAWMP Joint Ventures – the Playa Lakes (PLJV) and the Rainwater Basin (RBJV). The PLJV has an objective to protect 20,639 ha, restore 4,047 ha and enhance an additional 10,117 ha. To date, the PLJVhas accomplished about 20% of

their protection objective, 80% of their restoration objective and 38% of their enhancement objective. The RBJV has objectives to protect, restore, or create an additional 10,125 ha of wetlands, provide reliable water sources for a minimum of 33% of protected wetlands, and development and implementation of strategies that maximize wetland values to wildlife.

The causes of habitat loss and the biological consequences in both joint ventures are similar. Over-crowding of birds leads to disease outbreaks. Consequently, conservation programs of DU and its partners are similar throughout the SGP. Essentially, the over-riding needs are to protect existing wetlands, restore and/or enhance wetlands, and where feasible, provide a reliable source of water to assure availability of wetland habitat.

DU's participation in this region presently is focused on cooperating with state, federal and private partners to provide technical assistance related to wetland engineering, design and development and financial assistance with wetland development (Hackberry Flat, McPherson Valley Wetlands). DU does not currently have the financial or human resources to become extensively involved in delivery of a private lands program in the SGP conservation region. The Continental Conservation Plan identifies DU's future role in this region as cost-sharing habitat protection and enhancement activities and support of research on disease etiology, moist soil management of playas and winter mortality; and supporting resource policy issues that protect and enhance wetlands and associated uplands.

Goals

- Protect, restore, enhance, and manage wetland and waterfowl habitat throughout the region with particular emphasis on the objectives of the Rainwater Basin JV and Playa Lakes JV.

- Maintain and administer completed projects in the SGP, totaling over 3,343 ha as of March 1, 2000.

- Protect, restore, or enhance 1,900 ha in the Playa Lakes Joint Venture, 2,000 ha in the Rainwater Basin Joint Venture, and additional 1,000 ha within the SGP conservation region but outside of current NAWMP joint venture boundaries during the five years covered by this update.

Assumptions

- Foraging habitat is not a limiting factor to waterfowl populations in this conservation region.

- The amount and distribution of flooded habitat limits the ability of this region to support waterfowl.

- Reduced flooded habitat reduces survival rates via a direct relationship with overcrowding and disease.

- Increasing availability of flooded habitat above an undetermined threshold decreases the scale and frequency of mortality related to disease, thereby increasing annual survival rates of waterfowl using this conservation region.

Strategies

- Implement private land conservation programs in partnership with state, federal and private partners.

- Examine the potential to use conservation easements or revolving land acquisition programs to protect and restore habitat in the SGP conservation region.

- Maintain and expand existing partnerships, while simultaneously exploring and developing additional partnerships that are consistent with the DU mission.

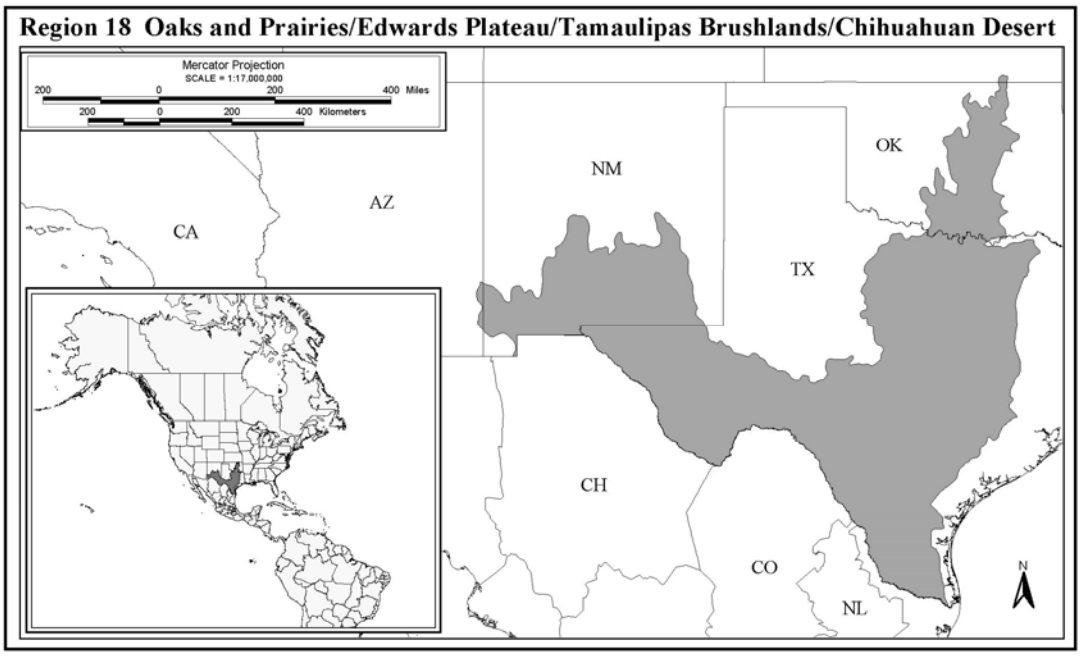
- Organize KS, OK, and TX into one management unit administered by the Southern Regional Office (SRO).

- Develop a GIS to assist with planning, monitoring and evaluation of conservation programs in this region.

Oaks and Prairies / Edwards Plateau / Tamaulipas Brushlands / Chihuahuan Desert[18]

The Oaks and Prairies and Tamaulipas Brushlands both have isolated wetlands that provide migration and winter habitat for several hundred thousand to over 1 million ducks and geese. The Texas Parks and Wildlife Department began flying midwinter counts in 2000. These surveys suggest that wetlands in these two conservation regions winter at least 1 million ducks each winter, making them second only to the Gulf Coast in importance for wintering waterfowl in Texas. The surveys indicate that these two conservation regions provide habitat for approximately 300,000 – 500,000 gadwalls, 200,000 to 450,000 mallards, 60,000 to 200,000 American wigeon, and 30,000 to 100,000 northern pintails. Further, these two regions also provided winter habitat for 50,000 to 1 million geese. Snow/Ross and white-fronted geese are the most common geese, though small numbers of Canada's occur each winter.

Generally, DU has worked in these areas only through the MARSH program. Habitat conditions in both regions vary with annual rainfall, particularly in the Tamaulipas Brushlands. Habitat conditions are less variable in the Oaks and Prairies region where stock ponds and reservoirs provide aquatic vegetation, and habitat from which birds can roost and feed in adjacent agricultural fields. Habitats in these regions do not appear to be threatened at this time, although certain isolated wetlands in the Tamaulipas Brushlands may become vulnerable pending outcome of wetland regulatory issues related to the SWANCC decision. In general, however, DU does not anticipate development of broader conservation programs in these regions. Projects will be considered on a case-by-case basis, and completed and administered with staff involved in programs targeted at other higher priority areas. Limited opportunities may exist to protect tracts with valuable wetlands or higher densities of wetlands through conservation easements.



[18] NABCI Bird Conservation Regions 20, 21, 35 & 36

The Edwards Plateau and Chihuahuan Desert have very limited numbers of wetlands and stock ponds that provide migration and winter habitat for several hundred to several thousand ducks and geese. Generally, DU has worked only through the MARSH program to conserve these sites. DU does not anticipate development of broader conservation programs in these regions. Projects will be considered on a case-by-case basis, and completed and administered with staff involved in programs targeted at other higher priority areas.

January 5, 2005 – Region 18
Minor updates and corrections

Upper Mississippi River[19]

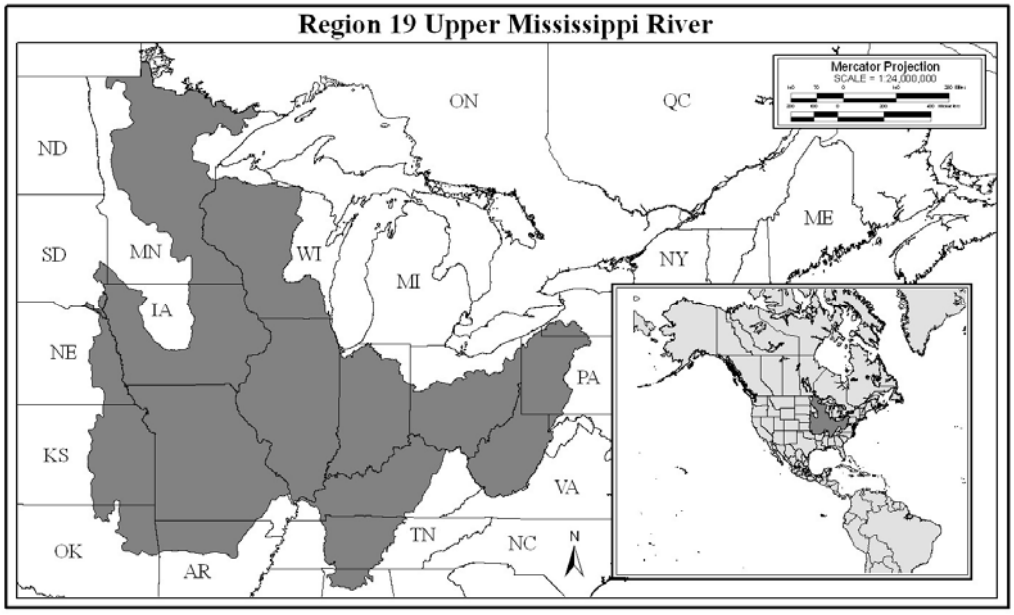
The Upper Mississippi River Waterfowl Conservation Region includes portions of the Eastern Tallgrass Prairie, Prairie Hardwood Transition and the Central Hardwoods of the Commission for Environmental Cooperation (IAFWA 1998). This region is bisected by the floodplain of the Mississippi River and its larger tributaries in all states of the watershed. The floodplains of the river systems include diverse wetland habitat, including temporarily and seasonally flooded bottomland hardwoods, permanently and semi-permanently flooded shrub and wooded swamps, emergent wetlands, mudflats and submerged aquatic beds, all of which are utilized by migrating waterbirds.

The Mississippi River and its major tributaries, the St. Croix, Chippewa, Wisconsin, and Rock Rivers, drain approximately 75% of Wisconsin's landscape. The Upper Mississippi River basin in Wisconsin has nearly 38,057 ha of riverine and bottomland habitat, 371 km river length, and almost 3,226 km of shoreline (USFWS 1998). This region provides important wildlife habitat and is vital to maintenance of water quality. Southeast Wisconsin contains the largest cattail marsh in the U.S., Horicon Marsh. Horicon Marsh is nearly 12,955 ha in size and is designated a RAMSAR Wetland of International Importance. Additionally, more than 35,830 ha are protected under public ownership in the Mississippi River and Trempleau NWRs.

Except for a small portion of the Chicago metropolitan area, all of Illinois occurs in the watershed of the Mississippi River. Approximately 90% of historic wetlands of Illinois have been lost (Dahl 1990). A major portion of Illinois that drains into the Mississippi River comes through the Illinois River Valley. Prior to settlement, the Illinois River basin contained approximately 141,700 ha of wetlands, but now less than 68,826 ha remain due primarily to drainage for agriculture. State and federal management areas protect 6,680 ha of existing habitat, and private duck clubs have secured an additional 6,478 ha (USFWS 1998). Because 80% of the watershed is used for agriculture, high erosion rates have impacted terrestrial and aquatic waterfowl habitat as well as water quality.

The Mississippi River Valley in southern Illinois contains more than 137,651 ha of wetlands. Along the Cache River, swamps, bottomland forests, limestone glades and success ional fields provide habitat for over 250 species of migratory waterfowl, wading birds and Neotropical migrant songbirds (USFWS 1998). This area has been designated as a wetland of international importance by the RAMSAR convention. Black Bottom, located at the southeastern tip of Illinois on the north side of the Ohio River contains low gravel hills with continual groundwater seeps. The area is rich in a diversity of unique flora, including cypress swamps, flood plain forests and rare species of orchids, mosses and ferns. Predominantly in private ownership, this unique wetland complex should be preserved for its integrity and benefit to all types of wetland bird species. Timber harvest, levee construction and surface mining have altered habitat conditions for migratory waterfowl and other wildlife in this region of Illinois.

[19] NABCI Bird Conservation Regions 22, 23 & 24 (Eastern Tallgrass Prairie, Prairie Hardwood Transition, Central Hardwoods)



Wetland loss in Indiana has been extreme with only 15% of the state's pre-settlement wetlands remaining (Dahl 1990). Clearing bottomland forests in southwest Indiana has been the primary impact on wetland habitat. Few flood control levees exist in southern Indiana, allowing rivers to flood over their banks and into the bottomlands in spring and fall. However, frequency and intensity of flooding events have been affected by agricultural and other human development. Threats to wetlands in this area include agricultural activities, commercial and residential development, road building, water development projects, timber harvest, mining, groundwater withdrawal and vegetation removal and sedimentation.

In addition to being dominated by the large river systems of the Ohio, Wabash, White and Patoka, the Indiana portion of this region also includes the Kankakee River basin in northeast Indiana, which once supported one of the largest freshwater wetland complexes in the U.S. (USFWS 1998). Known as the Grand Kankakee Marsh, this area once encompassed over 202,429 ha of prime waterfowl habitat. Wetland and prairies were intertwined with the Kankakee River as it meandered from South Bend, Indiana to the Illinois state line, taking a 387 km course to cover the 121 km distance. Channelization and drainage to support agriculture have resulted in the loss of nearly the entire marsh.

Several areas of importance in Ohio are the Killdeer Plains/Big Island Wetland Complex and the watersheds of the Scioto, Great and Little Miami, and Muskingum Rivers. The Killdeer Plains/Big Island Wetland Complex was originally the eastern-most extension of a large wetland and prairie complex that consisted of prairie pothole and oak savanna habitats. This region has been extensively drained and converted for agriculture. The Scioto River is a major tributary to the Ohio River, and its valley is a mosaic of broad floodplains, small streams, agricultural land, and bottomland forests. Much of this region has been cleared and drained for agriculture giving it a high potential and priority for restoration.

Minnesota and Iowa are also important areas once dominated by lakes and wetlands. Loss of wetlands and grasslands has diminished the waterfowl production capacity of this landscape, however it continues to provide vital waterfowl migration habitat that includes large marshes and shallow lakes on the prairie to natural wild rice wetlands in the forest. The large wetlands remaining serve as a vital link between southern wintering grounds and breeding areas to the north and west. During prairie droughts, more permanent water in Minnesota's lake country offers refuge to displaced waterfowl. Although direct drainage no longer threatens these wetlands, recent research suggests that productivity in these wetlands has seriously declined and may be directly impacting waterfowl populations.

In Missouri and eastern Kansas, important migration and winter habitat occurs along the Missouri River and its major tributaries, including the Osage and Grand River systems. However, wetlands associated with these river systems have been severely degraded as a result of the effects of flood control and navigation projects. These projects dramatically altered natural hydrology of these rivers, and they have created disconnects between the rivers and their floodplains where most of the valuable wetland habitat was located. Subsequent to alterations of hydrology came conversion of many former wetland areas to agriculture and other uses. The net effect has been a reduction in waterfowl carrying capacity in the region.

Importance to Waterfowl

Mallard nesting activity occurs throughout the Eastern Tallgrass Prairie, Prairie Hardwood Transition and the Central Hardwoods regions where there is suitable habitat, though little quantitative information is available. Wetland/grassland complexes provide beneficial breeding habitat for mallards and blue-winged teal. The bottomland hardwoods provide some of the best wood duck nesting and brood rearing habitat in the Upper Mississippi River Conservation Region. The breeding wood duck population in the Illinois River Valley is estimated at 20,000 (USFWS 1998). The Horicon Marsh and surrounding area provides some mallard and blue-winged teal production. Horicon supports the largest redhead breeding population east of the Mississippi River (WDNR 1973).

The Mississippi River and its major tributaries provide a major migration corridor for hundreds of thousands of dabbling ducks, and significant numbers of ring-necks, canvasbacks and scaup (USGS 1999). Managed areas and restored bottomland forests in the Eastern Tallgrass Prairie, Prairie Hardwood Transition and the Central Hardwoods regions provide wintering and migration habitat for mallards, black ducks, wood ducks, northern pintails, Mississippi Valley Population of Canada geese and other species. Horicon Marsh is a major migration stopover for the Mississippi Valley Population of Canada geese, with between 100,000 and 500,000 geese utilizing the marsh as they make their way from northern breeding grounds to wintering habitat in southern Illinois (Bellrose 1980). The Illinois River Valley and associated wetlands provide some of the most significant mid-migration habitat for mallards in the Mississippi Flyway, often peaking at over one million in the fall. Although not to the magnitude as the Illinois River, the River systems in Ohio provide important migration and wintering habitat for mallards and black ducks and other species crossing from the Atlantic coast, such as pintails.

The Missouri River and its major tributaries provide important migration habitat for mallards, green-winged teal, wood ducks and other puddle ducks, as well as Canada and snow geese. In years of mild winter weather, several hundred thousand waterfowl, particularly mallards, may over-winter in habitats associated with the Missouri River.

Current Habitat Conservation Programs

Within this Waterfowl Conservation Region, there area several significant areas in which DU delivers conservation programs. These include the Ohio Rivers area, Illinois River watershed, southeast and northwest Wisconsin, the Living Lakes area (MN and IA), and programs in Missouri.

The Illinois River watershed is a significant migration corridor. The number of mallards migrating through the valley has decreased by 65% and the number of divers, especially lesser scaup, have decreased by more than 90%. Despite these declines, 25% of all ducks I the Mississippi Flyway still use the Illinois River as a migratory corridor. The degradation of the system has also resulted in major non-point source pollution input to the Mississippi River ecosystem. Other significant areas in Illinois include the Rock River watershed for production and the confluence of the Ohio/Mississippi Rivers in southern Illinois and Indiana. In Illinois, the priority should be on diving duck migration habitat (fall and spring) mostly in the middle reach of the Illinois River. The second priority will be spring habitat for both dabblers and divers, and finally production in the upper reaches near Wisconsin.

Concentration areas in Wisconsin include the southeast and northwest parts of the state and conservation work is primarily focused on production, although these areas also provide important migratory habitat. The northwest area was historically dominated by pothole-type wetlands and the southwest area historically characterized by a glaciated mosaic of wetlands surrounded by tall grass prairie and oak savanna. Agriculture and urban development have resulted in substantial wetland loss, fragmented grasslands and increase sediment and nutrient loading to streams and rivers in both areas. The conservation focus in Wisconsin is on protecting and restoring small seasonal wetlands and re-establishing native prairie adjacent to wetlands for production and spring migratory habitat, and expansion of existing state and federal wildlife areas for fall habitat.

In Minnesota and Iowa, the Living Lakes initiative targets spring migratory habitat for multiple waterfowl species. The focus is to establish stepping stones of perpetually protected and managed wetland complexes for Keokuk Pool in southwestern Iowa through northern Minnesota that will provide waterfowl with the necessary food and habitat resources as they travel across this migratory pathway. This will be accomplished through shallow lake watershed improvements, shoreline protection and acquisition, and shallow lake and large marsh restoration, enhancement and protection.

The Scioto, Muskingum, and Miami River watershed s are currently being evaluated for the migration and wintering habitat benefits they provide. These river systems serve as primary migration corridors for tens of thousands of waterfowl between Lake Erie and the Ohio River, as well as waterfowl species traveling west from the Atlantic coast. Several thousand mallards, black ducks and Canada geese winter along these rivers, feeding in the rich agricultural fields lining the river valleys.

Conservation programs in Missouri and eastern Kansas also fall within the boundaries of the Upper Mississippi River Waterfowl Conservation Region. The focus of programs in Missouri and Kansas is on protection, restoration and development of migration habitat for waterfowl following corridors along major rivers such as the Marais des Cygnes, Kansas, Osage, Neosho, and Missouri and their major tributaries. To date, conservation efforts have been project-specific and include notable works at Marais des Cygnes Wildlife Area in Kansas, and Four Rivers and Grand Pass Conservation Areas in Missouri.

Goals

- Restore and protect wetlands and associated habitats that benefit waterfowl, wildlife, and people, improve water quality, and promote watershed health.

- Provide habitat of sufficient quality and quantity so to not be limiting to wintering, migrating and breeding waterfowl populations.

- Target wetland and lake restoration activities to provide adequate food resources to spring migratory waterfowl.

- Along river systems, aim for interconnected natural habitats of old-growth timber, buffered waterways, emergent flood plans, and complexes of wetland types by restoring Hydrology to the extent possible.

- Develop GIS targeting tools and the research needed to address current uncertainty in the life cycle needs and limitations of key waterfowl species within the Upper Mississippi Watershed.

- Establish outreach programs to educate the public on the importance of wetland values and a healthy environment.

- Evaluate the role of DU in regard to expanded conservation programs throughout the region, including: a) formation of new partnerships; b) provision of biological and engineering services to agencies and private landowners; c) development of partnership-driven private lands programs; and d) proactive use of conservation easements to protect habitat.

Assumptions

- Foraging habitat limits populations migrating through or wintering in the region.

- Wetland and grassland restorations provide all the habitat elements needed for successful reproduction and provide sustainable benefits.

- Wetlands and grasslands will continue to be restored, enhanced and managed to maximize productivity for waterfowl and other wildlife by state and federal agencies.
- Wetland restoration activities are additive towards improving water quality problems in the Mississippi River system and improving food resources for waterfowl

Strategies

- Restore wetlands and associated grasslands on private land, utilizing Farm Bill Programs such as WRP, CRP and CREP, DU Private Lands Programs and NAWCA.

- Develop hydrological restoration and management systems that emulate natural conditions.

- Maximize mid-migration habitat through the protection of habitats that are vulnerable to loss through acquisition, conservation easement or long-term management agreements and other cooperative land protection programs.

- Increase public awareness of DU's programs and the benefits to wetlands they provide by developing public relations plans for regional conservation programs.

- Restore wetlands and associated grasslands on public land.

- Incorporate management capability into restored wetlands to maximize wetland productivity for waterfowl and other wetland wildlife.

- Expand wetland conservation programs to watershed or landscape levels – targeting water quality as a major issue/benefit.

- Restore bottomland hardwood forests in concert with moist soil management units and enhancement of shrub/scrub wetlands to provide food resource benefits to migrating and wintering waterfowl.

- Develop shallow water habitat to benefit the large numbers of waterfowl that frequent flooded agricultural fields during spring migration.

January 17, 2005 – Region 19

Added background information on Minnesota and Iowa
Revised section on Current Habitat Conservation Programs
Revised section on Goals

West Gulf Coastal Plain[20]

The West Gulf Coastal Plain (WGCP) Bird Conservation Region encompasses southeastern Oklahoma, northeastern Texas, southwestern Arkansas, and northwestern Louisiana. The Mississippi Alluvial Valley (MAV) and the Gulf Coastal Prairies are the eastern and southern borders of the WGCP conservation region, respectively. For the purposes of conservation planning for waterfowl, the WGCP has been incorporated into the Lower Mississippi Valley Joint Venture focus area of the NAWMP (Loesch et al. 1994).

Uplands throughout the region are dominated by shortleaf pine in the northern two-thirds of the region, while longleaf pine dominates the southern one-third. Bottomland hardwood forested wetlands occur in the WGCP in association with major and minor river bottoms. Major rivers that have significant bottomland hardwood habitat associated with them include the Arkansas, Red, Sabine, Angelina, and Trinity.

Forested wetlands are similar in plant species composition to those found to the east in the MAV. They tend to flood seasonally, though reservoir construction on all of the rivers has negatively impacted their hydrology and generally reduced seasonal flooding and value to waterfowl in many years. Forested wetlands along the Arkansas and Red Rivers in particular have been converted to agriculture. Indiscriminate logging and subsequent conversion to pine timber production or pasture threaten remaining forested wetlands, particularly in eastern Texas. Also, increasing demands for water in the Dallas-Fort Worth metropolitan area has resulted in construction of numerous water supply reservoirs. Additional reservoirs have been proposed that would destroy additional forested wetlands. Hence, reservoir construction has caused loss of substantial forested wetland habitat and remains a threat so long as water supply needs for Dallas-Fort Worth, Houston, and other principal cities in eastern Texas increase.

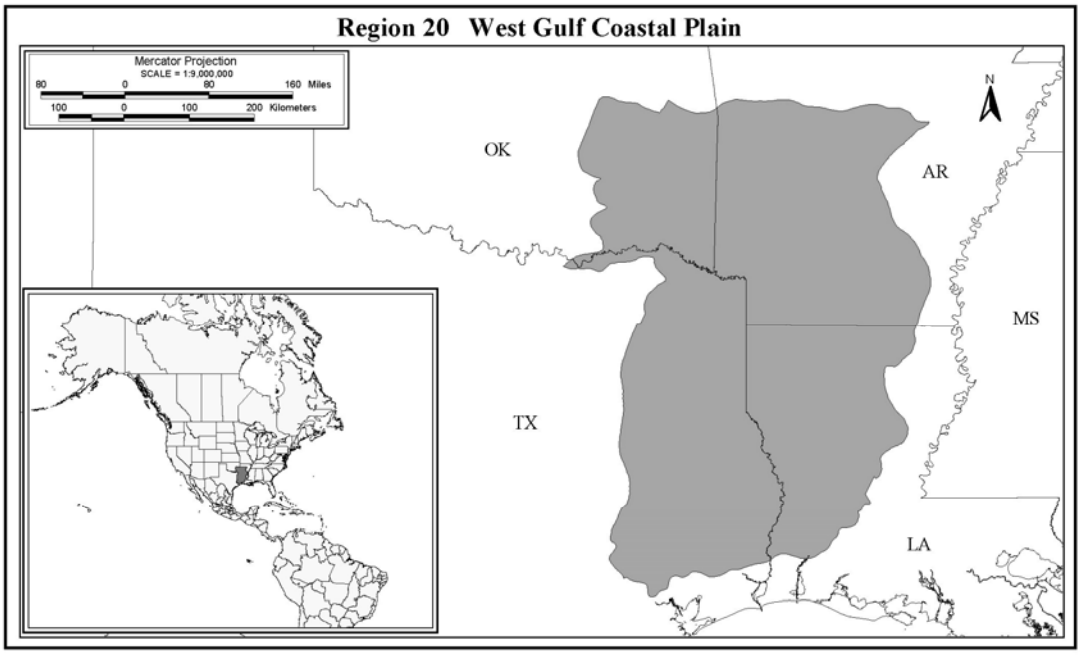
Waterfowl in the WGCP

The Lower Mississippi Valley Joint Venture (LMVJV) has set winter population objectives of 3.3 million ducks for the WGCP portion of this focus area (Loesch et al. 1994). These objectives do not include portions of Arkansas and Louisiana that are in the MAV proper. Approximately 44% of this objective consists of dabbling ducks, with mallards, gadwall and wigeon being the most common species in winter (Loesch et al. 1994). In some winters, up to 1.15 million diving ducks occur and make extensive use of aquatic vegetation in large reservoirs in the region. Ring-necked ducks, lesser scaup, and canvasbacks are the most common diving duck species. The population objective for wood ducks in the WGCP is 808,000. Wood ducks use naturally flooded forested wetlands extensively in the WGCP. An undetermined but likely sizeable and significant number of wood ducks breed in forested wetlands of this conservation region. Use of this region by wintering and migrating geese is insignificant relative to adjacent bird conservation regions like the MAV and Gulf Coastal Prairies.

The LMVJV West Gulf Coastal Plain Waterfowl Working Group established revised population goals and associated population-based foraging habitat objectives for dabbling ducks in 2005. Based upon that exercise, it is estimated that there is a dabbling duck foraging habitat shortfall of approximately 12,854 ha in the WGCP under average winter conditions. It should be noted that this analysis does not account for foraging habitat provided through the Wetland Reserve Program. Hence, in years of average to above average fall and winter precipitation,

[20] NABCI Bird Conservation Region 25

foraging habitat shortfalls likely are not a significant factor in limiting the regional population of wintering waterfowl. Wood ducks are assumed to use naturally flooded forested wetlands. The amount of naturally flooded forested wetlands is highly variable in the region, but no estimates are available in regard to potential shortfalls or surpluses of habitat. Diving duck habitat also has not been quantified for the WGCP.



Other Wildlife in the WGCP

The pine-dominated uplands that comprise the majority of this region are home to numerous colonies of red-cockaded woodpeckers. In addition, pine uplands are important habitat for Bachman's sparrows and brown-headed nuthatches. Riverine habitats, particularly sandbars, likely were important nesting habitat for interior least terns and provided some shorebird habitat. Most of the major rivers have been altered via reservoir construction or navigation projects and most sandbar habitat is no longer present. Bottomland hardwood wetlands along major rivers are important habitat for several species of colonial wading birds, and for neotropical migrant passerines, particularly Swainson's warblers.

Conservation Programs in the WGCP

DU conservation programs have grown considerably in each of the four states in the WGCP. Substantial restoration work has been completed through the Wetland Reserve Program, and through traditional private and public lands conservation programs in all four states. Through FY2004, DU has worked with multiple partners to conserve 27,790 ha in the WGCP conservation region. The estimated dabbing duck foraging habitat shortfall will be met within a 5-10 years through restoration activities associated with WRP, private lands conservation programs, and on public lands in cooperation with state and federal agencies.

Goals

The primary goal of conservation programs in the WGCP is to protect, restore, enhance and manage waterfowl and wetland habitat consistent with the objectives of the LMVJV of the NAWMP. Specific goals include:

- Maintain 27,790 ha conserved in the MAV prior to June 30, 2004, including 13,188 ha protected and 14,681 ha restored or enhanced.

- Expand the existing conservation easement program with a goal of protecting a minimum of 1,000 ha/yr through FY2008.

- Restore or enhance at least 1,250 ha/year in cooperation with state and federal agencies and private landowners, with emphasis on securing perpetual protection, through FY2008.

- Encourage active management on a minimum of 2,500 ha/yr through extension and technical assistance efforts.

Assumption

- Foraging habitat limits regional populations of over-wintering waterfowl in the region through effects on over-winter survival rates.

Strategies

- Emphasize programs that secure long-term conservation of foraging habitat and other wetland functions and values.

- Work with state and federal agency partners to conserve habitat on public lands.

- Emphasize extension efforts to assist landowners to restore, enhance and encourage active management of habitat on private lands.

- Maintain and expand existing partnerships, while simultaneously exploring and developing additional partnerships that are consistent with the DU mission.

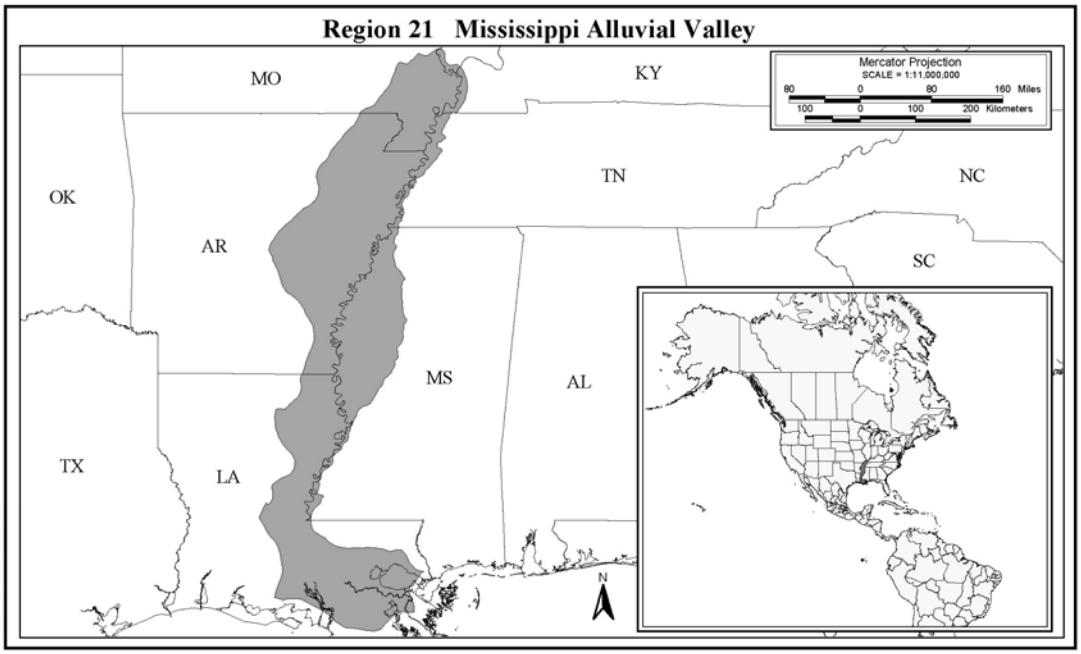
February 1, 2005 – Region 20

Extensive revision based on new conservation planning, program growth and adjustments to existing programs

Mississippi Alluvial Valley[21]

The MAV is the historic floodplain of the Mississippi River formed by melt water as glaciers receded approximately 12,000 years ago. The MAV is approximately 800 km long and covers portions of 7 states from southern Illinois to Louisiana.

The most recent climax plant community in the MAV consisted of approximately 10 million ha of bottomland hardwood forest dominated by hard and soft mast-producing trees including several species of oak (e.g., Nuttall, overcup, willow, water, etc.), hackberry, and green ash. Over 70 species of trees occur in the region. Elevation interacts with hydrology, especially the frequency, duration, and periodicity of flooding, to determine plant community composition and species distribution (Fredrickson 1978, Larson et al. 1981, Reinecke et al. 1989). For example, cherrybark and willow oaks occur on higher, less flood-prone sites, while overcup oak occurs on low sites that flood frequently and for long duration. Cypress and tupelo dominate permanently flooded sloughs (Reinecke et al. 1989).



Flooding in the MAV historically was driven by winter and spring precipitation. Winter rains in combination with greatly reduced plant evapotranspiration resulting from winter dormancy, typically resulted in winter flooding that made mast and other foods available to migrating and wintering waterfowl. Annual variation in duration and extent of flooding likely was great, but inundation of much of the MAV probably occurred each winter (Heitmeyer and Fredrickson 1981).

The landscape in the MAV has changed dramatically during the last 200 years, with the most rapid change occurring within the last 75 years. Today, only about 2 million ha or 20% of the original forest remains in the MAV, the rest having been converted to agricultural production. Initially higher elevation areas were cleared and placed into agriculture. However, even these

[21] NABCI Bird Conservation Region 26

relatively high sites were prone to flooding, which led to attempts to more or less successfully control hydrological events that sustained and were the very basis for development of this system. Flood control projects have reduced the extent of flooding in some parts of the MAV by as much as 88%, while simultaneously altering the ecologically important effects of flood periodicity, duration, and frequency (Reinecke et al. 1989).

Waterfowl in the Mississippi Alluvial Valley

As a consequence of alteration of hydrology and conversion of forest to agriculture, the current landscape in the MAV is highly fragmented and much drier than in historical times. It is dominated by agricultural land, some of which provides significant waterfowl habitat via flooding of waste grain, particularly rice and soybeans.

No data exist to estimate historical populations of migrating or wintering waterfowl in the MAV. Suffice to say that reliable winter flooding and abundant food resources in most years combined to make the MAV one of the most continentally significant areas of winter and migration habitat for several species, particularly mallards, wood ducks, gadwall, green-winged teal, American wigeon, and hooded mergansers (Reinecke et al. 1989). Reinecke et al. (1992) used aerial transects to estimate at least 1.1-1.8 million mallards, or approximately 17-29% of the breeding population, wintered in the MAV during winters of 1987-88 and 1988-89. However, these data were collected when mallards and many other species of ducks were at historically low population levels resulting from extended drought on prairie breeding areas in the 1980s (Reynolds 1987).

In 1999, the mid-continent mallard breeding population was estimated at 10.8 million, a 41-48% increase from the late 1980s (Wilkins and Cooch 1999). Applying that increase to the estimates derived by Reinecke et al. (1992) suggests that perhaps 1.6-2.7 million mallards wintered in the MAV in 1998. There are no other statistically valid surveys performed to estimate winter populations of mallards or other species in the MAV. However, harvest of mallards from the MAV states, including TN, KY, AR, MS, LA (including portions of those states *outside* of the MAV) during 1998 was estimated at 1.68 million. Assuming a very high harvest rate of 0.25 (which should lead to a conservative population estimate), as many as 4-5 million mallards may have wintered in this region. Hence, based upon past surveys, estimated breeding populations, and estimated harvest, it seems reasonable to conclude that at least 1.1 and perhaps <4 million mallards may winter in the MAV in some years, representing 17-40% of the estimated 1999 mid-continent breeding population. Clearly, the MAV is the most important wintering area for mallards in North America. Further, Nichols et al. (1983) suggested that the overall importance of the MAV to wintering mallards increases with winter severity and in wetter than average winters when habitat conditions are best.

The MAV is also a continentally important area for breeding and wintering wood ducks (Bellrose and Holm 1994), and following widespread conversion of forested wetlands to agriculture, has become more significant to northern pintails, green-winged teal, and northern shovelers, as well as snow and white-fronted geese. Catahoula Lake, a 12,150 ha basin that lies within the MAV, provides habitat to peak populations of 400,000 ducks. Catahoula Lake is particularly important to early migrant blue-winged teal and northern pintails, with September/October concentrations of 150,000-300,000 occurring in most years. Additionally, it has wintered up to 128,000 canvasbacks, which is the largest concentration in the world (LDWF unpublished data). Catahoula Lake and the Lower Mississippi River Delta (Gulf Coast Conservation Region) combined winter 10-25% of the continental population of canvasbacks.

Overall, the MAV is most important as migration and winter habitat, but it is also a primary breeding area for wood ducks. The primary limiting factor for populations of migrating and wintering waterfowl is assumed to be foraging habitat. Ducks Unlimited, in an effort to continually refine conservation programs through adaptive management, set about assessing the amount of foraging habitat potentially available to waterfowl in the MAV. In addition, during the course of this effort, DU also collected information on within and among year variation in winter habitat conditions in the MAV. This is complex evaluation effort was initiated in 1997 and remains a work in progress. However, information gained to date from this study as well as others recently completed by other researchers have allowed DU to refine conservation programs.

Following are some conclusions based upon data gathered from 1997 through the winter of 2003-2004:

(1) The absolute quantity of potential foraging habitat and associated estimates of duck-use-days provided are in excess of what is required by LMVJV population objectives in all but the driest of winters in the MAV.

(2) The bulk of the foraging habitat in the MAV consists of privately managed harvested agricultural habitat.

(3) Natural flooding of cleared agricultural land and forested wetlands remain a vital, viable component of the winter habitat complex in the MAV, and in most years, provides substantial potential foraging habitat.

(4) There remain questions about foraging habitat quality, the role of refuges and the need for additional refuges in the MAV to enable birds to maximize use of potential foraging habitat.

While foraging habitat currently does not appear to limit the population of birds wintering in the MAV, it should be noted that the bulk of foraging habitat has no long-term protection. Indeed, much of the potential foraging habitat in the MAV is agricultural in nature and subject to the whims of changes in agricultural policy, agribusiness and other factors. However, given the current estimated level of foraging habitat in excess of that needed to support desired populations, an opportunity exists to shift the emphasis of conservation programs, as discussed below, from short term effort aimed at adding to the foraging habitat based, to long-term efforts aimed at protecting and securing the foraging habitat based indefinitely.

Other Wildlife in the Mississippi Alluvial Valley

The forested wetland habitat that occurred in the MAV provided substantial habitat for a unique array of wildlife. Rivers in the MAV at one time provided habitat for some of the most diverse, abundant freshwater mussel populations on the continent (Christian 1995). Today, due to alterations in hydrology and increased sediment loads from agricultural lands, several mussel species in the MAV are endangered or have become extirpated or extinct. The complex of forested wetlands, sloughs and rivers supports over 60 species of fish, many of which have sport or commercial value (Hoover and Kilgore 1997). The life histories of many species are intricately related to the natural hydrology of the system. For example, some species key on peak riverine flood flows to stimulate spawning activities, whereas others use flooded forest as nursery habitat. Timing and duration of winter and spring flooding are important influences on fish population dynamics (Hoover and Kilgore 1997).

The forests of the MAV also supported a diverse resident and migrant avifauna in addition to waterfowl. Several species of neotropical migrant passerines, woodpeckers, and raptors likely had population centers, or source areas, centered in the MAV. Among these were many area-sensitive species that likely were common to abundant in the pre-agricultural MAV.

For example, species such as the cerulean warbler and Swainson's warbler likely occupied much of the northern and entire MAV respectively, whereas currently they exist only in a few isolated, large remnants of forest (Hunter et al. 1992). The ivory-billed woodpecker and Carolina parakeet, once likely residents of much of the MAV, are extinct. The swallow-tailed kite, an area-sensitive raptor that once occurred well into the mid-MAV, now is restricted as a breeding bird to the Atchafalaya Delta in the extreme southern portion of the MAV. The future of these remaining populations is uncertain, particularly because the ultimate effects of relatively recent large-scale clearing and resultant fragmentation are not completely clear or immediate (Faaborg et al. 1992).

As with birds, several species of mammals have suffered population declines or extirpation as a result of landscape-scale changes to the forest of the MAV. The panther has been extirpated from the MAV for several decades. The Louisiana black bear, a subspecies of the American black bear, is a federally listed endangered species whose decline is directly linked to deforestation and fragmentation. The future of this subspecies may well depend on our ability to reforest and reduce fragmentation within its range (Black Bear Conservation Committee 1992). Forested wetlands in the MAV also provide habitat for at least 7 species of bats. Bat populations have never been monitored, but some species in the MAV appear to rely extensively upon large, hollow cypress trees for nursery habitat, and some may be area sensitive. Bats appear to share their requirement for such trees with black bears. It is very likely that bat populations in the MAV were negatively affected by conversion of forest to agriculture, though to what degree remains unknown.

Conservation Programs in the Mississippi Alluvial Valley

DU, via the SRO, and in cooperation with many state and federal agencies, private corporations, and private landowners, offers a full range of conservation programs in the MAV. Nearly all of DU's accomplishments in the MAV have been through partnerships with other conservation interests, but DU is a leading partner in delivery of many of these programs. DU has a full staff of biologists, RS/GIS analysts, and engineers that work in tandem on a variety of wetland restoration, enhancement, development, protection and evaluation and monitoring projects.

DU will shift toward conservation programs that emphasize long-term protection of flooded native emergent vegetation and forested wetlands. DU will continue to emphasize work with the USFWS, USFS, and all state agencies in the region to develop, restore or enhance wetlands on public land that will provide foraging habitat in perpetuity. The conservation easement program will be expanded and targeted to emphasize protection in perpetuity of existing tracts of forested wetland and other valuable foraging habitats that flood naturally. Finally, DU has formed a partnership with the USDA NRCS to deliver a large percentage of the WRP in the MAV. WRP is uniquely suited to the MAV with its emphasis on restoration of marginal farmland via reforestation with mast producing hardwood trees, and some restoration of hydrology. The majority of work completed under WRP provides foraging habitat for waterfowl that is protected via perpetual conservation easements.

Through FY2004, DU has conserved 242,504 ha of habitat in the area loosely defined as the MAV (i.e., generally the area identified by the NAWMP). DU conservation programs are an integral part of the NAWMP LMVJV goals, which call for plan partners to provide at least 376,514 ha of foraging habitat for wintering waterfowl (Loesch et al. 1994). Notably, the LMVJV plan only accounts for foraging habitat needs for winter defined as the 90-day period from December 1 through February 28 (Loesch et al. 1994). Considerable numbers of waterfowl occur in migration before and after these periods, consequently LMVJV goals may be conservative.

DU conservation programs in the MAV are delivered at the landscape scale. Currently, opportunities exceed funding and staffing capability. As such, programs are not specifically targeted to any particular area of the MAV. Staff at the SRO developed a specific action plan targeting areas for proactive conservation work in the MAV over through fiscal year 2008. The action plans calls for continued restoration work through the Wetland Reserve Programs and other programs that both restore and provide perpetual protection to habitat, increased emphasis on securing conservation easements, and increased extension efforts aimed at encouraging land use and agricultural practices that are wildlife and waterfowl friendly. Toward this end, the SRO has developed a marketing initiative entitled River CARE to publicize conservation programs and assist with fundraising efforts to support conservation programs.

Goals

The primary goal of DU conservation programs in the MAV will be to protect, restore, enhance, and manage wetlands and waterfowl habitat in the MAV consistent with the objectives of the LMVJV and River CARE. Specific goals include:

- Maintain 242,504 ha conserved in the MAV prior to June 30, 2004, including 161,222 ha protected and 81,282 ha restored or enhanced.

- Make a deliberate shift in emphasis of private lands programs toward extension work with agricultural producers.

- Expand the existing conservation easement program and develop focus areas for the entire MAV, with a goal of protecting a minimum of 6,000 ha/yr through FY2008.

- Restore or enhance at least 14,164 ha of public land that offers habitat benefits in perpetuity, in cooperation with state and federal agencies through FY2008.

- Encourage active management on a minimum of 40,000 ha/yr through extension and technical assistance efforts.

Assumption

- The availability of foraging habitat during the wintering period can limit waterfowl population survival and recruitment rates as mediated through body condition, behavior, and mobility.

Strategies

- Protect private lands through by expanding the existing conservation easement program through developing focus areas for the entire MAV.

- Emphasize extension efforts to assist landowners to restore or enhance private land through partners programs and, and to encourage active management of habitat on private lands.

- Restore or enhance public land in cooperation with state and federal agencies.

- Maintain and expand existing partnerships, while simultaneously exploring and developing additional partnerships that are consistent with the DU mission.

January 26, 2005 – Region 21

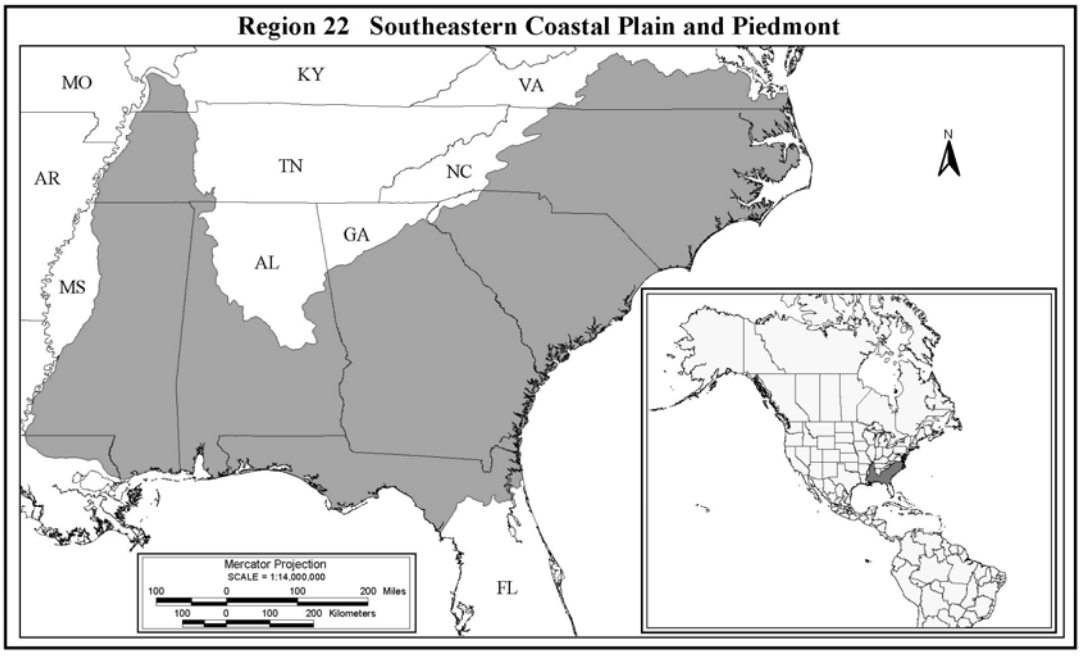
General updates of data

Incorporates new planning information from recent analyses

Southeastern Coastal Plain and Piedmont[22]

The Southeastern Coastal Plain (SCP) extends from the James River in Virginia, southward to approximately Jacksonville, Florida, westward through south central Georgia and Alabama, through roughly the eastern half of Mississippi, and then northward into extreme western Tennessee and Kentucky. It is located between the Piedmont to the north, and the Atlantic Ocean to the east. The western side of this conservation area is bordered by the MAV, while in Florida; it covers the northern portion above the Peninsular Florida Conservation Region. The southern border is the Gulf of Mexico. Geographically, this conservation region covers a large portion of the extreme southeastern U.S., including portions of two separate NAWMP joint ventures – the Atlantic Coast JV (Virginia, North Carolina, South Carolina, Georgia, and Florida only) and the Gulf Coast JV (coastal Alabama and Mississippi only).

The Piedmont Bird Conservation Region, which is located north and west of the SCP, also will be treated in this section of the Conservation Plan. This conservation region includes the Appalachian Piedmont (foothills) and southeastern plains that are dominated by pine (primarily loblolly and long leaf, some short leaf) and mixed pine hardwood forest. Minor alluvial plains are associated with many small rivers in this region and consist of southern bottomland hardwood forest (oak, tupelo, cypress). This region is located between the Appalachian Bird Conservation Region (BCR) and the Southeastern Coastal Plain BCR.



Important Wetlands - Lower Southeastern Coastal Plain

The South Atlantic coastal region encompasses the bays, sounds, and forested/agricultural lowlands of North Carolina (originally treated as part of the Mid-Atlantic Coast in the CCP), which is the second largest estuarine system on the Atlantic coast. It also takes

[22] NABCI Bird Conservation Regions 27, 29

in the pocosins, Carolina bays, swamps, estuarine marshes and former rice producing areas of southern North Carolina, South Carolina, Georgia, and extreme northeastern Florida. Minor alluvial floodplains dominated by bottomland hardwood forest occur throughout this portion of the conservation region (Gordon et al., 1989, Hindman and Stotts 1989, Hodges 1998, Sharitz and Gresham 1998).

Within North Carolina, the most important waterfowl habitat occurs in the Currituck-Abemarle-Pamlico Sounds region (Hindman and Stotts 1989). Land use is predominantly forestry, agriculture, and livestock (poultry and swine), which contribute to non-point source pollution that affects water quality and production of submerged aquatic vegetation in the bays and sounds. In this particular area, submerged aquatics are a very important food source for migrating and wintering waterfowl; hence water quality issues are an important management concern. North Carolina has lost approximately 24% of its original bottomland hardwood forested wetlands, with some 185,625 ha lost between the mid-1970s and mid-1980s (Hefner et al. 1994). Overall, North Carolina has lost 50% (2.4 million ha) of its original wetlands.

In coastal North Carolina, conversion of forested wetlands to agriculture and livestock operations is the primary causes of habitat loss (Hefner et al. 1994). While on one hand this conversion has had negative effects on water quality and aquatic vegetation production, it also has made available waste grain as a food source for wintering and migrant waterfowl. However, the net effect on waterfowl carrying capacity in this portion of the region is unknown, but likely has declined. Habitat within the bays and sounds has suffered moderate to severe degradation and subsequent loss of aquatic vegetation has affected waterfowl populations in the region.

Land use and habitat from Cape Lookout, NC, through extreme northeastern Florida, is similar to eastern North Carolina in many respects. Predominant land uses are agriculture and forestry. South Carolina has suffered a net loss of 1% or 24,686 ha of wetlands from the mid-1970s to the mid-1980s (Hefner et al. 1994). Losses primarily are related to development pressure on the coast and immediately inland as people move to find jobs in the tourism-related service industries. Up until about 1900, rice agriculture provided substantial waterfowl habitat. Today, rice is not grown commercially in the region, but in many cases former rice plantations have been purchased, infrastructure renovated, and they are now managed for waterfowl and other wildlife (Gordon et al. 1989).

The coastal rivers, floodplains and marshes of South Carolina are collectively referred to as the Lowcountry and encompass 11,655 km^2. The ACE Basin, which takes its name from the confluence of the Ashepoo, Combahee, and Edisto Rivers, consists of the largest undeveloped coastal wetland on the Atlantic Coast. This basin is recognized as the flagship project for the ACJV of the NAWMP. An UNESCO Biosphere Reserve and a Western Hemisphere Shorebird Reserve Network site are located within the project area along with two National Estuarine Research Reserve Systems and six National Wildlife Refuges.

Georgia has suffered loss of approximately 315,566 ha of wetlands from the mid-1970s to the mid-1980s (Hefner et al. 1994). Nearly 202,344 ha of additional wetlands have been converted from forested to scrub-shrub types as a result of timber harvest. Some important forested and coastal wetlands occur in association with Savannah and Altamaha River estuaries and floodplains. Forestry and agriculture are the dominant land uses in this region, and most wetland loss in Georgia has occurred in association with agriculture, forestry, and navigation projects.

Important Wetlands - Upper Southeastern Coastal Plain and Piedmont

This portion of the SCP and Piedmont take in higher elevation areas inland of traditional coastal habitats, including portions of the Gulf of Mexico coastal plain in northwestern Florida, Alabama, and eastern Mississippi, and extreme western Tennessee. The Piedmont Bird Conservation region is included in this conservation region.

Beaver ponds comprise important habitat in this region. Arner and Hepp (1989) suggested that the area of beaver ponds throughout the southeastern U.S. was increasing, and in the late 1980s, encompassed at least 288,000 ha of potential waterfowl habitat. Seasonally flooded minor alluvial plains occur along most rivers in this portion of the conservation region. Important seasonally flooded bottomland hardwood forest occurs in conjunction with the Savannah (GA, SC), Chattahoochee (AL, GA), Alabama (AL), Tombigbee (AL, MS), and Pearl (MS) and Big Black (MS) Rivers.

Alteration of hydrology for reservoir construction, flood control and subsequent clearing for agriculture on these and several other river systems has resulted in substantial loss of bottomland forested wetlands (Hodges 1998). However, many reservoirs have become important waterfowl habitat. Over 30 major reservoirs have been constructed for flood control, power generation, municipal water supply and navigation (Johnson and Montalbano 1989). Reservoirs provide over 300,000 ha of open water, an undetermined amount of which provides foraging habitat via production of submerged aquatic vegetation, and all of which provides open water areas for roosting/resting habitat. Eufaula NWR was created as mitigation for reservoir construction on the Chattahoochee River and has become a regionally important wintering area.

The Gulf Coast Region is relatively void of waterfowl habitat and only sparse, scattered concentrations of birds occur from St. Marks NWR, west through the coastal Florida panhandle, until the Mobile Bay and Delta. Within Mobile Bay, highway construction and reservoir construction have altered hydrology such that submerged aquatic vegetation beds are substantially reduced. Over 60,729 ha of bottomland forested wetlands occur in the northern reaches of the Mobile Delta. (Alabama Dept. Conserv. & Nat. Resour, unpubl. data). Farther west, the bays, sounds, and coastal marshes of Mississippi provide winter habitat, particularly for diving ducks (Barry Wilson, Gulf Coast Joint Venture (GCJV), pers. comm).

Overall, there has been a net loss of habitat throughout this conservation region. Generally, bottomland hardwood wetlands in North Carolina have sustained the greatest losses (Hefner et al. 1994). Approximately 50% of the original wetland base is gone in this region, lost to flood control, reservoir construction, development, agriculture, and navigation. From a continental perspective, importance of this conservation region relative to other areas of winter habitat such as the MAV, Gulf Coast and Coastal Prairies, and Southern Great Plains is considerably less. However, the importance, or potential importance, of this region to Atlantic Flyway waterfowl, particularly tundra swans, wood ducks, canvasbacks, ring-necked ducks, and lesser scaup should not be over-looked.

Waterfowl in the Southeastern Coastal Plain and Piedmont

Lower Southeastern Coastal Plain

Mid-winter survey data for the Atlantic Flyway suggest a long-term decline in the number of most species of wintering waterfowl (Steiner 1984, Hindman and Stotts 1989). The

decline is probably a function of multiple, interactive factors, but loss of aquatic vegetation, particularly in the Chesapeake Bay system likely is a significant factor. The bays and sounds of North Carolina are important to a number of dabbling and diving ducks, Canada geese, and tundra swans. Diving duck use of this area increased as habitat quality in the Chesapeake Bay system declined. North Carolina now winters up to 75% of the Atlantic Flyway canvasbacks, large numbers of the Atlantic subpopulation of Canada geese, and nearly the entire population of eastern tundra swans. Geese and swans in particular have adapted to field feeding on waste grain, no longer extensively foraging on aquatic vegetation in shoals and bays. Also, most of the American wigeon that once wintered in the Chesapeake Bay have shifted southward to the North Carolina bays and sounds to take advantage of available aquatic vegetation. The North Carolina bays and estuaries also are significant migration and winter habitat for lesser scaup, brant, and several species of sea ducks.

Numbers of waterfowl wintering in South Carolina and Georgia also have declined in recent years. This decline is perplexing in that, in general, habitat quality and quantity do not appear to have suffered a similar decline. The decline may be related to the overall decline of waterfowl in the Atlantic Flyway where habitat loss, alteration and degradation have been substantial. Alternatively, it has been suggested that many birds have shifted toward more inland habitats associated with major reservoirs where they are not counted during traditional mid-winter inventory flights. Nonetheless, coastal impoundments still winter several hundred thousand waterfowl, particularly green-winged teal, northern shovelers, American wigeon, northern pintails, wood ducks, and mallards, totaling about 30% of the birds typically found in the Atlantic Flyway. Diving ducks, especially ring-necked ducks and lesser scaup, winter in bays and sounds, but in relatively smaller numbers (generally <100,000) compared to North Carolina's (Gordon et al. 1989, Hindman and Stotts 1989).

Overall, this region is most important as winter habitat for tundra swans, Canada geese, and most species of dabbling and diving ducks common to the southern Atlantic Flyway. The SCP wetlands provide winter habitat to at least 50% of the waterfowl in the Atlantic Flyway. It has secondary importance to migrant lesser scaup, most of which winter in Florida. Factors limiting waterfowl use of habitat within the SCP are unclear. Foraging habitat may well be limiting overall, but before conclusions can be drawn the amount of foraging habitat and its value in terms of duck use days (energetic model) must be quantified. Wintering distributions of waterfowl in the Atlantic Flyway in general appear to have shifted, with a net decline in the number of birds using the flyway. Notable decreases have occurred in the Chesapeake Bay and South Carolina. Causes are unclear, but could relate to foraging habitat limitations caused by habitat loss and degradation. Also, waterfowl distributions may have been affected by inland or northward shifts of some species (mallards in particular) related to an increase in available waste grain and open water at more northern latitudes or in association with major inland reservoirs located in the Upper Southeastern Coastal Plain. Disease, severe weather, and other potential limiting factors are not generally significant problems.

Upper Southeastern Coastal Plain

Depending on their state of succession, beaver ponds can provide abundant food to migrating and wintering wood ducks, mallards, ring-necked ducks, hooded mergansers and limited numbers of other species. Beaver ponds provide very important habitat for breeding wood ducks and hooded mergansers (Arner and Hepp 1989). Minor alluvial floodplains throughout this portion of the region occasionally to regularly flood and provide habitat for wood ducks, mallards, gadwall, wigeon, ring-necked ducks, and limited numbers of other species.

Reservoirs provide an undetermined amount of foraging habitat for waterfowl throughout this region. For example, Eufaula NWR, which was created as mitigation for reservoir construction on the Chattahoochee River in Alabama and Georgia, typically over-winters 5,000-10,000 ducks, mostly mallards, green-winged teal, wood ducks, ring-necked ducks and American wigeon. Also on the Chattahoochee River, Lake Seminole in southern Georgia provides winter habitat for an average of 5,000 canvasbacks and approximately 5,000 to 25,000 ring-necked ducks, many of which feed on exotic hydrilla (Georgia DNR unpubl. data). Exotic plants, particularly hydrilla and Eurasian milfoil have become important foods in some southern reservoirs, particularly for gadwall, wigeon, ring-necked ducks, lesser scaup and canvasbacks (Johnson and Montalbano 1987, 1989). There has been a significant decline in exotic vegetation (i.e., hydrilla) on many of these southern reservoirs – Lakes Marion and Moultrie in SC, Lake Seminole (GA/FL), Lake Okeechobee and many others in FL. Aggressive control programs (herbicide and grass carp) are conducted by most of the southern states. In FL and SC, laws mandate control of exotic vegetation. However, there is evidence in FL that hydrilla is becoming resistant to herbicides and they expect to see increases throughout the state.

In northern Florida, the Tallahassee Lakes provide significant winter habitat for ring-necked ducks and lesser scaup (Johnson and Montalbano 1987, 1989). Managed coastal impoundments at St. Marks NWR and Big Bend Wildlife Management Area on the Florida Gulf Coast provide winter habitat for about 10,000 ducks. Offshore, in the general vicinity of the Great Bend/Appalachicola Bay in the eastern Gulf of Mexico, up to 70,000 redheads over-winter, representing perhaps 5-10% of the continental population. This region also winters approximately 40,000 lesser scaup. Few waterfowl over-winter in the Florida Panhandle region. Numbers of waterfowl increase beginning at the Mobile Bay and Delta, where 5,000-10,000 ducks have wintered in recent years. Forested wetlands in the Tensaw-Mobile Delta provide important habitat for wintering and resident wood ducks, and a limited number of other species. Approximately 15,000-20,000 ducks, of which approximately 10,000 are lesser scaup, over-winter in coastal Mississippi bays and marshes.

Importance to Other Wildlife

The wetlands, estuaries, bays and associated beaches and mudflats provide significant habitat to a diversity of wading and shorebirds. Along the Atlantic Coast, intertidal areas provide significant winter habitat for American oystercatchers, short-billed dowitchers, and dunlins. These areas also are important migration and staging habitat for these species as well as red knots. Substantial numbers of shorebirds also occur in association with mudflats and beaches of the eastern Gulf Coast of Mexico.

Coastal wetlands in this region are important habitat for resident, migrant, and wintering colonial water birds, including several species of herons, egrets, ibis, terns, and brown pelicans. There are at least 3 significant wood stork rookeries with over 700 nesting pairs occurring in the bottomland hardwood swamps of this region. Wetlands throughout this region support numerous colonies of great blue herons, common egrets, snowy egrets, little blue herons, and both black-crowned and yellow-crowned night herons. Populations of these species are not quantified, but they are very abundant and wetlands in this region are very important to both residents and migrants. Nearly the entire U.S. population of endangered wood storks nests either in this region or the adjacent Peninsular Florida conservation region, with at least 3 significant wood stork rookeries with over 700 nesting pairs occurring in the bottomland hardwood swamps of this region (Gough et al. 1998).

One migrant and one resident population of greater sandhill cranes occur in this area. The Eastern Population, which breeds in Ontario, Minnesota, Wisconsin and Michigan over-winters primarily in southeastern Georgia through central Florida. A resident population of cranes occurs in extreme southeastern Mississippi (Tacha et al. 1994). Much of the population of limpkins in North America occurs in association with cypress and bottomland hardwood swamps in the Florida and extreme southwestern Georgia portions of this region, with the remainder occurring in the Peninsular Florida region (Gough et al. 1998).

Barrier islands and some mainland beaches provide significant nesting habitat for loggerhead sea turtles. South Carolina is second only to Florida in numbers of nesting loggerhead sea turtles. These same islands support colonies of several species of terns and brown pelicans. In the Gulf of Mexico, offshore and near shore waters in the Big Bend region of Florida, west to Mississippi Sound, over-winter significant portions of the common loon population in eastern North America. The coastal marshes, bays, and estuaries also are essential nursery habitat for a variety of commercially important marine fish and shellfish, including red drum, flounder, speckled trout, blue crabs, brown shrimp and many others.

Forested wetlands in this region support a variety of neotropical migrant birds. Swainson's, hooded, and prothonotary warblers are common to uncommon in these areas, while swallow-tailed kites and red-shouldered hawks are locally uncommon and common raptors, respectively. At least two species that once were common to uncommon in this region are now extinct or believed so – the Carolina parakeet and Bachman's warbler. Pine uplands within and bordering this region support populations of red-cockaded woodpeckers and Bachman's sparrows.

Conservation Programs in the Southeastern Coastal Plain and Piedmont

Generally, DU conservation programs in this region support and contribute toward the goals of the NAWMP ACJV, and to a lesser extent the GCJV. Presently, both the ACJV and GCJV are revising their habitat goals through an enhanced conservation planning effort. Eventually, revised goals will be developed that will include habitat objectives for waterfowl and other bird groups of importance in the South Atlantic coastal zone as well as the Mobile Bay and Mississippi Gulf Coast portions of this region. Scale of delivery of conservation programs is localized and project-specific within this conservation region, and will remain that way until proactive conservation easement programs or private lands conservation programs are developed and public lands programs are expanded.

DU's most notable conservation program in this region has been the Lowcountry Initiative in South Carolina. Large privately owned plantations ranging in size from 800-21,000 ha (some dating to the 16th century) are the primary landholdings in this portion of the conservation region. This unique situation coupled with interest from many of the landowners creates an unparalleled opportunity to achieve significant land and water protection. Through a multi-agency partnership, 404,858 ha were already under protection by 1998.

The Lowcountry Initiative provides DU a unique opportunity to protect wetland and upland habitats using conservation easements on private lands. Approximately 30,600 ha have been protected by DU via conservation easements through FY2004. DU's conservation easement program accepts easements in perpetuity through its Wetlands America Trust. Such long-term protection conserves large, undeveloped upland and wetland ecosystems for the benefit of water birds, other wildlife, and the threatened and endangered species that occur in the region. Easements likely will remain a significant conservation tool in this region, but DU will begin to

focus on proactive habitat restoration and enhancement programs, particularly in North and South Carolina. In 2004, DU launched its new Sound CARE initiative. The goal of this initiative is to restore 9,000 ha of habitat in North Carolina, while simultaneously raising funds for conservation of breeding habitat through marketing the habitat conservation issues in areas from which the majority of North Carolina's harvest is derived.

Regarding more traditional conservation programs, DU's primary focus to date has been to provide funding via the MARSH program. DU has cooperated with many state and federal agencies in this conservation region to conserve 81,053 ha. Opportunities exist to expand and take a more proactive posture relative to delivery of conservation programs on both private and public land, particularly in coastal North Carolina.

Goals

The primary goal of DU conservation programs in the SCP conservation region is to protect, restore, enhance and manage waterfowl and wetland habitat consistent with the objectives of the ACJV and GCJV of the NAWMP. Specific objectives include:

- Maintenance of 81,053 ha of habitat projects completed through FY2004.
- Protection of an additional 10,000 ha by the end of FY2008.
- Restoration or enhancement of at least 10,000 ha of habitat by the end of FY2008.
- Evaluation of the role of DU in the region with an eye toward expansion of conservation programs. This may include: a) formation of new partnerships and provision of biological and engineering services to assist agencies and private landowners with habitat restoration and enhancement; b) development and delivery of a partnership-driven private lands program; and c) proactive use of conservation easements to protect habitat and stem urbanization and wetland conversion to agriculture and livestock production, particularly in North Carolina.

Assumption

- Waterfowl are limited by the quantity and quality of foraging habitats in the region through impacts on over-winter survival rates, and potentially on subsequent recruitment.

Strategies

- Evaluate staffing requirements that will enable DU to organize, expand, and serve as a primary partner in the conservation of waterfowl habitat in the SCP.
- Expand the conservation easement program throughout the region to protect the existing waterfowl habitat base, focusing attention on protection of important habitats and watersheds in North Carolina.
- Develop partnerships in cooperation with public agencies and private landowners.

- Work with Field Operations' staff, Development staff, and volunteers to secure a level of funding adequate to implement a full range of DU-lead conservation programs in the SCP conservation region.

- Quantify the relationships of waterfowl populations to available foraging habitat.

- Encourage ACJV staff to revise conservation plans for the region along the lines of the foraging habitat models developed for the LMVJV and under development for the GCJV.

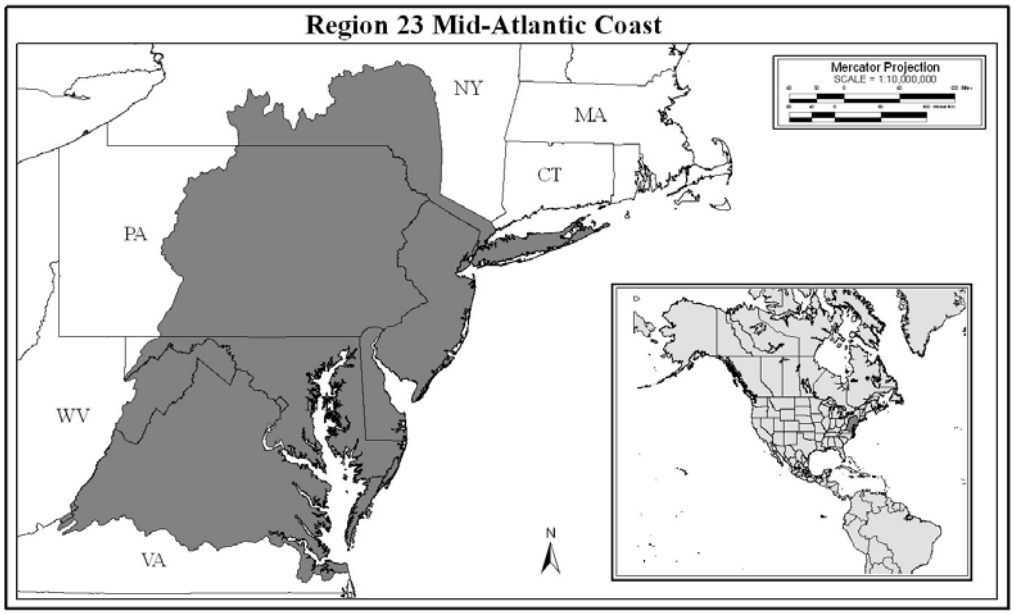
- Provide remote sensing and GIS support for the ACJV to further conservation planning in the region.

January 17, 2005 – Region 22

General updates of program activities and statistics
Added information about Sound CARE program in North Carolina

Mid-Atlantic Coast[23]

The Mid-Atlantic Coast Waterfowl Conservation Region includes portions of the North Atlantic Coastal Plain, Appalachian Mountains, Southeastern Plains/Piedmont and the Southern Atlantic Coastal Plain regions of the Commission for Environmental Cooperation (IAFWA 1998). A chain of extensive estuarine embayments characterizes the North Atlantic Coastal Plain, stretching from the Chesapeake and Delaware Bays, along the coastal bays of New Jersey to Long Island Sound. The portion of the Southern Atlantic Coastal Plain region that occurs in the Mid-Atlantic Coast Waterfowl Conservation Region includes the extensive swamps and marshes along the Atlantic coast from the mouth of the Chesapeake Bay to the Back Bay estuary. Highly productive shallow water and adjacent upland habitats including barrier beach and dune, submerged aquatic vegetation (SAV) beds, intertidal sand and mudflats, salt marsh islands, fringing tidal salt marshes, freshwater tidal marsh, and maritime forest characterize this portion of the region. The Mid-Atlantic coast contains several very significant areas for waterfowl and hence DU involvement: the Chesapeake Bay, the Delaware Bay, New Jersey coast and Long Island.



The Chesapeake Bay is the nations largest estuary that drains 64,000 square miles. This area is known for its historic abundance of waterfowl, shorebirds, songbirds, shellfish, and fish, and its network of fresh, brackish, and saltwater marshes that support these populations. These losses have lead to steep declines in water quality and 90% losses of bay grasses (SAV), with 70-80% declines in waterfowl populations (especially canvasback, redhead and black ducks). The Bay once housed over 3 million wintering waterfowl, but now only sees 1/3 of that historic number. Recreational and commercial fisheries have also declined. The two most important contributing factors to the decline in waterfowl populations are 1) widespread loss of SAV and 2)

[23] NABCI Bird Conservation Regions 27, 28, 29 and 30 (New England/Mid-Atlantic Coast, Appalachian Mountains, Piedmont, Southeastern Coastal Plain)

deterioration of shallow water wetland habitat within the watershed. The watershed has been identified as a priority area by the Atlantic Coast Joint Venture, a National Conservation Priority by the USDA, and a RAMSAR site by the Convention on Wetlands of International Importance. It is the most important wintering ground for waterfowl in the Atlantic Flyway.

The Delaware Bay is one of the most important wintering areas in North America and a major link in the migratory chain that stretches from South America to Canada along the Atlantic flyway. More than 250 different species of waterfowl, shorebirds, raptors and other neotropical migrants, totaling over one million birds, stage in the Delaware Bay in preparation for the next leg of their southward migration. Management of restored emergent wetlands within this watershed will benefit migrating and wintering green-winged teal, American black ducks, mallards, and Northern pintails. The amount of breeding and nesting habitat for American black ducks, mallards and wood ducks will increase as wetlands are restored and grassed and forested wetland buffers are planted. Further, the Delaware Bay watershed is an important wintering area for the Atlantic population (AP) of Canada geese. Canada geese, snow geese, and tundra swans will use the protected fields and restored wetlands as wintering habitat.

Long Island is traditionally known for its extensive network of coastal salt marshes that provided important nesting, staging, and wintering grounds for a large number of migratory water birds. Most of the tidal wetlands were grid-ditched in the 1930's and 40's in an attempt to control mosquito populations. This ditching inadvertently had negative impacts on waterfowl, water birds, and shorebirds by removing panne and pool areas that provide critical habitat for many migratory species. Ditching also caused significant changes to the vegetative community: palustrine and estuarine emergent communities converted to less desirable reed and brush communities. More than half the original tidal wetlands have been lost to development. Today, despite considerable loss and degradation, Long Island marshes represent some of the most important wintering grounds for waterfowl in the Atlantic Flyway. Priority species using this area include northern pintail, American black duck, mallard, lesser and greater scaup, cerulean warbler, Louisiana water thrush, and the salt marsh sharp-tailed sparrow. Remaining wetlands are critical to protect and restore not only because many species depend on these existing habitats, but also because conservation opportunities will decrease over time as population and development continues to increase throughout Long Island.

Coastal New Jersey, or the Atlantic Coastal Plain, covers 3/5 of southern New Jersey. In the east the landscape consists of pine forests and salt marshes. New Jersey's coast is an important, even vital, stop in the global migration of many birds. While significantly altered by human land-use activities, many of these habitats are still largely intact functioning natural communities. Through government legislation and regulation, some of the most destructive past practices, such as dredging and filling of coastal salt and freshwater marshes, have been largely eliminated. However, development and the consequent loss of adjacent, upland forests proceed. While large expanses of upland and wetland habitats are presently protected as public open space, additional open space acquisition is needed. Salt marshes and shallow water estuarine habitats of this area provide food and refuge for many fishes and crustaceans of recreational and commercial value as well as important habitat for birds, mammals, and other organisms

Waterfowl Characteristics

Areas of historical importance to waterfowl in the Mid-Atlantic Coast Waterfowl Conservation Region include coastal marshes and bays along the Long Island and New Jersey coast and the Delaware and Chesapeake Bays. Expansive estuarine and near-shore habitats along the Atlantic Coast historically provided abundant SAV and animal foods (including clams, snails

and other invertebrates) used by waterfowl (Peterson and Peterson 1979). Tidal and riverine freshwater and brackish emergent marshes provide sheltered resting areas for wintering ducks and geese (Gordon et al. 1989).

Twelve species of waterfowl nest and breed in the North Atlantic Coastal Plain region, of which mallard, wood duck, black duck, and Canada goose are the most numerous. Waterfowl migrate in substantial numbers down the Atlantic Coast, stopping to rest and feed in coastal bays and wetlands. During 1986-1990, 72% of all black ducks wintered in the Atlantic Flyway. A substantial number of wintering black ducks are found in bays, marshes, and flats in the back-barrier lagoons of Long Island and New Jersey.

About 80% of the wintering population of Atlantic brant is found in the back-barrier lagoons of New Jersey and Long Island, while the Delaware Bay wetlands are a major staging area for 80% of the Atlantic flyway population of snow geese (as many as 200,000 birds). In the 1980s, the Chesapeake Bay region wintered 80% of the Atlantic population of Canada geese, supporting a multi-million dollar hunting industry, while the Mid-Atlantic States wintered about 3%. Today, winter distributions have changed substantially: The Chesapeake winters only about 60% and the Mid-Atlantic about 30% of the population. Reduced recruitment, competition from resident geese, and hunting pressures all appear to have contributed to declines in overall numbers of these birds.

The Southern Atlantic Coastal Plain Region of Virginia has always supported large numbers of waterfowl. In the 1950s, some 250,000 canvasbacks, one-half of the continental population wintered in the extensive beds of SAV in the Chesapeake Bay. In recent years, wintering waterfowl populations have varied due to the abundance of submerged aquatic vegetation (SAV), a preferred food source of many waterfowl. Important species include Northern pintails, black ducks, scaup, canvasbacks, and redheads. The region also supports breeding populations of wood ducks, black ducks, and mallards.

In the Southeastern Plains/Piedmont Region, the freshwater tidal marshes of the Rappahannock, Pamunkey, Mattaponi, and James Rivers winter more waterfowl than any other areas in Virginia, including black ducks, mallards, pintails, green-winged teal, wood ducks, and ring-necked ducks. The farmland adjacent to these rivers also supplies critical wintering and migration habitat for tundra swans and the Atlantic population of Canada geese. The riverine forested and emergent wetlands provide breeding habitat for wood ducks, black ducks, and mallards. The Roanoke and Chowan River systems contain seasonally flooded (bottomland hardwoods) and permanently flooded (bald cypress, tupelo gum) forested wetlands that provide breeding habitat for wood ducks as well as support large wintering populations of black ducks, mallards, and wood ducks.

Historically, the Appalachian Mountains Region has never supported the populations of waterfowl that are found in adjacent piedmont and coastal habitats. However, the region does support breeding populations of wood ducks, mallards, black ducks, and Canada geese. Breeding waterfowl use, and population size is regulated by, the numerous beaver ponds (<1 colonies/km^2) and man-made reservoirs that exist throughout the region. The region provides habitat for waterfowl during fall and spring migration, and winters large numbers of black ducks and mallards. The majority of wintering waterfowl are found in beaver ponds, local reservoirs, impoundments, and riverine wetlands. Once beaver ponds and reservoirs begin to freeze, waterfowl start utilizing the main stem of the major rivers in the region, including the Susquehanna, Potomac, Delaware, Ohio, and New Rivers.

Other Wildlife

Extensive estuarine marshes and rivers of the Southern Atlantic Coastal Plains Region are critical spawning areas for anadromous fishes in the Chesapeake Bay, supporting an annual industry of $900 million in Maryland alone. Coastal and inland wetlands provide critical habitats for waterfowl, wading birds, and shorebirds, as well as other wildlife. Bald eagles winter in the Delaware Bay marshes and forage in this area year-round. Pea Patch Island, located in Delaware Bay is the largest Atlantic coast heronry north of Florida. The Harbor Herons Complex, spread throughout the heavily industrialized Arthur Kill waterway in New Jersey, is a regionally significant rookery, supporting up to 25% of all nesting wading birds along the Atlantic coast from Cape May, New Jersey to Rhode Island.

The Cape May Peninsula and Cape Charles, Virginia, concentrate millions of songbirds, including at least 75 species of long-distance Neotropical species, migrating south along the Atlantic Coast in the fall. All types of natural habitats, including marshes, fields, successional habitat, and woods, are used by fall migrants, although woodlands adjacent to salt marshes seem to be particularly important. The remaining maritime forests at the mouth of Chesapeake Bay provide important stopover habitat for migratory birds.

The Appalachian Mountain Region supports some of the highest diversities of breeding Neotropical and temperate migratory songbirds in the U.S. Priority forest breeding bird species include Cerulean warblers, black-and-white warblers, wood thrushes, and eastern wood pewees. Priority early successional and grassland species include the golden-winged warblers, Henslow's sparrows and northern flickers.

The coastal and intertidal beaches of Virginia Beach and Back Bay provide important habitat for over 40 species of wintering, migrating, and breeding shorebirds, including the semipalmated sandpiper, red knot, American avocet, and endangered piping plover. Delaware Bay is a critical spring migratory stopover for many species and numbers of shorebirds. An estimated 800,000 to 1.5 million shorebirds pass through the Bay each spring. Delaware Bay was dedicated as one of only two Hemispheric Shorebird Reserves on the Atlantic Coast (the other being the Bay of Fundy in Maritime Canada), recognizing that the Bay supports more than 30% of the hemispheric population of shorebirds. In 1992, Delaware's remaining coastal wetlands, from Woodland Beach to Cape Henlopen, were dedicated as a Wetland of International Importance under the RAMSAR Treaty.

Threats and Special Problems

Portions of the North and South Atlantic Coastal Plain are some of the most populous and heavily industrialized coastal areas in the world. Much of the upland and wetland shoreline of the major Atlantic bays and their watersheds have been developed, impaired, or degraded by industrial, commercial, and residential uses. Wetland losses have resulted from coastal impoundment and filling, dredging projects, and natural sea level rise. Urban development, including filling for roadway expansion, has resulted in substantial wetland loss (as much as 92% of losses in coastal New Jersey and 50% of losses in Virginia). Ecological impacts from urban and suburban development include point and nonpoint source pollution, oil and chemical spills, recreational overcrowding, floatable materials, atmospheric fallout of pollutants, dredging and dredged material deposition, over harvesting of fishery resources, competition from exotic and invasive species, and destruction of essential natural habitats (USFWS 1997).

Development pressures have accelerated the rates of erosion along shorelines that have been stripped of vegetation. Estuaries between Connecticut and Virginia are home to more than 10,000 public recreation sites and 42% of all private marinas in the country. Boat wakes, from commercial and recreational craft, create waves that hasten shoreline wasting. Erosion of coastal islands may be a limiting factor for black duck restoration efforts in the Chesapeake Bay. High recreational potential has lead to increasing numbers of second home construction, with concomitant demands on water and water quality. The need for more roads to meet the expanding growth results in greater habitat loss and increased storm water runoff and nonpoint pollution from roadways. Fortification of shorelines leads to the loss of critical shorebird feeding and nesting areas and valuable wintering habitat for black ducks and other waterfowl. Wetland loss due to a rise in sea level may be exacerbated in areas of high population density, where shoreline developments will prevent the natural landward migration of coastal wetlands.

Despite development pressures, significant portions of the region remain in agricultural use. About a third of the watershed of Chesapeake Bay remains in agricultural use, and 42% of the Delaware Bay. However, nonpoint runoff, including pesticides and fertilizers, from these lands is significant, contributing to degradation of water quality in coastal waters. Additionally, sedimentation from agriculture and development activities upstream may be silting in many of the region's tidal wetlands.

In addition, significant wetland losses are attributable to conversion of non-tidal, forested wetlands to agriculture (USFWS 1988). All of the Atlantic states have enacted laws and regulations to protect coastal wetlands. However, protection of inland wetlands has not been as effective. For example, while losses of estuarine wetlands in the Chesapeake Bay region had been curtailed between 1982 and 1989, during the same period, freshwater wetlands (including important headwater swamps) were being lost at rates greater than experienced in the 1970s. While emergent and shrub/scrub wetlands in the Southern Plains/Piedmont Region have increased as beaver populations have expanded, seasonally flooded-forested wetlands are still being loss to highway construction, residential development, and forestry.

Loss of headwater forests and wet meadows increases the amounts of sediments, animal wastes, pesticides, and fertilizers washed off nearby developed areas and farms, which eventually settle into bays and estuaries. Excessive inputs of nutrients and sediments from surrounding watersheds have caused a drastic decline in the abundance of SAV throughout the Chesapeake and Albemarle-Pamlico Estuaries.

In the Appalachian Mountain the majority of riverine wetlands (forested, shrub/scrub) have been lost to agriculture, industry, and the construction of reservoirs. Although the majority of riverine wetlands have been lost (>70% in some states), wetlands created by beaver ponds have met or exceeded historical levels in many states. As beaver populations continue to expand, shrub/shrub and emergent wetlands will continue to increase in this region. However, contamination from heavy metals from upstream mining and milling operations has had serious impacts on the water quality of the region's rivers and downstream habitats. Additionally, the region's agriculture community supports large numbers of livestock and poultry that has contributed excess runoff of nutrients (N, P) and sediments to local streams.

Current Conservation Programs

Several of the larger estuarine systems have been recognized as resources of national significance. The U.S. Environmental Protection Agency's National Estuary Program, in coordination with other state and federal agencies, has developed comprehensive management

documents to guide conservation efforts in the Delaware, Barnegat and Narragansett estuaries. In this Waterfowl Conservation Region, DU's major efforts include programs in Chesapeake and Delaware Bays, the New Jersey coast and Long Island.

DU's Chesapeake Bay Program was started in 1997 in partnership with the Chesapeake Bay Foundation. Through this program, DU is restoring wetlands and associated uplands on private land in PA, MD, and VA by plugging drainage ditches, shallow excavations, and building low-level dikes in marginal cropland and pastures. The Program encourages landowners to improve water quality by primarily restoring wetlands but also by fencing livestock out of streams, installing stream crossings and alternative watering systems, and restoring riparian habitat. These conservation practices will not only improve waterfowl habitat on participating properties, but also improve habitat conditions (SAV) in the Bay by removing excess nutrients and sediments. DU is also working with the USDA through the Wetlands Reserve and Conservation Reserve Enhancement Programs as well as the USFWS's Partners for Fish and Wildlife program to restore critical habitat for migratory birds and wetland dependent species on private lands in the watershed.

In the Delaware Bay, the predominant landscape use throughout the watershed is agriculture; hence current program delivery is focused on private lands. The conservation focus is on habitat restoration and improvements in the lower watershed and coastal marshes and key sub-watersheds that influence water quality in the bay. Breeding programs in the northern watershed are focused on habitat for mallards, black ducks, and wood ducks. Habitat conservation activities in the southern portion of the watershed are focused on wintering and spring staging habitat. Habitat Stewardship programs will concentrate on restoring wetland hydrology to sites by plugging drainage ditches, constructing low-level berms, creating shallow excavated areas, and installing water control structures. Riparian upland buffers will be restored to native grasses, trees, shrubs, and other habitat components. Water quality in the Bay will be improved by restoring wetlands and uplands across the watershed. These restoration practices will eventually contribute to the restoration of SAV beds throughout the Bay

On Long Island, restoration efforts have evolved from ditch plugging to integrated marsh management. This approach emphasizes restoring hydrology with multiple approaches to improving degraded marsh systems, food resources, and habitat for waterfowl and other coastal marsh dependent species. Conservation activities include filling ditches to restore hydrologic regimes on the marsh, which will hold water and encourage rejuvenation of high and low marsh vegetative communities. In some instances, scouring of pannes and ponds and restoring tidal channels to sinuous creeks are a component of restoring more natural habitat mosaics. A secondary focus on Long Island should be Phragmites control. New York State has begun an aggressive approach toward invasive species and a Marine task force has identified Phragmites as the number one problem on Long Island

In New Jersey, coastal marshes are relatively healthy. In addition to providing migratory and wintering habitat, New Jersey coastal areas may also be important for breeding mallards and black ducks. The coastal marshes of New Jersey have great potential to impact significant numbers of waterfowl and other birds. Within New Jersey, DU's focus has been mostly on the Delaware Bay watershed, however opportunities exist to be much more involved in the coastal area, particularly in engineering, design and delivery.

Goals

- Restore and protect ecological functions and values of coastal watersheds by striving to restore an intact, functioning coastal wetland system including intertidal bays with submerged aquatic vegetation, mud flats, low and high marsh habitat, and buffers.

- Work to ensure long-term protection of already enhanced/restored areas

- Concentrate conservation activities within targeted watersheds to restore buffers, via wetland restoration, to provide clean water

- Provide technical assistance and landowner education

- Identify and prioritize key research and evaluation needs.

- Establish outreach programs to educate the public on the importance of DU's wetland enhancement programs, wetland values and a healthy environment

Assumptions

- By restoring wetlands and riparian zones, this initiative will provide onsite and downstream water quality benefits, which will aid in the recovery of SAV

- Recovery of SAV will enable an increase in wintering waterfowl numbers.

- Habitat programs (wetland, grass and riparian restoration) that provide water quality benefits also provide waterfowl breeding habitat.
-
- Restorations designed for fall migrants will also benefit spring migrants and restorations designed for breeding waterfowl will also benefit spring migrants.
-
- Restoring tidal hydrology, via ditch plugging, restores function and habitat value to coastal marshes

- Restoration work in the headwaters will improve habitat by improving water quality in the coastal marshes

- Restoration of coastal habitat will improve survival of wintering waterfowl or increase carrying capacity
- Coastal restoration activities designed for migratory or wintering waterfowl will also benefit breeding waterfowl.

- Waterfowl habitat in this area will continue to be loss due to development pressure.

Strategies

- Restore wetlands and associated grasslands on private land, utilizing Farm Bill Programs such as WRP, CRP and CREP, DU Private Lands Programs (in partnership with the state and federal agencies), and NAWCA and other partnership grants.

- Develop restoration and management systems that emulate natural hydrological conditions, to the best extent possible.

- Maximize migration and wintering capacity through the protection of habitats that are vulnerable to loss through acquisition, conservation easement or long-term management agreements through cooperative land protection programs. Expand DU's conservation easement program.

- Increase public awareness of DU's programs and the benefits to wetlands they provide by developing public outreach plans for regional conservation programs.

- Restore wetlands and associated grasslands on public land. Incorporate management capability into these restored wetlands to maximize wetland productivity for waterfowl and other wetland wildlife.

- Expand wetland conservation programs to watershed or landscape levels – targeting water quality as a major issue/benefit.

- Work with partners to bring wetland function back to key landscape areas (e.g., conversion of salt hay to cordgrass marsh along the coast, conversion of drained agricultural land to wetland/grassland in the Delaware Bayshore).

January 27, 2005 – Region 23

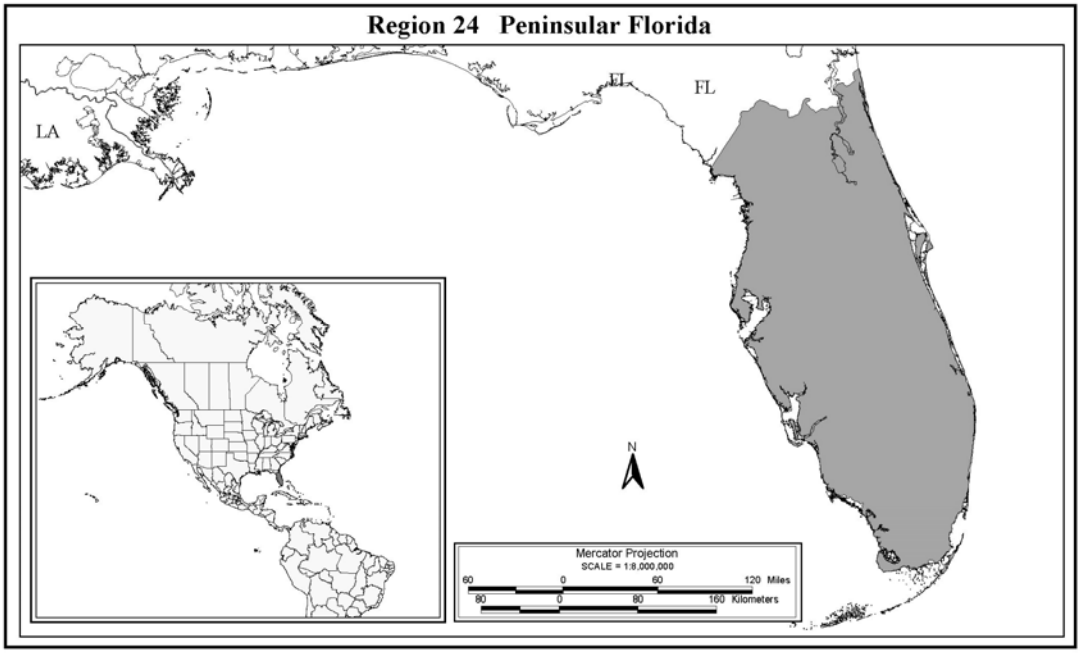
Updated the region description and current conservation programs
Revised goals, assumptions and strategies

Peninsular Florida[24]

The Peninsular Florida Conservation Region encompasses most of Florida south of a line extending approximately from Jacksonville to Steinhatchee on the Gulf Coast. Florida had nearly 8.22 million ha of wetlands, of which some 3.9 million ha were palustrine emergent wetlands that typically were most valuable to waterfowl. Florida has lost approximately 5 million ha of wetlands, primarily to urbanization and agriculture. Wetlands in Florida have been adversely affected by introductions of several species of invasive exotic plants (e.g., water hyacinth). Nonetheless, Florida contains some wetland areas that serve as important migration and winter habitat in the Atlantic Flyway, nearly all of which are located within the peninsula.

Waterfowl and Wetlands in Peninsular Florida

Important waterfowl habitat in peninsular Florida occurs in association with major rivers such as the St. Johns and Kissimmee, natural lakes such as Lake Okeechobee and many smaller lakes, associated with interior prairie wetlands, and in isolated coastal areas, particularly at Merritt Island NWR. Nearly all of these wetlands have been affected to some extent by urban development or agriculture.



There are about 7,800 natural lakes in Florida, some of which produce aquatic vegetation and provide good waterfowl habitat (Johnson and Montalbano 1989). The Kissimmee River and Lakes all provide significant winter habitat for lesser scaup and ring-necked ducks. The St. Johns River Valley marshes and lakes provide winter and migration habitat for an additional 15,000 ducks on average. Unfortunately, much of the best habitat in this region has been lost to channelization, flood control, development, and drainage. Degradation of interior Florida lakes

[24] NABCI Bird Conservation Region 31

and deepwater marshes, particularly due to agricultural run-off and introduced exotic vegetation, has reduced numbers of birds over-wintering there, which likely is a direct response to reduced foraging habitat (Johnson and Montalbano 1989).

Recently, the U. S. Army Corps of Engineers has undertaken a large-scale project to restore the Kissimmee River to its former channel, which will result in restoration of several thousand ha of emergent wetlands of great value to migrating and wintering waterfowl and resident mottled ducks. The first phase of that large-scale restoration effort was completed in 2001, with the entire project scheduled for completion in 2010. Peninsular Florida south of Alachua County has a resident mottled duck population of approximately 25,000-50,000 birds. Mottled ducks use interior wetlands and prairies extensively in Florida, and make only limited use of coastal habitats (Johnson et al. 1984, 1991). The Florida Fish and Wildlife Conservation Commission (FFWCC) completed a mottled duck conservation plan in 2003. The goal of that plan is to "maintain the Florida mottled duck as a functional member of the South Florida ecosystem, at a population that can sustain hunting and viewing opportunities over the long term." Ducks Unlimited conservation programs in peninsular Florida should, where and when possible, contribute directly toward the overall goals and objectives of the FFWCC Mottled Duck Conservation Plan.

The other major wetland ecosystem in the peninsula is Lake Okeechobee and the Everglades. With exception of Lake Okeechobee and an area referred to as the Everglades Agricultural Area located immediately south of the lake, the Everglades and associated habitats do not provide very high quality waterfowl habitat and winter relatively few birds. This system suffers from extensive alterations to hydrology for urban water supply demand, flood control, and eutrophication related to agricultural practices (Johnson and Montalbano 1989). Multiple canals and large water control structures divert much of the water for irrigation or municipal water supply to large metropolitan areas like Miami. Heavy fertilizer use on these relatively nutrient poor soils also has lead to heavy nutrient loading in the system, particularly for phosphorous. As a result, the everglades tend to be drier and water quality is poorer than in the relatively recent past, while Lake Okeechobee tends to be held at higher levels not conducive to growth of waterfowl food plants (Johnson 1987, Johnson and Montalbano 1989). A large, multi-agency effort, lead by the U. S. Army Corps of Engineers and the South Florida Water Management District, is underway to restore the hydrology of this system and reduce nutrient loading. Various projects within this effort will be authorized through 2014, with subsequent completion subject to appropriation of funding. DU has not participated and has no plans to increase its direct involvement in the large-scale restoration effort in the Everglades due to the relatively low value of waterfowl habitat provided by the system.

As noted previously, Lake Okeechobee and the Everglades Agricultural Area (rice, tomatoes and other truck-farm type crops, and sugar cane) winter an average of 170,000 ducks, of which scaup (<97,000) and ring-necked ducks (<35,000) are the most abundant species (Johnson 1987, Johnson and Montalbano 1989). Blue-winged teal also are common in winter on Lake Okeechobee and throughout the Everglades region. Mottled ducks and fulvous whistling ducks are present at relatively low densities (Johnson and Montalbano 1989, Moorman and Gray 1994).

Along Florida's Atlantic Coast, Merritt Island NWR contains brackish impoundments that produce abundant stands of wigeon grass. These impoundments originally created to control mosquitoes, typically over-winter several thousand dabbling ducks, including wigeon, pintails, and mottled ducks (Gordon et al. 1989). Also, the Indian and Banana Rivers provide important winter habitat for 200,000 to 300,000 lesser scaup. On the Gulf Coast, Tampa Bay and Charlotte

Harbor winter 45,000 and 20,000 scaup, respectively. Other coastal areas offer considerably less waterfowl habitat relative to interior wetlands discussed above.

Other Wildlife

One migrant population and one resident population of greater sandhill cranes occur in this area. The Eastern Population, which breeds in Ontario, Minnesota, Wisconsin and Michigan, over-winters primarily in southeastern Georgia through central Florida. A resident population of cranes occurs in peninsular Florida (Tacha et al. 1994). Much of the population of limpkins in North America occurs in association with cypress and bottomland hardwood swamps in Florida, with a small number of birds in extreme southwestern Georgia (Gough et al. 1998).

Substantial numbers of shorebirds use this region, particularly the Atlantic coast of Florida and the mudflats and beaches of the eastern Gulf Coast of Mexico. Wetlands in Florida are among the most important in North America for vast numbers of wading birds. In particular, the Everglades region has great significance to colonial wading birds, including nearly all species of herons, egrets and bitterns in North America, white ibis, limpkins, and wood storks. Many of these species annual events are linked to the annual flooding and gradual drying of the Everglades system. Alterations to hydrology in the Everglades have been responsible for a dramatic decline in the number of wading birds in this conservation region. This region also supports populations of endangered snail kites and Florida panthers. Also, efforts are underway to re-establish a resident population of whooping cranes.

DU Conservation Programs in Peninsular Florida

DU's conservation accomplishments in Florida have grown in recent years. In 2003, DU received a NAWCA grant to restore the Hickory Mound Impoundment in the Big Bend Region of Florida. Also, DU has partnered with the USDA NRCS to complete some large, site-specific Wetland Reserve Program projects in Florida. The remaining accomplishments in Florida are all related to the MARSH programIn Peninsular Florida, DU has worked with the FFWCC, the USFWS and other partners to conserve 9,284 ha of wetlands. Conservation staff are currently evaluating the need and potential expansion of conservation programs in Florida, particularly in the arena of conservation easements and private lands programs.

Goal

Peninsular Florida recently became part of the Atlantic Coast JV of the NAWMP. Conservation planning is underway to determine habitat goals for this conservation region, but data for the key habitats like freshwater lakes is scarce. It will be necessary to estimate the value of existing foraging habitat in light of both current and desired winter waterfowl populations to develop the habitat goals. DU conservation programs will be geared toward contributing to or meeting foraging habitat objectives after they are determined.

Assumption

The primary assumption in conservation planning for this region will be that foraging habitat limits the number of waterfowl wintering in the region, and indirectly influences over-winter survival rates.

Strategies

Evaluate the potential for growth of conservation programs in the region related to private lands conservation programs, conservation easements, and an increased role for DU to provide biological and engineering services to public land management agencies, particularly various water management districts.

- Work closely with the FFWCC in the implementation of the Florida Mottled Duck Conservation Plan.

- Work on a project-by-project basis in partnership with the USDA NRCS to complete Wetlands Reserve Program projects.

- Develop a GIS that will assist with planning, targeting and evaluation of conservation programs.

- Work with Field Operations and Development staff to secure funding to support all planned growth in this conservation region.

January 12, 2005 – Region 24

General update of program activities
Insert information on Florida Fish and Wildlife Conservation Commission program for mottled ducks.
Minor corrections and editing of text

Central Valley / Coastal California [25]

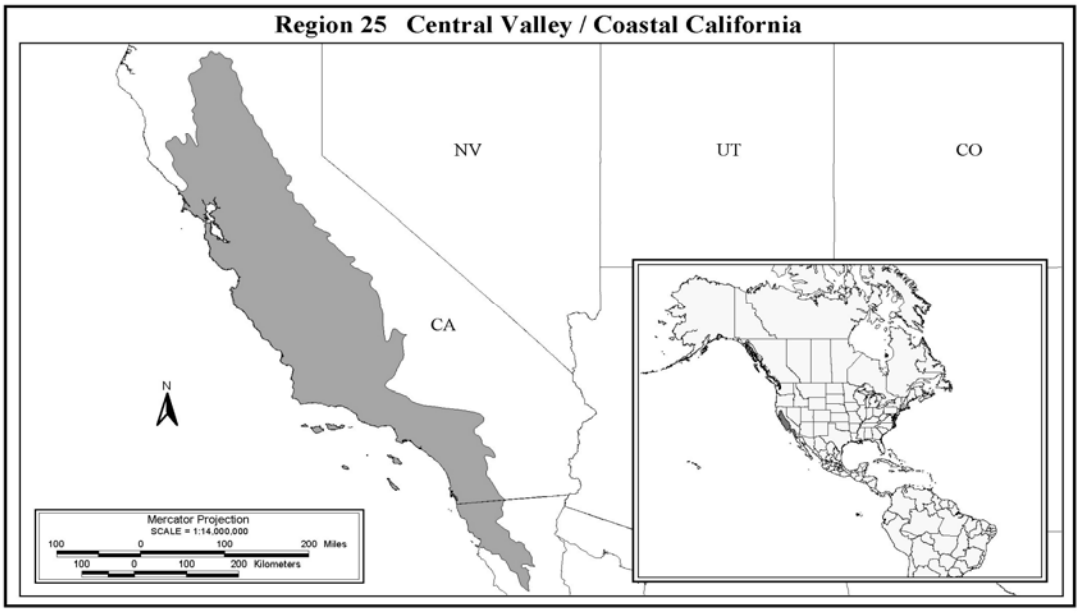
The Coastal California Region extends from Bodega Bay south to northern Mexico and includes the important San Francisco and San Diego Bays. The Coast Mountain Range is also considered in this region as is the Central Valley and the Salton Sea. The most important waterfowl habitat in the region is the Central Valley where DU has an extensive program of habitat restoration, protection, and enhancement.

The Central Valley of California averages 64 km wide by 644 km long and consists of the two lesser valleys, the Sacramento in the north and the San Joaquin in the south. One of the largest freshwater deltas in the world is formed at the confluence of the Sacramento, San Joaquin, Mokelumne, and Cosumnes Rivers. These waters then flow through Suisun Bay (Marsh) into San Francisco Bay. Wetlands in the Central Valley historically have hosted some of the largest concentrations of wintering waterfowl in the world. Estimates from the 1800's place waterfowl numbers between twenty and 40 million birds. More recently, population objectives for the Central Valley have been stepped down from the North American Waterfowl Management Plan (NAWMP). These population objectives call for the Central Valley to sustain peak wintering populations of nearly six million ducks and one million geese. Up to 60% of all Pacific Flyway waterfowl rely on the Central Valley during some portion of the migration or wintering period. Nowhere in North America do so many waterfowl winter on such a small wetland base.

Prior to the Gold Rush period of the mid-1800s, an estimated 5 million acres of wetlands were present in the state (Heitmeyer et al. 1989). However, the loss and degradation of these habitats has been dramatic. More than 95% of the historic wetland area and over 90% of the riparian corridors in California have been destroyed or modified (Gilmer et al. 1982). Although habitat loss in the Central Valley has slowed or even been reversed in recent years, population growth and urbanization continue. Human populations in California are expected to nearly double by 2040. Much of this growth will occur in the Central Valley where human populations are projected to increase from 5.7 million to13.1 million over the same period.

Population increases in the Central Valley will result in significant land use changes, especially with respect to agriculture. It is estimated that nearly 800,000 acres of irrigated farmland will be converted to urban uses by 2040. For waterfowl, rice is by far the most important irrigated crop grown and loss of this habitat would have significant consequences for ducks and geese. However, a closer look at human population growth suggests that most of this growth will occur outside of today's rice growing regions. Of the nearly 500,000 acres of rice that is now grown in the Valley, less than 40,000 acres, or 8% of the total, is forecast to be lost by 2040.

[25] NABCI Bird Conservation Regions 32



The Sacramento and San Joaquin Valleys differ substantially in the amount and types of habitat provided for waterfowl. Riparian forests, semi-permanent tule marshes, and grasslands historically dominated the Sacramento Valley. Of the 1.5 million acres of wetlands that once existed in the Sacramento Valley, approximately 79,000 acres remain. Some 60% of the current wetlands are in private ownership and most are managed as duck clubs. Some of the most important areas of private duck clubs include the Willow Creek, Lurline, Butte Sinks, Colusa Trough, and District 10. Harvested rice fields provide winter foods and habitats for several species of waterbirds, especially if they are shallow flooded after harvest. Virtually all of the rice grown in the Central Valley occurs in the Sacramento Valley, with approximately 70% of this rice being flooded after harvest.

The San Joaquin Valley consists of the San Joaquin and Tulare drainage basins. Most of the San Joaquin Basin once consisted of seasonally flooded grasslands and vernal pools. Historically wetlands within the Tulare Basin were confined to Tulare, Kern, Goose, and Buena Vista lakes that covered some 625,000 acres. At present, there are 90,000 acres of wetland habitat in the San Joaquin Valley. Most of this habitat occurs in the Grasslands District, which is the largest contiguous block of wetlands in the Central Valley.

The vast watershed of the Central Valley drains into the Sacramento-San Joaquin Delta at the confluence of the Sacramento, San Joaquin, Mokelumne, and Cosumnes rivers. The inland network of 700,000 acres of sloughs and islands form an inverted delta that is one of the 60 largest river deltas in the world (Heitmeyer et al. 1989); only the Yukon-Kuskokwim and Copper River deltas of Alaska are larger on the west coast of North America. Because of its unique geologic formation, the Delta is the largest inland delta, and its waters flow through the largest brackish estuary on the Pacific Coast. Recent estimates indicate that as little as 7,500 acres of wetlands and 29,000 acres of winter-flooded agriculture may exist in the eastern Delta. Suisun Marsh currently contains 38,375 acres of managed wetlands that provide important food resources for migrating

and wintering waterfowl. However, recent proposals to restore tidal flow to up to 6,750 acres of these managed habitats may reduce the carrying capacity of Suisun Marsh. As a result, DU and its partners in the Central Valley will determine the effects of tidal restoration on waterfowl populations in the Suisun Marsh.

Millions of migrant and wintering waterfowl once used Suisun Marsh. Market hunting in the late 1800s suggests the size of estuary waterfowl populations where more than 182,000 green-winged teal were sold in San Francisco markets in the 1895-96 season (Grinnell et al. 1918). Estimates of wintering pintail populations in the recent past, including the Delta, vary from 200,000 to 1.4 million (Michny 1979). San Francisco and San Pablo Bays made up one of the largest contiguous tidal marsh systems on the Pacific Coast and included over 545,000 acres of tidal wetlands. The hydraulic mining in the Sierra-Nevada foothills, conversion of tidelands to agriculture in the late 1800s and early 1900s, and urban and industrial expansion have reduced the quality of this system (Nichols et al. 1986). Urban expansion has created large residential developments within and adjacent to wetland areas; industrial, military, and commercial developments; over 320 marinas; solid waste landfills; and substantial disturbance of wildlife. Critical coastal wetland habitats still exist in southern California and include, Morro Bay, Bolsa Chica, and San Diego Bay, however, urban encroachment is severe.

Another crucial factor related to conservation of water birds and aquatic habitat in the Central Valley is that of water itself. Agriculture accounts for 80% of water use, and projected demographic changes will result in dramatically increased tensions among agriculture, urban development and conservation interests. Even in an above-average water year like 1998-99, farmers in the San Joaquin Valley did not fully receive adequate water supplies. Congressional actions, such as 1992 passage of the Central Valley Project Improvement Act, have helped assure adequate water supplies for wildlife conservation in some areas (such as federal and state refuges), yet much remains to be done to secure adequate supplies of water quantities of suitable quality for wetlands conservation (especially private lands).

An additional factor related to water in the west is that of threatened and endangered anadromous fish. Almost all rivers and streams in northern California have large and small dams that halt successful salmon and steelhead spawning cycles. Alterations of streamside habitat and water availability at important times in the year further exacerbate the problems. Water diversions from streams and rivers for agricultural or wildlife conservation use can result in entrapment of fish onto upland areas, further compromising their population status. If solutions to such fish issues cannot be found, direct conflict in floodplain management strategies would certainly develop.

Importance to Waterfowl

Waterfowl concentrations are greatest in California during fall and winter when migrants from northern latitudes join locally breeding or produced birds (Bellrose 1980). The Central Valley winters nearly six million ducks and 1 million geese and swans when waterfowl populations are at NAWMP goals. This represents >60% of all waterfowl (excluding sea ducks) wintering in the Pacific Flyway. Of special importance, California winters >20% of all mallards, wigeon, green-winged teal, northern shovelers, canvasbacks, and ruddy ducks; >30% of all lesser snow geese and tundra swans; >50% of all northern pintails, white-fronted geese, and Ross' geese. Today, the San Francisco Bay is still an important staging and wintering area for waterfowl, especially diving ducks, in the Pacific Flyway. More ducks winter in San Francisco Bay than in the much larger Chesapeake Bay (SFEP 1992). Midwinter surveys during 1981-90 indicated that an average of 193,000 waterfowl were present on the open water and salt ponds of

San Francisco Bay. During that time, the relative composition of waterfowl species in the Bay was scaup (35%), scoters (14%), shoveler (12%), ruddy duck (11%), canvasback (8%), other dabbling ducks (10%), and other ducks (10%). The most abundant diving ducks over the past 10 years have been scaup, surf scoter, ruddy duck, canvasback, and bufflehead – in that order (SFEP 1992).

Conservation Programs

Ducks Unlimited's Valley CARE Program was initiated in the Central Valley in 1993 to comprehensively address wetland and waterfowl conservation issues in this important wintering and migration area. The program integrates several strategies including wetland restoration, enhancement, and protection; promotes wildlife friendly agriculture practices, especially post-harvest flooding of ricelands; and develops public policy and communication initiatives that address conservation needs in the Valley.

There have been substantial increases in waterfowl habitat within the Central Valley since the 1990s, and we've used the update of the ICP to report on some of these accomplishments. Since the early 1990s, DU and its partners have restored approximately 60,000 acres of wetland habitat. This represents half of the 120,000 acres wetland restoration objective identified in the ICP. In addition, over 56,800 acres of existing wetlands have received long-term protection. This equals 70% of the ICP's 84,000 acres wetland protection goal.

The ICP has also called for enhancement of 444,000 acres of agricultural habitat that was divided as follows; 1) enhancement of 332,000 acres of grain fields to help meet the food energy needs of migrating and wintering waterfowl, and 2) enhancement of 112,000 acres of upland habitat to ensure adequate nest success for breeding waterfowl. Although habitat programs for breeding waterfowl are just now gaining momentum in the Valley, over 353,000 acres of rice habitat is now flooded annually to provide food resources for wintering and migrating waterfowl. Finally, the ICP recommended securing reliable water supplies for all National Wildlife Refuges and State Wildlife Areas in the Central Valley, as well as for private wetlands in the Grasslands Resource Conservation District. This equals 506,000 acre-feet of annual water supplies. To date, over 70% of this objective has been achieved (363,000 acre-feet) as a result of passage of the Central Valley Project Improvement Act.

Ducks Unlimited has recently updated habitat objectives for the Central Valley in cooperation with its Central Valley Joint Venture partners. The purpose of this update was to clearly link waterfowl objectives for the Valley to the NAWMP, and to identify the landscape conditions needed to sustain waterfowl populations at NAWMP goals. A critical assumption of this update is that wetlands must provide a minimum of 50% of waterfowl food energy needs in each of the Valley's nine drainage basins, which serve as planning units. In some basins, agriculture accounts for over 70% of available waterfowl foods. Agricultural habitats will continue to be important in meeting the needs of waterfowl in the Central Valley. However, changing agricultural markets and increases in harvest efficiency are largely beyond the control of DU and its partners. Increasing the amount of wetland habitat for waterfowl can offset some of these unforeseen changes. Finally, the approach to establishing wetland enhancement objectives has been changed for this version of the ICP. Wetland enhancement typically involves periodic maintenance or improvement of water control structure, levees, and ditch networks used to manage wetlands. Interviews with resource professionals suggest that wetlands in the Valley should undergo some level of enhancement every ten to fifteen years. The ICP assumes that managed wetlands in the Central Valley need some form of enhancement an average of every

twelve years. As a result, enhancement objectives are expressed on an annual basis and are perpetual. The annual enhancement objective in this version of the ICP assumes that wetland restoration objectives for the Valley are met.

Although most of DU's work in the Central Valley has focused on migrating and wintering waterfowl, there is a growing emphasis on meeting the needs of breeding waterfowl as well. For example mallard harvest in the Central Valley now exceeds that of pintails, and up to 75% of mallards shot in the Valley are produced there. As a result, DU and its partners have developed a plan to guide habitat efforts for breeding mallards. This includes identifying the types of habitat programs to be delivered, where these programs should be focused, and ongoing research to better understand what limits the size and success of breeding mallard populations in the Central Valley.

Goals

Ducks Unlimited, in cooperation with its partners in the CVJV, has recently updated habitat objectives for waterfowl in the Central Valley. These objectives are described below.

- Restore an additional 104,000 acres of wetland habitat.

- Protect an additional 12,600 acres of existing wetlands through fee title or perpetual easement.

- Annually enhance 26,000 acres of public and private wetlands. The goal assumes that wetland restoration objectives have been. The annual wetland enhancement goal based on the area of existing wetlands is 17,050 acres.

- Ultimately secure reliable and affordable water supplies for timely delivery to National Wildlife Refuges, State Wildlife Areas, and private wetlands both inside and out of the Grasslands Resources Conservation District. The total annual water needs for wetland management in the Central Valley when wetland restoration goals are met equals 1,472,000 acre-feet.

- Maintain waterfowl friendly practices on a minimum of 309,000 acres of small grain agricultural lands. Waterfowl friendly practices are defined as those that do not diminish the availability of waste-grains for ducks and geese. Of these 309,000 acres, maintain winter-flooding of 173,000 acres to specifically meet duck needs. These objectives assume that wetland restoration goals are met. There are now approximately 558,000 acres of small grain lands where waterfowl friendly practices occur in the Central Valley. Winter-flooding currently occurs on 386,000 of these acres

- Secure Central Valley Project power for NWR's, State WA's, the Grasslands Resource Conservation District, and other private lands dedicated to wetland management.

Specific to DU, the following goals have been adopted for the five-year planning horizon:

- Restore 9,900 acres of Valley and Bay habitats.

- Enhance additional 49,400 acres of Valley and Bay habitats.

- Develop effective approaches to work with industry and others in the mitigation arena to ensure that effective, functioning wetland ecosystems are restored or created as a result of mitigation actions.

- Protect 4,920 acres of wetlands and agricultural lands from conversion to urban development through conservation easements.

- Complete placement of fish screens on all diversions on lower Butte Creek, and begin fish screen operations on Yuba Creek to protect wetlands in District 10.

- Complete land use planning modeling for all wetland areas in the Central Valley.

- Develop and implement DU water policy analysis and program to help assure secured water supplies for wildlife.

Assumptions

- Human population growth will present significant challenges for waterfowl conservation in coming decades.
  .
- Energy is the primary nutritional requirement of waterfowl in the non-breeding period.

- Water quality and quantity issues must be addressed to secure waterfowl's future in the Central Valley.

- Anadromous fish issues must be addressed to assure adequate water supplies are available for wetlands and agricultural lands that can provide benefits to wildlife.

Strategies

- Prioritize wetland restoration as the core of DU's programs.

- Support agricultural uses that are compatible with wetland conservation and waterfowl use, especially in the most threatened areas.

- Develop and implement agricultural production techniques that create sustainable agricultural practices that benefit wildlife.

- Secure water policies and allocations favorable to fish and wildlife.

- Reconnect true hydrologic linkages, such as floodplains and riparian habitat systems.

- Develop and apply evaluation methods to ensure that current and future wetland restoration efforts result in functioning wetland ecosystems.

- Complete the interactive GIS land use planning process to help prioritize key landscapes and complexes for protection or restoration. Implement general usage of this model in normal planning activities.

January 31, 2005 – Region 25

- Editing updates throughout
- Completely revised descriptions of Conservations Programs
- Completely revised Goals

Sonoran and Mohave Deserts / Sierra Madre Occidental[26]

This extremely arid region is marked by few aquatic habitats. The most important is the lower Colorado River corridor. California, Arizona and Nevada now use their full 7.5 million acre-feet apportionment, and little water is available to reach the Sea of Cortez. Although water scarcity was a speculated subject in 1922 when the Colorado River was apportioned for water allocations, it is a reality of the year 2000. However, potential for restoration of floodplain wetlands exists. Several large wetlands (such as the 400 ha Martinez Marsh) exist, but exotic vegetation dominates many of them.

Wetlands of the Imperial and Coachella Valleys are now dominated by the Salton Sea. A diversion faltered in 1905, causing the Colorado River to flow into the Cahuilla Basin, forming the Salton Sea. Waterbirds were quickly attracted to this large water body; however, the shift of the Colorado River back to its original channel and high evapotranspiration resulted in drying of the lakebed. With nowhere to go, drain-water from 4,500 mi^2 of intensive farming operations in the Imperial Valley and northern Baja California has been filling the ancient lakebed. Water quality quickly began to decline. Salt content in Salton Sea is 30% more than in the Pacific Ocean. High salt content may be affecting the immune systems of fish causing them to become infected with deadly toxins and in turn passing on these contaminants to fish-eating birds. More than 200,000 eared grebes have died from disease outbreaks since 1992.

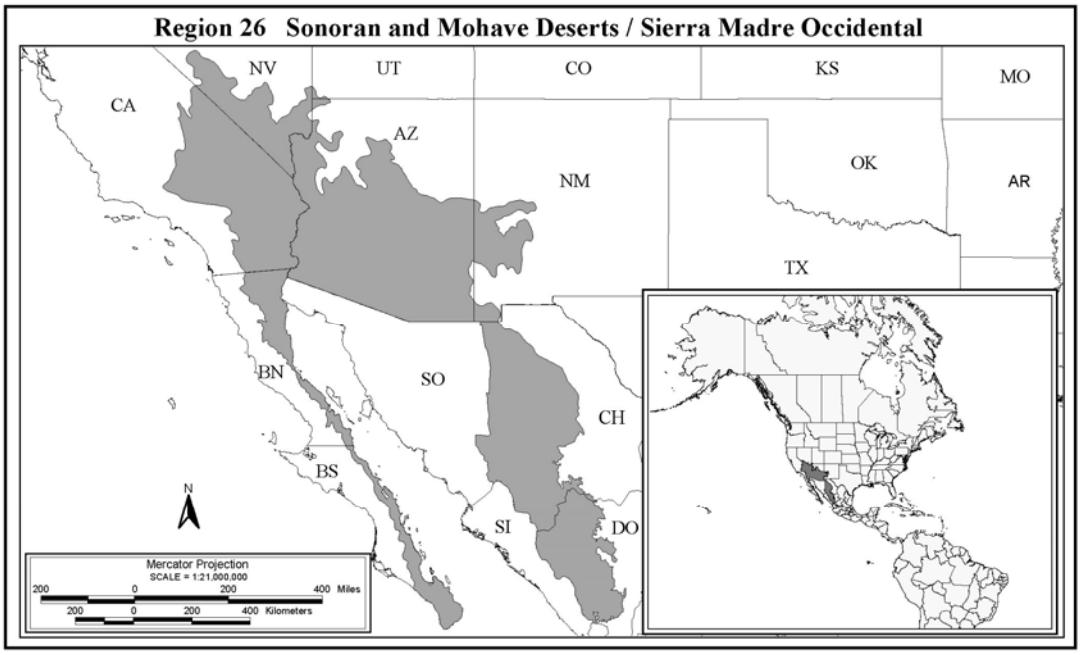
Avian botulism at the Salton Sea has claimed more than 27,000 birds, many of them white or California brown pelicans. The disease outbreaks are of concern for the large number of migrant waterbirds that winter on the Sea. Some 110,000 ducks and 25,000 geese (principally lesser snow and Ross') winter at Salton Sea. This is an extremely important wintering site for ruddy ducks and eared grebes. Shallow bays and mud flats attract more than 25 shorebird species, with peak numbers at 125,000 individuals, including western sandpipers, dowitchers, black-necked stilts, and American avocets. More than a third of the known breeding population of western species of gull-billed terns nest at Salton Sea. The 400 Yuma clapper rails represent 40% of the entire United States population. In addition to high salts and selenium, the New River (considered to be the most polluted waterway in the nation) flows into the Salton Sea from Mexico. The river's flow consists mainly of partially treated and raw sewage, agricultural drain water, pesticides, power plant effluent, detergents, and other industrial wastes. Specifically DDT and toxaphene has been identified in the water. Several alternatives to preserve the wildlife habitat values of the Salton Sea are now being considered.

Montane wetlands of the Southwest occur principally at 6,600 to 8,900 ft. The wetlands of the White Mountains account for 70% of all waterfowl production in Arizona (Fredrickson and Dugger 1993). The five National Forests in the Mogollon Rim (Apache-Sitgreaves, Coconino, Cibola, Gila, and Kaibab) contain almost 7,935 ha of lacustrine and palustrine wetlands (Fredrickson and Dugger 1993).

Importance to Waterfowl and Other Waterbirds

Where marshes occur in this region, migrant and wintering northern shoveler, green-winged teal, northern pintail, and American wigeon are the most common species. Based on the number of wintering waterfowl at the Salton Sea and migrants that use the Colorado Delta, >250,000 waterfowl (and at least as many shorebirds) may use wetlands in this region during

[26] NABCI Bird Conservation Regions 33 & 34



migration and wintering. Up to 49% of the Pacific Flyway ruddy duck population and over one million eared grebes winter at Salton Sea. Fourteen species of ducks regularly use southwest montane wetlands, and cinnamon teal, mallard, redhead, and ruddy duck are among the common nesting duck species. More than 50 waterbird species utilize wetlands of the Mogollon Rim (Gammonley 1996).

Current Conservation Programs

Ducks Unlimited completed several wetland enhancement projects in the Coconino National Forest in the late 1980s and early 1990s, and then aided in several wetland graduate projects in the region. Seasonal wetlands were restored on Salton Sea NWR by DU and the USFWS. These habitats are extensively used by snow geese, American wigeon, black-necked stilt, and colonial waterbirds. DU's current conservation program in this region has concentrated on viable floodplain restorations along the lower Colorado River corridor, partnering with the USFWS and Bureau of Reclamation. Current work emphasizes the eradication of exotic vegetation (such as tamarix) and mimics natural hydrologic conditions for native wetland vegetation to compete.

Goals

- Restore viable wetland and riparian habitats (at least 1,000 ha) along the lower Colorado River corridor and watershed and Gila River watershed.

- Restore wetlands in the Imperial, Cibola, and Havasu NWR complexes in the floodplain corridor of the lower Colorado River.

- Evaluate the viability of potential habitat projects at the Salton Sea.

Assumptions

- The availability of wetlands is the prime limiting factor for waterfowl and other waterbirds.
- All potential wetland restorations should be considered for disease and heavy metal risk.

Strategies

- Provide technical assistance and wetland restoration efforts to resource managers in the lower Colorado River corridor, Mogollon Rim and Choachella-Imperial Valleys.
- Partner with the USFWS, Bureau of Reclamation, Arizona Department of Game and Fish, Colorado River Indian Tribe, and others.
- Expand restoration of the Gila River watershed.
- Provide technical assistance to the USFS for montane, riparian and seasonal wetland restoration, such as the San Pedro River watershed.
- Evaluate potential habitat projects at the Salton Sea for long-term viability and to potentially partner with conservation organizations, such as the USFWS and National Audubon Society.

West Coast of Mexico[27]

The mainland west coast of Mexico contains several important areas for waterfowl. These habitats consist of tidal estuaries connected with brackish water marshes along the coast and inland fresh water wetlands and reservoirs. Fresh water streams and irrigation water empty into tidal lagoons and create flats, tidal pools, mangrove swamps and emergent vegetation dominated by cattail, bulrush, wigeongrass, muskgrass and algae.

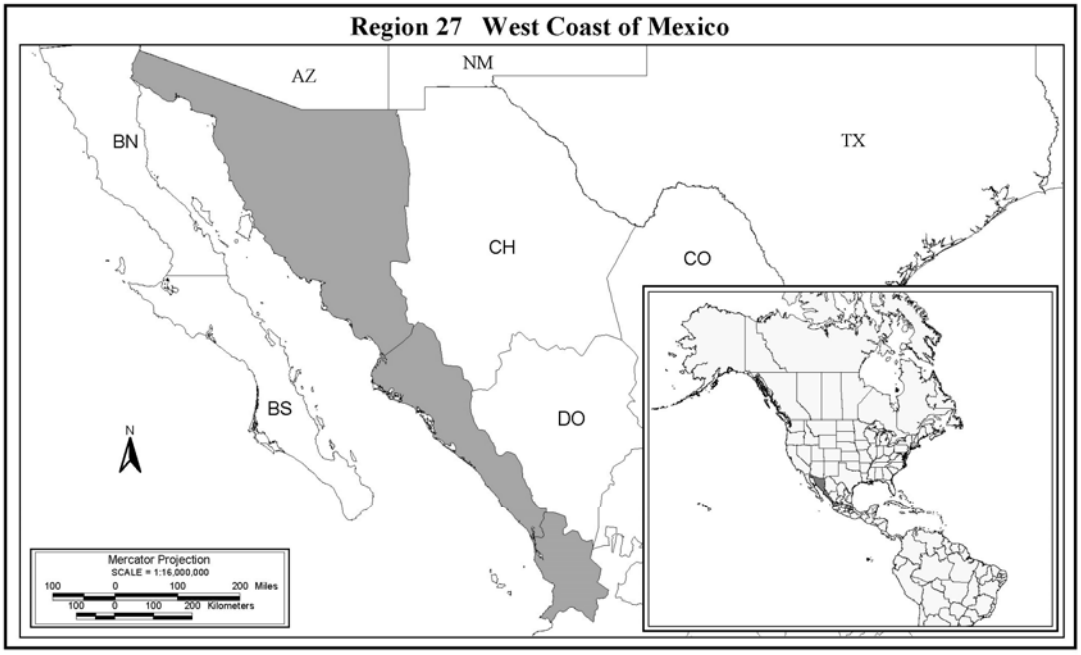
The coastal and interior wetlands in the state of Sinaloa support 22.5% of the migratory waterfowl that winter in Mexico. The states of Sonora and Nayarit held 6.1% and 4.5%, respectively. These wetlands and their wildlife are currently threatened by intensive agriculture, pollution, and development by the shrimp industry along the 2,124 km of littoral habitat that exists in the three states. Sonora encompasses 1,200 km with 66,000 ha of wetlands; Sinaloa 656 km with 453,200 ha of wetlands, and; Nayarit has more than 268 km where Marismas Nacionales encompass 200,000 ha.

Adjacent to the west coast lies 1.2 million ha of irrigated agriculture in the state of Sinaloa (including Los Mochis, Guasave, Guamuchil and the Culiacan agricultural valleys) and approximately 456,000 ha in the state of Sonora (including the Yaqui and Mayo valleys). These upland areas were converted to intensive agriculture during the last 30 to 40 years. As a result there have been major changes to west coast wetlands, as they have become less saline, more densely covered by cattails, and subjected to discharges of agricultural pesticides and fertilizers.

During the last decade, the shrimp industry has grown rapidly and caused important changes in the wetland areas of the three states. In Sinaloa for example, 227 shrimp farms have modified 21,357 ha of intertidal and mangrove swamps. There is only limited regulatory control by the state and federal governments. An additional 200,000 ha are targeted for more of this development (Dir. Pesca, Gob. del Estado de Sinaloa 1999). Thus we are concerned that there will be further deterioration those wetlands. We have observed considerable habitat loss following the construction of 11,000 ha of shrimp farms in the Chiricahueto area and on Pabellon Bay. The shrimp farm industry has not grown as much in Sonora (5,252 ha) and Nayarit (1,217 ha) but the potential for this to happen is enormous (Carrera and de la Fuente 1995). The shrimp industry and agriculture are the most significant threats these areas will face in the near future. Growth of the shrimp industry is supported by a loan from the World Bank.

Much of the irrigated farmland supported rice production after it was developed. This crop is very beneficial to waterfowl. However, between 1981 and 1998, rice production has decreased in the state of Sinaloa from 65,900 to 2,400 ha. This was correlated with a drop in use of the region by northern pintail from 880,000 birds in 1989, to 228,000 in 1990 and 310,000 for 1991. About 5,000 ha of 21.2 million ha of agricultural land on the west coast is currently in rice production. These changes are due to production costs in comparison to other crops.

[27] NABCI Bird Conservation Region 33 Sonoran and Mohave Deserts



Importance of the Region to Waterfowl

The complex of coastal wetlands along the states of Sonora, Sinaloa and Nayarit, represent the most important habitats for waterfowl in Mexico. Key wetlands in this area account for 33.1% of the total waterfowl population that winters in Mexico (USFWS 1989). On these wetlands during the 1980s, El Tobari Bay normally held, 1.8%, Lobos Bay, 0.3%, Santa Barbara, 1.6%. Agiabampo, 2.4%, Topolobampo Bay, 7.3%, Santa Maria Bay, 1.7%, Pabellon Bay, 9.4%, Caimanero, 1.9%, el Dorado to Dimas, 2.2% and Marismas Nacionales, 4.5% of the wintering waterfowl in Mexico (USFWS 1989). In January 1997, the USFWS reported a total of 627,787 ducks and 24,797 Geese, distributed along the western mainland. Of the ducks reported, 556,390 were dabblers and 71,397 were divers. Of the dabblers, the northern shoveler accounted for 251,950 (45%), the pintail, 151,740 (27%), blue-winged and cinnamon teal, 45,375 (8%), green-winged teal, 45,695 (8%) and American wigeon, 43,825. Of the divers, scaups accounted for 43,430 (64%), redhead, 17,900 (26%), ruddy duck 3,950 (6%) and canvasback, 2,050 (3%). Of the geese reported black brant accounted for, 22,720 (92%), snow geese 1,405 (6%) and white-fronted goose, 662 (3%).

Importance of the Region to Other Wildlife

The west Mexican wetlands and associated uplands support a diversity of wildlife species, particularly birds. The states of Sinaloa and Nayarit lie in the ecotone between two global climatic regions – the neotropic and the nearctic. Numerous mammals, including species of felids, still exist, such as the jaguar, ocelot and jaguarundi. The state of Sonora accounts for 894 species of wildlife, including 150 species of mammals, 474 species of birds, 131 species of reptiles, 37 species of amphibians and 102 species of fish (Moreno 1992). The states of Sinaloa and Nayarit, account for 482 species of wildlife (SEPESCA 1990), of which 51 are mammals, 347 are birds,

60 species are reptiles and 23 species are amphibians. Among these, 99 species are categorized as endemic and 73 species as in danger of extinction.

The coastal estuaries of Western Mexico are of global importance for wintering shorebirds of the Pacific Flyway. During 1993-94 ground surveys documented over 795,000 shorebirds wintering in the coastal bays of Pabellones and Santa Maria in Sinaloa. These surveys indicated that these areas support nearly one third of the shorebirds wintering in the North American portion of the Pacific Flyway (Engilis et al. 1998). These areas and the rest of the coastal wetlands of Sinaloa and the state of Sonora may well support over half of the shorebirds wintering on the Pacific Coast of North America. Two bays, Bahia Santa Maria and Ensenada Pabellones are sites of great importance to North American shorebirds in general. Both clearly exceed criteria of the Western Hemisphere Shorebird Reserve Network for classification as International Sites, hosting >100,000 individuals. Further surveys may elevate these areas to sites of Hemispheric Importance, by hosting >500,000 shorebirds.

Conservation Programs in the Region

The future of agriculture in Mexico, particularly in the states of Sonora, Sinaloa and Nayarit is very uncertain but there may be opportunities for implementing programs that benefit wildlife. Many fields are no longer producing crops because of the lack of subsidies and the high cost of production. Many landowners would welcome it if national or international interests would lease their properties so they can avoid debt and secure some measure of profit. Also, in Mexico communal farms known as Ejidos are becoming the property of the occupants as a result of changes in the constitution. We believe there are opportunities to secure some of these lands for wildlife habitat that would be beneficial for migratory waterfowl and other birds.

DU must work in partnership with local and national conservation institutions, to support conservation efforts that protect the most important habitats for waterfowl along the states of Sinaloa, Sonora and Nayarit. An example exists in a current project with Conservation International, at Bahia Santa Maria, in Sinaloa. Since many areas are under either state of federal protection, conservation initiatives must be developed in cooperation with municipal, state and federal governments. DU must seek a more effective role in the development of the shrimp industry by working with the three levels of government in Mexico to provide information and assistance.

There has been very little research to support future conservation planning in this region. Basic wetland ecology information is needed. Specific studies are needed on the ecology of cattail (*Typha*) on specific sites in Santa Maria and Pabellones Bay. A monitoring program is needed for migratory and neotropical species using the wetlands. Finally, public awareness of wetland and waterfowl conservation needs are imperative to support future conservation and sustainable use of the resources of this region.

Goals

- Protect and manage the most important habitats for waterfowl in the states of Sonora, Sinaloa and Nayarit.

- Develop a pilot project on 144 ha of land in the state of Sinaloa to test management methods to support wintering waterfowl and other waterbirds.

Strategies

- Strengthen partnerships with municipal, state and federal governments and with other non-government organizations.

- Serve as a source of assistance and information to support decision-making on programs that influence conservation, management and rational use of the habitats of importance for waterfowl.

- Work with partners to provide formal protection and recognition of importance, to Santa Maria and Pabellones Bays to shorebirds.

- Work within universities and other research institutions to develop information that is needed to support wetland and waterfowl conservation.

- Assure the dissemination of the information produced on past GIS mapping in the region to other conservation partners.

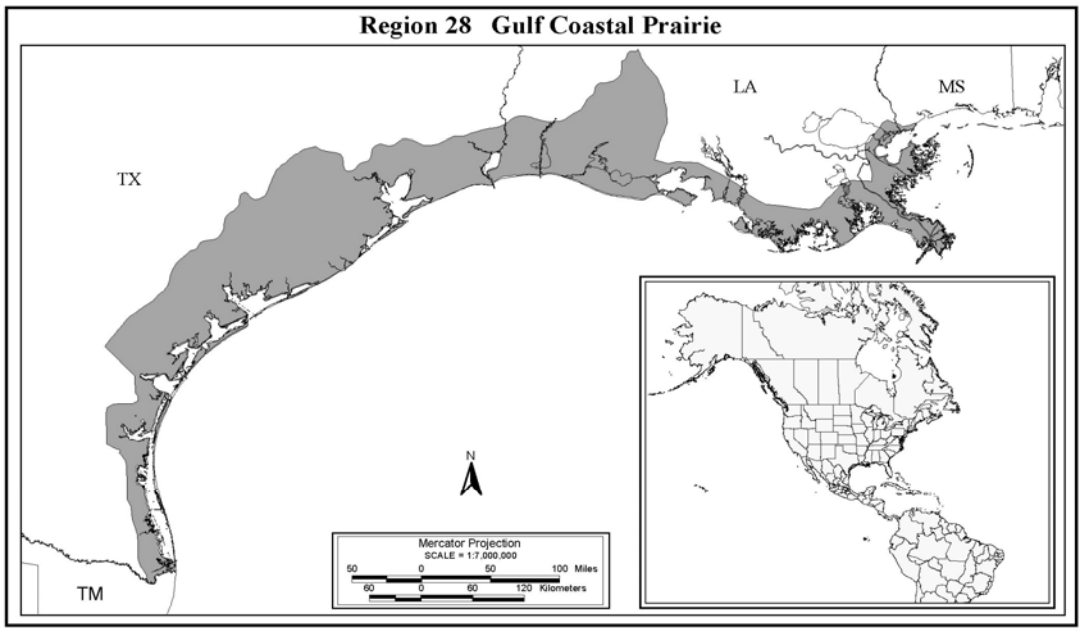
- Develop a public awareness program to motivate social participation and involvement.

Gulf Coastal Prairie[28]

As delineated in the North American Bird Conservation Initiative, the Gulf of Mexico marshes extend roughly from the Mississippi-Louisiana state boundary west and south to the mouth of the Rio Grande. This region also includes a large area of land that formerly was tall grass prairie interspersed with wetlands that today is largely converted to agricultural production.

The NAWMP GCJV divides the coastal marsh of Louisiana into separate but related initiative areas, the Mississippi River Coastal Marshes (Deltaic Plain) and the Chenier Plain (Gulf Coast Joint Venture 1990). Similarly, in Texas the coast is subdivided into 3 initiative areas, the Upper Texas Coast (Chenier Plain), the Mid-Texas Coast, and the Lower Texas Coast (Laguna Madre). Adjacent to and immediately north of the Chenier Plain and Texas Mid-Coast regions is a band of agricultural land dominated by rice production, sometimes referred to as the wet prairie or rice prairie. This region probably increased in importance to waterfowl when it was converted from wet tall grass prairie to rice agriculture (Hobaugh 1984, Hobaugh et al. 1989, Stuzenbaker 1980, 1984).

The characteristics of the Deltaic Plain historically were driven by the dynamics of the lower Mississippi River. Delta formation processes interacted with the Gulf of Mexico to give rise to a diverse ecosystem ranging from bottomland hardwood swamps and low-energy freshwater marshes to high-energy tidally influenced salt marshes. The Chenier Plain also is tied to Mississippi River Delta activity. When the Mississippi River was active in the western reaches of its delta, sediment was carried westward by near shore Gulf currents and deposited on mudflats that resulted in creation of the Chenier Plain region. Alternatively, when the river shifted east, near shore current carried fewer sediments and eroded shoreline and marsh. The Chenier Plain and wet prairie periodically are interrupted by rivers that drain upland areas to the north. A thorough review of Mississippi River delta formation processes and effects is presented in Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF 1998).



[28] NABCI Bird Conservation Region 37

The Texas Mid-Coast begins near Galveston Bay and ends near Corpus Christi. It is characterized by a relatively narrow band of marsh created in association with the estuaries and bays of minor rivers that drain the region (Moulton et al. 1997). Finally, the Laguna Madre is a shallow embayment stretching along the lower Texas Coast from Corpus Christi to Tamaulipas, Mexico. It is a hypersaline system with few fresh water inputs via rivers, and relatively few openings into the Gulf. Small freshwater wetlands occur immediately inland of the Laguna and provide important dietary fresh water for ducks feeding in nearby hypersaline habitats. Additionally, significant fresh water habitat formerly existed in the now highly agricultural Lower Rio Grande valley (Moulton et al. 1997).

Wetlands along the Gulf coast are declining in size and deteriorating in function resulting from both natural and human induced changes to the system. Historically, the amount of coastal marsh has fluctuated with changes in sea level, delta accretion and subsidence rates, and other factors. In recent history, Louisiana has had approximately 1.36 million ha of coastal marsh. Alarmingly, within the past 50 years, marsh loss rates have exceeded 104 km^2/yr with a resultant loss of over 364,219 ha in Louisiana (LCWCRTF 1998). During the 1990s, coastal marsh loss in Louisiana has slowed to an estimated rate of 65-91 km^2/year, with projections over the next 50 years that an additional 254,953 ha of marsh, swamps, and islands will be lost, even with completion of planned or proposed large-scale remedial measures (LCWCRTF 1998). Indeed, the LCWCRTF (1998) suggests the entire system of coastal marsh in Louisiana has deteriorated in size and function to the point of being on the verge of collapse, wherein ecological, commercial and cultural values will be lost without rapid and substantial intervention to reverse processes culminating in wetland losses.

Further west in Texas, approximately 1.62 million ha of coastal wetlands existed in the 1950s, but the scope and rate of loss, while substantial, is less severe than in Louisiana. For example, since 1955, approximately 85,264 ha of coastal wetlands have been lost, which is an annual rate of about 23 km^2/yr (Moulton et al. 1997). These rates consider changes to coastal marsh as well as to the inland coastal prairies, and techniques utilized to develop these estimates may have underestimated the rate and extent of wetland loss or conversion in Texas (Barry Wilson, pers. comm.).

These data do not reflect wetland loss or change associated with the conversion of the tall grass prairies of southwestern Louisiana to agriculture. Essentially all tall grass prairie that existed north of the coastal marsh has been converted to agriculture. Further, much of the area has been land-leveled, which eliminated many depressional wetlands and upland ridges that were important habitat for mottled ducks and a number of other species (Hobaugh et al. 1989). The value of this habitat to waterfowl prior to conversion is not well known, but this grassland area had a moderate density of shallow depressional wetlands that probably provided fair waterfowl habitat. With conversion to agriculture dominated by rice production, the region increased dramatically in importance to ducks, geese, and shorebirds. Since 1974, rice production in the region has declined 47% as a result of world competition, escalating costs of water for irrigation, and the reduction or removal of government subsidies. Declines in production have been more severe in the Texas Mid-Coast (50%) and Texas Chenier Plain (65%) than in the Louisiana Chenier Plain (40%) (USDA National Agricultural Statistics Service). Land taken out of rice production in some cases is converted to other crops of less (milo) or no (sugar cane) value to waterfowl, dry of wet pasture of moderate value to some species of waterfowl, or is lost to invasive, exotic stands of Chinese tallow tree.

Causes of wetland loss along the Gulf coast are complex, and both natural and man-induced in origin. Two related factors are at the root of much wetland loss in the region: (1) sea level rise; and (2) subsidence. The average rate of sea level rise currently is about 0.12 cm/yr. Until recently, rate of sea level rise has been slow relative to the rate of subsidence of coastal lands (LCWCRTF 1998). Subsidence is the combined effect of compaction of loosely consolidated, highly organic sediment, and geological movement along fault lines (LCWCRTF 1998). The rate of subsidence across the coast varies from 0.4 to 1.3 cm/yr (Penland et al. 1989; Gagliano and Van Beek 1993, Kuecher 1994). In combination, however, the two contribute greatly to overall rates of marsh loss. Other factors interact with subsidence and sea level rise and affect marsh loss rates and waterfowl habitat carrying capacity. These include alterations to hydrology (and salinity levels), reduced sedimentation rates, storms, erosion, herbivory by exotic nutria, and losses to exotic vegetation including water hyacinth, giant and common salvinia, and Chinese tallow trees (LCWCRTF 1998).

Waterfowl Along the Gulf Coast

The Gulf Coast Joint Venture recently established midwinter population objectives of 13.7 million ducks and 1.3 million geese (Barry Wilson, GCJV, pers. comm.). Duck population objectives are based upon 1970s winter distribution and breeding population estimates. Goose objectives are based upon December goose survey data from the mid-1980s.

Gulf Coast habitats are of particular significance as migration habitat to blue-winged teal, and as winter habitat for northern pintails, gadwall, wigeon, green-winged teal, redheads and lesser scaup. The GCJV winter population goals for pintails and wigeon represent approximately 25% of the NAWMP continental breeding population goals for these two species. For gadwall and green-winged teal, the GCJV midwinter population objectives represent over 95% and 80% of the continental NAWMP breeding population goals, respectively. Clearly this region is the most important wintering area for both species in North America. Mottled ducks are resident to peninsular Florida and the Gulf Coast from Mobile Bay west and south to Tampico, Mexico, which is approximately at the southern end of the Lower Laguna Madre. Approximately 90% of the mottled duck population, which may number between 600,000 and 1 million birds (LDWF unpubl. data, Barry Wilson, GCJV, pers. comm.), reside in coastal Louisiana and Texas. An undetermined, but apparently increasing number of fulvous and black-bellied whistling ducks now breed in southwestern Louisiana (mostly fulvous) and coastal Texas (mostly black-bellied).

Notably, the population objective for lesser scaup (2.5 million) does not include a substantial but undetermined number of birds that winter offshore in the Gulf of Mexico (Barry Wilson, GCJV, pers. comm.). However, even without those birds in the goal, it represents over 30% of the NAWMP continental breeding population goal, and when offshore populations are added in, perhaps over 40% of the continental breeding population estimate for scaup may over-winter in Gulf Coast habitats. Similarly, the winter redhead and canvasback population goals represent over 55% and 12% of the NAWMP breeding population goals. Nearly all redheads wintering in the region use habitats in the Laguna Madre.

The Gulf Coast marshes and rice fields provide substantial habitat for wintering white-fronted and snow geese. The GCJV midwinter goal for snow geese is approximately 1 million birds. Current numbers of snow geese wintering in the region likely exceed the goal in most years due to the burgeoning mid-continent population of these geese. Consequently, action should be taken to reduce the number of geese over-wintering in the region.

Overall, the Gulf Coast marshes are most important to North American waterfowl as migration and winter habitat. However, they are of critical importance to resident mottled ducks, with secondary importance to fulvous and black-bellied whistling ducks as breeding habitat. Limiting factors for breeding ducks are poorly understood, but availability of fresh water during spring and summer may limit availability of brood-rearing and molting habitat in some years. The primary limiting factor for populations of migrating and wintering waterfowl is assumed to be foraging habitat. The role of refuges and the need for additional refuges are not well understood in the region, and disease is generally not a factor.

Other Wildlife along the Gulf Coast

The extensive wetlands of the Gulf Coast region provide habitat to large numbers of wading birds and shorebirds. Among these are the great blue, little blue, and green heron, great and snowy egret, and the white-faced ibis. Less common, but still occurring in considerable numbers are resident roseate spoonbills and migrant wood storks. Importantly, the marshes in the general vicinity of Aransas NWR along the Texas Mid-Coast provide winter habitat for nearly the entire population of the endangered whooping crane. Marshes, wet pasture and agricultural fields along the Texas Mid-Coast and Lower Texas coast also provide habitat for approximately 30,000 mid-continent sandhill cranes (Tacha et al. 1994).

The mid-winter inventory data for the Gulf Coast suggest an average population of approximately 800,000 coots. Population estimates for common moorhens and purple gallinules are lacking, but Gulf Coast marshes are very important for these two species. Further, this region provides significant habitat for wintering king, Virginia, and sora rails, and year-round habitat for resident clapper rails, though population indexes do not exist for these species.

Mudflats, marshes and rice fields in the Gulf Coast region provide significant habitat to a substantial proportion of the shorebirds migrating through or wintering in the Mississippi and Central flyways. Resident species include the black-necked stilt, willet, Wilson's plover, and snowy plover. More abundant migrants include greater and lesser yellowlegs, common snipe, semipalmated, least, and stilt sandpipers, Wilson's phalarope, American avocet, marbled godwit, and long-billed curlew. Endangered piping plovers winter locally on beaches and mudflats along the Gulf Coast.

Several commercially important furbearers are resident in wetlands associated with the Gulf Coast, including the river otter, muskrat, and nutria. Nutria are an exotic species that contribute to coastal marsh loss by eating marsh vegetation beyond a point from which it can recover, resulting in large open water areas that accelerate erosion rates of interior marshes. The Louisiana marshes account for more than 40% of the national furbearer harvest recently valued at $1.3 million. The marshes also support an increasing American alligator population that is the basis for a $19.8 million industry in Louisiana (LDWF 1997).

The Gulf Coast marshes also provide important habitat for a variety of commercially important fish and shellfish, including red drum, spotted sea trout, menhaden, shrimp, blue crabs, and oysters. Collectively, these and other species contribute to over 20% of the national commercial fishery harvest (Southwick Associates 1997), which represents a $2.2 billion dollar industry in Louisiana alone. Recreational fisheries related to coastal marsh habitats support an additional $944 million dollar industry.

Conservation Programs on the Gulf Coast

DU, via the SRO, and in cooperation with many state and federal agencies, private corporations, and private landowners, offers a full range of conservation programs along the Gulf Coast. Nearly all of DU's accomplishments in the Gulf Coast conservation region have been through partnerships with other conservation interests, but DU is a leading partner in delivery of programs. DU has a full staff of biologists and engineers that work in tandem on a variety of wetland restoration, enhancement, development, or protection projects.

Presently, DU leads delivery of the Texas Prairie Wetlands Project, which is targeted at conservation of habitat on private land with a focus of seasonally flooding moist soil areas and cropland, particularly rice, to provide food for waterfowl. This program has been restricted to coastal Texas since 1991. Effective in fall of 1999, DU will expand this program to coastal Louisiana. DU also works with the USFWS, USDA-NRCS, the Louisiana Department of Wildlife and Fisheries, and the Texas Parks and Wildlife Department, to develop, restore or enhance wetlands on public land.

Through FY2000, DU has conserved 45,613 ha of habitat in the NAWMP GCJV Focus Area. This includes 10,735 ha of protected habitat, and 43,138 ha of restored or enhanced habitat. DU conservation programs are an essential component if the NAWMP GCJV goals are to be realized. The GCJV currently is revising its habitat goals based on waterfowl population objectives and related foraging habitat requirements.

DU conservation programs in the Gulf Coast are delivered at the landscape scale. Currently, opportunities exceed funding and staffing capability. Beyond the Texas Prairie Wetlands Project, programs are not specifically targeted to any particular area of the coast. Staff at the SRO will develop a specific action plan targeting areas for proactive conservation work along the coast over the next 5 years. Such work will call for proactive enrollment of cooperators in private lands programs, proactive public lands conservation work, conservation easement programs, and extension efforts aimed at encouraging agricultural practices that are wildlife and waterfowl friendly. Toward this end, the SRO will develop a marketing initiative to publicize conservation programs and assist with fundraising efforts to support conservation programs.

Goals

- Protect, restore, enhance, and manage wetlands and waterfowl habitat consistent with the objectives of the GCJV.

- Maintain 45,613 ha conserved through FY2000 in the Gulf Coast conservation region.

- Protect approximately 17,200 ha of private lands through state partners programs through FY2005.

- Determine the utility of the conservation easement program in protecting Gulf Coast habitats, and if feasible and useful, develop focus areas for the entire Gulf Coast, with a goal of protecting a minimum of 2,000 ha per year.

- Restore or enhance 25,000 ha of private land through partners programs and through cooperation with other efforts, and 8,100 ha of public land in cooperation with state and federal agencies through FY2005.

- Encourage active management on a minimum of 6,100 ha annually through extension and technical assistance efforts.

- Maintain and expand existing partnerships, while simultaneously exploring and developing additional partnerships that are consistent with the DU mission.

Assumption

- The availability of foraging habitat during the wintering period can limit waterfowl population survival and recruitment rates as mediated through body condition, behavior, and mobility.

Strategies

- Determine the utility of the conservation easement program in protecting Gulf Coast habitats and, where feasible, develop focus areas for the entire Gulf Coast.

- Protect, restore or enhance private land through partners programs and through cooperation with other efforts, and restore or enhance public land in cooperation with state and federal agencies.

- Encourage active management on private land outside of existing partners programs through extensions and technical assistance efforts.

- Maintain and expand existing partnerships while developing additional partnerships that are consistent with the DU mission

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- Develop a GIS for the Gulf Coast region to facilitate planning, monitoring, and evaluation of conservation programs, and serve as the lead partner in development and use of spatial data and information for conservation planning in the region.

Gulf Coast / Yucatan - Mexico[29]

Wetlands along the Mexican side of the Gulf Coast of Mexico encompass 2,970 km of littoral wetland habitat. They consist of numerous large complexes of fresh, brackish and salt marshes and mangrove swamps. These areas are negatively impacted by several major human-induced factors (oil drilling, dredging, shipping, agriculture and urban development) and natural events (hurricanes, flooding, etc).

There are five wetland areas that make up the most important habitats for wintering and resident waterfowl: Laguna Madre in Tamaulipas (including the Rio Grande Delta), Tamiahua and Alvarado Lagoons in Veracruz, Centla Wetlands in Tabasco and the complex of wetlands in Campeche-Yucatan.

Laguna Madre: This hypersaline coastal lagoon encompasses over 200,000 ha of shallow water, flats and shoalgrass beds that provide excellent habitat for several waterfowl species, particularly the redhead. There are 41,975 ha of sea grasses and algae, of which 33,776 ha are monotypic beds of shoalgrass (Carrera and de la Fuente 1994). During the 1970s, the mean biomass of shoalgrass in the Laguna Madre was estimated to be 413.7 g/m^2 (Cornelius 1975). Due to lowered salinity caused by construction of permanent channels along the barrier island and other dredging activities, shoalgrass has been reduced by about two-thirds (Mora 1994), with the subsequent reduction of carrying capacity for wintering waterfowl. There are also 36,330 ha of freshwater wetlands that are important to wintering waterfowl along the Laguna Madre (Carrera and de la Fuente 1994).

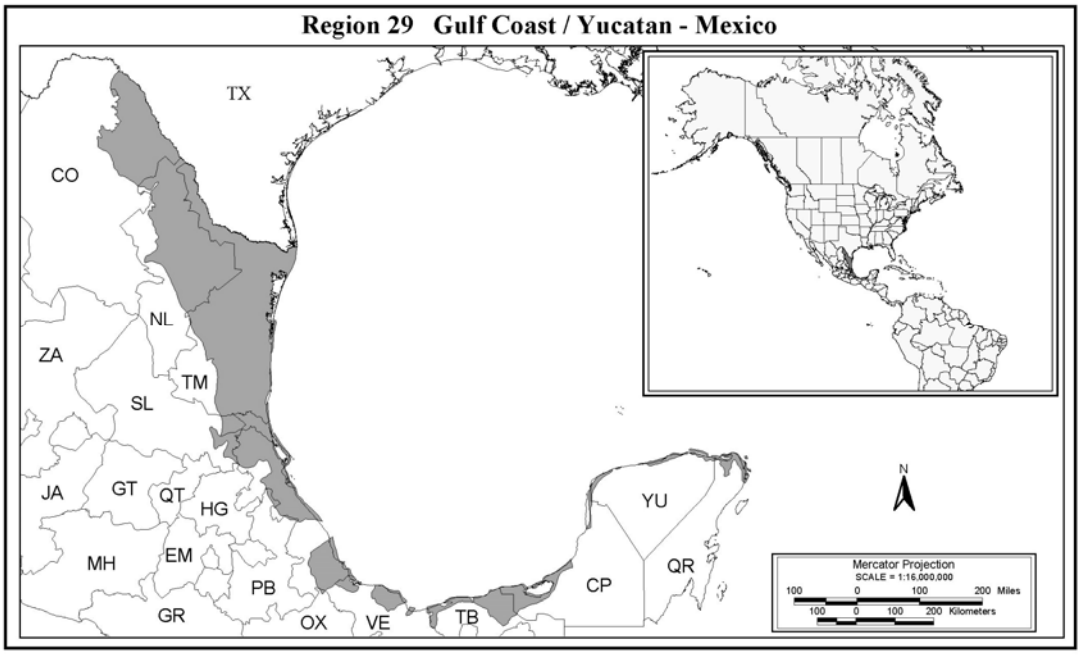
DU has worked to provide information to support the designation of the Laguna as a Federally Protected Area, but economic interests and development prospects have prevailed with the government of Tamaulipas and the area remains unprotected.

Tamiahua and Alvarado Lagoons: These areas are located in the state of Veracruz and measure 100,000 and 251,661 ha, respectively. Depending on local topography, they are a mosaic of mangroves, tropical flooded deciduous forest, and rain forest. In the Alvarado lagoon, the human population is mainly engaged in fishing activities. Nevertheless, cattle and other agricultural activities have caused the loss of almost all-natural vegetation. The lagoon system still contains vast mangrove communities and shallow lagoons with submerged and floating vegetation. The major threats are pollution from urban developments, sugar cane factories, paper, cellulose and other textile industries, beer factories and tanneries.

Tabasco Wetlands: Twelve percent of the state of Tabasco is protected as a Biosphere Reserve, which represent the most important freshwater resources in Mexico. The reserve is 302,706 ha; of which $1/3^{rd}$ is considered to be the nucleus and $2/3^{rd}$ is a buffer zone. Of the total area, 20% is permanently flooded freshwater delta wetlands formed at the confluence of the Grijalva and Usumacinta Rivers.

Campeche and Yucatan Lagoons: Within these two states, three protected areas have been established. Two are state reserves: the Petenes in Campeche and El Palmar in Yucatan, which are 68,000 and 59,177 ha in size, respectively. The third reserve is 85,474 ha and has been designated federally as the Celestun Special Biosphere Reserve in Yucatan. Wetlands of the Yucatan Peninsula are typically long, narrow lagoons inside sand barrier beaches running parallel to the Gulf of Mexico. Yucatan lagoons contain both open water and mangrove swamps that are

[29] NABCI Bird Conservation Region 36 & 37 (Mexico only)



interspersed with stands of cattails and is a transition zone to upland savannas. These areas contain extensive beds of wigeon grass, shoalgrass, musk grass and turtle grass. Many have been degraded by natural events, mainly hurricanes that created permanent breaches of the barrier island. Human disturbances are characterized by seaports, settlements and roads crossing the coastal wetlands that increase the salinity gradient, which can kill the mangrove swamps, and reducing cover and food supplies to waterfowl.

Ducks Unlimited de Mexico (DUMAC) is currently classifying wetlands of the Yucatan Peninsula, which includes the states of Centla, Campeche, Yucatan and Quintana Roo. This information will be key support for the development of future conservation projects.

Waterfowl in the Gulf Coast

The Gulf Coast of Mexico supports 35.2% of the wintering waterfowl in Mexico (DUMAC 1990). The Laguna Madre, Tamaulipas accounts for 18.8% (including the Rio Grande), Tamiahua 3.6% (including Panuco and Tamesi Rivers), Albarado 2.5%, Tabasco 6.9% and Campeche and Yucatan 3.8% (DUMAC 1990).

Waterfowl surveys in 1994 recorded a total of 818,015 ducks and 16,795 geese along the main wintering areas in the Gulf Coast. Of the total ducks reported, 506,600 were dabblers and 311,505 divers. The most abundant species were blue-winged teal (295,785) and redheads 230,075. Between 1991 and 1997 the average number of waterfowl distributed along this area was 649,413 ducks, of which 358,263 were dabblers and 431,273 divers. An average of 23,323 geese was counted during the same period (USFWS 1994).

The Laguna Madre in Tamaulipas, by itself, is a key wintering habitat for 36% of the North American population of redhead. The Laguna Madre in Texas accounts for 41% of the redheads and the rest of the Gulf Coast held 23% during between 1980-94 (Woodin 1996). The Tabasco, Campeche and Yucatan Lagoons are key wintering habitats for the blue-winged teal, holding 44.8% of the waterfowl distributed along the Gulf Coast (USFWS 1997).

Other Wildlife in the Gulf Coast

Laguna Madre Tamaulipas: 173 species of birds are found in this region, which account for 17% of Mexican (Peterson and Chalif 1989). Eighty-one are acquatic, 92 are terrestrial and 46% are migratory. About 1,500 reddish egrets winters in the Laguna Madre This is about 50% of all the species that migrate into Mexico in the fall (Farmer and Carrera 1993). This area is also a key wintering ground for the piping plover. Over 300 individuals have been counted, which represents about 30% of the North American population.

Tamiahua and Alvarado Lagoons: 19,071 pairs of colonial birds were reported in these areas by Sprunt and Knoder (1980). Between 30 and 50 species of fish are found in the Tamiahua Lagoon, with between 50-70 species in the Alvarado Lagoon. Out of 647 species of birds in the state of Veracruz, 113 species are aquatic and 534 are terrestrial. Resident species make up 73% of the total and 27 species are migratory.

Tabasco Wetlands: 540 wildlife species have been reported from this area, of which 49% are birds, 19% mammals, 16% reptilians, 14% fish and 2% amphibians. Twelve species are threatened or endangered. The Tabasco wetlands account for 11% of all the aquatic and sub-aquatic vegetation in Mexico. 374 species of 84 families of plants are reported for the area, of which 3 are considered threatened or endangered.

Campeche and Yucatan Lagoons: In the Yucatan, 271 species of birds have been recorded, of which 38% are migratory, 14 endemic, 18 threatened and 9 endangered. About 24,000 American flamingos are found in the Yucatan. They are an important tourist attraction for thousands of national and foreign tourists as are four species of cats: panther, cougar, ocelot and jaguar.

For the Campeche area, a total of 1,468 species of wildlife are reported, of which 79 species are protected, either at risk or endangered. The most charismatic species that can be found in the area include the manatee, jabiru, 2 species of crocodiles, and the 4 cat species.

Conservation Programs in the Gulf Coast

DU must work in partnership with municipal, state and federal governments and with local and national non-government institutions to conserve the most important wintering habitats for migratory and resident waterfowl. The Laguna Madre and the Tamiahua and Alvarado Lagoons are in need of formal protection through legislation or regulation. There are many opportunities to carry out restoration projects on the coast of Tamaulipas and Yucatan. In addition, there is a great need to work with state and federal governments to design roads that cross wetland areas to avoid future wetland loss and to correct past negative impacts.

Along the coastal plain of Tamaulipas, adjacent to the Laguna Madre, freshwater wetlands are key water sources for migratory waterfowl and are in need of protection or restoration. Close cooperation with the cattle industry will be key to the success of these programs.

Baseline wetland classification information is needed to document changes in habitat area and quality and to support future conservation planning. In addition, basic ecological studies of the structure and function of those habitats will provide essential guidance. This information is being gathered for the Yucatan Peninsula.

There are 20,000 ha of rice fields in the state of Campeche in the Edzna and Yohaltoon Valleys that are used by migratory and resident waterfowl. Unfortunately, the agricultural community sustains considerable economic loss (>$1 million/yr) because of waterfowl feeding in rice fields. Many waterfowl are poisoned every year to reduce their impact on the crops. Research is needed to evaluate the real effects of waterfowl on rice to support propose management activities that will minimize damage to both the rice and the waterfowl.

Public awareness will be a key factor in supporting the long-term conservation of wetlands and waterfowl.

Goals

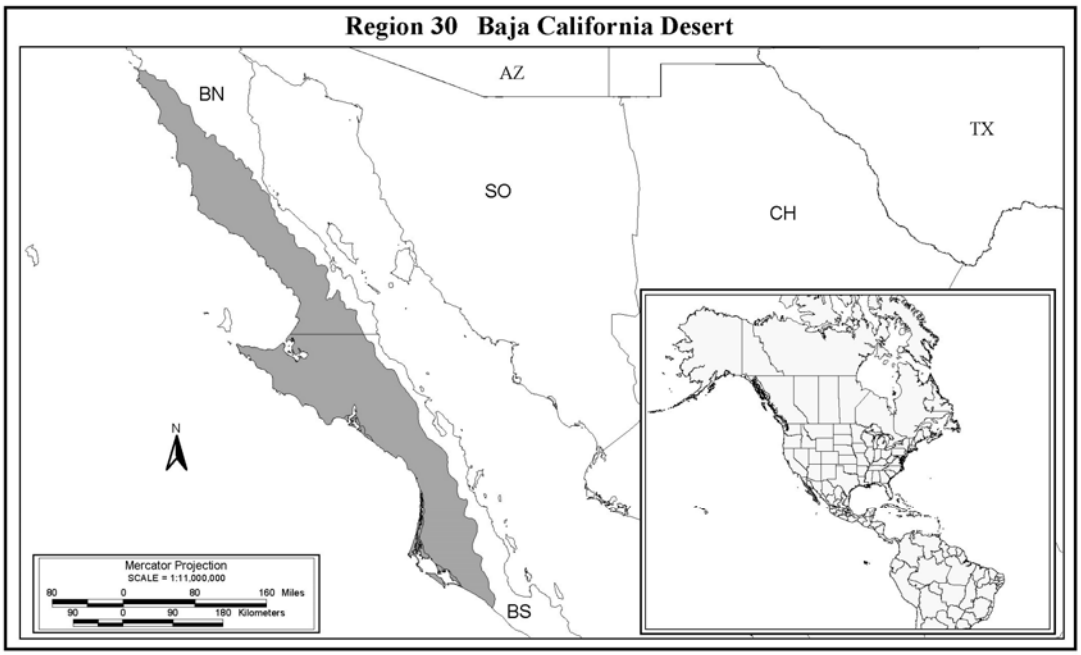
- Develop a wetland conservation plan for the wetlands of Mexico's Gulf Coast.
- Seek protected status for those habitats that remain vulnerable to loss and degradation.
- Complete wetland classification of the most important habitats for waterfowl along the Yucatan Peninsula.
- Restore and manage 13,000 ha of wetlands in the State of Yucatan and 6,187 ha in the State of Campeche.

Strategies

- Develop an initiative to ensure the conservation and restoration of the most important freshwater wetlands on areas adjacent to the Laguna Madre.
- Develop a public awareness program through all possible media, to motivate social participation and involvement in wetland and waterfowl conservation.
- Restore the most damaged wetland areas in the states of Campeche and Yucatan, caused by Natural events or Human Activities.
- Maintain and strengthen partnership with state and federal governments and with local and national non-government organizations, to support current and future wetland conservation initiatives.
- Develop a private land program to support the conservation and restoration of wetlands along the Laguna Madre.
- Provide the results of the wetland classification project to government and non-government organizations to support wetland conservation initiatives.
- Encourage universities and other research Institutions to generate information that is needed to support wetland and waterfowl conservation and management.
- Develop and implement a communications program to support waterfowl conservation in the Gulf Coast Region.

Baja California Desert[30]

The West Coast of the Peninsula of Baja California is adorned with a series of wetlands in near-pristine conditions. These areas play a major role for migratory birds on the Pacific Flyway, hosting thousands of shorebirds during the winter and on migration (Kjelmyr et al. 1991). They provide calving grounds for the gray whale, are the principal wintering area for Pacific black brant (Saunders and Saunders 1981) and contain endemic and endangered species of plants and animals. These wetlands also provide breeding habitat for many seabirds including several endangered and threatened species (Palacios and Alfaro 1991; Zembal and Masey 1981).



The Baja Peninsula is 50-250 km wide and 1,500 km long. The majority of the habitat for waterfowl consists of bays and estuaries along the pacific coast (Kramer and Migoya 1989). Four bays, San Quintin, Scammon´s, San Ignacio and Magdalena, constitute the major distribution areas for 85% of the North American population of the Pacific black brant. These bays are hypersaline, intertidal, shallow and dominated by 58,875 ha of eelgrass beds (Carrera and de la Fuente, in press). Red, white and black mangroves are present on 34,601 ha of the bays.

Waterfowl in the Baja California Peninsula

In 1998, 164,848 waterfowl were distributed along the Baja Peninsula, of which 108,018 were Pacific brant and 56,830 were ducks of which 4,085 were dabblers (northern pintail, shoveler and American wigeon), 26,235 were divers (redhead, scaup and bufflehead) and 26,510 were sea ducks (scoters and mergansers). Over 80% of the Pacific brant population winters in the Pacific coast of Mexico, and most of the Mexican wintering population (>70%) is found along the west coast of Baja California at three areas; San Quintin, Scammon´s and San Ignacio Lagoons. The rest of the population is scattered along the west coast of mainland Mexico, in the

[30] NABCI Bird Conservation Region 38 (Baja California portion only)

states of Sonora and Sinaloa, from the Infiernillo Canal to Santa Maria Bay north. According to USFWS surveys, brant use of the Mexican west coast has increased significantly from 84% of the total North American population in the 1960s, to 92.3% in the 1970s and 93% during the 1980s, distributed mainly on these three main Bays.

Other Wildlife

Scammon´s, San Ignacio and Magdelana Bays are important calving grounds for the gray whale in the winter. In 1998, Scammon´s Bay (Ojo de liebre) was declared to be a Biosphere Reserve under the protection of the federal government. In 1993, San Ignacio Bay was declared as a World Human Patrimony. Both designations are intended to contribute to the future conservation of these areas.

Canadian Wildlife Service surveys in the Northwest and Baja California coastline during 1992 recorded a total of 815,531 shorebirds, with almost 86% occurring in four key wetlands, in which Scammon´s Lagoon (Ojo de Liebre) accounted for 31.5% (Morrison et al. 1992). San Quintin and Scammon´s Bays provide habitat for the endangered clapper rail which uses the 7,350 ha of saltmarsh cordgrass (Spartina foliosa) within these bays. The four bays provide habitat for 17,295 brown pelican, 605 white pelican and 148 osprey (USFWS 1997). San Ignacio Lagoon provides the most important nesting habitat for the ospreys along the coast of Baja California. Shoreline habitats such as mangroves support several colonies of nesting magnificent frigatebirds and several species of herons and egrets.

Conservation Programs in the Baja California Peninsula

DUMAC works in close cooperation with the municipal, state and federal government in Mexico, to protection of the habitats of the Baja Peninsula. This work is accomplished in cooperation with local non-government institutions. These relationships must be strengthened especially on those areas that are currently protected by the federal government. The support of DU on the development and implementation of management plans for these areas is key to securing protection in harmony with sustainable use and development of these sites. DU should develop proposals and partnerships on those sites with no existing protection. This can be done directly by DU or by supporting the work that is currently underway by local institutions.

Research is needed to determine how these areas function as ecosystems to help guide decisions on projects that may harm the natural conditions of the bays. For example, a resort development is planned in the San Quintin Bay along the barrier island which will involve dredging to build a marina for boats. In San Ignacio Bay the most important salt production industry in Latin America may also be expanded in future years. In both cases, the deterioration of the natural habitats is possible. DU must build strong relationships with local and national research institutions and universities to help guide the research needed to guide the conservation and management of the Bays. A good example is the partnership that has been developed between DU with CICESE, University of Baja California, the USGS-Alaska Science Center and the University of Alaska – Fairbanks to conduct research on the major bays along the Baja California to support their future use by Pacific brant.

DU recently finished the wetlands inventory and classification of the major habitats for waterfowl along the pacific coast of Baja California. The distribution of this information is key to support other institutions' conservation and management initiatives. DU has initiated this process, by providing information to Proesteros, a local NGO in Baja that is working to conserve the natural values of San Quintin Bay. The opportunities and needs for leadership in conservation in

this region are enormous. The establishment of partnerships is essential to guarantee the delivery of programs needed to preserve these four crucial wetlands for waterfowl in Mexico.

Goals

- Protect the most important habitats for waterfowl along the Baja California Peninsula
- Assure past GIS mapping products are available to all wetland conservation efforts.

Strategies

- Build strong partnerships the municipal, state and federal governments.
- Build strong partnerships with other local conservation groups to support the development of management plans and other wetland conservation initiatives.
- Promote the designation of San Quintin Bay, as a federally protected area.
- Develop a public awareness program.

Interior Highlands[31]

The Interior Highlands (Northern and Central) Region of Mexico consists of the Mexican Plateau which slopes gradually from less than, 1000 m in the north to 1,500-2,000 m in the south (Leopold 1959). This plateau includes 5 of the physiographic regions outlined by Leopold (1959): Sierra Madre Occidental, Central (Northern) Plateau, Sierra Madre Oriental, Bajio and Volcanic Cordillera. The first three of these areas, which comprise the northern 2/3 of the Mexican Plateau, are combined here as the Northern Highlands. The remaining two, which comprise the southern 1/3 of the Mexican Plateau, are combined as the Central Highlands.

Included within the Mexican Plateau are all, or part of, the states of Chihuahua, Coahuila, Durango, Zacatecas, San Luis Potosi, Aguascalientes, Nayarit, Jalisco, Michoacan, Guanajuato, Queretaro, Mexico, Morelos, Hidalgo, Tlaxcala, Puebla and the Distrito Federal (Leopold 1959).

Three major zones of natural vegetation are defined for the Mexican Plateau (Leopold 1950, 1959):

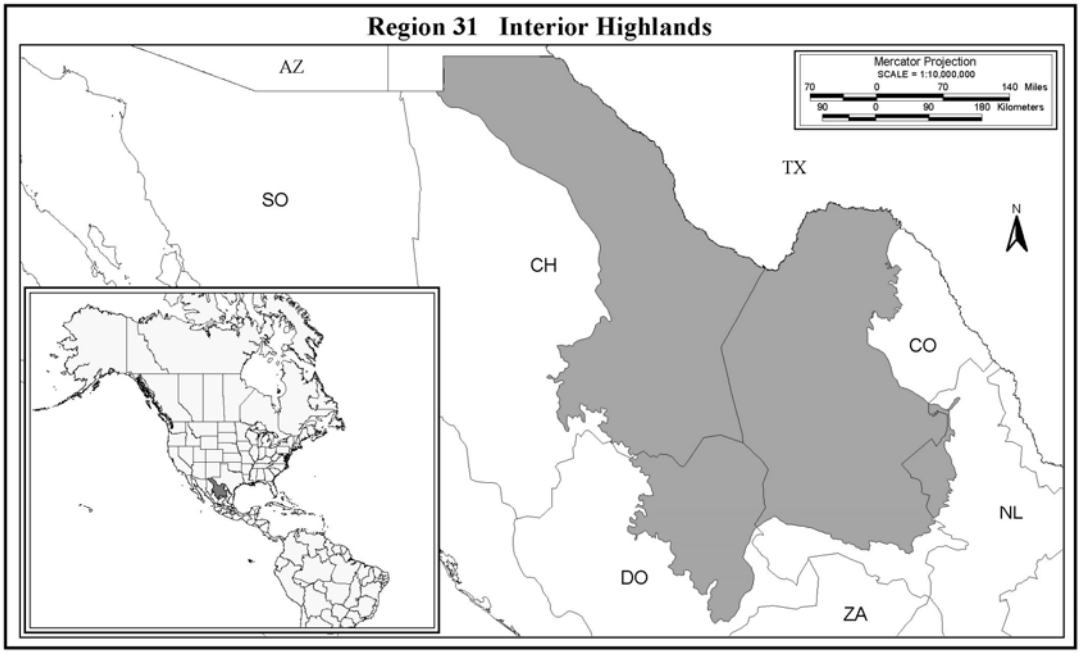
1. The pine-oak forest zone occupies much of the length and breadth of the Sierra Madre Occidental and the Volcanic Cordillera.

2. The mesquite-grassland zone occurs in the high plains or steppes from Chihuahua south trough central Durango, central Zacatecas, southwestern San Luis Potosi, northwestern Jalisco and much of Guanajuato.

3. The Desert zone occupies much of the eastern Chihuahua, western Coahuila, northeastern Zacatecas and northern and central San Luis Potosi.

Wetland vegetation includes both permanent and seasonal marsh communities. There are submerged and floating aquatic vegetation communities and the vegetation bordering lakes, reservoirs and watercourses. Hardstem bulrush, cattail and sedge species characterize permanent marsh communities. Seasonal marsh communities occur in low areas after the summer rains begin. Several species of *Cyperus*, *Carex* and *Eleocharis* are evident as are dense stands of smartweed and grasses such as *Echinochloa*. Aquatic plants of plateau lakes include species of pondweed, naiad, wigeongrass, coontail, bladderwort and others.

[31] NABCI Bird Conservation Region 35 (Chihuahuan Desert – Mexico only)



A total of 82,352 ha of wetlands have been classified for the states of Chihuahua and Durango. In Chihuahua there are 52,063 ha, of which 49,114 were lacustrine, littoral, open water systems, that included the areas known as Babicora, Mexicanos Bustillos, Fierro and Redonda and Guzman lagoons as well as other reservoirs and ponds. The remaining 2,474 ha were palustrine emergent habitats (Carrera and de la Fuente 1999). For Durango, 30,288 ha of wetlands were classified, where 25,970 ha are found in the Santiaguillo lagoon, 25,195 are lacustrine open water system, and 775 are palustrine emergent habitats. The rest 4,318 ha of wetlands were scattered around the area under classification (Carrera and de la Fuente 1999).

For the Central Region, the Cuitzeo, Chapala, Cavadas, Languillo and Sayula Lagoons as well as the seasonal fresh water wetlands distributed around the states of Guanajuato, Jalisco and Michoacan provide important habitats for migratory and resident waterfowl.

The original wetlands of the Northern and Central Highlands have been substantially altered or destroyed. Marshland has been diked and drained to increase cropland or to allow urban expansion; water has been diverted or pumped for irrigation, human consumption, power generation and industrial development. Permanent remaining wetlands have been seriously degraded by overgrazing, pollution and siltation, due to the progressive erosion of the surrounding watershed.

Waterfowl in the Interior Highlands

Waterfowl surveys in Mexico had been conducted since the early 1950s, by the USFWS and the Mexican Federal Authority. Based on those surveys and the concentration and trend distribution of the waterfowl among the years, 28 key wetlands for waterfowl had been identified, of which seven are in the Interior Highlands. These wetlands; Sayula, Chapala, Cuitzeo (Central Highlands), and Santiaguillo, Mexicanos, Bustillos and Babicora (Northern Highlands), accounted for 10.7% of the waterfowl wintering in Mexico.

Wetlands in the Northern Highlands accounted for 167,705 waterfowl during 1997, of which 70,155 were ducks and 97,550 were geese. Of the ducks, 69,340 were dabblers and 815 divers. Of the dabblers reported, 34,480 were green-winged teal and 22,670 were pintails. Snow/Ross' geese accounted for 87,805 individuals and the remaining 9,745 were white-fronted geese (USFWS 1997).

On the Central Highlands 320,955 waterfowl were reported. Of this total 319,780 were ducks and 1,175 were geese. Of the ducks reported, 293,330 were dabblers, of which 97,670 were green-winged teal, 64,075 northern shoveler, 52,805 pintail and 11,885 Mexican ducks. Of the divers, there were 15,825 canvasback, 6,040 ring-necked duck, 1,950 scaups and 1,405 redhead (USFWS 1997).

From a mid-continent population of white-fronted geese, 200,000 birds use the Northern part of Mexico. This number indicates that 10% occupy the wetlands in the Northern Highlands and the remaining 90% winter on the fresh water wetlands in the state of Tamaulipas. Even though just 10% of this population winters in the Northern Highlands, this region is very important because it supports geese which originate mostly from the Alaskan population, which is on decline (Nieman et al. 1999).

Historically these areas had been the most important habitats for the distribution of the Mexican duck with an average of 19,568 reported from 1951-1997 (USFWS 1997). However this species has fluctuated widely. In 1988, a record 50,000 individuals was reported, in1991 there were less than 10,000. From the total Mexican duck distributed in Mexico, 18% distribute among the Northern Highlands, principally in the states of Chihuahua and Durango and 82% in the Central Highlands, in the states of Jalisco, Guanajuato, Michoacan and Aguascalientes.

Other Wildlife in the Interior Highlands

The USFWS, 1997 surveys in Mexico, recorded among the Interior Highlands, 60,495 American coot, 13,650 sandhill cranes, 11,450 white pelicans, 9,615 white faced ibis, 6,846 avocets and 5,605 black-necked stilt. In the Northern Highlands there were 14,430 coots, 13,650 sandhill cranes, 820 white pelicans, 120 white-faced ibis, 91 avocets and 30 black-necked stilt. In the Central Highlands, 46,065 coots, 10,630 pelicans, 9,495 ibis, 6,755 avocets and 5,575 stilts were reported.

The Babicora Lagoon in the state of Chihuahua, accounts for 364 species of wildlife and 476 species of vascular plants (Lafon 1996). The Babicora Lagoon, is used by 4 million migratory birds during the spring, and 500,000 during the winter. The average population of waterfowl is 122,000 ducks, geese and cranes. This lagoon represents the most important wintering habitat for the snow goose and the sandhill crane in Mexico, with an annual population of 19,000 snow geese and 25,000 sandhill cranes.

Conservation Programs in the Interior Highlands

Interior freshwater wetlands are managed by watersheds to protect the natural wetland basins. Sustainable land uses in watersheds are critical such as the planned development of forestry and agriculture plans around key wetlands. Work of this nature is being carried out near Babicora, Chihuahua. with the University of Chihuahua and with the University of Guadalajara in the Cuitzeo Lagoon, Michoacan. In addition, DU should work to protect those key areas for

waterfowl. A close interaction with state and federal agencies will be needed to facilitate this effort.

The Interior Highlands have large concentrations of natural depressions used by waterfowl. Because many of these natural habitats have been lost or modified for agriculture uses, conservation of the few remaining natural and created wetlands is crucial for wintering waterfowl. The ini'habitat Initiative is designed to support this need and is directed towards private landowners. This initiative will provide habitat for both wintering and resident waterfowl.

More accurate and systematic waterfowl surveys and habitat evaluation are needed. Although the main areas for waterfowl in Mexico are surveyed every three years, the importance of the habitat in Mexico for waterfowl is underestimated. For example, the recent surveys for white-fronted geese by the USFWS found an average of 20,000 to 25,000 geese on the Northern Highlands. More thorough surveys by the CWS and other Mexican institutions found more than 200,000 birds. Better information is needed to determine the best sites for wintering and resident waterfowl.

A public awareness program is needed within this region, to motivate social participation and involvement, which will facilitate the success of future wetland conservation initiatives.

Goal

- Protect and manage the most important habitats for waterfowl in the Northern and Central Highlands.

Strategies

- Strengthen partnerships with state and federal governments and with local and national non-government organizations to support wetland conservation initiatives.

- Serve as a source of information to support decision-making on programs that influence wetlands conservation.

- Develop a private lands program, based on the Mini-habitat Wetland Conservation Initiative.

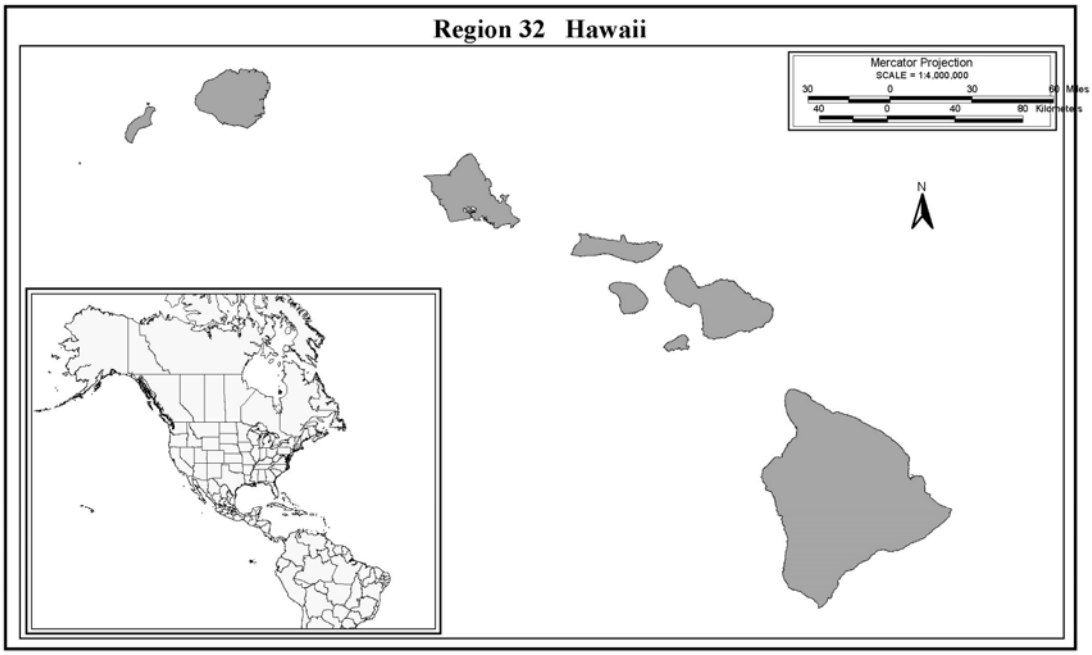
- Provide other partners with GIS map products to support their conservation initiatives.

- Work with universities and research institutions to develop information needed to support wetland and waterfowl conservation.

- Develop a public awareness program to support wetland conservation efforts.

Hawaii[32]

Prior to the arrival of the first Polynesian canoes nearly 1,500 years ago, Hawaii's natural wetlands provided habitat for resident and migratory waterbirds. Among the natural wetlands were forested bogs, streams, estuaries, lakes, and coastal marshes. Wetland mapping indicates that Hawaii contains approximately 44,860 ha of wetlands and deep-water habitats, of which 81% are classified as palustrine scrub-shrub and forested habitats. These wetlands are located at mid- to high elevations as bogs and rainforest ecosystems. The USFWS estimates 9,100 ha of wetlands within coastal plains of Hawaii circa 1780. In 1990, the USFWS estimates 6,265 ha remaining, a decrease of 31%.



A total of 106 endemic species and subspecies of birds have been described from the Hawaiian Islands (Pyle 1988, Olson and James 1991). Of these, 35 became extinct before the arrival of Captain Cook in 1778, and an additional 23 since then, leaving 48 extant endemic taxa. The Hawaiian Islands historically supported a diverse array of waterbirds in wetland and forest habitats. During the past 2,000 years of human presence, all of Hawaii's endemic rails, flightless geese, and an ibis have become extinct (Olson and James 1982). This massive extinction is attributed to the impacts of humans and the plants and animals they introduced to Hawaii. Polynesian settlers and Europeans have both played significant roles in the alteration of Hawaiian ecosystems and the resulting extinction of species (Olson and James 1991).

The six extant species of endemic waterbirds are koloa maoli or Hawaiian duck, Laysan duck, ʻalae ʻkeoʼkeo or Hawaiian coot, ʻaeo or Hawaiian stilt, ʻalae ʻula or Hawaiian moorhen, and nene or Hawaiian goose. All of these species are federally listed as endangered, have populations fewer than 3,000 birds, and require wetlands for survival (Engilis and Pratt 1993). Nearly 30 species of migratory ducks and geese and more than 30 species of migratory shorebirds have been recorded in the Hawaiian Islands (Pyle 1977). Among the most common species of

[32] Hawaii does not have a NABCI Bird Conservation Region Number

migrant waterfowl are northern pintail, northern shoveler, lesser scaup, American wigeon, and Eurasian wigeon. These species use the island habitat for wintering, with the exception of resident mallard and fulvous whistling duck that have become established. Migratory waterbirds have shown a marked decline from tens of thousands in the 1950s to only a few thousand in the 1990s.

In the two centuries since the first European ships reached the islands, most of the wetlands have been degraded. As early as the 1850s, significant losses in wetland habitat began with conversion of wetlands to taro and then crops such as rice and sugarcane. More recently, urbanization of lowland, coastal areas, particularly on Oahu, has accelerated the conversion or alteration of wetlands. The coastal wetlands of Waikiki were drained in the 1920s and have been totally lost to development. Most degraded wetland systems have been filled or hydrological modified and are now occupied by hotels, houses, golf courses, shopping centers, landfills, military installations, highways, agricultural fields, and industrial sites (Griffin et al. 1989).

Introduction of exotic species has negatively impacted waterbird species. Exotic plants, such as California grass, Indian fleabane, pickleweed, and red mangrove present serious threats in many wetlands by out-competing more desirable native species and eliminating the interspersion of open water and vegetated areas. A major threat to the Hawaiian duck is hybridization with increasing numbers of resident feral mallards. The threat of hybridization is exacerbated on Oahu with severe reduction in wetland habitat and increasing numbers of mallard in lake and golf course areas. Introduction of the mongoose to control rats has resulted in a very serious threat to ground nesting birds. Only Kauai, Lanai, and Niihau are free of mongoose.

Protection and restoration of Hawaii's wetlands are essential to the recovery of the endemic waterbirds, as well as the migrant waterfowl and shorebirds. There are 476 ha of secured wetland habitat on Kauai, principally at Hanalei NWR (371 ha) and Huleia NWR (96 ha). Oahu has 708 ha of secured wetlands, principally at Kawainui Marsh (304 ha), Heeia Marsh (162 ha), and Kahuku Wetlands (57.5 ha), although all of these systems have been hydrologically altered. Maui/Molokai have 287 ha of secure wetlands, principally Kealia Pond NWR (202 ha) and Kanaha Pond (58 ha). The Big Island has some 30 ha secured, principally at Aimakapa, Kaloko, and Parker Ranch.

Conservation Programs in Hawaii

Since 1990, DU and its partners have completed six restoration and four planning projects, protecting and restoring 143 ha and committing $157,828. Strategic partnerships have established conservation projects on six of the main Hawaiian Islands, thus providing program anchors from which to build "Wetlands Hawaii". Principal partnerships to date have included USFWS, Hawaii Division of Forestry and Wildlife, Natural Resource Conservation Service, Department of Defense (DOD), Bernice P. Bishop Museum, Harold K. L. Castle Foundation, Campbell Estate, Parker Ranch, Chalon International, Umikoa Ranch, and Cyanotech.

Kauai

DU's partnerships have been with the USFWS and National Audubon Society, with principal effort in developing managed wetlands on Hanalei NWR. Completed in 1993, the initial effort restored 8.1 ha of wetlands on the refuge. In 1997, DU began working with refuge staff in designing a fish screen to exclude tilapia from refuge wetlands. This non-native fish reproduces rapidly, can quickly populate small wetlands managed for waterbirds, and directly impact vegetation and insect-life. In addition, DU is assisting the expansion of new refuge lands,

restoration of existing lands, and support of taro field development on private lands where it is compatible with waterbird habitat needs.

Oahu

The partnerships on Oahu have been coordinated with the State Division of Forestry and Wildlife, USFWS, the DOD, NRCS, the City and County of Honolulu, and several private landowners. DU has developed two project anchors, one on windward Oahu, and the other in Pearl Harbor. The windward Oahu program is centered on the development of a wetlands information system using the restoration of Kawai nui Marsh as a model. This effort is underwritten by the Harold K. L. Castle Foundation, Kailua, Oahu. To date, DU has completed one project in the area, the protection of Hamakua Marsh. This was accomplished through a partnership involving a land donation to DU from Kaneohe Ranch. DU then took the value of this land and leveraged initial restoration funds from the USFWS. After restoration was completed, DU donated the wetland to the State of Hawaii.

The other project anchor is the Pouhala Marsh (Pearl Harbor) project that brings together a diverse partnership with DU coordinating project design and restoration planning. DU raised funds from internal programs and Mainland foundations to match USFWS and State grants to undertake the restoration design for this 28 ha tidal wetland. In addition, DU assisted Campbell Estate to continue its economic development by participating in a unique mitigation opportunity that allows the Estate to offset wetland losses at Barber's Point by partially funding DU's restoration at Pouhala Marsh. DU is also providing technical advice to Chevron Hawaii on Pouhala Marsh as a mitigation site to offset the effects of the 1985 oil spill at Pearl Harbor. Long-term goals are to restore and manage Pouhala Marsh and then address wetlands efforts in Pearl Harbor by expanding our partnership to lands owned and managed by the U.S. Navy and the USFWS.

Maui

One of the newest and most important wetland refuges in Hawaii, Kealia Pond NWR is the focus of restoration work on Maui. DU will provide wetlands planning, design for restoration and enhancement, and long-term management plans for the refuge. This site is a coastal playa with muted hydrology. Surveys are complete for the Ulupalakua Ranch, in partnership with the NRCS. Wetland restoration in concert with native forest rehabilitation are planned to benefit nene and koloa.

Molokai

The program anchor on Molokai is in the south coastal wetlands, west of Kaunakaki. DU has restored the Ohiapilo Marsh, a 10 ha mitigation project. DU is also working with Molokai Ranch and private landowners in enhancing wetlands in this important seasonal wetland complex, which can hold over 90% of the island's endangered stilt population.

Hawaii

The program anchor on Hawaii has been to develop partnerships with private landowners to provide wetlands that support native waterbirds. Our program has focused on our partnership with the NRCS and private ranches on the Big Island. WRP and NAWCA grants will support restoration efforts on three ranches: Parker Ranch, Chalon International, Inc., and Umikoa Ranch. Wetlands restored on these areas will directly support the endangered Hawaiian duck, nene, and

Hawaiian hawk. In an unrelated private lands project, DU and NRCS are working with the Bishop Estate to develop a restoration plan for Opaeula Pond. Lastly, DU has designed and assisted in development of a modified algae pond with Cyanotech that can support Hawaiian Stilt on their property. These algae processing ponds have attracted numerous stilts, but specific management plans need to be developed.

Goals

- Clearly define each major wetland area on the islands that can contribute to restoration of waterbird populations.

- Secure protected status, either in private or public ownership, for all major wetland areas within the next 10 years.

- Restore and enhance important wetland areas that are degraded.

- Increase all endangered waterbird populations above 2,000 individuals, with the exception of the Laysan duck where a goal of tripling the current population is feasible.

Assumptions

- Increasing wetland area and quality will increase waterbird populations.

- Major limiting factors for waterbirds are quality wetland habitat, introduced predators, and urban expansion.

- Wetlands in Hawaii can be individually recognized and analyzed for priorities in restoration and enhancement.

Strategies

- Concentrate initial restoration efforts at Hanalei floodplain, Kealia playa, Pouhala Marsh, and Big Island ranches.

- Develop prioritization model to assure restoration and protection is completed in order of highest need.

- Assist in population viability analyses for each of the endangered waterbird species (after Reed et al. 1994).

- Secure habitat usage information by koloa, both in montane breeding areas and coastal lowland wintering areas to better guide protection and restoration efforts.

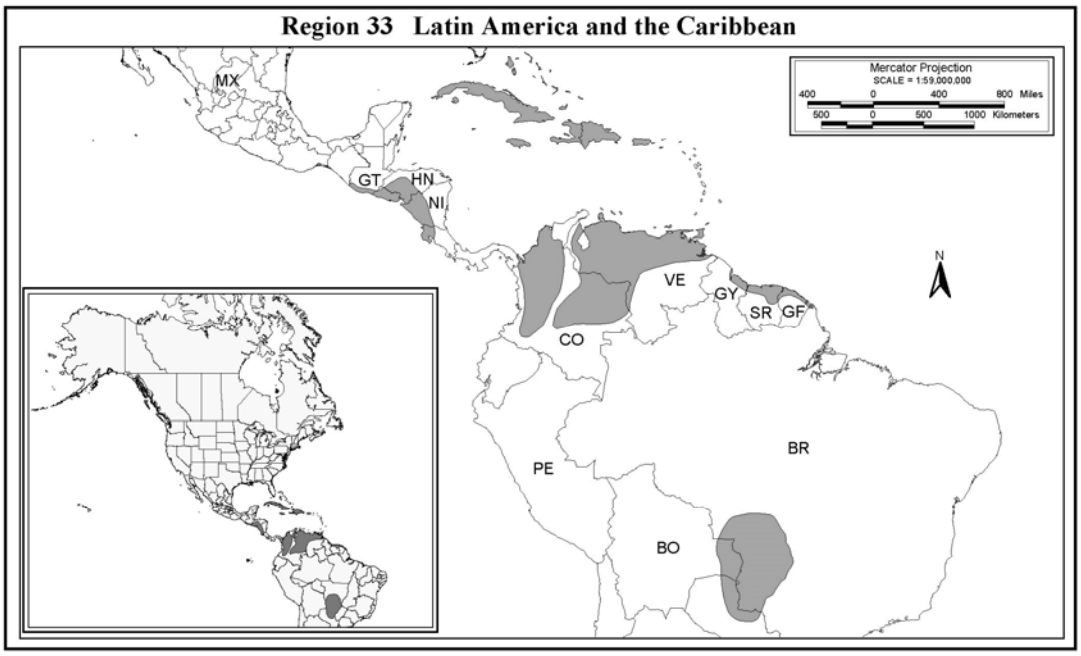
- Develop a better understanding of migrant pathways for wintering birds beyond the Pacific Ocean.

- Develop better understanding of natural hydrologic patterns to improve design of restoration efforts (e.g., Hanalei River floodplain).

- Establish adaptive resource management within the islands through cooperatively developed management plans and annual workshops for managers.

Latin America and the Caribbean[33]

The Latin America and Caribbean region is over 9,654 km long and comprises seven countries in Central America, 13 in South America, and 13 in the Caribbean. Also in this region, particularly in the Caribbean, a number of dependent territories still exist belonging to the United States, France, the Netherlands, and the United Kingdom.



There is a great diversity in the flora and fauna throughout the many ecosystems found in the Latin America/Caribbean region due to the great variation in climate (from antarctic cold to tropical) and in elevation (from sea level to 7,000 m peaks). Although some areas as well as certain groups of plants and animals have been studied thoroughly, the wetlands and the waterfowl found in Latin America and the Caribbean remain rather poorly known to science. Wetland ecosystem richness is varied, both in terms of species diversity and their abundance. The size of wetlands varies tremendously, from wetlands only a few hundred hectares on the Andes of Colombia to millions of hectares of the Llanos in Venezuela and many more millions of acres of the Pantanal (the largest freshwater marsh in the world).

Of the 47 species of waterfowl found in Latin America and the Caribbean, 14 are shared with North America. At least 4 species are known to be threatened, but it is very possible that several more also are under immediate threat. None of the 47 species have been studied in detail, not even any of the 14 North American migrants in relation to their Latin American and Caribbean habitats, but habitat deterioration continues at a high rate further impacting the security of waterfowl species.

The narrow strip of land that connects North and South America constitutes Central America. Less than 1,609 km long and 483 km wide, this region has very diverse wetlands, but they all share similar problems. Wars occurring during the past few decades, wide-scale deforestation and erosion in the surrounding watersheds, unwise agricultural practices, wide use

of agrochemicals, and reclamation of wetlands for banana, rice, and sugar cane plantations are just a few of the many threats to which these wetlands are exposed.

South American wetlands share many problems with those in Central America and the Caribbean. This is a thinly populated continent where most of the human population is concentrated in a few very large cities. However, these countries have enormous foreign debts and the governments are trying to attract large financial investments and develop liberal economic policies, which often cause serious conflict between development and conservation. For example, the Hidrovia proposal, similar to the dredging and channelization of the Mississippi River, if carried out, would involve a major modification of the Paraguay River that would alter seriously the Pantanal; or the Panamerican Highway which, if constructed, would destroy the wetlands of the Darien bottleneck between Panama and Colombia.

Caribbean wetlands probably are some of the least known, least protected, and most threatened. Threats to the integrity of these fragile, wetland ecosystems include the use of mangrove trees for charcoal and tanning; dumping of waste; land reclamation and conversion to mariculture; over-fishing; and uncontrolled and inappropriate tourism activities. The results are erosion, sedimentation, pollution and human disturbance, which negatively affect the waterfowl populations using these wetlands. In spite of the many functions performed by coastal wetlands, such as storm and flood mitigation, retention of nutrients, shoreline stabilization and tourism, and the many products generated, few wetlands in the Caribbean have received any sort of protection, let alone management plans, especially within the context of watersheds.

The Directory of Neotropical Wetlands, partially funded by DU and completed in the early 1980s, is still the only information available on wetlands across the region. One of the results of the Directory was the great interest it generated within the Latin American and Caribbean countries and the amount of information it provided for both decision-making managers and politicians, as well as for potential funding agencies. During the following two decades with support of several international organizations and funding agencies, countries started to consider wetlands among their priorities. Money and efforts were concentrated in developing policies of biodiversity, strategies, work plans, and management plans, both from international agencies as well as from national governmental institutions and NGOs. Budget cuts at all levels implied less and less research, so decision-making has been based not in what there is on the wetlands now, but on what there was two or more decades ago. Even worse, decision-making in many instances has been done by officials who have not had adequate training or the field experience necessary to implement the very strategies that they developed.

Fortunately, training has been one of the major priorities for several international agencies, such as the USFWS, the USDA USFS, The Nature Conservancy, and DU who have done much to build the institutional capacity of both NGOs and governmental agencies in Latin America and the Caribbean. Still, research and monitoring are far from being addressed properly and although these activities are considered of great importance by conservationists in the Latin American and Caribbean countries, very few international organizations are willing to support them. Enhancement and restoration are two actions which slowly are becoming of concern and interest to local governments and NGOs, but these usually are perceived as expensive and not as urgent as securing protection for areas which still appear to be in good condition. Unfortunately some of the wetlands that once were of great importance for waterfowl have disappeared or are almost gone.

Up to now, most international organizations involved in conservation in Latin America and the Caribbean have only included wetlands where and when they are of great importance to

biodiversity in general, considering waterfowl just as one more taxonomic group within that biodiversity.

Clearly, there is great room for DU to deliver expertise on research and monitoring of waterfowl populations and management, as well as the enhancement and restoration of wetland habitats in Latin America and the Caribbean. Through the building of partnerships with both national and international institutions and a sound and well-focused strategy, DU would make significant contributions to wetland and waterfowl conservation in this region.

At least 14 species of the 44 North American breeding waterfowl winter south of Mexico. However, very little if anything is known about their numbers, their main staging and wintering areas, their natural history, and their basic ecological requirements. No regular surveys have been carried out over any wetland, and existing data are occasional and have been collected from small areas. Large extensions of wetlands have not been surveyed and potential threats to waterfowl populations on their wintering grounds remain unknown.

Conservation efforts at the breeding grounds must be accompanied by conservation efforts in staging and wintering grounds to ensure that the annual life cycle needs of migratory species are met. Scattered data indicate that Central America, the Caribbean, and at least the northern portion of South America are of great importance to migratory waterfowl from North America. For example, in the 1970s in Palo Verde, a 1,500 ha wetland in Costa Rica, observations were made of 60,000 blue-winged teal and several hundreds each of northern shoveler, American wigeon, ring-necked duck and lesser scaup. DU's 1994 Continental Conservation Plan indicates that most blue-winged teal winter in northern South America. In Suriname an aerial survey in the late 1970s of a portion of the coastal wetlands indicated at least 20,000 blue-winged teal, and several Cuban authors indicate that both white-fronted goose and snow goose were common winter visitors, while blue-winged teal, pintail, American wigeon, northern shoveler, wood duck, ring-necked duck, and lesser scaup are still common.

Current Conservation Programs

DU has been involved in a small number of projects in Latin America and the Caribbean. Money has been provided for waterfowl surveys in South America, for coastal restoration in the Bahamas, for waterfowl monitoring, and the development of a GIS and management plan for the Llanos of Venezuela.

There is tremendous potential for DU to achieve further conservation success of North American waterfowl and wetlands by developing projects in Latin America and the Caribbean. There are great opportunities to get involved in a direct and active way in projects, from the development of proposals and the search for additional funding, to the implementation of projects on the ground, whether it is using GIS technology or carrying out engineering and biological work.

Goals

- Develop several "flagship" projects incorporating research, monitoring, enhancement and/or restoration) that will serve as demonstration for the kind of work DU is capable of doing, while at the same time helping to improve habitat for North American migratory waterfowl.

- Develop the national capacity for wetland and waterfowl conservation in the countries of Latin America and the Caribbean.

Strategies

- Quantify existing information about major wintering and staging sites of North American migratory waterfowl.

- Build partnerships with technical and/or funding agencies, at the local, national and international levels.

- Contribute to the institutional capacity building of government agencies and NGOs responsible for conservation in Latin American countries.

Part 3: Other Waterfowl Conservation Issues

Over-abundant Geese

Since 1997 waterfowl managers have recognized that over-abundant lesser snow geese have surpassed the carrying capacity of certain arctic and sub-arctic ecosystems upon which they depend during the breeding season. This has resulted in the long-term degradation and destruction of several southern nesting colonies. This degradation is expanding beyond historic colony boundaries throughout the arctic. Scientists and managers have concluded that, without effective management action, this will ultimately lead to the destruction of the vast majority of breeding areas used by lesser snow, greater snow and Ross' geese. Whole arctic ecosystems are in peril along with all the plant and animal communities that are supported by those systems. The scientific underpinnings of these conclusions are recorded in two recent reports (Batt 1997, 1998) and there are many studies underway that will refine and expand the understanding of this unprecedented phenomenon. Further, documentation has been developed by the USFWS (Federal Register etc.) and the Canadian Wildlife Service (Canadian etc.).

The unprecedented growth of these populations is driven by several contributing factors. The prime issue appears to be the adaptation of the birds to the continent's highly modified agricultural landscapes that effectively provide them with unlimited food supplies for about two-thirds of the year. This is thought to increase annual survival rates and to contribute to improved reproductive performance as a result of the birds arriving on the breeding grounds in better average body condition than was likely the case in historic times. Other factors include: the birds' innate ability to respond to protection provided by public and private refuges; their ability to create effective refuges by virtue of their flocking and flight patterns which typically put them out of reach of hunters, and; the age structure of the population and their innate flocking behavior which extends the acquired learning to avoid danger by older birds throughout the flock. As the result, harvest rates of most populations have been declining and most populations are growing at the rate of at least 5% per year.

Populations of these birds must be reduced to a level that can be sustained for the long-term by the arctic breeding grounds. A broad spectrum of activities by public agencies are under way to achieve this goal. At the core is an effort to reduce populations through expanded harvest by hunters. There is vast experience in North America with other goose populations that are effectively sustained at target population levels by managing harvest. Snow geese are a special case, however, because of behavioral differences that reduce the effectiveness of hunters. Thus, expanded season lengths and additional hunting methods and tools are currently being implemented in several states and provinces through an on-going adaptive harvest management program.

Other activities that are designed to solve the problem include: adjusting management programs for harvest opportunity and food provision in and around some refuges, research on harvest techniques, expanded research and monitoring of goose populations and arctic habitats and, expanded public education and communications efforts.

Management of this problem is at a very early stage. Management goals have been endorsed by scientists, wildlife managers, the public at large, elected officials and by helpful public policies in the U.S. and Canada. The prime needs for the future include the sustained support of these interest groups, expanded research and monitoring to support management programs and, effective communication amongst all interested parties.

Current Involvement by Ducks Unlimited

Ducks Unlimited has taken a central role developing the scientific basis for the current management, monitoring and research programs through participation in the Arctic Goose Joint Venture of the NAWMP. In coordination with others, DU has also sustained a very effective, wide-ranging communications program in print and visual media. Besides DU's own products which included magazine articles, traditional and video news releases, an educational video, testimony in public policy forums and conduct of a variety of workshops and educational events, DU staff have contributed to hundreds of additional newspaper, magazine, radio and television communications that have been done by others.

This communications effort is on going but requires a minimum of staff time and expense because the issue is broadly understood and there are now a multitude of agencies, organizations and individuals who serve as effective spokespersons. Many of them use communications tools provided by DU. DU also supports a small number of scientific research projects that address various aspects of the issue.

Goal

- Sustain light goose populations at levels that are in equilibrium with available breeding habitats.

Assumptions

- Failure to intervene in the current paths of population growth of most light goose populations will result in the long-term destruction of the finite amount of habitat necessary to support the birds.

- This problem affects all plant and animal species and communities that are supported by these ecosystems.

- There are effective management interventions that can solve the problem.

- Current management programs are the most promising approaches but future learning and adaptations will be crucial to long-term success.

Strategies

- Monitor the on-going development of new scientific information and participate, with other partners, in the promulgation of future approaches to management.

- Support communications efforts to keep DU members, the public at large, wildlife managers, scientists and policy makers informed on the development of the issue.

- Support targeted research programs needed to advance the scientific basis for future light goose management.

- Support the ability of state and federal agencies to implement appropriate management programs to solve the problems of over-abundant geese.

Scaup Populations

One of the most perplexing waterfowl conservation issues in North America lies in the failure of scaup populations to recover to the goals established by the North American Waterfowl Management Plan. Following several years of beneficial habitat conditions on the breeding grounds, all the common duck species, except scaup and northern pintails have reached, or exceeded, NAWMP goals. In 1998 breeding scaup populations were just under 3.5 million birds following about 2 decades of decline at the rate of approximately 150,000 birds per year. This count places scaup 44% below the NAWMP goal and 36% below the long-term average.

Waterfowl managers have few tools to apply to the resolution of this problem. The pattern of change is inconsistent with what has occurred in the past and there is little information from past research to provide leads as to the cause(s) of the problem. In 1999, the USFWS reduced the allowable daily bag limit on scaup. This is about the only action currently available to them despite limited evidence that harvest is an important factor in the decline.

Involvement of Ducks Unlimited

Ducks Unlimited staff, working with several partners, have undertaken an extensive analysis of the existing data to search for clues as to what is driving the scaup population decline. This started in 1997 and engaged the services and logistic support of a contract biologist as well as DU staff and other colleagues. The products of these analyses have been shared with other professionals through conference proceedings, special workshops and technical publications.

Some of the key findings were: 1) the decline appears to be driven by the lesser scaup as numbers are relatively stable in areas where most greater scaup occur; 2) both breeding and wintering grounds counts have shown the steady decline; 3) the decline in the wintering grounds has been most notable in the Mississippi Flyway; 4) the number of young birds in the harvest has been declining since the early 1960s, primarily in the Mississippi Flyway; 5) there has been a pattern of increasing portion of males in the harvest; 6) scaup breeding populations in Alaska appear to be relatively stable while numbers in northwest Canada have been declining, and; 7) during breeding bird surveys, there has been an increasing proportion of grouped birds and a decline of the proportion that are paired and in small groups. In summary, scaup populations appear to be declining most significantly in the Mississippi Flyway and most significantly among birds breeding in northwestern Canada. A lower portion of birds appears to be breeding and production is declining.

Several broad areas of further study have been identified to help elucidate the causes of the problem. For one, the deterioration of habitat quality in areas used by staging and wintering waterfowl from the mid-continent area may be reducing the body condition and survival of birds during the winter. Poorer condition may also contribute to poorer reproductive success and lower breeding propensity. There are many potential causes of lower habitat quality in these areas. The multitude of changes in water quality in the mid-continent's waterways is well known. Possible connections with scaup may be the decline in fingernail clams and other bivalves or, on the other hand, the establishment and increase of the exotic zebra mussel in areas used by scaup. Another correlated factor is the growth of the "dead zone" in the Gulf of Mexico where marine mollusks and other foods consumed by scaup have been depleted. Whatever the birds are now eating, it is also possible that scaup may have increased their intake of heavy metals or harmful organic chemicals that might affect body condition, survival or reproductive success.

So too, there may have been extensive ecological changes across breeding areas of northwestern Canada. There has been an increase in oil and gas extraction industries in these areas and there has been increased forestry development. Climatologists have also measured a 2.5º C increase in temperature in this region, one of the highest patterns of temperature increase anywhere in the world. Higher temperatures and a longer ice-free period may be related to factors such as increased river flow, different timing of seasonal flooding or changes in depth and extent of the permafrost zone.

In short, future research needs to address possible cause-and-effect relationships across broad ecological areas. DU and our partners have determined the most promising approaches to this work. Several preparatory studies have been initiated. However, the pace of learning is currently limited by inadequate funding.

Goals

- Secure average scaup populations at the level called for by the NAWMP.
- Establish key research programs on hypothesized relationships of scaup vital rates and the habitats they use throughout the annual cycle.

Assumption

- The scaup decline will not be resolved until the cause-and-effect relationships between the decline of the birds and changes in their environments are understood and effective corrective measures are implemented.

Strategies

- Complete the research that is necessary to guide future scaup conservation programs.
- Implement, or support others to implement, promising findings from the new research.

Northern Pintail Populations

Northern Pintail displayed one of the sharpest declines of any prairie duck population

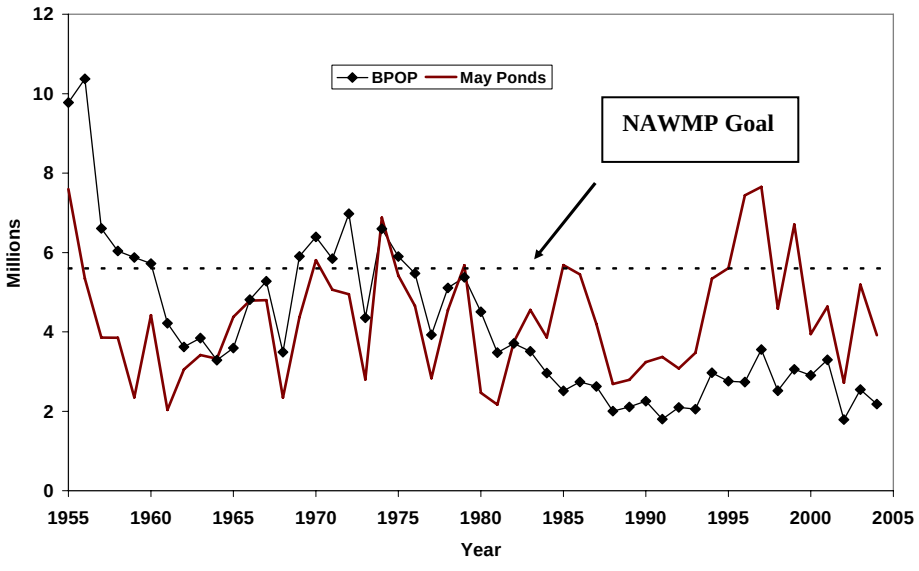


Figure 1. Pintail breeding population and May pond counts, 1955 – 2004.

during severe droughts of the late 1980s, and early 2000s, reaching lows of 1.8 million birds in 1991, and again in 2002. During 1993-97, favorable precipitation levels returned to waterfowl nesting areas of the prairies but unlike most other duck species, pintails failed to rebound. May wetland counts attained record high levels in 1996, and 1997, but the pintail breeding population exhibited only a modest 30% increase during the 1990s (Figure 1) remaining 19% below the long-term average, and 36% below the NAWMP goal of 5.6 million. In contrast, almost all other prairie-nesting dabbling duck populations increased dramatically in the 1990s to levels that exceeded objectives set by NAWMP. The failure of pintails to respond to improved water conditions has heightened concern, and suggests that the problems facing pintails may be more severe than previously thought. The situation has improved little today with the spring 2004 breeding population estimated to be 2.2 million birds which is 60% below the NAWMP goal and 48% below the long-term average.

The initial decline, and subsequent lack of recovery by pintails has alarmed waterfowl managers, and enthusiasts alike. The pintail "problem" was the focus of a meeting held in Sacramento, California in spring 2001, a forum that attracted waterfowl researchers, and managers from across North America. Participants debated, and synthesized current information about pintails and prioritized likely causes of the pintail decline and lack of recovery. There was a strong consensus that poor nest success on the prairie breeding grounds, especially in Canada, is the factor most plausible for explaining the decline in the pintail population and/or its lack of response to recently improved wetland conditions. Poor nest success is believed to result from factors that have accompanied the conversion of native prairie to cropland, including very high predation rates and changing cropping practices that result in the destruction of pintail nests.

As recently as the mid-1970s, 60% or more of the continental breeding population of pintails settled in southern Canada. By the early 1980s, the number of pintails that settled in southern Canada had dropped, while other breeding areas remained relatively stable (Figure 2). This trend is consistent with the notion that a large part of the problem lies in the Canadian prairies. Since the early 1900s, nearly 75% of the Canadian Prairies has been converted from

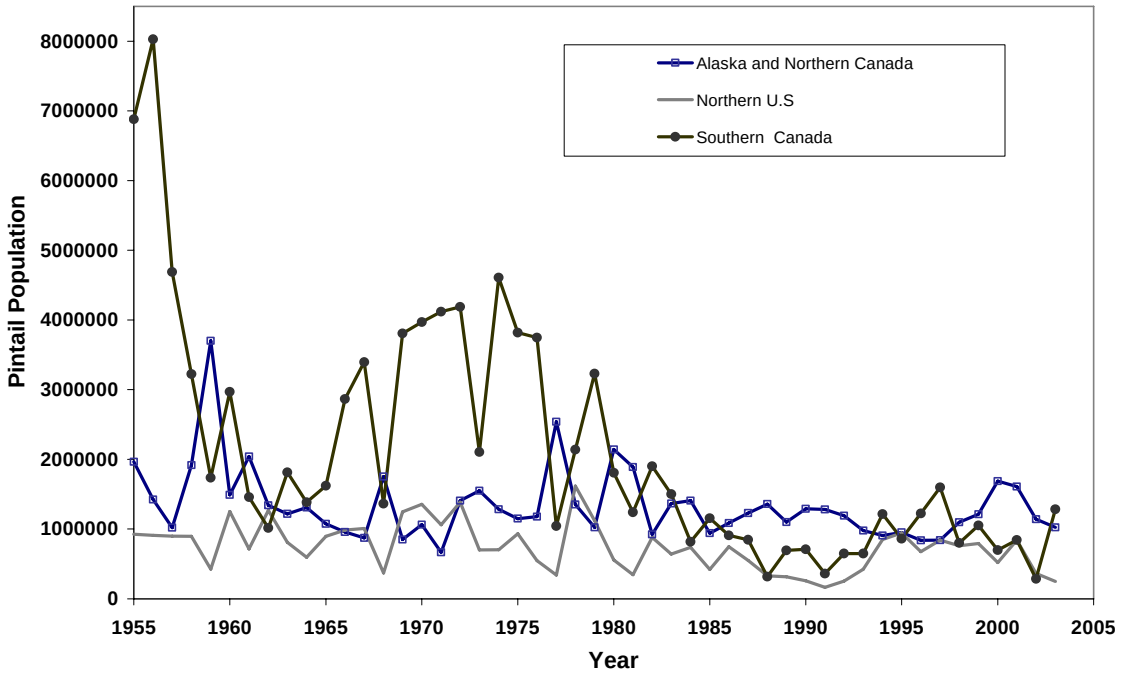


Figure 2. Northern Pintail population in Northern Canada/Alaska, Prairie Canada and U.S. Northern Prairies from 1955 – 2003.

grassland to cropland. More recent agricultural changes add to this problem. Due to soil conservation concerns, and increasing economic pressures, farmers have greatly curtailed the practice of leaving land fallow the entire summer (summer fallow), and are changing to stubble retention, and continuous cropping of spring-seeded crops. These changes, while good for soil conservation, could be particularly detrimental to pintails, since they will readily nest in crop stubble. Pintails nesting in spring-seeded stubble experience very low nest success, with most nest losses due to predators or farm machinery.

Although poor breeding success on the prairies is likely the most important factor affecting population recovery, other reasonable explanations cannot be ruled out. For example, uncertainty is fueled by unknown impacts of diseases such as avian botulism. Although avian botulism is not new to North America, very large losses have occurred in the past decade in Canada and the U.S. Botulism losses at Pakowki (Alberta), Old Wives (Saskatchewan), and Whitewater (Manitoba) Lakes during 1997 may have approached 500,000 pintails. These losses occurred mainly after nesting and before hunting season, and could have depressed pintail wintering populations and harvest. Although there is no evidence that botulism has caused the pintail population to decline over the long-term, this source of mortality, in combination with other detrimental factors, could prevent population recover.

Current Ducks Unlimited Conservation Programs

Ducks Unlimited has long been involved in improving habitat conditions for pintails throughout historical breeding and wintering areas. The main breeding areas on the prairies of Canada and the U.S. have been the focus of more habitat conservation work than any other in the continent (see Prairie Pothole Region). Up until recent years these programs were targeted on the general community of breeding waterfowl and assumed to benefit pintails in general. The lack of recovery in the pintail population has prompted DU to develop a pintail specific conservation strategy.

As part of this strategy, low breeding success will be addressed through large-scale habitat conservation programs. These programs will focus on reducing the area affected by annual or spring tillage operations within key pintail areas. Such programs would include: a) the conversion of cropland to permanent cover such as hayland, pasture or managed-use grassland. This type of program could be achieved using both direct land securement, and enhancement efforts, and agricultural policy initiatives; b) reduction of spring cultivation through the expansion of fall-seeded crops such as winter wheat or fall rye; and c) preventing loss of existing at risk grassland and wetland areas that are in prime pintail habitat.

Testing key assumptions about factors limiting pintail populations, and improving habitat management programs through evaluation will be vital for effectively meeting pintail population goals. The cyclic process of planning, implementation, and evaluation of habitat programs is what allows new information, and changing circumstance to be incorporated into conservation programs. To aid this effort, a research project aimed at better understanding pintail habitat selection and habitat-specific nest success in differing landscapes will begin in prairie Canada in 2005.

<u>Actions outside the Prairies</u>

Maintenance of existing high-quality habitats on wintering, staging, and northern breeding areas (e.g., Alaska) is required to ensure that efforts to enhance pintail recruitment on prairie breeding grounds are not compromised by habitat loss or degradation in other areas.

Currently, wintering areas in California appear to be meeting or exceeding demands of wintering pintails. However, human pressures on the Central Valley are growing, and wintering areas in Texas, and Louisiana are undergoing dramatic transformation. Wintering pintails are dependent on rice fields for winter habitat in California, and to a great extent in Arkansas, Louisiana, and Texas. Rice acreage has declined 40% in Texas in recent years, and some forecasts predict elimination of rice in the state within a decade. The west coast of Mexico was a historically important wintering area for pintails, and its future integrity must be considered in pintail conservation plans. Thus, programs to offset habitat losses and to mitigate existing and anticipated threats to key wintering areas will be essential.

Spring staging, and stop over areas is another concern. Shallow, ephemeral wetlands used by pintails for spring staging in the Rainwater Basin of Nebraska, Klamath Basin of California and Oregon, and other areas, continue to be threatened by degradation and loss. Although their precise importance in the pintail life cycle is unclear, understanding their pattern of use, and importance to productivity and body condition is a priority.

To better understand botulism, DU has made a major commitment to botulism research to learn about the under-lying mechanisms that cause outbreaks and to experiment with various management strategies. DU Canada staff have been key participants in this partnership that is addressing this issue in Canada where the problem is most prevalent (see Waterfowl Diseases, page 189).

Goal

- Secure average northern pintail populations at the level called for by the NAWMP.

Assumptions

- We can identify the key factors that control the size and distribution of northern pintail populations.
- Key factors controlling the size of northern pintail populations will be responsive to habitat management programs.
- Agencies responsible for regulations affecting pintails will promulgate harvest strategies that will protect the population from excessive harvest.

Strategies (more specific strategies are found within priority area descriptions)

- Expand commitment to research and management programs that benefit northern pintails.
- Aggressively implement and evaluate potential new management programs.
- Identify and promote public policies that are likely to benefit northern pintails throughout their range

April 15, 2005 - Content completely revised to reflect progress made as a result of international planning efforts with partners.

Sea Ducks

The sea ducks consist of 14 distinct species of North American waterfowl, including: 4 eider duck species, the bufflehead duck, 3 merganser species, 3 scoter species, the harlequin duck and 2 species of goldeneye. The basic ecology and population dynamics of most are relatively poorly documented. They generally reside in remote areas where research and inventory is difficult and expensive. Most species are harvested in relatively low numbers by sport hunters and several species are harvested by subsistence hunters at unknown rates.

Waterfowl management for these species has generally consisted of simple hunting regulations and kill estimates from regular harvest measurement programs. Population inventories have generally been lacking, other than at a few individual locations where some records of past numbers are available. Sea ducks have not been central to DU's management efforts because they use habitats that are relatively secure and thought to not be subject to degradation. The waterfowl management community in general has paid very little attention to sea duck management issues, in the face of so many other clear habitat and population threats that are apparent in the settled regions of the continent.

This situation has changed during the last decade as public agencies have directed increased resources towards consolidating historical data to get better measures of population trends and patterns. The core finding has been to verify that even the most basic ecological and population dynamics information is uniformly lacking for most sea ducks. Nevertheless, clear patterns of population decline have been accepted by management agencies and two populations of sea ducks (spectacled and Steller's eider) in the U.S. have been declared to be threatened and one (eastern harlequin duck) in Canada, has been declared to be endangered during the last few years.

The Sea Duck Joint Venture has been established under the 1998 revision of the North American Waterfowl Management Plan. It is charged with designing, prioritizing and implementing inventory and research programs that will fill the void of information needed by managers to direct future habitat and population harvest programs.

Involvement by Ducks Unlimited

Sea ducks are an integral component of North America's waterfowl fauna and thus should be a priority for DU's attention. As a science-based organization, DU staff have helped consolidate the basic scientific information that will guide the joint venture in identifying priorities for research and management programs. At the present time, two DU staff are involved with the joint venture - one on the Technical Committee and one of the Management Board.

Goal

- Secure the long-term status of sea duck species as integral components of North America's waterfowl fauna.

Assumption

- We can identify the key factors that control the size and distribution of sea duck populations.

Strategies

- Work in partnerships with others through the sea Duck Joint Venture to identify and fulfill priority information needs for sea duck management.

- Identify and support research needs that are consistent with the priorities of the Sea Duck Joint Venture.

Waterfowl Diseases

During recent years, diseases appear to have taken an extraordinary toll of waterfowl on breeding, wintering and staging areas. No new diseases are involved but the prevalence of botulism has increased markedly. Several millions of birds have died of botulism on several major marshes used by staging waterfowl in Prairie Canada and over a million have died on marshes associated with the Great Salt Lake in Utah. Most of the affected areas have had botulism outbreaks in the past but the recent situation has been extraordinary in its duration and in the numbers of birds that have died. There is widespread concern about how this devastating pattern will unfold in the future.

The other serious disease, although less prevalent, is avian cholera which has had its most marked effects on waterfowl at certain wintering or spring-staging locations. Historically, the most significant outbreaks have occurred in situations where the birds are stressed and crowded into restricted wetland habitats. The rice prairies of Texas and Louisiana and various wetlands in the Central Valley of California have been particularly susceptible. Annual outbreaks occur during the spring in the mid-continent area, especially in wetlands used by the millions of staging waterfowl in Nebraska. The main vector of the disease appears to be snow geese which have increased to unprecedented high populations during the last two decades. There is a broad consensus that the risk is great that an enormous outbreak of avian cholera is possible in this region that might kill millions of waterfowl during a spring cholera outbreak.

Current Management Programs

For botulism, the standard management practice is to mobilize manpower and other resources to pick up dead birds as they occur to remove the presumed toxin sources that promulgate the outbreaks. This is practiced widely by public agencies and is often supported by DU staff and equipment. In many circumstances, restored wetlands have built in water level management capability to minimize the likelihood of outbreaks or, should they occur, stop them before they grow too large. This is a standard construction criterion for wetlands restored by DU in botulism prone areas of the prairies.

DU is currently supporting research in Utah that is attempting to clarify the environmental conditions under which botulism outbreaks are triggered. Related studies are also under way in Prairie Canada. However, the main effort there is to systematically test various outbreak management programs to determine the most effective methods of managing outbreaks once they occur. These are major commitments by DU, resulting in the expenditure of up to a million dollars each year.

Pickup and incineration of dead birds is also the standard management practice for outbreaks of avian cholera. There is also a widespread recognition that reduced wetland availability in many areas has the effect of concentrating birds at extraordinary high numbers on wetlands that are prone to cholera outbreaks. In these cases, DU and partners have established priorities for increasing the number and extent of wetlands to help disperse the birds and reduce

their vulnerability to cholera. This is especially important on the rice prairies and Playa lakes of Texas and in the Rainwater Basin of Nebraska, which have frequent occurrences of avian cholera.

Goal

- Determine the most effective habitat and outbreak management strategies to optimize DU's commitment of resources to the prevention and management of botulism.

Assumptions

- Prevention of botulism and cholera outbreaks is effectively impossible.
- It is possible to maximize the efficacy of management actions during botulism and cholera outbreaks
- Effective wetland management practices can prevent, or reduce, the occurrence of outbreaks of botulism and avian cholera.

Strategies

- Assure that other partners are engaged in botulism prevention and management programs.
- Build in wetland management capability that allows managers to minimize the occurrence and extent of botulism and cholera outbreaks.
- Conclude the botulism management research that is underway in Prairie Canada.

Climate Change

There is clear evidence that the Earth's atmosphere is accumulating "greenhouse" gases, mainly carbon dioxide and methane. Atmospheric CO_2 levels have risen an average of 1.6 ppm/yr since mid-1980s while CH_4 and N_2O have risen more slowly at an average of 0.008 ppm/yr. There is also a broad consensus among scientists that this has been caused, in part, by a wide variety of human activities - primarily the use of fossil fuels for domestic and industrial purposes, and the conversion of native plant communities to agriculture and other uses. In short, much of the Earth's available carbon that was previously held in vegetation, soil, petroleum and coal is being converted to gaseous forms of carbon in the atmosphere. Other factors also contribute to the changes that have been measured but the pattern is likely driven by those listed above.

The present and projected climatic effects of these changes are controversial. However, in 1995 the Intergovernmental Panel on Climate Change concluded that, "the balance of evidence suggests that there is a discernible human influence on global climate". The changes in the Earth's gasses have the effect of reducing the amount of heat from the sun that is re-radiated back to space. Scientists believe this will result in a warmer atmosphere near the Earth's surface while cooling it at the higher levels. Several major scientific laboratories have developed huge quantitative models to help predict what the implications are for the Earth's climate. With the expected doubling of atmospheric carbon dioxide this century, all these models predict that the Earth will warm by approximately 1-4^{o}C.

There is still controversy about how much contemporary changes in temperature and drought patterns are part of a "natural" climate cycle and how much is being driven by changes in atmospheric gasses. Regardless of the definitive answer to this question, it is clear that the course of climate change has serious and far-reaching implications for the future of waterfowl conservation and for DU's programs. Clearly, it is only prudent for DU to track the development of this issue to better understand how the organization can most responsibly allocate resources in the face of climate change.

To illustrate, following are three examples of the types of implications that climate change might hold for the organization:

1. Sea level rise is currently occurring as measured by several scientific institutions throughout the world. The rate of rise is about 1-2 mm/yr and thought to be increasing. Among the most threatened habitats in the continent are coastal wetlands that support a multitude of waterbirds and other plant and animal communities. For example, recent predictions for the Gulf Coast region are a rise of approximately 50cm± over the next century. DU has programs that are designed to restore and protect coastal wetlands for the long-term. We know that increased water depth will ultimately destroy the very existence of wetlands as they change to shallow lakes or estuaries. How should DU most responsibly invest resources in coastal wetlands to secure their value for waterfowl and other wildlife for the long-term?

2. Most climate change models predict that the PPR of the continent will become warmer with lower soil moisture, as increased evaopotranspiration negates increased precipitation. However, the models also predict more variable precipitation patterns in the future. Intuitively, becoming drier seems like it would be a problem for wetland conservation as this region is the most crucial to many of the continent's waterfowl and it is already limited by frequent periods of below normal precipitation. However, moisture patterns on the prairies are already highly variable. Will increased variability, if that pattern emerges, increase or decrease the frequency by which the prairies are productive of waterfowl? How will the subregions and boundaries of the PPR change in a warmer world? How should DU invest resources to most prudently protect the productive capability of the prairies for the long-term?

3. The nations of the world have negotiated a major treaty, the Kyoto Protocol, which will commit the signatory countries to reducing their output of greenhouse gasses and to enhancing landscapes that sequester gasses. Many countries are engaged in extensive political and scientific debates on how or if they should respond to the mandate of the agreement. The Protocol may never be ratified, however, there does appear to be a growing recognition that such measures are crucial to the future of the world and it seems likely that most countries will ultimately commit to reducing their net output of greenhouse gasses and to enhancing carbon sinks. Indeed, several major industries have initiated measures to protect themselves by preparing for possible carbon emission regulatory imperatives in the future. For DU, one opportunity might be that restoration of native grasslands, forests and perhaps some wetlands, will be supported as methods to remove carbon from the atmosphere. If so, DU's habitat restoration programs may benefit from significant new sources of funding.

Current DU Programs

DU has supported one contract scientist and provided one staff member, part-time, who were engaged in reviewing the implications of climate change to the future of wetlands and waterfowl conservation. Staff have developed several specific recommendations on how DU should consider adjusting program activities in the future. We have also developed our own

internal expertise to help us determine the scientific and practical relevance of the climate change and associated carbon sequestration debates. DU has a measure of standing among the experts in the field, a fact that should assure that we will gain knowledge of how the scientific underpinnings of the debate are developing. In Canada, DU staff are also involved in identifying research needs on prairie wetlands that will further help clarify the role that these systems have in carbon sequestration.

The organization is also working hard to help direct initiatives that are designed to restore grasslands and forestlands as ecosystems that are capable of sequestering carbon from the atmosphere.

Goals

- Position waterfowl habitat conservation to most effectively take advantage of emerging public policy and industry actions related to restoration of native habitats to sequester carbon.

- Develop a document to help guide DU's conservation program delivery in response to a range future climate scenarios by December of 2001.

Assumption

- Climate change has major significance to the future of waterfowl conservation programs.

Strategies

- Maintain adequate staff involvement in climate change forums to assure internal expertise and high-quality outside contacts to help guide development of the organization's conservation programs.

- Establish a model arrangement with industry and government to assure that proactive habitat restoration is a key component of future efforts to sequester carbon from the atmosphere.

- Expand research on the role of wetland and upland habitats in carbon sequestration.

Part 4: Prioritization of Waterfowl Conservation Needs

Ducks Unlimited seeks to actively work wherever North American waterfowl are found. Our members, our partners, and the public expect nothing less. However, there are many choices for allocating DU's resources to the problems facing waterfowl. It is, therefore, critical that DU prioritizes areas and issues that are important to waterfowl and where DU can make a difference.

Priority rankings are based on judgment, which can change with new information or rationale. Relative position in the prioritized list generally indicates that DU will apply higher financial and human resources to solving the identified problems. However, for some areas or issues, the immediate needs do not require extensive resources because there are no obvious solutions at hand or because the best course of action does not require large commitments of funds and staff.

For example, lesser scaup and many sea ducks are species that are of major concern and high priority. However, for these species, we don't know what causes their low population status. The immediate need is for more and better information that will be secured through new research done by DU and others. Thus, as big as these problems are, they do not demand extensive resources at this time.

In a second example, the Western Boreal Forest is a high priority region because it is a major breeding area for many of North America's waterfowl species. DU must become involved in both government and industrial policy development to influence land use practices that negatively affect waterfowl habitat. There are also important research and habitat inventory needs in this area.

Finally, the prairie pothole region is clearly one of the most important breeding grounds in North America, and currently demands the greatest commitment of DU staff and funds. Nevertheless, we cannot accomplish everything that needs to be done by direct, on-the-ground programs. Beneficial public policies, especially on agricultural lands, are crucial to success in the prairies, as they are elsewhere on the continent. Thus, sensible and strategic allocations of resources to a suite of solutions to solve complex problems will be crucial to success.

The primary criteria used to determine DU's priority rankings for each region or issue were:

- Numbers and diversity of waterfowl impacted
- The effects of ecological processes in each area on waterfowl populations
- Degree of current or future threat to waterfowl habitat
- Existence of threatened, endangered or rare waterfowl species in area
- DU's ability to define issues/problems related to the area and waterfowl populations
- DU's ability to constructively address the situation
- Special circumstances, such as overpopulation issues

Five categories are used to prioritize the regions where DU should work. Important waterfowl habitat priorities are assigned to four levels and a group of other areas towards which little effort is warranted, as follows:

Level 1 priorities are most important to the accomplishment of DU's mission. DU will allocate the highest proportion of its effort to Level 1 priorities. These include financial

and manpower resources, focused campaigns for funding or public policy support and special efforts to motivate others to undertake complimentary habitat conservation programs. While Level 1 regions are crucial to success, it is recognized that continental waterfowl population goals cannot be supported by those regions alone.

Level 2 priorities are continentally important areas towards which DU will allocate significant resources and undertake other complimentary actions as appropriate to accomplish recognized regional conservation goals.

Level 3 priorities are regions where there are waterfowl resource values that are more regional in importance. DU will allocate limited internal resources but will seek external support for most actions that are taken.

Level 4 priorities are less important regions towards which DU will limit its work to specific sites of local importance. All resources allocated to level 4 priorities will be restricted by external donors or by internal funds ear-marked for use in specific jurisdictions.

Other Regions are those towards which DU will rarely allocate any resources. These regions have little significance to continental, and limited importance to local, waterfowl populations.

Comments on each of the waterfowl habitat regions follow and are summarized in Table 5.

Level 1 Habitat Priorities

Central Valley / Coastal California

This region includes the Central Valley of California that provides critical wintering habitat for 60% of the waterfowl wintering in the Pacific Flyway. Several populations, for which a large portion winters in the valley are below population goals. These include Aleutian geese, Wrangel Island snow geese and northern pintails. Over 90% of historic depressional wetlands and 84% of riparian wetlands have been lost to agriculture and urban development. Seasonal wetlands on private farmlands are vital to replacing those waterfowl habitat resource values. However, they too are threatened with continued urban development, extremely high land values and competition for limited water resources for fish and wildlife conservation.

Gulf Coastal Prairie

This region extends from the Mississippi/Louisiana border to the Rio Grande River and includes a great variety of coastal marsh and interior wet prairie/rice agriculture wetlands. The NAWMP Gulf Coast Joint Venture goals for this region are to over winter 13.7 million ducks and 1.3 million geese. Wetlands along the Gulf Coast winter high proportions of the continental populations of several species: 95% of gadwall, 90% of mottled duck, 80% of green-winged teal, 80% of redheads, 60% of lesser scaup, and 25% of pintails. The region also provides migration habitat for most of the blue-winged teal that winter in Central and South America and wintering habitat for mid-continent lesser snow and white-fronted geese. The coastal marshes have been

Table 5. – Priority rankings of waterfowl habitat areas (alphabetical within rankings).

Level 1 Priorities

Central Valley / Coastal California
Gulf Coastal Prairie
Mississippi Alluvial Valley
Prairie Pothole Region
Western Boreal Forest - Canada

Level 2 Priorities

Great Basin
Hardwood Transition / Lower Great Lakes / St Lawrence Plain - Ontario
Mid-Atlantic Coast
Pacific Northwest – British Columbia Coastal Region
Pacific Northwest – U.S. Upper Pacific Coast
Southern Great Plains
U.S. Great Lakes System

Level 3 Priorities

Atlantic Canada – Agricultural Lowlands
Atlantic Canada – Boreal Forest
Atlantic Canada – Coastal
Baja California Desert
British Columbia Intermountain
Gulf Coast / Yucatan – Mexico
North Atlantic Coast / New England Coast
Northern and Southern Rockies / Colorado Plateau
Northwestern Great Plains
Peninsular Florida
Southeastern Coastal Plain and Piedmont
Upper Mississippi River
West Coast of Mexico
West Gulf Coastal Plain
Western Boreal Forest - Alaska
Wetlands Hawaii

Level 4 Priorities

Arctic Plains and Mountains – Alaska
Atlantic Canada – Maritime Appalachian Forests
Boreal Softwood Shield
Chihuahuan Desert / Interior Highlands – Mexico
Eastern Canada – Arctic, Taiga and James Bay Lowlands
Latin America and the Caribbean
Northeastern U.S. Forests
Pacific Northwest – Cook Inlet / South Coastal Alaska
Western Alaska / Aleutian / Bering Sea Islands

Other Regions

Edwards Plateau
Oaks and Prairies
Sierra Nevada
Sonoran and Mohave Deserts
Tamaulipan Brushlands

severely degraded by major alterations to hydrology and subsequent subsidence and salt-water intrusion. They are further threatened by global climate change and related sea level rise. Coastal interior prairie wetlands have been heavily affected by agriculture. However, an important crop in the region is rice which, when properly managed, can provide important waterfowl foraging habitat. Recent declines in rice acreage in the region are of concern. Approximately 445,000 ha of coastal marsh have been lost in this region in the last 50 years. Large-scale restoration efforts are just beginning. Nevertheless, net losses of an additional 162,000 ha of coastal wetlands are expected to occur in the next 50 years in Louisiana alone. Some losses are not preventable; there are opportunities for restoration and protection that must be fully exploited in the continentally significant wintering area.

Mississippi Alluvial Valley

This region was once the largest bottomland hardwood forest on earth, consisting of about 10 million ha of alluvial floodplain from the confluence of the Mississippi and Ohio Rivers to the Gulf of Mexico. Today, only 20% of the forested wetlands remain. Also, hydrological alterations have been severe. Flood frequency and extent in some portions are only about 10% of historical levels. This is the continent's most important wintering habitat for mallards and wood ducks but other species, such as gadwall and green-winged teal also are common. With the advent of mechanized cultivation, lesser snow goose populations have expanded into the region from the Gulf Coast, a factor that has contributed importantly to the excessive growth of that species. In modern times, waterfowl are sustained by remnant forested habitats and flooded agricultural lands. However, these habitats are at risk as agricultural practices and commodity values change.

Prairie Pothole Region

The Prairie Pothole Region is an 870,000 km^2 crescent in the mid-continent of the U.S. and Canada. It is recognized as the most significant breeding waterfowl habitat in the world. During the breeding period it is also the region in which a very high proportion of annual mortality takes place to breeding female ducks. The PPR extends from southern Iowa to North Central Alberta and occurs in parts of, Iowa, South Dakota, North Dakota, Minnesota, Montana, Manitoba, Saskatchewan and Alberta. This region is also heavily used by agriculture and has undergone extensive drainage, land clearing and tillage. In most areas only remnant grasslands remain. Despite these changes, the PPR is still the key production area for a large portion of North America's ducks. As is the case for most areas of importance, this area is dramatically influenced by changes in agricultural policies in both the U.S. and Canada.

Western Boreal Forest - Canada

The Western Boreal Forest of Western Canada and Central Alaska covers 3 million km^2 and is the largest remaining forested ecosystem in North America. It holds 12-14 million ducks during the breeding season and is especially important to scaup, mallard, wigeon, green-winged teal and scoters. This region is also used heavily by waterfowl that are displaced from southern areas by drought. Millions of birds move there each year after the breeding season to undertake the annual wing molt. Once thought to be secure from development and a stable habitat for waterfowl and other waterbirds, the Western Boreal Forest is undergoing far-reaching changes as a result of the forestry, agriculture, and mineral industries and perhaps because of climate change. Scaup and scoters, two species with declining populations, also breed in this important area.

Level 2 Habitat Priorities

Great Basin

This region lies in the rain shadow of the Cascade and Sierra Nevada mountain ranges. The limited wetland areas are threatened by various human activities and provide vital habitat for waterfowl and other wetlands wildlife in this otherwise dry region. It is an important breeding area for redheads and cinnamon teal. Migrating waterfowl, including large numbers of northern pintail, mallard, redhead, tundra swan and cinnamon teal heavily uses the wetlands of the Great Salt Lake. These marshes are especially prone to botulism which can kill many hundreds of thousands of water birds in years with major outbreaks. Continued population growth in this region is placing increased demands on limited freshwater supplies which are needed to sustain wetlands and to help prevent disease outbreaks.

Hardwood Transition / Lower Great Lakes / St. Lawrence Plain - Ontario

The Lower Great Lakes / St. Lawrence Plain has lost over half the original wetland base to agriculture and other developments. The approximately 1 million ha of remaining wetland habitat supports areas of relatively high breeding waterfowl densities, and the region as a whole provides a significant contribution to waterfowl production within the Great Lakes basin and continentally. The lower Great Lakes and associated coastal wetland habitats provide critical habitat for waterfowl migrating in both spring and fall. Continued agricultural intensification and human expansion are clear and significant threats to remaining wetland habitats in both the Lower Great Lakes / St. Lawrence Plain and coastal areas. The Hardwood Transition region of Ontario is characterized by mixed hardwood and coniferous forest. Although the region generally has shallow soils of low fertility, the recent recovery of beaver populations has resulted in extensive complexes of highly diverse wetland habitats that are used by breeding waterfowl. Forestry activities have greatly altered this landscape, and current forest management policies do not consider beaver habitat requirements. Further, increasing conflicts between wetlands and recreational development, pose additional threats to the long-term viability of healthy beaver populations and thus the significant wetland resources within the Hardwood Transition region.

Mid-Atlantic Coast

The Mid-Atlantic Coast Region extends through a chain of extensive estuarine embayments from the Long Island Sound, through coastal bays of New Jersey down to the Chesapeake Bay. There are a multitude of highly productive shallow water and adjacent upland habitats across these systems. These habitats provide wintering habitat for at least 20 species of waterfowl including about: 70% of the black ducks, 80% of the Atlantic brant, 80% of the greater snow geese and 80% of the Atlantic and North Atlantic Flyway populations of Canada geese. The region has also been historically important to wintering diving ducks, most notably: canvasback, redheads, greater and lesser scaup and sea ducks. There have been major losses and degradations across all these wetland systems as a result of heavy industrial, transportation, recreational and urban development. These impacts result from drainage, impounding and filling, dredging, oil and chemical spills, invasive species, marina developments, atmospheric fallout of pollutants and natural sea level rise. All of these systems are also affected by point and non-point source pollution from nutrients, agricultural chemicals and sediment loads.

Pacific Northwest – British Columbia Coastal Region

The crest of the St. Elias, Coast and Cascade Mountains bound this region. Key wetland habitats consist of 60,000 ha of intertidal habitats, 35,000 ha of adjoining floodplains and freshwater marshes. These same low-relief areas are the focal points for urban development, which is the major threat to these habitats. Coastal land values have climbed to astronomical levels and there is great pressure on all remaining unprotected areas for development as industrial, agricultural and recreational uses. Forestry and agriculture cause the other main impacts that may have food chain and water quality impacts on the remaining wetlands. River deltas and shallow coastal areas provide key migration and wintering habitat for 35 common and 13 less common species of migrating and wintering waterfowl. Waterfowl numbers include over 1,000,000 ducks, 55,000 geese and 6,000 swans. Key species include mallard, pintail, wigeon, harlequin ducks, Wrangel Island snow geese, Pacific brant, Barrow's goldeneye and trumpeter swans.

Pacific Northwest – U.S. Upper Pacific Coast

The Upper Pacific Coast of the U.S. includes extensive tidal estuaries, intertidal zones, rivers and freshwater marshes of coastal Washington, Oregon and Northwest California. These areas provide critical habitat for migrating Pacific Flyway waterfowl and breeding habitat for a few species such as mallard and cinnamon teal. All are under great pressure from industrial, agricultural, urban and recreational interests. Conservation issues are further complicated by the presence of numerous runs of endangered anadromous fish.

Southern Great Plains

Wetland resources in this large, semi-arid region consist of a large variety of continentally significant wetland complexes, riparian corridors, saline wetland complexes, man-made reservoirs and playas. These wetlands provide the core migratory habitat for several million waterfowl in the Central Flyway. Most wetlands are in private ownership and most have undergone extensive changes to their hydrological regimes as a result of agricultural activities, primarily irrigation. During mild winters, up to 4 million ducks and 1 million geese winter in this region. Mallard, northern pintail, green-winged teal and Canada geese are the most common wintering waterfowl. Some waterfowl production occurs throughout the region. Avian diseases (cholera and botulism) are a serious problem in playa wetlands and the Rainwater Basin, especially in dry winters and springs when masses of birds are concentrated in the few remaining wetlands.

U.S. Great Lakes System

This large region extends across Michigan, Wisconsin, northern Minnesota, northern Illinois, Indiana and western Ohio through the lower Great Lakes area of northern New York. Coastal wetlands are the dominant waterfowl habitats and once consisted of a total area of more than 100,000 ha. Urban and agricultural development has completely eliminated some wetland systems and most of the remaining wetlands have been markedly degraded mainly through modification of hydrological regimes. Degradation and loss continue at high rates. Mallard, black duck, blue-winged teal, wood ducks and Canada geese dominate the varieties of waterfowl that nest throughout this region. More than 3 million waterfowl migrate through the Great Lakes System. Most are diving ducks using shallow water habitats in the lakes themselves and larger bays in the coastal marshes.

Level 3 Habitat Priorities

Atlantic Canada – Agricultural Lowlands

The agricultural lowlands encompass 64,000 km^2 with about half a million ha of wetlands in area. It includes riparian habitat along several major rivers, such as the St. Lawrence and St. John, the St. Lawrence estuary, Bay of Fundy diked wetlands, and the Northumberland Plain. About 200,000 breeding waterfowl use this region and about 2 million stage during spring and fall migration. Wetlands in this landscape are among the most productive habitats for breeding waterfowl in eastern Canada. Upland areas are dominated by small grain and livestock agriculture. Most small wetlands have been lost to agriculture and urban development. Wetland losses to drainage continues. The bulk of the human population resides in this landscape. Wetland degradation caused by sedimentation, nutrient run-off, and eutrophication occurs in most areas. Black ducks are common breeders in this landscape.

Atlantic Canada – Boreal Forest

The boreal forest covers 715,000 km^2 in Quebec, Newfoundland and Labrador. It is occupied by about 280,000 breeding ducks and Canada geese. There are over 3 million ha of wetlands although they are generally low in productivity. The dominant duck species are black ducks, green-winged teal, common and Barrow's goldeneye, scoters and Canada geese. This is an important area for the endangered eastern harlequin duck. Hydroelectric development, forestry and acid rain cause degradation of this landscape. However, the recovery of beaver populations has generally increased the availability of wetlands.

Atlantic Canada – Coastal

This landscape consists of 3,180 km of coastline where there are 457,100 ha of salt marsh, estuarine flats, saline ponds and islands. The dominant nesting waterfowl are common eiders (130,000 pairs) and black ducks. Scoters, eiders and endangered harlequin ducks molt on this coastline in late summer and several hundred thousand geese and ducks stage there in the spring and fall. About one-half million birds are present during most winters. Coastal habitats also support 4.8 million shorebirds during fall migration. There are also significant seabird populations that rely on this region. Over half the salt marsh has been converted to other uses, some of which are very harmful to waterfowl and other wildlife. Industrial spills and non-point source contamination occur in many areas although the impact on waterfowl has not been quantified. Industrial, agricultural and urban development are continuing and rapidly increasing threats.

Baja California Desert

The coastal lagoons of Baja California provide the great majority of habitat used by waterfowl and other waterbirds in this region. The main lagoons are: Scammon's, San Ignacio, San Quintin and Magdalena. These provide wintering habitat for 85% (about 125,000) of the Pacific brant, which are very dependent on intertidal wetlands where they feed especially on the 60,000 ha of eelgrass beds which occur. Other waterfowl occur in lower numbers and total about 50,000 additional birds. The major concern in this region occurs with the growing development pressures by residential, recreational and transportation industries, which threaten the integrity of intercoastal habitats used by the Pacific brant.

British Columbia Intermountain Region

This 320,000 km^2 region of BC supports a breeding population of 1.1 million birds with up to 8 million waterfowl migrating through the area. Only 12,300 km^2 of the area are wetlands. Over 60 percent of the continent's Barrow's goldeneye ducks nest in this region, however, it also has 26 other species of ducks and Canada geese. Total waterfowl numbers are relatively stable although mallards, northern pintails, blue-winged teal, common goldeneyes, ruddy ducks, harlequin ducks, common mergansers, and red-breasted mergansers have declined over historic levels, likely because of forestry practices, grazing, wetland drainage and urban expansion which are persistent threats.

Gulf Coast / Yucatan – Mexico

Wetlands on the Mexican Gulf Coast are found in several main areas: the Laguna Madre (200,000 ha), Tamiahua and Alvarado Lagoons (250,000 ha), Tabasco Wetlands (303,000 ha), Campeche and Yucatan Lagoons (220,000 ha). Each of these areas is substantially intact and apparently capable of supporting traditional numbers of wintering waterfowl and other water birds. However, each is undergoing changes because of modification to hydrology and water quality brought about as a result of agricultural, urban and road-building activities. This region supports about 1 million (35%) of the wintering waterfowl in Mexico. It is especially important for the redhead duck as about 30% winter on the Mexican side of the Laguna Madre.

North Atlantic Coast / New England Coast

This region has the densest human population of any region in North America. It extends from Maine to Long Island. Wetland habitats are primarily extensive estuarine complexes and embayments that have developed behind barrier beaches. These provide important wintering habitat for black ducks, canvasback and tundra swans, greater scaup, other diving ducks, several species of sea ducks, mallard, green-winged teal, and Canada geese. Wetland losses have been extensive as a result of filling, dredging, subsidence, sea level rise, contamination from oil and chemical spills, recreational use, mosquito control, exotic and invasive species, urban expansion, and generally declining water quality – all of which continue to be problems.

Northern and Southern Rockies / Colorado Plateau

Waterfowl habitats in these regions are found in mid- and high elevation lakes and streams, glacial ponds and beaver ponds along river tributaries. The area is generally mountainous, semi-arid or desert but waterfowl are common where there is water. The most heavily used areas are the parks that have a variety of wetland types. Most intermountain basins have few wetlands with the exception of the 13,000 km^2 San Luis Valley in south central Colorado, which has some of the highest breeding waterfowl densities on the continent. Mallard and green-winged teal are the most abundant species however; gadwall, cinnamon teal, American wigeon, shoveler and pintail ducks are common. There are many competing recreational, urban and agricultural demands on the limited water resources of the region.

Northwestern Great Plains

This region is an unglaciated, semi-arid rolling plain that is dominated by mixed-grass prairie. It lies to the west and south of the Prairie Pothole Region and east of the Rocky Mountains. Wetlands are limited to riparian corridors, reservoirs, and stock ponds that are generally stable through most wet and dry periods. During recent years, about 2 million

waterfowl have been counted in this region during May surveys. Production is relatively high in proportion to the number of breeding ducks because of the existence of extensive tracts of grassland and a generally more favorable predator community.

Peninsular Florida

Peninsular Florida has over 4 million ha of wetlands. Important interior freshwater marsh habitat occurs, or formerly occurred, in association with the St. John's and Kissimmee Rivers and Lake Okeechobee. Important coastal wetlands include the Mosquito Lagoon and the Indian and Banana River and a few other shallow coastal offshore areas. A limited number of waterfowl breed in this region, including about 50,000 Florida mottled ducks, a large but undetermined number of wood ducks and several thousand fulvous whistling-ducks. Florida may winter upwards of 1 million ducks in some winters, including nearly 400,000 lesser scaup. Other important species are blue-winged teal, ring-necked ducks and wigeon. Primary threats are agricultural conversion, impacts of agriculture on water quality, invasive exotic plants, urbanization and flood control projects.

Southeastern Coastal Plain and Piedmont

This region extends from the James River in Virginia to about Jacksonville, Florida and then westward along the Piedmont and along the Gulf Coast to the Mississippi Alluvial Valley. It has a great variety of wetland resources of which the most significant types are: the agricultural lowlands, bays and sounds of North Carolina, the pocosins, swamps, beaver ponds, estuaries and former rice producing farms of North Carolina, South Carolina, and Georgia and isolated coastal marshes along the Florida panhandle. Seasonally flooded bottomland hardwood forests occur along rivers in most of these southeastern states and are used by breeding wood ducks and a variety of wintering waterfowl. The bays and sounds of North Carolina winter approximately 75% of Atlantic Flyway canvasbacks in some winters and at least 80% of the continental population of tundra swans. Inland lakes, ponds and swamps provide significant habitat for wintering ring-necked ducks. Other offshore habitats are used by 50 – 100,000 scaup and other divers during most winters. Serious threats to coastal wetlands in the Carolinas are caused by urbanization of coastal areas, agricultural impacts on water quality and subsequent impacts on beds of submerged aquatic vegetation.

Upper Mississippi River

This large region is bisected by the floodplain of the Mississippi River and its larger tributaries in the states of Iowa, Missouri, Wisconsin, Illinois, Indiana and Ohio. The floodplains of the many rivers provide a wide diversity of riparian habitats that are used by waterfowl throughout the ice-free period. The importance of the region to breeding waterfowl has not been determined but is likely considerable for species like mallard, blue-winged teal and wood ducks. The region does contain an abundance of traditional waterfowl migration habitats, almost all of which have been highly modified by development for agricultural, industrial, transportation and recreational purposes. High proportions of at least two populations of Canada geese, canvasback and other diving ducks depend on wetlands of this region during migration in spring and fall.

West Coast of Mexico

The complex of coastal wetlands of the states of Sonora, Sinaloa and Nayarit provide habitat for about 35% of the waterfowl that winter in Mexico in a complex of 700,000 ha of tidal

pools and flats, lagoons, and mangrove swamps. About 700,000 birds are found there during most winters although the area is believed to be much more important during years when wintering habitats are especially dry in California and other southwestern areas. Most of these wetlands have undergone extensive hydrological modification with the development of irrigation reservoirs in the Sierra Madre mountain range. These have changed hydroperiods, reduced water quality through the addition of agricultural chemicals and nutrients, and changed the salinity of coastal wetlands. Expansion of freshwater cattail into the lagoons is a serious concern as is the development of the shrimp industry that has targeted 200,000 ha for development.

West Gulf Coastal Plain

Shortleaf pine forests dominate uplands in this region. Wetland habitats are mostly bottomland hardwoods along the major and minor rivers. These wetlands provide important wintering habitat for mallards, wood ducks and other dabbling ducks. NAWMP goals are to provide winter habitat for up to 3.2 million waterfowl during the average winter. Major reservoirs are common and have altered natural hydrological cycles that drive the productivity of the bottomland systems. Alternatively these same reservoirs provide wintering habitat for up to a million diving ducks during some winters.

Western Boreal Forest - Alaska

Alaska's wetlands cover more than 50% of the land surface area and produce an average of 4.6 million ducks and 100,000 geese in the fall flight. Wetlands in Interior Alaska have few immediate threats from man-induced changes although there are long-term issues to be resolved with forestry and the mineral and fossil fuel extraction industries.

Hawaii

The Hawaiian Islands once had about 60,000 ha of wetlands which were used by endemic and migratory waterbirds and other wildlife. About 45,000 were palustrine scrub-shrub and forested bogs and rainforest wetlands while 6,000 ha were on the coastal plain. The majority of Hawaiian wetlands have been filled or degraded by development. Only six endemic species of waterbirds remain: the Hawaiian duck, Laysan duck, NeNe goose, Hawaiian coot, Hawaiian stilt and Hawaiian moorhen. Several thousand North American waterfowl occupy Hawaii each winter.

Level 4 Habitat Priorities

Arctic Plains and Mountains – Alaska

This region is a 60,000 km^2 area that is bounded on the north and west by the Arctic Ocean. From 40 – 86% of the coastal plain is covered with wetlands that harbor over 1 million waterfowl during the breeding period. These numbers increase during dry years on the prairies when a few hundred thousand ducks, pintails especially, may be drought-displaced. Post-breeding molt migrations also bring many waterfowl to this region. The habitats are generally untouched and secure although there are threats at some locations where petroleum leases may be developed in the future.

Atlantic Canada – Maritime Appalachian Forests

About 100,000 pairs of breeding waterfowl occupy this landscape. It is about 200,000 km^2 in size and has about half a million ha of wetlands. Most of the land is privately owned and

impacted to various degrees by forestry and silviculture. Wetlands have low productivity although the size of the area results in significant production of black ducks, goldeneye and green-winged teal.

Boreal Softwood Shield

This region extends across Newfoundland, northern Quebec and Ontario. It is mostly coniferous forest with some hardwood mix at southern latitudes. It is a huge region consisting of about 1.5 million km^2 with over 6 million ha of wetland area that is dominated by generally unproductive lakes, rivers and beaver ponds. Over a million waterfowl breed in this region but survey data are sparse. A high proportion of the remaining black ducks breed in the Boreal Softwood Shield. Other common breeding waterfowl include goldeneye, green-winged teal, scoters and Canada geese. Habitats are generally stable and only threatened at several locations where there are more productive forest resources.

Chihuahuan Desert / Interior Highlands – Mexico

This is a dominantly desert region in Mexico where seven of the countries 28 key wetlands are found. About 160,000 ducks and geese have been recorded on northern highland wetlands during infrequent surveys in the past. About 325,000 waterfowl have been counted in the Central Highlands, including, in some years, up to 50,000 Mexican ducks. All of these wetlands are threatened by agricultural developments that would alter local hydrology and use up sparse water supplies.

Eastern Canada – Arctic, Taiga and James Bay Lowlands

This landscape consists of 1.3 million km^2 in the Arctic and sub-Arctic areas of Quebec and Labrador with almost 23 million ha of wetland habitat. The habitat is relatively stable with little human encroachment or degradation. More than 650,000 ducks and geese breed in these landscapes, but survey data are sparse. The endangered eastern harlequin duck and the eastern Barrow's goldeneye breed in this landscape. The area also supports Atlantic Flyway Canada geese.

Latin America and the Caribbean

Habitats in Latin America and the Caribbean support large numbers of waterfowl that breed in North America. These habitats are subjected to degradation and loss with varying degrees of threat. DU is investigating the numbers and locations of wintering waterfowl in Latin America and the Caribbean to help determine any future actions that DU might take.

Northeastern U.S. Forests

This is a region of generally nutrient-poor soils with limited wetland resources. The main breeding waterfowl are black and wood ducks although there are a few other species such as ring-necked ducks, common goldeneye, mergansers and green-winged teal. The Connecticut and Hudson Rivers and associated riparian habitats provide a corridor for migrating ducks and geese.

Pacific Northwest – Cook Inlet / South Coastal Alaska

This region is tremendously rich in waterfowl and wetland resources. The 61,000 km^2 area has a wide diversity of wetland habitats that are used by waterfowl. Over 10 million

waterfowl migrate through this area each spring and fall. Among these is the world's population of dusky Canada and tule white-fronted geese, 40% of all trumpeter swans and substantial numbers of dabbling, diving and sea ducks. Habitats are basically secure and not very threatened by man's activities at the present time.

Western Alaska / Aleutian / Bering Sea Islands

This region includes the Subarctic coastal plain from Kotzebue Sound and the Seward Peninsula to the Bristol Bay Lowlands, the Aleutian Islands which extend 1,700 km into the Bering Sea and the Bering Sea Islands including the Pribilofs, St. Matthew, Hall, St. Lawrence and Little Diomede. It is equal in significance to breeding waterfowl as is the Prairie Pothole Region, but for a different variety of specie. Significant habitats include 9.7 million ha of ocean less than 18 m in depth, 11,000 km of shoreline, 435,000 ha of lagoons, 160,000 ha of tidal river mouths, 534,000 ha of unvegetated intertidal zone, over 1 million ha of vegetated intertidal zone, 316 rivers and 3,600 streams. 1.3 – 1.7 million ducks breed in this region along with the world's populations of Aleutian Island Canada geese, dusky Canada geese, and emperor geese along with 70% of all Pacific brant and large numbers of about 25 species of ducks. About 9 million waterfowl depend on this region during some phase of the annual cycle. Most habitats are in near pristine condition and there are few threats from urban, industrial or recreational development. Coastal areas face growing threats from offshore oil development, oil spills and shipping accidents.

Other Regions

Edwards Plateau

Mesquite, juniper and oak savanna woodlands dominate this dry region. It has very low value for waterfowl.

Oaks and Prairies

This Bird Conservation Region represents a mix of prairie, savanna, cross-timbers, and shrubland. It has very little value to waterfowl and wetland resources.

Sierra Nevada

This mountainous region does not contain any significant tracts of wetland habitat other than what occurs along upstream riparian areas of tributaries to the Sacramento and San Joaquin Rivers. There are only limited lacustrine wetlands along water bodies such as Lake Tahoe.

Sonoran and Mohave Deserts / Sierra Madre Occidental

These mountainous desert regions have very limited riparian wetland resources that provide little value to waterfowl in general. This region has limited wetland habitat along the Colorado River, the Colorado River Delta and the Salton Sea in southern California. Other wetlands occur in montane areas where there is a variety of breeding waterfowl species in limited numbers.

Tamaulipan Brushlands

This region is dominated by grassland, savanna and thornscrub habitat. The limited wetland resources provide wintering habitat for most of the black-bellied whistling ducks that breed in the United States.

Other Conservation Issues

Several issues covered in Part 3 of this Conservation Plan are high priorities for DU because they severely impact waterfowl in a way that is critical to the long-term success of waterfowl conservation. Each issue is a priority but each will call for individual strategic decisions as to how DU becomes involved. These issues are not ranked in priority since they are all considered to be of major significance to the future of North American waterfowl.

Public Policy

Maintaining and expanding the CRP is a critical issue for the future of waterfowl. DU efforts were critical in maintaining CRP in the congressional debates over the last farm bill. Loss of this important program would have severe impacts on the continental waterfowl population. In Canada, DU is helping to develop a Permanent Cover Program which holds great promise for future waterfowl habitat conservation. The WRP has taken nearly 935,000 ha of converted wetlands out of agricultural production. These lands are being restored to functioning wetlands, often with the assistance of DU. Most of the WRP lands are in DU's highest priority areas. It is critical that DU work to expand WRP.

Water Quality / Supply

Maintaining water quality and supplies are paramount issues for waterfowl conservation. Both these factors have the potential of being prohibitive to future success in many regions. Threats and impacts include: salt-water intrusion in coastal regions which degrades fresh and brackish water wetlands; groundwater and surface water availability to irrigated agriculture which replaces lost wetland values in many regions, and; degradation of water quality by industry, urban areas and agriculture which impacts wetland productivity and quality. These problems are typically very complex and controlled by strong political and economic forces. Nevertheless, they must be actively pursued by DU if we are to be successful.

Northern Pintail Populations

Northern pintails remain far below the management goal level. The causes are unknown and there is great concern that the next dry period will drive the population down to unprecedented low levels from which recovery will be extremely difficult. New habitat programs and targeted research are needed to help bring about the recovery of the northern pintail.

Over-abundant Light Geese

Over-abundant light geese are destroying large portions of the fragile Arctic ecosystems that support them. This damage is very large scale, long-term, and degrades habitats that are used by the whole community of plants and animals with which they share the ecosystem. DU has taken a leading role in developing the scientific understanding of the issue as well as

communicating the issue to the scientific community, other professionals, policy makers and the public at large. DU should continue to support sound management practices that are designed to solve the problem.

Sea Ducks

During the last 10 years, three populations of North American sea ducks have been listed as endangered in the U.S. or Canada. The limited evidence available indicates that most species of sea ducks are likely undergoing a long-term pattern of decline. A new joint venture under the North American Waterfowl Management Plan has been formed to encourage pursuit of the most important information needs related to population status and factors that might be affecting population size and distribution. DU should participate fully in this joint venture by helping to advance the science needed to provide guidance for future management programs.

Scaup Populations

Scaup are common duck species that have declined significantly over the last 20 years. DU and its partners has conducted a comprehensive analysis of the historical data related to population change, harvest and related factors to search for clues as to what has driven the population to the current low level. Research is needed to help answer the major remaining questions as to the cause-and-effect relationships of scaup and the factors that might be causing their low populations.

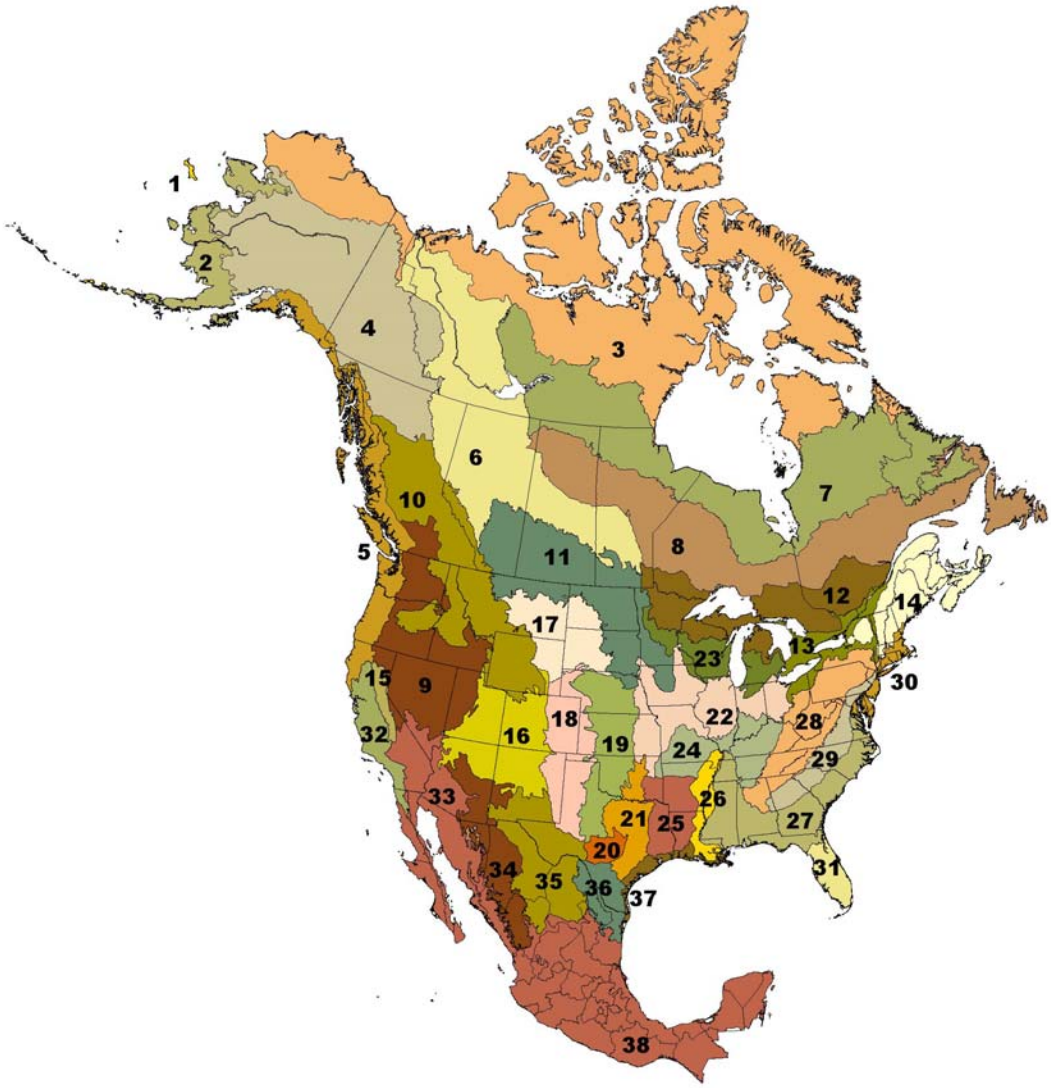
Climate Change

The course and consequences of climate change are focal points for greatly expanded scientific research and public policy debate. DU should monitor the progress of these discussions and be actively involved in matters that impinge on the future conservation of wetlands and associated upland habitats. Among the expected approaches to reducing greenhouse gasses are habitat restoration programs that promise to serve as “sinks” for atmospheric carbon.

Waterfowl Diseases

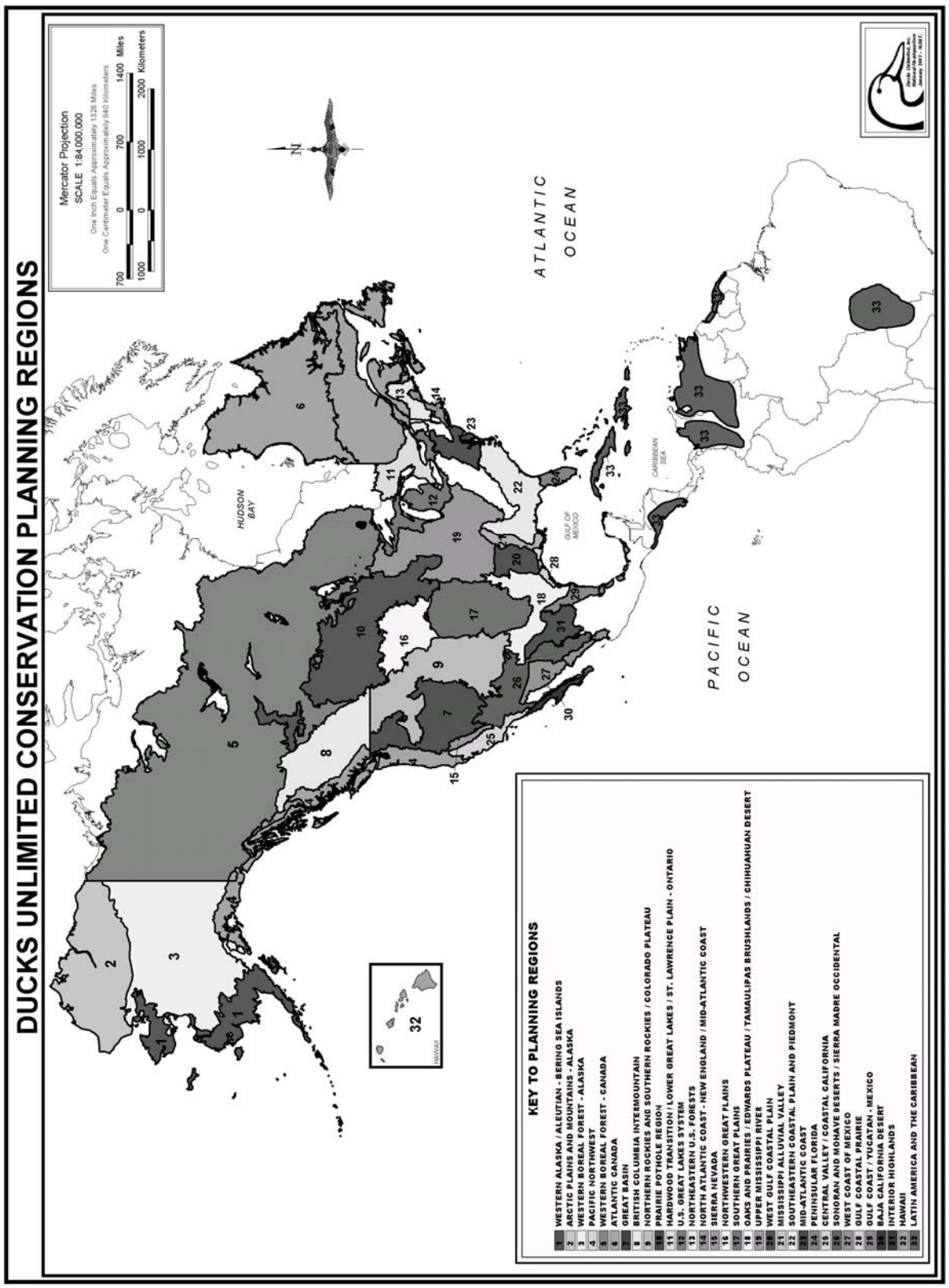
During recent years there have been numerous outbreaks of diseases that have killed hundreds of thousands of waterfowl, especially on post-breeding and wintering areas. DU is currently engaged, with several other partners, in key new research programs that should help manage future disease outbreaks.

APPENDIX I – NABCI Bird Conservation Regions



1	Aleutian / Bering Sea Islands	20	Edwards Plateau
2	Western Alaska	21	Oaks and Prairies
3	Arctic Plains and Mountains	22	Eastern Tallgrass Prairie
4	Northwestern Interior Forest	23	Prairie Hardwood Transition
5	Northern Pacific Rainforest	24	Central Hardwoods
6	Boreal Taiga Plains	25	West Gulf Coastal Plain / Ouachitas
7	Taiga Shield and Hudson Plains	26	Mississippi Alluvial Valley
8	Boreal Softwood Shield	27	Southeastern Coastal Plain
9	Great Basin	28	Appalachian Mountains
10	Northern Rockies	29	Piedmont
11	Prairie Potholes	30	New England / Mid-Atlantic Coast
12	Boreal Hardwood Transition	31	Peninsular Florida
13	Lower Great Lakes / St. Lawrence Plain	32	Coastal California
14	Atlantic Northern Forest	33	Sonoran and Mohave Deserts
15	Sierra Nevada	34	Sierra Madre Occidental
16	Southern Rockies / Colorado Plateau	35	Chihuahuan Desert
17	Badlands and Prairies	36	Tamaulipan Brushlands
18	Shortgrass Prairie	37	Gulf Coastal Prairie
19	Central Mixed Grass Prairie	38	Mexico mainland

APPENDIX II – Habitat Priority areas used by DU staff in developing this plan.



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APPENDIX IV – Scientific names of plant and animal species mentioned in the text.

Common Name	Scientific name
Birds	
Red-throated Loon	*Gavia stellata*
Arctic Loon	*Gavia arctica*
Pacific Loon	*Gavia pacifica*
Common Loon	*Gavia immer*
Yellow-billed Loon	*Gavia adamsii*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Eared Grebe	*Podiceps nigricollis*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
American White Pelican	*Pelecanus erythrorhynchos*
Brown Pelican	*Pelecanus occidentalis*
Red-faced Cormorant	*Phalacrocorax urile*
Pelagic Cormorant	*Phalacrocorax pelagicus*
Magnificent Frigatebird	*Fregata magnificens*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
White-faced Ibis	*Plegadis chihi*
Roseate Spoonbill	*Ajaia ajaja*
Jabiru	*Jabiru mycteria*
Wood Stork	*Mycteria americana*
Greater Flamingo	*Phoenicopterus ruber*
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*
Fulvous Whistling-Duck	*Dendrocygna bicolor*
Greater White-fronted Goose	*Anser albifrons*
Tule White-fronted Goose	*Anser albifrons gambelli*
Emperor Goose	*Chen canagica*
Greater Snow Goose	*Chen caerulescens alantica*
Lesser Snow Goose	*Chen caerulescens caerulescens*
Ross' Goose	*Chen rossii*
Canada Goose	*Branta canadensis*
Dusky Canada Goose	*Branta canadensis occidentalis*
Vancouver Canada Goose	*Branta canadensis fulva*
Aleutian Canada Goose	*Branta canadensis leucopareia*
Cackling Canada Goose	*Branta canadensis minima*
Hawaiian Goose	*Branta sandvicensis*
Brant	*Branta bernicla*
Pacific Brant	*Branta bernicla nigricans*
Atlantic Brant	*Branta bernicla hrota*

Trumpeter Swan	*Cygnus buccinator*
Tundra Swan	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Gadwall	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Mexican Duck	*Anas platyrhynchos diazi*
Mottled Duck	*Anas fulvigula*
Hawaiian Duck	*Anas wyvilliana*
Laysan Duck	*Anas laysanensis*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
European Common Teal	*Anas crecca crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Steller's Eider	*Polysticta stelleri*
Spectacled Eider	*Somateria fischeri*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta nigra*
Oldsquaw	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Snail Kite	*Rostrhamus sociabilis*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Goshawk	*Accipiter gentilis*
Red-shouldered Hawk	*Buteo lineatus*
Hawaiian Hawk	*Buteo solitarius*
Golden Eagle	*Aquila chrysaetos*
Peregrine Falcon	*Falco peregrinus*
White-tailed Ptarmigan	*Lagopus leucurus*
Blue Grouse	*Dendragapus obscurus*
Greater Prairie-Chicken	*Tympanuchus cupido*

Yellow Rail	*Coturnicops noveboracensis*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus longirostris*
King Rail	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Purple Gallinule	*Porphyrula martinica*
Common Moorhen	*Gallinula chloropus*
Hawaiian Moorhen	*Gallinula chloropus sandvicensis*
Hawaiian Coot	*Fulica alai*
American Coot	*Fulica americana*
Limpkin	*Aramus guarauna*
Sandhill Crane	*Grus canadensis*
Greater Sandhill Crane	*Grus canadensis tabida*
Lesser Sandhill Crane	*Grus canadensis canadensis*
Whooping Crane	*Grus americana*
American Golden-Plover	*Pluvialis dominica*
Snowy Plover	*Charadrius alexandrinus*
Wilson's Plover	*Charadrius wilsonia*
Piping Plover	*Charadrius melodus*
Mountain Plover	*Charadrius montanus*
American Oystercatcher	*Haematopus palliatus*
Black Oystercatcher	*Haematopus bachmani*
Black-necked Stilt	*Himantopus mexicanus*
Hawaiian Stilt	*Himantopus mexicanus knudseni*
American Avocet	*Recurvirostra americana*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Solitary Sandpiper	*Tringa solitaria*
Willet	*Catoptrophorus semipalmatus*
Wandering Tattler	*Heteroscelus incanus*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Bristle-thighed Curlew	*Numenius tahitiensis*
Long-billed Curlew	*Numenius americanus*
Hudsonian Godwit	*Limosa haemastica*
Bar-tailed Godwit	*Limosa lapponica*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Black Turnstone	*Arenaria melanocephala*
Red Knot	*Calidris canutus*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Rock Sandpiper	*Calidris ptilocnemis*
Dunlin	*Calidris alpina*
Stilt Sandpiper	*Calidris himantopus*
Buff-breasted Sandpiper	*Tryngites subruficollis*

Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Common Snipe	*Gallinago gallinago*
Northern Phalarope	*Lobipes lobatus*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicaria*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Franklin's Gull	*Larus pipixcan*
Mew Gull	*Larus canus*
California Gull	*Larus californicus*
Great Black-backed Gull	*Larus marinus*
Sabine's Gull	*Xema sabini*
Black-legged Kittiwake	*Rissa tridactyla*
Red-legged Kittiwake	*Rissa brevirostris*
Gull-billed Tern	*Sterna nilotica*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Forster's Tern	*Sterna forsteri*
Least Tern	*Sterna antillarum*
Aleutian Tern	*Sterna aleutica*
Black Tern	*Chlidonias niger*
Black Guillemot	*Cepphus grylle*
Marbled Murrelet	*Brachyramphus marmoratus*
Kittlitz's Murrelet	*Brachyramphus brevirostris*
Ancient Murrelet	*Synthliboramphus antiquus*
Cassin's Auklet	*Ptychoramphus aleuticus*
Least Auklet	*Aethia pusilla*
Whiskered Auklet	*Aethia pygmaea*
Horned Puffin	*Fratercula corniculata*
Carolina Parakeet	*Conuropsis carolinensis*
Burrowing Owl	*Athene cunicularia*
Spotted Owl	*Strix occidentalis*
Great Gray Owl	*Strix nebulosa*
Boreal Owl	*Aegolius funereus*
Black Swift	*Cypseloides niger*
Lewis's Woodpecker	*Melanerpes lewis*
Williamson's Sapsucker	*Sphyrapicus thyroideus*
Red-cockaded Woodpecker	*Picoides borealis*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Ivory-billed Woodpecker	*Campephilus principalis*
Eastern Wood-Pewee	*Contopus virens*
Willow Flycatcher	*Empidonax traillii*
Gray Vireo	*Vireo vicinior*
Brown-headed Nuthatch	*Sitta pusilla*
Bicknell's Thrush	*Catharus bicknelli*
Wood Thrush	*Hylocichla mustelina*
Sprague's Pipit	*Anthus spragueii*

Bachman's Warbler	*Vermivora bachmanii*
Golden-winged Warbler	*Vermivora chrysoptera*
Virginia's Warbler	*Vermivora virginiae*
Bay-breasted Warbler	*Dendroica castanea*
Cerulean Warbler	*Dendroica cerulea*
Black-and-white Warbler	*Mniotilta varia*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Hooded Warbler	*Wilsonia citrina*
Canada Warbler	*Wilsonia canadensis*
Bachman's Sparrow	*Aimophila aestivalis*
Baird's Sparrow	*Ammodramus bairdii*
Henslow's Sparrow	*Ammodramus henslowii*
McCown's Longspur	*Calcarius mccownii*
Lapland Longspur	*Calcarius lapponicus*
Brown-capped Rosy-Finch	*Leucosticte australis*

Mammals

Red Fox	*Vulpes vulpes*
Coyote	*Canis latrans*
American Black Bear	*Ursus americanus*
Louisiana Black Bear	*Ursus americanus luteolus*
Brown Bear	*Ursus arctos*
Polar Bear	*Ursue maritimus*
Raccoon	*Procyon lotor*
Badger	*Taxidea taxus*
Striped Skunk	*Mephitis mephitis*
River Otter	*Lontra canadensis*
Small Indian Mongoose	*Herpestes auropunctatus*
Ocelot	*Leopardus pardalis*
Jaguarundi	*Herpailurus yaguarondi*
Jaguar	*Panthera onca*
Cougar	*Puma concolor*
Florida Panther	*Puma concolor coryi*
Gray Whale	*Eschrichtius robustus*
Manatee	*Trichechus manatus*
Caribou	*Rangifer tarandus*
Moose	*Alces alces*
Vancouver Marmot	*Marmota vancouverensis*
Beaver	*Castor canadensis*
Lemming	*Lemmus spp.*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*

Fish

Bull Trout	*Salvelinus confluentus*
Carp	*Cyprinus carpio*
Cutthroat	*Salmo clarki*
Flounder	*Paralichthys spp.*
Menhaden	*Brevoortia tyrranus*
Red Drum	*Sciaenops ocellatus*
Salmon	*Oncorhynchus spp.*
Shortnose Sturgeon	*Acipenser brevirostrum*
Speckled Trout	*Salvelinus fontinalis*
Spotted Sea Trout	*Cynnoscion nebulosus*
Steelhead	*Salmo gairdneri*
Striped Bass	*Roccus saxatilis*
Tilapia	*Tilapia spp.*
Tomcod	*Microgadus tomcod*
White Perch	*Roccus americanus*

Reptiles

American Alligator	*Alligator mississippiensis*
Blanding's Turtle	*Emydoidea blandingi*
Copperbelly Watersnake	*Nerodia erythrogaster neglecta*
Loggerhead Sea Turtle	*Caretta caretta*
Massasauga Rattlesnake	*Sistrurus catenatus*

Amphibians

Blanchard's Cricket Frog	*Acris crepitans blanchardi*

Plants

Atlantic White Cedar	*Chamaecyparis thyoides*
Alder	*Alnus spp.*
Alpine Fir	*Abies lasiocarpa*
Aspen	*Populus spp.*
Bald Cypress	*Taxodium distichum*
Balsam Poplar	*Populus balsamifera*
Banana	*Musa spp.*
Barley	*Hordeum spp.*
Birch	*Betula spp.*
Black Greasewood	*Sarcobatus vermiculatus*
Black Mangrove	*Avicennia germinans*
Black Spruce	*Picea Mariana*
Bladderwort	*Utricularia spp.*
Bluegrass	*Poa spp.*
Blue Spruce	*Picea pungens*
Bulrush	*Scirpus spp.*

Burreed	*Sparganium spp.*
California grass	*Brachiaria mutica*
Canola	*Brassica spp.*
Carrot	*Daucus carota*
Cattail	*Typha spp.*
Chinese Tallow Tree	*Sapium sebiferum*
Common Reed	*Phragmites australis*
Common Salvinia	*Salvinia minima*
Coontail	*Ceratophyllum demersum*
Corn	*Zea mays*
Cottonwood	*Populus spp.*
Cowlily	*Nuphar luteum*
Cypress	*Taxodium spp.*
Douglas Fir	*Pseudotsuga menziesii*
Eelgrass	*Zostera marina*
Englemann Spruce	*Picea engelmannii*
Eurasian Watermilfoil	*Myriophyllum spicatum*
Fir	*Abies spp.*
Giant Salvinia	*Salvinia molesta*
Green Ash	*Fraxinus pennsylvanica*
Hackberry	*Celtis occidentalis*
Hardstem Bulrush	*Scirpus acutus*
Hemlock	*Tsuga canadensis*
Hydrilla	*Hydrilla verticillata*
Indian Fleabane	*Pluchea indica*
Loblolly Pine	*Pinus taeda*
Lodgepole Pine	*Pinus contorta var. latifolia*
Longleaf Pine	*Pinus palustris*
Millet	*Echinochloa spp.*
Milo	*Thespesia populnea*
Muskgrass	*Chara spp.*
Naiad	*Najas spp.*
Northern Mannagrass	*Glyceria borealis*
Nuttall Oak	*Quercus texana*
Overcup Oak	*Quercus lyrata*
Paper Birch	*Betula papyrifera*
Pea	*Lathyrus spp.*
Pendantgrass	*Arctophila fulva*
Pickleweed	*Salicornia spp.*
Pine	*Pinus spp.*
Pondweed	*Potamogeton spp.*
Poplar	*Populus spp.*
Potato	*Solanum spp.*
Purple Loosestrife	*Lythrum salicaria*
Rabbitbrush	*Chrysothamnus spp.*
Reed	*Phragmites spp.*
Reedgrass	*Calamagrostis spp.*
Red Mangrove	*Rhizophora mangle*
Rice	*Oryza sativa*
Rush	*Juncus spp.*
Sagebrush	*Artemisia spp.*

Saltgrass	*Distichlis spp.*
Saltmarsh Cordgrass	*Spartina Foliosa*
Sedge	*Cyperus spp.*
Smartweed	*Polygonum spp.*
Shoalgrass	*Halodule wrighti*
Shortleaf Pine	*Pinus echinata*
Sitka Spruce	*Picea sitchensis*
Smooth Cordgrass	*Spartina alterniflora*
Soybean	*Glycine max*
Spike Rushes	*Eleocharis spp.*
Spruce	*Picea spp.*
Subalpine Fir	*Abies lasiocarpa*
Sugar Cane	*Saccharum officinarum*
Tomatoe	*Solanum lycopersicum*
Tupelo	*Nyssa aquatica*
Turtlegrass	*Thalassia testudinum*
Virginia Pine	*Pinus virginiana*
Water Hyacinth	*Eichhornia crassipes*
Water Oak	*Quercus nigra*
Water Sedge	*Carex aquatilis*
Western Hemlock	*Tsuga heterophylla*
Wheat	*Triticum aestivum*
Wheatgrass	*Agropyron spp.*
White Mangrove	*Laguncularia racemosa*
White Spruce	*Picea rubens*
Wigeongrass	*Ruppia maritima*
Wild Celery	*Vallisneria americana*
Willow	*Salix spp.*
Willow Oak	*Quercus phellos*

Crustaceans

Blue Crab	*Callinectes sapidus*
Brine Shrimp	*Artemia spp.*
Brown Shrimp	*Crangon crangon*

Mollusks

Oyster	*Crassostrea spp.*
Zebra Mussel	*Dreissena polymorpha*

APPENDIX V – Glossary of abbreviations and acronyms used in the text.

ACJV	Atlantic Coast Joint Venture
BC	British Columbia
BLM	Bureau of Land Management
CICESE	Centro de Investigación Científica y de Educación Superior de Ensenada (Mexican educational institution)
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWS	Canadian Wildlife Service
CCP	Continental Conservation Plan
DOD	Department of Defense
DNR	Department of Natural Resources
DUC	Ducks Unlimited Canada
DU or DUI	Ducks Unlimited, Inc.
DUMAC	Ducks Unlimited de Mexico
GC	Gulf Coast
GCJV	Gulf Coast Joint Venture
GIS	Geographic Information System
GLSL	Great Lakes-St. Lawrence
ha	hectare
HMDC	Hackensack Meadowlands Development Commission
IAFWA	International Association of Fish and Wildlife Agencies
IWCP	Intermountain Wetland Conservation Program
IWJV	Intermountain West Joint Venture
IWP	Interior Wetlands Program
IWWR	Institute for Wetland and Waterfowl Research
KDWP	Kansas Department of Wildlife and Parks
JVs	Joint Ventures
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDWF	Louisiana Department of Wildlife and Fisheries
LMVJV	Lower Mississippi Valley Joint Venture
MARSH	Matching Aid to Restore States Habitat
MAV	Mississippi Alluvial Valley
MIDNR	Michigan Department of Natural Resources
MVNWR	Monte Vista National Wildlife Refuge
MWC	Montezuma Wetland Complex
NABCI	North American Bird Conservation Initiative
NAWCA	North American Wetlands Conservation Act
NAWMP	North American Waterfowl Management Plan
NF	National Forest
NGOs	Non-government organizations
NGP	Northwestern Great Plains
NP	National Parks
NPR-A	National Petroleum Reserve Area

NPS	National Park System
NRCS	Natural Resource Conservation Service
NWR	National Wildlife Refuge
ODWC	Oklahoma Department of Wildlife Conservation
OLC	Ontario Land CARE
OMWM	Open Marsh Water Management
PLYV	Playa Lakes Joint Venture
PPJV	Prairie Pothole Joint Venture
PPR	Prairie Pothole Region
RAMSAR	UN Convention to protect wetlands of international significance
RBJV	Rainwater Basin Joint Venture
RCP	Northern Rockies and Southern Rockies / Colorado Plateau Region
SAV	Submerged Aquatic Vegetation
SCP	Southeastern Coastal Plain
SGP	Southern Great Plains
SJBP	St James Bay Population
SRO	Southern Regional Office
TIO	Tonawanda-Iroquois-Oak Orchard
UMR/GLRJV	Mississippi River and Great Lakes Region Joint Venture
UNESCO	United Nations Educational Scientific and Cultural Organization
USDA	U.S. Department of Agriculture
USDA NRCS	U.S.D.A. Natural Resources Conservation Service
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBF	Western Boreal Forest
WGCP	West Gulf Coastal Plain
WRP	Wetlands Reserve Program