Midcontinent Shorebird

CONSERVATION INITIATIVE

Strategic Framework






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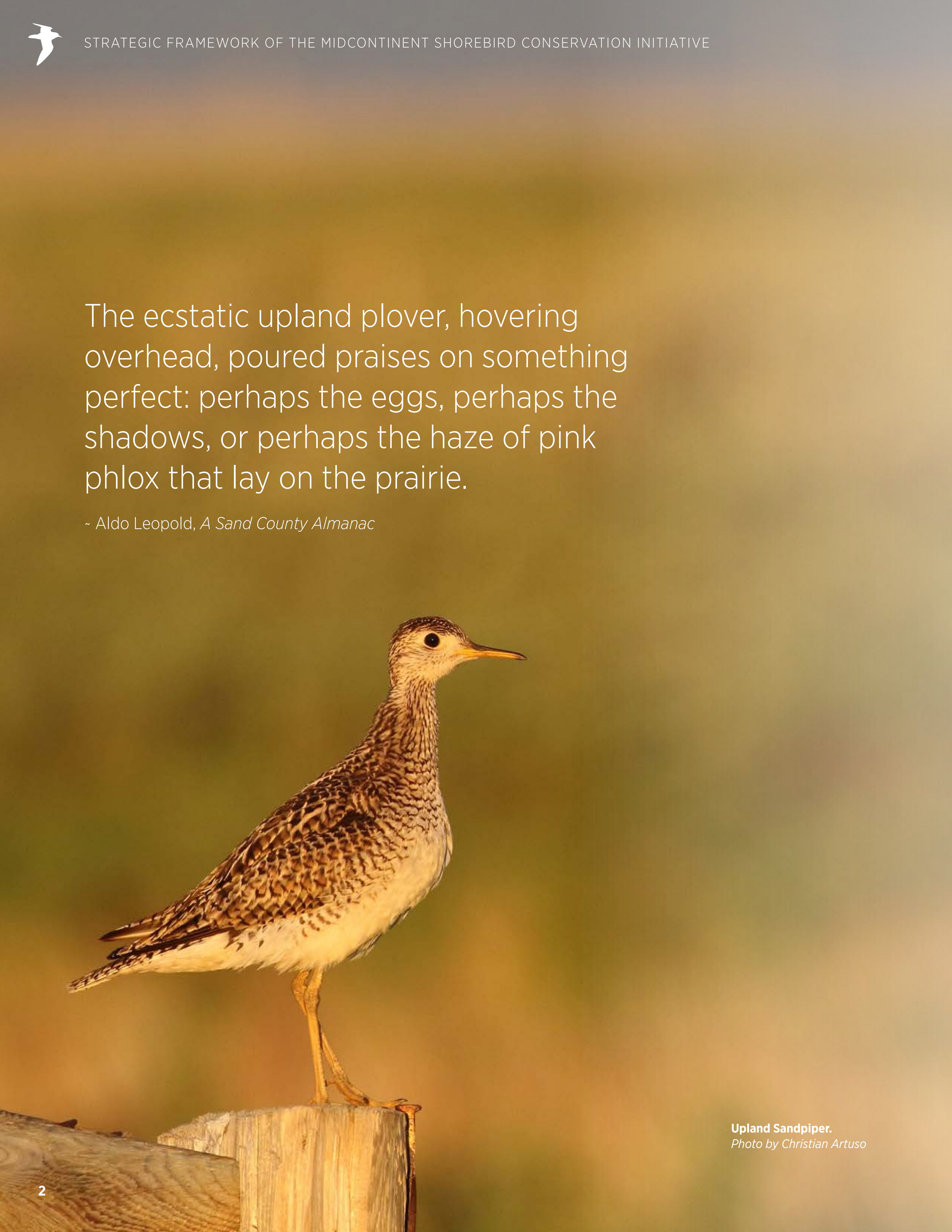


The ecstatic upland plover, hovering overhead, poured praises on something perfect: perhaps the eggs, perhaps the shadows, or perhaps the haze of pink phlox that lay on the prairie.

~ Aldo Leopold, *A Sand County Almanac*

Upland Sandpiper.
Photo by Christian Artuso

PREFACE

Leopold's Upland Plover (now Sandpiper) is exemplary of a group of shorebirds typically found far from shores, yet it is still a "shorebird," one of many dependent on a broad array of habitats throughout the interior of the Americas — the Midcontinent Flyway. Plovers, sandpipers, godwits, curlews, snipes, phalaropes, and more can be found in wetlands, grasslands, and water bodies throughout the Midcontinent, in habitats as diverse as high Andean salares (salt pans), Amazonian riverbanks, the South American Pampas, and the prairies of North America.

Many shorebird species migrate from Arctic breeding grounds to spend the boreal winter in inland or coastal habitats in South America. Others remain in South America year-round, including species that breed in southern South America and migrate north during the austral winter, as well as species that undertake altitudinal and intertropical movements. During their incredible journeys, shorebirds run the gauntlet of anthropogenic threats. In fact, migratory shorebirds are suffering one of the most dramatic declines of any group of birds in the Americas, the result of habitat loss, disturbance, and climate change. The declines are only getting worse, signaling the need for urgent conservation action.

Migratory shorebirds are powerful symbols of hope, endurance, and connection that have inspired human cultures for millennia. Moreover, they are a vital part of ecosystems across the globe, helping to keep nature in balance and acting as sentinels of the health of the ecosystems on which they — and, ultimately, human communities — depend. The challenges to the conservation of shorebirds are great, requiring concerted and coordinated action across borders, whether physical, political, cultural, or language, and connecting local action to global drivers of change.

Shorebird researchers, conservationists, and managers from throughout the Midcontinent Flyway have come together to develop a strategic framework to tackle the conservation issues facing shorebirds throughout their full lifecycles. Presented here, the framework sets conservation targets, identifies the major threats, and prioritizes the strategies and actions required to maintain and restore shorebird populations and the ecosystems on which they depend. Only through investment in this portfolio of strategies and actions will it be possible to conserve this extraordinary group of birds that connects human cultures and endeavors throughout the Americas.

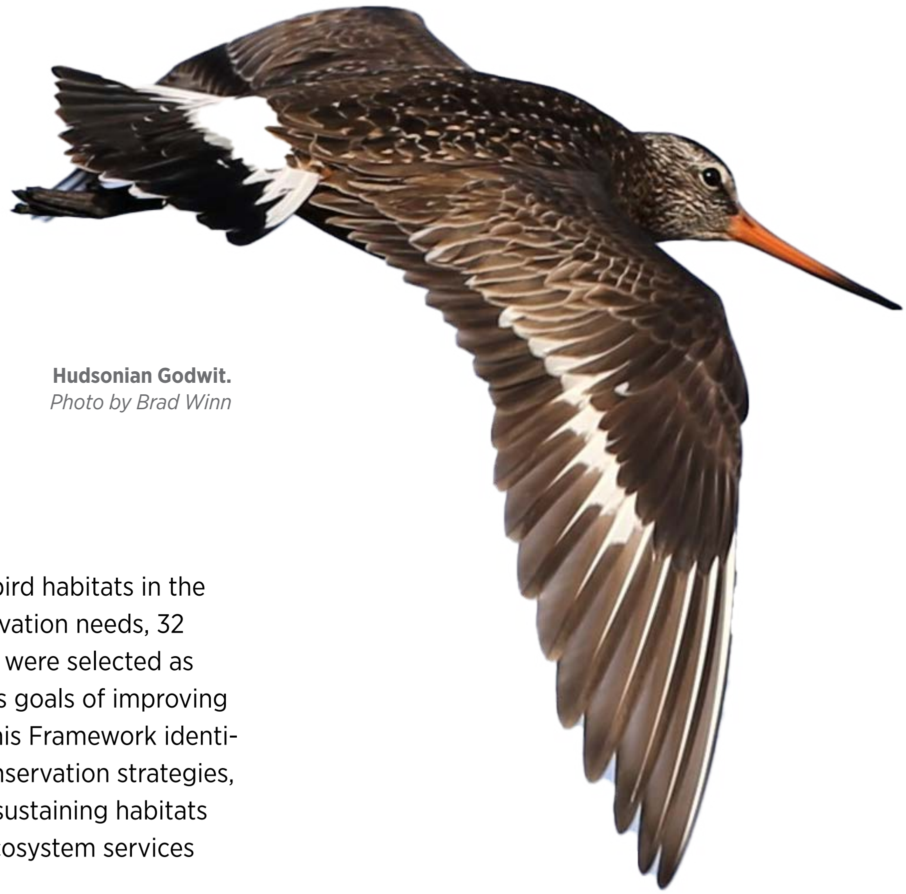
EXECUTIVE SUMMARY

Shorebirds are among the most imperiled bird groups globally, with many populations in the Americas experiencing sharp declines in the last decades. Because many species are long-distance migrants, shorebirds are vulnerable to changes occurring across their annual lifecycles, and their conservation requires a hemispheric approach. The Midcontinent Shorebird Conservation Initiative (MSCI) is the third flyway-scale initiative in the Americas, complementing the work undertaken by the Atlantic Flyway Shorebird Initiative and the Pacific Shorebird Conservation Initiative.

Recognizing the critical role of the Midcontinent Flyway for millions of shorebirds and people, the MSCI Strategic Framework provides a roadmap to guide collaborative, evidence-based conservation actions across vast and dynamic landscapes. The MSCI spans 16 countries across the interior regions of the Americas. In North America, it includes the Arctic and Boreal regions of Canada and Alaska, the Great Plains of Canada through Mexico, and the Mississippi Alluvial Valley to the Gulf of Mexico Coastal Plain. In South America, it covers most of the interior portions of the continent, including grasslands and riverine ecosystems such as the Llanos, Pampas, and the Amazon Basin, as well as the Andes and the Patagonian Steppe.

The Midcontinent Flyway is a mosaic of wetlands, grasslands, agricultural lands, and coastal shorelines that are essential to sustaining shorebirds and people. Along the Flyway, agricultural intensification, wetland degradation, habitat loss, and climate change are prominent factors contributing to shorebird declines. This Framework acknowledges the cultural, ecological, and economic values of shorebirds and their habitats to communities and aims to integrate these considerations into scalable conservation actions.

The Conservation Standards approach is a highly participatory process that was used to develop the MSCI Strategic Framework. Through this process, more than 250 participants engaged in facilitated discussions to organize their knowledge, thoughts, and experiences about shorebird conservation into threats, strategies, objectives, and indicators. This Framework aligns the efforts of diverse parties toward the common goal of safeguarding healthy and resilient populations of shorebirds and their habitats. While this is a hemispheric plan, it supports the implementation of local actions and positions them to address Flyway-scale priorities. Successful conservation outcomes require an integrated approach to conservation by aligning the shorebird conservation objectives with the social and environmental priorities of the governments within the Flyway, as well as other actors such as multilateral development banks and financial institutions, the private sector, and local communities.



Hudsonian Godwit.
Photo by Brad Winn

To represent the breadth of shorebird habitats in the Midcontinent and prioritize conservation needs, 32 shorebird species and populations were selected as conservation targets. To achieve its goals of improving the status of target populations, this Framework identifies the following Flyway-scale conservation strategies, aiming at reducing direct threats, sustaining habitats for shorebirds, and provisioning ecosystem services for people:

- Motivate governments to increase conservation capacity
- Strengthen and catalyze conservation alliances
- Increase incentives for habitat protection, enhancement, and restoration
- Manage existing and acquire new habitats
- Develop, expand, and share beneficial management practices
- Improve knowledge of environmental stressors' effects and address information gaps
- Integrate climate resiliency in conservation planning and implementation
- Build capacity for conservation by raising awareness and boosting education and training
- Sustain the Initiative's leadership and actions at the Flyway scale

The MSCI Framework is the foundation for concerted action by partners throughout the Flyway to address and meet the conservation needs of Midcontinent shorebirds. The Framework is a mechanism to unite partners under shared objectives and share knowledge and insights from western science, Indigenous and Native cultures, and the diverse array of communities and people living and working on these landscapes. In this manner, we can ensure a future where shorebirds and their habitats thrive, supporting the invaluable ecosystem services they provide to communities across the interconnected landscapes of the Americas.

GLOSSARY

Shorebirds feeding and resting in a tidal marsh on the shores of Hudson Bay, Canada. *Photo by Christian Friis*

Agricultural lands	Areas of land primarily used for the cultivation of crops, raising livestock, or other agricultural activities to produce food, fiber, fuel, and other commodities essential for human consumption and economic development. This includes farming, aquaculture, ranching, and small-scale forest plantations.
Alliances	Relationships between interest groups that are made to find win-win situations for all members, in a way that benefits shorebirds and their habitats. For example, an alliance between cattle ranchers, local NGOs, and government agencies can work to identify, incentivize, and implement grazing practices that maximize the profitability of cattle and create shorebird habitat.
Champions	Entities, individuals, or groups of individuals embedded in their communities who can serve as outreach partners, effectively linking communities to conservation experts and practitioners in the region by advocating for the interests of both groups.
Conservation areas	Areas set aside or managed for wildlife, biodiversity, or other natural resource objectives. These may include areas managed for recreational or commercial uses such as grazing or mineral extraction.
Ecosystem services	Benefits humans derive from ecosystems, including provisioning (e.g., food, water), regulating (e.g., climate regulation, water purification), supporting (e.g., nutrient cycling, soil formation), and cultural (e.g., recreational, spiritual) services.
Endemic species	Shorebird species restricted to a particular geographic area — in this case, within the Flyway.
Ephemeral wetlands	Wetlands that hold water only temporarily. Given the diversity of wetland types and nomenclatures in the MSCI geography, this broad term is intended to encompass depressional wetlands, vernal pools, and more.
Extractive industries	Mineral extraction (e.g., mining), hydrocarbon extraction (e.g., oil and natural gas), peat mining, and old-growth commercial forest logging, for example.
Important Bird Area (IBA)	Sites identified as being internationally significant for the conservation of birds and other biodiversity, based on a set of standardised, data-driven criteria.
Key sites	Sites of localized importance to shorebirds, identified based on WHSRN criteria of hosting at least 20,000 individuals and/or 1% of a biogeographic population.
Managed wetlands	Wetlands subject to human intervention or manipulation for various purposes, including wildlife management, agriculture, flood control, water purification, and conservation.
Migratory shorebird species	Shorebird species that regularly undertake seasonal migrations between breeding and non-breeding habitats.

Mitigation	Actions taken to reduce, minimize, or alleviate negative effects to individual shorebirds, shorebird populations, and their habitats.
Nature-based solutions	From the IUCN, "Nature-based Solutions address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefitting people and nature at the same time. They target major challenges like climate change, disaster risk reduction, food and water security, biodiversity loss, and human health, and are critical to sustainable development."
Non-breeding	The part of the lifecycle outside of the breeding and migratory seasons when birds are relatively sedentary. Often described as "wintering," the term is not used here as many long-distance Arctic-breeding migrants "winter" during the austral summer.
Permanent wetlands	Wetlands (managed or natural) that hold water 12 months out of the year. Given the diversity of wetland types and nomenclatures in the MSCI geography, this term is intentionally broad.
Planning unit	Geographical delineations used as a basis for conducting workshops and gathering regional experts to develop and implement the Framework. These were established based on commonality of threats and species. Threats and opportunities for conservation were ranked and identified independently in each unit.
Private landowners and managers	People, non-governmental organizations, companies, or communities (e.g., Ejidos in Mexico) managing lands for (a) economic gains, such as farming, ranching, or ecotourism, or (b) the benefit of wildlife or other conservation purposes (e.g., waterfowl production or biodiversity).
Private sector	Businesses and enterprises without government affiliation.
Protected areas	Sites set aside for wildlife or related purposes, such as National Parks, Provincial Wildlife Areas, or non-governmental sites such as National Audubon sanctuaries.
Public sector	Government entities responsible for policy-making, regulation, and implementation.
Renewable energy	Energy derived from naturally replenishing resources, including wind, solar, hydroelectric, geothermal, and biomass sources.
Resident species	Shorebird species that do not undertake cyclical and predictable movements (migrations) but remain in a particular location or area year-round.
Rightsholders	Individuals or groups who will be directly impacted by a decision or action, usually holding legally protected rights.
Stakeholders	Individuals, groups, or entities with vested interests, rights, or responsibilities in a particular resource, area, or issue.
Theory of change	A series of causally linked assumptions about how actions will help achieve intermediate results and longer-term conservation and human well-being goals.
Western science	Knowledge typically generated in universities, research institutions, and private firms that is transmitted through scientific journals and scholarly books. Some of its central tenets are observer independence, replicable findings, systematic scepticism, and transparent research methodologies with standard units and categories.
WHSRN	The Western Hemisphere Shorebird Reserve Network (WHSRN) is a science-based, partnership-driven conservation initiative for protecting the ecological integrity of the most important sites for shorebirds throughout the Americas.
Working groups	Collaborative teams or committees working on specific aspects of shorebird conservation, composed of experts, stakeholders, and practitioners.
Working landscapes	Ecologically, socially, and economically connected landscapes, often mosaics of diverse land ownership that include subsistence agriculture or commodity production. Activities may include farming, forestry, ranching, and aquaculture.

1. OVERVIEW

Mountain Plover.
Photo by Christian Artuso

1.1 WHY CONSERVE SHOREBIRDS

Shorebirds are a diverse group, including plovers, godwits, sandpipers, seedsnipes, phalaropes, and others, that includes some of the most mobile animals on Earth. In the Americas, many Arctic- and Boreal-breeding species migrate long distances to spend the nonbreeding season in southern South America, where they occupy environments from sea level to the highest elevations in the Andes alongside locally breeding shorebirds and migrants from the south. Unfortunately, shorebird habitats, such as grasslands, wetlands, and beaches, have been altered dramatically over the last century across the Americas and around the world (Newbold et al. 2016, Convention on Wetlands 2021). Shorebirds possess life-history traits that make them especially vulnerable to these alterations. They lay few eggs during nesting attempts, experience a high mortality risk in early life, are exposed to diverse threats during migrations, and tend to congregate in flocks that may contain many thousands of individuals. As a result, shorebirds in North America have lost 37% of their abundance since 1970 (Rosenberg et al. 2019), with the most substantial declines occurring in long-distance migrants (NABCI 2019). In South America, several endemic species with very small populations are also cause for elevated conservation concern. Together, these factors present significant challenges to sustaining shorebird populations and the landscapes they require.

Shorebirds are indicators of environmental change, often integrating the changes taking place in distant locations (Piersma and Lindström 2004). Declines in shorebird numbers and health are early signs of changes that will negatively affect human lives. Conversely, shorebird abundance and diversity are visible signals of fully functioning ecosystems that benefit human well-being. Grasslands in the vast Great Plains of North America and the Pampas of South America still provide habitats for shorebirds and livelihoods for people who grow crops, raise livestock for meat and milk, and make clothing. Functional interior wetlands throughout the Midcontinent, like the Pantanal in South America — the largest tropical wetland in the world — provide ecosystem services such as freshwater, food, water filtration, aquifer recharge, recreation, and flood protection. Wetlands and grasslands also sequester carbon, which helps mitigate the effects of global climate change. Estuarine shorebird habitats, including mangroves, marshes, intertidal flats, river deltas, and sand flats, provide nursing grounds for fisheries, food for human consumption (e.g., shellfish), and recreation. Coastlines and wetlands together provide a network of high-quality habitats for shorebirds crossing the Gulf of Mexico during migration, as well as storm and flood protection for human residents. In addition to reflecting the health of each of these ecosystems, shorebirds are vital for ecosystem functioning; they, disperse aquatic plants and vertebrates and move energy and nutrients among habitats and biomes (Moreira 1997, Green and Elmberg 2014).

Observing shorebirds in their natural environments enriches people emotionally, intellectually, and spiritually, fulfilling the profound need for connection with nature. Shorebirds spark interest in bird-watching tourism, which generates revenue for local economies and has particular value for rural communities. The fantastic journeys of migrant shorebirds inspire visual and performing artists working in various media and disciplines, many of whom share their creations at shorebird festivals in the Copper River Delta, Kachemak, Tofino, Lagoa do Peixe, and beyond. Shorebirds are also deeply tied to cultural identity and heritage. Many Indigenous cultures incorporate shorebirds into their worldviews, and some cultures harvest shorebirds for food. For all these reasons, shorebirds urgently need and deserve our attention. This flyway-scale approach to conservation protects shorebirds and helps ensure that the immeasurable value shorebirdsthey bring to human lives, communities, and ecosystems throughout the Americas is available for future generations.

1.2 FLYWAY-WIDE CONSERVATION

Although the marvelous migrations of shorebirds have been known to western scientists for over a century (Cooke 1910, Wetmore 1927) and longer to Indigenous and other human communities, it was not until the 1980s that conservationists promoted an approach to shorebird research and protection that extended across the Americas and throughout the entire annual cycle of shorebirds (Morrison 1984, Senner and Howe 1984). This recognition led to the development of the Western Hemisphere Shorebird Reserve Network (WHSRN), a voluntary, non-regulatory network of public and private partners working to protect the most important breeding, migratory, and non-breeding habitats for shorebirds across the Americas (Myers et al. 1987; see WHSRN). Subsequently, other international conservation efforts were initiated to benefit shorebirds, such as the African-Eurasian Waterbird Agreement (Boere and Lenten 1998) and the East Asian-Australasian Flyway Partnership (EAAFP 2024; see EAAFP). Matching conservation actions to the scale of the annual cycle of migrant shorebirds continues today with the recent development of flyway-scale conservation frameworks for the Atlantic Americas (AFSI 2015) and Pacific Americas Flyways (Senner et al. 2016). The Midcontinent Shorebird Conservation Initiative (MSCI) covers the (mostly) interior habitats of the Americas between these coastal frameworks, filling the gap for shorebird conservation planning in the Western Hemisphere.

1.3 VISION, GOAL, AND PURPOSE

Vision

Partners working together with diverse human communities throughout the Midcontinent Americas Flyway to benefit shorebirds, their habitats, and humans.

Goal

By 2040, the population status of shorebirds in the Midcontinent Americas Flyway will be improved by reducing direct threats and sustaining shorebird habitats that also provide important ecosystem services and benefits to humans.

Framework Purpose

The purpose of this Framework is to collaboratively identify significant threats to shorebirds and their habitats, develop key conservation strategies, and coordinate actions necessary for their maintenance and restoration. Recognizing the diverse human communities across the Midcontinent Americas Flyway, this effort seeks to equitably integrate their needs while advancing conservation goals.

Urgent, coordinated action is required at all scales to improve shorebird populations and habitats. Proactive efforts now can prevent the need for more drastic and costly interventions in the future. Many shorebird populations — and the habitats they rely on — are nearing a critical tipping point. Swift, decisive action is essential to ensure that future generations can experience, enjoy, and benefit from these invaluable natural resources.

1.4 CONSERVATION PLANNING PROCESS

An initial workshop was conducted in 2019 at the Western Hemisphere Shorebird Group Meeting in Panama to define the geographic scope of the Midcontinent Americas Flyway, set conservation targets, and start identifying major threats. The governance mechanism and process for developing the MSCI Framework were also established.

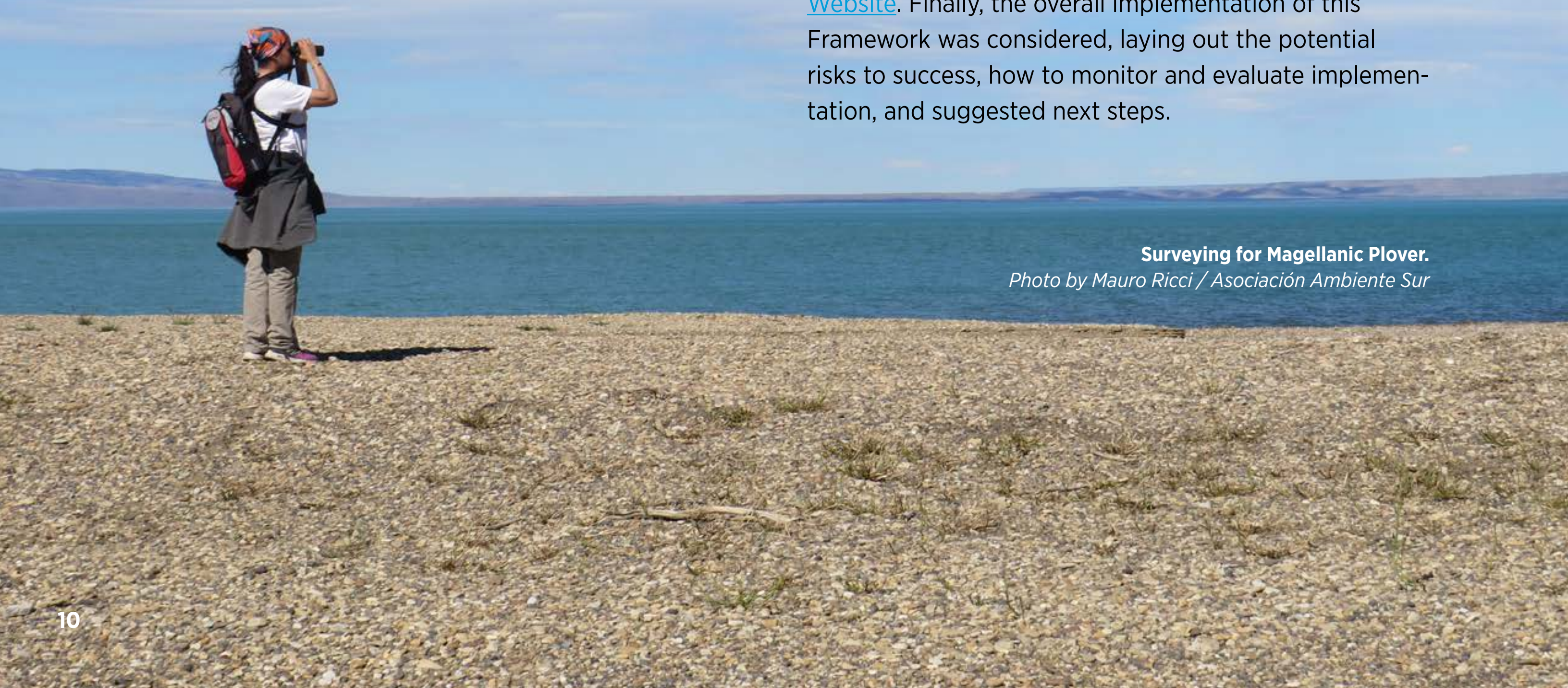
The Open Standards for the Practice of Conservation (hereafter, Conservation Standards; CMP 2020) was used to develop the MSCI Framework, including the Miradi™ software package (Miradi). The Conservation Standards process provides a common lexicon (e.g., Direct Threats and Actions Classification 2.0) and a logical sequence for developing results-oriented actions that address threats to defined conservation targets. It is used by numerous organizations for conservation planning on local to international scales and follows an adaptive management approach (see Appendix 1). Conservation Standards also incorporates human well-being and ecosystem services directly into conservation planning. The MSCI Framework was informed by the results of the Conservation Standards process used with partners throughout the Flyway.

Embarking on Flyway-scale conservation for shorebirds requires engaging partners and communities across the Western Hemisphere. Three general regions — the Arctic and Boreal, Temperate North America, and South America — were identified for the Midcontinent Americas Flyway. These regions were further divided into planning units to serve as a basis for conducting workshops and gathering information from experts and stakeholders. Concurrently, a set of target shorebird species was identified to represent the full suite of shorebirds and habitats within the Flyway. Shorebird habitats were also included as a conservation target because they are required to support shorebird populations and they link conservation with human well-being.

Through a series of regional planning unit workshops held virtually in North and South America in 2020, 2021, and 2022, partners from diverse organizational backgrounds contributed their knowledge of shorebird biology, habitat management, and the human communities within their planning units toward the development of the MSCI Framework (see Appendices 1 and 2). Stakeholders with expertise in habitat delivery, engagement with private landowners, and other disciplines not directly related to shorebirds but impacting shorebird habitats were also invited to participate in regional workshops.

At planning unit workshops, participants identified threats to shorebird populations and their habitats and the key factors that contribute to or mitigate these threats. These elements were used to build a model of the environmental, social, and political situations facing shorebirds across the Flyway. Participants then developed a set of strategies at key intervention points and generated theories of change (i.e., results chains) to describe how implementing the strategies will improve the status of shorebirds and their habitats and positively affect human well-being. Setting objectives within theories of change helps focus later efforts to monitor and evaluate conservation strategies.

To further develop Flyway-scale strategies, partners from all planning units participated in a series of virtual workshops in 2023. This MSCI Framework is based on the synthesized results of both the regional and Flyway-level workshops. The detailed planning unit and regional assessments and results will be available on the MSCI Website. Finally, the overall implementation of this Framework was considered, laying out the potential risks to success, how to monitor and evaluate implementation, and suggested next steps.



Surveying for Magellanic Plover.
Photo by Mauro Ricci / Asociación Ambiente Sur

2. GEOGRAPHIC SCOPE

Stilt Sandpiper.
Photo by drferry / iStock

The MSCI Framework focuses on the interior (i.e., central) areas of North and South America and coastal regions of the western Gulf of Mexico, defined as the Midcontinent Americas Flyway. The Midcontinent Americas Flyway (Figure 1) spans 135 degrees of latitude from Arctic Canada to the steppes of Patagonia, encompassing portions of the Americas that were not addressed in the Atlantic Flyway Shorebird Initiative business plan (AFSI 2015) or the Pacific Shorebird Conservation Initiative (PSCI) strategy (Senner et al. 2016). In Central America, the Atlantic Ocean coast (Belize to Panama) is included in the AFSI and the Pacific coast (Mexico to Panama) in the PSCI. Within the MSCI Framework's scope, 16 countries are represented (listed south to north): Chile, Argentina, Uruguay, Brazil, Paraguay, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana, Suriname, France (French Guiana), Mexico, the United States of America (U.S.), and Canada.

FIGURE 1. Geographic extent of the Midcontinent Americas Flyway in North and South America.
Map Credit: David Díaz Fernández.

Disclaimer: The designation of geographical entities and the presentation of material in this document do not imply any opinion by the authors or participating organizations regarding the legal status of any country, territory, or area, its authorities, or the delimitation of its frontiers or boundaries. The views expressed in this publication do not necessarily reflect those of participating organizations.

Given the size of the Midcontinent Americas Flyway, North and South America were each divided into multiple planning units, which served as the basis for Conservation Standards (CMP 2020) workshops. These planning units, as delineated in Figure 2, are not intended to limit the geographic extent of potential shorebird habitats in the Midcontinent Flyway.

In North America, the delineation of planning units was mostly based on Bird Conservation Regions (BCR). For the Arctic and Boreal planning unit, coastal areas in Alaska that were already included in the Pacific Americas Flyway were excluded (Figure 1). Temperate North America was divided into three major planning units: the Great Plains, the Mississippi Valley and Great Lakes, and the Gulf of Mexico Coastal Plain (Figure 2). In the U.S., the western boundary of the Midcontinent Americas Flyway corresponds with the western edge of the administrative boundary of the Central Flyway Council, and its eastern boundary is generally the eastern boundary of the Mississippi Flyway Council (U.S. Fish and Wildlife Service, Natural Resource Program Center 2017). Within this area, the MSCI geographic scope was adjusted slightly by Bird Conservation Region boundaries, and upland forested ecosystems that provide little migrant shorebird habitat were removed.

Central America was largely excluded from the onset of the planning process. While its Pacific and Atlantic coasts are (or planned to be) included in other flyway initiatives, the interior habitats were omitted due to their small relative size and less intensive use by shorebirds. This could be reviewed in the future as new information becomes available about the use of the interior portion of Central America by Midcontinent shorebirds.

South America was divided into four major planning units based on ecological classification (Griffith et al. 1998, Dinerstein et al. 2017) and similarities in species, threats, and landscapes: Northern Andes, Grasslands and Associated Wetlands, the Amazon, and Central-Southern Andes/Patagonian Steppe (Figure 2). As in North America, forested ecosystems that provide less shorebird habitat were generally removed.

Prairie pothole wetlands in South Dakota, U.S.
Photo by PatrickZiegler / iStock

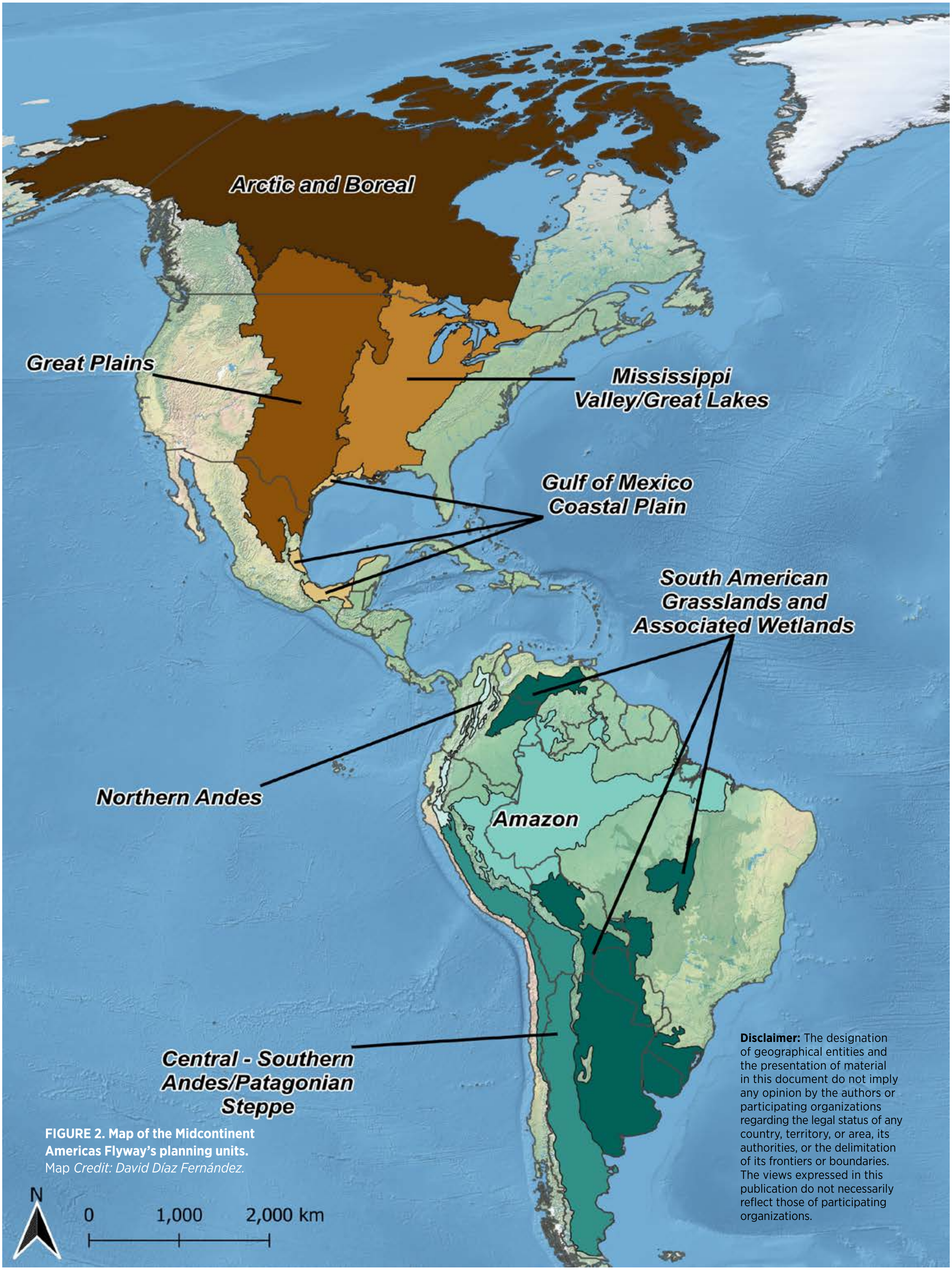


FIGURE 2. Map of the Midcontinent Americas Flyway's planning units. Map *Credit: David Díaz Fernández.*

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2.1 NORTH AMERICA

Arctic and Boreal

The Arctic and Boreal regions of Canada and Alaska provide breeding grounds for many shorebirds that use the Flyway. Breeding shorebirds respond to variability in wetness and shrub density across this vast region. Many species nest in the sedge/grass and dwarf-shrub tundra of northern Canada and Alaska (e.g., White-rumped Sandpiper), and some species nest in sparsely vegetated alpine areas (e.g., American Golden-Plover), glacially formed eskers (e.g., Red Knot), and coastlines (e.g., Ruddy Turnstone). Muskegs and other wetlands in the boreal forest and at the boreal-Arctic transition zone provide breeding habitat for Hudsonian Godwit, Lesser Yellowlegs, and Red-necked Phalarope, among other focal species. Coastal shorelines and inland wetlands can support large numbers of shorebirds during post-breeding staging and migration. Virtually all shorebirds leave this region in the non-breeding season.

Great Plains

The Great Plains extends from northern Mexico through the central U.S to south-central Canada. Grasslands, saline lakes, and wetlands in this region vary across gradients of precipitation, elevation, and latitude, which influences habitat use by breeding and migrant shorebirds. Native grasslands and grassland-wetland complexes support many breeding species, from Upland Sandpiper and Long-billed Curlew in drier areas to Marbled Godwit, Willet, and Wilson's Phalarope in grasslands interspersed with shallow wetlands. Piping Plover and Snowy Plover nest along major rivers and in alkali wetlands. Migrant shorebirds also use a gradient of grasslands and wetlands, with American Golden-Plover and Buff-breasted Sandpiper favoring drier grasslands and agricultural fields, while Hudsonian Godwit, Stilt Sandpiper, and Pectoral Sandpiper favor natural and managed wetlands and flooded agricultural fields. Wetlands, agricultural lands, and grasslands in the southern part of the region support temperate-breeding species, such as the Mountain Plover, during the non-breeding season.

Mississippi Valley/Great Lakes

This region, extending from southern Canada south, almost to the Gulf of Mexico, provides diverse and important habitats for shorebirds, especially migrants. The Mississippi Valley experiences dynamic climatic conditions, from floods to droughts, making habitat conditions for shorebirds less predictable when compared to conditions in the Great Lakes. During migration, natural and managed wetlands, river floodplains, forested wetlands, reservoirs, and flooded agricultural fields support migrants such as American Golden-Plover and Lesser Yellowlegs. Wetlands, grasslands, and Great Lakes shorelines provide nesting habitat for Wilson's Snipe, Upland Sandpiper, and Piping Plover. In the southern part of the region, shallow-water wetlands and flooded agricultural lands support substantial numbers of non-breeding shorebirds.

Gulf of Mexico Coastal Plain

The Gulf of Mexico Coastal Plain extends in the U.S. from Alabama through Texas to Tabasco and the Yucatan Peninsula in Mexico and is the only marine coastal region in the Midcontinent Americas Flyway. Grasslands, agricultural lands, coastal marshes, tidal flats, beaches, brackish lagoons, and mangrove forests provide habitats for breeding, migrant, and over-wintering shorebirds. Wilson's and Snowy Plover nesting along beaches and estuarine sand flats are joined in the boreal winter by Piping Plover, Red Knot, and Western Sandpiper; coastal saltmarshes support migrant Whimbrel and Willet. The irrigated agricultural areas and managed and natural wetlands of southeast Texas and southwest Louisiana provide important migration and non-breeding habitat for species such as Hudsonian Godwit, Pectoral and Stilt Sandpiper, Least Sandpiper, Long-billed Dowitcher, and Lesser Yellowlegs. In Mexico, mangrove-fringed wetlands provide migration and non-breeding habitat for many shorebird species.

2.2 SOUTH AMERICA

Northern Andes

This region extends from western Venezuela south to northwestern Peru. Swamps, marshes, and *ciénegas* (spongy wetlands associated with seeps or springs) occur in the lower, northern part of the region, along with agricultural lands. The Northern Andes have higher precipitation and primary productivity than the Central-Southern Andes. Wetlands in the Northern Andes support migrant and non-breeding Stilt and Pectoral Sandpiper. Moist mountain cloud forests and bogs in the transition zone to the páramo (an ecosystem composed mainly of giant rosette plants, shrubs, and grasses) support several resident snipe species, including Imperial, Jameson's, and Noble Snipe. Resident Rufous-bellied Seedsnipe nest above the treeline in the páramo.

South American Grasslands and Associated Wetlands

This discontinuous planning unit extends from Venezuela to Argentina and includes the Orinoco Llanos and savannas of the Guianan Highlands, the Beni Savanna, the Araguaia Depression and Pantanal, portions of the Gran Chaco, and the Pampas. These landscapes share the feature of having seasonally flooded grasslands interspersed with shrublands, palm savannas, temporary and permanent wetlands, rivers, and gallery forests. Portions of the planning unit in the south are drier than those in the north, including those closer to the crest of the Andes; agricultural lands are present in these drier parts of the planning unit. Migrant shorebirds from North America use grasslands (e.g., American Golden-Plover, Upland Sandpiper, and Buff-breasted Sandpiper) and flooded agricultural lands and wetlands (e.g., Pectoral Sandpiper, Lesser Yellowlegs, and Stilt Sandpiper) during the non-breeding season, where they join resident breeding shorebirds (e.g., Collared Plover, Pied Lapwing, and South American Painted Snipe) and austral migrants (e.g., Tawny-throated Dotterel).

Amazon

This region is the basin of the Amazon River, stretching from the lowland forests in southwestern Venezuela and eastern Colombia to Ecuador, northern Bolivia, and Peru, almost to the mouth of the river in Brazil. Much of the region is forested, and use by migrant shorebirds (e.g., Hudsonian Godwit, Buff-breasted Sandpiper) is restricted mainly to wetlands and sandbars associated with the Amazon River and its tributaries. Seasonal flooding can increase migrant shorebird habitat in less forested areas of the region. Because of the difficulty of access, information on shorebird use during migration is limited. Some shorebird species, such as the Pied Lapwing and Collared Plover, breed in the wet grassland and marshes of the region.

Central-Southern Andes/Patagonian Steppe

This region includes the high Andes of central and southern Peru, Bolivia, Chile, and Argentina, as well as the broad, dry plains in the rain shadow of the Andes in Chile and Argentina. Wet, temperate Andean forests in the southern portion of the region are the breeding grounds of the little-known Fuegian Snipe. Above the treeline, Gray-breasted Seedsnipe breed in puna grasslands (characterized by grasses, herbs, lichens, mosses, ferns, and shrubs), Puna Snipe nest in riverine wetlands, and Diademed Sandpiper-Plover breed in small wetlands in mountain valleys. Large saline lakes of the central Andes provide habitat for migrant and non-breeding Wilson's Phalarope and Baird's Sandpiper and breeding Andean Avocet and Puna Plover. Lower elevation saline wetlands in the shrub-dominated Patagonian Steppe are critical for nesting Magellanic Plover; Tawny-throated Dotterel and Rufous-chested Dotterel nest on the shrubby plains.

2.3 IMPORTANT SITES AND LANDSCAPES

Given the congregatory behavior of many shorebird species, identifying key shorebird sites is important for planning conservation efforts. The list of key sites for the Midcontinent Flyway is based on shorebird data from a variety of sources, including published literature, eBird, census data (i.e., Neotropical Waterbird Census, Caribbean Waterbird Census, Central American Waterbird Census), global and national Important Bird Area (IBA) factsheets, and more (Appendix 3). The WHSRN criteria were applied to identify key sites, the minimum being a site holding 20,000 shorebirds or 1% of the biogeographic population of a species. All sites can be found on the WHSRN Important Shorebird Sites in the Americas map, which allows for nominating new sites if available data shows they meet the WHSRN criteria. The list of key sites in the Midcontinent has been compiled over the past two decades and is not exclusive. It includes 200+ sites that meet the population criteria for WHSRN designation, though not all are yet WHSRN-designated sites. While these sites are a good starting point, current information on shorebird habitat use is lacking for some areas and species, especially in South America and for South American endemics. Additional work is needed and will likely lead to the identification of more key sites.

However, key sites that support large congregations of shorebirds will be insufficient to achieve species recovery targets in the Midcontinent Americas Flyway. Some focal species of the Midcontinent do not congregate in large numbers. Instead, they occupy dispersed sites in landscapes that are now predominantly used by people (e.g., croplands and rangelands). These sites may be ephemeral and vary in location from year to year, depending on conditions (Skagen et al. 2008). These focal species include the American Golden-Plover, Lesser Yellowlegs, and Buff-breasted, Pectoral, and Upland Sandpiper. These species and others depend on wetlands and upland habitats within historical grassland biomes of the Flyway. Most areas that historically supported native grasslands are now under private ownership or management (CEC 2015, Edwards et al. 2022). These "working landscapes" have significant implications for shorebird conservation. Working landscapes are cohesive units of land that are ecologically, socially, and economically connected, often characterized by mosaics of diverse land ownership (Rangelands Gateway 2022). Commodity production and subsistence agriculture play critical roles in the ecological, social, and economic fabric of these landscapes.

Mono Lake in California, U.S.
Photo by Fundación Líderes de Ansenuza

Within working landscapes, patches of habitat play a vital role in conservation (Garibaldi et al. 2021). However, the dispersed and dynamic nature of these sites, combined with their diverse management and ownership regimes, presents unique challenges. Grasslands evolved under cycles of natural disturbances such as fire, flooding, and grazing, which historically maintained a mosaic of bare earth, ephemeral water, and grasses of varying heights. In the Midcontinent, many of these natural disturbance regimes have been suppressed (e.g., through canalization, damming of waterways, fire suppression, and the loss of native grazers) or significantly altered (e.g., wetland drainage, overgrazing, and mismanaged livestock grazing). Despite these changes, working landscapes offer opportunities for large-scale conservation, as landowners and managers frequently apply alternative forms of disturbance to sustain these landscapes. Practices such as irrigation, sustainable cattle grazing, and prescribed fire can create or maintain the habitat conditions that grassland shorebirds need. Conservation efforts can be designed to align these management practices with the needs of both producers and shorebirds, ensuring ecological and economic benefits.

At the same time, because working landscapes are primarily oriented toward commodity production, they are particularly vulnerable to the boom-and-bust cycles of markets. Effective conservation strategies should take into account economic volatility and resource constraints that could threaten livelihoods. Additionally, conservation efforts should seek to counteract agricultural intensification, which not only degrades shorebird habitat but erodes biodiversity, traditional livelihoods, and cultural values.

Integrating shorebird conservation into working landscapes will be central to this Framework's implementation. While priority sites and areas are still being identified, many will be located in the most agriculturally productive regions of the Americas, including the Prairie Pothole Region, the Gulf of Mexico coastal plain, and the Mississippi Alluvial Plain in North America, as well as the Gran Chaco, the Pampas, and the Llanos grasslands of Colombia, Venezuela, and Bolivia in South America.

Laguna Mar Chiquita, Argentina.
Photo by Fundación Líderes de Ansenuza

3. CONSERVATION TARGETS

Baird's Sandpiper.
Photo by Shiloh Schulte

3.1 FOCAL SPECIES AND POPULATIONS

To establish conservation targets for the MSCI, 40 focal shorebird species or populations were selected to represent the breadth of shorebird habitats and conservation needs in the Midcontinent. Focal species or populations meet one or more of the following criteria: 1) representative of specific habitat types; 2) of conservation concern; 3) mainly restricted to the Flyway; 4) likely to benefit from management or conservation actions; and 5) to a lesser degree, considered in other planning efforts, such as national shorebird plans.

A focal conservation species or population may include a full species (e.g., Diademed Sandpiper-Plover, Pectoral Sandpiper), a specific subspecies (e.g., Ecuadorian Rufous-bellied Seedsnipe), a recognized portion of a species or subspecies (e.g., Great Plains-breeding Marbled Godwit), or a species group (e.g., South American Endemic Snipes).

In addition, to represent the variety of ways shorebirds use the Flyway, focal species and populations were selected to represent different migratory strategies: long-distance migrants traveling between North and South America (Table 1), and short-distance migrants or residents in North America (Table 2) or South America (Table 3).

Lesser Yellowlegs.
Photo by Christian Friis

Wilson's Phalarope.
Photo by Monica Iglecia

TABLE 1. Long-distance migrant focal species and their population status.

English Name	Population	Total Population				Max in Midcontinent[4]	
		Estimate[1]	Certainty/Range	IUCN Red List Status[2]	Trend[3]	%	Population
American Golden Plover	*Pluvialis dominica*	500,000	500,000-6,000,000	NT	SLD	90%-100%	500,000
Upland Sandpiper	*Bartramia longicauda*	750,000	100-150% of estimate	LC	STA	100%	750,000
Hudsonian Godwit	*Limosa haemastica*	77.000	75-125% of estimate	LC	SLD	UNK	UNK
Stilt Sandpiper	*Calidris himantopus*	1,200,000	800,000-1,250,000	NT	MOD	70%-80%	820,000
Baird's Sandpiper	*Calidris bairdii*	300.000	300,000-1,500,000	LC	STA	85%	250,000
Buff-breasted Sandpiper	*Calidris subruficollis*	56.000	56,000-760,000	VU	SLD	100%	56,000
Pectoral Sandpiper	*Calidris melanotos*	1,600,000	1,220,000-4,760,000	VU	SLD	95%	1,581,000
Wilson's Phalarope	*Phalaropus tricolor*	1,000,000	100-150% of estimate	LC	UNK	95%	1,350,000
Lesser Yellowlegs	*Tringa flavipes*	420,000(1a)	perhaps >150% of estimate	VU	SLD	80%	335,000

Footnotes for tables 1-3

[1] Population estimate refers to continental population size unless denoted in the population column as a subspecific or regional population estimate. Population estimates of North American species follow BirdLife International (2025), Partners in Flight (2024), Andres et al. (2012) and B. Andres (unpubl. data) except for: 1a COSEWIC (2020), 1b COSEWIC (2021), 1c COSEWIC (In press),. *Population estimate for Short-billed Dowitcher is for *hendersoni/griseus* subspecies combined. Population estimates for South America species follow BirdLife International (2025) and Lesterhuis et al. (in prep.).

[2] Refers to the global population IUCN Red List Status Version 2024-2. LC = Least Concern, NT = Near Threatened, VU = Vulnerable.

[3] Population trend refers to global population trend unless denoted in the population column as a subspecific or regional population estimate. Trends follow BirdLife International (2025), Smith et al. (2023), Andres et al. (2012) and B. Andres (unpubl. data). SLD = significant large decrease, MOD = moderate to possible large decrease, UNK = uncertain change to small decrease, STA = stable to small increase, SLI = Significant large increase

[4] Highest seasonal abundance of a species occurring in the Midcontinent Flyway expressed as a percentage of the continental population and highest seasonal abundance.

TABLE 2. North American short-distance migrant and resident focal species and their population status.

English Name	Population	Total Population				Max in Midcontinent[4]	
		Estimate[1]	Certainty/Range	IUCN Red List Status[2]	Trend[3]	%	Population
Snowy Plover (Interior/Gulf Coast)	*Anarhynchus nivosus nivosus (Interior)*	22,900	95% = 16,600-29,200	NT	SLD	50%	11,100
Wilson's Plover (U.S./Mexico breeding)	*Anarhynchus wilsonia wilsonia (U.S./Mexico breeding)*	14,100	13,500–14,650	LC	MOD	60%-75%	10,600
Piping Plover (Great Lakes)	*Charadrius melodus circumcinctus (Great Lakes)*	147	5-year range = 140-152	NT	SLI	100%	147
Piping Plover (Great Plains)	*Charadrius melodus circumcinctus (Great Plains)*	3,500	100-150% of estimate	NT	UNK	100%	3,500
Mountain Plover	*Anarhynchus montanus*	20,000	100-150% of estimate	NT	SLD	90%-95%	17,500
Long-billed Curlew	*Numenius americanus*	140,000	90% = 98,000-198,000	LC	MOD	60%-75%	100,000
Marbled Godwit (Great Plains breeding)	*Limosa fedoa fedoa (Great Plains breeding)*	170,000	100-150% of estimate	VU	MOD	100%	170,000
Marbled Godwit (James Bay breeding)	*Limosa fedoa fedoa (James Bay breeding)*	2,000	100-150% of estimate	VU	UNK	100%	2,000
Red Knot (Atlantic)	*Calidris canutus rufa*	37,000(1b)	estimated 32,000–45,000	NT	SLD	15%	6,000
Red Knot (Pacific)	*Calidris canutus roselaari*	22,000(1b)	95% = 16,200–30,300	NT	SLD	<5%	1,000
Western Sandpiper	*Calidris mauri*	3,500,000	75-125% of estimate	LC	UNK	<5%	130,000
Short-billed Dowitcher	*Limnodromus griseus hendersoni*	< 78,000(1c)*	UNK	VU	SLD	UNK	UNK

American Golden-Plovers in a field.
Photo by Monica Iglecia

TABLE 3. South American short-distance migrant and resident focal species and their population status.

English Name	Population	Total Population				Max in Midcontinent[4]	
		Estimate[1]	Certainty/Range	IUCN Red List Status[2]	Trend[3]	%	Population
Magellanic Plover	*Pluvianellus socialis*	330	250-1,000	NT	STA	100%	330
Andean Avocet	*Recurvirostra andina*	7,750	75-125% of estimate	LC	STA	100%	7,750
Tawny-throated Dotterel	*Oreopholus ruficollis*	21,300	75-125% of estimate	LC	MOD	100%	5,000
Two-banded Plover	*Anarhynchus falklandicus (mainland)*	133,000	46,000-139,000	LC	STA	>50%	66,500
Diademed Sandpiper-Plover	*Phegornis mitchellii*	3,300	1,500-7,000	NT	MOD	100%	3,300
Rufous-bellied Seedsnipe (Ecuadorian)	*Attagis gayi latreillii*	500	350-650	LC	UNK	100%	500
Rufous-bellied Seedsnipe (Simon's)	*Attagis gayi simonsi*	6,600	4,550-8,450	LC	UNK	100%	6,600
Rufous-bellied Seedsnipe (Southern)	*Attagis gayi gayi*	4,500	3,150-5,850	LC	UNK	100%	4,500
Gray-breasted Seedsnipe (Inga's)	*Thinocorus orbignyianus ingae*	10,000	6,500-12,100	LC	UNK	100%	10,000
Gray-breasted Seedsnipe (d'Orbignyianus)	*Thinocorus orbignyianus orbignyianus*	15,000	9,750-18,050	LC	UNK	100%	15,000
Endemic South American Snipes (*Gallinago ssp.*)							
Imperial Snipe	*Gallinago imperialis*	4,500	2,100-5,400	NT	MOD	100%	4,500
Jameson's Snipe	*Gallinago jamesoni*	6,500	75-125% of estimate	LC	UNK	100%	6,500
Fuegian Snipe	*Gallinago stricklandii*	3,750	2,500-10,000	NT	MOD	100%	3,750
Noble Snipe	*Gallinago nobilis*	4,850	2,500-15,000	NT	MOD	100%	4,850
Giant Snipe (Wavy)	*Gallinago undulata undulata*	12,700	75-125% of estimate	LC	MOD	100%	12,700
Giant Snipe (Giant)	*Gallinago undulata gigantea*						
Pantanal Snipe	*Gallinago paraguaiae*	100,000	75-125% of estimate	-	STA	100%	100,000
Magellanic Snipe	*Gallinago magellanica (mainland)*	40,000	100-150% of estimate	-	STA	100%	40,000
Puna Snipe	*Gallinago andina*	9,000	75-125% of estimate	LC	STA	100%	9,000

3.2 OTHER CONSERVATION TARGETS: HUMAN WELL-BEING AND CO-BENEFITS

The conservation of shorebird habitats along the Midcontinent Americas Flyway supports vital ecosystem services that maintain and improve the quality of life and well-being in the human communities that share the landscape. The Millennium Ecosystem Assessment (2005) identified four categories of ecosystem services: 1) provisioning (e.g., food, water, timber, and fiber); 2) regulating (e.g., climate, floods, disease and waste control, and water quality); 3) cultural (e.g., recreational, aesthetic, and spiritual benefits); and 4) supporting (e.g., soil formation, carbon sequestration, photosynthesis, and nutrient cycling). While the MSCI Framework is first and foremost driven by biological conservation targets (i.e., shorebirds and their habitats), achieving target objectives is nonetheless intrinsically linked to maintaining ecosystem services and supporting human well-being. Successful efforts to preserve and restore ecosystems through the MSCI Framework will also contribute to the Sustainable Development Goals (United Nations 2023). Across the Framework workshops, participants identified at least 20 ecosystem services provided by shorebird habitats, including six services provided directly by shorebirds (Table 4).

Additionally, six human well-being targets were identified:

1. Enabling community engagement in conservation
2. Improving sustainable livelihoods (including maintaining traditional ways of life)
3. Offering recreational and tourism opportunities
4. Providing access to clean water
5. Granting security from natural disaster
6. Supporting mental, emotional, physical, and spiritual health

Although these targets do not have their own theories of change, they were included in the Flyway's situational model and linked to specific conservation strategies.

TABLE 4. Ecosystem services provided by shorebirds and their habitats in the Midcontinent Americas Flyway, as defined by workshop participants.

Category	Ecosystem Service	Shorebird Habitats	Shorebird Populations
Provisioning	Water	x	
	Raw materials	x	
	Livestock grazing	x	
	Food	x	x
Regulating	Flood control	x	
	Carbon sequestration	x	
	Nutrient retention	x	
	Pest control		x
	Water filtration	x	
	Climate regulation	x	
	Aquifer recharge	x	
	Water storage	x	
Cultural	Spirituality	x	x
	Artistic inspiration	x	x
	Tourism	x	x
	Recreation	x	x
Supporting	Primary production	x	
	Species habitat	x	
	Biodiversity	x	x
	Water cycle	x	
	Nutrient cycle	x	x

Shorebirds using cattle pastures.
Photo by Monica Iglecia

Lesser Yellowlegs.
Photo by Alan Kneidel

4. THREATS

Seven major threats to shorebirds and their habitats were identified at the Flyway scale (Table 5). Threats were systematically evaluated using the Level 2 threat categories from the Conservation Standards lexicon (CMP 2020). Within each planning unit, workshop participants assessed threat scope, severity, and irreversibility, as defined by the Conservation Standards (Appendices 7 and 8). Assessment scores were combined in the Miradi software to generate a final ranking (low, medium, high, or very high) for each threat. Major threats were designated as those with a "high" or "very high" ranking in at least one planning unit. A Flyway-wide rating was subsequently assigned to each major threat based on the highest threat ranking from any planning unit (Table 5). Given the large spatial scale of the Midcontinent Americas Flyway, threat scoring varied across the Flyway's planning units, and a more detailed threat assessment at the planning unit level is presented in Appendices 7 and 8.

The initial threats assessment was conducted through facilitated virtual Conservation Standards workshops across all planning units between October 2020 and April 2021. Since then, developments across the Flyway — including improvements in our understanding of key issues and their potential impacts on shorebirds and their habitats — have taken place. If reassessed today, threat rankings might differ, though the primary threats at the Flyway scale would likely remain unchanged. To account for emerging threats, this Framework includes a section addressing significant risks to shorebirds and their habitats that were not evaluated during the initial workshops.

TABLE 5. Ratings of the seven major Flyway threats by region and planning unit.

Major Threat	Arctic/Boreal		Temperate North America			South America				Flyway-wide rating
	Arctic	Boreal	Great Plains	Mississippi Valley/ Great Lakes	Gulf of Mexico Coastal Plain	Northern Andes	Grasslands & Associated Wetlands	Amazon	Cen.-So. Andes/ Patagonian Steppe	
Climate change	Very High	High	Medium	Medium	Very High	Very High	Very High	Very High	High	Very High
Habitat conversion and incompatible agricultural practices	Negligible	Negligible	High	Medium	High	High	Very High	Medium	Medium	Very High
Incompatible water management	Negligible	Low	High	Medium	High	High	Very High	High	Medium	Very High
Residential and commercial development	Negligible	Negligible	Medium	Medium	High	High	Medium	Low	Low	High
Oil, gas, and mining	Low	Low	Medium	Negligible	Medium	High	Low	High	Medium	High
Fire management and suppression	Negligible	Medium	Low	Low	Negligible	Medium	High	Medium	Low	High
Incompatible livestock ranching practices	Negligible	Negligible	Low	Negligible	Low	High	Medium	Medium	High	High

4.1 CLIMATE CHANGE

Human-induced climate change is a global threat to shorebirds, ecosystems, and people. Within the Midcontinent Americas Flyway, climate change was ranked the highest threat to shorebirds and their habitats in all three regions, with a rank of "very high" to "high" in seven of nine planning units (Table 5).

Because many of the focal shorebird species in the Flyway are migratory, climate change threatens their survival at various locations. Climate change will very likely exacerbate the pressures on shorebird populations and their habitats by 1) reducing the quantity and quality of habitats used throughout their annual cycles, 2) altering food availability and quality, 3) increasing exposure to severe weather events, 4) increasing drought conditions, 5) causing mismatches between the timing of breeding and peak abundance of food resources, particularly for migratory species, and 6) increasing the prevalence and transmission of diseases by creating favorable conditions for pathogens and expanding the range of disease vectors.

Migratory shorebirds that breed at higher latitudes, where temperatures are rising faster, are thought to be more vulnerable to climate change. In Arctic ecosystems, the effects on shorebird habitats are already measurable — from the northward expansion of shrubs (Myers-Smith et al. 2011, Mekonnen et al. 2021) and treelines (Harsch et al. 2009) into tundra nesting habitats, to landscape drying (Liljedahl et al. 2016), to the earlier arrival of spring, which causes mismatches between chick hatching and the emergence of arthropod prey (Saalfeld et al. 2019). As warming temperatures continue to advance arthropod emergence in the Arctic, with immediate effects on chick growth and survival, shorebirds may be unable to keep up with the speed of change (Saalfeld and Lanctot 2017). Climate change also affects the reproductive success of Arctic-breeding shorebirds indirectly, driving population crashes in lemmings that cause predators to rely instead on shorebird chicks, as well as favoring the expansion of breeding geese that overgraze shorebird breeding habitat (Kubelka et al. 2018, Flemming et al. 2019). The increased frequency of storms associated with earlier ice melt can also flood nesting habitats (Walpole et al. 2008). In the boreal forest, wildfire season is expected to lengthen due to drier conditions (Price et al. 2013). Forest fires will continue to increase in frequency (Kasischke and Turetsky 2006) and severity (Turetsky et al. 2011), especially in the western boreal region, which could impact boreal-breeding species like Lesser Yellowlegs and Short-billed Dowitcher.

Grasslands ecosystems across the Flyway experience cycles of wet and dry years, with wet years replenishing the land and likely providing abundant food for shorebirds. However, future climate scenarios predict warmer and drier climates for many grasslands (Swain and Hayhoe 2015, Joyce et al. 2016, Damasceno 2021) with longer and more frequent droughts (Pörtner et al. 2022, Londe et al. 2023). Drought alters water levels and soil and vegetation dynamics, reducing available habitat and increasing the risk of wildfires. Climate change-induced droughts in the Great Plains are leading to reduced wetland inundation periods, which diminish habitat availability and connectivity for migratory shorebirds.

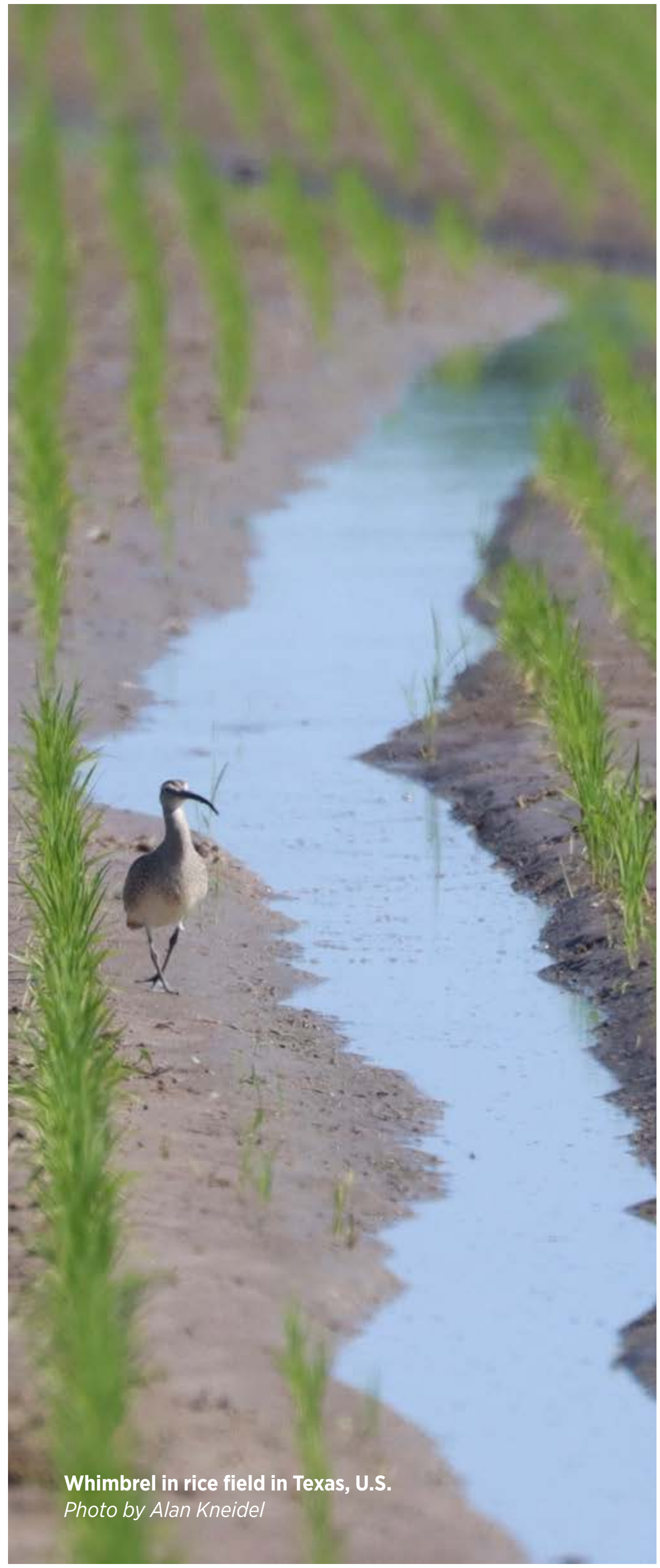
The Pantanal biome recently experienced one of the longest drought periods recorded in the last 50 years (Marengo et al. 2021). In 2020 alone, wildfires destroyed over 4 million hectares in the Brazilian Pantanal — nearly a third of the biome (Shimabukuro et al. 2023). The Pantanal and Amazon River Basin will continue to suffer major shorebird habitat loss, with some species projected to lose more than 50% of their habitat by 2050 or 2070 (Damasceno 2021). While precipitation trends vary across South America, annual precipitation has also decreased in most tropical regions and central Chile (Pabón-Caicedo et al. 2020, Pörtner et al. 2022).

In U.S. Midwest and Great Lakes, greater extremes in wetness and drought are expected. Short-term or seasonal transitions between abnormally wet and dry periods are also expected to increase (Chen and Ford 2023). Short-term seasonal precipitation extremes can limit or enhance shorebird habitats and wetland management efforts, depending on the timing and sequence of the extremes and management objectives. East of the Rocky Mountains, extreme precipitation events are expected to show a strong upward trend in frequency, with a larger increase expected during warm weather seasons (Kunkel et al. 2020). Correspondingly, Midwestern daily peak streamflows that meet or exceed 100-year reoccurrence intervals are predicted to increase between 10–30% by 2080 (Byun et al. 2019). Mid to late summer floods resulting from extreme precipitation events can inundate areas that would have otherwise provided foraging mudflats and shallow water for the fall shorebird migration. An increased frequency of early summer and late winter floods may enhance habitat availability if receding water levels are temporally matched with seasonal shorebird migrations.

Historical time series indicate an increasing warming trend in many regions of South America (Pörtner et al. 2022). Temperatures in the Amazon Basin have warmed over the last 40 years (Marengo et al. 2021), as have temperatures in the Andes, especially in the interior and at high-elevation sites (Vuille et al. 2015, Burger et al. 2018, Vicente-Serrano et al. 2018, Pabón-Caicedo et al. 2020, Frau et al. 2021). While the direct impact of climate change on shorebirds in high Andean ecosystems is poorly studied, decreases in lake levels and the drying of wetlands could have adverse effects on both resident and migratory species. Warmer temperatures will also trigger upward altitudinal shifts in species distributions (Seimon et al. 2007, Hardy and Hardy 2008) and anthropogenic activities such as farming and cattle ranching in the high Andes (Halloy et al. 2005).

In coastal habitats, climate change-induced sea level and sea temperature rise will modify shorebird feeding habits. Sea level rise will cause flooding and erosion, particularly in low-lying coastal and intertidal areas. Within the next three decades, the sea level along the West Gulf of Mexico coast is expected to rise by, on average, 0.1–0.2 meters and could reach as much as 0.6 meters in some areas by 2100 (Galbraith et al. 2002, Osland et al. 2017). In Louisiana, where the effects of sea level rise are exacerbated by subsidence, 35% of coastal wetlands are projected to disappear by 2067 (Boesch 2020, CPRA 2023). Additionally, an estimated 16% of the Gulf of Mexico's U.S. coastline is already hardened (Neumann et al. 2022), meaning the coastline consists of human-made structures (e.g., seawalls, bulkheads, and breakwaters) that protect against erosion, flooding, and storm surges. However, where urban development is limited and the coastline is free to recede, new wetlands could form (Moon et al. 2021). Under certain climate scenarios, the Gulf of Mexico is projected to become warmer, saltier, more acidic, and less oxygenated (Quinlan et al. 2023), which may alter the distribution and quality of shorebird food sources, such as invertebrates and biofilm, or cause phenological mismatches. Along Canada's Hudson and James Bay coastlines, sea level rise could affect invertebrate community composition and total productivity (Rehfisch and Crick 2003), although the isostatic rebound might somewhat mitigate sea level rise (Tsuji et al. 2009).

Extreme weather leading to more frequent droughts also can impact shorebird migratory behavior (Anderson et al. 2021). During migration, changes in broad-scale climatological patterns affect shorebirds that rely on predictable wind patterns for their annual migrations (Handel and Gill 2010, Gill et al. 2014). More severe and frequent storms might deplete invertebrate food resources and vegetation communities in the low-lying coastal areas that serve as shorebird stopovers or breeding sites (Alaska Shorebird Group 2019). Intense spring and summer storms can negatively affect reproduction and even kill adult shorebirds.



Whimbrel in rice field in Texas, U.S.
Photo by Alan Kneidel

4.2 HABITAT CONVERSION AND INCOMPATIBLE AGRICULTURAL PRACTICES

The Midcontinent Americas Flyway is characterized by large expanses of grasslands, savannas, and shrublands that provide habitats for shorebirds throughout the year. These landscapes are also favorable for the development of agriculture and support the livelihood of millions of people. The expansion and intensification of some agricultural practices contribute to habitat loss and degradation by influencing water and invertebrate prey quality and availability. In particular, agricultural intensification (i.e., higher yields per area) has led to the widespread use of chemicals (e.g., pesticides, herbicides, and fertilizers), the recontouring of landscapes to expedite the drainage of surface water, and, in some locations, the decline of aquifers due to groundwater pumping for irrigation. The expansion and intensification of some agriculture practices contribute to habitat loss and degradation by influencing water and invertebrate prey quality and availability. Wetlands are also more vulnerable to conversion to agriculture during dry years, further exacerbating the negative impacts of habitat loss during frequent droughts.

The North American Great Plains is one of the most productive agricultural areas in the world for canola, barley, and particularly corn, soy, and wheat (Gleason et al. 2011, Main et al. 2014). The expansion of row crops is one of the main drivers for the disappearance of native grasslands in the Great Plains. Over the last decade, 800,000 hectares of native grasslands disappeared per year in Canada and the U.S. (WWF 2021). In the Chihuahuan desert of northern Mexico, 66% of natural grasslands were lost from 2003–2021 (D. Borre, pers. comm. 2023). The loss of native grasslands directly reduces nesting cover for temperate-breeding shorebirds, and the associated loss of wetlands eliminates foraging areas for breeding and migrating shorebirds. While precise estimates of wetland loss for this region are not attainable, historic wetland acreage has been estimated using land records, the current extent of hydric drained soils, and a variety of other resources (Dahl 1990). The resulting loss estimates for states in the Midwestern U.S. 'Corn Belt' range between 90–99%, with a total loss exceeding 10 million hectares (McCorvie and Lant 1993, Nugent et al. 2015). Much of the wetland loss in this region was sponsored by U.S. government programs to convert wet prairies, sedge meadows, and marshes to row-crop agriculture.

In the Mississippi Alluvial Valley, agricultural practices, including wetland drainage for crop cultivation, have led to significant habitat loss, with over 50% of historic wetlands lost since the 18th century (Dahl 2011). Additionally, more than 75% of riparian forests have been converted to other land uses, primarily agriculture, leaving highly fragmented patches (Faulkner et al. 2011). This has negative consequences not only for wetland-dependent species like shorebirds but also for people since wetlands provide numerous ecosystem services, such as flood control, carbon sequestration, and water filtration (WWF 2021).

South American grasslands have experienced high rates of land use and land cover change during the last century (Baeza and Paruelo 2020). In many areas, traditional agriculture has been replaced by intensive production systems that have a larger ecological footprint. As a result, large portions of South America's natural grasslands have been replaced by crops, leading to the fragmentation and degradation of native ecosystems, which negatively affects resident, migrant, and non-breeding shorebirds (Azpiroz et al. 2012). Conversion to croplands (soybeans, corn, rice, potatoes, wheat, and palm oil, among others) is occurring throughout the Orinoco Plains (Venezuela and Colombia), Pampas and Campos (Brazil, Uruguay, Argentina), and Beni Savanna (Bolivia).


Marbled Godwits.
Photo by Monica Iglecia

In the Orinoco Plains, for example, 14% of the Eastern Plains savanna region of Colombia underwent some type of land use change between 1987 and 2007, primarily associated with the expansion of African Oil Palm (*Elaeis guineensis*) and rice plantations (Romero-Ruiz et al. 2012). In the Pampas and Campos regions, rapid expansion of cultivated areas began in the early 2000s. Soybean culture alone expanded by 200% between 2000 and 2015 (Modernel et al. 2016, Kuplich et al. 2018). In Brazil, 38% of the Pampas region has already been converted to agriculture, mostly soybeans. Within the Río de la Plata basin only (border region between Argentina and Uruguay), 23% (50,000 km^2) of grasslands were lost between 2000 and 2014 (Baeza and Paruelo 2020). In Bolivia, the government of the Department of Beni is promoting the conversion of large areas of grasslands (9–10 million hectares) to intensive agriculture (GAD Beni 2019). Although remnants of natural grasslands still persist, they are found in areas considered marginal by commercial agriculture, where intensive cropland or cattle ranching are not profitable activities (Baeza and Paruelo 2020).

In the High Andes, agricultural expansion began in the 1950s and has increased rapidly since the 1990s (Robineau et al. 2010). The agricultural activity of the region has also shifted from primarily subsistence farming to intensive commercial potato production. Cropland farming and livestock ranching are expected to continue to expand in the region in the future (Robineau et al. 2010, Castellanos-Mora and Agudelo-Hz 2020). This will affect high-altitude forests and the páramo, which supports several resident snipe species, including the Imperial, Jameson's, and Noble Snipe, as well as the Rufous-bellied Seedsnipe. As new areas are cleared, secondary vegetation colonizes abandoned fields, causing further transformation of important shorebird habitats (Redo et al. 2012, Gutiérrez B. et al. 2013).

An additional challenge in South America, especially in Colombia, Peru, and Bolivia, is the presence of groups cultivating illegal crops such as coca (Bradley and Millington 2008, Armenteras et al. 2011). Settlers hired by these groups occupy the land, cultivate illicit crops, and raise livestock, which all contribute to habitat degradation. This, in combination with a general lack of governance, has resulted in rapid land conversion, even within protected areas (Clerici et al. 2020). Outside protected areas, the inability of governmental authorities to control these activities leads to extensive settling of pristine lands, which is economically supported by large landowners (Clerici et al. 2019). How much this affects shorebird habitat is unclear, but these activities also limit research and conservation work.

While many agricultural practices reduce habitat availability for shorebirds, others can temporarily create appropriate conditions for some species. Shallowly flooded rice fields and other agricultural fields (Elliott and McKnight 2000, Dias et al. 2014, Choi et al. 2014) and irrigated tame-grass pastures, turf farms, and plowed agricultural fields can provide foraging and roosting habitat for shorebirds (Rodkey et al. 2024, Lyons et al. 2025). Whether these sites constitute an ecological trap due to the use of chemicals and crop boom-and-bust cycles remains to be studied. This Framework supports the conservation and restoration of natural habitats, but where agricultural practices can be compatible with shorebird use, beneficial management practices should be implemented.

4.3 INCOMPATIBLE WATER MANAGEMENT

As their name implies, many shorebird species rely on water for foraging and other needs during all or parts of their annual lifecycles. They use river, stream, lake, and reservoir edges as well as a wide variety of wetland types, including permanent, ephemeral, and managed wetlands. Dredging, draining, groundwater pumping, and the alteration of water and sediment flows can negatively affect shorebirds and their habitats. In areas managed for migratory birds, notably waterfowl in North America, water management practices can produce conditions incompatible (i.e., water too deep, wrong time of year) to meet the needs of migrating and breeding shorebirds. This often occurs due to outdated and inefficient water management infrastructure, a lack of understanding of the needs of shorebirds, and a common misconception that managing for shorebirds is completely at odds with achieving other species and habitat management goals. Further complicating the issue is the fact that shifting to more water-efficient irrigation practices sometimes inadvertently harms shorebirds by phasing out beneficial practices. Flood irrigation and wheel-line sprinklers, deemed inefficient irrigation practices, create abundant shallow, ephemeral wetlands during important periods in many shorebird species' annual lifecycles, particularly during migration.

In temperate North America, human population centers (cities and municipalities) and industrial developments compete with shorebird habitats for freshwater resources. In some cases, water is directly removed from the landscape. In other cases, streams, rivers, and other waterways are highly modified by dams and other infrastructure, resulting in a suite of impacts on ecosystems and shorebird habitats. The declining frequency of scouring flood events reduces vegetation-free habitats at the local scale, ultimately limiting the supply of sediments and nutrients to coastal habitats downstream and mediating plant succession (Elliott and McKnight 2000). For example, the most important freshwater tributary of the Gulf of Mexico — the Mississippi River — has been modified over the last century through an extensive array of dams, reservoirs, levees, dikes, and channels. These structures prevent sediments from reaching the river delta, where they play a key role in maintaining the barrier islands system and enriching the brackish water and saltwater marshes. These marshes provide nursery habitats for species that are economically important for humans and serve as shorebird food sources. Current sediment management in the lower Mississippi River could be improved through sediment diversion projects to restore the connection between the river and its delta wetlands (CPRA 2023). Incorporating shorebird-friendly habitat features in barrier island and mainland beach restoration efforts, which otherwise focus on storm protection, also has the potential to improve shorebird breeding and foraging habitats. In addition, the management of sediment from maintenance dredging operations along the Western Gulf of Mexico could be improved to provide greater benefits to shorebirds by creating nesting areas and restoring coastal dunes and marshes. The current practices of consolidating smaller wetlands into larger impoundments and maintaining high reservoir water levels eliminate potential habitat for breeding Piping Plover (McCauley et al. 2015) and migrating shorebirds (Russell et al. 2016) throughout all planning units.

In the South American Grasslands and Associated Wetlands planning unit, water is diverted from natural ecosystems to support cropland and livestock production. For example, 15–42% of wetlands in a portion of Córdoba Province, Argentina, were lost in the last two decades due to channelization practices (Brandolin et al. 2013). In Buenos Aires Province, at least 17% of the watercourses in the Mar Chiquita Basin have been channelized and straightened (Booman et al. 2012). Stream channelization usually involves channel straightening and widening to remove water from areas used to produce crops or livestock or to minimize the area occupied by natural meanders. This affects resource availability in small wetland systems immersed in a grassland matrix (Brandolin and Blendinger 2016) and consequently reduces available habitat for shorebirds that depend on inland wetlands, such as Hudsonian Godwit, Stilt Sandpiper, Pectoral Sandpiper, Wilson's Phalarope, and Lesser Yellowlegs (Brandolin and Blendinger 2016, Navedo and Ruiz 2020).

In the Northern Andes and Amazon planning units, dams created to meet energy demands are the main source of fragmentation and degradation of rivers. Between the Andean mountains and the Amazonian plain, there is a diverse mosaic of ecosystems and vegetation formations represented by forest, savanna, and swamp biomes (Moraes et al. 2021). By altering river flows, dams change landscapes and modify almost every aspect of downstream Amazonian aquatic ecosystems, threatening shorebirds and other biodiversity (Fearnside et al. 2021). In addition to landscape changes, upstream disturbances can disrupt sediment and nutrient flow downstream, thereby affecting soils, vegetation, and animal biodiversity throughout the watershed (Winemiller et al. 2016, Cochrane et al. 2017, Latrubesse et al. 2021).

In the Pantanal, energy infrastructure projects represent one of the greatest threats. The Paraná-Paraguay Waterway is part of a water system that allows navigation inland between Argentina, Brazil, Bolivia, Paraguay, and Uruguay. Its over 3,000,000 km^2 catchment area discharges water into the La Plata River. To maintain the navigability of this waterway under climate change scenarios (especially during drought), there are plans to straighten and alter the structure of the Paraguay River channel to make it deeper (Gottgens et al. 2001, Hamilton 2002). This would lead to large-scale and irreversible degradation of the ecological processes that govern the Pantanal plain and, as a consequence, shorebird habitats (Junk and Cunha 2005, Junk et al. 2006)

4.4 RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Coastal wetlands in the Western Gulf of Mexico constitute 66% of the total estuarine wetland acreage in the continental U.S. (EPA 2022a). These wetlands are disappearing rapidly due to several factors, which often intersect to accelerate the rate of wetland loss: subsidence and sea level rise, destruction from increasingly intense hurricanes, and encroachment from human development. Overall, it is estimated that 50% of the Gulf of Mexico's inland and coastal wetlands have been lost in some areas (Moulton et al. 1997), with some areas (e.g., Louisiana) experiencing greater losses (Needham et al. 2012). Although agriculture was the main driver of coastal wetland loss until the 1990s, rapid population growth, notably in Texas, has contributed greatly to habitat loss in recent decades. Coastal zones are some of the most densely populated and fastest-growing regions in the U.S. In Louisiana, 2.3 million people (50% of the state population) live in coastal zones, as do 7.2 million (25% of the state population) in Texas. In particular, the population in the Houston-Galveston area in Texas has increased by 38% in the past 20 years (Balderrama et al. 2020).

Dredging, draining, groundwater pumping, and the alteration of water and sediment flows can negatively affect shorebirds and their habitats.

Flooded fields and water management infrastructures in Arkansas, U.S.
Photo by Ryan Askren / Five Oaks Agriculture Research and Education Center

Increases in population along the coast are linked to concurrent commercial and industrial development. In 2019, the Gulf of Mexico oil and natural gas industry alone provided 345,000 jobs and contributed an estimated $28.7 billion to the U.S. economy (EIAP 2019). Another growing industry along the Texas Gulf Coast is bringing an increasing frequency of rocket launches, which can impact habitats and create disturbances. These activities are conducted within critical shorebird habitats, including designated wintering habitat for Piping Plover in the U.S. and proposed critical habitat for the U.S. federally threatened rufa Red Knot (86 FR 37410-37668). Beyond direct habitat loss, urbanization and industrialization also increase human disturbance to shorebirds by disrupting foraging, resting, and breeding activities, facilitating invasions of non-native species, and introducing pollutants into critical coastal habitats. Given that coastal wetlands protect coastlines, supply seafood, filter contaminants, store carbon, improve water quality, and provide recreational opportunities (Osland et al. 2017), the failure to create or enact policies that preserve these ecosystem services in development planning, zoning, and permitting negatively affects people and shorebirds in the Western Gulf of Mexico.

In South America, residential and commercial development was identified as a high threat in the Northern Andes. Although both direct (i.e., habitat loss and destruction) and indirect (e.g., pollution, disturbance) impacts of urbanization on shorebird populations have not been quantified, bird diversity is significantly lower in urban environments compared to rural environments (Carvajal-Castro et al. 2019). This lack of knowledge is probably related to the fact that high congregations of shorebirds are not observed in the Andes as they are in other biomes (Johnston-González et al. 2010). The wetlands, marshes, peatlands, and wet savannas of the Northern Andes, particularly those located between 2,500–3,900 meters above sea level, constitute one of the main habitats for Noble Snipe (Van Gils et al. 2020). Although no specific studies are available on the effects of urbanization on this or other shorebird species inhabiting the Northern Andes, available information suggests that residential development could be one of their main threats (BirdLife International 2024). Urban sprawl could be a serious problem for migratory and non-breeding sites of Lesser Yellowlegs (Clay et al. 2012). In this regard, population declines reported in Bogotá, Colombia, are probably associated with the fact that only approximately 5% of the wetlands that existed in the area in the mid-20th century currently persist there (BirdLife International 2024). The profound reduction of these habitats is a consequence of population growth in the area, which is home to about 20% of Colombia's population (BirdLife International 2024).

4.5 OIL, GAS, AND MINING

Oil, gas, and mining activities (including sand mining) can affect shorebirds and their habitats at multiple spatial scales through direct and indirect processes and at all stages of a project's life (i.e., exploration, development, operation, closure, and reclamation). Examples include: 1) habitat loss due to a project's footprint; 2) contamination from oil and mining residue spills; 3) reduction of aquifer levels; 4) disturbance from people, machinery, noise, and lights; 5) increased predator density; and 6) in-use and abandoned infrastructure.

The Amazon region contains considerable mineral reserves, mostly gold and copper, but also iron, manganese, tin, diamonds, bauxite, and oil, among others (Veiga 2018). Recent estimates suggest that industrial mining concessions cover approximately 1.3 million km^2 of the Amazon, representing approximately 19% of the region's surface area. While most mines in this planning unit are located in Brazil and Peru, the Venezuelan government also designated a strategic mining zone in 2016 covering about 12% of the national territory for the exploitation of gold, diamond, bauxite, coltan, and other minerals (García et al. 2018).

Illegal and unregulated gold mining operations have skyrocketed in the Amazon in recent years due to high gold prices. In 2016, it was estimated that about 28% of gold mined in Peru, 30% in Bolivia, 77% in Ecuador, 80% in Colombia, and 80–90% in Venezuela was produced illegally (Vallejos et al. 2020). Additionally, the gold extraction process requires mercury, which is released into the air during the refining process and finds its way into the soil and water. Artisanal and small-scale mining in the Amazon are responsible for the largest releases of mercury in the environment (EPA 2022b) and account for 64% of the mercury entering aquatic systems (Roulet et al. 1999, 2000, Artaxo et al. 2000, Guimarães

Salt flats in Bolivia.
Photo by psyberartist / Flickr

et al. 2000). Mercury's persistence in the environment is attributed to its efficient absorption across biological membranes, leading to biomagnification through food webs. This process adversely affects higher trophic level species, such as shorebirds, causing behavioral alterations, reduced fertility and growth rates, and increased mortality (Scheuhammer et al. 2007).

The highlands of Argentina, Chile, and Bolivia in the Central and Southern Andes planning unit contain 67% of the planet's lithium reserves in brine salts. Lithium extraction has surged in recent decades to meet the growing demand for lithium-ion batteries, driven by the transition to low-carbon technologies and efforts to address the climate crisis (FARN et al. 2021). Lithium mining in the high Andean plateau (Altiplano) covering shared portions of Argentina, Chile, and Bolivia is carried out using deep vertical wells to reach the brine containing the lithium. The brine is then pumped to surface pools and allowed to evaporate for months, resulting in a lithium-rich solution. This method jeopardizes the delicate balance between freshwater and saltwater in an extremely arid region; extraction that occurs in the central area of the salt flat causes freshwater runoff from the edges of the flat towards the center, resulting in salinization and loss of the region's natural freshwater deposits (Gerlo and Troost 2023). Lithium mining infrastructure and activity drive wetland habitat loss, conversion, and degradation through the salinization of soils and wetlands, contamination and alteration of water flows, and land subsidence, all of which can affect the distribution and abundance of invertebrate prey for shorebirds (Kaunda 2020, Marconi et al. 2022). Although there are no studies of the impacts of lithium mining on Wilson's Phalarope, surveys across their wintering habitats in South America have demonstrated the importance of the Altiplano region for a large proportion of the world population (Hurlbert et al. 1984, Jehl 1988, Castellino and Lesterhuis 2020). These high Andean wetlands also provide critical habitat for other North American-breeding shorebirds (e.g., Baird's Sandpiper, Greater and Lesser Yellowlegs, American Golden-Plover, Upland Sandpiper) and resident species (e.g., Diademed Sandpiper-Plover and Rufous-bellied Seedsnipe).

In continental Patagonia, oil exploitation is a main economic activity (Aguiar and Paruelo 2003). Oil activities cause changes in vegetation and soils through the traffic of machinery on roads and beaches and maneuvers associated with oil wells. This not only alters vegetation cover but also generates changes in the soil, such as compaction and erosion (Aguiar and Paruelo 2003). Loss of plant biodiversity (Buzzi et al. 2020) could negatively affect the breeding areas of focal species that nest in the Patagonian Steppe, such as the Tawny-throated Dotterel and Least Seedsnipe. Oil activity represents a threat with a direct risk of mortality due to open-air drilling pools that attract and kill birds (Paruelo et al. 2005).

Since 2007, gas and oil exploitation (including fracking) has increased across the prairies in Canada and the U.S. (Allred et al. 2015). In the boreal, oil sands developments require open-pit mines that fragment habitats in areas otherwise rich in wetlands that support breeding species like Lesser Yellowlegs. Although oil, gas, and mining development rated low for the Arctic at expert workshops, there is an important concern about their impacts on shorebird habitat. Oil and gas exploration and exploitation projects are rapidly increasing in number and expanding into prime shorebird habitat in the National Petroleum Reserve-Alaska (NPR-A), including the Willow Project, which was approved during the production of this Framework. The full impact of these developments is still poorly understood, but a recent study found that nest survival of shorebirds in Prudhoe Bay (Alaska) was negatively affected by the presence of high-use infrastructure (McGuire et al. 2023). Further, transporting oil and gas requires pipelines that extend far beyond the areas where they are extracted, creating a potential risk for oil spills. In the West Gulf Coast, large and small spills via ships or tankers transporting oil, drill rigs, platforms, and pipelines are a constant threat. There have been at least three major oil spills since 1979: the Ixtoc-I spill, a persistent leak in a pipeline (Taylor Energy MC-2) due to structural damage by Hurricane Ivan, and the Deepwater Horizon spill (DHNRDAT 2016). In the aftermath of the Deepwater Horizon catastrophe, 19 species of shorebirds were impacted, corresponding to 20% of all 93 bird species impacted (J. Gleason, pers. comm.).

Exposure to oil and associated chemicals can result in mortality, as well as short- and long-term sub-lethal effects (Leighton 1993, King et al. 2021). Exposure pathways can be complex but may occur via direct contact with oiled habitat or ingestion while preening oiled feathers, ingestion of contaminated prey items, and inhalation, all of which can negatively affect flight capabilities, thermoregulation, and immune system functioning, as well as causing adverse effects to cell, organ, and endocrine function (DHNRDAT 2016, King et al. 2021). Such negative sub-lethal effects can manifest through declines in body condition and lowered fat reserves, as well as potential declines in future reproductive performance. In addition, oil spills can negatively affect habitat availability and quality and have energetic consequences due to disturbance-related effects from spill clean-up activities at the impact site (Henkel et al. 2012, 2014). Large, catastrophic oil spills like Deepwater Horizon are rare, but small, chronic oil spills occur annually and thus represent a persistent threat to migrating and staging shorebirds in the northern Gulf of Mexico environment.

4.6 FIRE MANAGEMENT AND SUPPRESSION

Fires are a natural part of grassland ecosystems, maintaining an ecological balance by returning nutrients to the soil and favoring the growth of native grassland vegetation while reducing colonization by woody vegetation. Many grassland ecosystems in the Midcontinent Americas Flyway depend upon fire to maintain important biological characteristics and functioning. Fire has been used as a land management tool by Indigenous peoples in the Americas for millennia and more recently by rural producers throughout the Flyway (Raish et al. 2005, Mistry et al. 2019, Lombardo et al. 2019, Sühs et al. 2020). In the 20th century, fire was primarily perceived as a threat to people and natural resources, so many countries developed fire prevention programs, created fire suppression organizations, and/or adopted “zero-fire” policies. In many areas, this induced profound changes in the vegetation, fueling more intense fires in exceptionally dry years (Myers 2006). Over much of the Midcontinent Americas Flyway, native grasslands have been replaced by agriculture, degraded by overgrazing, or lost to the establishment and spread of woody plants. Native grasslands now only occur in a small portion of their former range and are so fragmented that historical fire regimes are seriously disrupted. More frequent fires are needed in some ecosystems to prevent the transition to shrubland. Habitat and fire management focused on preventing the establishment and spread of woody plants is more effective than post hoc restoration efforts. While fire can be beneficial, an altered or undesirable fire regime (i.e., one that has been modified by human activities such as fire suppression, fire prevention, or excessive or inappropriate burning) can be a major threat to breeding shorebird habitats (Hardesty et al. 2005).

While frequent prescribed burns can be temporarily detrimental to nesting shorebirds, burns can positively influence the distribution and abundance of migratory shorebirds that favor short-grass vegetation, such as Upland Sandpiper, Buff-breasted Sandpiper, and American Golden-Plover (Hovick et al. 2017). Adequate fire management helps restore natural cycles, which can benefit human well-being (e.g., high-quality grazing for cattle) while preventing more intense fires. Effective shorebird conservation in the Midcontinent Americas Flyway requires not only managing for intact and healthy grasslands but also maintaining disturbance regimes that are compatible with shorebird and human use.

4.7 INCOMPATIBLE LIVESTOCK RANCHING PRACTICES

Livestock production is widespread across the Midcontinent Americas Flyway, from the Great Plains of North America to the Patagonian Steppe of South America. When not managed sustainably, high stocking rates and other intensive production practices can degrade shorebird habitat by reducing vegetation cover, compacting soil, introducing invasive plant species, and damaging riparian areas (Powers and Glimp 1996). These changes can lead to habitat loss, altered hydrology, and reduced food availability for shorebirds. Additionally, livestock production is a major source of greenhouse gas emissions (Thornton 2010, Lerner et al. 2017). However, moderate cattle grazing that mimics the historical grazing patterns of native herbivores, combined with ecosystem-appropriate management, can support healthier grasslands and create a mosaic of vegetation structures that benefits breeding and migratory shorebirds, such as Buff-breasted Sandpiper and American Golden-Plover (Aldabe et al. 2019). Balancing livestock production with conservation is critical, especially as climate change adds further challenges to maintaining suitable shorebird habitats.

In the Chihuahuan Desert and Great Plains, overgrazing can shift grasslands to shrub-dominated ecosystems (Kerley and Whitford 2000), reducing habitat quality for grassland-dependent shorebirds. Large ranches, despite their modified ecosystems, often provide more habitat opportunities for shorebirds than if these lands were converted to other uses. Maintaining appropriate stocking densities, implementing rotational grazing, and restoring riparian areas can help mitigate habitat degradation while sustaining livestock production.

In the Northern Andes, livestock grazing has large-scale impacts on páramo ecosystems (3,000–4,900 meters above sea level). Soil compaction from cattle prevents natural vegetation regeneration and alters water drainage, leading to long-term changes in plant communities (Curll and Wilkins 1983, Molinillo and Monasterio 2002, Cárdenas 2013). At lower elevations, burning is often used to improve forage for cattle, further degrading habitat by increasing soil exposure and reducing water retention (Verweij and Budde 1992, Hofstede et al. 1995). These pressures threaten specialist páramo shorebirds, such as Imperial Snipe.

Buff-breasted Sandpipers in Lagoa do Peixe, Brazil.
Photo by Marco Silva

In the Central-Southern Andes and Patagonian Steppe, sheep overgrazing has contributed to severe desertification, with 93.6% (73.5 million hectares) of the steppe showing signs of degradation (Valle et al. 1998). Historical overstocking increased sheep numbers from 1.79 million in 1895 to 25 million in 1952 (Huerta 1991), resulting in significant vegetation loss and soil erosion. This habitat decline threatens species like the Magellanic Plover, which nests along the edges of lakes and rivers (Lishman and Nol 2012). Sustainable grazing practices are essential to prevent further desertification and protect shorebird populations in this region.

4.8 EMERGING THREATS

This Framework presents Flyway-level threats as they were scored during participant workshops and at the time of writing (i.e., threats that scored as either "high" or "very high" within one of the main regions; Table 5). However, new developments and announcements of emerging threats, including large-scale renewable energy developments and private space exploration, have emerged since the MSCI threat assessment exercise was conducted. Two notable examples of renewable energy developments are proposed offshore wind leasing and wind developments for the production of hydrogen from water ("green hydrogen").

Wind energy development poses several risks to shorebirds, including collision, habitat displacement, and attraction effects such as light disorientation. Migratory shorebirds are particularly vulnerable due to their long-distance flights, with factors such as flight altitude, speed, and behavior influencing their susceptibility to wind turbine impacts. Turbines can also indirectly affect shorebirds by altering predator-prey dynamics — providing perches for raptors like Peregrine Falcons — and increasing disturbances from construction and maintenance activities. These risks are particularly concerning as wind energy expands in key shorebird habitats across the Midcontinent.

Offshore wind energy development is expanding in the U.S. Gulf of Mexico. In January 2022, the Bureau of Ocean Energy Management (BOEM) announced a draft environmental assessment for potential offshore wind leasing in federal waters. By December 2024, BOEM issued a Determination of Competitive Interest in response to an unsolicited request for a commercial wind energy lease (BOEM 2024). The National Renewable Energy Laboratory estimates that the Gulf of Mexico could generate nearly 510,000 megawatts of offshore wind energy annually, a significant increase from the 17,000 megawatts produced across the U.S. as of 2021. This expansion raises concerns about increased interactions between migratory shorebirds and offshore wind infrastructure. While no offshore wind projects have been announced in the Mexican portion of the Gulf, the region has some of the highest wind energy potential in the country. The shallow waters of Laguna Madre, particularly in Tamaulipas, have been identified as prime development sites (Carrasco-Díaz et al. 2015).

Onshore wind energy expansion is also occurring elsewhere in the Midcontinent, particularly in southern Chile. In December 2021, Chile announced its largest green hydrogen project in the Magallanes Region, requiring extensive wind energy infrastructure (Highly Innovative Fuels 2020, Ministerio de Energía 2021, La Prensa Austral 2022). Green hydrogen, produced by splitting water molecules using renewable energy, is considered a carbon-free alternative to fossil fuels (Garip 2023). By 2027, up to 2,900 wind turbines could be installed across 150,000 hectares in the region (Norambuena et al. 2022).

Extrapolating bird collision rates from central Chile (República de Chile 2021) suggests that large-scale wind projects in Magallanes could result in 1,740–5,220 bird collisions annually (Norambuena et al. 2022). This development poses significant risks to shorebird populations, particularly the Magellanic Plover. Beyond direct wildlife impacts, conservationists warn of broader socio-environmental consequences, including increased inequality, loss of traditional livelihoods, and worsening water scarcity (La Prensa Austral 2022, Norambuena et al. 2022, Cifuentes Díaz 2023, Josep and Marina 2024).

5. KEY CONSERVATION STRATEGIES

Pectoral Sandpipers.
Photo by Christian Artuso

Through a series of Conservation Standards workshops, regional action plans were developed to identify activities that reduce threats to shorebirds and support the maintenance, creation, or restoration of their habitats. These actions were ranked according to their urgency, potential impact, and feasibility and were then synthesized into nine Flyway-level strategies.

The Framework's Key Conservation Strategies are not meant to replace conservation strategies developed at the planning unit level, which will be made available on the Midcontinent Shorebird Conservation Initiative website. Rather, they provide guidance on how to align objectives with Flyway-scale priorities and facilitate the coordination of efforts across local, national, and planning unit scales. All strategies are rooted in an approach that emphasizes diverse systems of knowledge, expertise, and values. Engaging a diverse range of potential partners — including local communities, Indigenous peoples, landowners, government agencies, conservation organizations, industry representatives, and researchers — is critical for the successful implementation of these conservation strategies. Additionally, integrating human well-being, local knowledge, and socio-economic factors into conservation efforts will ensure that all relevant perspectives are considered and that the outcomes are sustainable and inclusive.

For each strategy, a set of outcomes, objectives, and indicators was developed to define what needs to be achieved and provide the means to measure success. Together, they help ensure that conservation actions are both effective and accountable.

STRATEGY 1.

Motivate governments to increase conservation capacity

Government leaders and public officials at local, regional, and national levels are key decision makers who can contribute to shorebird conservation through their governance, regulatory frameworks (i.e., policies, laws, regulations), and funding. When governments explicitly recognize the importance of conserving shorebirds and habitats within their jurisdictions, they can greatly improve the outcomes of the MSCI Framework. By prescribing what should be done, governments can also encourage funding agencies to support shorebird conservation actions.

Although shorebird conservation can be mainstreamed into existing regulatory frameworks that address the climate change and global biodiversity crises generally, more focused approaches and targeted resources are also required. For example, the Global Biodiversity Framework is a multilateral agreement that can help bolster support for shorebird conservation, but without targeted efforts, it lacks the specificity needed to address the imminent threats shorebirds are facing. Shorebird conservation plans are tools that can help governments frame how best to address shorebird conservation within their jurisdictions, as these plans provide the background required to influence policies, laws, and regulations and facilitate access to funding.

This strategy has three main outcomes: 1) shorebird conservation is integrated in local, regional, and national programs, laws, policies, and regulations 2) international agreements are leveraged to increase capacity for shorebird conservation; and 3) resources dedicated to shorebird conservation increase.

Diademed Sandpiper-Plover.
Photo by Eduardo Navarro

OBJECTIVES:

Objective 1.1: Investments made for shorebird conservation in the Midcontinent Flyway support national and international conservation goals and objectives

- Indicator 1.1) Number (or %) of projects that report a contribution to:
  - a) Global Biodiversity Framework
  - b) Convention on Migratory Species
  - c) Ramsar Convention
  - d) Others (e.g., National Shorebird/Biodiversity Conservation Plans)

Objective 1.2: All countries and nations in the Midcontinent Flyway have published a national shorebird conservation plan, and those plans are being implemented

- Indicator 1.2a) Number of national conservation plans published/updated under implementation
- Indicator 1.2b) Number of national conservation plans assessed for effectiveness based on measurable outcomes and key performance indicators

Objective 1.3: Increase eligibility of shorebird-focused conservation projects in the Midcontinent Flyway through the adoption of appropriate evaluation criteria in governmental funding programs

- Indicator 1.3) Number of key funding programs or organizations that have evaluation criteria specifically designed to support shorebird conservation

Objective 1.4: Increase and diversify funding and capacity from governments and agencies for shorebird conservation in the Midcontinent Flyway

- Indicator 1.4a) Amount of funding invested in the Midcontinent Flyway for shorebird conservation (on an annual basis)
- Indicator 1.4b) Number of partners at different levels providing funding and capacity:
  - b1) International agencies (i.e., multilateral and bilateral)
  - b2) National agencies (i.e., federal)
  - b3) Regional agencies (i.e., state/provincial)
  - b4) Local agencies (i.e., municipal)

Objective 1.5: Mitigate threats to shorebirds and their habitats by enhancing or adopting new laws, regulations, and policies

- Indicator 1.5) Number of laws, regulations, and policies adopted or modified to support shorebird conservation

IMPLEMENTATION STEPS:

Implementing changes at the appropriate decision levels requires an understanding of the critical status of shorebirds by key decision makers. To engage this audience, communication points must be developed to clearly and concisely explain the benefits of shorebird conservation for human well-being. Key decision makers must be identified at each level of government, and tailored approaches should be designed, ideally by communication experts, to speak to their priorities. Identifying influential stakeholders and rightsholders can provide new angles with which to elevate the importance of shorebird conservation to decision makers, for example by using the influence of producer associations. This includes advocating for the use of existing mechanisms, such as the North American Wetland Conservation Act, which has conserved more than 13 million hectares in Canada, the U.S., and Mexico through federal and partner investments of $4.53 billion USD. Encouraging U.S. states to invest in full annual cycle bird conservation through Fall Flights, which focuses on wetland and grassland habitat protection in Canada, and Southern Wings, which supports migratory bird conservation across a variety of habitats in Central and South America as well as the Caribbean, creates an opportunity to strengthen U.S. state involvement in international partnerships, expand funding, and raise awareness about the conservation needs of shorebirds.

Internationally, advocacy should bring up issues overlapping with shorebird conservation at bilateral and multilateral meetings to catalyze the development of frameworks specifically for shorebird conservation. This can take the form of business plans that include shorebirds, such as the plan developed by the Rio Grande Joint Venture (U.S. and Mexico), or Memorandums of Understanding between countries, such as the Memorandum of Understanding on the Conservation of Southern South American Migratory Grassland Bird Species and Their Habitats. These frameworks can be leveraged alongside the MSCI Framework to fund shorebird-related projects.

Integrating shorebird conservation into national and subnational programs, laws, policies, and regulations will facilitate access to funds and capacity for enacting conservation actions. This is greatly supported by national shorebird conservation plans. These plans address resource and funding needs through sources dedicated directly to shorebirds, as well as sources with broader cross-cutting benefits (e.g., climate change adaptation, carbon sequestration). They should also seek to address gaps in laws, policies, and regulations that negatively impact shorebirds. A registry of case studies highlighting effective versus adverse policies that pertain to shorebird conservation, as well as situational analyses identifying critical gaps in policy, can help guide these efforts. In countries where national shorebird conservation plans already exist, they must be given adequate attention and support to be successfully implemented.

At the municipal level, partners should advocate that shorebird habitat protections be incorporated into zoning and planning laws and regulations, as related to wetland drainage or prairie conversion, for example. Mapping important sites in coordination with municipalities can facilitate connections with influential staff, identify areas where action is most needed, and catalyze training and exchange opportunities. These international and domestic actions simultaneously support and build momentum for each other.

International and domestic actions simultaneously support and build moment for each other.

EXAMPLES:

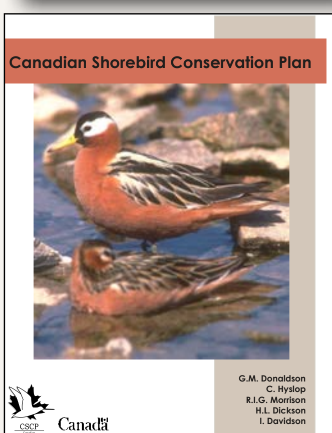
Proposal for the Inclusion of the Magellanic Plover in CMS Appendix I

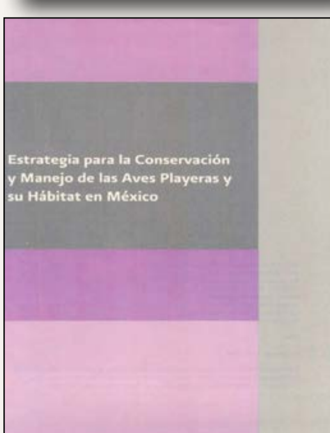
The governments of Chile and Argentina submitted a proposal to include the Magellanic Plover in Appendix I of the Convention on Migratory Species (CMS) that was accepted at the 14th Conference of the Parties. Appendix I listing enhances binational cooperation on impact assessments, research, monitoring, and protection of critical sites and habitats. Some of the anticipated benefits include the creation of binational recovery plans, coalitions between regional governments and municipalities for the conservation of the species, and the creation of guidelines for environmental impact evaluations of proposed energy projects on areas of importance for the species. The CMS, of which Chile and Argentina are both party members, enables cooperation between governments towards the conservation of a shared shorebird species.

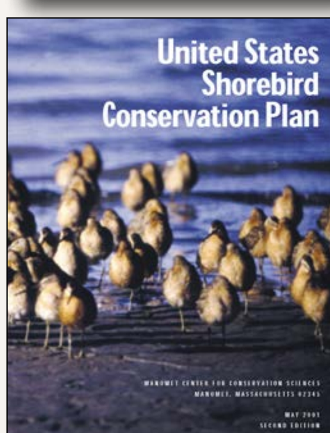
Magellanic Plover.
Photo by Pablo Cáceres

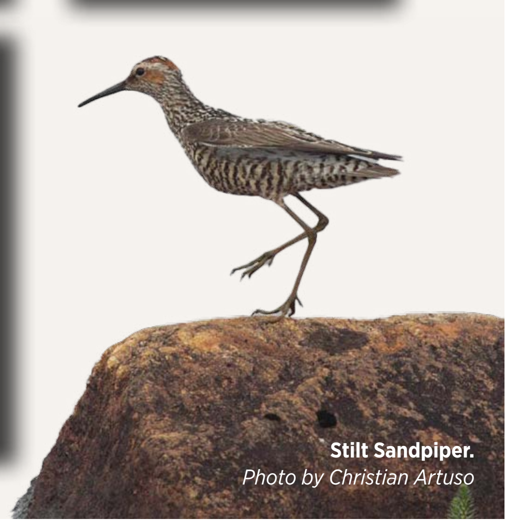
National Shorebird Conservation Plans

National Shorebird Conservation Plans provide a science-based, coordinated strategy to protect shorebirds and their habitats while ensuring conservation efforts are effective, well-funded, and aligned with national policies. They prioritize actions, guide resource allocation, foster collaboration among governments, NGOs, and communities, and enable Flyway-scale conservation. Beyond ecological benefits, these plans also enhance human well-being by supporting clean water, healthy soils, flood regulation, and carbon storage — all essential for climate resilience. Conserving grasslands, wetlands, and river basins sustains local economies through agriculture, fisheries, and ecotourism while also protecting biodiversity.








Stilt Sandpiper.
Photo by Christian Artuso

STRATEGY 2.

Strengthen and catalyze alliances for conservation

Collaboration and capacity building are essential for effective conservation. Developing multi-sector, cross-cultural alliances between individuals, entities, and agencies across the Flyway is key to increasing the capacity to effect change for shorebirds. Alliances bring together people with diverse backgrounds from various sectors (i.e., private, civil, and public) to collaborate on common objectives. In these spaces, members' voices are elevated on equal footing, which provides opportunities to address specific issues and achieve win-win solutions for biodiversity and people.

Alliances are generally composed of multiple organizations or individuals gathered around one common goal. Mainstreaming shorebird conservation objectives into alliances whose goals are already centered on conserving biodiversity is a valuable approach, but it will be equally important to work with existing alliances centered around more economic activities or sectors (e.g., livestock ranching and energy development), as well as alliances for social and environmental justice (e.g., against polluting and land dispossession). The overall objective should be to mainstream shorebird conservation within these alliances' existing frameworks or create new alliances around objectives that positively impact shorebirds or their habitats.

This strategy has three main outcomes: 1) alliances integrate shorebirds and their habitats into their goals and objectives; 2) new alliances are established; and 3) alliances are more sustainable and effective at creating positive change for shorebirds.

OBJECTIVES:

Objective 2.1: Establish and support new alliances where it is the most appropriate approach

- Indicator 2.1a) Number of planning units for which a situation analysis report of alliances is available
- Indicator 2.1b) Number of new alliances created that integrate shorebird conservation in their principles, in particular from the following sectors:
  - b1) agriculture (crop farming and ranching; including fire management)
  - b2) mining & energy (including renewable energy)
  - b3) water & watershed management

Objective 2.2: Mainstream shorebirds and their habitats as conservation targets into alliances' goals and objectives

- Indicator 2.2a) Number of alliances that integrate shorebird needs in their guiding principles
- Indicator 2.2b) Number of alliances that engage with their members about shorebird conservation on a regular basis

Objective 2.3: Increase the capacity and effectiveness of alliances and their members to provide appropriate shorebird habitat conditions

- Indicator 2.3a) Number of knowledge-sharing activities on shorebird conservation with, within, and among alliances (e.g., workshops)
- Indicator 2.3b) Number of alliances that report an increase in:
  - b1) Understanding of how to support shorebird-focused projects
  - b2) Implementation of shorebird-focused projects
  - b3) Number of projects supporting shorebird needs
  - b4) Amount of funding for projects supporting shorebird needs

IMPLEMENTATION STEPS:

To effectively mainstream shorebird conservation within existing alliances, there must be a shared understanding of the value of shorebirds and their habitats, as well as their cross-benefits to human well-being and other alliance objectives. Bringing potential allies into the fold will require targeted messaging and advocacy to promote dialogue about the intersection of shorebird conservation and member goals. In the case of alliances formed around biodiversity conservation, including shorebirds and their habitats may be straightforward. In other cases, mainstreaming shorebirds into alliance objectives may require building awareness of shorebird needs and recognizing how they complement existing conservation goals.

For example, Migratory Bird Habitat Joint Ventures were established to facilitate regional partnerships for bird habitat conservation in Canada, the U.S., and parts of Mexico. These collaborative, regional partnerships bring together various federal and state agencies, private landowners, non-governmental organizations (NGOs; e.g., Ducks Unlimited and Pheasants Forever), and industry representatives for the conservation of migratory birds and their habitats. While initially focused on waterfowl, many Joint Ventures have expanded their scope over the past few decades to include a wider range of species, such as passerines, shorebirds, and waterbirds. Although the shift to an all-bird approach has been gradual in some areas, recent declines in certain bird populations, the urgency of conservation needs (such as aquifer depletion), and new funding opportunities have prompted most Joint Ventures to incorporate shorebirds into their objectives and conservation actions. Advocating for the integration of shorebird conservation into these partnerships not only highlights the importance of these species but also demonstrates how such inclusion can enhance overall conservation outcomes, motivating alliances to prioritize shorebird needs in their agendas.

This advocacy will be all the more important when catalyzing new alliances outside of the conservation realm. To make this step more effective, it may be useful to prioritize sectors and geographies in which there is the greatest potential to replicate or expand alliances that have already proven successful at delivering conservation actions for birds. Advocacy and educational campaigns about the importance of shorebirds and their habitats can then be targeted to these prioritized sectors and geographies, thereby fostering dialogue and negotiations. Some sectors to consider are agriculture, mining, and renewable energy, as well as water management authorities. The Southern Cone Grasslands Alliance is an example of how to catalyze an alliance between producers (in this case, livestock ranchers) and conservation organizations. This model has been replicated in the Beni savannas of Bolivia, where the Beni Eco-friendly Ranching Alliance was recently formed. The rapid development of renewable energy infrastructure has also catalyzed the formation of alliances such as the Regional Wildlife Science Collaborative for Offshore Wind, including industry representatives, scientists, and government agencies, facilitating the prioritization of site selection to minimize harm to wildlife. Finally, sustainable watershed management intersects with many other initiatives that impact shorebird habitats, including environmental justice organizations advocating for clean water for their communities and producers advocating for water rights to sustain their farming livelihoods. Supporting the goals of these organizations can lay the groundwork for establishing alliances between these groups.

Once alliances have shorebirds and their habitats as direct objectives, they must be supported by ensuring communication among partners, increasing local capacity, and sharing beneficial management practices. This can facilitate knowledge and skill-sharing, which in turn will augment interest in joining these alliances, ensuring their long-term sustainability and increasing the scope of their influence. This may take the form of knowledge-sharing activities, such as workshops and demonstrations, or the development of tools like online platforms to collectively share and store data or success stories. It is important that local and regional alliances are not isolated but connected with other alliances across the Flyway. Finally, recognizing alliance contributions to shorebird conservation at the national and international levels (such as formal mention in national conservation plans, strategies, and policies) will considerably strengthen these relationships and bolster their long-term sustainability.

EXAMPLES:

Alianza del Pastizal — Brazil, Argentina, Uruguay, and Paraguay
The Grasslands Alliance is an initiative of BirdLife International and BirdLife partners in Brazil, Argentina, Uruguay, and Paraguay, which seeks to conserve Southern Cone grasslands. The Alliance brings together producers, researchers, governments, and entrepreneurs to work towards the sustainable use of grasslands, deriving value from their ecological, cultural, and economic significance. Some of the Alliance's successes include more than 1 million hectares under sustainable management, more than 1.5 tons of carbon per hectare stored, and over 700 producers as members of the Alliance.

Northern Great Plains Joint Venture — Great Plains, U.S.
Migratory Bird Joint Ventures are great examples of conservation in action in North America (see full list in Appendix 10). The Northern Great Plains Joint Venture (NGPJV) is a public-private partnership of people with a shared interest in building and sustaining resilient grasslands in the Northern Great Plains region of North America. Resilient grasslands support vibrant ranching communities, robust grassland bird populations, and sustainable ecosystem services. The NGPJV brings ecological and social science tools and information to local planning and decision-making. This partnership catalyzes conservation by convening networks and supporting the people who live in the region. The NGPJV also administers a financial assistance program helping land-owners and other conservation partners enhance and restore intact grasslands and wetlands. Habitat projects benefit the NGPJV's 26 priority bird species, which include Long-billed Curlew, Marbled Godwit, Upland Sandpiper, and Wilson's Phalarope. Collectively, partners invested in the NGPJV have impacted over 1 million hectares of working grasslands and wetlands, leading to over 35 million metric tons of potential carbon storage and supporting over 1.7 million grassland birds, including shorebirds.

Cattle ranchers in Paraguay.
Photo by Andrea Ferreira

STRATEGY 3.

Increase incentives for habitat protection, enhancement, and restoration

Increasing the quality and quantity of shorebird habitats can incur additional costs compared to business as usual, especially on privately and communally owned lands managed for purposes other than conservation. Robust incentive programs are needed to support the willingness and ability of landowners, managers, and communities to maintain and improve shorebird habitats on their lands. Incentives can be financial, such as tax breaks and direct payments for ecosystem services, or non-financial, such as technical assistance and forms of social recognition. For example, farmers can be incentivized to maintain water on the landscape during shorebird migration either through direct payment or by receiving technical advice on how to achieve this.

In some areas of the Midcontinent, new incentive programs are required, while in other areas, existing programs could be expanded to support more actions for shorebird conservation. This involves aligning program objectives to include shorebird conservation objectives, increasing the eligibility of shorebird-focused actions, and lowering the entry barriers for applicants willing to implement shorebird conservation actions. This can be achieved by demonstrating the wider co-benefits of incentives for biodiversity conservation and human well-being, advocating to relevant agencies about those co-benefits, and reducing the burden on end-users by demystifying what incentive programs involve through training and guidance. Since incentives can be difficult to sustain over time, it will be imperative to seek synergies with programs that have objectives outside of the wildlife conservation arena.

This strategy has three main outcomes: 1) Secure funding for new and existing incentives that explicitly consider shorebirds; 2) Expand existing incentive programs to include practices that support shorebird habitat needs; and 3) Ensure accessibility to these programs at various scales to maximize use of incentives and effective shorebird conservation.

OBJECTIVES:

Objective 3.1: Expand incentive programs to include provisions that support shorebird habitat conservation

- Indicator 3.1) Number of incentive programs that include provisions for shorebirds

Objective 3.2: Prioritize the use of incentives in the most critical sites/areas

- Indicator 3.2a) Number of critical sites/areas identified
- Indicator 3.2b) Number of critical sites/areas where incentives are used to support habitat conservation for shorebirds

Objective 3.3: Conduct outreach and capacity building to disseminate guidance about incentive programs

- Indicator 3.3a) Number of capacity-building activities (e.g., meetings, workshops) organized to inform landowners about incentives programs
- Indicator 3.3b) Number of landowners participating in capacity-building activities

Objective 3.4: Increase the use of incentive programs to protect, restore, or enhance shorebird habitat

- Indicator 3.4a) Area (e.g., hectares) of shorebird habitat restored or enhanced through incentive programs
- Indicator 3.4b) Number of applicants (e.g., landowners) who report using incentive programs to protect, restore, and enhance shorebird habitat

Objective 3.5: Assess how incentives benefit shorebirds and human well-being

- Indicator 3.5) Number of publications that highlight the benefits of incentives for shorebirds and human well-being

IMPLEMENTATION STEPS:

Several incentive programs are well established within the Midcontinent but have not been adequately leveraged to support shorebird conservation. To expand incentive programs, areas and properties where incentive programs are relevant must first be identified. Available incentive programs and potential gaps should be assessed to identify how and where incentive programs can be most effective for shorebird conservation. To fund incentives at the required scales, it is crucial to seek funding outside of the explicitly shorebird or wildlife conservation arenas. By aligning the objectives of the MSCI with those of partners dedicated to safeguarding biodiversity and human well-being, it will be possible to expand incentive schemes across diverse land ownership and management types. Target incentive programs may include, for example, habitat management, flood risk mitigation, aquifer recharge, carbon credits, or the protection of traditional rural livelihoods. These may be led by NGOs, governmental agencies (such as the USDA's Natural Resources Conservation Service), programs (such as the Environmental Quality Incentives Program, funded through the U.S. Farm Bill), or other pathways (such as the North American Wetland Conservation Act). Advocacy and coalition building at the highest levels will be required to increase the reach of incentive programs. In addition, new incentive programs will be required in areas where they are currently inadequate. Exchanging information and experiences and demonstrating co-benefits for both shorebirds and people will be critical in developing new programs.

Ensuring inclusivity and accessibility across the Flyway will enable landowners and managers to support both shorebirds and their own economic, cultural, and social well-being.

Once relevant incentive programs have been identified or established, communication tools will be needed. At the Flyway scale, repositories of incentive schemes should be created to help partners find relevant programs for their geography. At the local level, it is critical to ensure that potential incentive recipients (e.g., landowners, communities) know how to access these programs. Reaching individuals is often most effective through contact points at relevant agencies and NGOs. It is therefore important to educate staff members at the agencies and organizations that will manage program implementation. Efforts must be made to lower barriers to entry for incentive recipients by developing guidance documents and accompanying them through the application process and beyond. Ensuring inclusivity and accessibility across the Flyway will enable landowners and managers to support both shorebirds and their own economic, cultural, and social well-being.

To sustain these programs over time, effort must be dedicated to monitoring and describing their outcomes, such as assessing the cost-benefit for the program recipient (e.g., the producer) compared to business as usual and assessing any unintended effects on shorebirds. Monitoring schemes and costs should be integrated into programs from their inception.


Wilson's Plover.
Photo by Katie Barnes

EXAMPLES:

Socio Páramo — Ecuador

As part of the Socio Bosque Program in the Ministerio del Ambiente, Agua y Transición Ecológica, this Ecuadorian government incentive program for private and communal landowners has successfully preserved many of the country's native forests and páramos. Socio Páramo works through voluntary agreements and economic incentives to persons or communities to preserve native ecosystems. By 2022, the program had 257 agreements signed and 52,000 hectares under conservation. In the combined area of Bosque-Páramo, 78,000 hectares were put under conservation through 45 agreements. Besides its impact on the fragile páramo systems on which several endemic snipe species depend, this model could be adapted to other ecosystems important to shorebirds. The program demonstrates the MSCI values of inclusivity and the integration of socio-economic values with shorebird conservation, making it an exemplary model to imitate.

Rufous-bellied Seedsnipe.
Photo by Nigel Voaden / Flickr

Shorebirds of Louisiana Wetlands Initiative — Louisiana, U.S.

The "Shorebirds of Louisiana Wetlands Initiative" is a U.S. federal government initiative incentivizing the enhancement of wetland habitat for shorebirds in the state. As part of the larger "Working Lands for Wildlife" state-based partnership, the Natural Resource Conservation Service (NRCS), together with Manomet Conservation Sciences and Ducks Unlimited, provide technical and financial incentives to producers to manage water on their fields, thus providing fall habitat for southbound migrants. Manomet is working with NRCS to expand the program to include practices that would also create short grassland habitats for Buff-breasted Sandpiper and other upland shorebirds.

Buff-breasted Sandpiper.
Photo by Bob Friedrichs

STRATEGY 4.

Manage existing and acquire new habitats

Creating, restoring, and maintaining habitat is essential for shorebird population recovery across the Flyway. Active management is often required to create or sustain suitable conditions — such as shallow water, unvegetated mudflats, or short grass — at key points in species' lifecycles.

Private and communal land managers are crucial partners in this work, and they often need information and technical support to balance habitat conservation with their operational needs. Public land managers — including those overseeing Provincial and State Wildlife Areas, National Grasslands, and NGO-managed lands like National Audubon properties — also play significant roles by integrating shorebird-friendly practices into their management strategies. Many lands with potential for improved shorebird habitat are also managed for recreation, economics, subsistence, or ecological conservation (e.g., national parks, wildlife refuges, and private reserves). By adapting or enhancing management practices, these areas can provide higher-quality habitat for shorebirds while maintaining their broader purposes. Providing technical training to land managers and owners can also enhance both the quality and quantity of functional shorebird habitats, particularly in areas designated for wildlife conservation. Efforts to expand partners' knowledge of land management practices that benefit shorebirds should incorporate local ecological knowledge and regional expertise.

In some areas of the Flyway, acquiring land or establishing new partnerships for habitat management will significantly strengthen shorebird conservation. While land acquisition is traditionally seen as a protection strategy, this Framework prioritizes increasing habitat availability — not only for shorebirds but also for other wildlife and broader objectives such as recreation. Efforts should also include Other Effective Area-Based Conservation Measures (OECMs), such as privately or communally owned lands and Indigenous-led initiatives. In all regards, a coordinated approach is essential to building an interconnected network of conservation sites across the Flyway. Strengthening communication among partners and allies will be key to ensuring effective collaboration and long-term success.

This strategy aims to increase the quality and quantity of habitats during critical times in shorebird lifecycles through 1) elevating shorebird needs to explicit targets in land management objectives, and 2) new land acquisitions and management partnerships.

Grasslands in Paraguay.
Photo by Andrea Ferreira

OBJECTIVES:

Objective 4.1: Increase the quantity of habitats providing suitable conditions for shorebirds in conservation or managed areas, including privately owned lands

- Indicator 4.1a) Number of conservation areas that report managing habitat for shorebirds
- Indicator 4.1b) Area (e.g., hectares) of conservation areas which are managed in ways that create shorebird habitat
- Indicator 4.1c) Area (e.g., hectares) of private/communally owned lands which are managed in ways that create shorebird habitat

Objective 4.2: Decision and policymakers elevate and prioritize shorebird habitat conservation and management

- Indicator 4.2a) Number of activities carried out to raise awareness among decision and policy makers about shorebird conservation (e.g., meetings, workshops)
- Indicator 4.2b) Number of policies adapted and developed to elevate and prioritize shorebird habitat conservation and management

Objective 4.3: Increase capacity and technical knowledge of land managers and key stakeholders where shorebird habitat management can be improved

- Indicator 4.3a) Number of technical trainings (e.g., workshops) or other knowledge-sharing activities with land managers and key stakeholders, focusing on integration of shorebird conservation needs
- Indicator 4.3b) Number of land managers and key stakeholders who report an increase in:
  - b1) Competency in how to improve and optimize habitats for shorebirds
  - b2) Number of sites where habitats management for shorebirds has improved
  - b3) Area (e.g.; hectares) where habitat management for shorebirds has improved

Objective 4.4: Acquire lands that incorporate management and conservation actions for shorebirds

- Indicator 4.4a) Area (e.g., hectares) of habitat acquired that incorporates management and conservation actions for shorebirds
- Indicator 4.4b) Number of actions for shorebird conservation incorporated into management plans of newly acquired lands
- Indicator 4.4c) Number of newly acquired or protected sites incorporating innovative governance models (e.g., co-management, Indigenous leadership)
- Indicator 4.4d) Proportion of key shorebird sites protected or managed under area-based conservation strategies, including ethnic community titles

IMPLEMENTATION STEPS:

For existing shorebird habitats, improvement begins with advocating for conservation to key decision makers among landowners, agencies, NGOs, and other strategic partners. Providing training and sharing best practices ensures that habitat management decisions align with shorebird needs at critical stages of their lifecycles. Often, minor adjustments to water level management, vegetation control, or disturbance reduction can significantly enhance habitat quality. Many wetlands managed primarily for waterfowl in North America can also serve as high-quality shorebird habitats with strategic modifications. Sustained advocacy and capacity building are essential to expand the number of landowners and land managers who integrate shorebird-friendly practices into their work.

For new land acquisitions and management agreements, the process begins by identifying and prioritizing key shorebird sites where conservation can be expanded. This requires robust data collection and spatial analyses to identify key sites and assess threats and opportunities. Once priority areas are identified, it is essential to engage with potential partners, including government agencies, NGOs, private landowners, Indigenous and local communities, and industry representatives. Early outreach efforts should seek to build trust, communicate conservation benefits, and explore voluntary agreements such as easements, leases, or land purchases. Conservation actions should also align with broader biodiversity and climate adaptation goals while ensuring that they do not contribute to the dispossession of local and Indigenous groups. Taking a holistic approach — such as safeguarding clean water, flood mitigation, and other benefits of maintaining wetlands

— can help build support and ensure long-term project sustainability. When appropriate, seeking legal protections and securing funding for land purchase could be required. This includes identifying government grants, NGO programs, conservation finance mechanisms, and private donations to support land acquisition and long-term management. Collaboration among partners ensures that funding is effectively allocated and that a sustainable management plan is in place for newly protected areas.

Once habitat protection and management strategies are implemented, long-term stewardship and monitoring are needed to sustain conservation gains. This includes engaging local communities as stewards of the land, securing ongoing funding for reserve management, integrating climate adaptation strategies, and regularly assessing habitat conditions and shorebird populations. By following this structured approach, conservation efforts can be more effective, inclusive, and resilient in protecting shorebird habitats.

EXAMPLES:

Migratory Shorebird Habitat Initiative — Texas, U.S.
The Coastal Bend Bays & Estuaries Program launched their Migratory Shorebird Habitat Initiative in 2023 to monitor shorebird use of agricultural lands and moist-soil management units along the Texas Coast, where some landowners use financial incentives to provide waterfowl habitat on their farms and ranches. The NGO is working with rice growers, ranchers, and others to monitor which practices also benefit shorebirds. They will then seek opportunities to work with federal agencies and others to expand existing or develop new shorebird-specific incentives, with the objective of increasing the quality and quantity of shorebird habitats in the Gulf Coast Prairies and Marshes region.

Sustainable Rivers Program at Saylorville Lake and Lake Red Rock Reservoirs — Iowa, U.S.
The U.S. Army Corps of Engineers, with support from The Nature Conservancy, provides important habitat to south-bound migrating shorebirds at Saylorville Lake and Lake Red Rock in the U.S. state of Iowa through the Sustainable Rivers Program. The goals of the program include optimizing benefits from river infrastructure for people and nature, including shorebirds, when not operating for flood risk management. The Des Moines River Adaptive Management and Monitoring Plan guides management strategies at these reservoirs. At Lake Red Rock, water drawdown to expose mudflats starts in late summer or early fall, attracting thousands of shorebirds that rest and feed on invertebrates until they continue their migrations. Vegetation becomes established, produces seeds, and is flooded later in the fall for migrating waterfowl. The timing of drawdown and subsequent pool rise is coordinated with Iowa State University and the Iowa Department of Natural Resources; the University also monitors shorebird response to management actions.

Lake Red Rock delta in Iowa, U.S.
Photo by USACE

STRATEGY 5.

Develop, expand, and share beneficial management practices

Enhancing shorebird habitats in human-dominated landscapes requires implementing beneficial management practices (BMPs) that support both shorebirds and local livelihoods. This is especially important in the Midcontinent, where shorebird habitats are often integrated into large agricultural working landscapes. BMPs enhance human practices to more closely mimic natural shorebird habitats, creating conditions that better support shorebird populations.

Depending on the context, BMPs can guide habitat creation, habitat enhancement, or threat mitigation. For example, watershed and fire management practices that restore or replicate historic processes can create valuable habitats for shorebirds, as can certain livestock grazing techniques. Evidence-based conservation is essential for identifying the most effective BMPs, ensuring that their design and implementation are grounded in scientific data and local knowledge. Developing "win-win" solutions for both human and shorebird communities requires evaluating the economic, ecological, or social benefits that landowners, agencies, or communities may gain by implementing these practices. Communicating these benefits clearly is critical for the adoption and sustained implementation of BMPs.

To maximize impacts, it is important to identify and leverage synergies among existing conservation efforts. Many BMPs developed for waterfowl, prairie, or wetland conservation have significant potential to also benefit shorebirds, often with only minor adjustments. Once these practices are established or expanded to support target shorebird species, the next step is to facilitate their adoption and further integrate them into broader conservation strategies.

This strategy has two main outcomes: 1) develop and expand practices that create "win-win" scenarios for humans and shorebirds; and 2) facilitate the adoption of practices and the exchange of management expertise with partners across the Flyway.

OBJECTIVES:

Objective 5.1: Use collaborative approaches to develop new and improve existing beneficial management practices

- Indicator 5.1) Number of BMPs that are developed or improved for shorebird conservation

Objective 5.2: Implement demonstration sites for beneficial management practices and measure their benefits for shorebirds and human well-being

- Indicator 5.2a) Number of demonstration/pilot sites where BMPs are implemented
- Indicator 5.2b) Area (e.g., hectares) of demonstration/pilot sites where BMPs are implemented
- Indicator 5.2c) Number of publications documenting the effectiveness of BMPs

Objective 5.3: Conduct extensive outreach to increase capacity and scale up the implementation of beneficial management practices

- Indicator 5.3a) Number of knowledge-sharing activities with landowners and managers focusing on shorebird-inclusive BMPs (e.g., meetings, workshops)
- Indicator 5.3b) Number of participants who report an increase in:
    - b1) Competency of how to implement BMPs
    - b2) Number of sites where BMPs have improved shorebird habitat
    - b3) Area (e.g., hectares) where BMPs are implemented
    - b4) Livelihood quality and productivity as a result of applying BMPs

IMPLEMENTATION STEPS:

Many partners and practitioners working from local to national levels have developed BMPs which can be expanded to other regions or refined to be more inclusive of shorebird habitat needs. Existing BMPs should be inventoried to identify which practices have been successfully implemented and where gaps in coverage persist — whether in geographies or threats. This includes considering practices that may indirectly generate or improve shorebird habitat yet do not consider shorebirds as conservation targets. For example, many practices currently promoted in North America for waterfowl could benefit shorebirds if they are slightly modified to address their overlapping needs. It is also necessary to coordinate teams of experts, agency personnel, and practitioners throughout Flyway to refine existing or develop new BMPs. To ensure that human well-being is considered, this process should include dialogue with and the participation of affected communities, such as local producers or Indigenous peoples, as well as social scientists and economists. Care should also be taken to assess desired outcomes, avoid unintended consequences, and consistently monitor BMP effectiveness. Practices should protect shorebirds and their habitats from detrimental developments, and they should not be limited to private landowners. Where needed, BMPs should be developed for regional jurisdictions, federal and state regulatory agencies, and permitting processes for industrial and residential development, to name a few. The development of BMPs should include monitoring to evaluate their effectiveness at creating suitable conditions for shorebirds, as well as their ability to meet the needs of human communities, as part of an ongoing refinement process.

Sharing practices that successfully sustain human livelihoods and accommodate shorebird needs will assist in the widespread adoption of these practices. Efforts should focus on evaluating and communicating the economic and other benefits of relevant practices to target audiences across the Flyway and facilitating the exchange of expertise among partners at various scales, such as through in-person demonstrations and workshops or online resources. This process should feed back into the development phase of BMPs, incorporating lessons learned and ensuring an adaptive, flexible framework. Monitoring shorebird populations will be an essential component in evaluating the effectiveness of these practices.

EXAMPLES:

El Renacer de la Bertha and El Gabán Farms — Colombia

Working with the NGO Asociación Calidris, El Renacer de la Bertha and El Gabán farms in Colombia have been pioneers in the production of bird-friendly rice in Latin America since 2009. José Jarvi Bazán and Jaime Mendoza use beneficial management practices advocated within the "Wings of Rice" program, such as sustainable water and soil management, and have eliminated the use of agrochemicals. Both farms are a model of how to keep agricultural businesses economically viable while providing good shorebird habitat in the Midcontinent Flyway.

Sustainable cattle-ranching model, Asociación Armonía — Barba Azul Reserve, Bolivia

In the Barba Azul Nature Reserve, a WHSRN site, Asociación Armonía has designed a sustainable cattle ranching model that supports the long-term financial and ecological sustainability of the Reserve. They are developing guidelines for stocking rates and rotation practices that can create the lawns of short grass needed by Buff-breasted Sandpiper and other grassland shorebirds without sacrificing productivity. Barba Azul is also used as a demonstration site to teach other regional producers how they can create habitat for vulnerable species such as the Blue-throated Macaw, as well as many shorebirds, without impacting their operations. This sustainable and eco-friendly model is now being expanded across the Bolivian savanna through the Beni Eco-friendly Grassland Alliance, with the goal of producing shorebird-friendly beef.

Sustainable cattle ranching at the Barba Azul Nature Reserve, Bolivia.
Photo by John Mittermeier / Asociación Civil Armonía

STRATEGY 6.

Improve knowledge of environmental stressors' effects and address information gaps

While multiple factors contribute to shorebird declines, a comprehensive understanding of their impacts on individual birds and populations is lacking for most Midcontinent focal species. For example, many physical and chemical alterations to the environment — such as extreme temperatures, water availability, and contaminants like fertilizers, pesticides, plastics, factory effluent, and mine tailings — may negatively affect shorebirds. However, their specific effects on survival and reproductive success are often not well-quantified. Contaminants can also affect broader ecosystems, posing risks to other wildlife and human communities, making it essential to communicate their full impact effectively. A One Health approach, which recognizes the interconnectedness of wildlife, human, and environmental health, can help address these challenges by promoting collaborative research, monitoring, and conservation strategies.

To better understand how these stressors affect shorebirds, it is crucial to integrate evidence-based conservation approaches that draw on scientific research, traditional ecological knowledge, and local insights. In addition to synthesizing existing knowledge, conducting new studies will be vital to gain a deeper understanding of how various contaminants and environmental changes specifically impact shorebird health and behavior. Identifying which stressors have the greatest effects across the full lifecycles of shorebirds will help prioritize conservation actions, such as developing BMPs to mitigate these impacts.

Furthermore, to inform and support these efforts, it is essential to communicate findings on the impacts of contaminants clearly to landowners, policymakers, and local communities. This communication will help foster a shared understanding of the issue and drive collective action. Alongside these efforts, comprehensive population surveys are needed to fill key knowledge gaps — such as estimates of population sizes, distribution, and migration timing — and to track changes in these metrics over time.

This strategy has three main outcomes: 1) improve understanding of the impacts of environmental stressors on shorebirds; 2) address knowledge gaps about species' distributions, population sizes, and trends; and 3) use full lifecycle approaches to understand population-level effects.

OBJECTIVES:

Objective 6.1: Study and measure the effects of environmental stressors on conservation targets across their lifecycles

- Indicator 6.1a) Number of projects studying the effects of environmental stressors on conservation targets
- Indicator 6.1b) Number of publications on the effects of environmental stressors on conservation targets

Objective 6.2: Collect data for, and develop, integrated population models for conservation targets

- Indicator 6.2) Number of conservation targets for which an integrated population model is available

Objective 6.3: Develop and implement standardized shorebird monitoring protocols across the Flyway

- Indicator 6.3) Number of standardized monitoring protocols developed and implemented

Objective 6.4: Re-assess conservation targets' population estimates, trends, and key sites at regular intervals as new information becomes available

- Indicator 6.4a) Number of conservation targets for which robust population estimates are available
- Indicator 6.4b) Number of conservation targets for which robust population trends are available
- Indicator 6.4c) Number of key sites or priority areas identified for each conservation target

IMPLEMENTATION STEPS:

Threat assessments should be informed by local studies on a given stressor's effects, supported by monitoring, and prioritized through full lifecycle research and coordination. Suspected drivers of decline that require more attention include incompatible cropping, grazing, fire management, and water management practices, including by industry, residential development, and agriculture.

At the site level, research should focus on the local impacts of a given stressor on shorebirds and their habitat. Depending on the threats particular to a certain region, research could focus on how industrial development is likely to impact shorebird abundances, how eutrophication from agricultural runoff affects shorebird food resources, or how different stocking rates impact shorebird habitat, to name a few. This can also include research that addresses how one part of the lifecycle carries forward to the next (i.e., carry-over effects). For example, research could investigate how drought during the non-breeding season affects departure date, or how contaminant exposure during migration affects breeding. Studies during the non-breeding period of shorebirds' lifecycles are particularly needed, as research to date has focused on ecology during the breeding period.

Robust monitoring schemes are crucial for assessing the effects of stressors at the population level. Expanding and maintaining monitoring efforts for shorebirds in the Midcontinent is essential to achieve this goal. Significant gaps still exist in understanding shorebird distributions across the Flyway, particularly in South America. Standardizing monitoring protocols can help maximize the effectiveness of these efforts by reducing the barriers to initiating new monitoring programs and enhancing the collective analytical power of surveys conducted across different regions.

Understanding how threats impact shorebirds requires comprehensive lifecycle research. For example, full-cycle projects could involve coordinating tracking studies with surveys and integrating these data into integrated population models. These population models are essential for identifying survival bottlenecks and highlighting critical information gaps by synthesizing data from various sources.

Tracking studies are particularly important in this process, as they provide valuable insights into shorebirds' migratory patterns, habitat use, and connectivity across seasons. By tracking shorebirds throughout their annual cycles, we can map how different sites or regions are linked through individual movements, identifying key stopover locations, breeding areas, and non-breeding grounds. This migratory connectivity data not only helps prioritize conservation sites but also enables us to identify key stressors at various life stages, guiding the development of more targeted and effective conservation strategies.

Once existing information on the impacts of environmental stressors is compiled, further research or input from local experts should be sought to explore effective strategies for mitigating these impacts. This research can inform the development of recommendations to address threats and enhance shorebird habitat management through BMPs. The effectiveness of these recommendations should be regularly monitored, with adjustments made iteratively based on findings and across different geographies. This adaptive approach will require fostering dialogue between conservation practitioners and landowners or managers, facilitating the exchange of lessons learned. Additionally, efforts should be made to collaborate with other Flyway Initiatives to investigate and prioritize common threats.

GPS transmitter deployed on a Fuegian Snipe in Chile.
Photo by Red de Observadores de Aves y Vida Silvestre de Chile

EXAMPLES:

Research on agricultural wetlands by the Lesser Yellowlegs Working Group — Dakotas, U.S.

Lesser Yellowlegs.
Photo by Alan Kneidel

The Lesser Yellowlegs Working Group, supported by the Knobloch Family Foundation, aims at stopping the decline of the species through coordinated research on threats and implementation of conservation actions throughout its lifecycle. This includes studying the impacts of agricultural practices on shorebird abundance, body condition, and macroinvertebrate biomass in the Prairie Pothole Region during migration. A team of researchers from the University of Idaho and the University of Saskatoon are quantifying neonicotinoid insecticide concentrations in the environment and shorebird plasma to measure their associated impacts on shorebird physiology and macroinvertebrate biomass. Their work also evaluates the quality of agricultural wetlands used by Lesser Yellowlegs and other migratory shorebirds during their passage through the region. This research will provide valuable insights into how agricultural practices impact Lesser Yellowlegs during spring and fall migration, ultimately supporting more informed decision making for the species.

Hudsonian Godwit Research in the Argentinean Pampas — Argentina, Chile, and U.S.
Recent research and monitoring efforts conducted by the Instituto de Investigaciones Marinas y Costeras (CONICET-Universidad Nacional de Mar Del Plata), Universidad Austral de Chile, and the University of Massachusetts Amherst have identified previously unknown key non-breeding areas for Hudsonian Godwit and Lesser Yellowlegs in the interior Pampas of Argentina (Martínez-Curci et al., 2025). Current research efforts are focused on understanding the impacts of incompatible water management, habitat conversion, and unsustainable agricultural practices by integrating habitat modeling, movement ecology studies, and contaminant impact assessments.

Hudsonian Godwits in Pampas wetlands, Argentina.
Photo by Natalia Martínez-Curci

STRATEGY 7.

Integrate climate resiliency in conservation planning and implementation

Earth's changing climate is already impacting shorebirds and their habitats, and it will continue to do so in the future. Addressing the root causes of climate change is beyond the scope of this Framework, so instead the focus is on enhancing habitat resiliency. Key steps include assessing current climate impacts, projecting future changes, and integrating these insights into conservation planning. Efforts should prioritize the most vulnerable areas as well as those with the potential to serve as climate refuges for shorebirds. Adapting conservation strategies to future climate scenarios is essential for ensuring they align with broader climate adaptation initiatives, ultimately supporting the long-term sustainability of conservation efforts.

This strategy has three main outcomes: 1) shorebird habitat resiliency is increased by establishing or expanding conserved areas under future climate change scenarios; 2) funding for climate change adaptation and resilience is leveraged for shorebird habitat conservation; and 3) shorebird habitat conservation is recognized as a means to increase climate resiliency for human well-being.

OBJECTIVES:

Objective 7.1: Develop shorebird habitat models under various climate change scenarios
• Indicator 7.1) Number of sites/areas for which habitat models are available
Objective 7.2: Prioritize conservation of critical sites/areas based on vulnerability to climate change
• Indicator 7.2a) Number of sites for which a climate change vulnerability assessment has been conducted • Indicator 7.2b) Number of sites identified as a priority for conservation based on its vulnerability to climate change
Objective 7.3: Integrate the effects of climate change in the management of the most vulnerable sites, including through nature-based solutions
• Indicator 7.3a) Number of sites where climate change adaptation recommendations have been formulated and/or implemented • Indicator 7.3b) Number of sites that have implemented nature-based solutions to increase climate resiliency
Objective 7.4: Demonstrate the benefits of shorebird habitat conservation for climate change adaptation and resilience through case studies representing the breadth of habitats and conditions across the Flyway
• Indicator 7.4) Number of case studies documented

Fuegian Snipe habitat in Chile.
Photo by Red de Observadores de Aves y Vida Silvestre de Chile

Nature-based solutions provide one of the best avenues for achieving resilient shorebird populations and human communities.

IMPLEMENTATION STEPS:

Across the Midcontinent, there are efforts underway to describe and forecast the effects of climate change across various scales, ecosystems, and taxa. Similar efforts directed at shorebirds should build on these initiatives, applying existing models to shorebird habitats to assess their vulnerability.

When conducting climate vulnerability assessments and prioritizing vulnerable sites, it will be important to consider both the gradual, long-term impacts of climate change (e.g., shifting phenology, increasing mean temperatures) and impacts that arise from the increased frequency and intensity of extreme events like hurricanes, droughts, and floods. Vulnerability assessments should be conducted for specific species, sites, and landscapes (e.g., conservation areas versus a watershed). Conservation actions can then be prioritized, such as adjusting the boundaries of conservation areas to include more resilient sites where appropriate shorebird habitats are likely to persist. Other potential conservation actions include the adjustment of priorities for habitat creation by, for example, increasing incentives for habitat management in some geographies to mitigate expected habitat loss in others. Linking shorebird-focused priorities with other wildlife or ecosystem conservation initiatives maximizes outcomes and reduces potential conflicts between priorities.

Wherever relevant, shorebird conservation should be linked with human well-being. Nature-based solutions, which weave natural features or processes into climate adaptation strategies, provide one of the best avenues for achieving resilient shorebird populations and human communities. Examples include: conserving prairies to mitigate flooding and erosion from extreme weather events; protecting natural wetland features in grasslands to provide critical habitat while sustaining groundwater recharge; and restoring the historical timing of fire to keep climate-induced shrub encroachment at bay, reduce the intensity and spread of wildfires, and preserve valuable grazing lands. Examples should be developed into case studies which can be used to engage key decision makers. When the proposed adaptation measures create conflict between human communities and shorebird needs, as is often the case with sea walls or other coastal engineering projects such as sand mining for beach replenishment, partners can use success stories from evidence-based projects to help communities understand and engage in more sustainable options. It will be crucial to find the “middle ground” between apparently conflicting interests by emphasizing the climate adaptation benefits of shorebird habitat itself (e.g., flood control and carbon sequestration). With increasing recognition internationally that nature-based solutions are a way to tackle both the biodiversity and climate crises, there are funding opportunities under this umbrella that could support shorebird conservation. Projects under the MSCI should take advantage of this momentum and advocate for the role of shorebird habitat in climate adaptation measures.

EXAMPLES:

Resilient Coastal Sites of the U.S. portion of the Gulf of Mexico

In partnership with the U.S. Fish and Wildlife Service, as well as numerous state and non-governmental partners, The Nature Conservancy assessed over 1,500 coastal sites along the Gulf of Mexico for their ability to support biodiversity and ecosystem services under projected sea level rise. The future resiliency of each site was scored based on the likelihood that habitat projected to become inundated would be able to migrate inland. This assessment of resiliency, or the ability of sites to accommodate change, can be used to identify areas for targeting conservation, restoration, or management. Such efforts conducted within other parts of the MSCI geography can be used to understand the relative vulnerabilities of sites important for shorebirds and prioritize sites accordingly.

Assessment of future shorebird habitat in Brazil under climate change

Research predicts significant habitat losses for 25 shorebird species in Brazil by 2050 and 2070, with areas along the southeastern coast, the Pantanal, and the Amazon River facing major declines (Damasceno 2021). While the study didn't focus on conservation actions, it represents a crucial step in understanding climate change impacts on shorebirds, informing future adaptation strategies and habitat management plans in Brazil. Similar analyses across the Midcontinent Americas Flyway could be invaluable for developing climate adaptation strategies and prioritizing conservation actions.

Hudsonian Godwit in Lagoa do Peixe, Brazil.
Photo by Raphael Kurz

STRATEGY 8.

Build capacity for conservation by raising awareness and boosting education and training

The long-term success of shorebird conservation depends on the commitment of people, organizations, and communities to effect change. At the same time, the ability to create positive and durable change for shorebirds and people is directly linked to people's knowledge and capacity to act within their circles of influence. For example, governments and agencies can have direct impacts through legislation and incentive programs, while local communities can impact shorebirds through behavior change and grass-roots approaches to protect habitat. Which stakeholders should be engaged will differ across projects and geographies, but engagement and advocacy at all levels in parallel is required to make progress.

Furthermore, education and training based on science and the interests of diverse audiences is vital to inform many of the MSCI's other strategies. Awareness is the foundation from which to persuade governments of the importance of conserving shorebirds and their habitats. Education is also integral to strong alliances and effective incentive programs and beneficial management practices. Increasing knowledge and building the capacity of key stakeholders is thus essential for the implementation of many strategies.

This strategy's outcomes are to increase the knowledge and the capacity of key stakeholder groups to effect change for shorebirds, such as: 1) local community members; 2) conservation organizations and practitioners; 3) the private sector; and 4) decision makers at various levels of government. The ultimate outcome of this strategy is to support the execution of actions that benefit shorebirds and communities.

The long-term success of shorebird conservation depends on the commitment of people, organizations, and communities to effect change.

Sunset birding at Four Winds Refuge in Mississippi, U.S.
Photo by Jason Hoeksema / Delta Wind Birds

OBJECTIVES:

Objective 8.1: Implement awareness campaigns to call attention to the importance of conserving shorebirds and the benefits this provides to communities across the hemisphere

- Indicator 8.1a) Number of outreach materials produced
- Indicator 8.1b) Number of communities, schools and/or students engaged in awareness campaigns (e.g., by using the Shorebird Curriculum)
- Indicator 8.1c) Number of shorebird festivals hosted/organized (on an annual basis)
- Indicator 8.1d) Number of priority sites that have educational signage
- Indicator 8.1e) Number of participants reached by awareness campaigns who report an increase in knowledge/understanding

Objective 8.2: Increase capacity of key stakeholders to implement conservation actions that are beneficial to shorebirds

- Indicator 8.2a) Number of capacity-building activities conducted (on an annual basis)
- Indicator 8.2b) Number of participants attending each capacity-building activity
- Indicator 8.2c) Number of participants who report an improvement in knowledge and/or skills to support shorebird conservation

Objective 8.3: Develop value propositions to increase endorsement of shorebird conservation by a wider range of actors

- Indicator 8.3a) Number of value propositions developed
- Indicator 8.3b) Number and diversity of actors targeted
- Indicator 8.3c) Number of times value propositions are used to promote shorebird conservation

Objective 8.4: Develop champion schemes to identify, train, support, and acknowledge the contribution of conservation champions

- Indicator 8.4a) Number of champions schemes developed
- Indicator 8.4b) Number of champions identified, trained, supported or acknowledged for their contributions to shorebird conservation

IMPLEMENTATION STEPS:

Raising awareness and building capacity begin by identifying key stakeholders within the scope of a project. These may include institutions or individuals from various groups: local community members (e.g., schools and universities, Indigenous peoples, community producer associations, and birdwatchers); conservation organizations and practitioners (e.g., NGOs and protected area managers); the private sector (e.g., industry staff, landowners such as farmers and ranchers, and tourism companies); and decision makers (e.g., government personnel, development bank executives, and funding agency staff).

Identified stakeholders should be consulted to gauge their current interest in a conservation project and their ability to effect change. This consultation should foster reciprocal engagement, assessing overlaps between shorebird conservation and ecosystem services or cultural values important to target communities. Involving social scientists here can enhance stakeholder engagement by aligning messaging to common interests and providing insight into how to encourage behavior change. Communication and educational materials can then emphasize the benefits of shorebird conservation for human well-being in contexts relevant to target audiences. Depending on the stakeholder group, materials can range from memos to maps and plans, beneficial management practice reports, classroom lessons and more. These should be co-developed with diverse stakeholders (rightsholders in particular), using communication methods suitable for audience education levels, native languages, and interests. Disseminating results may take many forms depending on the stakeholder group, including school activities, festivals, webinars, meetings with decision makers, or workshops with practitioners. It will be important to emphasize long-term capacity building by training not only conservation practitioners and their private partners, such as ranchers and farmers, but also developing conservation leaders in various sectors and levels of government. One effective approach is engaging conservation "champions."

Champions are respected members of a community who, because of either their role as leaders, mobilizers, or examples of best practices, can serve as outreach partners, maintaining two-way communication between practitioners and community members. Champions advocate for the interests of both groups. For example, a respected rancher who participates in capacity-building workshops can increase credibility, retention, and engagement within the community. These champions can also be members of international communities, engaging with governments and multinational organizations.

To succeed over the long term, outreach, education, and capacity-building efforts should be in continuous, adaptive engagement with target communities. This requires consistent long-term funding and frequent re-evaluations of how actions impact behaviors and create positive outcomes for shorebirds and engaged communities. Celebrating success stories and recognizing the contributions of communities, partners, and conservation champions can renew current engagements and initiate new partnerships and advocacy opportunities.

EXAMPLES:

Discover Shorebirds Curriculum by SAVE Brasil — Lagoa do Peixe, Brazil

The Discover Shorebirds Curriculum was developed by Manomet Conservation Sciences, the Executive Office of WHSRN, Raincoast Education Society, Environment and Climate Change Canada, and the U.S. Forest Service. The curriculum is designed to help students connect to shorebirds, conservation, and the importance of local ecosystems, and it is easily adaptable to different settings.

Children taking part in an activity from the Discover Shorebird Curriculum.
Photo by SAVE Brasil

At Lagoa do Peixe National Park, a WHSRN Site of International Importance in southern Brazil, the Discover Shorebirds Curriculum was used to train K-12 teachers from schools in two municipalities. The training of 80 teachers in 2022 and 77 in 2023 reached 1,984 students across both years and changed the relationship between the community, shorebirds, and the park. The disconnect that existed before was transformed into a sense of ownership and pride and led to the inclusion of shorebird themes in local festivities, commitment from the school boards to include shorebirds in their official curricula, and increased support for the park. Recently, teachers have requested training on shorebird identification and the International Shorebird Survey protocol.

Mountain Plover Festival — Karval, Colorado, U.S.

Looking for ways to bring in economic opportunities for their small town, community members of Karval, Colorado, started a festival to celebrate the Mountain Plover. Karval is nestled in the shortgrass prairie of the Eastern Plains — the summer home to this shorebird, which is endemic to the grasslands of the North American Midcontinent. This festival not only brings bird lovers from across the country to see this emblematic shorebird, it also highlights the local human and ecological history of the area. Local landowners, ranchers, and biologists mingle with visitors to share how they are working together to conserve the nesting habitat for this species, as well as to preserve the way of life for the people who live there. As of 2025, the Karval Community Alliance has been running the festival for 17 years.

Youth leaders participating in a workshop organized by Experiencia Ambientalia.
Photo by Fundación Líderes de Ansenuza

Experiencia Ambientalia — Córdoba, Argentina, and beyond

Experiencia Ambientalia, led by Fundación Lideres de Ansenuza and the Executive Office of WHSRN, fosters sustainable change in the Mar Chiquita lagoon by empowering local youth leaders to undertake impactful projects and become stewards of WHSRN sites. Over three years, the program has engaged 500 young people from 22 villages in Córdoba, Argentina, in conservation leadership, resulting in 40 projects. Additional capacity building includes 50 school teachers who have participated in the program annually. The initiative has expanded virtually to 15 other WHSRN sites.

Conservation Champion Bill Sullivan, Delta Wind Birds — Mississippi, U.S.

Bill Sullivan, one of four owners of Four Winds Refuge in the Lower Mississippi Alluvial Valley, transformed this former catfish farm first into a private game reserve and recreational property, and now into a haven for shorebirds. In partnership with Delta Wind Birds, a non-profit organization incentivizing landowners to create shorebird habitat in the region, Bill creates over 24 hectares of shorebird habitat on his property each year. Beyond being a participant in the incentive program, Bill integrates shorebird conservation into his management philosophy, experimenting with practices, studying the birds, and dedicating considerable personal resources to the cause. He also welcomes scientists, educators, and students onto his property so they may all learn from each others' practices and experiences in an equal exchange of expertise and ideas.

Shorebirds using Four Winds Refuge in Mississippi, U.S.
Photo by Jason Hoeksema / Delta Wind Birds

STRATEGY 9.

Sustain the Initiative's leadership and actions at the Flyway scale

Flyway-level leadership is critical to coordinate actions within the Midcontinent with other conservation initiatives, identify funding opportunities, advocate for shorebird conservation at all levels across the hemisphere, and ensure Framework implementation. The MSCI itself is an alliance and its leadership will bring partners together to foster effective collaboration in the Midcontinent and facilitate cross-flyway coordination with the Pacific and Atlantic Shorebird Initiatives. While the MSCI focuses on restoring and maintaining healthy midcontinental shorebird populations, it is evident that collaboration and partnership outside the "shorebird world" is required to achieve this goal. To be effective at such a large scale, it will be necessary to develop relationships with partners working in other spheres (e.g., human well-being, climate change adaptation, answering the biodiversity crisis). Engaging a multitude of partners at the Flyway scale and advocating for shorebirds alongside them will depend on the MSCI's leadership.

This strategy focuses on sustaining MSCI's leadership and its ability to support actions across and beyond the Flyway, with the following expected outcomes: 1) establish a leadership and collaboration structure; 2) secure funding and capacity for MSCI's implementation; 3) support and track Flyway-scale projects and programs; and 4) integrate efforts with the Atlantic and Pacific Shorebird Conservation Initiatives.

OBJECTIVES:

Objective 9.1: Secure capacity to maintain an efficient MSCI governance structure
• Indicator 9.1a) Number of committees and working groups established • Indicator 9.1b) Number of members actively involved in each committee and working group • Indicator 9.1c) Number of meetings held by committees and working groups (on an annual basis)
Objective 9.2: Sustainably fund a coordinator position to support the MSCI's implementation
• Indicator 9.2) Number of full-time employee equivalent positions funded (or provided in capacity) per year
Objective 9.3: Coordinate conservation actions and resources with the Atlantic and Pacific Shorebird Initiatives
• Indicator 9.3a) Number of collaborative projects with Atlantic and Pacific Shorebird Conservation Initiatives • Indicator 9.3b) Funding to sustain and manage inter-flyway communication needs is secured (e.g., website)
Objective 9.4: Continuously track investments and progress against objectives and indicators
• Indicator 9.4) An online dashboard is available and maintained regularly to track: a) Number of projects/programs/initiatives contributing to the MSCI b) Amount of funding directed annually at shorebird conservation in the Flyway c) Progress towards other indicators from Strategies 1 to 8

Magellanic Plovers.
Photo by Santiago Imberti

IMPLEMENTATION STEPS:

To be effective, the MSCI will establish a governance structure. The suggested approach is a Steering Committee composed of members from lead organizations across the Flyway, supported by a coordination team. The Steering Committee will provide general oversight and guidance, while the coordination team will play a central role in executing this Framework. Coordinator activities may include inter-flyway coordination, representation in other initiatives, coordinating strategic working groups, developing and sharing communication materials, leading events (e.g., webinars), and fundraising.

The coordination of MSCI activities will be organized around working groups (or communities of practice), which will focus on strategic themes such as conservation in working lands, habitat management, and science and communication. The sustainability of the MSCI also depends on leveraging sufficient funding and capacity to sustain its implementation. To this end, the MSCI will develop an implementation cost estimate and play a role in identifying and leveraging funding and capacity. Securing funding to hire one full-time employee to serve as an MSCI coordinator will be one of the main short-term objectives.

Once the governance structure is established and coordination position(s) secured, several Flyway-scale projects can be undertaken. These may include: prioritizing conservation sites and landscapes; coordinating monitoring efforts; developing toolkits for beneficial management practices and incentives; developing justice, equity, diversity and inclusion guidance documents; and creating and sharing communication materials. The MSCI coordination team will also be tasked with tracking investments and progress against the established objectives and indicators for each of the Strategies. This will be critical to measure the success of the plan and identify implementation gaps.

As much as possible, MSCI's implementation will take a multi-flyway approach to synergize resources and improve conservation outcomes, and when relevant, partners will be encouraged to participate in existing working groups from the Atlantic and Pacific Flyway Initiatives. The integration of conservation actions and priorities across the three flyway initiatives of the Western Hemisphere will help maximize the impact of each and is essential to address the problems facing shorebirds at the required scale. Sharing resources, communication materials, and leadership support between Flyways will be central roles for the coordination team. In addition, the MSCI's Steering Committee and Coordination Team will play a role in projecting the Initiative's goals and objectives outside the "shorebird world" and advocating for shorebird conservation at a large scale with a multitude of potential partners and funders.

6. IMPLEMENTATION

Upland Sandpiper.
Photo by Gerald DeBoer/iStock

The MSCI Framework was developed by first identifying a global geographic scope (the Midcontinent Americas Flyway), which was then broken down into large regions (Arctic/Boreal, Temperate North America, and South America) and finally smaller planning units. Results from the various regional workshops were then compiled into a Flyway-scale conservation plan. In the same fashion, the successful implementation of the MSCI Framework will require work across different scales, with activities conducted by a diverse range of stakeholders and funded through both traditional and new opportunities.

6.1 FLYWAY-SCALE IMPLEMENTATION

The highest level of implementation for the MSCI Framework involves coordinating efforts at the Flyway scale. This includes establishing and managing various working groups, identifying funding opportunities and synergies, tracking progress toward conservation outcomes, and collaborating with other flyway initiatives. To ensure effective oversight, it is proposed that a Flyway Steering Committee, composed of diverse stakeholders from across the Americas, be created, along with a Flyway Coordinator position to facilitate implementation.

While multiple partners will contribute to the MSCI's implementation, working groups will serve as a primary mechanism for action. Comprising experts and partners from diverse organizations, working groups foster collaboration by bringing together a range of perspectives, skills, and resources to identify and prioritize the most urgent actions and drive their implementation. By coordinating efforts and leveraging available funding and capacity, working groups can achieve more impactful, on-the-ground conservation outcomes in a strategic and cost-effective manner. The MSCI will first encourage partners to engage with existing Flyway-level working groups from the Atlantic and Pacific Flyway Initiatives. However, the Midcontinent Americas Flyway presents unique challenges and opportunities, especially concerning working landscapes and interior habitats. These landscapes not only support essential shorebird habitats but also sustain the livelihoods of many people.

The Western Hemisphere Shorebird Group (WHSG) and its biennial meetings provide an important forum for MSCI working groups and partners to convene, share progress, and strengthen collaboration across the Flyway. In parallel — and often complementary to MSCI working groups — species-based working groups established through other initiatives also play a vital role. For example, the Lesser Yellowlegs working group under the Road to Recovery (R2R) initiative is already addressing pressing conservation needs (R2R 2022; see Appendix 10). Additionally, several existing international working groups are focused on key MSCI target species, such as the Buff-breasted Sandpiper, Mountain Plover, and Phalarope Working Groups. These species-specific efforts complement and strengthen the MSCI, and alignment between them will enhance the overall effectiveness of shorebird conservation across the Americas.

6.2 PLANNING UNIT-LEVEL IMPLEMENTATION

The MSCI Framework was divided into planning units (such as the Arctic, the Great Plains of North America, or the Central-Southern Andes/Patagonian Steppe), which represent large but cohesive ecoregions. Planning units share common biomes and similarities in terms of threats to shorebirds and political, economic, and cultural contexts. As such, priority strategies and related results chains were developed at the planning unit level.

While planning units were helpful in developing the MSCI, most conservation actions will happen at the country or local scale (see below). However, there are a few examples of conservation initiatives that can help implement the MSCI Framework at the planning unit level, such as the Memorandum of Understanding on the Conservation of Southern South American Migratory Grassland Bird Species and Their Habitats (Uruguay, Argentina, Brazil, Paraguay and Bolivia), the Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management, and the Migratory Birds Joint Ventures in North America.

6.3 NATIONAL-SCALE IMPLEMENTATION

As a step down from the Flyway-scale implementation, each of the 16 countries included in the MSCI have responsibilities, commitments, and objectives regarding the safeguarding of biodiversity within their borders. Appointing National Shorebird Coordinators is an excellent step to helping ensure implementation at the national level and internationally since those positions are poised to communicate and coordinate with each other. MSCI partners should seek to involve other partners within their countries and in neighboring countries that have similar objectives and challenges. As an example, many countries in the Midcontinent Americas Flyway are signatories of the same international agreements, such as the Convention on Biological Diversity (CBD), the Ramsar Convention on Wetlands, and the Convention on Migratory Species (CMS). Additionally, several countries have specific shorebird conservation plans (see Appendix 9) and/or bird conservation strategies that support the implementation of the MSCI Framework. As much as possible, MSCI partners should seek synergies between the MSCI Framework and other existing conservation plans or international agreements, then leverage these existing initiatives to fund, support, and strengthen their conservation actions. Conversely, governmental agencies should use the MSCI Framework as a tool to develop policies, laws, and regulations that have the potential to benefit shorebirds and their habitats.

6.4 LOCAL-SCALE IMPLEMENTATION

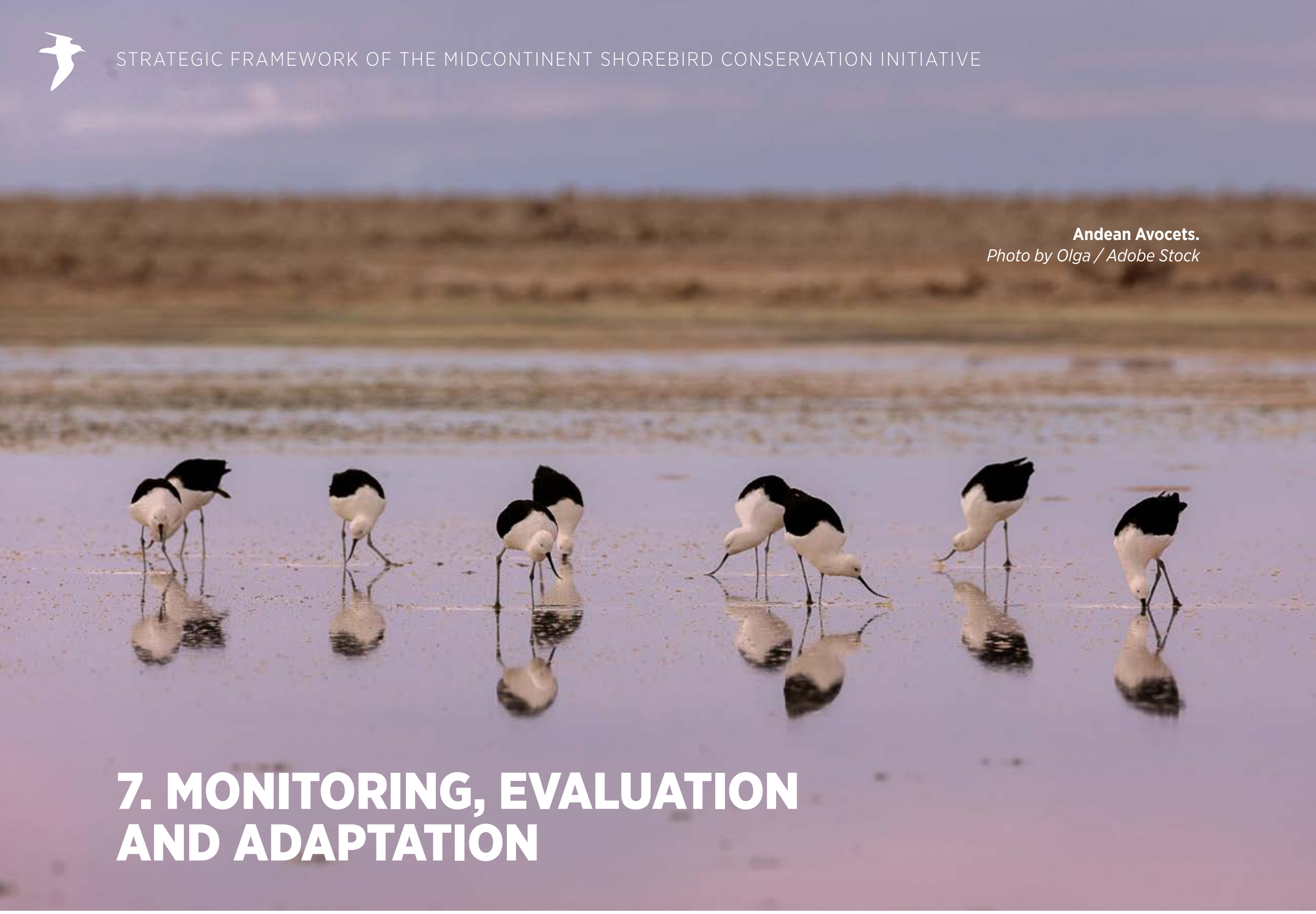
While the MSCI Framework was developed with a Flyway-scale approach, its implementation ultimately relies on conservation actions realized at the local level. This includes projects conducted at the site level or within a very specific geographic scope (e.g., a municipality). Because of their scope, these projects are more likely to yield measurable outcomes, which can then be elevated to the national, planning unit, and Flyway levels.

In order to contribute to the overarching strategies and goals of the MSCI, local project leaders are encouraged to look at the planning unit results chains and develop actions and programs based on the products that are relevant to their sites (i.e., based on threats and opportunities).

6.5 CONSERVATION PARTNERS

The successful implementation of the MSCI Framework will depend on the collaboration of a diverse network of partners. These include organizations and individuals working directly with shorebirds and their habitats — such as biologists, researchers, and conservation practitioners — as well as those whose primary activities and goals lie outside of conservation but still influence shorebird habitats, such as community associations, municipal governments, and industry representatives.

A strong conservation network must engage a broad spectrum of funders, organizations, communities, and individuals. It is essential to actively involve diverse stakeholders and rightsholders, including conservation NGOs, Indigenous communities, governmental agencies, land users, and landowners. A list of supporting instruments and initiatives is also presented in Appendix 10. By leveraging the combined resources, expertise, and efforts of these varied partners, the MSCI Framework can drive meaningful, lasting conservation impact across the Midcontinent Americas Flyway.



Andean Avocets.
Photo by Olga / Adobe Stock

7. MONITORING, EVALUATION AND ADAPTATION

Standardized and coordinated monitoring at the Flyway scale will be used to assess whether the strategies and underlying actions are achieving their intended results, as well as to track progress toward conservation outcomes. Monitoring and evaluation will occur over two timeframes: the short term, using the strategic objectives and their indicators, and the long term, by tracking shorebird population trends. Assessment of progress toward objectives will be made available periodically on the MSCI's website. These assessments will demonstrate progress, justify continued support from funders, and provide context to partners about their roles within the larger scope of the MSCI. These assessments will also put the MSCI in the context of larger initiatives, such as the Global Biodiversity Framework. The MSCI endorses adaptive management, so the content of this Framework will be adapted over time to reflect changing conditions and the latest scientific information.

7.1 SHORT-TERM PROJECT-BASED MONITORING AND EVALUATION

Short-term assessment (within 10 years) of the Framework's progress towards its conservation goals will be monitored and evaluated through the 36 strategic objectives and 89 indicators developed from Flyway-scale strategies. Individual projects under the umbrella of the MSCI Framework will report their contributions to the strategic objectives and indicators, and these results will be combined at the Flyway scale. Indicators span ecological, social, financial, and legislative approaches and are proxies for the immediate impacts of projects on long-term shorebird conservation outcomes. This allows project leads to assess the contributions of their projects faster than measuring population trends and adapt their actions to contribute to the broader intended outcomes. Taking a broad view of how projects impact shorebirds, their habitats, and relevant financial or social spheres will ensure that shorebird conservation is supporting human well-being as much as possible.

7.2 LONG-TERM SHOREBIRD POPULATION MONITORING

The goal of this initiative is to enhance shorebird conservation across the Flyway by halting population declines and, where possible, increasing populations. The success of the Framework will be assessed through changes in population trends and sizes, which requires data collected through standardized long-term monitoring programs. Hence, a key objective of the MSCI is to expand both the spatial and temporal coverage of monitoring efforts along the Flyway. Below is a brief overview of some of the key existing programs that will support the monitoring of shorebird populations and the assessment of focal species.

The Arctic Program for Regional and International Shorebird Monitoring (PRISM) is a monitoring scheme spanning the U.S. and Canadian Arctic regions that aims at estimating long-term change in Arctic-breeding population size (Bart et al. 2012). Arctic PRISM's first round of surveys was recently completed (2002–2020) and will provide a baseline for a second round of surveys (2021–2033). Data collected in the first round was also used to generate population estimates for 12 species using the Midcontinent Flyway (Smith et al. in prep.).

In other areas, data collected through citizen science programs can be used to estimate population sizes and trends for both migratory and resident shorebird species in the Midcontinent. Among the largest multinational, volunteer-based monitoring efforts are the Neotropical Waterbird Census, the International Shorebird Survey (ISS), and eBird. The Neotropical Waterbird Census is a coordinated count conducted twice a year across South America, while the ISS is an international program designed to track shorebird populations over time. eBird is a global, online citizen science platform developed by the Cornell Lab of Ornithology that allows birdwatchers to record and share their observations. eBird Status and Trends and ShorebirdViz webpages are good visualization tools of shorebird distribution, abundance and population trends models.

Despite their value, these programs face limitations in the Midcontinent. Between 2012 and 2021, twice as many ISS surveys were conducted in the Atlantic Flyway than in the Midcontinent, even though the Midcontinent spans a much larger area. This disparity highlights gaps in survey efforts, particularly in remote regions. Additionally, ISS methodologies were originally designed for coastal shorebird species, raising concerns about their effectiveness in monitoring shorebirds in inland wetlands and grasslands. For example, shorebird surveys in the Great Plains face additional challenges due to the low and unpredictable densities of shorebirds, the ephemeral nature of wetlands, and the vast, remote landscapes in which they occur (Skagen 1993, Skagen and Knopf 1994). Many wetlands in this region are seasonal or temporary, making it difficult to time surveys to coincide with peak shorebird use. Furthermore, the scattered distribution of shorebirds in inland habitats complicates efforts to apply standardized survey methodologies, which were originally developed for more predictable coastal stopover sites. Accessibility is also a barrier, as many key shorebird habitats in the Great Plains occur on private lands, requiring landowner cooperation.

Pantanal Snipe.
Photo by Raphael Kurz

Expanding survey coverage, adapting methodologies for dynamic inland systems, and increasing collaboration with landowners and local observers would improve the effectiveness of these programs in tracking shorebird populations across the Midcontinent. However, the feasibility and cost of large-scale inland surveys present significant challenges. The vastness and remoteness of many key shorebird habitats require substantial financial and logistical resources, including travel, equipment, and personnel. Additionally, the need for repeated surveys across unpredictable wetland conditions further increases costs and complexity. Addressing these limitations will require innovative survey approaches, improved resource allocation, and greater reliance on community-based monitoring and citizen science programs.

Regional programs could also be continued or expanded to monitor changes in site-specific or regional populations. For example, the Grassland Shorebird Survey in the Southern Cone was a volunteer-based monitoring program led by BirdLife to survey four species of grassland-dependent shorebirds. Shorebird surveys have also been conducted in recent years across parts of the Amazon and Llanos in several countries, the Altiplano, and key non-breeding habitats of Wilson's Phalarope. Exploratory river surveys were conducted along the major rivers of the Amazon Basin in Brazil, Colombia, Ecuador, Peru, and Bolivia in 2021–2024. The main goal of these surveys was to collect preliminary data on shorebird abundance and distribution along major rivers and to establish a suitable monitoring protocol. Surveys in the Altiplano of Argentina, Bolivia, Chile, and Peru have been carried out to increase knowledge of the importance of high-altitude wetlands for shorebirds. These simultaneous surveys were carried out in 2010, 2020, and 2025 in collaboration with the High Andean Flamingo Conservation Group (GCFA).

The implementation of the MSCI will provide an opportunity to expand these monitoring programs, in concert with more Flyway-scale programs, in order to derive robust population trend analyses. Finally, species-specific monitoring programs (e.g., Piping, Mountain, and Snowy Plover) will also be used to assess progress toward population objectives.

7.3 DATA MANAGEMENT

Centralized data management systems are essential for efficient project implementation, progress tracking, and partner collaboration. Investing early in standardized data management for Flyway-scale population monitoring and individual shorebird tracking will have long-lasting benefits for the success of the MSCI project. Platforms like NatureCounts, managed by Birds Canada, and eBird, developed by the Cornell Lab of Ornithology, serve as key tools for collecting, storing, and sharing shorebird data. While NatureCounts focuses on biodiversity data management and analysis, eBird provides a user-friendly, scientifically grounded framework for bird observations. Although primarily used by birding enthusiasts, eBird also supports structured monitoring efforts through customized protocols, such as those used by the International Shorebird Survey (ISS).

Systems for centralizing and managing shorebird tracking data include the Motus Wildlife Tracking System (Motus) and Movebank. Motus, a program of Birds Canada, is a collaborative network of automated radio telemetry stations that track small flying animals, including shorebirds. It relies on a system of receiving towers to detect radio-tagged individuals, providing high-resolution movement data at a broad scale. These data are stored in a centralized database and can be shared for collaborative research and large-scale analyses. However, Motus only collects data from its own radio telemetry network. Movebank is an online global database for animal tracking data that also serves as a long-term repository for tracking datasets from various telemetry methods. Movebank allows researchers to securely manage and analyze their movement data while also facilitating collaboration between scientists and conservation organizations. Many shorebird tracking projects, including those using GPS and satellite telemetry, are archived in Movebank, ensuring accessibility and data continuity over time.

The Shorebird Science and Conservation Collective, led by the Smithsonian Migratory Bird Center, is a collaborative initiative that compiles and standardizes shorebird tracking datasets from multiple technologies, including Motus, satellite transmitters, geolocators, and GSM tags. Through data-sharing agreements with tracking data owners, the Collective centralizes these datasets, making them more accessible and actionable for conservation practitioners. Their primary mission is to facilitate on-the-ground conservation by analyzing tracking data in a standardized way and providing reports that inform conservation efforts across the Americas.

Finally, collecting data on project implementation can support the development of online dashboards, story maps, and impact reports, which can then be shared between evaluations of the Framework. These narratives not only encourage transparency and accountability; they provide a relatively accessible means through which to engage partners and funders.

7.4 ADAPTIVE MANAGEMENT

The MSCI acknowledges that adaptive management is required to successfully achieve desired conservation outcomes. An adaptive approach emphasizes continuous learning and transparency while acknowledging that there will always be uncertainty regarding how best to achieve outcomes. This is generally structured as a five-step cycle, moving through assessment, design, implementation, monitoring, and evaluation. The Framework itself is a result of the assessment of the status of shorebirds in this Flyway and the design of a plan to coordinate and scale up conservation actions. Monitoring and evaluating the implementation of the Key Strategies will allow partners across the Flyway to revise strategies as needed in order to improve effectiveness. This step is essential to carry the Framework forward into the future, emphasizing accountability to the stated outcomes of this plan and supporting informed, transparent decision making.

To support this approach, the Framework should be understood as a living document, expected to evolve as partners and practitioners learn more about the social and ecological systems at play, and as new challenges and opportunities arise. Relevant documents and updates to this Framework will be published on the Midcontinent Shorebird Conservation Initiative website.

Two-banded Plover.
Photo by Arne Lesterhuis

8. BARRIERS TO SUCCESS

Piping Plover.
Photo by Joel Jorgensen

8.1 REGULATORY AND GOVERNANCE

Most shorebirds are migratory, traveling across multiple political boundaries — national, provincial, state, and municipal — in a single year. As such, shorebirds and their habitats throughout the Midcontinent Americas Flyway are subject to different regulatory and policy regimes regarding endangered and migratory species protection, development, water management, pollution control, agriculture, and ranching practices. Additionally, the capacity to enforce policy or regulatory frameworks that would otherwise favor shorebird conservation varies across jurisdictions. In many instances, regulatory systems favor economic benefits and undervalue biodiversity and the ecosystem services that healthy habitats provide. Although some international programs and agreements cross national borders (see Appendices 9 and 10), none covers the entire geography of the Midcontinent Americas Flyway. Sharing model statutes, policies, regulations, incentive programs (financial and non-financial), and beneficial management practices will help build a consistent, substantive framework that is beneficial for Flyway-scale shorebird conservation. Greater collaboration and alignment across international frameworks of relevance to migratory species will also be important.

Good governance is critical to addressing many of the threats and underlying drivers of successful conservation at key sites and geographies for shorebirds. Good governance covers the rules and procedures of decision-making and includes access to information and participation in decision-making processes. Potential good governance mechanisms and tools include multi-stakeholder management committees, management plans developed through participatory processes, local authority byelaws that regulate the use of an area, building support for and developing proposals for official protected area status, and the development of projects that integrate site conservation efforts with local development.

8.2 FINANCIAL

Shorebird declines have accelerated over the past 30–40 years (Smith et al. 2023). Stabilizing this situation and subsequently recovering shorebird populations will take many decades and require funding for long-term, consistent efforts. Addressing the broader biodiversity crisis is an even larger task, on top of more immediate efforts to halt and reverse declines. Therefore, the funding gap is a major barrier to the successful implementation of the MSCI Framework. To address the gap, public, private, and civil society sectors must get involved.

The public sector (i.e., governments) is typically a lead funder of biodiversity conservation. While national priorities might not align perfectly with this Framework, there are nonetheless innovative angles that MSCI partners should be able to leverage, such as nature-based solutions. It is imperative that program decision makers allow shorebird-related projects to be eligible for these mechanisms. As explained throughout this Framework, shorebird conservation is intrinsically linked to ecosystem services and human well-being (e.g., working landscape conservation projects). Multilateral international development aid programs also should be available to fund conservation projects that demonstrate benefits to both people and shorebirds.

The private sector (e.g., industry, energy development companies) also plays an important role in funding conservation projects from local to international scales in order to mitigate their direct impacts, act as responsible corporate citizens, and, in some cases, meet their own conservation goals. However, the private sector often lacks the expertise to invest in the best conservation projects. The Framework will help identify areas where private sector resources are required and how their operations can be improved through beneficial management practices. Conversely, privately owned companies can pose a significant risk to conservation if they exclude themselves from the conservation landscape.

Although civil society often lacks resources for conservation projects, there are examples where civil society can play a crucial role in funding conservation projects that benefit migratory shorebirds while addressing socioeconomic, climate, and biodiversity challenges. The Americas Flyways Initiative (AFI), a partnership between Audubon, BirdLife International, and the Development Bank of Latin America and the Caribbean (CAF), integrates nature-based solutions with large-scale bird-friendly infrastructure projects. The Initiative merges conservation with economic and social development, embedding environmental principles into key investment sectors. It focuses on protecting and restoring critical habitats, ensuring the resilience of migratory bird populations across their annual cycles. By 2050, AFI aims to safeguard at least 10% of key migratory species through strategic conservation efforts. Over the next decade, it will mobilize $3–5 billion for 30 priority projects, leveraging additional international and private sector investments.

8.3 ENVIRONMENTAL

There are a number of system-wide threats that can impact the overall results of even well-supported conservation projects. The uncertainty surrounding climate change and its effects (e.g., population-level impacts in the Arctic and Boreal, wetlands drying up, sea level rise) are substantial. Although the root causes of climate change must be acknowledged and addressed, projects under the MSCI should focus on adapting to climate change and integrating climate-smart solutions to mitigate potential negative impacts, rather than addressing the root causes of climate change. Other system-wide threats are related to pollution, particularly plastic pollution and pesticide-laden agricultural run-off. Both of these sources of contamination started decades ago, so the long-term effects have yet to fully materialize. Even in the best-case scenarios, plastic pollution, agricultural run-off, and climate change will negatively affect shorebirds and their habitats for the foreseeable future. Additional research is needed to understand the potential impacts of these environmental factors, which will ultimately help project leaders make the best possible decisions to limit negative effects and adapt when and where possible.

8.4 SCIENTIFIC

The main scientific barrier to success is the lack of up-to-date information on many issues required for sound decision making. This is especially true in Latin America, where global inequities in research funding have resulted in significant knowledge gaps for several endemic shorebird species and far less tracking data capturing shorebird migratory movements and over-summering behavior (Michel et al. 2024). Throughout the Flyway, basic information about habitats (natural or man-made), lifecycles (e.g., productivity and survival), and migration timing and connectivity is lacking for most species. This information is critical for ensuring that time and effort are invested where the "returns" will be highest, as well as for mitigating direct and immediate threats to shorebirds and their habitats. In many areas, economically driven decisions (e.g., job and value creation) cannot consider shorebirds and other wildlife simply because the knowledge does not exist or has not been presented effectively to decision makers. Environmental impact assessment studies, for instance, must often acquire baseline information rapidly, but this information does not offer the same perspective as long-term data. Additionally, there are relatively new industries across the Midcontinent Flyway that are rapidly growing (e.g., wind and solar farms, lithium mining), and their potential impacts on shorebirds and other biodiversity components are not well understood. At a minimum, a precautionary approach should prevail when data is sparse or unavailable.

The main reason for this problem is a lack of resources and capacity to develop and implement sound scientific monitoring programs. MSCI partners should focus on the biggest, most immediate gaps. To make significant progress, western scientists must also look for opportunities to work with local communities, producers, and Indigenous groups, who are often the best experts on habitat management and the local environmental, social, and political context. Indigenous groups across the hemisphere possess a rich knowledge that is too often overlooked. Bridging the gap between contemporary conservation and Indigenous knowledge systems is a challenge that Indigenous groups, western scientists, and conservationists must overcome together.

8.5 ECONOMIC

Although the principle of sustainable development has gained much traction since the Rio de Janeiro Declaration on Environment and Development in 1992 (i.e., equitable considerations for social, environmental, and economic components), the reality is that economic decisions often prevail over social and environmental needs. Constituencies too often adopt short-sighted, economically driven visions over long-term visions with less tangible outcomes that will ultimately benefit human well-being, the environment, and the economic landscape. An example of this is the pace at which some coastal areas are being developed for residential and commercial purposes, with limited long-term returns to the general population, severe consequences for biodiversity, and high risks to landowners due to sea level rise. Another example is the transformation of the agricultural sector towards intensive production systems instead of small-scale systems, which provide better livelihoods to local communities and preserve ecosystem services. The MSCI Framework proposes to consider (and measure where possible) the value of ecosystem services, including not only the monetary value of the service but also its intrinsic and cultural value. While some industries might appear to be highly detrimental to shorebirds and their habitats at first, there are many cases where human activities can actually benefit shorebirds (e.g., wastewater ponds, rice farming, cattle ranching). Developing guidelines to make these activities compatible with conservation can increase the value and return to local communities (e.g. small-scale regenerative ranching). Nature-based solutions also help to maintain ecosystem integrity while minimizing future economic risks, especially due to the uncertainty about climate change and its impacts on water availability and sea level rise.

8.6 SOCIAL/CULTURAL

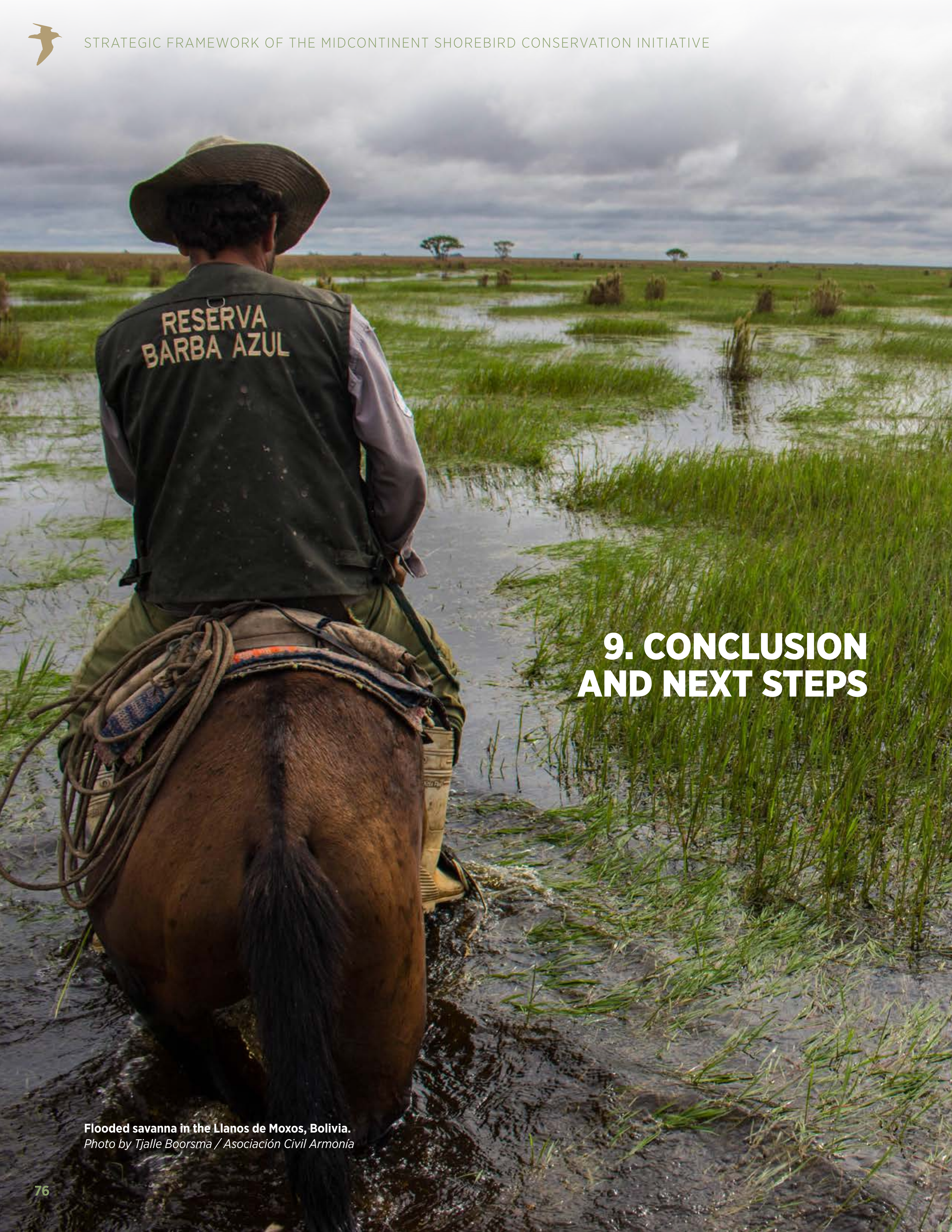
Given the breadth of the Midcontinent Flyway (16 countries), there are a number of cultural or social barriers to overcome in order to meaningfully engage with a diverse range of actors, including stakeholders and rightsholders. For one, there are three main languages (English, Spanish, and Portuguese) spoken by more than 200 million people each, as well as a multitude of local and indigenous languages and dialects. Indigenous peoples inhabited the Americas for millennia before European settlers traveled to the continent, and many of these groups have persisted through multiple challenges over the last centuries. Their history is rich, but they share the scars of European colonization. While there has been some progress in recent years to recognize Indigenous peoples' rights (e.g., United Nations Declaration on the Rights of Indigenous Peoples), there is still a long way to go to full reconciliation. Western scientists and conservationists have much to learn from Indigenous peoples, with whom they share a concern for the health of our ecosystems. Flyway-scale conservation plans such as the MSCI offer opportunities to weave together western and Indigenous/traditional knowledge systems.

Inequality is another social and cultural barrier to success, particularly across the North-South divide. While this plan focuses on conserving shorebirds and their habitats, the vision must be compatible with the safety and well-being of humans throughout the Flyway. In some areas, drug-trafficking groups pose threats to scientists and conservationists working in the field. More broadly, systemic poverty, racism, and forced displacement often prohibit the meaningful participation of communities that are most affected by environmental degradation. Ultimately, the responsibility of bridging the gap with severely disadvantaged groups lies with western scientists and conservationists. The MSCI will strive to be inclusive and respectful of socioeconomic and Indigenous contexts and will support partners who are trying to address these inequalities but acknowledges that there is still a long way to go.

8.7 INSTITUTIONAL

Institutional capacity plays a critical role in the delivery of conservation actions. A lack of capacity in staffing, operational support, and infrastructure can hinder conservation outcomes. Institutions with strong technical expertise and leadership can engage in policy advocacy, influence land-use practices or environmental protections at local, national, and international levels, better resources, and adapt strategies in response to new data or changing conditions, all of which are essential for long-term conservation success. Institutional capacity varies across the Western Hemisphere. The NGO landscape in North America is generally a network of large, medium, and small organizations, while it is much more fragmented in South America. Because of significant threats and more extensive knowledge gaps in Latin America, this lack of capacity hinders effective conservation efforts, including the implementation of this Framework. Efforts should focus on consolidating NGOs' capacities in Latin America, using, among other things, international mechanisms such as multilateral agreements.

Prairie potholes.
Photo by USFWS



9. CONCLUSION AND NEXT STEPS

Flooded savanna in the Llanos de Moxos, Bolivia.
Photo by Tjalle Boorsma / Asociación Civil Armonía

The completion of the MSCI Framework marks the beginning of a new era of shorebird conservation in the Americas. Combined with the Atlantic and Pacific Shorebird Conservation plans, the MSCI Framework completes the picture of shorebird conservation needs, offering for the first time a hemispheric roadmap to the work that lies ahead. All three initiatives share a central goal: to restore and maintain healthy shorebird populations; To this end, the MSCI Framework outlines partner-developed strategies that will be vital for addressing priority threats in the Midcontinent.

Over 300 partners from across the Midcontinent contributed to the backbone of the MSCI Framework. Looking ahead, implementing the Framework will require carrying forward this unified approach. Meeting the challenge of threats like climate change — rated by partners as the highest threat across the Flyway — will require building alliances, promoting beneficial practices, and engaging all levels of government. While the Framework highlights conservation actions over research, addressing persistent knowledge gaps is also important, including the effects of a changing climate and contaminants on shorebirds, shorebirds' movements, and exposure to threats throughout their full lifecycles. Ongoing outreach to the public, agencies, Indigenous peoples, rightsholders, and others will be essential to elevate the concerns raised in this plan to the levels where significant decisions are made and actions taken.

With strategies and actions now established, partners must swiftly mobilize the financial and human resources for implementation. Seeking funding and engagement with major financial backers must begin immediately. Committees and working groups will be critical to implementing the Flyway strategies and developing actionable steps aligned with their regional and local-scale needs. In addition to immediate and concrete action, the MSCI is committed to regularly reviewing its activities and adapting to evolving conditions. Concurrently, communication with traditional and new partners is vital to grow the MSCI community and ensure the Initiative's sustainability and, thus, shorebird conservation in this important Flyway.

Although the challenges are significant, the Midcontinent Flyway is primed for positive change. The Midcontinent's ecosystems, which include some of the largest relatively intact ecosystems on the planet, once were considered insurmountable barriers to human development. Today, these working landscapes offer tremendous opportunities for novel approaches and collaborations with many partners to enact on-the-ground conservation actions. There is also growing scientific attention to the roles that the Midcontinent's extensive grasslands, vast interior wetland networks, northern peatlands, and large river systems play in regulating global carbon and water cycles and stabilizing global temperatures. In many ways, the shorebirds that navigate this Flyway mirror the variety and vulnerability of the human communities that share its landscapes. Now is the time to act decisively to protect these irreplaceable species and the ecosystems on which we all depend.

Tawny-throated Dotterel.
Photo by Raphael Kurz

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- Asociación Bogotana Ornitología - Colombia
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- Asociación Tolimense de Ornitologia - Colombia
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- Aves Bolivianas
- Aves y Conservación - Ecuador
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- Canadian Parks & Wilderness Society - Saskatchewan Chapter
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- Centro Bahia Lomas - Chile
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- Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO)
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- Ministry of Land and Forest Management - Suriname
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- Montana Fish, Wildlife and Parks
- Museo de Historia Natural Arequipa - Perú
- National Audubon Society
- Nature Conservancy Canada
- Nature Manitoba
- Nebraska Game and Parks Commission
- North Carolina Museum of Natural Sciences
- Oak Hammock March Interpretive Center
- Ohio State University
- Oikonos - Chile
- Oklahoma Department of Wildlife Conservation
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- OVIS XXI - Argentina
- Pacto Orinoquía - Colombia
- Paisaje Protegido Laguna de Rocha - Uruguay
- Parks Canada - Grasslands National Park
- Parque Nacional Amacayacu - Colombia
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- Pronatura A.C.: Noreste, Península de Yucatán, Sur, Veracruz
- Provita - Venezuela
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- Servicio Nacional Forestal y de Fauna Silvestre - Perú
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- Sociedad Conservacionista Audubon de Venezuela
- South Rupununi Conservation Society - Guyana
- Tennessee Valley Authority
- Tennessee Wildlife Resoures Agency
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- Texas Department of Parks and Wildlife
- The Nature Conservancy
- Trent University
- Tulane University
- Universidad Austral de Chile - Chile
- Universidad Autónoma de Nuevo León y de Tamaulipas
- Universidad Central de Venezuela - Venezuela
- Universidad Nacional de Córdoba - Argentina
- Universidad de la Amazonía - Colombia
- Universidad de Los Andes - Venezuela
- Universidad de los Llanos - Colombia
- Universidad Federal de Pernambuco - Brazil
- Universidad Nacional de Colombia - Colombia
- Universidad Nacional de la Patagonia Austral - Argentina
- Universidad Nacional de Mar del Plata - Argentina
- Universidad Nacional Experimental de Guayana
- Universidad Nacional Experimental de Los Llanos Occidentales “Ezequiel Zamora”
- Universidad Simón Bolívar - Venezuela
- Universidade Federal do Rio Grande do Sul - Brazil
- Universidade Federal do Tocantins - Brazil
- University of Saskatchewan
- University of South Carolina
- WCS Arctic Beringia
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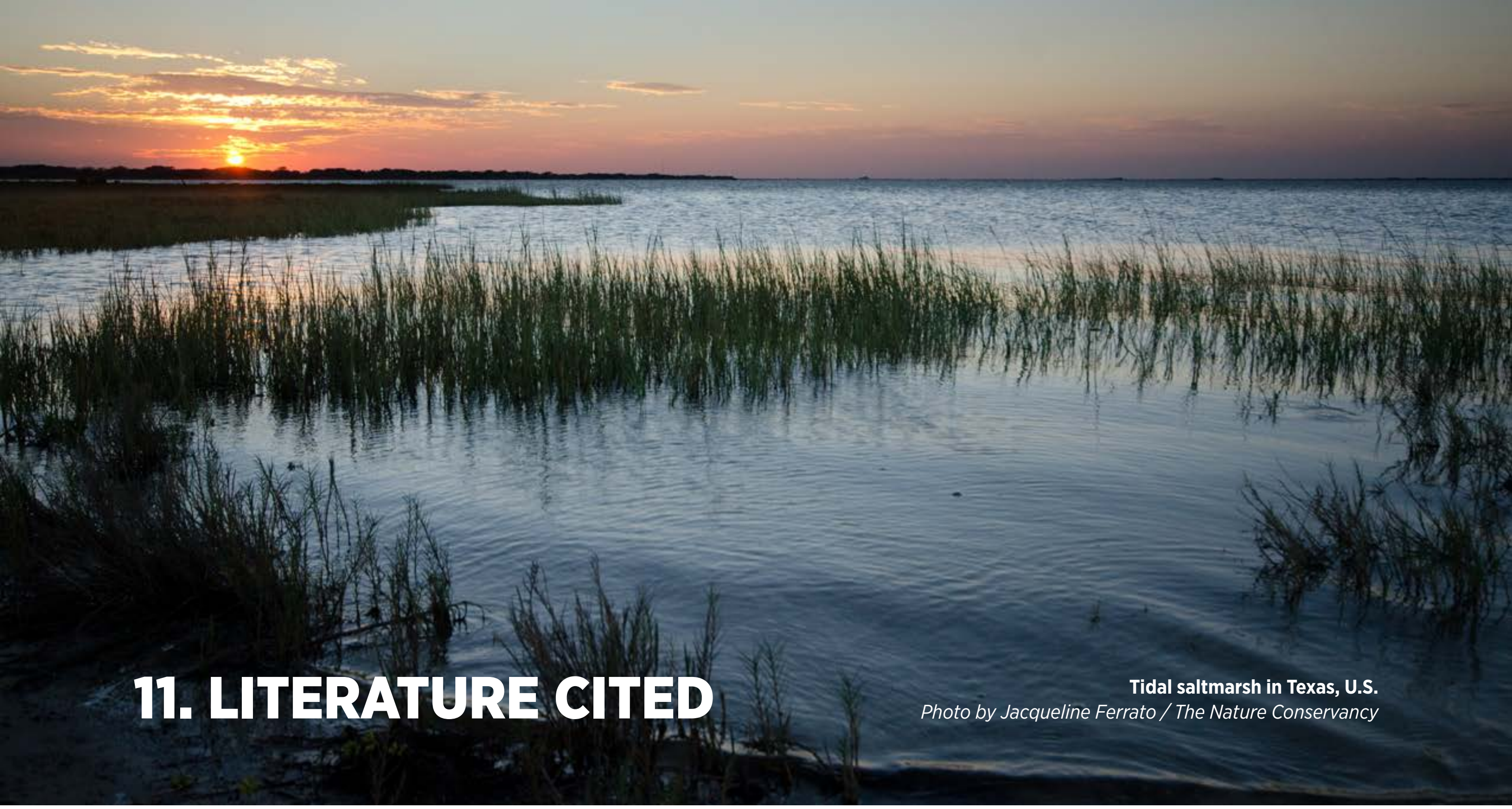
Gray-breasted Seedsnipe in Bolivia.
Photo by Arne Lesterhuis



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Tidal saltmarsh in Texas, U.S.
Photo by Jacqueline Ferrato / The Nature Conservancy

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Resilient coastal marsh in Texas, U.S.
Photo by Kenny Braun

12. APPENDICES

Snowy Plover.
Photo by Joel Jorgensen

APPENDIX 1

PROCESS AND PARTNER ENGAGEMENT IN DEVELOPING MIDCONTINENT SHOREBIRD CONSERVATION INITIATIVE (MSCI) FRAMEWORK

HEMISPHERIC STEERING COMMITTEE[1]

PLANNING REGIONS IN MIDCONTINENT FLYWAY

- **ARCTIC BOREAL**
  Coordinator[1]
- **TEMPERATE NORTH AMERICA**
  Coordinator & Regional Committee[1]
- **SOUTH AMERICA**
  Coordinator & Regional Committee[1]

PLANNING UNITS

- **Arctic & Boreal**
  Canada, U.S
- **Great Plains**
  Canada, U.S, Mexico
  - **Mississippi Valley & Great Lakes**
    Canada, U.S
  - **Gulf of Mexico Coastal Plain**
    U.S, Mexico
- **Northern Andes**
  Colombia, Venezuela, Ecuador, Peru
  - **Amazon**
    Colombia, Venezuela, Guyana, Suriname, France (French Guiana), Brazil, Bolivia, Peru, Ecuador
  - **Central-Southern Andes/ Patagonian Steppe**
    Peru, Bolivia, Chile, Argentina
  - **South American Grasslands & Associated Wetlands**
    Brazil, Bolivia, Paraguay, Argentina, Uruguay, Colombia, Venezuela

[1]See Acknowledgement section for names and affiliations.

Virtual and facilitated Conservation Standards (The Open Standards for the Practice of Conservation) workshops were held with partners in each planning unit. See Appendix 2 for numbers of participants in workshops, dates, and more.

MSCI workshops and the process to develop the Framework were conducted by Western Scientists. Indigenous communities and Tribal Governments were invited and highly encouraged to attend virtual workshops. However, the Initiative fully acknowledges that more engagement and consultation with Indigenous communities and Tribal governments is needed throughout the entire Flyway.

APPENDIX 2

WORKSHOP ATTENDANCE FOR DEVELOPING THE MIDCONTINENT SHOREBIRD CONSERVATION INITIATIVE FRAMEWORK

Date	Topic	Total attendance	Countries/Jurisdictions represented
ARCTIC/BOREAL			
March 1, 23, 2021	Threat Assessment	17	Canada & U.S.
November 22, December 1, 2021	Contributing Factors	12	Canada & U.S.
March 4, 13, 2022	Strategies	17	Canada & U.S.
TEMPERATE NORTH AMERICA			
October 29, 2020	All regions in NA: Situation Model & Identification of Threats	112	Mexico, U.S. and Canada
November 18-19, 2020	Gulf of Mexico Coastal Plain Regional Workshop: Threat assessment, contributing factors, strategies	25	Mexico & U.S.
December 9-10, 2020	Great Plains Regional Workshop: Threat assessment, contributing factors, strategies	39	Canada, U.S. and Mexico
January 13-14, 2021	Miss. Valley/Great Lakes Regional Workshop: Threat assessment, contributing factors, strategies	34	Canada & U.S.
SOUTH AMERICA			
April 14, 2021	Situation Model - All Regions	32	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela
May 4-5, 2021	Strategies - All Regions	25	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela
May 18, 25, June 1, 8, 2021	Situation Model by Region	139	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela
June 22, 30, 2021	Prioritization of Strategies - All Regions	11	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela
July 13, 27, August 3, 16, 17, 2021	Strategies by Region	118	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
FLYWAY-SCALE INTEGRATION			
September 27, 2023	Flyway-scale Strategies	19	Argentina, Bolivia, Brazil, Canada, Colombia, Ecuador, Mexico, Paraguay, Uruguay, U.S. and Venezuela
October 18, 2023	Motivate governments to increase conservation capacity	15	Canada, Colombia, Mexico, U.S. and Venezuela

Date	Topic	Total attendance	Countries/Jurisdictions represented
FLYWAY-SCALE INTEGRATION ***continued***			
October 19, 2023	Strengthen and catalyze conservation alliances	8	Argentina, Canada, Mexico and U.S.
October 25, 2023	Increase incentives for habitat protection, enhancement, and restoration	9	Argentina, Bolivia, Canada, Colombia and U.S.
October 26, 2023	Manage existing and acquire new habitats	6	Argentina, Bolivia, Canada, Colombia, Mexico and U.S.
November 1, 2023	Integrate climate resiliency in conservation planning and implementation	8	Canada, Mexico and U.S.
November 15, 2023	Improve knowledge of environmental stressors' effects and address information gaps	10	Bolivia, Brazil, Canada, Mexico and U.S.
November 16, 2023	Develop, expand, and share beneficial management practices	11	Argentina, Brazil, Canada, Colombia, U.S. and Venezuela
November 22, 2023	Build capacity for conservation by raising awareness and boosting education and training	8	Argentina, Brazil, Canada, Colombia and U.S.
November 29, 2023	Sustain the Initiative's leadership and actions at the Flyway-scale	8	Brazil, Canada, Mexico and U.S.

Pectoral Sandpiper.
Photo by Marco Silva

APPENDIX 3

LIST OF KEY SITES IN THE MIDCONTINENT

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Category[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
1	Blow River Delta (Shingle Point to Tent Island)	R	Canada		Y	Y	
2	Mackenzie River Delta & Yukon coastline	R	Canada		Y (3)	Y (3)	Mackenzie River Delta IBA, Nunaluk Spit to Herschel Island IBA, Babbage and Spring River Deltas IBA
3	Anderson River Delta	-	Canada			Y	
4	Creswell Bay	R	Canada			Y	
5	Rasmussen Lowlands	R	Canada		Y	Y	
6	Foxe Basin Islands	R	Canada		Y	Y	
7	Peace-Athabasca Delta	R	Canada	Y	Y	Y	
8	Kimiwan Lake	R	Canada			Y	
9	Muskiki Lake	R	Canada				
10	Miquelon Lake	R	Canada		Y	Y	
11	Whitford Lake	R	Canada		Y	Y	Whitford and Rush Lakes IBA
12	**Beaverhill Lake**	**R**	**Canada**		**Y**	**Y**	
13	Dowling Lake	R	Canada		Y	Y	
14	Gooseberry Lake	R	Canada		Y	Y	
15	Metiskow Lake	R	Canada		Y	Y	Metiskow and Sunken Lakes IBA
16	Sounding Lake	R	Canada		Y	Y	
17	Killarney Lake/Leane Lake	R	Canada		Y	Y	Killarney, Dillberry and Leane Lakes IBA
18	Manito/Wells/Reflex Lakes	R	Canada		Y	Y	Manito Lake Area IBA
19	Chappice Lake	R	Canada		Y	Y	
20	Landis Lake	R	Canada		Y	Y	
21	Opuntia Lake Bird Sanctuary	R	Canada				
22	Catherwood Lake	R	Canada				
23	Blaine Lakes	R	Canada		Y	Y	
24	Luck Lake	I	Canada		Y	Y	
25	**Chaplin/Old Wives/Reed Lake**	**H**	**Canada**		**Y (3)**	**Y (3)**	**Chaplin Lake IBA, Old Wives-Frederick IBA, Reed Lake IBA**
26	Porter Lake	R	Canada		Y	Y	
27	Buffer Lake	R	Canada		Y	Y	
28	Pelican Lake	R	Canada		Y	Y	
29	**Last Mountain Lake**	**R**	**Canada**		**Y**	**Y**	
30	Lenore Lake/Basin Lake/Middle Lake	R	Canada		Y (2)	Y (2)	Lenore Lake IBA, Basin and Middle Lakes IBA
31	Kutawagan Lake	R	Canada			Y	
32	**Quill Lakes**	**I**	**Canada**		**Y**	**Y**	
33	East Coteau Lake	R	Canada			Y	Coteau Lakes IBA
34	Whitewater Lake	R	Canada		Y	Y	
35	Delta Marsh	R	Canada	Y	Y	Y	
36	North, West, and East Shoal Lakes	R	Canada		Y	Y	
37	Oak Hammock Marsh	R	Canada	Y	Y	Y	
38	Lake of the Woods Sand Spit Archipelago	R	Canada				
39	Churchill Area	R	Canada		Y	Y	Churchill and Vicinity IBA

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Category[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
40	Nelson River Estuary	I	Canada			Y	Nelson River Estuary and Marsh Point IBA
41	Pen Islands (Hudson Bay)	I	Canada		Y	Y	
42	Shagamu River and area (Hudson Bay)	R	Canada	Y	Y (3)	Y (3)	Shagamu River and Area IBA, Severn River Coastline IBA, Niskibi Cape
43	Chickney Point	R	Canada		Y	Y	Albany River Estuary and associated Coastline IBA
44	Akimiski Island	R	Canada		Y	Y	
45	Northbluff Point	R	Canada		Y	Y	Pei lay sheesh kow IBA
46	James Bay (west coast)	H	Canada		Y (7)	Y (7)	Pei lay sheesh kow IBA, Albany River Estuary and associated Coastline IBA, Akimiski Strait IBA, Akimiski Island IBA, Ekwan to Lakitusaki Shores IBA, Cape Henrietta Maria IBA, Sutton River Coastline IBA
47	Northern Quebec: Rupert/Boatswain Bays	I	Canada			Y	Boatswain Bay IBA, Miinshtuk-Wiinebek IBA
48	Onion fields and St. Clair lowlands in southwestern Ontario	R	Canada			Y	Eastern Lake St. Clair
49	Western end of Lake Ontario	R	Canada		Y	Y	West End of Lake Ontario IBA
50	Presqu'ile Provincial Park, Lake Ontario	R	Canada		Y	Y	
51	Banks Island Migratory Bird Sanctuary	I	Canada		Y		
52	**Benton Lake National Wildlife Refuge**	**R**	**U.S.**				
53	Big Lake	R	U.S.				
54	**Bowdoin National Wildlife Refuge**	**R**	**U.S.**				
55	Medicine Lake National Wildlife Refuge Complex	R	U.S.				
56	**J. Clark Salyer National Wildlife Refuge**	**R**	**U.S.**				
57	Devils Lake	R	U.S.				
58	**Kelly's Slough National Wildlife Refuge Complex**	**R**	**U.S.**				
59	McKenzie Slough/Horsehead Lake Complex	R	U.S.				
60	**Long Lake National Wildlife Refuge**	**R**	**U.S.**				
61	North Dakota State University, Fargo	R	U.S.				
62	St. Vital Point, Lake Michigan	R	U.S.				
63	Shiawassee National Wildlife Refuge	R	U.S.				
64	**Lake Erie Marsh Region**	**R**	**U.S.**				
65	Harney Basin	R	U.S.				
66	Goose Haven Rd.	R	U.S.		Y	Y	Jepson Grasslands IBA
67	Robinson Road	R	U.S.		Y	Y	Jepson Grasslands IBA
68	Flannery Rd.	R	U.S.		Y	Y	Jepson Grasslands IBA
69	R/SMadera	R	U.S.		Y	Y	Lone Willow Slough IBA
70	Madera Ranch	R	U.S.		Y	Y	Lone Willow Slough IBA
71	Panoche Valley	R	U.S.		Y	Y	
72	Panoche School	R	U.S.		Y	Y	Panoche Valley IBA
73	Panoche Rd. Mountain Plover 2013 stop	R	U.S.		Y	Y	Panoche Valley IBA

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Category[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
74	Eucalyptus Ponds	R	U.S.		Y	Y	Tulare Lake Bed IBA
75	West Utica Fields	R	U.S.		Y	Y	Tulare Lake Bed IBA
76	Pelican Island	R	U.S.				
77	Kettleman City-Utica Ave.	R	U.S.		Y	Y	Tulare Lake Bed IBA
78	Alpaugh Irrigation Ponds	R	U.S.		Y	Y	Tulare Lake Bed IBA
79	Pixley National Wildlife Refuge	R	U.S.		Y	Y	Tulare Lake Bed IBA
80	Rd. 88 north of Ave. 56	R	U.S.		Y	Y	Tulare Lake Bed IBA
81	Rd. 80 at Ave. 24	R	U.S.		Y	Y	Tulare Lake Bed IBA
82	Field Road 80 Ave 24	R	U.S.		Y	Y	Tulare Lake Bed IBA
83	Lost Hills-Garces Hwy	R	U.S.		Y	Y	Tulare Lake Bed IBA
84	SLO/Carrizo/Panorama Rd/Metal Bldg	R	U.S.		Y	Y	Carrizo Plain IBA
85	Carrizo Plain NM	R	U.S.		Y	Y	Carrizo Plain IBA
86	SLO Co.; Elkhorn Plain, Elkhorn Grade Rd. to California Vall	R	U.S.		Y	Y	Carrizo Plain IBA
87	Antelope Valley	R	U.S.		Y		Antelope Valley-Edwards AFB IBA
88	Harper Dry Lake	R	U.S.		Y		Antelope Valley-Edwards AFB IBA
89	Riverside Co.; Lakeview area	R	U.S.		Y	Y	San Jacinto Valley IBA
90	Sinclair Rd. at Hwy 111	R	U.S.		Y	Y	Imperial Valley IBA
91	Blair Rd. at E Hoober Rd. (Calipatra)	R	U.S.		Y	Y	Imperial Valley IBA
92	Bowles and Lack	R	U.S.		Y	Y	Imperial Valley IBA
93	Calipatria (fields)	R	U.S.		Y	Y	Imperial Valley IBA
94	Hwy 115 and Yocum Rd	R	U.S.		Y	Y	Imperial Valley IBA
95	Ag lands E of Calipatria	R	U.S.		Y	Y	Imperial Valley IBA
96	Westmorland (Imperial Co)	R	U.S.		Y	Y	Imperial Valley IBA
97	Imperial Valley	R	U.S.		Y	Y	Imperial Valley IBA
98	Brawley	R	U.S.		Y	Y	Imperial Valley IBA
99	Edgar Road	R	U.S.		Y	Y	Imperial Valley IBA
100	Fig Lagoon	R	U.S.		Y	Y	Imperial Valley IBA
101	Crescent Lake National Wildlife Refuge	R	U.S.				
102	Jackson Reservoir	R	U.S.				
103	**Rainwater Basin**	**L**	**U.S.**				
104	**Loess Bluffs National Wildlife Refuge**	**R**	**U.S.**				
105	**Swan Lake National Wildlife Refuge**	**R**	**U.S.**				
106	**Chautauqua National Wildlife Refuge**	**R**	**U.S.**				
107	Kenosha	R	U.S.				
108	American Golden-Plover Staging Grounds (Benton County and parts of White County, Indiana)	R	U.S.				
109	Neenoshe Reservoir	R	U.S.				
110	Kearny County - Curlew	R	U.S.				
111	Finney County	R	U.S.				
112	**Cheyenne Bottoms**	**H**	**U.S.**			**Y**	
113	**Quivira National Wildlife Refuge**	**R**	**U.S.**			**Y**	
114	**Flint Hills**	**L**	**U.S.**			**Y**	
115	**Salt Plains National Wildlife Refuge**	**I**	**U.S.**			**Y**	
116	Carlyle Lake FWA (Fayette Co.)	R	U.S.				
117	Newton-Prairie Ridge area	R	U.S.				
118	Jasper	R	U.S.				

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Cate-gory[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
119	Prairie Ridge State Natural Area (Jasper Co.)	R	U.S.		Y	Y	
120	Green Chaparral Turf Farm, Moriarty	R	U.S.				
121	Castro County	R	U.S.				
122	Grulla National Wildlife Refuge	R	U.S.		Y	Y	NM Lesser Prairie Chicken Complex IBA
123	Shafter Lake	R	U.S.				
124	Kerr	R	U.S.				
125	Treadway Minnow Farm	R	U.S.				
126	Saul's Fish Farm	R	U.S.				
127	Bob White Road (Crittenden Co.) - N Benwoon Lake	R	U.S.				
128	Warbler Woods CA	R	U.S.				
129	MO-Dunklin-CR 723	R	U.S.				
130	Robinson Bayou Road	R	U.S.				
131	Catahoula Lake	R	U.S.	Y	Y	Y	Catahoula-Dewey Wills-Three Rivers IBA
132	Halff Brother Ranch/sod farm US57@ FM140	R	U.S.				
133	Pearsall--private property west of town	R	U.S.				
134	East Lake and La Sal del Rey	R	U.S.				
135	**South Texas Salt Lakes**	**I**	**U.S.**				
136	Copano Bay/Aransas Bay	R	U.S.				
137	Shoalwater Bay	R	U.S.				
138	**Texas Mid-Coast National Wildlife Refuge Complex**	**I**	**U.S.**				
139	**Bolivar Flats**	**I**	**U.S.**		**Y**	**Y**	**Port Bolivar Bird Sanctuaries - Bolivar Flats IBA**
140	Chambers County	R	U.S.				
141	**Anahuac National Wildlife Refuge**	**I**	**U.S.**				
142	Thornwell-Southern Jefferson Davis Parish shorebird census area	R	U.S.		Y	Y	Coastal Prairie IBA
143	Rice Prairies	H	U.S.		Y	Y	Coastal Prairie IBA
144	Grand Terre, Jefferson Parish	R	U.S.		Y	Y	Barataria Terrebonne IBA
145	**Laguna Madre**	**I**	**Mexico and U.S.**		**Y**		
146	Point Lay to Demarcation Point (Alaska Coastal Plain)	H	U.S.		Y		Kasegaluk Lagoon IBA
147	Teshekpuk Lake-E. Dease Inlet	R	U.S.		Y		Teshekpuk Lake Area IBA
148	Arctic National Wildlife Refuge, "1002 Area"	I	U.S.				National Wildlife Refuge
149	Arctic National Wildlife Refuge	R	U.S.				
150	**Pastizales de Janos y Ascensión**	**R**	**Mexico**		**Y**		**Janos - Nuevo Casas Grandes IBA**
151	La Hediondilla NPA	R	Mexico		Y	Y	
152	**Llano de la Soledad**	**I**	**Mexico**		**Y**		
153	**Lago de Cuitzeo**	**R**	**Mexico**		**Y**		**Cuitzeo IBA**
154	**Lago Texcoco**	**R**	**Mexico**		**Y**		**Texcoco IBA**
155	Belize Off-shore & Barrier Islands	R	Belize		Y	Y	Belize Off-shore & Barrier Islands IBA
156	Arrozales de Turén	R	Venezuela				
157	Llanos bajos (Apure)	R	Venezuela		Y	Y	

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Cate-gory[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
158	Complejo Lacustre de Fúquene, Cucunubá y Palacio	R	Colombia		Y	Y	Complejo Lacustre de Fúquene, Cucunubá y Palacio IBA
159	**Sabanas de Paz de Ariporo y Trinidad**	**R**	**Colombia**		**Y**		**Chaviripa - El Rubí IBA, Reserva Natural Puerto Rico & La Polonia IBA, and Reservas de la vereda Altagracia IBA**
160	Papallacta (Old road west of pass)	R	Ecuador				Reservas de la vereda Altagracia IBA
161	Parque Nacional Cayambe-Coca	R	Ecuador		Y	Y	IBA Parque Nacional Cayambe -Coca IBA
162	Papallacta (Pass)	R	Ecuador				
163	Road to Cayambe-Coca	R	Ecuador		Y	Y	
164	Hot Springs Resort (Papallacta)	R	Ecuador				
165	Valle del Tambo	R	Ecuador		Y	Y	
166	Parque Nacional Antisana	R	Ecuador		Y	Y	Parque Nacional Antisana IBA
167	Laguna de Mica (Antisana Ecological Reserve)	R	Ecuador		Y	Y	Reserva Ecológica Antisana (west) and adjacent areas IBA
168	Parque Nacional Cotopaxi	R	Ecuador		Y	Y	Parque Nacional Cotopaxi IBA
169	Reserva de Producción Faunística Chimborazo	R	Ecuador				
170	Edward Whymper Refuge (Chimborazo)	R	Ecuador				
171	Lago de Junín	R	Peru	Y	Y		Lago de Junín IBA
172	Reserva Nacional Salinas y Aguada Blanca	R	Peru		Y	Y	Reserva Nacional Salinas y Aguada Blanca IBA
173	**Barba Azul Nature Reserve**	**R**	**Bolivia**		**Y**		
174	Finca Capiri (12 km W Viacha, La Paz)	R	Bolivia				
175	Laguna Kollpa Khota	R	Bolivia				
176	Lagos Poopó y Uru Uru	R	Bolivia		Y	Y	Lago Poopó y Río Laka Jahuira IBA
177	Laguna Chulluncani	R	Bolivia				
178	Lago Hedionda	R	Bolivia		Y	Y	
179	Laguna Pastos Grandes	R	Bolivia		Y	Y	
180	Laguna Colorado	R	Bolivia	Y	Y	Y	
181	Laguna Kalina	R	Bolivia		Y	Y	
182	Laguna Loromayu	R	Bolivia		Y	Y	
183	**Lagoa do Peixe**	**I**	**Brazil**		**Y**	**Y**	**Parque Nacional da Lagoa do Peixe IBA**
184	Estuário da Laguna dos Patos	R	Brazil		Y	Y	Estuário da Laguna dos Patos IBA
185	Yavi	R	Argentina		Y	Y	Yavi y Yavi Chico IBA
186	Sierra de Santa Victoria	R	Argentina		Y	Y	Sierra de Santa Victoria IBA
187	**Monumento Natural Laguna de los Pozuelos**	**I**	**Argentina**		**Y**		**Monumento Natural Laguna de los Pozuelos IBA**
188	Lagunas Runtuyoc – Los Enamorados	R	Argentina		Y	Y	Lagunas Runtuyoc – Los Enamorados IBA
189	Sistema de lagunas de Vilama-Pululos	R	Argentina		Y	Y	Sistema de lagunas de Vilama-Pululos IBA
190	Laguna Guayatayoc	R	Argentina		Y	Y	Laguna Guayatayoc IBA
191	Reserva Provincial Olaroz-Cauchari	R	Argentina		Y	Y	Reserva Provincial Olaroz-Cauchari IBA
192	Salar del Hombre Muerto	R	Argentina		Y	Y	Salar del Hombre Muerto IBA
193	Recta Tin Tin	R	Argentina		Y	Y	
194	Reserva Provincial y de la Biosfera Laguna Blanca	R	Argentina		Y	Y	Reserva Provincial y de la Biosfera Laguna Blanca IBA

Site ID[1]	Midcontinent Flyway Key Shorebird Sites	Site Category[2]	Country	Ramsar[3]	Global IBA[4]	National IBA	Official IBA names
195	Parque Provincial Cumbres Calchaquíes	R	Argentina		Y	Y	Parque Provincial Cumbres Calchaquíes IBA
196	Parque Provincial La Florida	R	Argentina		Y	Y	Parque Provincial La Florida IBA
197	Parque Nacional Campo de los Alisos	R	Argentina		Y	Y	Parque Nacional Campo de los Alisos IBA
198	Reserva Provincial Laguna Brava	R	Argentina		Y	Y	Reserva Provincial Laguna Brava IBA
199	Laguna de los Porongos	R	Argentina		Y	Y	
200	**Laguna Mar Chiquita**	**H**	**Argentina**	**Y**	**Y**		**Reserva de Uso Múltiple Bañados del Río Dulce y Laguna Mar Chiquita IBA**
201	Laguna Melincué	R	Argentina		Y	Y	Laguna Melincué IBA
202	Reserva Provincial Laguna de Llancanelo	R	Argentina		Y	Y	Reserva Provincial Laguna de Llancanelo IBA
203	Laguna de Varvarco Campos y Tapia	R	Argentina		Y	Y	Laguna de Varvarco Campos y Tapia IBA
204	Laguna Epecuen	R	Argentina		Y	Y	Lagunas Encadenadas del Oeste de la Provincia de Buenos Aires IBA
205	Caldenal del Sudoeste de Buenos Aires	I	Argentina		Y	Y	Caldenal del Sudoeste de Buenos Aires IBA
206	Lago Ghio	R	Argentina				
207	Meseta Lago Strobel	I	Argentina		Y	Y	Meseta Lago Strobel IBA
208	**Bahía Samborombón**	**I**	**Argentina**		**Y**	**Y**	**Bahía Samborombón IBA**
209	**Estancia Medaland**	**R**	**Argentina**		**Y**	**Y**	**Estancia Medaland IBA**
210	Estancia La Argentina	R	Argentina				
211	Claudio Molina, Tres Arroyos	R	Argentina				
212	Campo La Margarita	R	Argentina				
213	Fortín Sur	R	Argentina				
214	Estancia La Verbena /Copetonas	R	Argentina				
215	Lagunas y Bañados de Monte Hermoso	R	Argentina				
216	Parque Nacional Lauca	R	Chile		Y	Y	Parque Nacional Lauca IBA
217	Laguna De Los Palos	R	Chile				
218	Monumento Natural Laguna de los Cisnes	R	Chile		Y	Y	Monumento Natural Laguna de los Cisnes IBA
219	Laguna Ganzo	R	Paraguay		Y	Y	Laguna Ganzo IBA
220	Lagunas Saladas – Riacho Yacaré	I	Paraguay	Y	Y	Y	Lagunas Saladas – Riacho Yacaré IBA
221	Parque Nacional Tinfunqué – Estero Patiño	I	Paraguay		Y	Y	Parque Nacional Tinfunqué – Estero Patiño IBA
222	**Bahía de Asunción**	**R**	**Paraguay**		**Y**		**Bahía de Asunción IBA**
223	Camino a Arerunguá	R	Uruguay		Y	Y	
224	**Laguna de Rocha**	**R**	**Uruguay**	**Y**	**Y**	**Y**	**Laguna de Rocha IBA**

[1]Site ID number referenced on maps of important sites (Appendices 4, 5 and 6). The list of sites is based on shorebird data from a variety of sources, including Important Shorebird Sites in the Americas, BirdLife International 2025 and McKellar et al. 2020. Sites documented to host at least 20,000 shorebirds or 1% of the biogeographic population of a species are presented in this list.

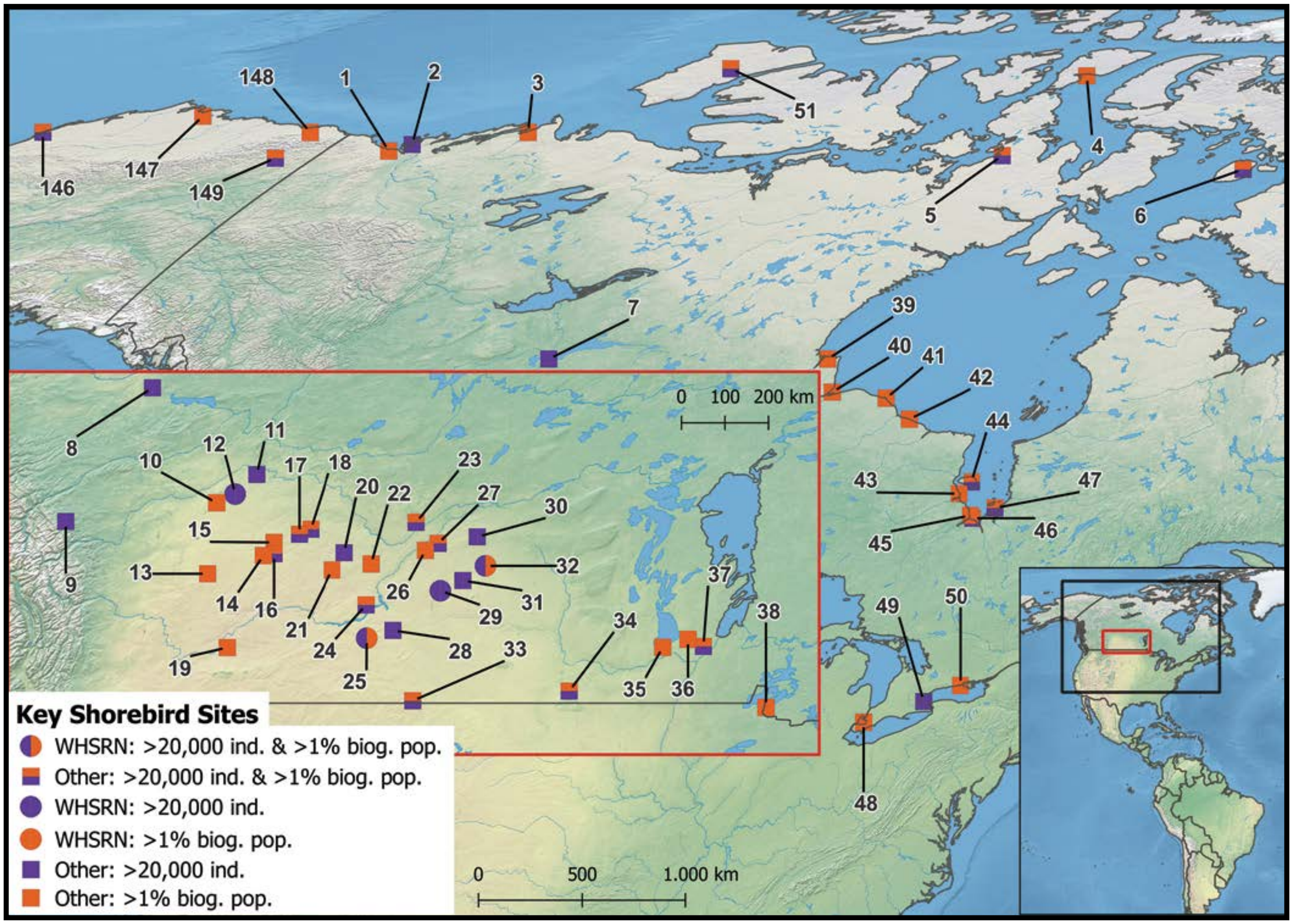
[2]WHSRN criteria: H = Hemispheric Shorebird Use (at least 500,000 shorebirds annually, or at least 30% of the biogeographic population for a species), I = International Shorebird Use (at least 100,000 shorebirds annually, or at least 10% of the biogeographic population for a species), R = Regional Shorebird Use (at least 20,000 shorebirds annually, at least 1% of the biogeographic population for a species), L = Landscape (to accomodate vast areas or comples habitats where defining a site is not feasible). WHSRN, December 2024. WHSRN sites are indicated in bold.

[3]Designated Wetlands of International Importance as per the Ramsar Convention on Wetlands. Y = Yes.

[4]BirdLife International's A4 category for globally important congregations of birds. Y = Yes. Parentheses with a number indicate that the key shorebird site has more than one IBA.

APPENDIX 4

MAP OF KEY SITES IN ALASKA AND CANADA

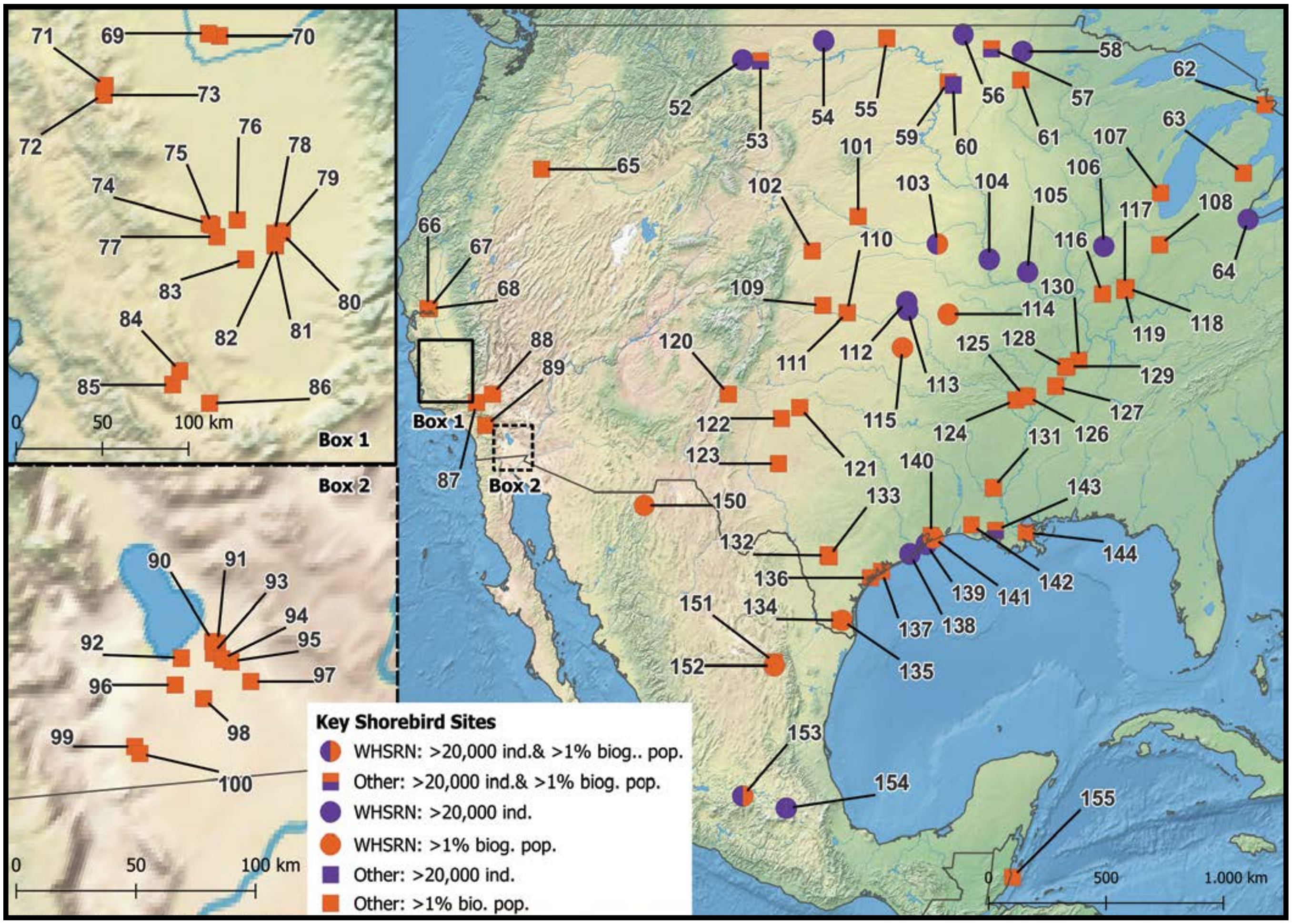


Map of key sites in Alaska and Canada. Details on numbered sites can be found in Appendix 3. *Map Credit: David Díaz Fernández.*

American Golden-Plover.
Photo by Shiloh Schulte

APPENDIX 5

MAP OF KEY SITES IN THE U.S., MEXICO, AND BELIZE

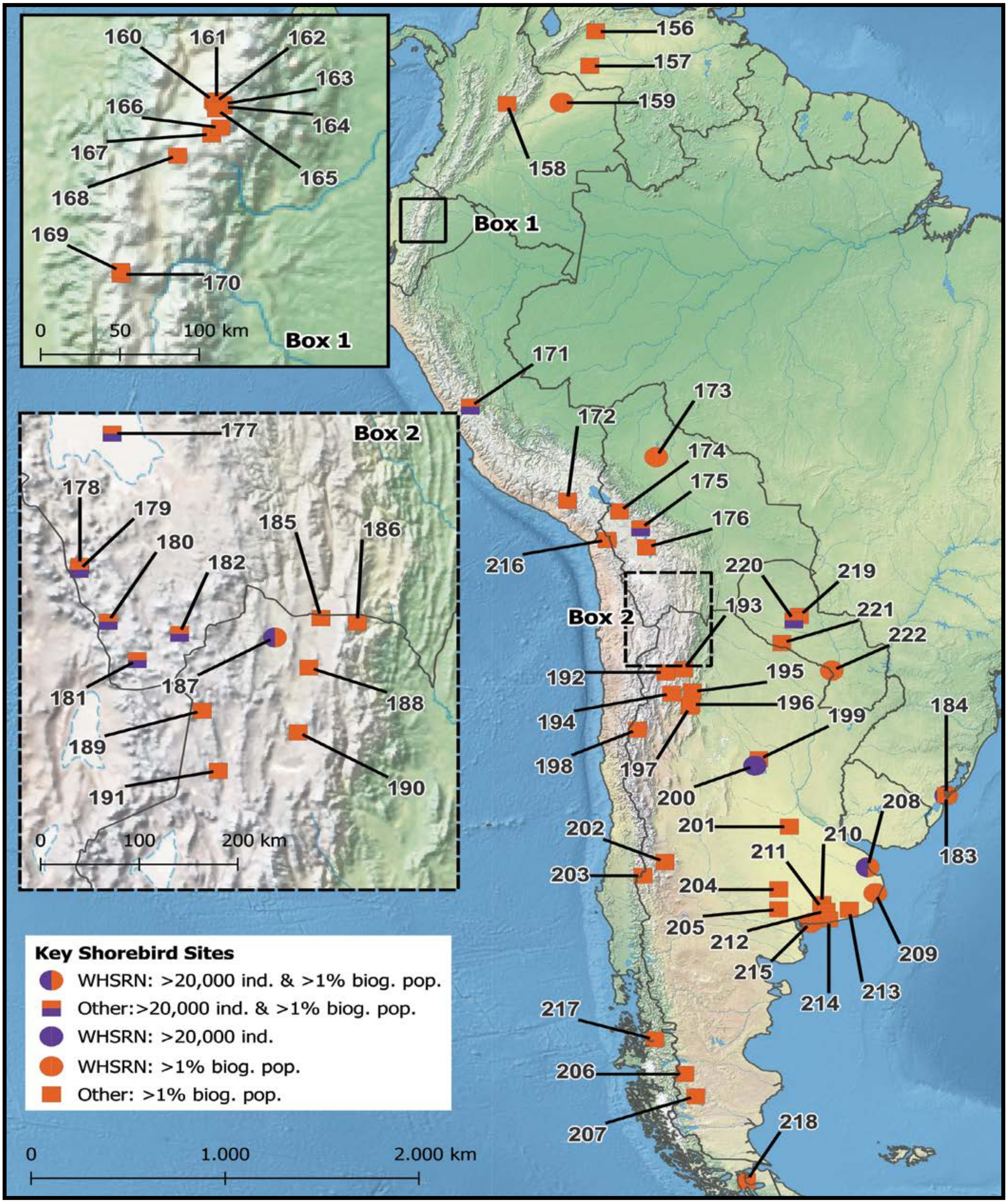


Map of key sites in the U.S., Mexico, and Belize. Details on numbered sites can be found in Appendix 3. *Map Credit: David Díaz Fernández.*

Black necked-Stilts.
Photo by Jacqueline Ferrato / The Nature Conservancy

APPENDIX 6

MAP OF KEY SITES IN SOUTH AMERICA



Map of key sites in South America. Details on numbered sites can be found in Appendix 3. *Map Credit: David Díaz Fernández.*

APPENDIX 7

THREAT RANKING IN NORTH AMERICA

	Arctic/Boreal				Temperate North America						
	Arctic BR	**Boreal BR**	**Arctic/Boreal NB**	**Arctic/Boreal (overall)**	**Great Plains BR**	**Great Plains NB**	**Mississippi Valley and Great Lakes BR**	**Mississippi Valley and Great Lakes NB**	**Gulf of Mexico Coastal Plain BR**	**Gulf of Mexico Coastal Plain NB**	**Temperate North America (overall)**
Residential & Commercial Development											
Housing and urban areas					Low	Med	Med	Med	Med	High	**Med**
Commercial, tourism, and industrial areas					Med	Med	Med	Med	High	High	**High**
Agriculture & Aquaculture											
Logging and wood harvest		Med									
Habitat conversion and incompatible agricultural practices		Low			High	High	Med	Med	High	High	**High**
Incompatible livestock ranching practices					Low	Low			Low	Low	**Low**
Energy Production & Mining											
Oil, gas, and mineral mining	Low	Low		**Low**	Med	Med		Low	Med	Low	**Med**
Renewable energy					Low	Med	Low	Med	Med	Med	**Med**
Transportation & Service Corridors											
Roads and railroads					Med	Med	Low	Low	Med	Med	**Med**
Human Intrusions & Disturbance											
Human disturbance from recreation					Low	Low	Low	Med	High	Med	**Med**
Natural System Modifications											
Water and sediment management/use			Low	**Low**	High	High	Low	High	High	High	**High**
Shoreline hardening and infrastructure							Med	High	Med	Med	**Med**
Land management conflicts					Med	Med	Low	Med	Med	Med	**Med**
Fire and fire suppression		High		**Med**	Low	Low	Low	Low			**Low**
Invasive & Problematic Species, Pathogens & Genes											
Invasive alien and problematic native species	Low	Low	Low	**Low**	Med	Med	Low	Med	Med	Med	**Med**
Pollution											
Industrial effluent (e.g., oil spills)	Low	Low	Low	**Low**							
Garbage & solid waste					Low	Low		Low	Med	Med	**Med**
Agricultural effluents and pesticides					Low	Med	Low	Med	Med	Med	**Med**
Climate Change											
Ecosystem encroachment (e.g., sea level rise, shrubification)	V High	Med	High	**High**					V High	V High	**V High**
Changes in temperature regimes/ocean acidification	V High	High	Med	**High**	Low	Low	Low	Med	High	Low	**Med**
Changes in precipitation and hydrological regimes	Med	Low		**Med**	Med	Med	Med	Med	High	High	**High**
Severe weather events	Med	Low	Med	**Med**	Low	Med	Low	Med	High	Med	**Med**

BR = Breeding, NB = Non-breeding

APPENDIX 8

THREAT RANKING IN SOUTH AMERICA

	Northern Andes BR	Northern Andes NB	Grasslands and Associated Wetlands BR	Grasslands and Associated Wetlands NB	Amazon BR	Amazon NB	Central-Southern Andes/ Patagonian Steppe BR	Central-Southern Andes/ Patagonian Steppe NB	South America (overall)
Residential & Commercial Development									
Housing and urban areas	High	High	Med	Med	Low	Low	Low	Low	**High**
Commercial, tourism, and industrial areas									
Agriculture & Aquaculture									
Logging and wood harvest									
Habitat conversion and incompatible agricultural practices	High	High	V High	V High	Med	Med	Med	Med	**V High**
Incompatible livestock ranching practices	High	High	Med	Med	Med	Med	High	High	**High**
Energy Production & Mining									
Oil, gas, and mineral mining	High	High	Low	Low	High	High	Med	Med	**High**
Renewable energy							Unk	Unk	**Unk**
Transportation & Service Corridors									
Roads and railroads									
Human Intrusions & Disturbance									
Human disturbance from recreation									
Natural System Modifications									
Water and sediment management/use	High	High	V High	V High	High	High	Med	Med	**V High**
Shoreline hardening and infrastructure									
Land management conflicts									
Fire and fire suppression	Med	Med	High	High	Med	Med	Low	Low	**High**
Invasive & Problematic Species, Pathogens & Genes									
Invasive alien and problematic native species	Low	Low	Low	Low	Low	Low	Low	Low	**Low**
Pollution									
Industrial effluent (e.g., oil spills)	Low	Low	Low	Low	Low	Low	Low	Low	**Low**
Garbage & solid waste									
Agricultural effluents and pesticides									
Climate Change									
Ecosystem encroachment (e.g., sea level rise, shrubification)	High	High	High	High	High	High	High	High	**High**
Changes in temperature regimes/ocean acidification	High	High	High	High	High	High	High	High	**High**
Changes in precipitation and hydrological regimes	V High	V High	V High	V High	V High	V High	High	High	**V High**
Severe weather events	Med	Med	Med	Med	Med	Med	Med	Med	**Med**

BR = Breeding, NB = Non-breeding

APPENDIX 9

LIST OF CONSERVATION PLANS

Scope	Name	Reference
HEMISPHERIC SHOREBIRDS CONSERVATION FRAMEWORKS		
Flyway	Atlantic Flyway Shorebird Initiative - A Business Plan	Atlantic Flyway Shorebird Initiative 2015
Flyway	Pacific Americas Shorebird Conservation Strategy	Pacific Shorebird Conservation Initiative 2016
NATIONAL SHOREBIRDS CONSERVATION PLANS		
Canada	Canadian Shorebird Conservation Plan	Donaldson et al. 2000
United States	United States Shorebird Conservation Plan	Brown et al. 2001
Mexico	Estrategia para la Conservación y Manejo de las Aves Playeras y su Hábitat en México	SEMARNAT 2008
Brazil	Plano de Ação Nacional para Conservação das Aves Limícolas Migratórias (Brazil)	ICMBIO 2023
Chile	Plan de Acción para la Conservación de Aves Playeras en Chile	MMA 2023
Colombia	Plan de Conservación para Aves Playeras en Colombia	Johnston-González et al. 2010
Ecuador	Plan Nacional de Acción para la Conservación de las Aves Playeras en Ecuador	Ágreda 2017
Peru	Plan Nacional de Conservación de las Aves Playeras en el Perú	SERFOR 2023
Argentina	Plan Nacional para la Conservación de las Aves Playeras en Argentina	Ministerio de Ambiente y Desarrollo Sostenible et al. 2020
REGIONAL CONSERVATION PLANS		
Arctic-Boreal	Alaska Shorebird Conservation Plan	Alaska Shorebird Group 2019
Temperate North America	Multi-species Action Plan for Point Pelee National Park of Canada and Niagara National Historic Sites of Canada	Parks Canada Agency 2016
Temperate North America	Central Hardwoods Joint Venture Strategic Plan	JV8 Central Grasslands Conservation Initiative 2024
Temperate North America	Great Plains Grasslands Biome: A Framework for Conservation Action 2021-2025	NRCS 2021
Temperate North America	Migratory Bird Management for the Northern Great Plains Joint Venture: Implementation Plan	Pool and Austin 2006
Temperate North America	Prairie Pothole Joint Venture Implementation Plan	PPJV 2017
Temperate North America	Rainwater Basin Joint Venture Shorebird Plan: A Regional contribution to the United States Shorebird Conservation Plan and the Rainwater Basin Joint Venture Implementation Plan	RWBJV 2013
Temperate North America	Playa Lakes Joint Venture	N/A
Temperate North America	Oaks and Prairies Joint Venture	N/A
Temperate North America	Rio Grande Joint Venture	N/A
Temperate North America	Habitat Objectives for Priority Gulf Coast Joint Venture Shorebird Species	Vermillion et al. 2022
Temperate North America	Upper Mississippi River and Great Lakes Region Joint Venture Shorebird Habitat Conservation Strategy	Potter et al. 2007

Scope	Name	Reference
REGIONAL CONSERVATION PLANS *continued*		
Temperate North America	Upper Mississippi Valley/Great Lakes Regional Shorebird Conservation Plan	Russell Koch and Lewis 2016
Temperate North America	Lower Mississippi Valley Joint Venture Shorebird Plan	LMVJV Shorebird Working Group 2019
Temperate North America	Implementation Plan, East Gulf Coastal Plain Joint Venture	EGCPJV 2008
Temperate North America	PLAN_DE_ACCION_PARA_LA_CONSERVACION_Y_RECUPERACION_DE_ESPECIES_DE_FAUNA_SILVESTRE_PRIORITARIA_EN_EL_ESTADO_DE_CHIHUAHUA	De la Maza-Benignos M. et al. 2014
South America	Plan de Conservación para las Aves Playeras Migratorias de Chiloé	Delgado Sepúlveda and Álvarez 2010
TARGET SPECIES CONSERVATION PLANS		
Charadrius melodus	Action Plan for the Piping Plover (*Charadrius melodus circumcinctus*) in Ontario	Environment Canada 2013
Charadrius melodus	Alberta Piping Plover Recovery Plan, 2010-2020	Alberta Piping Plover Recovery Team 2010
Charadrius melodus	Comprehensive Conservation Strategy for the Piping Plover in its Coastal Migration and Wintering Range in the Continental United States	U.S. Fish and Wildlife Service 2012
Charadrius melodus	Recovery Strategy (Amended) and Action Plan for the Piping Plover melodus subspecies (*Charadrius melodus melodus*) in Canada	Environment and Climate Change Canada 2022
Calidris rufa	Recovery Strategy for the Red Knot rufa subspecies (*Calidris canutus rufa*) in Ontario	Ministry of the Environment Conservation and Parks 2018
Calidris rufa	Red Knot Conservation Plan for the Western Hemisphere (*Calidris canutus*) Version 1.1.	Niles et al. 2010
Calidris rufa	Recovery Strategy and Management Plan for the Red Knot (*Calidris canutus*) in Canada	Environment and Climate Change Canada 2017
Calidris rufa	Endangered and Threatened Wildlife and Plants; Draft Recovery Plan for the Rufa Red Knot	U.S. Fish and Wildlife Service 2021
Limosa fedoa	Conservation Plan for the Marbled Godwit (*Limosa fedoa*) Version 1.2.	Melcher et al. 2010

Shorebirds on drawdown and Red Rock Lake in Iowa, U.S.
Photo by Stephen J. Dinsmore

Scope	Name	Reference
TARGET SPECIES CONSERVATION PLANS *continued*		
Limosa haemastica	Conservation Plan for the Hudsonian Godwit Version 1.1	Senner 2010
Tringa flavipes	Conservation Plan for the Lesser Yellowlegs (*Tringa flavipes*) Version 1.0.	Clay et al. 2012
Calidris mauri	Conservation Plan for the Western Sandpiper (*Calidris mauri*) Version 1.1.	Fernández et al. 2010
Phalaropus tricolor	Conservation Plan for Wilson's Phalarope (*Phalaropus tricolor*) Version 2.0.	Castellino et al. 2024
Anarhynchus wilsonia	Conservation Plan for the Wilson's Plover (*Charadrius wilsonia*) Version 1.0.	Zdravkovic 2013
Numenius americanus	Long-billed Curlew Conservation Management Plan No. 3	Alberta Environment and Parks 2017
Numenius americanus	Management Plan for the Long-billed Curlew (*Numenius americanus*) in Canada	Environment and Climate Change Canada 2013
Numenius americanus	Status assessment and conservation action plan for the Long-billed Curlew (*Numenius americanus*)	Fellows and Jones 2009
Calidris subruficollis	Management Plan for the Buff breasted Sandpiper (*Tryngites subruficollis*) in Canada	Environment and Climate Change Canada 2021
Calidris subruficollis	Conservation Plan for the Buff-breasted Sandpiper (*Tryngites subruficollis*) Version 1.1.	Lanctot et al. 2010
Anarhynchus montanus	Recovery Strategy for the Mountain Plover (*Charadrius montanus*) in Canada	Environment and Climate Change Canada 2006
Anarhynchus montanus	Conservation Plan for the Mountain Plover (*Charadrius montanus*), Version 1.1.	Andres and Stone 2010
Anarhynchus montanus	Plan De Conservación Del Chorlo Llanero. Estrategia para la conservación de los pastizales del Desierto Chihuahuense I	Benignos et al. 2015
Pluvialis dominica	Conservation Plan for the American Golden-Plover (*Pluvialis dominica*), Version 1.1.	Clay et al. 2010
Bartramia longicauda	Conservation Plan for the Upland Sandpiper (*Bartramia longicauda*), Version 1.1.	Vickery et al. 2010

APPENDIX 10

LIST OF INSTRUMENTS AND INITIATIVES FOR SHOREBIRD CONSERVATION

Instruments and Initiatives for Conservation	Spatial scope	Actors
International Environmental Agreements and Treaties		
Convention on Biological Diversity	Global	State
Ramsar Convention on Wetlands	Global	State
Convention on Migratory Species	Global	State
Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere	Hemispheric	State
Memorandum of Understanding on the Conservation of Southern South American Migratory Grassland Bird Species and Their Habitats	South America	State
U.S.-Canada Migratory Bird Treaty	Bilateral	State
U.S.-Mexico Migratory Bird Treaty	Bilateral	State
North American Agreement on Environmental Cooperation	North America	State
Trilateral Committee for Wildlife and Ecosystem Conservation and Management	North America	State
Memorandum of Understanding related to the Conservation of Shorebirds in the Western Atlantic Flyway	Caribbean	State
Ramsar Regional Initiative: Conservation and wise use of wetlands of the Plata River Basin	South America	State
Ramsar Regional Initiative: Conservation and wise use of High Andean wetlands	South America	State
Ramsar Regional Initiative: Conservation and sustainable use of wetlands in the Amazon River Basin	South America	State
Chile-Canada Agreement on Environmental Cooperation	BIlateral	State
Protocol Concerning Specially Protected Areas and Wildlife of the Wider Caribbean Region	Caribbean	State
Conservation Alliances		
Southern Cone Grasslands Alliance (Alianza del Pastizal)	South America	Non-state actors
Red de Reservas Naturales Urbanas de la Patagonia Austral	South America	Non-state actors
Alianza por las sabanas de la Orinoquia colombiana	Colombia	Non-state actors
Alianza Eco Ganadera Beni	Bolivia	Non-state actors
Conservation Initiatives and Voluntary Frameworks		
Western Hemisphere Shorebird Reserve Network	Hemispheric	Multi-actor
North American Bird Conservation Initiative	North America	Multi-actor
Atlantic Flyway Shorebird Initiative	Hemispheric	Multi-actor
Pacific Shorebird Conservation Initiative	Hemispheric	Multi-actor
Copper River International Migratory Bird Initiative	Hemispheric	Multi-actor
Americas Flyway Initiative	Hemispheric	Multi-actor
Arctic Migratory Bird Initiative-Conservation of Arctic Flora and Fauna	Hemispheric	State
Conserva Aves	Hemispheric	Multi-actor
Central Grassland Roadmap Initiative	North America	Multi-actor
JV8 Central Grasslands Conservation Initiative	North America	Multi-actor
One Health	Hemispheric	Multi-actor

Instruments and Initiatives for Conservation	Spatial scope	Actors
Governmental Programs and Partnerships		
Atlantic Flyway Council	North America	State
Mississippi Flyway Council	North America	State
Central Flyway Council	North America	State
Pacific Flyway Council	North America	State
Association of Fish and Wildlife Agencies - Southern Wings	Hemispheric	Multi-actor
Association of Fish and Wildlife Agencies - Fall Flights	North America	State
U.S. Fish and Wildlife Service - Partners for Fish and Wildlife Program	U.S.	State
U.S. Fish and Wildlife Service - Coastal Program	U.S.	State
National Fish and Wildlife Foundation	U.S.	Multi-actor
Natural Resources Conservation Service (NRCS)	U.S.	State
Commission for Environmental Cooperation (CEC)	North America	State
North American Wetland Conservation Act (NAWCA)	North America	Multi-actor
Neotropical Migratory Birds Conservation Act (NMBCA)	Hemispheric	Multi-actor
U.S. Department of Agriculture - Farm Bill Conservation Programs	U.S.	State
Joint Ventures in Canada, U.S. and Mexico in the MSCI Planning Effort		
North American Waterfowl Management Plan	North America	State
Pairie Pothole Joint Venture	U.S.	Multi-actor
Northern Great Plains Joint Venture	U.S.	Multi-actor
Rainwater Basin Joint Venture	U.S.	Multi-actor
Playa Lakes Joint Venture	U.S.	Multi-actor
Oaks and Prairies Joint Venture	U.S.	Multi-actor
Rio Grande Joint Venture	Bilateral	Multi-actor
Gulf Coast Joint Venture	U.S.	Multi-actor
Upper Mississippi River/Great Lakes Joint Venture	U.S.	Multi-actor
Lower Mississippi Valley Joint Venture	U.S.	Multi-actor
Prairie Habitat Joint Venture	Canada	Multi-actor
Prairie Habitat Joint Venture - Western Boreal Forest	Canada	Multi-actor
Eastern Habitat Joint Venture	Canada	Multi-actor
Species Working Groups		
International Lesser Yellowlegs Working Group	Hemispheric	Multi-actor
International Phalarope Working Group	Hemispheric	Multi-actor
International Mountain Plover Working Group	North America	Multi-actor
Buff-breasted Sandpiper Working Group	Hemispheric	Multi-actor

Buff-breasted Sandpipers in Bolivia.
Photo by Tjalle Boorsma / Asociación Civil Armonía

Midcontinent Shorebird
CONSERVATION INITIATIVE

For more information:
www.midamericasshorebirds.org
and www.shorebirdflyways.org

COVER PHOTOS
Left to right, top to bottom:

Buff-breasted Sandpiper
Photo by AGAMI stock/iStock

Upland Sandpiper
Photo by Gerald DeBoer/iStock

Flock of Dunlins and Western Sandpipers
Photo by David Newstead

Flint Hills in Kansas, U.S.
Photo by tomofbluesprings/iStock

Fuegian Snipe habitat in Chile
Photo by Red de Observadores de Aves y Vida Silvestre de Chile

Pectoral Sandpipers
Photo by Christian Artuso

BACK COVER PHOTOS
Left to right, top to bottom:

Wilson's Plover
Photo by Katie Barnes

Red Knots and Black-bellied Plovers at Chaplin Lake, Canada
Photo by Chaplin Nature Center/ WHSRN

Wilson's Phalarope
Photo by Max Malmquist

Ranching in Paraguay
Photo by Andrea Ferreira

Recommended citation:
Midcontinent Shorebird Conservation Initiative (MSCI). 2025. Midcontinent Shorebird Conservation Initiative Strategic Framework.
Available at www.midamericasshorebirds.org.

AMBI Arctic Migratory Birds Initiative

CAFF Conservation of Arctic Flora and Fauna

ConocoPhillips

Environment and Climate Change Canada

Environnement et Changement climatique Canada

WHSRN WESTERN HEMISPHERE SHOREBIRD RESERVE NETWORK

MANOMET CONSERVATION SCIENCES