

The Pacific Flyway Shorebird Survey: Identifying Threats and Conservation Hotspots in Northwest Mexico

Partners: Terra Peninsular, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Centro de Investigación en Alimentación y Desarrollo, A.C. (CIAD Guaymas, Sonora), Point Blue Conservation Science, Universidad Nacional Autónoma de México (UNAM), Centro de Investigaciones Biológicas del Noroeste (CIBNOR), Universidad Autónoma de Baja California Sur (UABCS), U.S. Forest Service International Program (USFSIP), Grupo Aves del Noroeste De México (GANO)

States that have participated to date: Pacific Flyway Council (\$5,000.00 in 2020), Arizona, California

Overview: Nearctic-neotropical migratory shorebirds (Order: Charadriiformes; Families: Charadriidae, Recurvirostridae, Scolopacidae) are highly mobile animals that traverse thousands of kilometers across the Western Hemisphere bi-annually and are reliant upon a network of coastal and interior wetland ecosystems. The Pacific Coast of the Americas (Figure 1) supports entire populations of neotropical migratory shorebird species during winter (November-February). Wetlands stretching from western Alaska to southern Chile are critical for the survival of these birds; including 13 Western Hemisphere Shorebird Reserve Network sites in NW Mexico.

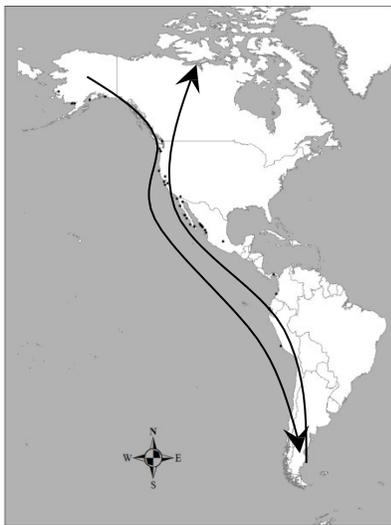


Figure 1: The Western Hemisphere with stylized migration route of shorebirds along the Pacific Coast of the Americas and important wetland sites (black dots) as designated by the Western Hemisphere Shorebird Reserve Network.

The health of these sites is critical to supporting shorebird populations during their annual migrations. Current research indicates populations of shorebirds are declining (Andres et al. 2012) but the causes of these changes are not well understood (Butler et al. 2004).

The lack of broad-scale coordinated monitoring for Pacific Flyway shorebirds has limited our ability to effectively manage their populations particularly in light of the predictions of climate change, which will likely alter habitat conditions (e.g. sea-level rise, reduced wetlands due to drought). In 2011, in collaboration with the Copper River International Migratory Bird Initiative and >100 individual and organizational partners throughout the Pacific Flyway, we initiated the Pacific Flyway Shorebird Survey (PFSS) and then the Migratory Shorebird Project (MSP) to fill gaps in Pacific Flyway population status and trends and then to assess hypothesized threats to shorebirds and identify priority conservation locations, respectively. Specifically, the objectives of the PFSS and then the Migratory Shorebird Project are to: (1) quantify spatial and temporal trends in distribution and abundance of shorebirds and other waterbirds both at the individual site level and across their wintering ranges; (2) provide science-based guidance for managers to inform actions and measure the response; (3)

develop an “iterative learning” analytical framework to critically evaluate specific hypotheses about the factors influencing population changes and to identify priority wetlands; and (4) educate individuals, communities, and governments about the importance of their wetland resources and their connectivity with people, via shorebirds, throughout the Americas. These programs now collect standardized bird and habitat condition data on over 2.5 million non-breeding waterbirds from 14 countries annually.

Threats: The primary threats to shorebirds in the Pacific Flyway include:

- 1) changes in habitat availability;

- 2) exposure to contaminants and pollutants;
- 3) human disturbance;
- 4) climate change; and
- 5) increasing predator populations.

Human disturbance is thought to particularly be a problem in beach habitats (important for populations of threatened or endangered species such as the Snowy Plover and Red Knot), which get a lot of use by humans compared to intertidal mudflats and rocky areas commonly used by other shorebird species.

Birds: Shorebirds (Families: Charadriidae, Haematopodidae, Recurvirostridae, Scolopacidae); Waterfowl (Pacific Brant and ducks); Raptors; and Waterbirds (terns, egrets, etc.). See Table 2 for a complete list of species. The wetland habitats and sites used by shorebirds during the non-breeding season and monitored as part of this program are important for other migratory waterbirds. For example; all 13 sites of importance for wintering Pacific Brant in northwest Mexico are surveyed each year, and brant as well as other waterfowl are counted as part of the MSP (Table 1).

Project goal: The overall goal is to improve the efficiency of conservation and management for coastal wetlands, shorebirds, waterbirds and waterfowl in Mexico through the integration of data and prioritization in decision-making. This will be achieved by conducting the following actions.

1. Complete annual non-breeding bird surveys at 21 sites across Mexico (Figure 2) and compile these survey data in to the PFSS node of the Avian Knowledge Network (AKN). Data collected includes the number of birds (shorebirds, waterbirds and waterfowl), measures of bird disturbance, and assessment of habitat condition. The number of avian predators (raptors) of shorebirds and other waterbirds are also recorded.
2. Expand survey efforts on sandy beaches to improve sampling for snowy plover, red knot, willet, and sanderling, and improve our understanding of human impacts which primarily occur on beaches.
3. Integrate survey data from new and existing sites, along with spatial data on the distribution of shorebird habitat across Mexico, into models to determine drivers of shorebird distribution and abundance, and the prevalence of different threats. Distribution models developed with these data for Pacific Flyway State Wildlife Action Plan focal species will be used to highlight priority areas for non-breeding shorebird conservation.

Southern Wings Successes in 2020: Funds have helped to conduct midwinter Pacific Brant surveys in all major wintering sites in northwest Mexico, nonbreeding shorebird and waterfowl surveys as part of the MSP, breeding shorebird surveys at coastal wetlands and sandy beaches (targeting breeding snowy plover, Wilson's plover and American oystercatchers), identify key wintering sites and develop conservation strategies (as data becomes available and analyzed). Also, these funds have strengthened conservation and management of specific sites, disseminated information to land managers, and conducted education/outreach to the general public. Achievements of the project to date include:

Nonbreeding Surveys

- **Nonbreeding Shorebirds Monitoring:** During January-February of 2020 we completed the annual non-breeding midwinter shorebird surveys at 21 sites across northwest Mexico (Fig. 2). These sites included 250 sampling units that are surveyed by about 50 volunteers in northwest Mexico.
- **Pacific Brant Surveys:** We provided a summary report on the 2020 mid-winter Pacific Brant surveys in Mexico to The Pacific Flyway Council for their annual meeting.

- Snowy Plover Nonbreeding Surveys: During January 2020 we coordinated with the Snowy Plover midwinter window survey along the Pacific coast of United States to conduct Nonbreeding Snowy Plovers surveys in five sites in northwest Mexico (Estero de Punta Banda, Bahía San Quintin, Laguna Atotonilco, Marismas Nacionales and Bahía Ceuta).
- Nonbreeding American Oystercatcher Monitoring: During January 2020 we completed winter surveys of roosting aggregations of American Oystercatchers during high tides at 15 priority sites across northwest Mexico.

Breeding Surveys

- Snowy Plover Monitoring: From April through June of 2020 breeding Western Snowy Plovers were monitored in Estero de Punta Banda, Baja California; Laguna Atotonilco, Jalisco; and Bahía Ceuta, Sinaloa. In collaboration with partners during May-June, 2020 we monitored 22 nests and banded 29 Snowy Plovers with color bands in Ensenada, BC.
- California Least Tern Monitoring: During June we conducted surveys and sightings of color alpha-numeric bands of the endangered California Least Tern colony in the Estero de Punta Banda, Baja California, in La Paz, and Los Cabos, Baja California Sur. In Estero de Punta Banda, among 112 adults, we re-sighted seven individuals originally banded in California.
- American Oystercatcher Monitoring: During April through June we conducted repeated counts of American oystercatchers breeding pairs in Natural Protected Areas of Northwest Mexico, including Marismas Nacionales, (Nayarit); Bahías Santa María, Ceuta and Navachiste, (Sinaloa); El Tóbari, Bahía Kino, and Puerto Peñasco, (Sonora); Laguna Ojo de Liebre, Bahía Magdalena, Bahía de La Paz, Bahía de Loreto, and Isla San Marcos, (Baja California Sur).

Education/Outreach/Training

- Public Outreach: To celebrate the Migratory Bird Day, we gave a [talk on bird watching](#) at home and the importance of waterbirds of Bahía Todos Santos (Ensenada).
- Public Outreach: A story on [Snowy Plovers in times of COVID-19](#)
- Public Outreach: On June 4th, we did a facebook live event about the [Snowy Plover conservation project in Bahía Todos Santos](#) in collaboration with the Secretary of Sustainable Economy and Tourism of the State of Baja California, reaching a live audience of over 1000 viewers, and total accumulated views of more than 7800.
- Scientific Publication: Palacios, E. et al. Submitted to Journal of Field Ornithology. *Impact of human disturbance on the abundance of nonbreeding shorebirds in a subtropical wetland*. In review.

Data Entry

- Database: We entered all 2020 mid-winter shorebird survey data into the project's online data entry portal hosted by CADC (California Avian Data Center), which is a node of the Avian Knowledge Network. Data includes the number of shorebirds, waterbirds and waterfowl, measures of human disturbance and raptors, and assessment of habitat condition.

Conservation Planning/Management

- Management and Monitoring of local Hunting Area: Collaborated with the local hunting organization of San Quintín "Los Volcanes" to monitor wintering Pacific Brant in Bahia San Quintin and protect their wetland habitat (protection of loafing and gritting sites), conduct patrols to reduce illegal hunting and human disturbance, and adjust hunting rules to make harvest more sustainable.
- Application of shorebird data: Technical report, Palacios, E. and M. Reiter. 2020. *Landscape assessment of shorebird disturbance hotspots for Mexico to Chile, 2016 – 2019*. Unpubl. Summary Report to Point Blue Conservation Science. La Paz, Baja California Sur. 17 pp. We also compiled and analyzed disturbance data

from all 21 sites of northwest Mexico to identify spatial and temporal patterns of disturbance. As well as hot spots of disturbance and “refuge” sites for shorebirds.

- Application of shorebird data: Mentored graduate students on data analysis and interpretation for use in conservation and management. Daniela Valdez started her M.Sc. thesis at UABCS by using Wilson’s Plover data collected in the MSP for the site Ensenada de La Paz. Jennifer Hernandez, continues working on her M.Sc. thesis at UABCS by using shorebird data from Ensenada de La Paz collected by this project (MSP). Jonathan Vargas, a fellow of the Coastal Solutions Fellows program continues focusing his project on reducing human disturbance on the western Snowy Plovers in Baja California. In addition, Estefanía Muñoz is making progress on her M.Sc. thesis at CICESE on the abundance and distribution patterns of three large shorebirds in California and northwest Mexico in relation to weather, also using the data from MSP.
- Protection of Habitat: In order to protect the nests of Snowy Plovers and California Least Tern in early April 2020 we installed predator excluders and a temporary fence on the nesting beach of Estero de Punta Banda, northwest Baja California ([see online note](#) in Spanish). This action also includes monitoring of the Least Tern breeding season. The fence will remain installed until August.
- Protection of Habitat: To protect the public beach of the City of Ensenada, that is nesting ground for the Snowy Plover, Terra Peninsular is applying to the Federal Government to get a land use designation called Acuerdo de Destino for the municipality to have stewardship rights of the area. The technical study to support this designation was completed. The municipal authorities will have the legal background to control disturbance and promote best management practices in this beach.
- Protection of Habitat: Terra Peninsular along with partners worked to pass a municipal ordinance to designate the beaches of Ensenada as tobacco smoke free.
- Management in the Reserves: As part of the signage project within the Terra Peninsular reserves, a signage manual was developed. The manual lays the foundations for the design and elaboration of the different types of signs that are necessary within the reserves, as well as the distinctive logos of each one. In light of the Covid-19 Pandemic, signs were installed to promote responsible recreation in outdoor areas. These signs were placed at different points in the Punta Mazo and Monte Ceniza Natural Reserves in order to raise awareness and invite visitors to enjoy the area responsibly. These Reserves provide important habitat for a suite of migrants including thousands of Pacific Brant, Surf Scoter, Western Sandpiper, Marbled Godwit, Willet, and dozens of Long-billed Curlew, Snowy Plover, and Sanderling.

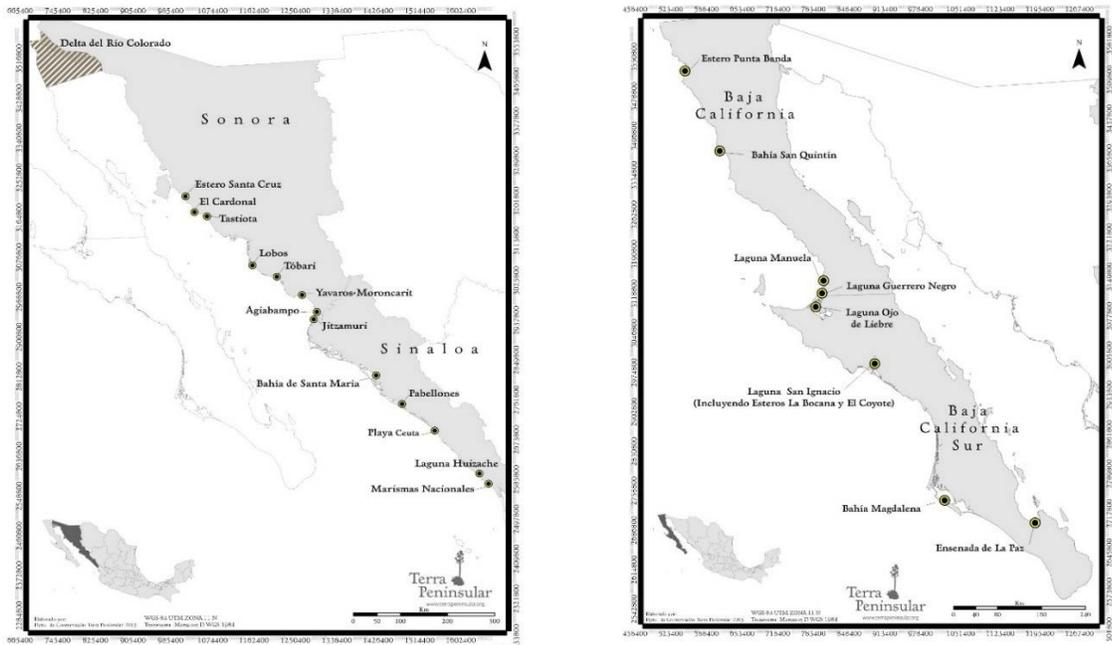


Figure 2: Location of 21 coastal wetland sites which are part of the PFSS in NW Mexico.

Table 1: Waterfowl abundance and distribution documented in the sampling units of the MSP sites in NW Mexico.

Common Name	Abundance	Percent of sites	Number of sites
northern shoveler	35606	29	7
green-winged teal	28380	38	9
Brant	5378	50	12
Redhead	4932	17	4
ruddy duck	4032	29	7
northern pintail	3457	58	14
American wigeon	2872	25	6
gadwall	2568	13	3
blue-winged teal	889	33	8
lesser scaup	858	33	8
cinnamon teal	689	25	6
surf scoter	557	17	4
black-bellied whistling-duck	259	8	2
red-breasted merganser	193	46	11
bufflehead	116	29	7
mallard	34	4	1
fulvous whistling-duck	10	8	2
greater white-fronted goose	5	4	1
white-winged scoter	3	4	1

Table 2: SGCN in the project area, listed by state.

Species (SGCN)	AK	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY
spotted sandpiper	X											
western grebe		X			X						X	
northern pintail							X					X
cinnamon teal											X	
greater white-fronted goose	X											
great egret		X										
ruddy turnstone			X									
black turnstone	X		X									
lesser scaup	X											X
brant goose			X								X	
Pacific black brant	X								X			
sanderling	X		X									
red knot			X								X	
western sandpiper	X						X					
semipalmated sandpiper	X											
mountain plover		X	X	X		X		X				X
snowy plover			X					X		X	X	
western snowy plover		X		X			X		X			
killdeer	X											
black tern			X	X	X		X					X
black-bellied whistling duck		X										
fulvous whistling duck			X									
snowy egret		X							X			X
common loon			X		X		X				X	X
gull-billed tern			X									
black oystercatcher	X		X						X			
black-necked stilt									X			
Caspian tern					X	X			X	X		X
loggerhead shrike			X	X			X	X	X		X	
California gull					X							
ring-billed gull					X							
short-billed dowitcher	X											
long-billed dowitcher	X						X					
marbled godwit												
belted kingfisher	X											
surf scoter											X	
wood stork			X									
long-billed curlew				X	X		X	X	X			X
whimbrel	X											
black-crowned night heron												X
American white pelican			X	X	X		X		X	X	X	
brown pelican (California)			X						X		X	
neotropic cormorant								X				

Species (SGCN)	AK	AZ	CA	CO	ID	MT	NV	NM	OR	UT	WA	WY
Brandt's cormorant			X									
red phalarope	X											
red-necked phalarope							X					
Wilson's phalarope							X					
white-faced ibis				X	X		X			X		X
black-bellied plover	X											
eared grebe								X				
American avocet							X					
black skimmer			X									
Forster's tern												X
least tern				X		X		X				
California least tern		X	X									
elegant tern			X									
royal tern			X									
lesser yellowlegs	X											
Total species	18	7	21	8	9	3	13	7	10	4	10	11

Red-tailed Hawk, American Kestrel, Mountain Bluebird, Burrowing Owl, Long-billed curlew, Aplomado Falcon, White-tailed Kite, Ferruginous Hawk, Prairie Falcon and Golden Eagle.

Threats: Intensive cropland agriculture is rapidly expanding in Janos and the Valles Centrales, threatening to eliminate remaining native valley-bottom grasslands by 2025. Between 2006 and 2011, croplands in Valles Centrales expanded by 34%, destroying 170,000 acres of grasslands and displacing 355,000 grassland birds, including 133,000 wintering Chestnut-collared Longspurs. Land use change has continued since then, and croplands now occupy more than 63% of former low-slope grasslands in the Valles Centrales. Long-term unsustainable grazing along with increased aridity/drought have reduced rangeland productivity and increased financial strain on ranchers, driving many to sell their land for farming. This phenomenon is also happening across the desert grasslands of northern Mexico.

Success to Date: Bird Conservancy of the Rockies (BCR) and its partners have conducted coordinated bird monitoring across the region since 2007 and have forged working relationships with many landowners that have provided opportunities for collaborative conservation of grassland birds. Together, we are creating a Sustainable Grazing Network - SGN (Figure 1) focused on engaging ranchers in grasslands conservation and management, working collaboratively to support their transition to more efficient and sustainable production practices, and enhancing habitat for birds. Since 2013, we have enrolled 18 ranches on over 250,000 acres into the SGN and have identified another 250,000 acres of ranchlands with a high potential for enrollment. With each landowner we develop an integrated wildlife and grazing management plan and provide technical and cost-share assistance for implementing the plan. We have improved over 75,000 acres of grasslands through these actions, and we are monitoring the response of birds and vegetation to assess progress and inform our next steps. This collaborative, win-win and science-based approach now has significant proof-of-concept and is ready to be scaled up.

Goals:

1. Enroll an additional 50,000 acres in the Chihuahuan Desert into the Sustainable Grazing Network (SGN) in 2018, and at least 500,000 acres in total by 2020.
2. Restore, enhance or improve at least an additional 25,000 acres of desert grasslands, and at least 125,000 acres by 2020.
3. Increase abundance and survival of priority grassland bird species on SGN lands, including Sprague's Pipit, Baird's Sparrow and Chestnut-collared Longspur, through habitat restoration.
4. Increase the Aplomado Falcon population to at least 12 breeding pairs and improve habitat for endangered Pronghorn and other resident grassland species.

Current Capacity and Needs: Keeping ranchers on the land by helping them improve their management, profitability and carrying capacity for birds and other wildlife is the most immediate and cost-effective way to slow and begin to reverse the decline in grassland birds. BC collaborates closely with IMC-Vida Silvestre, A.C., a Chihuahua-based non-profit with expertise in landowner outreach, grazing management and grassland birds. Thanks to support from our many partners, we currently support five full-time private lands biologists at IMC-Vida Silvestre who operate all aspects of the SGN from outreach and landowner relations, to development and implementation of management plans, to bird monitoring and evaluation.

Southern Wings Successes in 2020:

We conducted 10 range and habitat enhancement projects in 2020 impacting a total of 19,054 ha (47,635 acres), including 15,077 ha (37,693 acres) of Chihuahuan Desert grassland, on 8 Sustainable Grazing Network (SGN) partner ranches in Chihuahua and Sonora. These projects involved installation of range infrastructure to facilitate planned grazing, including 11 permanent or mobile watering troughs for cattle and wildlife (with built in escape ramps), construction of a 100,000 liter water storage tank, a solar generator to pump ground water, 3.6 km of buried waterlines, and 6.6 km of permanent or temporary cross-fencing.

We conducted 4 habitat restoration projects impacting 279 ha (697 acres) of degraded Chihuahuan Desert grassland, including three keyline plowing projects impacting 199 ha and 1 shrub-removal project impacting 80 ha (Figure 2). We also constructed 18 escape ladders to be installed on various SGN ranches to provide safe access to drinking water for birds and prevent accidental drowning in open water storage tanks.

These projects cost a total of \$47,518 USD in materials and services, and were matched by \$33,009 USD in landowner in-kind and cash contributions.

Bird Conservancy and our partners at IMC Vida Silvestre, A.C. also enrolled two new ranches into the Sustainable Grazing Network in 2020, Terrenates ranch (15,000 acres) in the Valles Centrales Grassland Priority Conservation Area (GPCA), and Tapiecitas ranch (6,450 acres) in the Janos GPCA. The landowners of these ranches have signed agreements with Bird Conservancy of the Rockies to protect their ranches for a period of 15 years in exchange for technical and financial assistance to improve the ecological health and sustainability of their properties through range and habitat improvements. Including our co-managed and reference ranches, the SGN now encompasses over 500,000 acres in 4 GPCAs in northern Mexico.

Matching Funds: This project leverages significant additional investment from Mexican landowners, CONANP, the Carlos Slim Foundation-WWF, Bobolink Foundation, Dixon Water Foundation, Canadian Wildlife Service, Neotropical Migratory Bird Conservation Act (USFWS), Bureau of Land Management, the U.S. Forest Service International Program, U.S. states including Montana, Colorado, New Mexico and Arizona, and the City of Fort Collins, Colorado. Every dollar invested leverages at least one additional dollar from other sources.

Figure 1: The Sustainable Grazing Network (SGN).

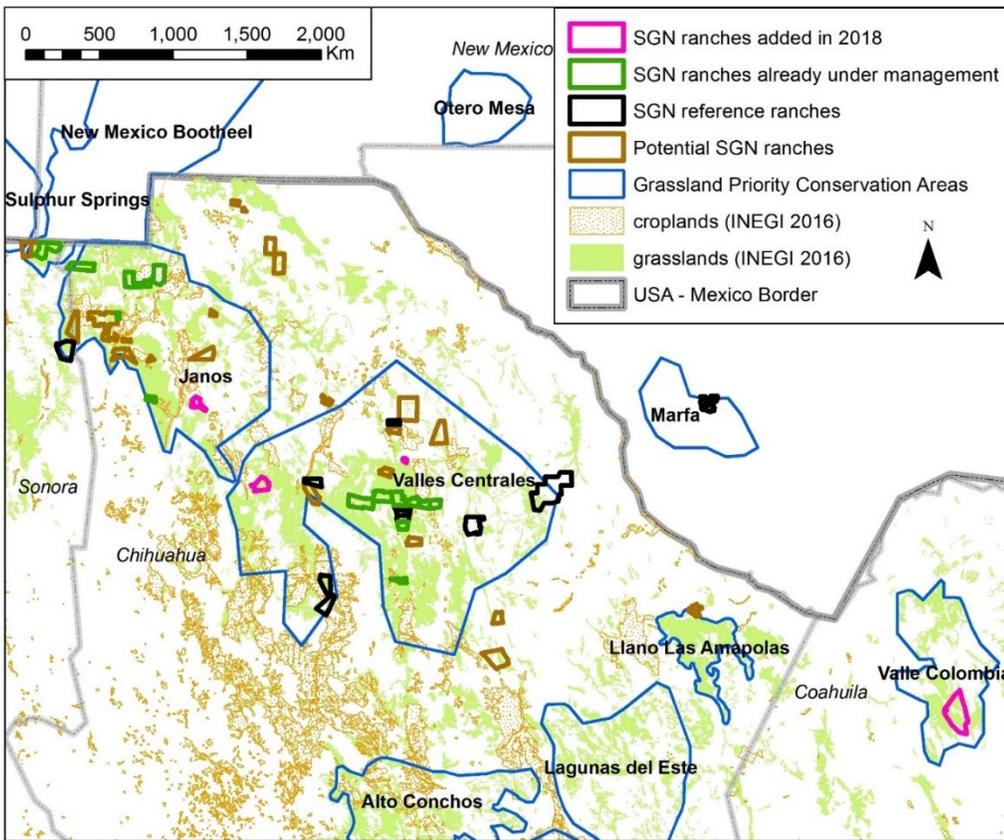


Figure 2. Shrub removal work in a Chihuahuan Desert grassland, as part of the Sustainable Grazing Network.



Protecting stopover and wintering habitat for key priority species of shorebirds and waterbirds in Laguna Madre, Mexico

Partners: American Bird Conservancy, Rio Grande Joint Venture, and Pronatura Noreste. U.S.-based partners that have provided matching funds include U.S. Fish and Wildlife Service (Neotropical Migratory Bird Conservation Act) and National Fish and Wildlife Foundation.

States that have participated to date: Pacific Flyway Council (\$12,500.00 in 2020), Texas

Overview: Shorebird and waterbird species are experiencing serious population declines. For some we understand the biggest threats, but for many others we are still identifying important stopover and wintering sites, and developing conservation strategies. For example, the International Reddish Egret Working Group has been active and is currently in the process of updating the rangewide conservation action plan for this species, as well as the development of a conservation business plan for the U.S. The anticipated completion date is April 2020. Also, our partner PNE, along with American Bird Conservancy (ABC) and the Rio Grande Joint Venture led the development of a Reddish Egret Conservation Plan for Mexico that identified five priority regions for that country, including Laguna Madre, in the state of Tamaulipas in northeast Mexico.

Laguna Madre (Figure 1) is formed by a barrier island, enclosing a lagoon more than 100 miles long and as wide as 15 miles in some places, although on average it is much narrower. There are many bays, inlets, and sand islands; overall the water is hypersaline, with some bays at times reaching salinity levels that are 150% greater than sea water. Large numbers of shorebirds and ducks winter in the lagoon and on its shores and the barrier island, including hundreds of thousands of Redheads—more than two-thirds of the total population. The lagoon and its islands also serve as important breeding, stopover and wintering areas for priority bird species including piping plover, American oystercatcher, red knot, long-billed curlew, reddish egret, snowy and Wilson’s plovers, gull-billed tern, and black skimmer. Conservation action at Laguna Madre has been identified as a priority in the Rio Grande Joint Venture implementation plan, and supports priorities identified in the United States Shorebird Conservation Plan (Brown et al, 2001) and The North American Waterbird Conservation Plan, Version 1 (Kushlan et al, 2002). Our focus in Laguna Madre has been on habitat restoration, biological monitoring, community engagement, and land protection.

Threats: The principal threats to shorebirds include shoreline and wetland modification, aquaculture, poor water management policies and enforcement, habitat disturbance from recreation activities and predators, invasive species, development, and climate change. Frequently, sites experience many or all these threats. In Laguna Madre drought is a serious issue and is reducing wetland habitat. The loss of mangroves in this ecosystem has led to increased erosion of barrier islands and is decreasing available resting and roosting habitat for migratory water birds. Furthermore, fishers frequent barrier islands and leave dogs there that disturb and prey on birds.

Birds: The focal species include: reddish egret, Wilson’s plover, snowy plover, red knot, long-billed curlew, and piping plover. Secondary focal species include: American oystercatcher, sanderling, least tern, black skimmer, western sandpiper, and semipalmated sandpiper, redhead duck.

Project goals: Conservation planning with our partners have identified the following objectives for Reddish Egrets in Mexico.

- Improve management and conservation of existing habitats
- Cultivate and empower conservation constituencies
- Engage commercial industries impacting natural resources
- Strengthen compliance and enforcement of local laws

- Develop and improve environmental, water and wildlife policies
- Improve knowledge of current habitat use and threat status
- Increase partner and stakeholder capacity

Specific conservation objectives in the Laguna Madre de Tamaulipas include:

- Conservation and stabilization of the current populations
- Mapping and better understanding of breeding populations
- Determination of breeding and foraging habitat use
- Better understanding of the hydrological regimes in breeding and foraging areas

Activities: In the 240,000-ha Laguna Madre, our conservation priorities include:

- Mangrove reforestation on key breeding islands
- Coastal dune reforestation on key barrier islands
- Construction and installation of containment barriers
- Breeding season monitoring
- Community outreach and education –fishermen, school children, etc

Specific 2020 PFC funded activity: Reforestation in 90 ha / 222 acres of islands of Laguna Madre with black and red mangroves.

Previous Southern Wings Successes: In 2013 and 2017, Southern Wings invested in the Laguna Madre project, funding mangrove reforestation that resulted in the planting of nearly 21,000 mangrove saplings over 75.6 acres. Previously, with funding from NFWF, ABC and PNE created two new conservation agreements on private lands totaling over 10,000 acres, began a program to control feral animals on islands, improved fencing to reduce cattle and other agricultural animals from entering sensitive areas of Laguna Madre, conducted focal species monitoring, began mangrove restoration, and protected key nesting and wintering sites. In 2018, Southern Wings funding went to advancing the development of range-wide conservation plan for the Reddish Egret and the development of a Mexico specific conservation plan.

Southern Wings Successes in 2020:

- Conducted multiple field visits to identify specific areas for optimal restoration potential. For each identified site, developed logistical plans for restoration activities, defined perimeter of restoration footprint, and documented any ongoing human disturbance.
- Prepared community nursery (La Capilla, Matamoros, Tamaulipas) to handle mangrove seeds and vegetative material.
- About 12,000 black mangrove seeds were collected and transferred to the community nursery to grow them to a suitable planting stage.
- About 3000 pieces of red mangrove vegetative material was collected and established in the community nursery in preparation for reforestation planting.

Plants to be used for reforestation are currently being raised in the community nursery (Figure 2) and it's anticipated that material will be ready for planting by mid-march 2021 with reforestation of sites starting in late March through mid-April.

Due to the Covid-19 pandemic, the community nursery has been operating under a reduced capacity in keeping with health protocols. This has represented a delay in the production of mangrove seedlings.

