Birds and Climate Change

National Park Service
U.S. Department of the Interior

Padre Island National Seashore

Background

Birds are useful indicators of ecological change because they are highly mobile and generally conspicuous. As climate in a particular place changes, suitability may worsen for some species and improve for others. These changes in climate may create the potential for local extirpation or new colonization. **This brief summarizes projected changes in climate suitability by mid-century for birds at Padre Island National Seashore (hereafter, the Seashore) under two climate change scenarios (see Wu et al. 2018 for full results, and Langham et al. 2015 for more information regarding how climate suitability is characterized).** The high-emissions pathway (RCP8.5) represents a future in which little action is taken to reduce global emissions of greenhouse gases. The low-emissions pathway (RCP2.6) is a best-case scenario of aggressive efforts to reduce emissions. These emissions pathways are globally standardized and established by the Intergovernmental Panel on Climate Change for projecting future climate change. The findings below are model-based projections of how species distributions may change in response to climate change. A 10-km buffer was applied to each park to match the spatial resolution of the species distribution models (10 x 10 km), and climate suitability was taken as the average of all cells encompassed by the park and buffer.

IMPORTANT

This study focuses exclusively on changing climatic conditions for birds over time. But projected changes in climate suitability are not definitive predictions of future species ranges or abundances. Numerous other factors affect where species occur, including habitat quality, food abundance, species adaptability, and the availability of microclimates (see Caveats). Therefore, managers should consider changes in climate suitability alongside these other important influences.

We report trends in climate suitability for all species identified as currently present at the Seashore based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Seashore is projected to become suitable in the future (Figure 1 & Table 1). This brief provides park-specific projections whereas Wu et al. (2018), which did not incorporate park-specific species data and thus may differ from this brief, provides system-wide comparison and conclusions.

Results

Climate change is expected to alter the bird community at the Seashore, with greater impacts under the high-emissions pathway than under the low-emissions pathway (Figure 1). Among the species likely to be found at the Seashore today, climate suitability in summer under the high-emissions pathway is projected to improve for 6 (e.g., Figure 2), remain stable for 23, and worsen for 20 species. Suitable climate ceases to occur for 5 species in summer, potentially resulting in extirpation of those species from the Seashore. Climate is projected to become suitable in summer for 12 species not found at the Seashore today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 27, remain stable for 60, and worsen for 45 species. Suitable climate ceases to occur for 8 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 16 species not found at the Seashore today, potentially resulting in local colonization.

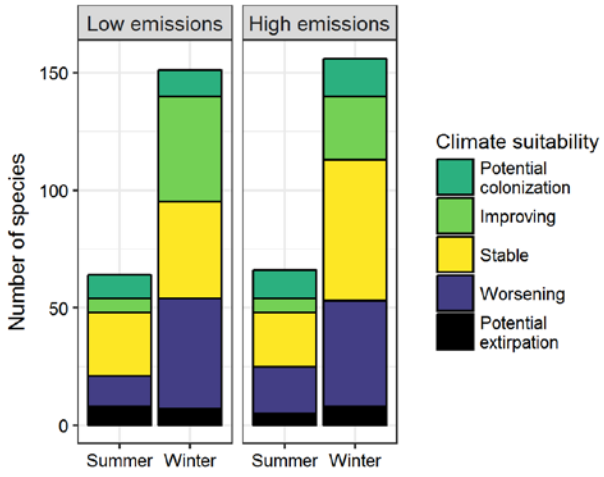

Figure 1. Projected changes in climate suitability for birds at the Seashore, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.10 in summer (12th percentile across all national parks) and 0.07 in winter (1st percentile) under the high-emissions pathway. Potential species turnover declines to 0.09 in summer and 0.05 in winter under the low-emissions pathway. Turnover index was calculated based on the theoretical proportions of potential extirpations and potential colonizations by 2050 relative to today (as reported in Wu et al. 2018), and therefore assumes that all potential extirpations and colonizations are realized. According to this index, no change would be represented as 0, whereas a complete change in the bird community would be represented as 1.

Climate Sensitive Species

The Seashore is or may become home to 30 species that are highly sensitive to climate change across their range (i.e., they are projected to lose climate suitability in over 50% of their current range in North America in summer and/or winter by 2050; Table 1; Langham et al. 2015). While the Seashore may serve as an important refuge for 28 of these climate-sensitive species, 2 might be extirpated from the Seashore in at least one season by 2050.

Figure 2. Climate at the Seashore in summer is projected to remain suitable for the Red-winged Blackbird (*Agelaius phoeniceus*) through 2050. Photo by Andy Reago & Chrissy McClarren/Flickr (CC BY 2.0).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Padre Island National Seashore falls within the low change group.** Parks anticipating low change can best support landscape-scale bird conservation by emphasizing habitat restoration, maintaining natural disturbance regimes, and reducing other stressors.

Furthermore, park managers have an opportunity to focus on supporting the 28 species that are highly sensitive to climate change across their range (Table 1; Langham et al. 2015) but for which the park is a potential refuge. Monitoring to identify changes in bird communities will inform the selection of appropriate management responses.

Caveats

The species distribution models included in this study are based solely on climate variables (i.e., a combination of annual and seasonal measures of temperature and precipitation), which means there are limits on their interpretation. Significant changes in climate suitability, as measured here, will not always result in a species response, and all projections should be interpreted as potential trends. Multiple other factors mediate responses to climate change, including habitat availability, ecological processes that affect demography, biotic interactions that inhibit and facilitate species' colonization or extirpation, dispersal capacity, species' evolutionary adaptive capacity, and phenotypic plasticity (e.g., behavioral adjustments). Ultimately, models can tell us where to focus our concern and which species are most likely to be affected, but monitoring is the only way to validate these projections and should inform any on-the-ground conservation action.

More Information

For more information, including details on the methods, please see the scientific publication (Wu et al. 2018) and the project overview brief, and visit the NPS Climate Change Response Program website.

References

eBird Basic Dataset (2016) Version: ebd_relAug-2016. Cornell Lab of Ornithology, Ithaca, New York.

Langham et al. (2015) Conservation Status of North American Birds in the Face of Future Climate Change. PLOS ONE.

Wu et al. (2018) Projected avifaunal responses to climate change across the U.S. National Park System. PLOS ONE.

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Species Projections

Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the Seashore based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Seashore is projected to become suitable in the future. "Potential colonization" indicates that climate is projected to become suitable for the species, whereas "potential extirpation" indicates that climate is suitable today but projected to become unsuitable. Omitted species were either not modeled due to data deficiency or were absent from the I&M and eBird datasets. Observations of late-season migrants may result in these species appearing as present in the park when they may only migrate through. Species are ordered according to taxonomic groups, denoted by alternating background shading.

*** Species in top and bottom 10th percentile of absolute change**

^ Species that are highly climate sensitive

- Species not found or found only occasionally, and not projected to colonize by 2050

x Species not modeled in this season

Common Name	Summer Trend	Winter Trend
Black-bellied Whistling-Duck	Stable	x
Fulvous Whistling-Duck	Stable	-
Gadwall	-	Stable
American Wigeon	-	Stable
Mallard	Improving^	Improving*
Mottled Duck	Worsening	Stable
Blue-winged Teal	Stable	Worsening
Cinnamon Teal	-	Improving*
Northern Shoveler	-	Improving
Green-winged Teal	-	Stable
Canvasback	-	Stable
Ring-necked Duck	-	Stable
Greater Scaup	-	Potential extirpation^
Lesser Scaup	-	Stable
Surf Scoter	-	Stable

Common Name	Summer Trend	Winter Trend
Bufflehead	-	Potential extirpation
Common Goldeneye	-	Potential extirpation
Hooded Merganser	-	Stable^
Red-breasted Merganser	-	Stable^
Ruddy Duck	Stable	Stable
Scaled Quail	-	Potential colonization
Northern Bobwhite	Worsening	Stable
Common Loon	-	Worsening*^
Least Grebe	-	Worsening*
Pied-billed Grebe	x	Worsening
Horned Grebe	-	Potential colonization
Eared Grebe	-	Worsening*
Wood Stork	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Northern Gannet	-	Potential extirpation^
Neotropic Cormorant	x	Stable
Double-crested Cormorant	x	Worsening
American White Pelican	x	Stable
Brown Pelican	Worsening	Stable^
American Bittern	-	Worsening^
Great Blue Heron	Stable	Improving
Great Egret	Stable	Stable
Snowy Egret	x	Improving
Little Blue Heron	Worsening	Stable
Tricolored Heron	Worsening*^	Improving
Reddish Egret	x	Stable
Cattle Egret	Worsening*	Stable
Black-crowned Night-Heron	x	Worsening
Yellow-crowned Night-Heron	-	Improving*
White Ibis	Worsening	Stable
White-faced Ibis	x	Worsening^
Roseate Spoonbill	x	Stable
Black Vulture	Worsening	Worsening
Turkey Vulture	x	Improving
Osprey	x	Improving
White-tailed Kite	-	Improving
Swallow-tailed Kite	Potential colonization	-
Northern Harrier	-	Stable
Harris's Hawk	-	Improving*
White-tailed Hawk	x	Stable
Red-shouldered Hawk	-	Stable
Red-tailed Hawk	-	Worsening
Clapper Rail	-	Stable
Sora	-	Improving
Common Gallinule	-	Worsening

Common Name	Summer Trend	Winter Trend
American Coot	x	Worsening
Black-necked Stilt	x	Stable
American Avocet	x	Worsening*^
American Oystercatcher	x	Worsening*^
Black-bellied Plover	x	Stable
Snowy Plover	x	Worsening
Wilson's Plover	x	Improving*
Semipalmated Plover	-	Stable^
Piping Plover	-	Worsening*^
Killdeer	Worsening	Worsening
Spotted Sandpiper	-	Improving
Greater Yellowlegs	Potential extirpation	Improving
Willet	Worsening*^	Stable^
Lesser Yellowlegs	Stable^	Stable
Whimbrel	-	Improving*
Long-billed Curlew	Stable^	Improving
Marbled Godwit	Stable^	Worsening*
Ruddy Turnstone	x	Stable^
Red Knot	x	Worsening^
Stilt Sandpiper	x	Stable
Sanderling	x	Stable
Dunlin	-	Stable^
Least Sandpiper	x	Improving*
Western Sandpiper	Stable	Stable
Short-billed Dowitcher	-	Worsening^
Long-billed Dowitcher	-	Stable
Wilson's Snipe	-	Worsening
American Woodcock	-	Potential colonization
Bonaparte's Gull	-	Potential extirpation
Laughing Gull	Stable^	Improving
Franklin's Gull	Stable	x
Ring-billed Gull	-	Stable

Common Name	Summer Trend	Winter Trend
Yellow-footed Gull	-	Potential colonization
Herring Gull	Stable	Stable^
Gull-billed Tern	x	Stable
Caspian Tern	x	Stable
Black Tern	Stable	-
Forster's Tern	x	Stable
Royal Tern	x	Worsening^
Sandwich Tern	x	Worsening^
Black Skimmer	x	Worsening*^
Rock Pigeon	Potential colonization	Stable
White-crowned Pigeon	Potential colonization	-
White-winged Dove	Improving*	Worsening
Mourning Dove	Worsening	Improving
Barn Owl	-	Worsening
Western Screech-Owl	-	Potential colonization
Eastern Screech-Owl	-	Potential colonization
Great Horned Owl	-	Potential extirpation
Lesser Nighthawk	Stable	-
Common Nighthawk	Worsening	-
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Stable	-
Belted Kingfisher	-	Worsening
Red-bellied Woodpecker	Potential colonization	-
Crested Caracara	Worsening*	Worsening*
American Kestrel	x	Stable
Merlin	-	Worsening^
Peregrine Falcon	-	Worsening
Acadian Flycatcher	Stable	-
Black Phoebe	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Eastern Phoebe	-	Stable
Great Crested Flycatcher	Potential colonization	-
Great Kiskadee	-	Worsening
Scissor-tailed Flycatcher	Worsening	-
Loggerhead Shrike	Worsening*	Worsening*
Red-eyed Vireo	Stable	-
Black-whiskered Vireo	Potential colonization	-
Horned Lark	Potential extirpation	Potential extirpation
Northern Rough-winged Swallow	Improving*	Improving*
Purple Martin	Worsening	x
Tree Swallow	-	Improving*
Barn Swallow	Potential extirpation	-
Cliff Swallow	Stable	-
Rock Wren	-	Potential colonization
House Wren	-	Worsening*
Sedge Wren	-	Worsening
Marsh Wren	-	Worsening
Blue-gray Gnatcatcher	Potential colonization	-
California Gnatcatcher	-	Potential colonization
Black-tailed Gnatcatcher	Potential colonization	-
Ruby-crowned Kinglet	-	Worsening
Gray Catbird	-	Stable
Bendire's Thrasher	-	Potential colonization
Crissal Thrasher	Potential colonization	-
Sage Thrasher	-	Potential colonization
Northern Mockingbird	Worsening	Stable
European Starling	Stable	Stable

Common Name	Summer Trend	Winter Trend
American Pipit	-	Stable
Sprague's Pipit	-	Worsening
Cedar Waxwing	-	Improving
Black-and-white Warbler	-	Stable
Orange-crowned Warbler	-	Stable
Common Yellowthroat	-	Improving
Palm Warbler	-	Potential colonization^
Yellow-rumped Warbler	-	Worsening
Prairie Warbler	Potential colonization	-
Wilson's Warbler	-	Stable
Canyon Towhee	Potential colonization	-
Abert's Towhee	Potential colonization	-
Rufous-winged Sparrow	-	Potential colonization
Vesper Sparrow	-	Stable
Lark Sparrow	-	Improving*
Black-throated Sparrow	-	Potential colonization
Savannah Sparrow	-	Stable
Grasshopper Sparrow	Improving	Worsening*
LeConte's Sparrow	-	Worsening*

Common Name	Summer Trend	Winter Trend
Seaside Sparrow	-	Worsening*^
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Worsening
Swamp Sparrow	-	Stable
Northern Cardinal	-	Improving
Pyrrhuloxia	-	Worsening*
Blue Grosbeak	Stable	-
Indigo Bunting	Improving	-
Painted Bunting	Worsening*	-
Red-winged Blackbird	Improving	Stable
Eastern Meadowlark	Worsening	Stable
Western Meadowlark	-	Stable
Brewer's Blackbird	-	Stable
Great-tailed Grackle	Worsening	Worsening
Bronzed Cowbird	Stable	-
Brown-headed Cowbird	Potential extirpation	Stable
Orchard Oriole	Potential extirpation	-
Cassin's Finch	-	Potential colonization
American Goldfinch	-	Stable
House Sparrow	x	Improving*