Birds and Climate Change

National Park Service
U.S. Department of the Interior

San Antonio Missions National Historical Park

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 San Antonio Missions National Historical Park (hereafter, the Park) 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 Park based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Park 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 Park, 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 Park today, climate suitability in summer under the high-emissions pathway is projected to improve for 9 (e.g., Figure 2), remain stable for 30, and worsen for 19 species. Suitable climate ceases to occur for 11 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 9 species not found at the Park today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 16, remain stable for 44, and worsen for 31 species. Suitable climate ceases to occur for 15 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 37 species not found at the Park today, potentially resulting in local colonization.

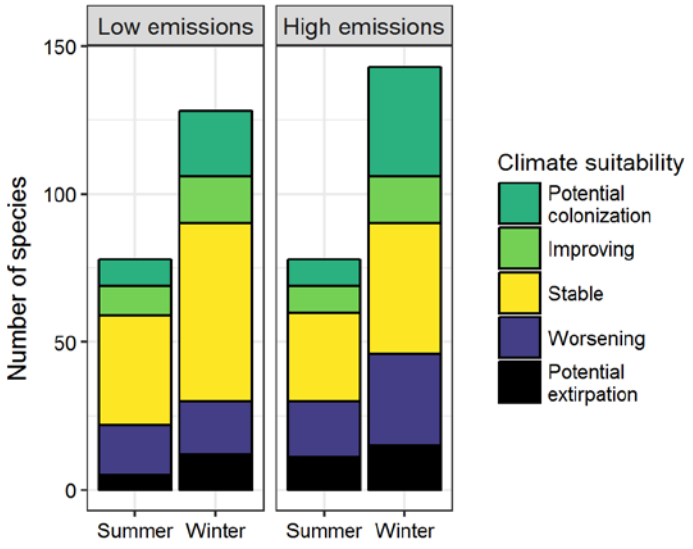

Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.09 in summer (9th percentile across all national parks) and 0.13 in winter (14th percentile) under the high-emissions pathway. Potential species turnover declines to 0.07 in summer and 0.10 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 Park is or may become home to 13 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). Suitable climate is not projected to disappear for these 13 species at the Park; instead the Park may serve as an important refuge for these climate-sensitive species.

Figure 2. Climate at the Park 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, San Antonio Missions National Historical Park 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 13 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.

Contacts

Gregor Schuurman, Ph.D.
Ecologist, NPS Climate Change Response Program
970-267-7211, gregor_schuurman@nps.gov

Joanna Wu
Biologist, National Audubon Society
415-644-4610, science@audubon.org

Species Projections

Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the Park based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Park 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
Muscovy Duck	-	Potential colonization
Wood Duck	-	Potential extirpation
Gadwall	-	Worsening
American Wigeon	-	Stable
Mallard	Improving^	Potential extirpation
Blue-winged Teal	-	Stable
Northern Shoveler	-	Stable
Green-winged Teal	-	Stable
Redhead	Potential colonization^	-
Ring-necked Duck	-	Stable
Lesser Scaup	-	Stable
Bufflehead	-	Potential colonization
Plain Chachalaca	-	Potential colonization
Wild Turkey	x	Stable
Pacific Loon	-	Potential colonization
Pied-billed Grebe	x	Worsening
Magnificent Frigatebird	-	Potential colonization
Neotropic Cormorant	x	Worsening*
Double-crested Cormorant	-	Stable
Least Bittern	-	Potential colonization
Great Blue Heron	Stable	Worsening
Great Egret	Stable	Stable
Snowy Egret	x	Improving*
Little Blue Heron	Stable	Improving
Tricolored Heron	Stable^	Potential colonization
Cattle Egret	Stable	Improving*
Green Heron	Stable	-
Black-crowned Night-Heron	x	Improving*

Common Name	Summer Trend	Winter Trend
Yellow-crowned Night-Heron	Stable	Stable
White Ibis	-	Improving*
Black Vulture	Worsening	Worsening
Turkey Vulture	x	Improving
Osprey	-	Improving*
Swallow-tailed Kite	Potential colonization	-
Sharp-shinned Hawk	-	Worsening
Cooper's Hawk	x	Stable
Red-shouldered Hawk	Stable	Stable
Swainson's Hawk	Improving^	-
Red-tailed Hawk	Potential extirpation	Stable
American Coot	-	Worsening
Limpkin	-	Potential colonization
American Oystercatcher	-	Potential colonization^
Wilson's Plover	-	Potential colonization
Semipalmated Plover	-	Potential colonization^
Killdeer	Potential extirpation	Worsening
Spotted Sandpiper	-	Improving
Wandering Tattler	-	Potential colonization
Greater Yellowlegs	-	Improving
Lesser Yellowlegs	-	Improving*
Marbled Godwit	-	Potential colonization
Ruddy Turnstone	-	Potential colonization^
Red Knot	-	Potential colonization^
Least Sandpiper	-	Improving*
Short-billed Dowitcher	-	Potential colonization^
Bonaparte's Gull	-	Potential colonization
Laughing Gull	-	Potential colonization
Ring-billed Gull	-	Improving
Yellow-footed Gull	-	Potential colonization
Black Skimmer	-	Potential colonization^
Rock Pigeon	Stable	Improving
Eurasian Collared-Dove	x	Stable
White-winged Dove	Stable	Stable
Mourning Dove	Stable	Worsening
Inca Dove	Stable	Improving
Common Ground-Dove	Improving*	Stable
White-tipped Dove	-	Potential colonization
Yellow-billed Cuckoo	Worsening	-
Western Screech-Owl	-	Potential colonization
Great Horned Owl	-	Potential extirpation
Burrowing Owl	Potential colonization^	-
Lesser Nighthawk	Improving*	-
Common Nighthawk	Worsening	-
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Stable	-
Black-chinned Hummingbird	Worsening	-
Anna's Hummingbird	-	Potential colonization
Calliope Hummingbird	Potential colonization	-
Belted Kingfisher	-	Worsening
Green Kingfisher	x	Worsening*
Golden-fronted Woodpecker	Worsening*	Worsening*
Red-bellied Woodpecker	Potential colonization	-
Yellow-bellied Sapsucker	-	Stable

Common Name	Summer Trend	Winter Trend
Red-naped Sapsucker	-	Potential colonization
Ladder-backed Woodpecker	Worsening*	Stable
Downy Woodpecker	Potential extirpation	Potential extirpation
Northern Flicker	-	Potential extirpation
Crested Caracara	Worsening	Worsening*
American Kestrel	x	Stable
Merlin	-	Stable^
Eastern Wood-Pewee	Stable	-
Black Phoebe	Improving	Stable
Eastern Phoebe	Potential extirpation	Stable
Ash-throated Flycatcher	Worsening	-
Great Crested Flycatcher	Stable	Potential colonization
Brown-crested Flycatcher	Improving*	-
Great Kiskadee	Potential colonization	-
Couch's Kingbird	Improving*	Stable
Western Kingbird	Worsening	-
Scissor-tailed Flycatcher	Stable	-
Loggerhead Shrike	Worsening	Stable
White-eyed Vireo	Stable	Stable
Black-whiskered Vireo	Potential colonization	-
Blue Jay	Stable	Potential extirpation
American Crow	Stable	Potential extirpation
Common Raven	-	Stable
Northern Rough-winged Swallow	Potential colonization	-
Purple Martin	Worsening	x
Tree Swallow	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Violet-green Swallow	-	Potential colonization
Barn Swallow	Potential extirpation	-
Cliff Swallow	Worsening	-
Cave Swallow	Stable	-
Carolina Chickadee	Worsening	Worsening*
Mountain Chickadee	-	Potential colonization
Black-crested Titmouse	Worsening*	Stable
Verdin	-	Improving*
Rock Wren	-	Improving*
House Wren	-	Worsening
Carolina Wren	Stable	Worsening
Bewick's Wren	Worsening*	Worsening*
Blue-gray Gnatcatcher	Improving*	Stable
Golden-crowned Kinglet	-	Worsening
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	-	Worsening
Hermit Thrush	-	Worsening
American Robin	-	Potential extirpation
Long-billed Thrasher	-	Stable
LeConte's Thrasher	Potential colonization	Potential colonization
Northern Mockingbird	Worsening	Stable
European Starling	Potential extirpation	Stable
American Pipit	-	Stable
Cedar Waxwing	-	Potential extirpation
Ovenbird	-	Potential colonization
Black-and-white Warbler	-	Stable
Orange-crowned Warbler	-	Stable
Common Yellowthroat	-	Stable

Common Name	Summer Trend	Winter Trend
Palm Warbler	-	Potential colonization^
Pine Warbler	-	Stable
Yellow-rumped Warbler	-	Worsening
Yellow-throated Warbler	-	Potential colonization
Bachman's Sparrow	-	Potential colonization
Chipping Sparrow	-	Worsening
Brewer's Sparrow	-	Potential colonization
Field Sparrow	-	Stable
Vesper Sparrow	-	Stable
Lark Sparrow	Worsening*	Stable
Savannah Sparrow	-	Worsening
Fox Sparrow	-	Potential extirpation
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Worsening
White-throated Sparrow	-	Potential extirpation
White-crowned Sparrow	-	Worsening
Dark-eyed Junco	-	Potential extirpation
Summer Tanager	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Northern Cardinal	Stable	Stable
Pyrrhuloxia	Stable	Worsening*
Indigo Bunting	Potential extirpation	-
Painted Bunting	Worsening	Potential colonization
Dickcissel	Worsening	-
Red-winged Blackbird	Improving*	Worsening
Eastern Meadowlark	Stable	Worsening
Western Meadowlark	-	Worsening
Common Grackle	Stable	Worsening
Great-tailed Grackle	Stable	Stable
Bronzed Cowbird	Stable	-
Brown-headed Cowbird	Stable	Stable
Orchard Oriole	Potential extirpation	-
Altamira Oriole	-	Potential colonization
House Finch	Potential extirpation	Potential extirpation
Cassin's Finch	-	Potential colonization
Lesser Goldfinch	Potential extirpation	Potential extirpation
American Goldfinch	-	Stable
House Sparrow	x	Stable