Birds and Climate Change

National Park Service
U.S. Department of the Interior

Amistad National Recreation Area

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 Amistad National Recreation Area (hereafter, the Recreation Area) 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 Recreation Area based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Recreation Area 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 Recreation Area, 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 Recreation Area today, climate suitability in summer under the high-emissions pathway is projected to improve for 13 (e.g., Figure 2), remain stable for 32, and worsen for 28 species. Suitable climate ceases to occur for 5 species in summer, potentially resulting in extirpation of those species from the Recreation Area. Climate is projected to become suitable in summer for 9 species not found at the Recreation Area today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 27, remain stable for 52, and worsen for 25 species. Suitable climate ceases to occur for 10 species in winter, potentially resulting in extirpation from the Recreation Area. Climate is projected to become suitable in winter for 31 species not found at the Recreation Area today, potentially resulting in local colonization.

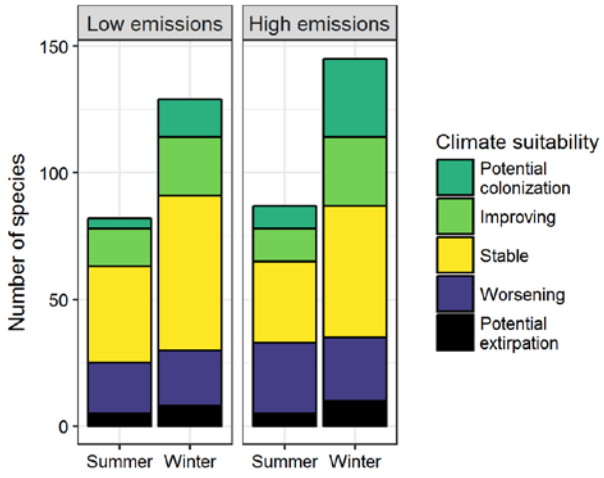

Figure 1. Projected changes in climate suitability for birds at the Recreation Area, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Recreation Area between the present and 2050 is 0.11 in summer (12th percentile across all national parks) and 0.13 in winter (14th percentile) under the high-emissions pathway. Potential species turnover declines to 0.06 in summer and 0.07 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 Recreation Area is or may become home to 9 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 Recreation Area may serve as an important refuge for 8 of these climate-sensitive species, one, the Herring Gull (*Larus argentatus*), might be extirpated from the Recreation Area in winter by 2050.

Figure 2. Climate at the Recreation Area 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, Amistad National Recreation Area 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 8 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 Recreation Area based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Recreation Area 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
Muscovy Duck	-	Potential colonization
Gadwall	-	Stable
American Wigeon	-	Stable
Mallard	Stable^	Potential extirpation
Blue-winged Teal	-	Stable
Northern Shoveler	-	Stable
Green-winged Teal	-	Stable
Canvasback	-	Stable
Ring-necked Duck	-	Stable
Lesser Scaup	-	Stable
Bufflehead	-	Improving*
Red-breasted Merganser	-	Potential colonization^
Ruddy Duck	-	Stable
Scaled Quail	Stable	Stable
Gambel's Quail	Potential colonization	Potential colonization
Northern Bobwhite	Stable	Improving*
Chukar	-	Potential colonization
Wild Turkey	x	Potential extirpation
Pacific Loon	-	Improving
Common Loon	-	Stable^
Least Grebe	-	Worsening
Pied-billed Grebe	-	Worsening
Horned Grebe	-	Stable
Eared Grebe	-	Stable
Magnificent Frigatebird	-	Potential colonization
Double-crested Cormorant	x	Stable
Anhinga	-	Potential colonization
American White Pelican	-	Stable
Least Bittern	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Great Blue Heron	Stable	Worsening
Great Egret	Stable	Stable
Snowy Egret	x	Improving*
Green Heron	Improving	-
Yellow-crowned Night-Heron	Worsening	-
Black Vulture	Worsening	Worsening*
Turkey Vulture	x	Stable
Osprey	-	Stable
White-tailed Kite	-	Potential colonization
Swallow-tailed Kite	Potential colonization	-
Golden Eagle	-	Potential colonization
Northern Harrier	-	Stable
Sharp-shinned Hawk	-	Worsening
Cooper's Hawk	-	Stable
Bald Eagle	-	Improving*
Harris's Hawk	Improving*	Stable
Swainson's Hawk	Stable^	-
Red-tailed Hawk	Worsening	Worsening
Clapper Rail	-	Potential colonization
Virginia Rail	-	Potential colonization
American Coot	x	Worsening
Limpkin	-	Potential colonization
Black-necked Stilt	-	Potential colonization
Snowy Plover	-	Potential colonization
Wilson's Plover	-	Potential colonization
Killdeer	Stable	Stable
Spotted Sandpiper	-	Stable
Whimbrel	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Dunlin	-	Potential colonization^
Bonaparte's Gull	-	Stable
Laughing Gull	-	Potential colonization
Ring-billed Gull	-	Stable
Yellow-footed Gull	-	Potential colonization
Herring Gull	-	Potential extirpation^
Forster's Tern	x	Improving*
Royal Tern	-	Potential colonization^
Rock Pigeon	Stable	Improving
Eurasian Collared-Dove	x	Improving
White-winged Dove	Stable	Worsening*
Mourning Dove	Stable	Improving
Inca Dove	Stable	Stable
Common Ground-Dove	Stable	Improving
Yellow-billed Cuckoo	Stable	-
Greater Roadrunner	Worsening	Improving
Great Horned Owl	x	Potential extirpation
Northern Pygmy-Owl	-	Potential colonization
Lesser Nighthawk	Improving	-
Common Nighthawk	Worsening*	-
Chimney Swift	Stable	-
White-throated Swift	x	Improving*
Black-chinned Hummingbird	Worsening	-
Anna's Hummingbird	-	Stable
Belted Kingfisher	-	Stable
Gila Woodpecker	Potential colonization	Potential colonization
Golden-fronted Woodpecker	Stable	Worsening
Ladder-backed Woodpecker	Worsening	Stable

Common Name	Summer Trend	Winter Trend
Northern Flicker	-	Potential extirpation
Crested Caracara	Worsening	Worsening*
American Kestrel	-	Stable
Dusky Flycatcher	Potential colonization	-
Black Phoebe	Improving	Improving*
Eastern Phoebe	-	Stable
Say's Phoebe	Worsening	Improving
Vermilion Flycatcher	Worsening	Improving
Ash-throated Flycatcher	Stable	x
Great Crested Flycatcher	-	Potential colonization
Brown-crested Flycatcher	Stable	-
Great Kiskadee	Improving	-
Couch's Kingbird	Worsening	Worsening
Western Kingbird	Worsening	-
Scissor-tailed Flycatcher	Worsening	-
Loggerhead Shrike	Stable	Stable
White-eyed Vireo	-	Stable
Bell's Vireo	Worsening*	-
Black-whiskered Vireo	Potential colonization	-
Pinyon Jay	-	Potential colonization
Chihuahuan Raven	Stable	Stable
Common Raven	Stable	Potential extirpation
Northern Rough-winged Swallow	Improving	-
Purple Martin	Worsening	-
Tree Swallow	-	Potential colonization
Violet-green Swallow	-	Potential colonization
Barn Swallow	Potential extirpation	-
Cliff Swallow	Worsening	-

Common Name	Summer Trend	Winter Trend
Cave Swallow	Worsening	-
Mountain Chickadee	-	Potential colonization
Juniper Titmouse	Potential colonization	-
Verdin	Stable	Improving
Pygmy Nuthatch	-	Potential colonization^
Rock Wren	Improving	Improving*
Canyon Wren	x	Worsening*
House Wren	-	Stable
Carolina Wren	Stable	-
Bewick's Wren	Worsening*	Worsening*
Cactus Wren	Stable	Improving
Blue-gray Gnatcatcher	Improving	Improving*
Black-tailed Gnatcatcher	Stable	Improving
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	-	Potential extirpation
Mountain Bluebird	-	Improving
Hermit Thrush	-	Potential extirpation
Curve-billed Thrasher	Improving	Improving
Long-billed Thrasher	-	Improving
LeConte's Thrasher	-	Potential colonization
Crissal Thrasher	Potential colonization	-
Sage Thrasher	-	Stable
Northern Mockingbird	Stable	Stable
European Starling	Potential extirpation	-
American Pipit	-	Stable
Sprague's Pipit	-	Worsening
Cedar Waxwing	-	Potential extirpation
Phainopepla	-	Improving*

Common Name	Summer Trend	Winter Trend
Orange-crowned Warbler	-	Stable
Common Yellowthroat	Improving	Stable
Yellow-rumped Warbler	-	Worsening
Townsend's Warbler	-	Potential colonization
Hermit Warbler	-	Potential colonization^
Yellow-breasted Chat	Stable	-
Olive Sparrow	Worsening	-
Green-tailed Towhee	-	Stable
Rufous-crowned Sparrow	x	Stable
Canyon Towhee	Stable	Stable
Abert's Towhee	Potential colonization	-
Cassin's Sparrow	Worsening	Worsening*
Chipping Sparrow	-	Worsening
Brewer's Sparrow	-	Improving*
Field Sparrow	-	Worsening*
Vesper Sparrow	-	Worsening
Lark Sparrow	Worsening	Improving
Black-throated Sparrow	Stable	Improving
Lark Bunting	-	Stable
Savannah Sparrow	-	Stable
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Worsening*

Common Name	Summer Trend	Winter Trend
White-crowned Sparrow	-	Worsening
Summer Tanager	Potential extirpation	-
Northern Cardinal	Worsening	Stable
Pyrrhuloxia	Worsening*	Worsening*
Blue Grosbeak	Worsening	-
Painted Bunting	Worsening*	-
Dickcissel	Worsening*	-
Red-winged Blackbird	Improving*	Worsening
Eastern Meadowlark	-	Stable
Western Meadowlark	-	Stable
Yellow-headed Blackbird	Improving	-
Common Grackle	-	Stable
Great-tailed Grackle	Worsening	Stable
Bronzed Cowbird	Worsening*	-
Brown-headed Cowbird	Stable	-
Orchard Oriole	Potential extirpation	-
Hooded Oriole	Stable	-
Bullock's Oriole	Improving*	-
Scott's Oriole	Stable	-
House Finch	Potential extirpation	Stable
Cassin's Finch	Potential colonization	-
Lesser Goldfinch	Stable	Worsening*
House Sparrow	x	Stable