Birds and Climate Change

National Park Service
U.S. Department of the Interior

White Sands National Monument

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 White Sands National Monument (hereafter, the Monument) 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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Monument 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 Monument, 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 Monument today, climate suitability in summer under the high-emissions pathway is projected to improve for 15, remain stable for 15 (e.g., Figure 2), and worsen for 6 species. Suitable climate ceases to occur for 5 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 22 species not found at the Monument today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 15, remain stable for 16, and worsen for 12 species. Suitable climate ceases to occur for 7 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 33 species not found at the Monument today, potentially resulting in local colonization.

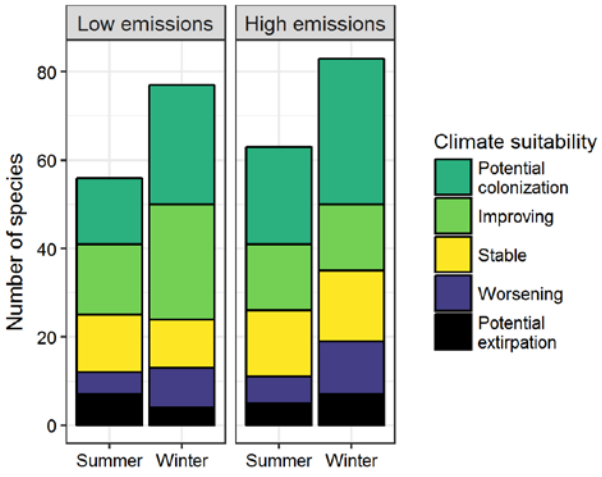

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.22 in summer (35th percentile across all national parks) and 0.15 in winter (17th percentile) under the high-emissions pathway. Potential species turnover declines to 0.18 in summer and 0.11 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 Monument is or may become home to 8 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 8 species at the Monument; instead the Monument may serve as an important refuge for these climate-sensitive species.

Figure 2. Climate at the Monument in summer is projected to remain suitable for the Mourning Dove (*Zenaida macroura*) through 2050. Photo by KS Black/Flickr (Public Domain).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, White Sands National Monument falls within the high potential colonization group.** Parks anticipating high potential colonization can focus on actions that increase species' ability to respond to environmental change, such as increasing the amount of potential habitat, working with cooperating agencies and landowners to improve habitat connectivity for birds across boundaries, managing the disturbance regime, and possibly more intensive management actions. 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.

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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Monument 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
Fulvous Whistling-Duck	Potential colonization	-
Gadwall	Potential colonization^	Stable
Mottled Duck	Potential colonization	-
Northern Shoveler	-	Worsening
Green-winged Teal	-	Stable
Common Merganser	-	Worsening
Ruddy Duck	Potential colonization	Stable
Scaled Quail	Worsening*	Worsening*
Gambel's Quail	Improving	Improving*
Least Grebe	-	Potential colonization
Wood Stork	Potential colonization	-
Anhinga	Potential colonization^	-

Common Name	Summer Trend	Winter Trend
Tricolored Heron	Potential colonization^	-
Green Heron	-	Potential colonization
Roseate Spoonbill	-	Potential colonization
White-tailed Kite	Potential colonization	-
Golden Eagle	-	Stable
Northern Harrier	-	Stable
Sharp-shinned Hawk	x	Worsening
Gray Hawk	Potential colonization	-
Swainson's Hawk	Worsening*^	-
Red-tailed Hawk	Worsening	Improving
Ferruginous Hawk	-	Stable
American Coot	-	Improving
Limpkin	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Black-necked Stilt	x	Potential colonization
Killdeer	Stable	Improving
Stilt Sandpiper	-	Potential colonization
Least Sandpiper	-	Stable
Western Sandpiper	-	Potential colonization
Wilson's Phalarope	Stable^	-
Yellow-footed Gull	-	Potential colonization
Gull-billed Tern	-	Potential colonization
White-winged Dove	Improving*	Worsening*
Mourning Dove	Stable	Improving
Inca Dove	Potential colonization	-
Common Ground-Dove	Potential colonization	Potential colonization
Greater Roadrunner	Stable	Improving
Groove-billed Ani	-	Potential colonization
Great Horned Owl	x	Stable
Burrowing Owl	Worsening*^	Worsening
Lesser Nighthawk	Stable	-
Common Pauraque	-	Potential colonization
Anna's Hummingbird	-	Potential colonization
Costa's Hummingbird	Potential colonization	Potential colonization
Buff-bellied Hummingbird	-	Potential colonization
Red-naped Sapsucker	-	Worsening*
Ladder-backed Woodpecker	Improving	Stable
Crested Caracara	-	Potential colonization
American Kestrel	x	Improving
Peregrine Falcon	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Northern Beardless-Tyrannulet	Potential colonization	-
Gray Flycatcher	-	Potential colonization
Say's Phoebe	Improving	Improving
Ash-throated Flycatcher	Improving	-
Cassin's Kingbird	Improving	Potential colonization
Western Kingbird	Stable	-
Loggerhead Shrike	Worsening*	Improving
American Crow	-	Potential extirpation
Chihuahuan Raven	Stable	Worsening*
Common Raven	Improving	Stable
Horned Lark	Potential extirpation	Worsening
Northern Rough-winged Swallow	Improving	-
Purple Martin	Potential colonization	-
Tree Swallow	-	Potential colonization
Violet-green Swallow	-	Potential colonization
Barn Swallow	Potential extirpation	-
Cave Swallow	Potential colonization	-
Mountain Chickadee	Potential extirpation	Potential extirpation
Cactus Wren	Stable	Stable
Blue-gray Gnatcatcher	Stable	-
Black-tailed Gnatcatcher	Improving*	Improving*
Long-billed Thrasher	Potential colonization^	Potential colonization
LeConte's Thrasher	Potential colonization	Potential colonization
Crissal Thrasher	-	Stable
Northern Mockingbird	Stable	Improving
European Starling	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Cedar Waxwing	-	Potential extirpation
Phainopepla	Improving	-
Chestnut-collared Longspur	-	Worsening
Black-and-white Warbler	-	Potential colonization
Yellow-rumped Warbler	Stable	Improving
Black-throated Gray Warbler	-	Potential colonization
Townsend's Warbler	-	Potential colonization
Hermit Warbler	-	Potential colonization^
Wilson's Warbler	-	Potential colonization
Yellow-breasted Chat	Improving*	-
Spotted Towhee	Improving	x
Abert's Towhee	Potential colonization	-
Bachman's Sparrow	Potential colonization	-
Brewer's Sparrow	-	Improving*
Lark Sparrow	-	Potential colonization
Black-throated Sparrow	Improving	Improving
Sagebrush/Bell's Sparrow (Sage Sparrow)	-	Stable
Savannah Sparrow	-	Stable
Grasshopper Sparrow	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Henslow's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Improving
Dark-eyed Junco	x	Potential extirpation
Summer Tanager	Potential colonization	-
Northern Cardinal	Potential colonization	Potential colonization
Blue Grosbeak	Improving	-
Indigo Bunting	-	Potential colonization
Tricolored Blackbird	Potential colonization	-
Western Meadowlark	Potential extirpation	Worsening
Yellow-headed Blackbird	Stable	-
Brewer's Blackbird	-	Stable
Great-tailed Grackle	Worsening	-
Brown-headed Cowbird	Stable	-
Bullock's Oriole	Stable	-
Scott's Oriole	Stable	-
House Finch	Improving	Stable
Cassin's Finch	-	Worsening*
American Goldfinch	-	Potential extirpation
Evening Grosbeak	-	Potential extirpation
House Sparrow	x	Potential extirpation