Birds and Climate Change

National Park Service
U.S. Department of the Interior

Noatak National Preserve

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 Noatak National Preserve (hereafter, the Preserve) 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Preserve 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 Preserve, 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 Preserve today, climate suitability in summer under the high-emissions pathway is projected to improve for 23, remain stable for 10 (e.g., Figure 2), and worsen for 15 species. Suitable climate ceases to occur for 2 species in summer, potentially resulting in extirpation of those species from the Preserve. Climate is projected to become suitable in summer for 20 species not found at the Preserve today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 1, remain stable for 1, and worsen for 0 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 13 species not found at the Preserve today, potentially resulting in local colonization.

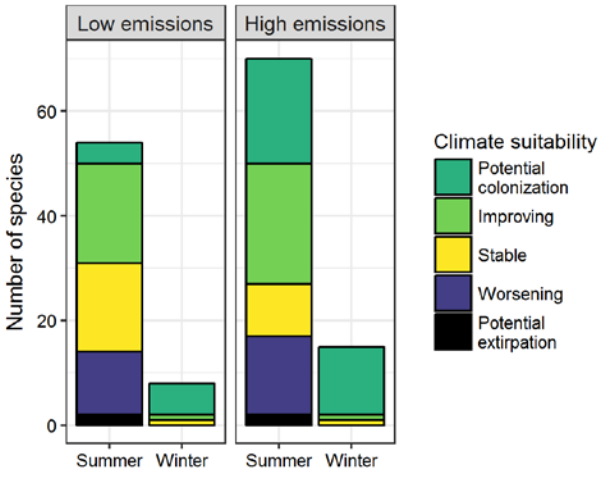

Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.21 in summer (32nd percentile across all national parks) and 0.18 in winter (24th percentile) under the high-emissions pathway. Potential species turnover declines to 0.09 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 Preserve is or may become home to 19 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 Preserve may serve as an important refuge for 18 of these climate-sensitive species, one, the Smith's Longspur (*Calcarius pictus*), might be extirpated from the Preserve in summer by 2050.

Figure 2. Climate at the Preserve in summer is projected to remain suitable for the Northern Pintail (*Anas acuta*) through 2050. Photo by Becky Matsubara/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, Noatak National Preserve 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 18 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Preserve 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

Common Name	Summer Trend	Winter Trend
Tundra Swan	Improving	-
American Wigeon	Improving*^	-
Mallard	Potential colonization^	-
Northern Shoveler	Improving^	-
Northern Pintail	Stable	-
Redhead	Potential colonization^	-
Greater Scaup	Stable	-
Harlequin Duck	-	Potential colonization
Long-tailed Duck	Worsening	Potential colonization
Common Merganser	-	Potential colonization
Red-breasted Merganser	Improving*	-
Chukar	-	Potential colonization
Greater Sage-Grouse	-	Potential colonization^
Willow Ptarmigan	Worsening*	-
Rock Ptarmigan	Worsening	-
Red-throated Loon	Improving*	-
Pacific Loon	Worsening*	-
Red-necked Grebe	-	Potential colonization^
Northern Fulmar	-	Potential colonization
Northern Harrier	Improving^	-
Rough-legged Hawk	Worsening	-
American Golden-Plover	Worsening*	-
Semipalmated Plover	Stable	-
Greater Yellowlegs	Potential colonization	-
Lesser Yellowlegs	Stable^	-
Wilson's Snipe	Stable	-
Red-necked Phalarope	Worsening*	-
Parasitic Jaeger	Worsening	-
Long-tailed Jaeger	Worsening	-

Common Name	Summer Trend	Winter Trend
Marbled Murrelet	Potential colonization	-
Mew Gull	Improving	-
California Gull	-	Potential colonization^
Glaucous-winged Gull	Improving	-
Glaucous Gull	Worsening*	-
Arctic Tern	Stable	-
Snowy Owl	-	Potential colonization
Burrowing Owl	Potential colonization^	-
Belted Kingfisher	Improving	-
Black-backed Woodpecker	-	Potential colonization
Olive-sided Flycatcher	Potential colonization	-
Western Wood-Pewee	Potential colonization^	-
Alder Flycatcher	Potential colonization	-
Dusky Flycatcher	Potential colonization	-
Say's Phoebe	Stable	-
Gray Jay	Improving	-
Common Raven	Improving	Stable
Horned Lark	Potential extirpation	-
Tree Swallow	Improving*	-
Cliff Swallow	Potential colonization	-
Boreal Chickadee	Improving^	-
Arctic Warbler	Improving	-
Townsend's Solitaire	Potential colonization^	-
Gray-cheeked Thrush	Improving	-
Swainson's Thrush	Potential colonization	-
American Robin	Improving	-

Common Name	Summer Trend	Winter Trend
Varied Thrush	Stable^	-
American Pipit	Stable	-
Sprague's Pipit	Potential colonization^	-
Bohemian Waxwing	-	Potential colonization
Lapland Longspur	Worsening*	-
Smith's Longspur	Potential extirpation^	-
Snow Bunting	-	Potential colonization
Tennessee Warbler	Potential colonization	-
Yellow Warbler	Improving	-
Blackpoll Warbler	Improving*	-
Yellow-rumped Warbler	Improving	-
Townsend's Warbler	Potential colonization	-
Wilson's Warbler	Improving	-
American Tree Sparrow	Worsening	-
Savannah Sparrow	Worsening	-
Baird's Sparrow	Potential colonization^	-
Fox Sparrow	Improving	-
Lincoln's Sparrow	Potential colonization	-
White-throated Sparrow	Potential colonization	-
White-crowned Sparrow	Worsening	-
Golden-crowned Sparrow	Stable	Potential colonization
Pine Grosbeak	Improving^	-
Red Crossbill	Potential colonization^	-
White-winged Crossbill	Potential colonization	-
Common Redpoll	Improving*	Improving*
Hoary Redpoll	Worsening	-