Birds and Climate Change

National Park Service
U.S. Department of the Interior

John D. Rockefeller, Jr., Memorial Parkway

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 John D. Rockefeller, Jr., Memorial Parkway (hereafter, the Parkway) 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 Parkway based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Parkway 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 Parkway, 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 Parkway today, climate suitability in summer under the high-emissions pathway is projected to improve for 13, remain stable for 24, and worsen for 13 species. Suitable climate ceases to occur for 2 species in summer, potentially resulting in extirpation of those species from the Parkway. Climate is projected to become suitable in summer for 12 species not found at the Parkway today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 0, remain stable for 2, and worsen for 1 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 9 species not found at the Parkway today, potentially resulting in local colonization.

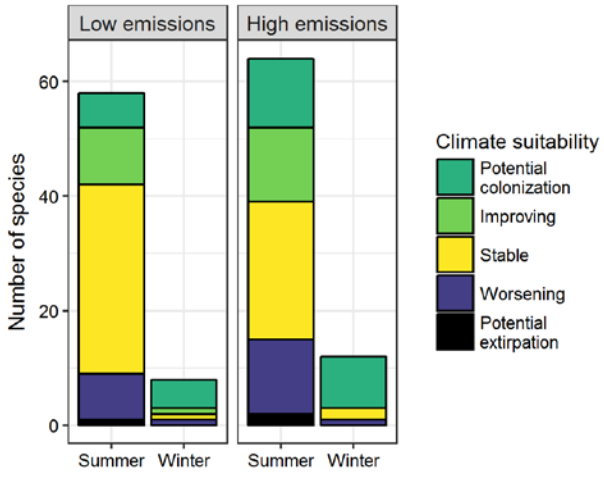

Figure 1. Projected changes in climate suitability for birds at the Parkway, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Parkway between the present and 2050 is 0.19 in summer (28th percentile across all national parks) and 0.10 in winter (8th percentile) under the high-emissions pathway. Potential species turnover declines to 0.10 in summer and 0.09 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 Parkway 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 Parkway may serve as an important refuge for 8 of these climate-sensitive species, one, the Swainson's Hawk (*Buteo swainsoni*), might be extirpated from the Parkway in summer by 2050.

Figure 2. Although the American Goldfinch (*Spinus tristis*) is not currently found at the Parkway, climate is projected to become suitable for it here in winter by 2050, potentially resulting in local seasonal colonization. Photo by John Benson/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, John D. Rockefeller, Jr., Memorial Parkway falls within the high potential extirpation group.** Parks anticipating high potential extirpation 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 Parkway based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Parkway 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
American Wigeon	Worsening^	-
Mallard	Stable^	-
Bufflehead	x	Stable
Wild Turkey	-	Potential colonization
Great Blue Heron	Improving	-
Swainson's Hawk	Potential extirpation^	-
Red-tailed Hawk	Stable	-
Killdeer	Potential extirpation	-
Wilson's Snipe	Stable	-
Ring-billed Gull	Stable^	-
Common Nighthawk	Stable	-
Rufous Hummingbird	Potential colonization	-
Belted Kingfisher	Improving	-
Red-naped Sapsucker	Stable^	-
Hairy Woodpecker	Improving	-
Northern Flicker	Improving	-
Pileated Woodpecker	Potential colonization	-
Olive-sided Flycatcher	Stable	-
Western Wood-Pewee	Stable^	-
Willow Flycatcher	Stable	-
Dusky Flycatcher	Stable	-
Warbling Vireo	Stable	-
Gray Jay	Worsening*	-
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	-	Potential colonization
Clark's Nutcracker	Worsening^	-
American Crow	-	Potential colonization
Common Raven	Improving	Stable
Northern Rough-winged Swallow	Potential colonization	-
Tree Swallow	Stable	-
Violet-green Swallow	Stable	-

Common Name	Summer Trend	Winter Trend
Barn Swallow	Improving	-
Cliff Swallow	Worsening	-
Black-capped Chickadee	Potential colonization	-
Mountain Chickadee	Worsening*	Worsening*
Bushtit	-	Potential colonization
Red-breasted Nuthatch	Improving*	-
White-breasted Nuthatch	-	Potential colonization
House Wren	Potential colonization	-
Pacific/Winter Wren	Potential colonization	-
Golden-crowned Kinglet	-	Potential colonization
Ruby-crowned Kinglet	Worsening	-
Mountain Bluebird	Worsening*	-
Swainson's Thrush	Stable	-
American Robin	Worsening	-
European Starling	Improving*	-
Bohemian Waxwing	-	Potential colonization
Cedar Waxwing	Improving	-
Orange-crowned Warbler	Potential colonization	-
Nashville Warbler	Potential colonization	-
Common Yellowthroat	Improving	-
Yellow Warbler	Stable	-

Common Name	Summer Trend	Winter Trend
Yellow-rumped Warbler	Stable	-
Grace's Warbler	Potential colonization	-
Wilson's Warbler	Worsening*	-
Spotted Towhee	Potential colonization	-
Chipping Sparrow	Improving	-
Savannah Sparrow	Stable	-
Song Sparrow	Stable	-
Lincoln's Sparrow	Worsening*	-
White-crowned Sparrow	Worsening*	-
Dark-eyed Junco	x	Potential colonization
Western Tanager	Stable	-
Red-winged Blackbird	Stable	-
Yellow-headed Blackbird	Worsening	-
Brewer's Blackbird	Stable	-
Brown-headed Cowbird	Improving	-
Pine Grosbeak	Worsening^	-
Cassin's Finch	Stable	-
Red Crossbill	Stable^	-
Pine Siskin	Stable	-
Lesser Goldfinch	Potential colonization	-
American Goldfinch	Improving*	Potential colonization
Evening Grosbeak	Potential colonization	-