Birds and Climate Change

National Park Service
U.S. Department of the Interior

Saratoga 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 Saratoga 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 28, remain stable for 14 (e.g., Figure 2), and worsen for 20 species. Suitable climate ceases to occur for 30 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 20 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 33, remain stable for 5, and worsen for 13 species. Suitable climate ceases to occur for 8 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 40 species not found at the Park today, potentially resulting in local colonization.

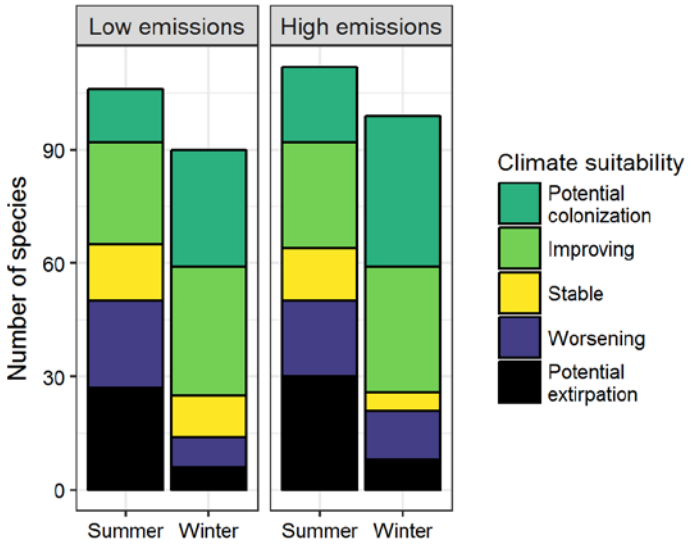

Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.33 in summer (57th percentile across all national parks) and 0.41 in winter (68th percentile) under the high-emissions pathway. Potential species turnover declines to 0.28 in summer and 0.34 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 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 Park may serve as an important refuge for 4 of these climate-sensitive species, 5 might be extirpated from the Park in at least one season by 2050.

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, Saratoga National Historical Park falls within the high turnover group.** Parks anticipating high turnover 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 4 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
Cackling/Canada Goose	x	Improving
Wood Duck	x	Potential colonization
Gadwall	-	Potential colonization
American Wigeon	-	Potential colonization
American Black Duck	x	Potential extirpation
Mallard	Potential extirpation^	Improving
Northern Shoveler	-	Potential colonization
Green-winged Teal	-	Potential colonization
Canvasback	-	Potential colonization
Ring-necked Duck	-	Improving
Greater Scaup	-	Improving^
Lesser Scaup	-	Potential colonization
Bufflehead	-	Improving
Common Goldeneye	-	Stable
Hooded Merganser	-	Improving^
Common Merganser	-	Worsening*
Northern Bobwhite	Improving*	Potential colonization
Ring-necked Pheasant	Worsening	-
Ruffed Grouse	x	Potential extirpation
Wild Turkey	x	Stable
Pied-billed Grebe	-	Potential colonization
Horned Grebe	-	Potential colonization
Double-crested Cormorant	x	Potential colonization
American White Pelican	-	Potential colonization
Great Blue Heron	Stable	Potential colonization
Great Egret	Improving	-

Common Name	Summer Trend	Winter Trend
Green Heron	Improving	-
Black Vulture	-	Potential colonization
Turkey Vulture	x	Potential colonization
Mississippi Kite	Potential colonization	-
Northern Harrier	Stable^	Improving
Sharp-shinned Hawk	x	Improving
Cooper's Hawk	x	Stable
Bald Eagle	x	Improving
Red-shouldered Hawk	Improving	Potential colonization
Red-tailed Hawk	Improving	Improving
Rough-legged Hawk	-	Worsening*
American Coot	-	Potential colonization
Killdeer	Improving	Potential colonization
Bonaparte's Gull	-	Potential colonization
Ring-billed Gull	Potential extirpation^	Stable
Herring Gull	-	Potential extirpation^
Great Black-backed Gull	-	Potential extirpation
Rock Pigeon	Worsening	Worsening
Mourning Dove	Improving	Worsening
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Worsening	-
Eastern Screech-Owl	-	Improving
Great Horned Owl	x	Potential colonization
Barred Owl	x	Improving
Chuck-will's-widow	Potential colonization	-
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Stable	-

Common Name	Summer Trend	Winter Trend
Belted Kingfisher	Worsening	Improving
Red-bellied Woodpecker	Improving	Improving
Yellow-bellied Sapsucker	Potential extirpation	Potential colonization
Downy Woodpecker	Improving	Worsening
Hairy Woodpecker	Potential extirpation	Worsening
Northern Flicker	Potential extirpation	Improving
Pileated Woodpecker	Stable	Improving
American Kestrel	x	Improving
Merlin	x	Improving^
Eastern Wood-Pewee	Improving	-
Acadian Flycatcher	Potential colonization	-
Alder Flycatcher	Potential extirpation	-
Willow Flycatcher	Worsening*	-
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Stable	-
Great Crested Flycatcher	Stable	-
Eastern Kingbird	Improving	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Potential colonization	Potential colonization
Northern Shrike	-	Potential extirpation
White-eyed Vireo	Potential colonization	-
Bell's Vireo	Potential colonization	-
Yellow-throated Vireo	Stable	-
Warbling Vireo	Stable	-
Red-eyed Vireo	Worsening	-
Blue Jay	Stable	Worsening
American Crow	Worsening	Worsening

Common Name	Summer Trend	Winter Trend
Fish Crow	Potential colonization	-
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	-	Improving
Northern Rough-winged Swallow	Improving	-
Purple Martin	Potential colonization	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Improving	-
Carolina Chickadee	Potential colonization	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Tufted Titmouse	Improving	Improving
Red-breasted Nuthatch	Potential extirpation	-
White-breasted Nuthatch	Stable	Worsening
Brown Creeper	Potential extirpation^	Improving
House Wren	Worsening	-
Pacific/Winter Wren	-	Potential colonization
Carolina Wren	Improving*	Improving
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Improving
Ruby-crowned Kinglet	-	Potential colonization
Eastern Bluebird	Improving	Improving
Veery	Potential extirpation	-
Hermit Thrush	Potential extirpation	Potential colonization
Wood Thrush	Worsening	-
American Robin	Worsening	Improving
Gray Catbird	Worsening	-
Brown Thrasher	Improving	Potential colonization

Common Name	Summer Trend	Winter Trend
Northern Mockingbird	Improving*	Improving
European Starling	Worsening	Worsening
Cedar Waxwing	Potential extirpation	Improving
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Potential extirpation
Ovenbird	Potential extirpation	-
Worm-eating Warbler	Potential colonization	-
Blue-winged Warbler	Worsening	-
Golden-winged Warbler	Potential extirpation	-
Black-and-white Warbler	Potential extirpation	-
Prothonotary Warbler	Potential colonization	-
Kentucky Warbler	Potential colonization	-
Common Yellowthroat	Worsening	-
American Redstart	Potential extirpation	-
Northern Parula	Potential colonization	-
Yellow Warbler	Potential extirpation	-
Chestnut-sided Warbler	Potential extirpation	-
Pine Warbler	Potential extirpation^	-
Yellow-rumped Warbler	-	Potential colonization
Yellow-throated Warbler	Potential colonization	-
Prairie Warbler	Improving	-
Black-throated Green Warbler	Potential extirpation	-
Yellow-breasted Chat	Potential colonization	-
Eastern Towhee	Improving	-

Common Name	Summer Trend	Winter Trend
American Tree Sparrow	-	Worsening
Chipping Sparrow	Worsening	-
Field Sparrow	Improving	Potential colonization
Vesper Sparrow	Stable	-
Savannah Sparrow	Potential extirpation	Potential colonization
Grasshopper Sparrow	Improving*	-
LeConte's Sparrow	-	Potential colonization
Fox Sparrow	-	Potential colonization
Song Sparrow	Potential extirpation	Improving
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	Potential extirpation	Potential colonization
White-throated Sparrow	Potential extirpation	Improving
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Improving*
Dark-eyed Junco	-	Improving
Summer Tanager	Potential colonization	-
Scarlet Tanager	Worsening*	-

Common Name	Summer Trend	Winter Trend
Northern Cardinal	Improving	Improving
Rose-breasted Grosbeak	Worsening*	-
Blue Grosbeak	Potential colonization	-
Indigo Bunting	Improving	-
Dickcissel	Potential colonization	-
Bobolink	Potential extirpation	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Improving	Potential colonization
Brewer's Blackbird	-	Potential colonization
Common Grackle	Worsening	Potential colonization
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Worsening	-
Orchard Oriole	Improving*	-
Baltimore Oriole	Stable	-
House Finch	Potential extirpation	Worsening
Purple Finch	Potential extirpation	-
American Goldfinch	Worsening	Stable
House Sparrow	x	Worsening