Birds and Climate Change

National Park Service
U.S. Department of the Interior

Vicksburg National Military 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 Vicksburg National Military 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 4, remain stable for 28 (e.g., Figure 2), and worsen for 26 species. Suitable climate ceases to occur for 6 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 29 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 6, remain stable for 36, and worsen for 18 species. Suitable climate ceases to occur for 10 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 63 species not found at the Park today, potentially resulting in local colonization.

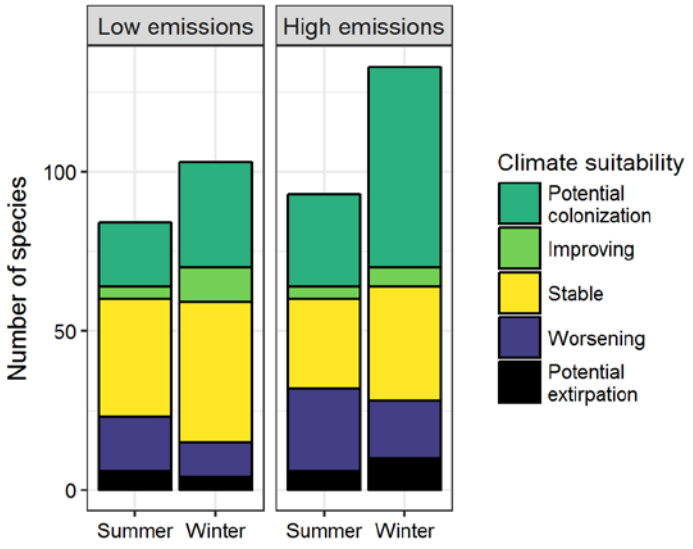

Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.19 in summer (28th percentile across all national parks) and 0.23 in winter (33rd percentile) under the high-emissions pathway. Potential species turnover declines to 0.15 in summer and 0.14 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 7 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 7 species at the Park; instead the Park may serve as an important refuge for these climate-sensitive species.

Figure 2. Climate at the Park in summer is projected to remain suitable for the Northern Cardinal (*Cardinalis cardinalis*) through 2050. Photo by Andy Morffew/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, Vicksburg National Military Park 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 7 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 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
Black-bellied Whistling-Duck	Potential colonization	-
Fulvous Whistling-Duck	Potential colonization	-
Muscovy Duck	-	Potential colonization
Mallard	-	Worsening
Mottled Duck	Potential colonization	Potential colonization
Cinnamon Teal	-	Potential colonization
Plain Chachalaca	-	Potential colonization
Scaled Quail	Potential colonization	Potential colonization
Chukar	-	Potential colonization
Wild Turkey	x	Potential extirpation
Pacific Loon	-	Potential colonization
Least Grebe	-	Potential colonization
Neotropic Cormorant	-	Potential colonization
Double-crested Cormorant	-	Stable
Brown Pelican	Potential colonization	-
American Bittern	-	Potential colonization^
Great Blue Heron	Stable	Stable
Great Egret	Stable	Improving
Little Blue Heron	-	Potential colonization
Tricolored Heron	Potential colonization^	-
Cattle Egret	Improving*	Stable
Green Heron	-	Potential colonization
Glossy Ibis	-	Potential colonization

Common Name	Summer Trend	Winter Trend
White-faced Ibis	-	Potential colonization^
Roseate Spoonbill	-	Potential colonization
Black Vulture	Improving*	Improving
Turkey Vulture	x	Improving
White-tailed Kite	Potential colonization	Potential colonization
Swallow-tailed Kite	Potential colonization	-
Mississippi Kite	Worsening	-
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	-	Stable
Harris's Hawk	Potential colonization	Potential colonization
White-tailed Hawk	-	Potential colonization
Red-shouldered Hawk	-	Stable
Red-tailed Hawk	Stable	Stable
Black-necked Stilt	-	Potential colonization
American Avocet	-	Potential colonization^
Snowy Plover	-	Potential colonization
Killdeer	Stable	Stable
Stilt Sandpiper	-	Potential colonization
Ring-billed Gull	-	Potential extirpation
Yellow-footed Gull	-	Potential colonization
Gull-billed Tern	-	Potential colonization
Caspian Tern	-	Potential colonization
Forster's Tern	-	Stable
Sandwich Tern	-	Potential colonization^
Rock Pigeon	Stable	Potential extirpation

Common Name	Summer Trend	Winter Trend
Eurasian Collared-Dove	x	Stable
White-winged Dove	Potential colonization	Potential colonization
Mourning Dove	Worsening	Improving
White-tipped Dove	Potential colonization	Potential colonization
Yellow-billed Cuckoo	Stable	-
Groove-billed Ani	-	Potential colonization
Western Screech-Owl	-	Potential colonization
Barred Owl	-	Stable
Lesser Nighthawk	Potential colonization	Potential colonization
Common Pauraque	-	Potential colonization
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Stable	-
Black-chinned Hummingbird	Potential colonization	-
Allen's Hummingbird	-	Potential colonization
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	-	Stable
Red-headed Woodpecker	Worsening	Worsening*
Gila Woodpecker	Potential colonization	-
Red-bellied Woodpecker	Stable	Worsening
Yellow-bellied Sapsucker	-	Stable
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Worsening	Potential extirpation
Hairy Woodpecker	-	Potential extirpation
Northern Flicker	-	Worsening
Pileated Woodpecker	-	Worsening*
Crested Caracara	Potential colonization	-

Common Name	Summer Trend	Winter Trend
American Kestrel	-	Worsening
Peregrine Falcon	-	Potential colonization
Eastern Wood-Pewee	Worsening	-
Acadian Flycatcher	Stable	-
Eastern Phoebe	-	Stable
Say's Phoebe	-	Potential colonization
Great Crested Flycatcher	Worsening	-
Brown-crested Flycatcher	Potential colonization	-
Great Kiskadee	Potential colonization	Potential colonization
Couch's Kingbird	Potential colonization	Potential colonization
Western Kingbird	Potential colonization	-
Eastern Kingbird	Worsening*	-
Loggerhead Shrike	Stable	Stable
White-eyed Vireo	Stable	-
Yellow-throated Vireo	Worsening	-
Red-eyed Vireo	Stable	-
Green Jay	Potential colonization	Potential colonization
Blue Jay	Worsening	Worsening
American Crow	Worsening	Potential extirpation
Fish Crow	Worsening*	Worsening*
Chihuahuan Raven	Potential colonization	-
Northern Rough-winged Swallow	Worsening	Potential colonization
Purple Martin	Worsening	x
Barn Swallow	Worsening	-
Cliff Swallow	Improving*	-
Carolina Chickadee	Stable	Stable
Tufted Titmouse	Worsening	Stable
Verdin	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
White-breasted Nuthatch	Stable	Stable
House Wren	-	Stable
Pacific/Winter Wren	-	Worsening*
Sedge Wren	-	Stable
Carolina Wren	Stable	Worsening
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Worsening*	-
Black-tailed Gnatcatcher	-	Potential colonization
Golden-crowned Kinglet	-	Worsening
Ruby-crowned Kinglet	-	Stable
Eastern Bluebird	Worsening	Stable
Hermit Thrush	-	Stable
Wood Thrush	Worsening	-
American Robin	Stable	Worsening
Gray Catbird	Potential extirpation	-
Curve-billed Thrasher	Potential colonization	Potential colonization
Brown Thrasher	Potential extirpation	Worsening
Long-billed Thrasher	Potential colonization^	-
Sage Thrasher	-	Potential colonization
Northern Mockingbird	Worsening	Worsening
European Starling	Stable	Stable
Cedar Waxwing	-	Potential extirpation
Black-and-white Warbler	Stable	-
Swainson's Warbler	Improving*	-
Orange-crowned Warbler	-	Improving
Kentucky Warbler	Stable	-
Common Yellowthroat	Potential extirpation	-
Hooded Warbler	Worsening*	-
American Redstart	Stable	-

Common Name	Summer Trend	Winter Trend
Northern Parula	Stable	Potential colonization
Pine Warbler	Worsening^	Stable
Yellow-rumped Warbler	-	Worsening
Black-throated Gray Warbler	-	Potential colonization
Wilson's Warbler	-	Potential colonization
Yellow-breasted Chat	Worsening	-
Olive Sparrow	-	Potential colonization
Green-tailed Towhee	-	Potential colonization
Eastern Towhee	Potential extirpation	x
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	-	Potential colonization
Chipping Sparrow	-	Stable
Brewer's Sparrow	-	Potential colonization
Field Sparrow	Stable	Stable
Lark Sparrow	Potential colonization	-
Black-throated Sparrow	Potential colonization	Potential colonization
Savannah Sparrow	-	Stable
Song Sparrow	-	Worsening
Swamp Sparrow	-	Stable
White-throated Sparrow	-	Stable
Dark-eyed Junco	-	Potential extirpation
Summer Tanager	Worsening	-
Western Tanager	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Northern Cardinal	Stable	Stable
Pyrrhuloxia	-	Potential colonization
Blue Grosbeak	Worsening*	-
Indigo Bunting	Worsening*	Potential colonization
Dickcissel	Stable	-
Red-winged Blackbird	Stable	Stable
Eastern Meadowlark	-	Stable
Western Meadowlark	-	Potential colonization
Rusty Blackbird	-	Worsening*
Common Grackle	Potential extirpation	Worsening
Great-tailed Grackle	-	Potential colonization
Bronzed Cowbird	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	Improving
Orchard Oriole	Worsening*	-
Altamira Oriole	-	Potential colonization
Audubon's Oriole	-	Potential colonization
Baltimore Oriole	Stable	-
House Finch	Potential extirpation	Stable
Purple Finch	-	Potential extirpation
Pine Siskin	-	Stable
Lesser Goldfinch	Potential colonization	-
American Goldfinch	-	Stable
House Sparrow	x	Potential extirpation