



Eisenhower National Historic Site

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 Eisenhower National Historic Site (hereafter, the Site) 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.

Results

Climate change is expected to alter the bird community at the Site, 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 Site today, climate suitability in summer under the high-emissions pathway is projected to improve for 31, remain stable for 10 (e.g., Figure 2), and worsen for 10 species. Suitable climate ceases to occur for 17 species in summer, potentially resulting in extirpation of those species from the Site. Climate is projected to become suitable in summer for 18 species not found at the Site today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 29, remain stable for 9, and worsen for 12 species. Suitable climate ceases to occur for 5 species in winter, potentially resulting in extirpation from the Site. Climate is projected to become suitable in winter for 35 species not found at the Site today, potentially resulting in local colonization.

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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Site 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.

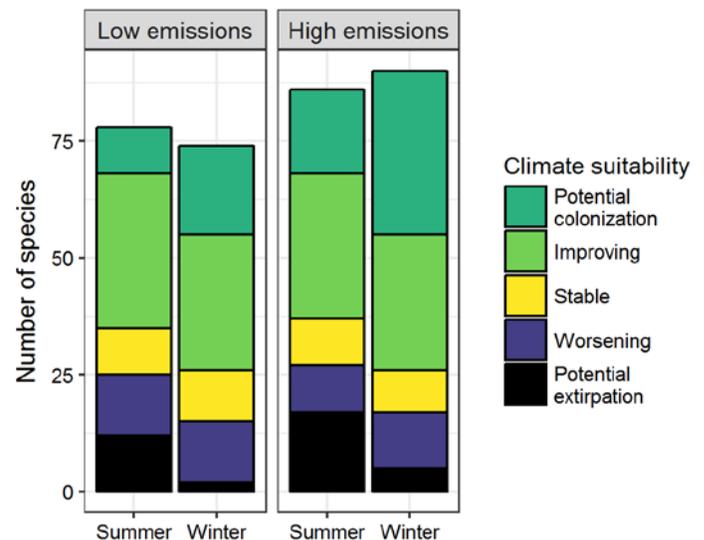


Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Site between the present and 2050 is 0.24 in summer (38th percentile across all national parks) and 0.20 in winter (27th percentile) under the high-emissions pathway. Potential species turnover declines to 0.15 in summer and 0.12 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 Site is or may become home to 6 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 Site may serve as an important refuge for 5 of these

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Eisenhower National Historic Site falls within the intermediate change group.** Parks anticipating intermediate change can best support landscape-scale bird conservation by emphasizing habitat restoration, maintaining natural disturbance regimes, and

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

climate-sensitive species, one, the Mallard (*Anas platyrhynchos*), might be extirpated from the Site in summer by 2050.



Figure 2. Climate at the Site 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).

reducing other stressors. Furthermore, park managers have an opportunity to focus on supporting the 5 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.

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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Site 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 | Stable |
| American Black Duck | - | Potential extirpation |
| Mallard | Potential extirpation [^] | Stable |
| Blue-winged Teal | - | Potential colonization |
| Bufflehead | - | Potential colonization |
| Hooded Merganser | - | Improving [^] |
| Common Merganser | - | Potential extirpation |
| Red-breasted Merganser | - | Potential colonization [^] |
| Eared Grebe | - | Potential colonization |
| American White Pelican | - | Potential colonization |
| Great Blue Heron | Improving | - |
| Great Egret | Potential colonization | Potential colonization |

| Common Name | Summer Trend | Winter Trend |
|----------------------------|------------------------|-----------------------|
| Little Blue Heron | Potential colonization | - |
| Cattle Egret | Potential colonization | - |
| Green Heron | Improving | - |
| Yellow-crowned Night-Heron | Potential colonization | - |
| Black Vulture | Improving | Improving |
| Turkey Vulture | x | Improving |
| Mississippi Kite | Potential colonization | - |
| Northern Harrier | - | Improving |
| Sharp-shinned Hawk | - | Improving |
| Cooper's Hawk | x | Worsening* |
| Bald Eagle | - | Improving |
| Red-shouldered Hawk | Improving | Improving |
| Red-tailed Hawk | Improving | Improving |
| Rough-legged Hawk | - | Potential extirpation |
| Killdeer | Improving | Improving |

| Common Name | Summer Trend | Winter Trend |
|---------------------------|------------------------|------------------------|
| Greater Yellowlegs | - | Potential colonization |
| Least Sandpiper | - | Potential colonization |
| Long-billed Dowitcher | - | Potential colonization |
| Bonaparte's Gull | - | Potential colonization |
| Forster's Tern | - | Potential colonization |
| Rock Pigeon | Worsening | Worsening* |
| Eurasian Collared-Dove | - | Potential colonization |
| Mourning Dove | Improving | Worsening |
| Yellow-billed Cuckoo | Improving* | - |
| Greater Roadrunner | Potential colonization | Potential colonization |
| Barn Owl | - | Potential colonization |
| Barred Owl | x | Improving |
| Common Nighthawk | Potential colonization | - |
| Chuck-will's-widow | Potential colonization | - |
| Chimney Swift | Worsening | - |
| Ruby-throated Hummingbird | Improving | - |
| Belted Kingfisher | - | Improving |
| Red-headed Woodpecker | Stable | Improving |
| Red-bellied Woodpecker | Improving | Improving |
| Yellow-bellied Sapsucker | - | Improving |
| Downy Woodpecker | Improving | Worsening |
| Hairy Woodpecker | - | Worsening |
| Northern Flicker | Potential extirpation | Stable |
| Pileated Woodpecker | Improving | - |
| American Kestrel | x | Stable |
| Eastern Wood-Pewee | Improving | - |
| Acadian Flycatcher | Stable | - |

| Common Name | Summer Trend | Winter Trend |
|-------------------------------|-------------------------|------------------------|
| Willow Flycatcher | Potential extirpation | - |
| Eastern Phoebe | Improving | Potential colonization |
| Great Crested Flycatcher | Improving | - |
| Eastern Kingbird | Stable | - |
| Scissor-tailed Flycatcher | Potential colonization | - |
| Loggerhead Shrike | Potential colonization | Potential colonization |
| Red-eyed Vireo | Potential extirpation | - |
| Blue Jay | Improving | Stable |
| American Crow | Worsening | Worsening |
| Fish Crow | Stable | - |
| Common Raven | Potential extirpation | Potential extirpation |
| Horned Lark | - | Stable |
| Northern Rough-winged Swallow | Improving | - |
| Tree Swallow | Potential extirpation | - |
| Barn Swallow | Improving | - |
| Cliff Swallow | Potential colonization | - |
| Carolina Chickadee | Improving* | Improving |
| Tufted Titmouse | Improving | Improving |
| White-breasted Nuthatch | Stable | Worsening |
| Brown-headed Nuthatch | Potential colonization^ | Potential colonization |
| Brown Creeper | - | Worsening |
| House Wren | Potential extirpation | Potential colonization |
| Sedge Wren | - | Potential colonization |
| Carolina Wren | Improving | Improving |
| Bewick's Wren | - | Potential colonization |
| Blue-gray Gnatcatcher | Improving* | - |
| Eastern Bluebird | Improving | Improving |

| Common Name | Summer Trend | Winter Trend |
|----------------------------|------------------------|-------------------------------------|
| Wood Thrush | Potential extirpation | - |
| American Robin | Worsening | Improving |
| Gray Catbird | Potential extirpation | - |
| Brown Thrasher | Stable | Potential colonization |
| Northern Mockingbird | Improving | Improving |
| European Starling | Worsening | Worsening |
| American Pipit | - | Potential colonization |
| Cedar Waxwing | Potential extirpation | - |
| Chestnut-collared Longspur | - | Potential colonization |
| Smith's Longspur | - | Potential colonization |
| Prothonotary Warbler | Potential colonization | - |
| Swainson's Warbler | Potential colonization | - |
| Orange-crowned Warbler | - | Potential colonization |
| Common Yellowthroat | Worsening | - |
| Yellow Warbler | Potential extirpation | - |
| Palm Warbler | - | Potential colonization [^] |
| Pine Warbler | - | Potential colonization |
| Yellow-breasted Chat | Improving* | - |
| Eastern Towhee | Worsening | - |
| American Tree Sparrow | - | Worsening* |
| Chipping Sparrow | Potential extirpation | Improving* |
| Field Sparrow | Improving | Improving |
| Vesper Sparrow | - | Potential colonization |
| Lark Sparrow | Potential colonization | - |
| Savannah Sparrow | Potential | Potential |

| Common Name | Summer Trend | Winter Trend |
|------------------------|-------------------------------------|------------------------|
| | extirpation | colonization |
| Grasshopper Sparrow | Stable | - |
| Henslow's Sparrow | - | Potential colonization |
| LeConte's Sparrow | - | Potential colonization |
| Seaside Sparrow | Potential colonization [^] | - |
| Song Sparrow | Potential extirpation | Stable |
| Lincoln's Sparrow | - | Potential colonization |
| White-throated Sparrow | - | Improving |
| Harris's Sparrow | - | Potential colonization |
| White-crowned Sparrow | - | Improving |
| Dark-eyed Junco | - | Stable |
| Scarlet Tanager | Potential extirpation | - |
| Northern Cardinal | Improving | Improving |
| Blue Grosbeak | Improving* | - |
| Indigo Bunting | Improving | - |
| Painted Bunting | Potential colonization | - |
| Dickcissel | Improving | - |
| Bobolink | Potential extirpation | - |
| Red-winged Blackbird | Stable | Improving |
| Eastern Meadowlark | Improving | Improving |
| Brewer's Blackbird | - | Potential colonization |
| Common Grackle | Worsening | Improving |
| Great-tailed Grackle | Potential colonization | Potential colonization |
| Brown-headed Cowbird | Stable | Improving |
| Orchard Oriole | Stable | - |
| Baltimore Oriole | Worsening | - |
| House Finch | Potential extirpation | Potential extirpation |

| Common Name | Summer Trend | Winter Trend |
|--------------------|---------------------|---------------------|
| Purple Finch | - | Stable |
| American Goldfinch | Worsening | Worsening |

| Common Name | Summer Trend | Winter Trend |
|--------------------|---------------------|---------------------|
| House Sparrow | x | Worsening |