# Birds and Climate Change

National Park Service
U.S. Department of the Interior

## Washita Battlefield 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 Washita Battlefield 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.

**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.

### 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 2, remain stable for 1, and worsen for 0 species. Suitable climate does not cease to occur for any species in summer. Climate is projected to become suitable in summer for 34 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 0, remain stable for 0, and worsen for 2 species. Suitable climate ceases to occur for 1 species in winter, potentially resulting in extirpation from the Site (Figure 2). Climate is projected to become suitable in winter for 67 species not found at the Site today, potentially resulting in local colonization.

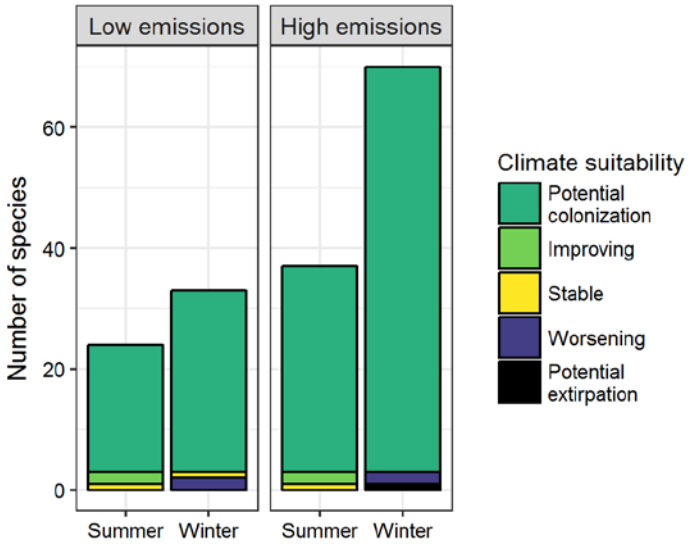


**Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.**

## Results (continued)

### Potential Turnover Index

**Potential bird species turnover for the Site between the present and 2050 is 0.25 in summer (41st percentile across all national parks) and 0.28 in winter (42nd percentile) under the high-emissions pathway. Potential species turnover declines to 0.16 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 8 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 8 species at the Site; instead the Site may serve as an important refuge for these climate-sensitive species.

**Figure 2. Although currently found at the Site, suitable climate for the American Goldfinch (*Spinus tristis*) may cease to occur here in winter by 2050, potentially resulting in local seasonal extirpation.** 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, Washita Battlefield National Historic Site 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 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

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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 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 |
|---|---|---|
| Cinnamon Teal | - | Potential colonization |
| Greater Scaup | - | Potential colonization^ |
| Gambel's Quail | Potential colonization | Potential colonization |
| Least Grebe | - | Potential colonization |
| Clark's Grebe | - | Potential colonization |
| Wood Stork | Potential colonization | - |
| Neotropic Cormorant | - | Potential colonization |
| Anhinga | Potential colonization^ | - |
| Great Egret | - | Potential colonization |
| Snowy Egret | - | Potential colonization |
| Tricolored Heron | Potential colonization^ | - |

| Common Name | Summer Trend | Winter Trend |
|---|---|---|
| Black Vulture | Potential colonization | - |
| Osprey | - | Potential colonization |
| Harris's Hawk | Potential colonization | Potential colonization |
| Sora | - | Potential colonization |
| Common Gallinule | - | Potential colonization |
| American Avocet | - | Potential colonization^ |
| Mountain Plover | Potential colonization | - |
| Spotted Sandpiper | - | Potential colonization |
| Lesser Yellowlegs | - | Potential colonization |
| Stilt Sandpiper | - | Potential colonization |
| Western Sandpiper | - | Potential colonization |

| Common Name | Summer Trend | Winter Trend |
|---|---|---|
| American Woodcock | - | Potential colonization |
| Yellow-footed Gull | - | Potential colonization |
| Herring Gull | - | Potential colonization^ |
| Forster's Tern | - | Potential colonization |
| Eurasian Collared-Dove | - | Potential colonization |
| White-winged Dove | Potential colonization | Potential colonization |
| Inca Dove | Potential colonization | - |
| Common Ground-Dove | Potential colonization | - |
| Common Pauraque | - | Potential colonization |
| White-throated Swift | - | Potential colonization |
| Costa's Hummingbird | Potential colonization | - |
| Ringed Kingfisher | - | Potential colonization |
| Gila Woodpecker | Potential colonization | Potential colonization |
| Golden-fronted Woodpecker | Potential colonization | - |
| Red-naped Sapsucker | - | Potential colonization |
| Northern Flicker | Improving | Worsening* |
| Gilded Flicker | Potential colonization | Potential colonization |
| Crested Caracara | - | Potential colonization |
| American Kestrel | x | Worsening* |
| Peregrine Falcon | - | Potential colonization |
| Northern Beardless-Tyrannulet | Potential colonization | - |
| Hammond's Flycatcher | - | Potential colonization |
| Gray Flycatcher | - | Potential colonization |

| Common Name | Summer Trend | Winter Trend |
|---|---|---|
| Dusky Flycatcher | - | Potential colonization |
| Say's Phoebe | - | Potential colonization |
| Vermilion Flycatcher | - | Potential colonization |
| Ash-throated Flycatcher | Potential colonization | - |
| Brown-crested Flycatcher | Potential colonization | - |
| Great Kiskadee | Potential colonization | - |
| Western Kingbird | Stable | - |
| White-eyed Vireo | - | Potential colonization |
| Chihuahuan Raven | - | Potential colonization |
| Northern Rough-winged Swallow | - | Potential colonization |
| Purple Martin | Potential colonization | - |
| Violet-green Swallow | - | Potential colonization |
| Cliff Swallow | Improving | - |
| Cave Swallow | Potential colonization | - |
| Mountain Chickadee | - | Potential colonization |
| Juniper Titmouse | Potential colonization | - |
| Verdin | Potential colonization | - |
| Bushtit | - | Potential colonization |
| Pygmy Nuthatch | - | Potential colonization^ |
| Rock Wren | Potential colonization | - |
| Sedge Wren | - | Potential colonization |
| Cactus Wren | Potential colonization | Potential colonization |
| Blue-gray Gnatcatcher | - | Potential colonization |

| Common Name | Summer Trend | Winter Trend |
|---|---|---|
| Black-tailed Gnatcatcher | Potential colonization | Potential colonization |
| Long-billed Thrasher | - | Potential colonization |
| Bendire's Thrasher | - | Potential colonization |
| LeConte's Thrasher | Potential colonization | Potential colonization |
| Crissal Thrasher | - | Potential colonization |
| Sage Thrasher | - | Potential colonization |
| American Pipit | - | Potential colonization |
| Chestnut-collared Longspur | Potential colonization^ | - |
| Orange-crowned Warbler | - | Potential colonization |
| Lucy's Warbler | Potential colonization | - |
| Black-throated Gray Warbler | - | Potential colonization |
| Green-tailed Towhee | Potential colonization^ | Potential colonization |
| Canyon Towhee | Potential colonization | - |
| Abert's Towhee | Potential colonization | Potential colonization |

| Common Name | Summer Trend | Winter Trend |
|---|---|---|
| Rufous-winged Sparrow | - | Potential colonization |
| Cassin's Sparrow | - | Potential colonization |
| Bachman's Sparrow | Potential colonization | - |
| Brewer's Sparrow | - | Potential colonization |
| Lark Sparrow | - | Potential colonization |
| Black-throated Sparrow | - | Potential colonization |
| Grasshopper Sparrow | - | Potential colonization |
| Henslow's Sparrow | - | Potential colonization |
| Pyrrhuloxia | Potential colonization | - |
| Altamira Oriole | - | Potential colonization |
| Audubon's Oriole | - | Potential colonization |
| Scott's Oriole | Potential colonization | - |
| Cassin's Finch | - | Potential colonization |
| American Goldfinch | - | Potential extirpation |