



## Chickasaw National Recreation Area

### 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 Chickasaw National Recreation Area (hereafter, the Recreation Area) 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 Recreation Area, 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 Recreation Area today, climate suitability in summer under the high-emissions pathway is projected to improve for 5, remain stable for 27 (e.g., Figure 2), and worsen for 18 species. Suitable climate ceases to occur for 10 species in summer, potentially resulting in extirpation of those species from the Recreation Area. Climate is projected to become suitable in summer for 31 species not found at the Recreation Area today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 7, remain stable for 36, and worsen for 26 species. Suitable climate ceases to occur for 12 species in winter, potentially resulting in extirpation from the Recreation Area. Climate is projected to become suitable in winter for 74 species not

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

found at the Recreation Area today, potentially resulting in local colonization.

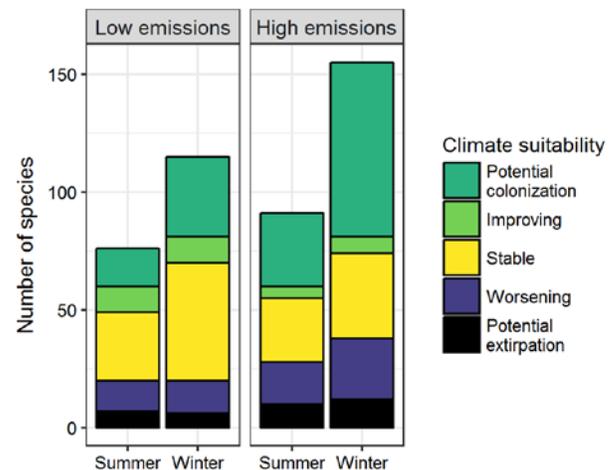


Figure 1. Projected changes in climate suitability for birds at the Recreation Area, by emissions pathway and season.

## Results (continued)

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### Potential Turnover Index

**Potential bird species turnover for the Recreation Area between the present and 2050 is 0.21 in summer (33<sup>rd</sup> percentile across all national parks) and 0.29 in winter (45<sup>th</sup> percentile) under the high-emissions pathway. Potential species turnover declines to 0.12 in summer and 0.16 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 Recreation Area 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.

## Management Implications

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Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Chickasaw National Recreation Area 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

### 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

2015). Suitable climate is not projected to disappear for these 6 species at the Recreation Area; instead the Recreation Area may serve as an important refuge for these climate-sensitive species.



**Figure 2. Climate at the Recreation Area in summer is projected to remain suitable for the Northern Cardinal (*Cardinalis cardinalis*) through 2050.** Photo by Andy Morffew/Flickr (CC BY 2.0).

across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 6 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.

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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 Recreation Area based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Recreation Area 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	-
Cackling/Canada Goose	-	Potential extirpation
Muscovy Duck	-	Potential colonization
Gadwall	-	Worsening
American Wigeon	-	Stable
Mallard	-	Worsening
Mottled Duck	Potential colonization	Potential colonization
Cinnamon Teal	-	Potential colonization
Green-winged Teal	-	Stable
Ring-necked Duck	-	Stable
Bufflehead	-	Stable
Common Goldeneye	-	Potential extirpation

Common Name	Summer Trend	Winter Trend
Hooded Merganser	-	Worsening <sup>^</sup>
Northern Bobwhite	Worsening	Worsening*
Wild Turkey	x	Potential extirpation
Common Loon	-	Worsening* <sup>^</sup>
Least Grebe	-	Potential colonization
Pied-billed Grebe	-	Stable
Horned Grebe	-	Worsening*
Magnificent Frigatebird	-	Potential colonization
Neotropic Cormorant	-	Potential colonization
Double-crested Cormorant	-	Worsening
Anhinga	Potential colonization <sup>^</sup>	Potential colonization
American White Pelican	-	Stable
Great Blue Heron	Stable	Worsening
Great Egret	Stable	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Snowy Egret	-	Potential colonization
Little Blue Heron	Stable	-
Tricolored Heron	Potential colonization <sup>^</sup>	-
Green Heron	Improving*	Potential colonization
Yellow-crowned Night-Heron	-	Potential colonization
White Ibis	Potential colonization	-
Roseate Spoonbill	-	Potential colonization
Black Vulture	Improving*	Stable
Turkey Vulture	x	Stable
Osprey	-	Potential colonization
Mississippi Kite	Stable	-
Northern Harrier	-	Worsening
Sharp-shinned Hawk	-	Stable
Bald Eagle	-	Potential extirpation
Harris's Hawk	-	Potential colonization
White-tailed Hawk	-	Potential colonization
Red-shouldered Hawk	Stable	Stable
Red-tailed Hawk	Stable	Worsening
Sora	-	Potential colonization
Common Gallinule	-	Potential colonization
American Coot	-	Improving
Killdeer	Worsening	Stable
Spotted Sandpiper	-	Potential colonization
Greater Yellowlegs	-	Stable
Willet	Potential colonization <sup>^</sup>	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Stilt Sandpiper	-	Potential colonization
Least Sandpiper	-	Stable
Western Sandpiper	-	Potential colonization
Wilson's Snipe	-	Stable
Bonaparte's Gull	-	Stable
Ring-billed Gull	-	Worsening
Yellow-footed Gull	-	Potential colonization
Herring Gull	-	Improving <sup>^</sup>
Gull-billed Tern	-	Potential colonization
Rock Pigeon	-	Potential extirpation
Eurasian Collared-Dove	-	Improving
White-winged Dove	Potential colonization	Potential colonization
Mourning Dove	Stable	Stable
Inca Dove	Potential colonization	-
Common Ground-Dove	Potential colonization	Potential colonization
Yellow-billed Cuckoo	Improving	-
Greater Roadrunner	Stable	-
Groove-billed Ani	-	Potential colonization
Eastern Screech-Owl	x	Stable
Great Horned Owl	x	Potential extirpation
Barred Owl	x	Worsening
Lesser Nighthawk	Potential colonization	Potential colonization
Common Nighthawk	Improving*	-
Chuck-will's-widow	Worsening	-
Chimney Swift	Stable	-
White-throated Swift	-	Potential colonization
Ruby-throated Hummingbird	Stable	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Buff-bellied Hummingbird	-	Potential colonization
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	Potential extirpation	Worsening
Green Kingfisher	-	Potential colonization
Red-bellied Woodpecker	Worsening	Stable
Yellow-bellied Sapsucker	-	Worsening
Red-naped Sapsucker	-	Potential colonization
Downy Woodpecker	Potential extirpation	Stable
Hairy Woodpecker	Potential extirpation	Potential extirpation
Northern Flicker	Stable	Worsening
Gilded Flicker	Potential colonization	-
Pileated Woodpecker	-	Potential extirpation
Crested Caracara	Potential colonization	Potential colonization
American Kestrel	-	Stable
Peregrine Falcon	-	Potential colonization
Hammond's Flycatcher	-	Potential colonization
Gray Flycatcher	-	Potential colonization
Dusky Flycatcher	-	Potential colonization
Black Phoebe	-	Potential colonization
Eastern Phoebe	Worsening	Stable
Say's Phoebe	-	Potential colonization
Vermilion Flycatcher	-	Potential colonization
Ash-throated Flycatcher	Potential colonization	-
Great Crested Flycatcher	Worsening*	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Brown-crested Flycatcher	Potential colonization	-
Great Kiskadee	Potential colonization	Potential colonization
Couch's Kingbird	Potential colonization	Potential colonization
Western Kingbird	Stable	-
Eastern Kingbird	Worsening	-
Scissor-tailed Flycatcher	Stable	-
Loggerhead Shrike	-	Improving
White-eyed Vireo	Stable	Potential colonization
Red-eyed Vireo	Stable	-
Green Jay	Potential colonization	Potential colonization
Blue Jay	Worsening	Worsening
American Crow	Potential extirpation	Worsening
Chihuahuan Raven	-	Potential colonization
Northern Rough-winged Swallow	Worsening	Potential colonization
Purple Martin	Improving	-
Barn Swallow	Worsening	-
Cliff Swallow	Stable	-
Cave Swallow	Potential colonization	-
Carolina Chickadee	Stable	Stable
Bridled Titmouse	-	Potential colonization
Tufted Titmouse	Worsening*	Stable
Verdin	-	Potential colonization
White-breasted Nuthatch	Potential extirpation	-
Brown Creeper	-	Worsening
Rock Wren	-	Potential colonization
Marsh Wren	-	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Carolina Wren	Worsening*	Stable
Bewick's Wren	Stable	-
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Worsening*	Potential colonization
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Ruby-crowned Kinglet	-	Stable
Eastern Bluebird	Worsening	Stable
Mountain Bluebird	-	Potential colonization
Hermit Thrush	-	Stable
American Robin	Potential extirpation	Worsening
Gray Catbird	-	Potential colonization
Curve-billed Thrasher	Potential colonization	-
Brown Thrasher	Potential extirpation	-
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
Northern Mockingbird	Stable	Stable
European Starling	Potential extirpation	Stable
Cedar Waxwing	-	Potential extirpation
Phainopepla	Potential colonization	Potential colonization
Lucy's Warbler	Potential colonization	-
Northern Parula	Worsening	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Yellow-rumped Warbler	-	Stable
Black-throated Gray Warbler	-	Potential colonization
Olive Sparrow	Potential colonization	Potential colonization
Green-tailed Towhee	-	Potential colonization
Abert's Towhee	Potential colonization	Potential colonization
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	-	Potential colonization
Bachman's Sparrow	Potential colonization	Potential colonization
Brewer's Sparrow	-	Potential colonization
Field Sparrow	Worsening*	Stable
Black-throated Sparrow	-	Potential colonization
Savannah Sparrow	-	Stable
Grasshopper Sparrow	-	Potential colonization
LeConte's Sparrow	-	Stable
Fox Sparrow	-	Worsening*
Song Sparrow	-	Worsening
Lincoln's Sparrow	-	Stable
Swamp Sparrow	-	Worsening*
White-throated Sparrow	-	Stable
Harris's Sparrow	-	Improving
White-crowned Sparrow	-	Improving
Dark-eyed Junco	-	Potential extirpation
Summer Tanager	Stable	-
Northern Cardinal	Stable	Stable
Pyrrhuloxia	Potential colonization	-
Indigo Bunting	Potential extirpation	Potential colonization
Painted Bunting	Stable	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Dickcissel	Stable	-
Red-winged Blackbird	Worsening	Worsening
Eastern Meadowlark	Stable	Worsening*
Common Grackle	Stable	-
Great-tailed Grackle	Stable	-
Bronzed Cowbird	Potential colonization	Potential colonization
Brown-headed Cowbird	Worsening	Improving
Orchard Oriole	Stable	-
Hooded Oriole	Potential colonization	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Altamira Oriole	-	Potential colonization
Audubon's Oriole	-	Potential colonization
Baltimore Oriole	Potential extirpation	-
House Finch	-	Potential extirpation
Purple Finch	-	Potential extirpation
American Goldfinch	-	Worsening
House Sparrow	x	Worsening