Birds and Climate Change

National Park Service
U.S. Department of the Interior

Tallgrass Prairie National Preserve

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 Tallgrass Prairie National Preserve (hereafter, the Preserve) 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Preserve 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 Preserve, 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 Preserve today, climate suitability in summer under the high-emissions pathway is projected to improve for 21, remain stable for 31, and worsen for 11 species. Suitable climate ceases to occur for 21 species in summer, potentially resulting in extirpation of those species from the Preserve (e.g., Figure 2). Climate is projected to become suitable in summer for 27 species not found at the Preserve today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 21, remain stable for 18, and worsen for 13 species. Suitable climate ceases to occur for 4 species in winter, potentially resulting in extirpation from the Preserve. Climate is projected to become suitable in winter for 53 species not found at the Preserve today, potentially resulting in local colonization.

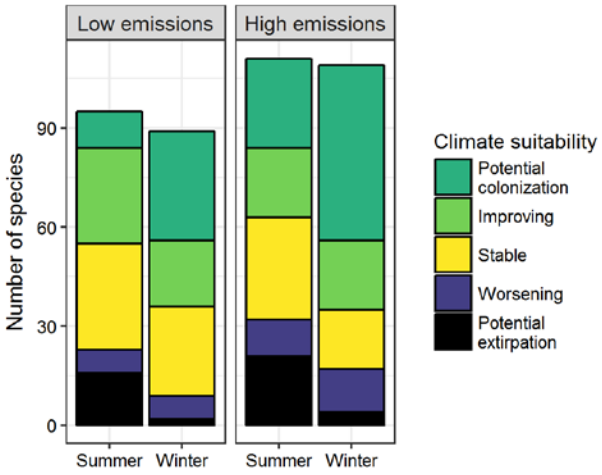

Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.29 in summer (50th percentile across all national parks) and 0.26 in winter (39th percentile) under the high-emissions pathway. Potential species turnover declines to 0.18 in summer and 0.18 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 Preserve 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). While the Preserve may serve as an important refuge for 6 of these climate-sensitive species, one, the Mallard (*Anas platyrhynchos*), might be extirpated from the Preserve in summer by 2050.

Figure 2. Although currently found at the Preserve, suitable climate for the American Goldfinch (*Spinus tristis*) may cease to occur here in summer 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, Tallgrass Prairie National Preserve 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 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.

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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Preserve 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
Gadwall	-	Improving
American Wigeon	-	Improving
Mallard	Potential extirpation^	Improving
Blue-winged Teal	Stable	Potential colonization
Canvasback	-	Improving
Bufflehead	-	Improving*
Common Goldeneye	-	Stable
Red-breasted Merganser	-	Potential colonization^
Ruddy Duck	-	Potential colonization
Scaled Quail	Potential colonization	-
Gambel's Quail	-	Potential colonization
Northern Bobwhite	Stable	Stable
Ring-necked Pheasant	Worsening*	-
Wild Turkey	x	Worsening*
Common Loon	-	Potential colonization^
Least Grebe	-	Potential colonization
Horned Grebe	-	Potential colonization
Eared Grebe	-	Potential colonization
Neotropic Cormorant	-	Potential colonization
Great Blue Heron	Stable	Improving
Great Egret	Potential colonization	Potential colonization
Little Blue Heron	Potential colonization	-
Cattle Egret	Improving*	-
Green Heron	Stable	-
Black Vulture	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Osprey	-	Potential colonization
Mississippi Kite	Improving*	-
Northern Harrier	Stable^	Stable
Bald Eagle	-	Potential extirpation
Harris's Hawk	Potential colonization	Potential colonization
Red-shouldered Hawk	-	Potential colonization
Swainson's Hawk	Improving^	-
Red-tailed Hawk	Worsening	Improving
Ferruginous Hawk	-	Potential colonization
Rough-legged Hawk	-	Stable
Sora	-	Potential colonization
Killdeer	Worsening	Improving
Greater Yellowlegs	-	Potential colonization
Upland Sandpiper	Worsening	-
Least Sandpiper	-	Potential colonization
American Woodcock	-	Potential colonization
Bonaparte's Gull	-	Potential colonization
Forster's Tern	-	Potential colonization
Rock Pigeon	Potential extirpation	Worsening
Eurasian Collared-Dove	x	Potential colonization
White-winged Dove	-	Potential colonization
Mourning Dove	Stable	Stable
Inca Dove	-	Potential colonization
Yellow-billed Cuckoo	Improving	-
Black-billed Cuckoo	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Greater Roadrunner	Potential colonization	Potential colonization
Barn Owl	-	Potential colonization
Great Horned Owl	x	Worsening*
Barred Owl	x	Stable
Common Nighthawk	Improving	-
Common Pauraque	-	Potential colonization
Chimney Swift	Improving	-
Ruby-throated Hummingbird	Improving	-
Belted Kingfisher	Potential extirpation	Stable
Red-headed Woodpecker	Stable	Worsening
Golden-fronted Woodpecker	Potential colonization	-
Red-bellied Woodpecker	Stable	Improving
Ladder-backed Woodpecker	Potential colonization	-
Downy Woodpecker	Worsening	Worsening
Hairy Woodpecker	Potential extirpation	Potential extirpation
Red-cockaded Woodpecker	-	Potential colonization
Northern Flicker	Stable	Worsening
Gilded Flicker	Potential colonization	-
Pileated Woodpecker	Stable	-
American Kestrel	x	Stable
Merlin	-	Stable^
Northern Beardless-Tyrannulet	Potential colonization	-
Eastern Wood-Pewee	Stable	-
Acadian Flycatcher	Improving	-
Eastern Phoebe	Improving	Potential colonization
Great Crested Flycatcher	Stable	-
Brown-crested Flycatcher	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Great Kiskadee	Potential colonization	-
Western Kingbird	Stable	-
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Improving*	-
Loggerhead Shrike	Improving*	-
White-eyed Vireo	Potential colonization	Potential colonization
Bell's Vireo	Improving*	-
Warbling Vireo	Potential extirpation	-
Red-eyed Vireo	Stable	-
Blue Jay	Stable	Stable
American Crow	Stable	Stable
Chihuahuan Raven	Potential colonization	Potential colonization
Horned Lark	Potential extirpation	Worsening*
Northern Rough-winged Swallow	Stable	Potential colonization
Purple Martin	Stable	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Stable	-
Cliff Swallow	Improving*	-
Cave Swallow	Potential colonization	-
Carolina Chickadee	-	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Tufted Titmouse	Improving	Improving
White-breasted Nuthatch	Potential extirpation	Stable
Brown-headed Nuthatch	Potential colonization^	-
Brown Creeper	-	Worsening*
Rock Wren	-	Potential colonization

Common Name	Summer Trend	Winter Trend
House Wren	Potential extirpation	-
Sedge Wren	-	Potential colonization
Marsh Wren	-	Potential colonization
Carolina Wren	Stable	Improving
Bewick's Wren	Improving*	Potential colonization
Blue-gray Gnatcatcher	Improving	-
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Eastern Bluebird	Improving	Improving
Mountain Bluebird	-	Potential colonization
American Robin	Potential extirpation	Worsening
Gray Catbird	Potential extirpation	-
Curve-billed Thrasher	Potential colonization	-
Brown Thrasher	Worsening	-
Bendire's Thrasher	-	Potential colonization
LeConte's Thrasher	-	Potential colonization
Northern Mockingbird	Stable	Improving
European Starling	Potential extirpation	-
American Pipit	-	Potential colonization
Chestnut-collared Longspur	-	Potential colonization
Smith's Longspur	-	Improving*
Prothonotary Warbler	Potential colonization	-
Swainson's Warbler	Potential colonization	-
Common Yellowthroat	Potential extirpation	-
Northern Parula	Stable	-

Common Name	Summer Trend	Winter Trend
Yellow Warbler	Potential extirpation	-
Yellow-throated Warbler	Potential colonization	-
Yellow-breasted Chat	Stable	-
Eastern Towhee	Potential extirpation	-
Rufous-crowned Sparrow	-	Potential colonization
Abert's Towhee	Potential colonization	Potential colonization
Cassin's Sparrow	Potential colonization	Potential colonization
Bachman's Sparrow	Potential colonization	Potential colonization
American Tree Sparrow	-	Stable
Chipping Sparrow	Potential extirpation	Potential colonization
Field Sparrow	Stable	Improving
Vesper Sparrow	-	Potential colonization
Lark Sparrow	Stable	Potential colonization
Lark Bunting	-	Potential colonization
Grasshopper Sparrow	Worsening	-
Henslow's Sparrow	x	Potential colonization
Fox Sparrow	-	Improving
Song Sparrow	-	Stable
Harris's Sparrow	-	Stable
White-crowned Sparrow	-	Stable
Dark-eyed Junco	-	Worsening
Summer Tanager	Stable	-

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