



Mississippi National River and 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 Mississippi National River and Recreation Area (hereafter, the River) 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 River, 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 River today, climate suitability in summer under the high-emissions pathway is projected to improve for 48, remain stable for 14 (e.g., Figure 2), and worsen for 14 species. Suitable climate ceases to occur for 51 species in summer, potentially resulting in extirpation of those species from the River. Climate is projected to become suitable in summer for 10 species not found at the River today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 58, remain stable for 11, and worsen for 6 species. Suitable climate ceases to occur for 13 species in winter, potentially resulting in extirpation from the River. Climate is projected to become suitable in winter for 20 species not found at the River 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 River based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the River 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.

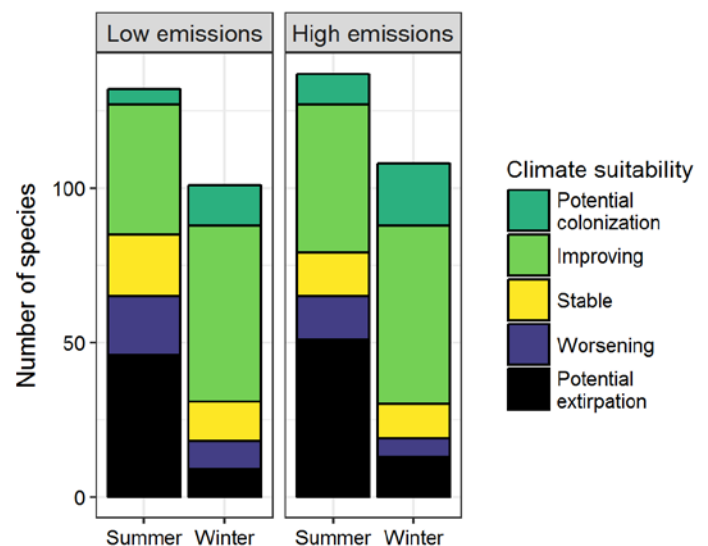


Figure 1. Projected changes in climate suitability for birds at the River, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the River between the present and 2050 is 0.33 in summer (58th percentile across all national parks) and 0.41 in winter (69th percentile) under the high-emissions pathway. Potential species turnover declines to 0.23 in summer and 0.31 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 River is or may become home to 16 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

Management Implications

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

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

River may serve as an important refuge for 8 of these climate-sensitive species, 8 might be extirpated from the River in at least one season by 2050.



Figure 2. Climate at the River 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).

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.

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 River based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the River 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	Improving
Wood Duck	x	Improving
Gadwall	Potential extirpation [^]	Improving
American Wigeon	-	Potential colonization
American Black Duck	-	Potential extirpation
Mallard	Potential extirpation [^]	Improving
Blue-winged Teal	Worsening	-
Northern Shoveler	Potential extirpation [^]	-
Green-winged Teal	-	Improving
Canvasback	x	Improving
Redhead	Potential extirpation [^]	x
Ring-necked Duck	x	Improving
Greater Scaup	-	Improving [^]
Lesser Scaup	-	Improving

Common Name	Summer Trend	Winter Trend
Harlequin Duck	-	Potential extirpation
White-winged Scoter	-	Potential extirpation
Long-tailed Duck	-	Improving
Bufflehead	-	Improving
Common Goldeneye	x	Improving
Barrow's Goldeneye	-	Potential extirpation [^]
Hooded Merganser	x	Improving [^]
Common Merganser	-	Improving
Red-breasted Merganser	-	Improving [^]
Ruddy Duck	Potential extirpation	Improving
Northern Bobwhite	Potential colonization	Potential colonization
Ring-necked Pheasant	Worsening	Worsening*
Wild Turkey	x	Improving
Common Loon	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Double-crested Cormorant	x	Improving
American White Pelican	x	Improving
American Bittern	Potential extirpation	-
Great Blue Heron	Improving	Improving
Great Egret	Worsening*	-
Little Blue Heron	Improving	-
Cattle Egret	Improving	-
Green Heron	Improving	-
Yellow-crowned Night-Heron	Potential colonization	-
Mississippi Kite	Potential colonization	-
Northern Harrier	Worsening^	Improving
Sharp-shinned Hawk	-	Improving
Cooper's Hawk	x	Improving
Bald Eagle	x	Stable
Red-shouldered Hawk	Improving	Stable
Swainson's Hawk	Stable^	-
Red-tailed Hawk	Improving	Improving
Rough-legged Hawk	-	Improving
American Coot	x	Stable
Killdeer	Improving	-
Greater Yellowlegs	Stable	-
Lesser Yellowlegs	Potential extirpation^	-
Wilson's Snipe	Potential extirpation	Potential colonization
Bonaparte's Gull	-	Potential colonization
Franklin's Gull	Potential extirpation	-
Ring-billed Gull	Potential extirpation^	Improving
Herring Gull	Potential extirpation	Improving^
Iceland Gull (Thayer's)	-	Improving

Common Name	Summer Trend	Winter Trend
Black Tern	Potential extirpation	-
Rock Pigeon	Worsening*	Worsening*
Eurasian Collared-Dove	x	Improving
Mourning Dove	Improving	Improving
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Improving	-
Eastern Screech-Owl	x	Improving
Great Horned Owl	x	Improving
Snowy Owl	-	Potential extirpation
Burrowing Owl	Potential colonization^	-
Barred Owl	x	Improving
Common Nighthawk	Improving*	-
Chimney Swift	Improving	-
Ruby-throated Hummingbird	Improving	-
Belted Kingfisher	Potential extirpation	Improving
Red-headed Woodpecker	Improving	Improving
Red-bellied Woodpecker	Improving*	Improving
Yellow-bellied Sapsucker	Potential extirpation	Improving*
Downy Woodpecker	Improving	Worsening
Hairy Woodpecker	Potential extirpation	Worsening
Northern Flicker	Potential extirpation	Improving
Pileated Woodpecker	Potential extirpation	Stable
American Kestrel	x	Improving
Merlin	x	Improving^
Peregrine Falcon	x	Stable
Prairie Falcon	-	Improving
Olive-sided Flycatcher	Potential extirpation	-
Eastern Wood-Pewee	Improving	-

Common Name	Summer Trend	Winter Trend
Yellow-bellied Flycatcher	Potential extirpation	-
Acadian Flycatcher	Improving	-
Alder Flycatcher	Potential extirpation	-
Willow Flycatcher	Potential extirpation	-
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Improving	-
Great Crested Flycatcher	Improving	-
Western Kingbird	Improving	-
Eastern Kingbird	Improving	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Improving	Potential colonization
Northern Shrike	-	Potential extirpation
Bell's Vireo	Improving*	-
Yellow-throated Vireo	Worsening	-
Warbling Vireo	Stable	-
Philadelphia Vireo	Potential extirpation	-
Red-eyed Vireo	Stable	-
Blue Jay	Stable	Stable
American Crow	Stable	Improving
Horned Lark	Potential extirpation	Improving
Northern Rough-winged Swallow	Improving*	-
Purple Martin	Improving	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Improving	-
Cliff Swallow	Worsening	-
Black-capped Chickadee	Improving	Stable
Tufted Titmouse	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Stable	Worsening
Brown Creeper	Potential extirpation^	Stable
House Wren	Worsening	-
Pacific/Winter Wren	-	Potential colonization
Sedge Wren	Worsening*	-
Carolina Wren	Improving*	Improving*
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Improving
Eastern Bluebird	Improving	Improving*
Townsend's Solitaire	-	Potential extirpation
Veery	Potential extirpation	-
Swainson's Thrush	Potential extirpation	-
Wood Thrush	Potential extirpation	-
American Robin	Worsening	Improving
Varied Thrush	-	Potential extirpation
Gray Catbird	Stable	-
Brown Thrasher	Improving	-
Northern Mockingbird	Improving*	Potential colonization
European Starling	Stable	Worsening
Cedar Waxwing	Potential extirpation	Improving
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Potential extirpation
Ovenbird	Potential extirpation	-
Blue-winged Warbler	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Black-and-white Warbler	Potential extirpation	-
Prothonotary Warbler	Improving	-
Tennessee Warbler	Potential extirpation	-
Nashville Warbler	Potential extirpation	-
Mourning Warbler	Potential extirpation	-
Kentucky Warbler	Potential colonization	-
Common Yellowthroat	Worsening	-
American Redstart	Potential extirpation	-
Northern Parula	Improving	-
Yellow Warbler	Potential extirpation	-
Chestnut-sided Warbler	Potential extirpation	-
Yellow-rumped Warbler	-	Potential colonization
Yellow-throated Warbler	Improving	-
Yellow-breasted Chat	Potential colonization	-
Eastern Towhee	Improving	-
American Tree Sparrow	-	Improving
Chipping Sparrow	Worsening	-
Clay-colored Sparrow	Potential extirpation	-
Field Sparrow	Improving*	Potential colonization
Vesper Sparrow	Potential extirpation	-
Lark Sparrow	Improving*	-
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Improving*	-
LeConte's Sparrow	-	Potential colonization
Fox Sparrow	-	Improving*

Common Name	Summer Trend	Winter Trend
Song Sparrow	Potential extirpation	Improving*
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	Potential extirpation	Potential colonization
White-throated Sparrow	Potential extirpation	Improving
White-crowned Sparrow	-	Potential colonization
Dark-eyed Junco	-	Improving
Summer Tanager	Potential colonization	-
Scarlet Tanager	Potential extirpation	-
Northern Cardinal	Improving	Improving
Rose-breasted Grosbeak	Stable	-
Blue Grosbeak	Improving	-
Indigo Bunting	Improving	-
Dickcissel	Improving*	-
Bobolink	Worsening*	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Improving*	Potential colonization
Western Meadowlark	Stable	Potential colonization
Yellow-headed Blackbird	Potential extirpation	-
Rusty Blackbird	-	Potential colonization
Brewer's Blackbird	Potential extirpation	Potential colonization
Common Grackle	Improving	Improving
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	Improving*
Orchard Oriole	Improving	-
Baltimore Oriole	Improving	-
House Finch	Stable	Stable
Purple Finch	-	Stable

Common Name	Summer Trend	Winter Trend
White-winged Crossbill	-	Potential extirpation
Common Redpoll	-	Potential extirpation

Common Name	Summer Trend	Winter Trend
Pine Siskin	Potential extirpation	Potential extirpation
American Goldfinch	Worsening	Improving
House Sparrow	x	Stable