Birds and Climate Change

National Park Service
U.S. Department of the Interior

Saint Croix National Scenic Riverway

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 Saint Croix National Scenic Riverway (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.

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.

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 41 (e.g., Figure 2), remain stable for 15, and worsen for 14 species. Suitable climate ceases to occur for 63 species in summer, potentially resulting in extirpation of those species from the River. Climate is projected to become suitable in summer for 8 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 36, remain stable for 4, and worsen for 3 species. Suitable climate ceases to occur for 11 species in winter, potentially resulting in extirpation from the River. Climate is projected to become suitable in winter for 26 species not found at the River today, potentially resulting in local colonization.

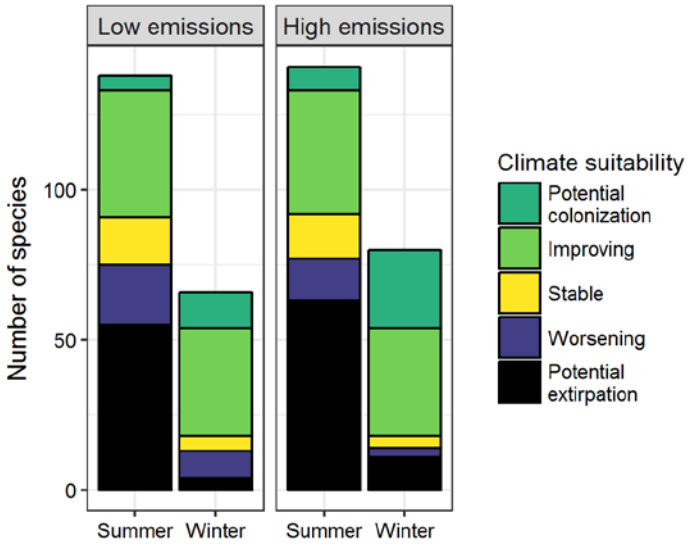

Figure 1. Projected changes in climate suitability for birds at the River, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the River between the present and 2050 is 0.42 in summer (75th percentile across all national parks) and 0.52 in winter (89th percentile) under the high-emissions pathway. Potential species turnover declines to 0.35 in summer and 0.34 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 9 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 River may serve as an important refuge for 3 of these climate-sensitive species, 6 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).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Saint Croix National Scenic Riverway falls within the high potential extirpation group.** Parks anticipating high potential extirpation 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 3 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 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	Potential colonization
Mallard	Potential extirpation^	Improving
Blue-winged Teal	Worsening	-
Common Goldeneye	x	Improving
Common Merganser	x	Improving
Red-breasted Merganser	Potential extirpation	-
Northern Bobwhite	Potential colonization	Potential colonization
Ring-necked Pheasant	Improving	-
Ruffed Grouse	x	Potential extirpation
Sharp-tailed Grouse	Potential extirpation^	-
Wild Turkey	x	Improving
Common Loon	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
American White Pelican	-	Potential colonization
American Bittern	Potential extirpation	-
Great Blue Heron	Improving	Improving*
Great Egret	Improving	-
Green Heron	Improving	-
Golden Eagle	-	Potential extirpation
Northern Harrier	Worsening^	Potential colonization
Sharp-shinned Hawk	x	Improving
Cooper's Hawk	x	Improving
Bald Eagle	x	Improving
Red-shouldered Hawk	Improving	Improving
Red-tailed Hawk	Improving	Improving
Rough-legged Hawk	-	Improving
Killdeer	Improving	-
Lesser Yellowlegs	Potential extirpation^	-

Common Name	Summer Trend	Winter Trend
Upland Sandpiper	Improving	-
Wilson's Snipe	Potential extirpation	Improving
Ring-billed Gull	Potential extirpation^	Potential colonization
Herring Gull	Potential extirpation	Improving^
Iceland Gull (Thayer's)	-	Potential colonization
Black Tern	Potential extirpation	-
Rock Pigeon	Stable	Improving
Mourning Dove	Improving	Improving
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Worsening	-
Eastern Screech-Owl	-	Potential colonization
Great Horned Owl	x	Improving
Burrowing Owl	Potential colonization^	-
Barred Owl	x	Improving
Common Nighthawk	Improving	-
Chimney Swift	Improving*	-
Ruby-throated Hummingbird	Stable	-
Belted Kingfisher	Potential extirpation	Improving
Red-headed Woodpecker	Improving*	Potential colonization
Red-bellied Woodpecker	Improving*	Improving
Yellow-bellied Sapsucker	Potential extirpation	Potential colonization
Downy Woodpecker	Improving	Stable
Hairy Woodpecker	Potential extirpation	Stable
Northern Flicker	Stable	Improving
Pileated Woodpecker	Potential extirpation	Potential extirpation
American Kestrel	x	Improving

Common Name	Summer Trend	Winter Trend
Prairie Falcon	-	Potential colonization
Olive-sided Flycatcher	Potential extirpation	-
Eastern Wood-Pewee	Stable	-
Yellow-bellied Flycatcher	Potential extirpation	-
Acadian Flycatcher	Improving	-
Alder Flycatcher	Potential extirpation	-
Willow Flycatcher	Stable	-
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Stable	-
Great Crested Flycatcher	Worsening	-
Eastern Kingbird	Improving	-
Loggerhead Shrike	Potential colonization	Potential colonization
Northern Shrike	-	Worsening
Bell's Vireo	Potential colonization	-
Yellow-throated Vireo	Stable	-
Warbling Vireo	Improving	-
Philadelphia Vireo	Potential extirpation	-
Red-eyed Vireo	Potential extirpation	-
Blue Jay	Stable	Stable
American Crow	Worsening	Improving
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	Potential extirpation	Potential colonization
Northern Rough-winged Swallow	Improving*	-
Purple Martin	Improving	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Improving	-
Cliff Swallow	Worsening	-

Common Name	Summer Trend	Winter Trend
Black-capped Chickadee	Worsening	Worsening
Tufted Titmouse	Potential colonization	Potential colonization
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Stable	Stable
Brown Creeper	Potential extirpation^	Improving
House Wren	Improving	-
Pacific/Winter Wren	Potential extirpation	Potential colonization
Sedge Wren	Worsening*	-
Carolina Wren	Improving	Potential colonization
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	Potential extirpation	Improving
Ruby-crowned Kinglet	Potential extirpation	-
Eastern Bluebird	Improving	Improving*
Veery	Potential extirpation	-
Swainson's Thrush	Potential extirpation	-
Hermit Thrush	Potential extirpation	-
Wood Thrush	Stable	-
American Robin	Worsening	Improving
Gray Catbird	Stable	-
Brown Thrasher	Improving*	-
European Starling	Improving	Improving
Bohemian Waxwing	-	Potential extirpation
Cedar Waxwing	Potential extirpation	Improving
Snow Bunting	-	Potential extirpation
Ovenbird	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Northern Waterthrush	Potential extirpation	-
Blue-winged Warbler	Stable	-
Golden-winged Warbler	Potential extirpation	-
Black-and-white Warbler	Potential extirpation	-
Prothonotary Warbler	Improving	-
Tennessee Warbler	Potential extirpation	-
Nashville Warbler	Potential extirpation	-
Mourning Warbler	Potential extirpation	-
Common Yellowthroat	Worsening	-
American Redstart	Potential extirpation	-
Cape May Warbler	Potential extirpation	-
Northern Parula	Stable	-
Magnolia Warbler	Potential extirpation	-
Blackburnian Warbler	Potential extirpation	-
Yellow Warbler	Potential extirpation	-
Chestnut-sided Warbler	Potential extirpation	-
Blackpoll Warbler	Potential extirpation	-
Palm Warbler	Potential extirpation	-
Pine Warbler	Potential extirpation^	-
Yellow-rumped Warbler	Potential extirpation	-
Black-throated Green Warbler	Potential extirpation	-
Canada Warbler	Potential extirpation	-
Wilson's Warbler	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Eastern Towhee	Improving*	-
American Tree Sparrow	-	Improving
Chipping Sparrow	Worsening	-
Clay-colored Sparrow	Potential extirpation	-
Field Sparrow	Improving*	-
Vesper Sparrow	Stable	-
Lark Sparrow	Improving	-
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Improving*	-
Song Sparrow	Worsening	Potential colonization
Lincoln's Sparrow	Potential extirpation	-
Swamp Sparrow	Potential extirpation	Potential colonization
White-throated Sparrow	Potential extirpation	Potential colonization
Dark-eyed Junco	x	Improving
Scarlet Tanager	Potential extirpation	-
Northern Cardinal	Improving*	Improving
Rose-breasted Grosbeak	Stable	-
Blue Grosbeak	Potential colonization	-
Indigo Bunting	Improving	-
Dickcissel	Improving*	-
Bobolink	Worsening	-
Red-winged Blackbird	Improving	Potential colonization

Common Name	Summer Trend	Winter Trend
Eastern Meadowlark	Improving*	Potential colonization
Western Meadowlark	-	Potential colonization
Yellow-headed Blackbird	Potential extirpation	-
Rusty Blackbird	-	Potential colonization
Brewer's Blackbird	Potential extirpation	Potential colonization
Common Grackle	Improving	-
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Improving	Potential colonization
Orchard Oriole	Potential colonization	-
Baltimore Oriole	Improving	-
Pine Grosbeak	-	Potential extirpation
House Finch	Improving	Improving
Purple Finch	Potential extirpation	Improving
White-winged Crossbill	-	Potential extirpation
Common Redpoll	-	Potential extirpation
Pine Siskin	Potential extirpation	Worsening
American Goldfinch	Worsening	Improving
Evening Grosbeak	Potential extirpation	Potential extirpation
House Sparrow	x	Improving
Eurasian Tree Sparrow	-	Potential colonization