Birds and Climate Change

National Park Service
U.S. Department of the Interior

Rio Grande Wild and Scenic River

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 Rio Grande Wild and Scenic River (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 39, remain stable for 23 (e.g., Figure 2), and worsen for 17 species. Suitable climate ceases to occur for 9 species in summer, potentially resulting in extirpation of those species from the River. Climate is projected to become suitable in summer for 13 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 38, remain stable for 42, and worsen for 36 species. Suitable climate ceases to occur for 17 species in winter, potentially resulting in extirpation from the River. Climate is projected to become suitable in winter for 40 species not found at the River today, potentially resulting in local colonization.

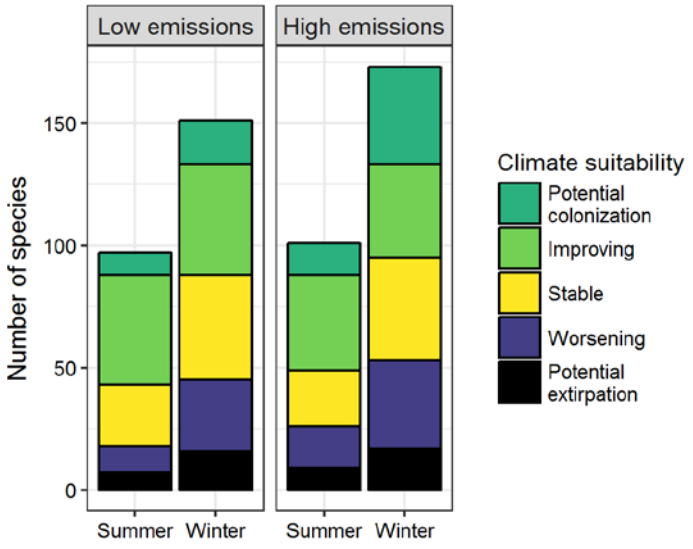

Figure 1. Projected changes in climate suitability for birds at the River, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the River between the present and 2050 is 0.14 in summer (20th percentile across all national parks) and 0.13 in winter (14th percentile) under the high-emissions pathway. Potential species turnover declines to 0.09 in summer and 0.08 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 15 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 15 species at the River; instead the River may serve as an important refuge for these climate-sensitive species.

Figure 2. Climate at the River in summer is projected to remain suitable for the Northern Cardinal (*Cardinalis cardinalis*) through 2050. Photo by Andy Morffew/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, Rio Grande Wild and Scenic River falls within the low change group.** Parks anticipating low change can best support landscape-scale bird conservation by emphasizing habitat restoration, maintaining natural disturbance regimes, and reducing other stressors.

Furthermore, park managers have an opportunity to focus on supporting the 15 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 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
Muscovy Duck	-	Potential colonization
Wood Duck	-	Potential extirpation
Gadwall	-	Stable
American Wigeon	-	Stable
Mallard	Improving^	Potential extirpation
Blue-winged Teal	Potential extirpation	-
Cinnamon Teal	-	Improving*
Northern Shoveler	-	Improving
Green-winged Teal	-	Improving
Ring-necked Duck	-	Stable
Lesser Scaup	-	Stable
Common Goldeneye	-	Potential colonization
Hooded Merganser	-	Stable^
Common Merganser	-	Potential colonization
Red-breasted Merganser	-	Potential colonization^
Ruddy Duck	Potential colonization	Improving
Scaled Quail	Worsening*	Worsening*
Montezuma Quail	-	Potential colonization
Pacific Loon	-	Potential colonization
Least Grebe	-	Worsening
Pied-billed Grebe	x	Worsening
Clark's Grebe	-	Potential colonization
Magnificent Frigatebird	-	Potential colonization
Double-crested Cormorant	-	Stable
Brown Pelican	-	Potential colonization^
American Bittern	-	Potential colonization^
Least Bittern	-	Improving

Common Name	Summer Trend	Winter Trend
Great Blue Heron	Improving	Worsening
Great Egret	Potential colonization	Improving*
Cattle Egret	Improving	-
Green Heron	Improving	Improving
Black-crowned Night-Heron	x	Improving*
Black Vulture	Worsening	Worsening*
Turkey Vulture	x	Stable
White-tailed Kite	-	Potential colonization
Swallow-tailed Kite	Potential colonization	-
Golden Eagle	-	Stable
Mississippi Kite	Potential extirpation	-
Northern Harrier	-	Improving
Sharp-shinned Hawk	-	Worsening
Cooper's Hawk	x	Stable
Harris's Hawk	Improving	Stable
Gray Hawk	Stable	-
Swainson's Hawk	Stable^	-
Red-tailed Hawk	Improving	Worsening
Ferruginous Hawk	-	Stable
Clapper Rail	-	Potential colonization
Virginia Rail	-	Improving*
Sora	-	Improving*
American Coot	x	Worsening
Limpkin	-	Potential colonization
Black-necked Stilt	-	Potential colonization
Black-bellied Plover	-	Potential colonization
Snowy Plover	-	Potential colonization
Wilson's Plover	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Semipalmated Plover	-	Potential colonization^
Killdeer	Improving*	Worsening
Spotted Sandpiper	-	Stable
Willet	-	Potential colonization^
Whimbrel	-	Potential colonization
Marbled Godwit	-	Potential colonization
Dunlin	-	Potential colonization^
Least Sandpiper	-	Improving*
Short-billed Dowitcher	-	Potential colonization^
Wilson's Snipe	-	Stable
Laughing Gull	-	Potential colonization
Heermann's Gull	-	Potential colonization
Ring-billed Gull	-	Stable
Yellow-footed Gull	-	Potential colonization
Forster's Tern	-	Potential colonization
Royal Tern	-	Potential colonization^
Black Skimmer	-	Potential colonization^
White-crowned Pigeon	Potential colonization	-
Band-tailed Pigeon	Improving	-
Eurasian Collared-Dove	x	Stable
White-winged Dove	Improving*	Worsening
Mourning Dove	Worsening	Stable
Inca Dove	Stable	Stable
Common Ground-Dove	Improving	Improving
Yellow-billed Cuckoo	Potential extirpation	-
Greater Roadrunner	Stable	Improving

Common Name	Summer Trend	Winter Trend
Western Screech-Owl	x	Improving
Great Horned Owl	x	Potential extirpation
Northern Pygmy-Owl	-	Potential colonization
Lesser Nighthawk	Improving*	-
Common Nighthawk	Worsening*	-
White-throated Swift	x	Improving*
Black-chinned Hummingbird	Improving	-
Anna's Hummingbird	Potential colonization	Improving*
Costa's Hummingbird	Potential colonization	-
Belted Kingfisher	-	Stable
Green Kingfisher	x	Worsening*
Acorn Woodpecker	Stable	Stable
Golden-fronted Woodpecker	Worsening	Worsening*
Yellow-bellied Sapsucker	-	Potential extirpation
Red-naped Sapsucker	-	Stable
Ladder-backed Woodpecker	Stable	Worsening
Northern Flicker	Improving	Worsening
American Kestrel	x	Stable
Peregrine Falcon	x	Improving
Western Wood-Pewee	Improving^	-
Hammond's Flycatcher	-	Potential colonization
Gray Flycatcher	-	Stable
Dusky Flycatcher	-	Improving
Cordilleran Flycatcher	Potential colonization	-
Black Phoebe	Improving	Improving
Eastern Phoebe	-	Worsening*
Say's Phoebe	Worsening	Improving
Vermilion Flycatcher	Stable	Improving
Ash-throated Flycatcher	Stable	x

Common Name	Summer Trend	Winter Trend
Great Crested Flycatcher	-	Potential colonization
Brown-crested Flycatcher	Improving*	-
Great Kiskadee	Potential colonization	-
Couch's Kingbird	Stable	-
Cassin's Kingbird	Stable	-
Western Kingbird	Improving	-
Scissor-tailed Flycatcher	Worsening*	-
Loggerhead Shrike	Improving	Worsening
White-eyed Vireo	-	Stable
Bell's Vireo	Stable	-
Warbling Vireo	Improving	-
Black-whiskered Vireo	Potential colonization	-
Green Jay	-	Potential colonization
Chihuahuan Raven	Stable	Stable
Common Raven	Stable	Potential extirpation
Northern Rough-winged Swallow	Improving*	Improving*
Tree Swallow	-	Potential colonization
Violet-green Swallow	Improving	Potential colonization
Barn Swallow	Potential extirpation	-
Cliff Swallow	Improving	-
Cave Swallow	Worsening	-
Juniper Titmouse	Potential colonization	-
Black-crested Titmouse	Potential extirpation	Potential extirpation
Verdin	Improving	Improving
Bushtit	-	Worsening
Brown Creeper	-	Potential extirpation
Rock Wren	Stable	Improving

Common Name	Summer Trend	Winter Trend
Canyon Wren	x	Worsening*
House Wren	-	Improving
Marsh Wren	-	Stable
Carolina Wren	Potential extirpation	-
Bewick's Wren	Worsening*	Worsening*
Cactus Wren	Stable	Improving
Blue-gray Gnatcatcher	Stable	Stable
Black-tailed Gnatcatcher	Improving*	Improving*
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	-	Potential extirpation
Western Bluebird	-	Stable
Mountain Bluebird	-	Stable
Hermit Thrush	-	Stable
American Robin	-	Potential extirpation
Gray Catbird	-	Improving
Curve-billed Thrasher	Improving	Improving
Brown Thrasher	-	Potential extirpation
LeConte's Thrasher	Potential colonization	Potential colonization
Crissal Thrasher	Improving*	Stable
Sage Thrasher	-	Improving
Northern Mockingbird	Worsening	Worsening
European Starling	Improving	Improving
American Pipit	-	Stable
Cedar Waxwing	-	Potential extirpation
Phainopepla	Improving	Improving*
Orange-crowned Warbler	-	Stable
Lucy's Warbler	Improving*	-
Common Yellowthroat	Improving	Stable
Northern Parula	-	Improving
Yellow-rumped Warbler	-	Worsening

Common Name	Summer Trend	Winter Trend
Black-throated Gray Warbler	-	Improving
Townsend's Warbler	-	Potential colonization
Hermit Warbler	-	Potential colonization^
Red-faced Warbler	Potential colonization	-
Yellow-breasted Chat	Stable	-
Green-tailed Towhee	-	Stable
Spotted Towhee	Improving	x
Rufous-crowned Sparrow	x	Worsening*
Canyon Towhee	Stable	Worsening*
Cassin's Sparrow	Worsening*	Worsening
Chipping Sparrow	-	Stable
Brewer's Sparrow	-	Improving*
Black-chinned Sparrow	x	Stable
Vesper Sparrow	-	Worsening
Black-throated Sparrow	Worsening*	Improving
Sagebrush/Bell's Sparrow (Sage Sparrow)	-	Improving
Lark Bunting	-	Worsening
Savannah Sparrow	-	Stable
Fox Sparrow	-	Potential extirpation
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Worsening
Swamp Sparrow	-	Worsening
White-throated Sparrow	-	Potential extirpation
White-crowned Sparrow	-	Stable
Dark-eyed Junco	-	Stable
Hepatic Tanager	Improving	-
Summer Tanager	Potential extirpation	-
Western Tanager	Improving	-
Northern Cardinal	Stable	Worsening

Common Name	Summer Trend	Winter Trend
Pyrrhuloxia	Worsening*	Worsening*
Black-headed Grosbeak	Stable	-
Blue Grosbeak	Worsening	-
Painted Bunting	Worsening*	-
Dickcissel	Potential extirpation	-
Red-winged Blackbird	Improving*	Worsening
Tricolored Blackbird	Potential colonization	-
Eastern Meadowlark	-	Worsening
Western Meadowlark	Improving	Stable
Yellow-headed Blackbird	Improving	-
Brewer's Blackbird	-	Worsening*
Great-tailed Grackle	Improving*	Stable
Bronzed Cowbird	Stable	-
Brown-headed Cowbird	Improving	-

Common Name	Summer Trend	Winter Trend
Orchard Oriole	Potential extirpation	-
Hooded Oriole	Stable	-
Bullock's Oriole	Improving	-
Altamira Oriole	-	Potential colonization
Scott's Oriole	Worsening*	-
Black Rosy-Finch	-	Potential colonization^
House Finch	Worsening	Worsening
Pine Siskin	-	Potential extirpation
Lesser Goldfinch	Stable	Worsening*
American Goldfinch	-	Potential extirpation
House Sparrow	x	Potential extirpation