Birds and Climate Change

National Park Service
U.S. Department of the Interior

Curecanti 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 Curecanti 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.

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.

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 24, remain stable for 41, and worsen for 21 species. Suitable climate ceases to occur for 8 species in summer, potentially resulting in extirpation of those species from the Recreation Area (e.g., Figure 2). Climate is projected to become suitable in summer for 10 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 9, remain stable for 8, and worsen for 1 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 42 species not found at the Recreation Area today, potentially resulting in local colonization.

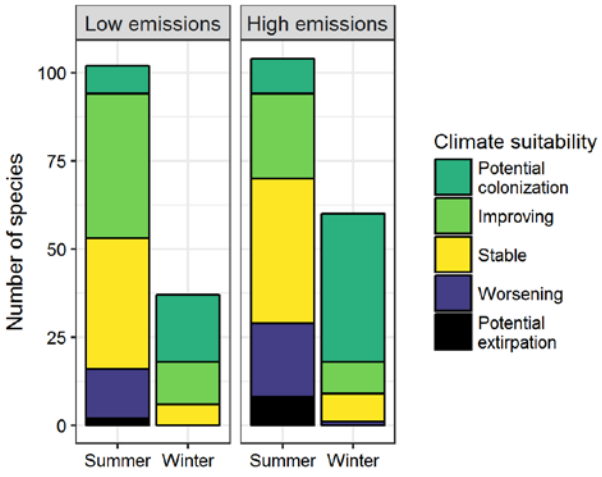

Figure 1. Projected changes in climate suitability for birds at the Recreation Area, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Recreation Area between the present and 2050 is 0.19 in summer (29th percentile across all national parks) and 0.30 in winter (46th percentile) under the high-emissions pathway. Potential species turnover declines to 0.10 in summer and 0.17 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 14 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 14 species at the Recreation Area; instead the Recreation Area may serve as an important refuge for these climate-sensitive species.

Figure 2. Although currently found at the Recreation Area, suitable climate for the Red-winged Blackbird (*Agelaius phoeniceus*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation. 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, Curecanti National Recreation Area 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 14 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 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
Wood Duck	-	Potential colonization
Gadwall	Improving^	Potential colonization
American Wigeon	-	Potential colonization
Mallard	Stable^	Stable
Cinnamon Teal	x	Potential colonization
Northern Shoveler	Worsening^	-
Ring-necked Duck	x	Potential colonization
Lesser Scaup	-	Potential colonization
Bufflehead	-	Potential colonization
Common Goldeneye	-	Stable
Scaled Quail	Potential colonization	-
Wild Turkey	x	Potential colonization

Common Name	Summer Trend	Winter Trend
Pied-billed Grebe	-	Potential colonization
Eared Grebe	x	Potential colonization
American Bittern	Potential colonization	-
Great Blue Heron	Stable	-
Golden Eagle	x	Stable
Northern Harrier	-	Potential colonization
Sharp-shinned Hawk	x	Potential colonization
Bald Eagle	-	Stable
Harris's Hawk	Potential colonization	-
Swainson's Hawk	Worsening^	-
Red-tailed Hawk	Stable	-
Rough-legged Hawk	-	Stable
Virginia Rail	-	Potential colonization

Common Name	Summer Trend	Winter Trend
American Coot	x	Potential colonization
Killdeer	Stable	Improving
Wilson's Snipe	Worsening*	-
Wilson's Phalarope	Worsening^	-
Ring-billed Gull	Stable^	-
Rock Pigeon	-	Potential colonization
Eurasian Collared-Dove	x	Potential colonization
Mourning Dove	Improving	Improving*
Common Nighthawk	Stable	-
Black-chinned Hummingbird	Stable	-
Broad-tailed Hummingbird	Stable	-
Belted Kingfisher	Stable	-
Acorn Woodpecker	-	Potential colonization
Red-naped Sapsucker	Stable^	-
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Stable	-
Hairy Woodpecker	Stable	-
Northern Flicker	Stable	Improving
American Kestrel	x	Potential colonization
Merlin	-	Potential colonization^
Olive-sided Flycatcher	Worsening*	-
Western Wood-Pewee	Worsening^	-
Willow Flycatcher	Stable	-
Least Flycatcher	Stable	-
Hammond's Flycatcher	Worsening	-
Gray Flycatcher	Improving	-
Dusky Flycatcher	Worsening	-
Cordilleran Flycatcher	Improving*	-
Say's Phoebe	Improving	Potential colonization

Common Name	Summer Trend	Winter Trend
Ash-throated Flycatcher	Potential colonization	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Improving*	-
Loggerhead Shrike	Potential colonization	Potential colonization
Warbling Vireo	Worsening*	-
Steller's Jay	Improving*	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Improving	-
Black-billed Magpie	Stable^	Worsening*
Clark's Nutcracker	Stable^	-
American Crow	Improving*	-
Chihuahuan Raven	Potential colonization	-
Common Raven	Stable	Stable
Horned Lark	Potential extirpation	Stable
Northern Rough-winged Swallow	Improving	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Stable	-
Barn Swallow	Stable	-
Cliff Swallow	Stable	-
Black-capped Chickadee	Stable	-
Mountain Chickadee	Stable	-
Red-breasted Nuthatch	Potential extirpation	-
White-breasted Nuthatch	Improving*	-
Brown Creeper	-	Potential colonization
Rock Wren	Stable	Potential colonization
House Wren	Stable	-
Marsh Wren	x	Potential colonization

Common Name	Summer Trend	Winter Trend
Bewick's Wren	-	Potential colonization
Blue-gray Gnatcatcher	Improving*	-
Ruby-crowned Kinglet	Worsening*	Potential colonization
Western Bluebird	Improving*	Potential colonization
Mountain Bluebird	Stable	Improving*
Townsend's Solitaire	Worsening^	Improving
Veery	Potential extirpation	-
Hermit Thrush	Improving	-
American Robin	Worsening	Improving
Gray Catbird	Stable	-
Curve-billed Thrasher	Potential colonization	Potential colonization
Crissal Thrasher	-	Potential colonization
Sage Thrasher	Worsening	-
Northern Mockingbird	Improving	-
European Starling	Stable	Potential colonization
Cedar Waxwing	Stable	-
Chestnut-collared Longspur	-	Potential colonization
Orange-crowned Warbler	Worsening*	-
MacGillivray's Warbler	Worsening*	-
Common Yellowthroat	Improving	-
Yellow Warbler	Worsening	-
Yellow-rumped Warbler	Stable	-
Yellow-breasted Chat	Improving	-
Green-tailed Towhee	Stable^	Potential colonization
Spotted Towhee	Improving*	-
Rufous-crowned Sparrow	-	Potential colonization
Canyon Towhee	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Cassin's Sparrow	Potential colonization	-
Chipping Sparrow	Improving*	-
Brewer's Sparrow	Stable	Potential colonization
Vesper Sparrow	Stable	-
Lark Sparrow	Improving	-
Black-throated Sparrow	-	Potential colonization
Sagebrush/Bell's Sparrow (Sage Sparrow)	Stable^	Potential colonization
Savannah Sparrow	Potential extirpation	-
Fox Sparrow	Potential extirpation	-
Song Sparrow	Stable	Improving*
Lincoln's Sparrow	Potential extirpation	-
White-crowned Sparrow	Worsening*	Potential colonization
Dark-eyed Junco	x	Improving
Western Tanager	Stable	-
Black-headed Grosbeak	Improving*	-
Lazuli Bunting	Stable	-
Red-winged Blackbird	Potential extirpation	Improving
Western Meadowlark	Worsening	-
Yellow-headed Blackbird	Improving	-
Brewer's Blackbird	Worsening	-
Common Grackle	Stable	-
Brown-headed Cowbird	Stable	-
Bullock's Oriole	Stable	-
House Finch	Improving	Potential colonization
Cassin's Finch	Worsening	-
Pine Siskin	Worsening*	-
Lesser Goldfinch	Improving	-
American Goldfinch	Stable	Potential colonization

Common Name	Summer Trend	Winter Trend
House Sparrow	x	Potential colonization