



Grand Canyon-Parashant National Monument

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 Grand Canyon-Parashant National Monument (hereafter, the Monument) 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 Monument, 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 Monument today, climate suitability in summer under the high-emissions pathway is projected to improve for 17, remain stable for 24 (e.g., Figure 2), and worsen for 9 species. Suitable climate ceases to occur for 24 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 26 species not found at the Monument today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 15, remain stable for 16, and worsen for 7 species. Suitable climate ceases to occur for 6 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 40 species not found at the Monument 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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Monument 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.

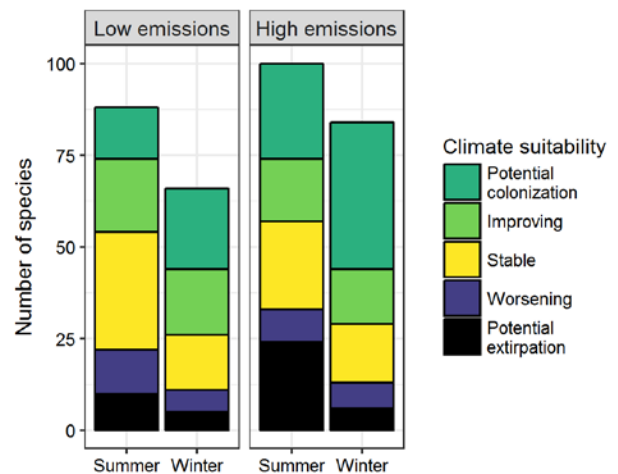


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.24 in summer (40th percentile across all national parks) and 0.15 in winter (17th percentile) under the high-emissions pathway. Potential species turnover declines to 0.14 in summer and 0.10 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 Monument is or may become home to 11 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 Monument may serve as an important refuge for 9 of these climate-sensitive species, 2 might be extirpated from the Monument in at least one season by 2050.



Figure 2. Climate at the Monument in summer is projected to remain suitable for the Mourning Dove (*Zenaida macroura*) through 2050. Photo by KS Black/Flickr (Public Domain).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Grand Canyon-Parashant National Monument falls within the intermediate change group.** Parks anticipating intermediate 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 9 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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Monument 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	-	Potential extirpation
Mottled Duck	Potential colonization	-
Blue-winged Teal	-	Potential colonization
Green-winged Teal	-	Stable
Plain Chachalaca	-	Potential colonization
Gambel's Quail	Improving*	Improving
Northern Bobwhite	Potential colonization	-
Chukar	Worsening	-
Least Grebe	-	Potential colonization
Wood Stork	Potential colonization	-
Magnificent Frigatebird	-	Potential colonization
Neotropic Cormorant	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Brown Pelican	Potential colonization	-
Least Bittern	-	Potential colonization
Great Blue Heron	-	Worsening
Great Egret	-	Potential colonization
Tricolored Heron	Potential colonization [^]	-
Cattle Egret	Potential colonization	Potential colonization
Roseate Spoonbill	-	Potential colonization
Osprey	-	Potential colonization
White-tailed Kite	Potential colonization	-
Harris's Hawk	-	Potential colonization
White-tailed Hawk	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Gray Hawk	Potential colonization	-
Red-tailed Hawk	Improving	Stable
Clapper Rail	-	Potential colonization
American Coot	-	Stable
Limpkin	-	Potential colonization
American Avocet	-	Potential colonization^
Killdeer	Improving	Improving
Mountain Plover	Potential colonization	-
Whimbrel	-	Potential colonization
Long-billed Curlew	-	Potential colonization
Stilt Sandpiper	-	Potential colonization
Yellow-footed Gull	-	Potential colonization
Band-tailed Pigeon	Stable	-
Eurasian Collared-Dove	-	Potential colonization
White-winged Dove	Potential colonization	-
Mourning Dove	Stable	Stable
Inca Dove	Potential colonization	-
Common Ground-Dove	-	Potential colonization
White-tipped Dove	Potential colonization	-
Greater Roadrunner	Improving*	Improving*
Lesser Nighthawk	-	Potential colonization
Common Nighthawk	Stable	-
Black-chinned Hummingbird	Stable	-
Broad-tailed Hummingbird	Potential extirpation	x
Acorn Woodpecker	Stable	-

Common Name	Summer Trend	Winter Trend
Gila Woodpecker	Potential colonization	-
Ladder-backed Woodpecker	Improving*	Improving*
Hairy Woodpecker	Potential extirpation	Potential extirpation
Northern Flicker	Potential extirpation	Worsening
American Kestrel	x	Stable
Peregrine Falcon	-	Potential colonization
Western Wood-Pewee	Potential extirpation^	-
Willow Flycatcher	Stable	-
Hammond's Flycatcher	-	Potential colonization
Gray Flycatcher	Potential extirpation	-
Dusky Flycatcher	Stable	Potential colonization
Black Phoebe	Potential colonization	-
Say's Phoebe	Worsening	Improving
Vermilion Flycatcher	Potential colonization	-
Ash-throated Flycatcher	Improving*	-
Great Kiskadee	Potential colonization	-
Cassin's Kingbird	Stable	-
Western Kingbird	Improving	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Improving	Improving
Bell's Vireo	Improving*	-
Hutton's Vireo	-	Potential colonization
Warbling Vireo	Potential extirpation	-
Black-whiskered Vireo	Potential colonization	-
Green Jay	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Pinyon Jay	Potential extirpation	Worsening*
Steller's Jay	Potential extirpation	-
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Stable	Stable
Clark's Nutcracker	Stable^	Potential extirpation
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	Potential extirpation	Worsening*
Purple Martin	Improving	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Worsening*	-
Cave Swallow	Potential colonization	-
Mountain Chickadee	Potential extirpation	Worsening*
Juniper Titmouse	Worsening	Worsening*
Bushtit	Worsening	Stable
White-breasted Nuthatch	Stable	Stable
Pygmy Nuthatch	Stable	Stable^
Brown Creeper	Potential extirpation^	Stable
Rock Wren	Worsening*	Improving
Canyon Wren	x	Improving
House Wren	Potential extirpation	Potential colonization
Bewick's Wren	Improving	Worsening
Cactus Wren	Improving*	Improving*
Blue-gray Gnatcatcher	Stable	-
Ruby-crowned Kinglet	-	Improving
Western Bluebird	Potential extirpation	Stable
Mountain Bluebird	Potential extirpation	Stable
Townsend's Solitaire	Stable^	Stable

Common Name	Summer Trend	Winter Trend
American Robin	Potential extirpation	Potential extirpation
Long-billed Thrasher	Potential colonization^	Potential colonization
Crissal Thrasher	Improving	-
Northern Mockingbird	Improving	-
American Pipit	-	Improving
Sprague's Pipit	-	Potential colonization
Phainopepla	Improving	-
Black-and-white Warbler	-	Potential colonization
Lucy's Warbler	Potential colonization	-
Common Yellowthroat	-	Potential colonization
Yellow Warbler	Potential extirpation	-
Yellow-rumped Warbler	Stable	Improving
Grace's Warbler	Stable	-
Black-throated Gray Warbler	Potential extirpation	Potential colonization
Wilson's Warbler	-	Potential colonization
Green-tailed Towhee	Stable^	Improving*
Spotted Towhee	Potential extirpation	x
Abert's Towhee	Potential colonization	-
Rufous-winged Sparrow	-	Potential colonization
Chipping Sparrow	Potential extirpation	-
Brewer's Sparrow	Stable	Improving*
Lark Sparrow	Stable	Potential colonization
Black-throated Sparrow	Stable	Improving*
Sagebrush/Bell's Sparrow (Sage Sparrow)	Worsening^	-
White-crowned Sparrow	-	Stable

Common Name	Summer Trend	Winter Trend
Dark-eyed Junco	x	Potential extirpation
Hepatic Tanager	Stable	-
Western Tanager	Potential extirpation	-
Northern Cardinal	-	Potential colonization
Black-headed Grosbeak	Worsening	-
Lazuli Bunting	Potential extirpation	-
Indigo Bunting	-	Potential colonization
Painted Bunting	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Eastern Meadowlark	Potential colonization	Potential colonization
Western Meadowlark	Worsening*	-
Bronzed Cowbird	Potential colonization	Potential colonization
Brown-headed Cowbird	Improving*	-
Altamira Oriole	-	Potential colonization
Scott's Oriole	Stable	-
House Finch	Stable	Stable
Cassin's Finch	Potential extirpation	-
Red Crossbill	Stable^	x
Lesser Goldfinch	Improving	Stable