



Devils Postpile 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 Devils Postpile 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 climate suitability projected to improve for some species and worsen for others (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 27 (e.g., Figure 2), remain stable for 24, and worsen for 18 species. Suitable climate ceases to occur for 4 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 16 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 10, remain stable for 12, and worsen for 8 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 20 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.

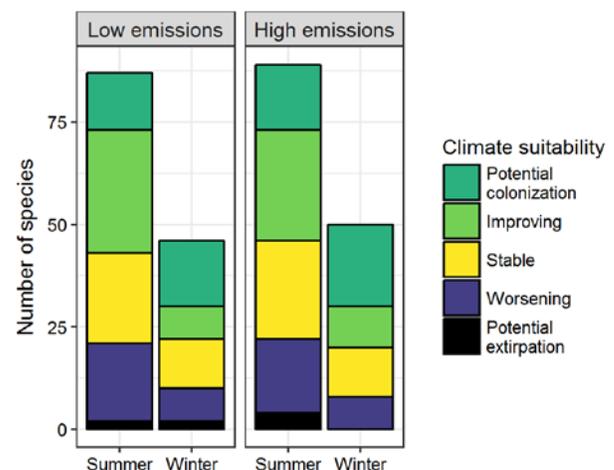


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.19 in summer (30th percentile across all national parks) and 0.16 in winter (19th percentile) under the high-emissions pathway. Potential species turnover declines to 0.17 in summer and increases to 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 Monument is or may become home to 18 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).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Devils Postpile 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

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

Suitable climate is not projected to disappear for these 18 species at the Monument; instead the Monument may serve as an important refuge for these climate-sensitive species.



Figure 2. Climate at the Monument in summer is projected to remain suitable for the Violet-green Swallow (*Tachycineta thalassina*) through 2050. Photo by Becky Matsubara/Flickr (CC BY 2.0).

reducing other stressors. Furthermore, park managers have an opportunity to focus on supporting the 18 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.

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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
Gadwall	Potential colonization [^]	Potential colonization
Mallard	Improving [^]	Improving
Northern Shoveler	Potential colonization [^]	Potential colonization
Green-winged Teal	-	Potential colonization
Canvasback	-	Potential colonization
Ring-necked Duck	-	Potential colonization
Bufflehead	-	Potential colonization
Hooded Merganser	-	Potential colonization [^]
Common Merganser	-	Improving
Mountain Quail	Worsening	Worsening*
Gray Partridge	Potential colonization	-
Ring-necked Pheasant	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Ruffed Grouse	-	Potential colonization
Pied-billed Grebe	x	Potential colonization
Great Blue Heron	-	Potential colonization
Northern Harrier	Potential colonization [^]	-
Swainson's Hawk	Potential colonization [^]	-
Red-tailed Hawk	Improving	Stable
Killdeer	Improving	Improving
Long-billed Dowitcher	-	Potential colonization
Mew Gull	-	Potential colonization
Ring-billed Gull	Potential colonization [^]	-
Band-tailed Pigeon	Stable	-
Mourning Dove	Improving*	-

Common Name	Summer Trend	Winter Trend
Common Nighthawk	Improving*	-
Anna's Hummingbird	Worsening	-
Calliope Hummingbird	Stable	-
Belted Kingfisher	Improving	Improving
Acorn Woodpecker	Improving	-
Red-breasted Sapsucker	Worsening*	-
Downy Woodpecker	Stable	-
Hairy Woodpecker	Stable	Stable
White-headed Woodpecker	Stable^	Stable
Black-backed Woodpecker	x	Stable
Northern Flicker	Stable	Improving
Merlin	-	Potential colonization^
Olive-sided Flycatcher	Worsening	-
Western Wood-Pewee	Improving^	-
Dusky Flycatcher	Worsening	-
Pacific-slope Flycatcher	Improving	-
Black Phoebe	Worsening	-
Say's Phoebe	Potential colonization	-
Western Kingbird	Improving*	-
Warbling Vireo	Stable	-
Steller's Jay	Stable	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Potential colonization	-
Black-billed Magpie	Potential colonization^	-
Clark's Nutcracker	Worsening*^	Worsening*
American Crow	Improving	-
Common Raven	Stable	Worsening
Northern Rough-winged Swallow	Potential colonization	-
Tree Swallow	Improving	-
Violet-green Swallow	Improving*	-
Cliff Swallow	Improving*	-

Common Name	Summer Trend	Winter Trend
Black-capped Chickadee	-	Potential colonization
Mountain Chickadee	Worsening*	Stable
Chestnut-backed Chickadee	-	Potential colonization
Bushtit	Improving	-
Red-breasted Nuthatch	Worsening	Stable
White-breasted Nuthatch	Improving	Worsening
Pygmy Nuthatch	Improving	-
Brown Creeper	Worsening^	Worsening
Rock Wren	Stable	Improving
House Wren	Improving*	-
Pacific/Winter Wren	Potential colonization	-
Bewick's Wren	Improving	Improving
American Dipper	x	Worsening*
Golden-crowned Kinglet	Stable	Improving
Ruby-crowned Kinglet	Potential extirpation	-
Mountain Bluebird	Stable	Stable
Townsend's Solitaire	Worsening^	Worsening*
Hermit Thrush	Worsening*	-
American Robin	Worsening	Stable
Varied Thrush	Potential colonization^	-
Bohemian Waxwing	-	Potential colonization
Orange-crowned Warbler	Improving	-
Nashville Warbler	Stable	-
MacGillivray's Warbler	Stable	-
Yellow Warbler	Stable	-
Yellow-rumped Warbler	Potential extirpation	-
Hermit Warbler	Worsening*	-
Wilson's Warbler	Improving	-
Green-tailed Towhee	Stable^	-
Spotted Towhee	Improving*	-

Common Name	Summer Trend	Winter Trend
Chipping Sparrow	Potential extirpation	-
Brewer's Sparrow	Stable	-
Vesper Sparrow	Potential colonization	-
Lark Sparrow	Potential colonization	-
Fox Sparrow	Worsening*	Stable
Song Sparrow	Stable	Improving
Lincoln's Sparrow	Potential extirpation	-
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	Worsening	Worsening*
Dark-eyed Junco	x	Improving
Western Tanager	Stable	-
Black-headed Grosbeak	Improving*	-

Common Name	Summer Trend	Winter Trend
Lazuli Bunting	Stable	-
Red-winged Blackbird	Improving	Potential colonization
Western Meadowlark	Potential colonization	-
Brewer's Blackbird	Improving*	-
Brown-headed Cowbird	Stable	-
Pine Grosbeak	Worsening^	-
House Finch	Improving	-
Cassin's Finch	Worsening*	Stable
Red Crossbill	Stable^	-
Common Redpoll	-	Potential colonization
Pine Siskin	Stable	Stable
Lesser Goldfinch	Improving	-
Evening Grosbeak	Stable	-