



Pipestone 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 Pipestone 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 32, remain stable for 18 (e.g., Figure 2), and worsen for 10 species. Suitable climate ceases to occur for 17 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 10 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 23, remain stable for 9, and worsen for 4 species. Suitable climate ceases to occur for 3 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 38 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.

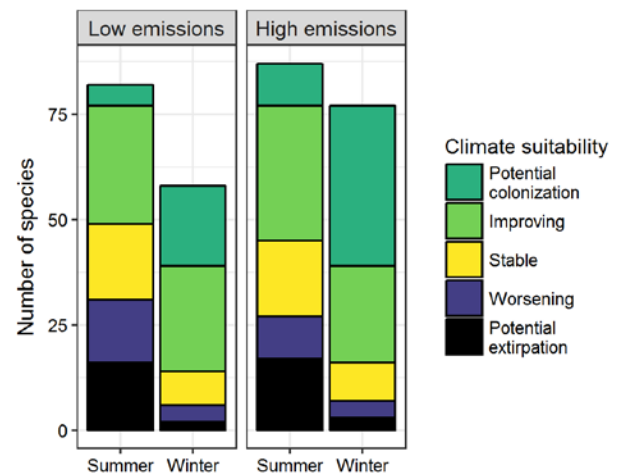


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.34 in summer (59th percentile across all national parks) and 0.43 in winter (71st percentile) under the high-emissions pathway. Potential species turnover declines to 0.22 in summer and 0.29 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 6 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, Pipestone National Monument 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

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

While the Monument may serve as an important refuge for 5 of these climate-sensitive species, one, the Mallard (*Anas platyrhynchos*), might be extirpated from the Monument in summer by 2050.



Figure 2. Climate at the Monument 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).

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 5 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
Cackling/Canada Goose	x	Improving
Wood Duck	x	Improving
Gadwall	-	Potential colonization
American Wigeon	-	Potential colonization
Mallard	Potential extirpation [^]	Improving
Blue-winged Teal	Worsening	-
Northern Shoveler	Worsening [^]	-
Common Goldeneye	-	Potential colonization
Common Merganser	-	Potential colonization
Northern Bobwhite	Potential colonization	Potential colonization
Gray Partridge	Stable	Potential extirpation
Ring-necked Pheasant	Stable	Stable
Wild Turkey	x	Improving

Common Name	Summer Trend	Winter Trend
American White Pelican	-	Potential colonization
Great Blue Heron	Improving	Potential colonization
Great Egret	Potential colonization	-
Green Heron	Improving	-
Yellow-crowned Night-Heron	Potential colonization	-
Northern Harrier	Worsening [^]	Potential colonization
Sharp-shinned Hawk	-	Potential colonization
Cooper's Hawk	x	Potential colonization
Bald Eagle	-	Stable
Swainson's Hawk	Stable [^]	-
Red-tailed Hawk	Improving	Improving
Ferruginous Hawk	-	Potential colonization

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

Common Name	Summer Trend	Winter Trend
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Improving	-
Great Crested Flycatcher	Improving	-
Eastern Kingbird	Improving	-
Loggerhead Shrike	-	Potential colonization
Bell's Vireo	Potential colonization	-
Warbling Vireo	Stable	-
Red-eyed Vireo	Stable	-
Blue Jay	Improving	Stable
American Crow	Stable	Stable
Horned Lark	Potential extirpation	Improving
Northern Rough-winged Swallow	Improving	-
Purple Martin	Stable	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Improving	-
Cliff Swallow	Worsening	-
Black-capped Chickadee	Improving	Worsening
Tufted Titmouse	Potential colonization	Potential colonization
White-breasted Nuthatch	Stable	Worsening
House Wren	Stable	-
Pacific/Winter Wren	-	Potential colonization
Sedge Wren	Worsening*	-
Carolina Wren	-	Potential colonization
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Improving
Eastern Bluebird	Improving	Potential colonization
American Robin	Worsening	Improving
Gray Catbird	Improving	-

Common Name	Summer Trend	Winter Trend
Brown Thrasher	Improving	-
Northern Mockingbird	Potential colonization	-
European Starling	Stable	Stable
Cedar Waxwing	Potential extirpation	Improving
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Potential extirpation
Common Yellowthroat	Worsening	-
Yellow Warbler	Potential extirpation	-
Yellow-rumped Warbler	-	Potential colonization
Eastern Towhee	Potential colonization	-
American Tree Sparrow	-	Improving
Chipping Sparrow	Potential extirpation	-
Clay-colored Sparrow	Potential extirpation	-
Field Sparrow	Improving	Potential colonization
Vesper Sparrow	Potential extirpation	-
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Improving	-
LeConte's Sparrow	-	Potential colonization
Fox Sparrow	-	Potential colonization
Song Sparrow	Potential extirpation	Potential colonization
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	Potential extirpation	Potential colonization

Common Name	Summer Trend	Winter Trend
White-throated Sparrow	-	Potential colonization
Harris's Sparrow	-	Improving*
White-crowned Sparrow	-	Potential colonization
Dark-eyed Junco	-	Improving
Northern Cardinal	Improving*	Improving
Rose-breasted Grosbeak	Stable	-
Blue Grosbeak	Improving	-
Indigo Bunting	Improving*	-
Dickcissel	Improving	-
Bobolink	Worsening*	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Potential colonization	Potential colonization
Western Meadowlark	Improving	Potential colonization
Yellow-headed Blackbird	Worsening	-
Brewer's Blackbird	-	Potential colonization
Common Grackle	Improving	Improving
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	Potential colonization
Orchard Oriole	Improving	-
Baltimore Oriole	Improving	-
House Finch	Stable	Stable
American Goldfinch	Worsening	Improving
Evening Grosbeak	-	Potential extirpation
House Sparrow	x	Stable
Eurasian Tree Sparrow	-	Potential colonization