Birds and Climate Change

National Park Service
U.S. Department of the Interior

Dinosaur 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 Dinosaur 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.

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.

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 20, remain stable for 49 (e.g., Figure 2), and worsen for 9 species. Suitable climate ceases to occur for 21 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 12 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 19, remain stable for 8, and worsen for 4 species. Suitable climate ceases to occur for 1 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 54 species not found at the Monument today, potentially resulting in local colonization.

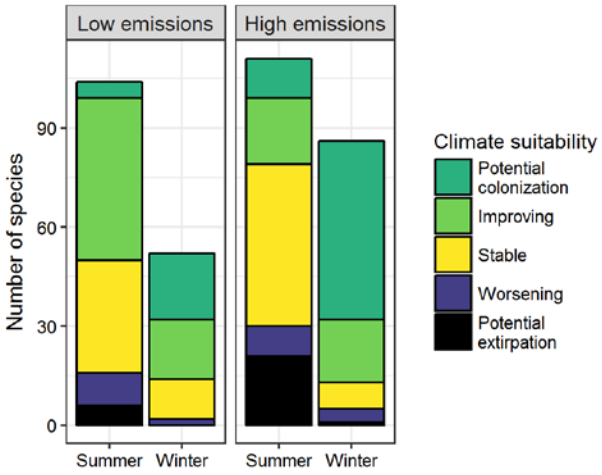

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.19 in summer (29th percentile across all national parks) and 0.38 in winter (62nd percentile) under the high-emissions pathway. Potential species turnover declines to 0.10 in summer and 0.21 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 13 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 12 of these climate-sensitive species, one, the American Wigeon (*Anas americana*), 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 Violet-green Swallow (*Tachycineta thalassina*) through 2050. Photo by Becky Matsubara/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, Dinosaur National Monument 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 12 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	x	Stable
Wood Duck	-	Potential colonization
Gadwall	Worsening^	Potential colonization
American Wigeon	Potential extirpation^	-
Mallard	Worsening^	Stable
Cinnamon Teal	x	Potential colonization
Northern Shoveler	-	Potential colonization
Canvasback	-	Potential colonization
Ring-necked Duck	-	Potential colonization
Greater Scaup	-	Potential colonization^
Lesser Scaup	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Bufflehead	-	Potential colonization
Common Goldeneye	-	Stable
Hooded Merganser	-	Potential colonization^
Common Merganser	x	Stable
Ruddy Duck	Potential extirpation	-
Scaled Quail	Potential colonization	Potential colonization
California Quail	Improving	-
Northern Bobwhite	-	Potential colonization
Wild Turkey	x	Improving
Pied-billed Grebe	-	Potential colonization
Eared Grebe	-	Potential colonization
Western Grebe	x	Potential colonization

Common Name	Summer Trend	Winter Trend
Clark's Grebe	-	Potential colonization
American White Pelican	-	Potential colonization
Great Blue Heron	Stable	Potential colonization
Black-crowned Night-Heron	-	Potential colonization
White-faced Ibis	-	Potential colonization^
Golden Eagle	x	Worsening*
Northern Harrier	Stable^	-
Sharp-shinned Hawk	x	Potential colonization
Cooper's Hawk	x	Potential colonization
Bald Eagle	x	Worsening*
Red-tailed Hawk	Stable	Improving
American Coot	x	Potential colonization
Killdeer	Potential extirpation	Improving
Ring-billed Gull	-	Potential colonization
Iceland Gull (Thayer's)	-	Potential colonization
Rock Pigeon	Stable	Stable
Eurasian Collared-Dove	x	Improving
White-winged Dove	-	Potential colonization
Mourning Dove	Stable	Improving*
Inca Dove	-	Potential colonization
Greater Roadrunner	-	Potential colonization
Barn Owl	-	Potential colonization
Great Horned Owl	x	Stable
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Improving	-

Common Name	Summer Trend	Winter Trend
Black-chinned Hummingbird	Improving*	-
Broad-tailed Hummingbird	Stable	-
Red-naped Sapsucker	-	Potential colonization
Ladder-backed Woodpecker	Potential colonization	Potential colonization
Downy Woodpecker	Improving	-
Hairy Woodpecker	Stable	-
Northern Flicker	Stable	Improving
Gilded Flicker	Potential colonization	-
American Kestrel	x	Improving
Olive-sided Flycatcher	Potential extirpation	-
Western Wood-Pewee	Stable^	-
Willow Flycatcher	Potential extirpation	-
Hammond's Flycatcher	Potential extirpation	-
Gray Flycatcher	Stable	-
Dusky Flycatcher	Stable	-
Cordilleran Flycatcher	Stable	-
Say's Phoebe	Stable	Potential colonization
Ash-throated Flycatcher	Stable	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Improving*	-
Eastern Kingbird	Stable	-
Loggerhead Shrike	Improving	Potential colonization
Warbling Vireo	Stable	-
Pinyon Jay	Stable	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Improving*	Improving*
Black-billed Magpie	Worsening*^	Worsening*
Clark's Nutcracker	Stable^	-

Common Name	Summer Trend	Winter Trend
American Crow	Stable	Potential colonization
Chihuahuan Raven	Potential colonization	Potential colonization
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	Stable	Improving
Northern Rough-winged Swallow	Stable	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Stable	-
Barn Swallow	Improving*	-
Cliff Swallow	Stable	-
Black-capped Chickadee	Stable	-
Mountain Chickadee	Stable	Worsening*
Juniper Titmouse	Stable	Stable
Bushtit	Improving	Improving*
Red-breasted Nuthatch	Potential extirpation	-
White-breasted Nuthatch	Stable	Potential colonization
Brown Creeper	-	Potential colonization
Rock Wren	Stable	Potential colonization
Canyon Wren	x	Improving
House Wren	Stable	-
Marsh Wren	x	Improving
Bewick's Wren	Improving	Potential colonization
Blue-gray Gnatcatcher	Stable	-
Ruby-crowned Kinglet	Potential extirpation	Potential colonization
Western Bluebird	Stable	Potential colonization
Mountain Bluebird	Worsening*	-
Townsend's Solitaire	Stable^	-
Hermit Thrush	Stable	-

Common Name	Summer Trend	Winter Trend
American Robin	Potential extirpation	Improving
Gray Catbird	Stable	-
Curve-billed Thrasher	Potential colonization	Potential colonization
Crissal Thrasher	Potential colonization	-
Sage Thrasher	Worsening*	Potential colonization
Northern Mockingbird	Improving*	-
European Starling	Stable	Improving
American Pipit	-	Potential colonization
Cedar Waxwing	Potential extirpation	-
Chestnut-collared Longspur	-	Potential colonization
Common Yellowthroat	Stable	-
Yellow Warbler	Potential extirpation	-
Yellow-rumped Warbler	Potential extirpation	Potential colonization
Black-throated Gray Warbler	Stable	-
Wilson's Warbler	Potential extirpation	-
Yellow-breasted Chat	Stable	-
Green-tailed Towhee	Stable^	Potential colonization
Spotted Towhee	Stable	-
Canyon Towhee	Potential colonization	Potential colonization
Abert's Towhee	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
Chipping Sparrow	Stable	-
Brewer's Sparrow	Worsening*	Potential colonization
Vesper Sparrow	Potential extirpation	-
Lark Sparrow	Improving*	-

Common Name	Summer Trend	Winter Trend
Black-throated Sparrow	Improving	Potential colonization
Sagebrush/Bell's Sparrow (Sage Sparrow)	Worsening*^	-
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Potential colonization	-
Song Sparrow	Potential extirpation	Improving
Lincoln's Sparrow	Potential extirpation	-
White-crowned Sparrow	Potential extirpation	Improving*
Dark-eyed Junco	x	Improving
Western Tanager	Stable	-
Black-headed Grosbeak	Stable	-
Blue Grosbeak	Improving*	-
Lazuli Bunting	Stable	-
Indigo Bunting	Improving	-

Common Name	Summer Trend	Winter Trend
Red-winged Blackbird	Stable	-
Western Meadowlark	Worsening	-
Yellow-headed Blackbird	Stable	-
Brewer's Blackbird	Worsening*	Improving
Common Grackle	Improving*	-
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	-
Bullock's Oriole	Improving	-
Scott's Oriole	Improving	-
House Finch	Improving	Improving
Cassin's Finch	Stable	-
Pine Siskin	Potential extirpation	-
Lesser Goldfinch	Improving*	Potential colonization
American Goldfinch	Stable	Potential colonization