Birds and Climate Change

National Park Service
U.S. Department of the Interior

John Day Fossil Beds 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 John Day Fossil Beds 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 15, remain stable for 27, and worsen for 17 species. Suitable climate ceases to occur for 11 species in summer, potentially resulting in extirpation of those species from the Monument (e.g., Figure 2). 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 19, remain stable for 9, and worsen for 11 species. Suitable climate ceases to occur for 2 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 39 species not found at the Monument today, potentially resulting in local colonization.

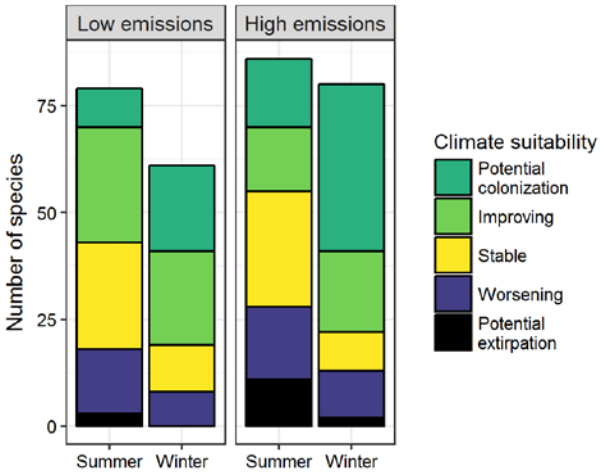

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.14 in summer (19th percentile across all national parks) and 0.16 in winter (20th percentile) under the high-emissions pathway. Potential species turnover declines to 0.11 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 7 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 5 of these climate-sensitive species, 2 might be extirpated from the Monument in at least one season by 2050.

Figure 2. Although currently found at the Monument, 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, John Day Fossil Beds 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 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.

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.

Contacts

Gregor Schuurman, Ph.D.
Ecologist, NPS Climate Change Response Program
970-267-7211, gregor_schuurman@nps.gov

Joanna Wu
Biologist, National Audubon Society
415-644-4610, science@audubon.org

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	Worsening
Gadwall	Worsening^	-
Mallard	Potential extirpation^	Stable
Green-winged Teal	x	Improving
Ring-necked Duck	-	Stable
Common Goldeneye	-	Worsening*
Ruddy Duck	Potential extirpation	-
Mountain Quail	Stable	-
California Quail	Worsening	Worsening*
Chukar	Worsening	-
Ring-necked Pheasant	Stable	Worsening*
Great Blue Heron	Stable	Stable
Great Egret	-	Potential colonization
Golden Eagle	x	Worsening
Northern Harrier	Worsening^	-
Red-tailed Hawk	Stable	Improving
Killdeer	Potential extirpation	Improving
Spotted Sandpiper	x	Potential colonization
Greater Yellowlegs	-	Potential colonization
Dunlin	-	Potential colonization^
Least Sandpiper	-	Potential colonization
Long-billed Dowitcher	-	Potential colonization
Wilson's Snipe	Potential extirpation	-
Rock Pigeon	Improving	Potential extirpation
Mourning Dove	Improving	Improving
Inca Dove	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Greater Roadrunner	Potential colonization	Potential colonization
Burrowing Owl	-	Potential colonization
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Worsening*	-
White-throated Swift	x	Potential colonization
Anna's Hummingbird	-	Potential colonization
Costa's Hummingbird	-	Potential colonization
Belted Kingfisher	Stable	Worsening
Acorn Woodpecker	-	Potential colonization
Gila Woodpecker	Potential colonization	-
Red-naped Sapsucker	Potential extirpation^	-
Ladder-backed Woodpecker	Potential colonization	Potential colonization
Downy Woodpecker	Improving	-
Northern Flicker	Worsening	Improving
Gilded Flicker	Potential colonization	Potential colonization
American Kestrel	x	Improving
Prairie Falcon	x	Worsening
Olive-sided Flycatcher	Stable	-
Western Wood-Pewee	Stable^	-
Gray Flycatcher	Worsening	-
Dusky Flycatcher	Stable	-
Black Phoebe	-	Potential colonization
Say's Phoebe	Improving	-
Ash-throated Flycatcher	Improving*	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Improving	-
Eastern Kingbird	Stable	-

Common Name	Summer Trend	Winter Trend
Loggerhead Shrike	Stable	Improving*
Northern Shrike	-	Potential extirpation
Black-billed Magpie	Worsening*^	Worsening*
American Crow	Stable	Stable
Chihuahuan Raven	Potential colonization	Potential colonization
Common Raven	Stable	Stable
Horned Lark	Potential extirpation	-
Northern Rough-winged Swallow	Improving*	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Stable	Potential colonization
Barn Swallow	Stable	-
Cliff Swallow	Stable	-
Mountain Chickadee	Worsening	Worsening*
Bridled Titmouse	Potential colonization	-
Verdin	-	Potential colonization
Bushtit	Stable	Improving
Rock Wren	Stable	-
Canyon Wren	x	Improving
Bewick's Wren	Improving*	-
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	-	Potential colonization
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Western Bluebird	Stable	-
Mountain Bluebird	Worsening*	Improving
Townsend's Solitaire	-	Worsening*
Hermit Thrush	-	Potential colonization
American Robin	Potential extirpation	Improving

Common Name	Summer Trend	Winter Trend
Curve-billed Thrasher	-	Potential colonization
Crissal Thrasher	Potential colonization	Potential colonization
Sage Thrasher	Worsening*	-
Northern Mockingbird	Improving*	Improving*
European Starling	Stable	Improving
American Pipit	-	Potential colonization
Cedar Waxwing	Stable	-
Phainopepla	Potential colonization	Potential colonization
Chestnut-collared Longspur	-	Potential colonization
Lucy's Warbler	Potential colonization	-
Yellow Warbler	Stable	-
Yellow-rumped Warbler	-	Potential colonization
Black-throated Gray Warbler	Improving*	-
Yellow-breasted Chat	Stable	-
Green-tailed Towhee	-	Potential colonization
Spotted Towhee	Improving*	x
Rufous-crowned Sparrow	-	Potential colonization
Canyon Towhee	-	Potential colonization
Abert's Towhee	-	Potential colonization
Rufous-winged Sparrow	Potential colonization	-
Chipping Sparrow	Stable	-
Brewer's Sparrow	Worsening*	Potential colonization

Common Name	Summer Trend	Winter Trend
Vesper Sparrow	Potential extirpation	-
Lark Sparrow	Improving	Potential colonization
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Potential colonization
Song Sparrow	Stable	Improving
White-crowned Sparrow	Potential extirpation	Improving
Dark-eyed Junco	x	Improving
Western Tanager	Stable	-
Pyrrhuloxia	-	Potential colonization
Lazuli Bunting	Worsening	-
Red-winged Blackbird	Potential extirpation	Improving
Western Meadowlark	Worsening	Improving
Yellow-headed Blackbird	Worsening	-
Brewer's Blackbird	Worsening*	-
Great-tailed Grackle	Potential colonization	-
Brown-headed Cowbird	Stable	Potential colonization
Hooded Oriole	Potential colonization	-
Bullock's Oriole	Improving	-
House Finch	Improving*	Improving
Cassin's Finch	Worsening*	Stable
Pine Siskin	-	Stable
Lesser Goldfinch	Improving*	-
American Goldfinch	Stable	Stable
Evening Grosbeak	-	Worsening*
House Sparrow	x	Stable