Birds and Climate Change

National Park Service
U.S. Department of the Interior

Oregon Caves National Monument and Preserve

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 Oregon Caves National Monument and Preserve (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 12, remain stable for 15, and worsen for 33 species. Suitable climate ceases to occur for 7 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 6 species not found at the Monument today, potentially resulting in local colonization. Among the species likely to be found at the Monument today, climate suitability in winter under the high-emissions pathway is projected to improve for 8 (e.g., Figure 2), remain stable for 1, and worsen for 3 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 23 species not found at the Monument today, potentially resulting in local colonization.

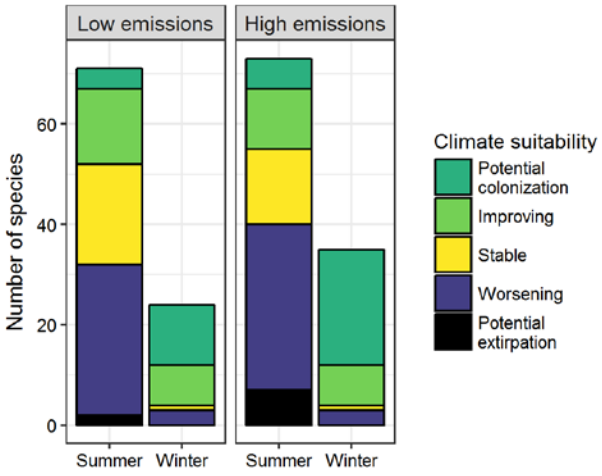

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.11 in summer (12th percentile across all national parks) and 0.15 in winter (17th percentile) under the high-emissions pathway. Potential species turnover declines to 0.08 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 6 of these climate-sensitive species, one, the Green-tailed Towhee (*Pipilo chlorurus*), might be extirpated from the Monument in summer by 2050.

Figure 2. Climate at the Monument in winter is projected to remain suitable for the American Goldfinch (*Spinus tristis*) through 2050. Photo by John Benson/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, Oregon Caves National Monument and Preserve 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 6 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
Gadwall	-	Potential colonization
Mountain Quail	Worsening*	-
California Quail	Stable	-
Wild Turkey	-	Potential colonization
Clark's Grebe	-	Potential colonization
Double-crested Cormorant	-	Potential colonization
Snowy Egret	-	Potential colonization
Green Heron	-	Potential colonization
Black-crowned Night-Heron	-	Potential colonization
Osprey	-	Potential colonization
Northern Harrier	-	Potential colonization
Cooper's Hawk	x	Potential colonization
Red-shouldered Hawk	Potential colonization	Potential colonization
Red-tailed Hawk	Improving	Improving
Sora	-	Potential colonization
Killdeer	Improving	Improving
Greater Yellowlegs	-	Potential colonization
Long-billed Curlew	-	Potential colonization
Least Sandpiper	-	Potential colonization
Band-tailed Pigeon	Worsening	-
Mourning Dove	Improving*	-
Burrowing Owl	-	Potential colonization
Black-chinned Hummingbird	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Rufous Hummingbird	Stable	-
Acorn Woodpecker	Stable	-
Red-breasted Sapsucker	Worsening	-
Hairy Woodpecker	Worsening	-
Northern Flicker	Worsening	Improving
Pileated Woodpecker	Stable	Improving
Olive-sided Flycatcher	Worsening*	-
Western Wood-Pewee	Worsening^	-
Hammond's Flycatcher	Worsening	-
Dusky Flycatcher	Worsening*	-
Pacific-slope Flycatcher	Stable	-
Black Phoebe	Stable	-
Loggerhead Shrike	-	Potential colonization
Hutton's Vireo	Stable^	-
Warbling Vireo	Worsening	-
Gray Jay	Stable	-
Steller's Jay	Worsening	Worsening*
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Improving*	-
American Crow	Improving*	Improving
Common Raven	Worsening	Worsening*
Northern Rough-winged Swallow	Improving	-
Tree Swallow	Stable	-
Violet-green Swallow	Improving	-
Cliff Swallow	Potential colonization	-
Black-capped Chickadee	Stable	-
Mountain Chickadee	Worsening*	-
Chestnut-backed Chickadee	Stable	-
Red-breasted Nuthatch	Worsening	-
White-breasted Nuthatch	Improving	-
Brown Creeper	Worsening^	-
Pacific/Winter Wren	Worsening	-

Common Name	Summer Trend	Winter Trend
Cactus Wren	-	Potential colonization
Blue-gray Gnatcatcher	Potential colonization	-
American Dipper	x	Worsening*
Golden-crowned Kinglet	Worsening*	-
Ruby-crowned Kinglet	Potential extirpation	-
Wrentit	Stable	-
Western Bluebird	Stable	-
Townsend's Solitaire	Worsening^	-
Swainson's Thrush	Worsening	-
Hermit Thrush	Potential extirpation	Improving
American Robin	Worsening	Improving
Varied Thrush	Worsening^	-
European Starling	Improving*	-
American Pipit	-	Potential colonization
Phainopepla	-	Potential colonization
Orange-crowned Warbler	Stable	-
Nashville Warbler	Worsening*	-
MacGillivray's Warbler	Worsening*	-
Yellow-rumped Warbler	Potential extirpation	-
Black-throated Gray Warbler	Worsening	-
Hermit Warbler	Worsening*	-^
Wilson's Warbler	Worsening	-
Yellow-breasted Chat	Improving*	-
Green-tailed Towhee	Potential extirpation^	-
Spotted Towhee	Worsening	-
Chipping Sparrow	Stable	Potential colonization
Savannah Sparrow	-	Potential colonization
Grasshopper Sparrow	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Fox Sparrow	Potential extirpation	-
Song Sparrow	Improving	-
Lincoln's Sparrow	Potential extirpation	-
White-throated Sparrow	-	Potential colonization
Dark-eyed Junco	x	Stable
Western Tanager	Worsening	-
Black-headed Grosbeak	Worsening	-

Common Name	Summer Trend	Winter Trend
Lazuli Bunting	Worsening	-
House Finch	Potential colonization	-
Purple Finch	Worsening	-
Cassin's Finch	Worsening	-
Red Crossbill	Worsening^	-
Pine Siskin	Potential extirpation	-
American Goldfinch	Improving*	Improving