Birds and Climate Change

National Park Service
U.S. Department of the Interior

Lava 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 Lava 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 34, and worsen for 33 species. Suitable climate ceases to occur for 28 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 17 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 30, remain stable for 30, and worsen for 13 species. Suitable climate ceases to occur for 4 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 27 species not found at the Monument today, potentially resulting in local colonization.

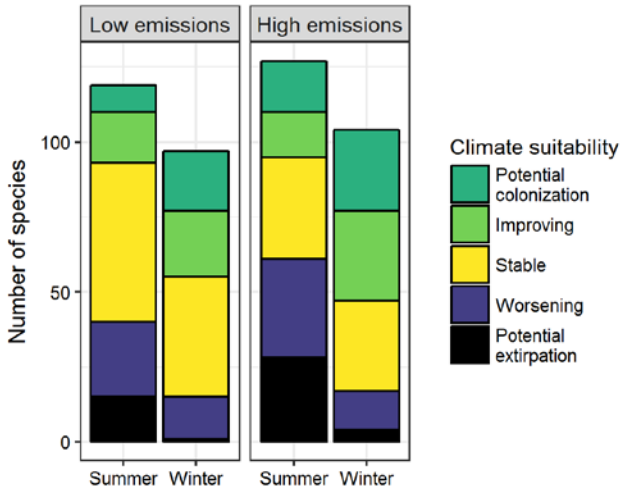

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.17 in summer (25th percentile across all national parks) and 0.15 in winter (18th percentile) under the high-emissions pathway. Potential species turnover declines to 0.08 in summer and 0.12 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 23 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 18 of these climate-sensitive species, 5 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, Lava 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 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.

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^	Stable
Eurasian Wigeon	-	Stable
American Wigeon	Potential extirpation^	Stable
Mallard	Worsening*^	Stable
Blue-winged Teal	Potential extirpation	-
Northern Shoveler	Worsening^	Improving
Northern Pintail	Worsening	x
Green-winged Teal	x	Improving
Canvasback	x	Improving
Redhead	Worsening^	x
Ring-necked Duck	x	Stable
Lesser Scaup	x	Worsening*
Bufflehead	x	Worsening

Common Name	Summer Trend	Winter Trend
Common Goldeneye	-	Worsening
Common Merganser	-	Stable
Ruddy Duck	Worsening	Stable
Mountain Quail	Worsening	-
Scaled Quail	Potential colonization	-
California Quail	Stable	Stable
Ring-necked Pheasant	Stable	Stable
Greater Sage-Grouse	x	Potential extirpation^
Pied-billed Grebe	x	Stable
American White Pelican	x	Potential colonization
American Bittern	Potential extirpation	Potential colonization^
Great Blue Heron	Potential extirpation	Improving
Great Egret	Potential extirpation	-
Golden Eagle	x	Stable

Common Name	Summer Trend	Winter Trend
Northern Harrier	Worsening^	Stable
Cooper's Hawk	-	Stable
Bald Eagle	x	Stable
Red-shouldered Hawk	Improving	-
Swainson's Hawk	Improving^	-
Red-tailed Hawk	Stable	Improving
Rough-legged Hawk	-	Worsening*
American Coot	x	Improving
Killdeer	Potential extirpation	Improving*
Greater Yellowlegs	Potential extirpation	-
Willet	Potential extirpation^	-
Marbled Godwit	Potential extirpation^	-
Dunlin	-	Potential colonization^
Least Sandpiper	-	Potential colonization
Long-billed Dowitcher	x	Potential colonization
Wilson's Phalarope	Potential extirpation^	-
Bonaparte's Gull	Potential extirpation	-
Franklin's Gull	Potential extirpation	-
Ring-billed Gull	Worsening*^	Stable
California Gull	x	Stable^
Black Tern	Potential extirpation	-
Rock Pigeon	Improving	Stable
Band-tailed Pigeon	Stable	-
Eurasian Collared-Dove	x	Improving
Mourning Dove	Improving	Improving
Greater Roadrunner	Potential colonization	Potential colonization
Barn Owl	x	Stable

Common Name	Summer Trend	Winter Trend
Great Horned Owl	x	Stable
Burrowing Owl	-	Potential colonization
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Worsening	-
Anna's Hummingbird	Stable	Improving
Rufous Hummingbird	Stable	-
Calliope Hummingbird	Worsening	-
Acorn Woodpecker	-	Potential colonization
Gila Woodpecker	-	Potential colonization
Red-breasted Sapsucker	Worsening	Worsening*
Ladder-backed Woodpecker	Potential colonization	Potential colonization
Downy Woodpecker	Stable	-
Hairy Woodpecker	Potential extirpation	Potential extirpation
Northern Flicker	Worsening*	Improving
Gilded Flicker	-	Potential colonization
American Kestrel	x	Improving
Prairie Falcon	x	Stable
Western Wood-Pewee	Worsening^	-
Hammond's Flycatcher	Worsening	-
Gray Flycatcher	Stable	-
Dusky Flycatcher	Worsening*	-
Say's Phoebe	Stable	Improving*
Ash-throated Flycatcher	Improving*	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Improving*	-
Loggerhead Shrike	Stable	Improving*
Northern Shrike	-	Worsening*
Hutton's Vireo	Potential colonization^	-
Gray Jay	Potential	-

Common Name	Summer Trend	Winter Trend
	extirpation	
Pinyon Jay	Stable	Improving
Steller's Jay	Worsening*	Worsening*
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Stable	Improving
Black-billed Magpie	Stable^	Worsening
Clark's Nutcracker	Worsening^	Worsening*
American Crow	Stable	-
Common Raven	Stable	Stable
Horned Lark	Stable	Improving*
Purple Martin	Stable	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Improving*	-
Barn Swallow	Potential extirpation	-
Cliff Swallow	Worsening	-
Black-capped Chickadee	-	Potential colonization
Mountain Chickadee	Worsening*	Worsening
Chestnut-backed Chickadee	Potential colonization	-
Bridled Titmouse	Potential colonization	-
Bushtit	Improving	Improving
Red-breasted Nuthatch	Worsening*	Potential extirpation
White-breasted Nuthatch	Stable	Stable
Pygmy Nuthatch	Worsening	Worsening*^
Brown Creeper	Worsening^	Stable
Rock Wren	Stable	Improving*
Canyon Wren	x	Stable
House Wren	Worsening	-
Bewick's Wren	Improving*	Improving*
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Improving*	-
Black-tailed Gnatcatcher	Potential	-

Common Name	Summer Trend	Winter Trend
	colonization	
Golden-crowned Kinglet	Potential extirpation	Potential extirpation
Ruby-crowned Kinglet	Potential extirpation	-
Wrentit	-	Potential colonization
Western Bluebird	Stable	Improving*
Mountain Bluebird	Worsening*	Stable
Townsend's Solitaire	Worsening*^	Worsening*
Hermit Thrush	-	Potential colonization
American Robin	Potential extirpation	Improving
Curve-billed Thrasher	Potential colonization	-
Crissal Thrasher	Potential colonization	-
Sage Thrasher	Worsening	-
European Starling	Stable	Improving
Cedar Waxwing	Stable	Stable
Phainopepla	Potential colonization	-
Chestnut-collared Longspur	-	Potential colonization
Orange-crowned Warbler	Stable	-
Lucy's Warbler	Potential colonization	-
Nashville Warbler	Stable	-
Common Yellowthroat	Stable	-
Yellow Warbler	Stable	-
Yellow-rumped Warbler	Potential extirpation	Potential colonization
Wilson's Warbler	Stable	-
Green-tailed Towhee	Worsening*^	Potential colonization
Spotted Towhee	Stable	x
Rufous-crowned Sparrow	-	Potential colonization
Canyon Towhee	Potential	-

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

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