Birds and Climate Change

National Park Service
U.S. Department of the Interior

Nez Perce National Historical Park

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 Nez Perce National Historical Park (hereafter, the Park) 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 Park based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Park 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 Park, 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 Park today, climate suitability in summer under the high-emissions pathway is projected to improve for 11, remain stable for 23 (e.g., Figure 2), and worsen for 43 species. Suitable climate ceases to occur for 33 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 21 species not found at the Park today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 44, remain stable for 13, and worsen for 25 species. Suitable climate ceases to occur for 4 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 30 species not found at the Park today, potentially resulting in local colonization.

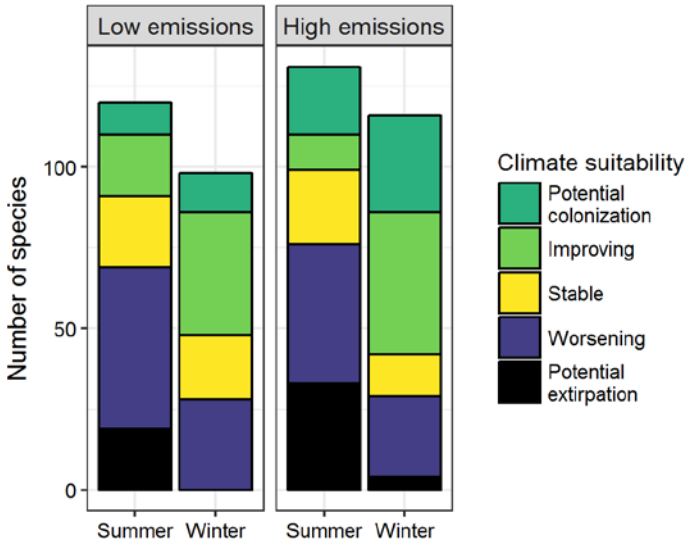

Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.28 in summer (46th percentile across all national parks) and 0.24 in winter (35th percentile) under the high-emissions pathway. Potential species turnover declines to 0.19 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 Park is or may become home to 29 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 Park may serve as an important refuge for 21 of these climate-sensitive species, 8 might be extirpated from the Park in at least one season by 2050.

Figure 2. Climate at the Park 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).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Nez Perce National Historical Park 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 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 21 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

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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 Park based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Park 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	Worsening^	Improving
Eurasian Wigeon	-	Stable
American Wigeon	Potential extirpation^	Improving
Mallard	Worsening^	Improving
Blue-winged Teal	Potential extirpation	-
Cinnamon Teal	x	Potential colonization
Northern Shoveler	Worsening^	-
Northern Pintail	Potential extirpation	-
Green-winged Teal	x	Improving
Canvasback	-	Improving
Redhead	Worsening^	-
Ring-necked Duck	x	Improving
Lesser Scaup	x	Improving

Common Name	Summer Trend	Winter Trend
Bufflehead	-	Stable
Common Goldeneye	-	Worsening
Barrow's Goldeneye	-	Worsening*^
Hooded Merganser	-	Improving^
Common Merganser	x	Worsening
Ruddy Duck	Potential extirpation	Potential colonization
California Quail	Worsening	Worsening*
Gambel's Quail	-	Potential colonization
Northern Bobwhite	Potential colonization	Potential colonization
Chukar	Stable	Worsening
Gray Partridge	Potential extirpation	Worsening*
Ring-necked Pheasant	Worsening	Worsening
Wild Turkey	x	Stable
Pied-billed Grebe	x	Improving
Double-crested Cormorant	-	Improving*

Common Name	Summer Trend	Winter Trend
American White Pelican	-	Potential colonization
Great Blue Heron	Stable	Improving
Great Egret	Potential colonization	-
Black Vulture	-	Potential colonization
Golden Eagle	x	Worsening
Northern Harrier	Worsening^	Improving
Sharp-shinned Hawk	x	Improving
Cooper's Hawk	x	Improving
Bald Eagle	x	Worsening
Swainson's Hawk	Worsening^	-
Red-tailed Hawk	Stable	Improving
Ferruginous Hawk	Worsening^	-
Rough-legged Hawk	-	Worsening
American Coot	x	Improving
Killdeer	Stable	Potential colonization
Greater Yellowlegs	-	Potential colonization
Willet	Potential extirpation^	-
Long-billed Curlew	Worsening^	-
Marbled Godwit	Potential extirpation^	-
Dunlin	-	Potential colonization^
Long-billed Dowitcher	-	Potential colonization
Wilson's Snipe	Potential extirpation	-
Wilson's Phalarope	Potential extirpation^	-
Ring-billed Gull	Worsening^	Improving
California Gull	x	Stable^
Herring Gull	-	Stable^
Rock Pigeon	Stable	Stable
Eurasian Collared-Dove	x	Improving

Common Name	Summer Trend	Winter Trend
Mourning Dove	Improving	Improving
Yellow-billed Cuckoo	Potential colonization	-
Greater Roadrunner	Potential colonization	Potential colonization
Barn Owl	x	Improving
Great Horned Owl	x	Stable
Northern Pygmy-Owl	-	Worsening
Common Nighthawk	Worsening	-
Chimney Swift	Potential colonization	-
Black-chinned Hummingbird	Stable	-
Rufous Hummingbird	Worsening	-
Calliope Hummingbird	Stable	-
Belted Kingfisher	Stable	Improving
Red-naped Sapsucker	Worsening^	-
Ladder-backed Woodpecker	Potential colonization	Potential colonization
Downy Woodpecker	Improving*	Stable
Hairy Woodpecker	-	Stable
Northern Flicker	Worsening*	Improving
American Kestrel	x	Improving
Merlin	-	Stable^
Olive-sided Flycatcher	Potential extirpation	-
Western Wood-Pewee	Worsening*^	-
Willow Flycatcher	Worsening	-
Hammond's Flycatcher	Worsening*	-
Dusky Flycatcher	Worsening*	-
Pacific-slope Flycatcher	Worsening	-
Cordilleran Flycatcher	Worsening	-
Say's Phoebe	Worsening	Improving
Ash-throated Flycatcher	Potential colonization	-
Western Kingbird	Stable	-
Eastern Kingbird	Stable	-

Common Name	Summer Trend	Winter Trend
Loggerhead Shrike	-	Potential colonization
Northern Shrike	-	Worsening*
Bell's Vireo	Potential colonization	-
Warbling Vireo	Worsening	-
Red-eyed Vireo	Stable	-
Steller's Jay	-	Worsening*
Blue Jay	-	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Potential colonization	Potential colonization
Black-billed Magpie	Worsening^	Worsening*
American Crow	Stable	Improving
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	Potential extirpation	-
Northern Rough-winged Swallow	Improving	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Worsening	-
Barn Swallow	Improving	-
Cliff Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Mountain Chickadee	Worsening	Worsening*
Chestnut-backed Chickadee	-	Worsening
Tufted Titmouse	Potential colonization	Potential colonization
Red-breasted Nuthatch	Potential extirpation	Worsening
White-breasted Nuthatch	Potential colonization	Potential colonization
Pygmy Nuthatch	Worsening	Worsening^
Brown Creeper	Potential extirpation^	Improving

Common Name	Summer Trend	Winter Trend
Rock Wren	Worsening	Potential colonization
Canyon Wren	x	Stable
House Wren	Worsening	-
Bewick's Wren	Improving*	Improving
Cactus Wren	Potential colonization	-
Blue-gray Gnatcatcher	Potential colonization	-
American Dipper	-	Worsening*
Golden-crowned Kinglet	Potential extirpation	Improving
Ruby-crowned Kinglet	Potential extirpation	Improving*
Western Bluebird	-	Stable
Mountain Bluebird	Potential extirpation	-
Townsend's Solitaire	-	Worsening*
Swainson's Thrush	Potential extirpation	-
Hermit Thrush	-	Potential colonization
American Robin	Worsening	Improving
Varied Thrush	Potential extirpation^	Worsening
Gray Catbird	Stable	-
Northern Mockingbird	Potential colonization	Potential colonization
European Starling	Stable	Improving
American Pipit	-	Potential colonization
Sprague's Pipit	Potential extirpation^	-
Bohemian Waxwing	-	Potential extirpation
Cedar Waxwing	Potential extirpation	Improving
Chestnut-collared Longspur	-	Potential colonization
MacGillivray's Warbler	Worsening*	-

Common Name	Summer Trend	Winter Trend
Common Yellowthroat	Stable	-
Yellow Warbler	Potential extirpation	-
Yellow-rumped Warbler	Stable	Improving*
Yellow-breasted Chat	Improving	-
Spotted Towhee	Worsening	x
Rufous-winged Sparrow	Potential colonization	-
Chipping Sparrow	Stable	-
Clay-colored Sparrow	Potential extirpation	-
Brewer's Sparrow	Worsening	-
Field Sparrow	Potential colonization	Potential colonization
Vesper Sparrow	Potential extirpation	-
Lark Sparrow	Improving	-
Black-throated Sparrow	-	Potential colonization
Lark Bunting	Worsening	-
Savannah Sparrow	Potential extirpation	Potential colonization
Grasshopper Sparrow	Improving	-
Baird's Sparrow	Potential extirpation^	-
Fox Sparrow	Potential extirpation	Potential colonization
Song Sparrow	Worsening	Improving
Lincoln's Sparrow	Potential extirpation	Potential colonization
White-crowned Sparrow	Potential extirpation	Improving*
Dark-eyed Junco	x	Improving
Western Tanager	Worsening*	-

Common Name	Summer Trend	Winter Trend
Northern Cardinal	Potential colonization	-
Black-headed Grosbeak	Worsening	-
Blue Grosbeak	Potential colonization	-
Lazuli Bunting	Worsening	-
Bobolink	Potential extirpation	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Potential colonization	Potential colonization
Western Meadowlark	Worsening*	Improving
Yellow-headed Blackbird	Worsening	-
Brewer's Blackbird	Worsening*	-
Common Grackle	Improving*	-
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	Potential colonization
Bullock's Oriole	Stable	-
Baltimore Oriole	Stable	-
Gray-crowned Rosy-Finch	-	Worsening^
House Finch	Improving	Improving
Cassin's Finch	Worsening	Worsening*
Red Crossbill	Worsening*^	x
Common Redpoll	-	Potential extirpation
Pine Siskin	Potential extirpation	Worsening
Lesser Goldfinch	Improving	Improving
American Goldfinch	Stable	Improving
Evening Grosbeak	-	Worsening
House Sparrow	x	Improving