



Grant-Kohrs Ranch National Historic Site

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 Grant-Kohrs Ranch National Historic Site (hereafter, the Site) 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.

Results

Climate change is expected to alter the bird community at the Site, 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 Site today, climate suitability in summer under the high-emissions pathway is projected to improve for 14, remain stable for 37 (e.g., Figure 2), and worsen for 15 species. Suitable climate ceases to occur for 11 species in summer, potentially resulting in extirpation of those species from the Site. Climate is projected to become suitable in summer for 14 species not found at the Site today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 33, remain stable for 13, and worsen for 8 species. Suitable climate ceases to occur for 1 species in winter, potentially resulting in extirpation from the Site. Climate is projected to become suitable in winter for 21 species not found at the Site today, potentially resulting in local colonization.

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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Site 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.

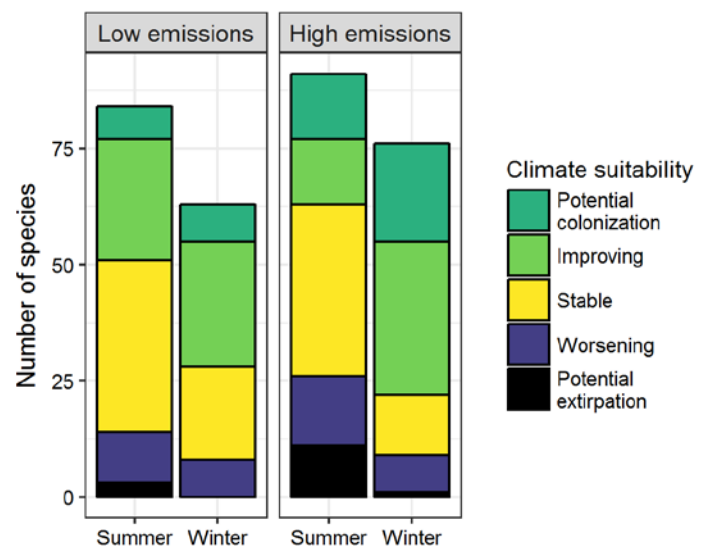


Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Site between the present and 2050 is 0.17 in summer (25th percentile across all national parks) and 0.27 in winter (40th percentile) under the high-emissions pathway. Potential species turnover declines to 0.11 in summer and 0.13 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 Site is or may become home to 16 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). Suitable

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Grant-Kohrs Ranch National Historic Site 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

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

climate is not projected to disappear for these 16 species at the Site; instead the Site may serve as an important refuge for these climate-sensitive species.



Figure 2. Climate at the Site 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).

other stressors. Furthermore, park managers have an opportunity to focus on supporting the 16 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.

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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Site 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	Potential colonization
Gadwall	Worsening [^]	Potential colonization
American Wigeon	Worsening [^]	Improving*
Mallard	Worsening [^]	Improving
Blue-winged Teal	Stable	-
Northern Shoveler	Worsening [^]	Potential colonization
Green-winged Teal	x	Improving
Canvasback	x	Potential colonization
Redhead	Worsening [^]	-
Ring-necked Duck	x	Improving*
Lesser Scaup	x	Potential colonization
Bufflehead	x	Improving
Common Goldeneye	x	Stable
Barrow's Goldeneye	x	Worsening* [^]

Common Name	Summer Trend	Winter Trend
Common Merganser	-	Improving
Ruddy Duck	Stable	-
Scaled Quail	Potential colonization	-
California Quail	-	Potential colonization
Gray Partridge	Stable	Worsening*
Wild Turkey	-	Potential colonization
Eared Grebe	x	Potential colonization
Western Grebe	-	Potential colonization
Great Blue Heron	Improving	Improving
Golden Eagle	x	Worsening
Northern Harrier	Stable [^]	Improving
Sharp-shinned Hawk	-	Improving
Bald Eagle	x	Stable
Swainson's Hawk	Stable [^]	-
Red-tailed Hawk	Stable	Improving*

Common Name	Summer Trend	Winter Trend
Rough-legged Hawk	-	Stable
American Coot	x	Potential colonization
Killdeer	Stable	Improving
Long-billed Curlew	Worsening*^	-
Wilson's Snipe	Worsening*	-
Wilson's Phalarope	Worsening*^	-
Ring-billed Gull	Worsening^	-
Rock Pigeon	Improving	Improving
Eurasian Collared-Dove	x	Improving
Mourning Dove	Improving	Improving*
Western Screech-Owl	-	Potential colonization
Great Horned Owl	x	Improving
Common Nighthawk	Improving*	-
Black-chinned Hummingbird	Potential colonization	-
Rufous Hummingbird	Stable	-
Belted Kingfisher	Stable	Stable
Red-naped Sapsucker	Stable^	-
Downy Woodpecker	Improving	Improving
Hairy Woodpecker	Stable	Improving
Northern Flicker	Stable	Improving
American Kestrel	x	Improving*
Merlin	-	Improving^
Prairie Falcon	x	Stable
Western Wood-Pewee	Stable^	-
Willow Flycatcher	Potential extirpation	-
Least Flycatcher	Stable	-
Gray Flycatcher	Potential colonization	-
Ash-throated Flycatcher	Potential colonization	-
Eastern Kingbird	Stable	-

Common Name	Summer Trend	Winter Trend
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Potential colonization	Potential colonization
Black-billed Magpie	Worsening*^	Worsening
Clark's Nutcracker	-	Worsening*
American Crow	Stable	Improving
Common Raven	Stable	Potential extirpation
Horned Lark	Worsening	Stable
Northern Rough-winged Swallow	Improving*	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Stable	-
Barn Swallow	Improving*	-
Cliff Swallow	Stable	-
Black-capped Chickadee	Improving	Worsening
Mountain Chickadee	Stable	Stable
Bushtit	-	Potential colonization
Red-breasted Nuthatch	Potential extirpation	Stable
White-breasted Nuthatch	-	Potential colonization
Pygmy Nuthatch	Potential colonization	-
Brown Creeper	-	Potential colonization
Canyon Wren	-	Potential colonization
House Wren	Stable	-
Marsh Wren	x	Improving
Golden-crowned Kinglet	Potential extirpation	Improving
Ruby-crowned Kinglet	Potential extirpation	-
Western Bluebird	Potential colonization	-
Mountain Bluebird	Worsening*	Potential colonization
Townsend's Solitaire	Stable^	Stable

Common Name	Summer Trend	Winter Trend
Veery	Potential extirpation	-
Swainson's Thrush	Potential extirpation	-
American Robin	Potential extirpation	Improving
Gray Catbird	Improving	-
European Starling	Stable	Improving
Bohemian Waxwing	-	Worsening*
Cedar Waxwing	Stable	Improving
Common Yellowthroat	Stable	-
Yellow Warbler	Worsening	-
Yellow-rumped Warbler	Stable	-
Grace's Warbler	Potential colonization	-
Black-throated Gray Warbler	Potential colonization	-
Yellow-breasted Chat	Potential colonization	-
Cassin's Sparrow	Potential colonization	-
American Tree Sparrow	-	Stable
Chipping Sparrow	Stable	-
Clay-colored Sparrow	Potential extirpation	-
Vesper Sparrow	Worsening*	-
Black-throated Sparrow	Potential colonization	-
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Potential colonization	-

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