



Grand Teton National 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 Grand Teton National 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.

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 43, remain stable for 44 (e.g., Figure 2), and worsen for 26 species. Suitable climate ceases to occur for 13 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 7 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 26, remain stable for 20, and worsen for 10 species. Suitable climate ceases to occur for 2 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 8 species not found at the Park 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 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.

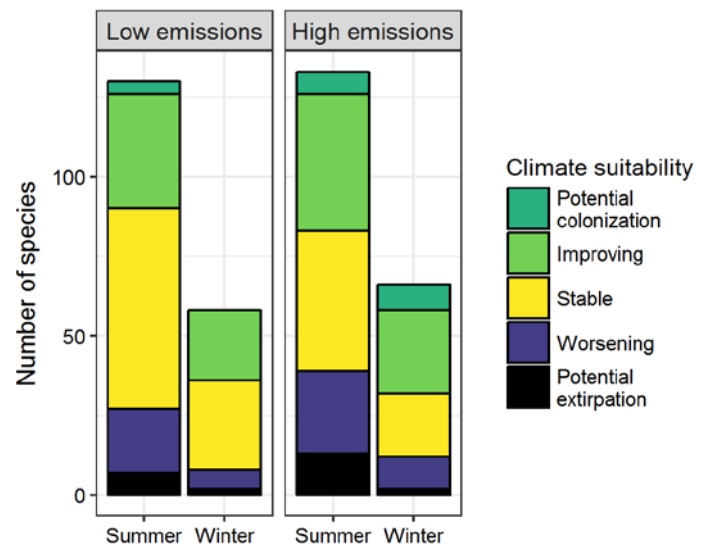


Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.19 in summer (28th percentile across all national parks) and 0.15 in winter (17th percentile) under the high-emissions pathway. Potential species turnover declines to 0.13 in summer and 0.05 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 27 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

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Grand Teton National 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

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

Park may serve as an important refuge for 24 of these climate-sensitive species, 3 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).

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 24 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 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	Stable
Gadwall	Stable [^]	-
American Wigeon	Worsening [^]	Improving
Mallard	Stable [^]	Improving
Blue-winged Teal	Stable	-
Northern Shoveler	Worsening [^]	-
Northern Pintail	Potential extirpation	-
Green-winged Teal	x	Stable
Redhead	Worsening [^]	-
Ring-necked Duck	x	Improving
Bufflehead	x	Stable
Common Goldeneye	-	Stable
Barrow's Goldeneye	x	Worsening* [^]
Hooded Merganser	x	Improving [^]
Common Merganser	x	Stable
Ruddy Duck	Stable	-
Ring-necked Pheasant	Potential	-

Common Name	Summer Trend	Winter Trend
	colonization	
Ruffed Grouse	x	Improving
Greater Sage-Grouse	x	Worsening [^]
Sharp-tailed Grouse	Potential extirpation [^]	-
Wild Turkey	x	Potential colonization
Common Loon	Potential extirpation	-
Red-necked Grebe	Potential extirpation	-
Eared Grebe	x	Potential colonization
American Bittern	Improving	-
Great Blue Heron	Improving	-
Golden Eagle	x	Worsening*
Northern Harrier	Stable [^]	Improving
Northern Goshawk	x	Improving
Bald Eagle	x	Stable
Swainson's Hawk	Worsening [^]	-

Common Name	Summer Trend	Winter Trend
Red-tailed Hawk	Stable	Improving*
Ferruginous Hawk	Potential extirpation^	-
Rough-legged Hawk	-	Stable
Killdeer	Stable	-
Greater Yellowlegs	Potential extirpation	-
Willet	Potential extirpation^	-
Long-billed Curlew	Worsening^	-
Wilson's Snipe	Worsening	Improving
Wilson's Phalarope	Worsening^	-
Franklin's Gull	Potential extirpation	-
Ring-billed Gull	Stable^	-
Rock Pigeon	Improving	-
Eurasian Collared-Dove	x	Stable
Mourning Dove	Improving*	Improving*
Great Horned Owl	x	Stable
Common Nighthawk	Improving	-
Black-chinned Hummingbird	Improving	-
Broad-tailed Hummingbird	Stable	-
Rufous Hummingbird	Improving	-
Calliope Hummingbird	Stable	-
Belted Kingfisher	Improving	Stable
Red-naped Sapsucker	Stable^	-
Downy Woodpecker	Improving	Improving
Hairy Woodpecker	Improving	Improving
Northern Flicker	Stable	Improving*
Pileated Woodpecker	Potential colonization	-
Olive-sided Flycatcher	Stable	-
Western Wood-Pewee	Stable^	-
Willow Flycatcher	Stable	-
Least Flycatcher	Stable	-
Hammond's Flycatcher	Stable	-

Common Name	Summer Trend	Winter Trend
Dusky Flycatcher	Stable	-
Cordilleran Flycatcher	Improving*	-
Say's Phoebe	Potential extirpation	-
Ash-throated Flycatcher	Potential colonization	-
Western Kingbird	Stable	-
Eastern Kingbird	Improving	-
Loggerhead Shrike	Improving	-
Northern Shrike	-	Improving
Warbling Vireo	Worsening	-
Gray Jay	Worsening	Worsening*
Pinyon Jay	Improving	-
Steller's Jay	Stable	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Potential colonization	Potential colonization
Black-billed Magpie	Stable^	Worsening*
Clark's Nutcracker	Worsening**^	Worsening*
American Crow	Improving*	Improving
Common Raven	Stable	Stable
Horned Lark	Potential extirpation	Stable
Northern Rough-winged Swallow	Improving*	-
Tree Swallow	Improving	-
Violet-green Swallow	Stable	-
Barn Swallow	Improving	-
Cliff Swallow	Worsening	-
Black-capped Chickadee	Improving*	Worsening
Mountain Chickadee	Worsening*	Worsening
Oak/Juniper Titmouse (Plain Titmouse)	-	Potential colonization
Bushtit	-	Potential colonization
Red-breasted Nuthatch	Improving	Stable
White-breasted Nuthatch	Improving*	Improving
Brown Creeper	Improving^	Improving

Common Name	Summer Trend	Winter Trend	Common Name	Summer Trend	Winter Trend
Rock Wren	Worsening	-	Townsend's Warbler	Stable	-
House Wren	Improving	-	Wilson's Warbler	Worsening*	-
Marsh Wren	x	Stable	Yellow-breasted Chat	Improving	-
Bewick's Wren	-	Potential colonization	Green-tailed Towhee	Stable^	-
Blue-gray Gnatcatcher	Improving	-	Spotted Towhee	Improving*	-
American Dipper	x	Stable	Chipping Sparrow	Improving*	-
Golden-crowned Kinglet	Stable	-	Clay-colored Sparrow	Stable	-
Ruby-crowned Kinglet	Worsening*	-	Brewer's Sparrow	Worsening*	-
Western Bluebird	-	Potential colonization	Vesper Sparrow	Worsening*	-
Mountain Bluebird	Worsening*	-	Lark Sparrow	Improving	-
Townsend's Solitaire	Worsening*^	Stable	Sagebrush/Bell's Sparrow (Sage Sparrow)	Stable^	-
Veery	Improving	-	Lark Bunting	Potential extirpation	-
Swainson's Thrush	Stable	-	Savannah Sparrow	Stable	-
Hermit Thrush	Stable	-	Fox Sparrow	Stable	-
American Robin	Worsening	Improving*	Song Sparrow	Improving	Improving*
Gray Catbird	Improving	-	Lincoln's Sparrow	Worsening*	-
Sage Thrasher	Worsening	-	White-crowned Sparrow	Worsening*	Stable
European Starling	Improving*	-	Dark-eyed Junco	x	Improving
American Pipit	Potential extirpation	-	Western Tanager	Stable	-
Cedar Waxwing	Improving	Improving*	Black-headed Grosbeak	Improving*	-
Snow Bunting	-	Potential extirpation	Lazuli Bunting	Improving*	-
Northern Waterthrush	Improving	-	Red-winged Blackbird	Stable	Improving
Orange-crowned Warbler	Stable	-	Western Meadowlark	Worsening*	-
Nashville Warbler	Potential colonization	-	Yellow-headed Blackbird	Stable	-
MacGillivray's Warbler	Stable	-	Brewer's Blackbird	Stable	-
Common Yellowthroat	Improving	-	Common Grackle	Stable	-
American Redstart	Improving	-	Brown-headed Cowbird	Stable	-
Yellow Warbler	Stable	-	Bullock's Oriole	Improving	-
Yellow-rumped Warbler	Stable	-	Black Rosy-Finch	x	Stable^
Grace's Warbler	Potential colonization	-	Pine Grosbeak	Worsening^	Worsening*
Black-throated Gray Warbler	Improving	-	House Finch	Improving	-
			Cassin's Finch	Stable	Stable
			Red Crossbill	Worsening*^	x

Common Name	Summer Trend	Winter Trend
White-winged Crossbill	Potential extirpation	Potential extirpation
Common Redpoll	-	Worsening*
Pine Siskin	Stable	Improving
Lesser Goldfinch	Potential	Potential

Common Name	Summer Trend	Winter Trend
	colonization	colonization
American Goldfinch	Improving*	Improving
Evening Grosbeak	Improving	Improving
House Sparrow	x	Improving