

Black Canyon of the Gunnison 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 Black Canyon of the Gunnison 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 16, remain stable for 36, and worsen for 24 species. Suitable climate ceases to occur for 15 species in summer, potentially resulting in extirpation of those species from the Park (e.g., Figure 2). Climate is projected to become suitable in summer for 11 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 5, 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 55 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.

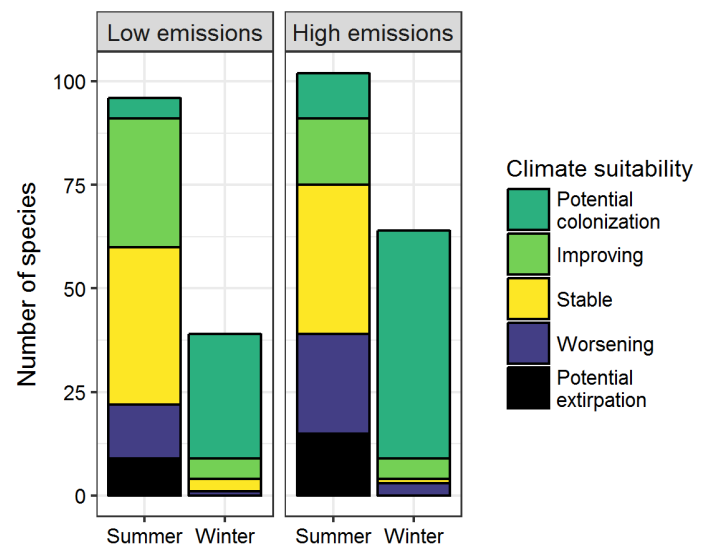


Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.18 in summer (26th percentile across all national parks) and 0.31 in winter (48th percentile) under the high-emissions pathway. Potential species turnover declines to 0.11 in summer and 0.19 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 12 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 11 of these

climate-sensitive species, one, the Pine Grosbeak (*Pinicola enucleator*), might be extirpated from the Park in summer by 2050.



Figure 2. Although currently found at the Park, suitable climate for the American Robin (*Turdus migratorius*) 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, Black Canyon of the Gunnison 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 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 11 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.

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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
Wood Duck	-	Potential colonization
Gadwall	-	Potential colonization
Mallard	Worsening [^]	-
Cinnamon Teal	-	Potential colonization
Northern Shoveler	-	Potential colonization
Canvasback	-	Potential colonization
Lesser Scaup	-	Potential colonization
Bufflehead	-	Potential colonization
Hooded Merganser	-	Potential colonization [^]

Common Name	Summer Trend	Winter Trend
Ruddy Duck	-	Potential colonization
Scaled Quail	-	Potential colonization
Chukar	Stable	-
Pied-billed Grebe	-	Potential colonization
Eared Grebe	-	Potential colonization
Western Grebe	-	Potential colonization
Clark's Grebe	-	Potential colonization
American White Pelican	-	Potential colonization
Great Blue Heron	Stable	Potential colonization

Common Name	Summer Trend	Winter Trend
Black-crowned Night-Heron	-	Potential colonization
Northern Harrier	Worsening [^]	-
Sharp-shinned Hawk	x	Potential colonization
Cooper's Hawk	x	Potential colonization
Harris's Hawk	Potential colonization	-
Swainson's Hawk	Stable [^]	-
Red-tailed Hawk	Stable	Potential colonization
American Coot	-	Potential colonization
Killdeer	-	Potential colonization
Rock Pigeon	Stable	-
White-winged Dove	-	Potential colonization
Mourning Dove	Improving	Improving*
Inca Dove	-	Potential colonization
Greater Roadrunner	-	Potential colonization
Barn Owl	-	Potential colonization
Great Horned Owl	x	Potential colonization
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Stable	-
Black-chinned Hummingbird	Improving*	-
Broad-tailed Hummingbird	Stable	-
Gila Woodpecker	-	Potential colonization
Red-naped Sapsucker	Worsening [^]	-
Ladder-backed Woodpecker	Potential colonization	Potential colonization
Downy Woodpecker	Stable	-

Common Name	Summer Trend	Winter Trend
Hairy Woodpecker	Stable	-
Northern Flicker	Worsening	Improving
American Kestrel	x	Potential colonization
Olive-sided Flycatcher	Potential extirpation	-
Western Wood-Pewee	Worsening [^]	-
Hammond's Flycatcher	Potential extirpation	-
Gray Flycatcher	Stable	-
Dusky Flycatcher	Worsening*	-
Cordilleran Flycatcher	Stable	-
Black Phoebe	-	Potential colonization
Say's Phoebe	Improving	-
Ash-throated Flycatcher	Improving*	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Improving*	-
Warbling Vireo	Worsening	-
Pinyon Jay	Improving	-
Steller's Jay	Stable	Worsening*
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Improving*	Improving
Black-billed Magpie	Worsening**	Worsening*
Clark's Nutcracker	Stable [^]	Worsening*
American Crow	Stable	-
Chihuahuan Raven	Potential colonization	-
Common Raven	Stable	Stable
Northern Rough-winged Swallow	Stable	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Worsening	-
Barn Swallow	Improving	-

Common Name	Summer Trend	Winter Trend
Cliff Swallow	Worsening	-
Black-capped Chickadee	Stable	-
Mountain Chickadee	Stable	-
Juniper Titmouse	Stable	-
Verdin	-	Potential colonization
Bushtit	Improving	-
Red-breasted Nuthatch	Potential extirpation	-
White-breasted Nuthatch	Improving	-
Rock Wren	Stable	Potential colonization
House Wren	Worsening	-
Marsh Wren	-	Potential colonization
Bewick's Wren	Improving	-
Cactus Wren	Potential colonization	-
Blue-gray Gnatcatcher	Stable	Potential colonization
Ruby-crowned Kinglet	Potential extirpation	Potential colonization
Western Bluebird	Stable	-
Mountain Bluebird	Worsening	-
Townsend's Solitaire	Worsening	-
Swainson's Thrush	Potential extirpation	-
Hermit Thrush	Stable	-
American Robin	Potential extirpation	Improving
Gray Catbird	Stable	-
Curve-billed Thrasher	Potential colonization	Potential colonization
LeConte's Thrasher	Potential colonization	-
Crisal Thrasher	-	Potential colonization
Sage Thrasher	Worsening	-

Common Name	Summer Trend	Winter Trend
Northern Mockingbird	Improving*	Improving
European Starling	Stable	Potential colonization
American Pipit	-	Potential colonization
Chestnut-collared Longspur	-	Potential colonization
Orange-crowned Warbler	Worsening	-
MacGillivray's Warbler	Worsening	-
Common Yellowthroat	Stable	-
Yellow Warbler	Potential extirpation	-
Yellow-rumped Warbler	Stable	Potential colonization
Black-throated Gray Warbler	Stable	-
Wilson's Warbler	Potential extirpation	-
Yellow-breasted Chat	Stable	-
Green-tailed Towhee	Worsening**	Potential colonization
Spotted Towhee	Stable	-
Rufous-crowned Sparrow	-	Potential colonization
Canyon Towhee	-	Potential colonization
Abert's Towhee	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
Chipping Sparrow	Stable	-
Brewer's Sparrow	Worsening*	Potential colonization
Vesper Sparrow	Worsening*	-
Lark Sparrow	Improving*	-
Black-throated Sparrow	-	Potential colonization
Lark Bunting	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Savannah Sparrow	Potential extirpation	-
Song Sparrow	Potential extirpation	Potential colonization
White-crowned Sparrow	-	Potential colonization
Western Tanager	Stable	-
Pyrrhuloxia	-	Potential colonization
Black-headed Grosbeak	Stable	-
Blue Grosbeak	Potential colonization	-
Lazuli Bunting	Worsening	-
Red-winged Blackbird	Stable	-
Western Meadowlark	Worsening	-
Brewer's Blackbird	Worsening*	-
Common Grackle	Stable	-
Great-tailed Grackle	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Brown-headed Cowbird	Potential extirpation	-
Bullock's Oriole	Improving	-
Pine Grosbeak	Potential extirpation [^]	-
House Finch	Improving*	Potential colonization
Cassin's Finch	Worsening	-
Red Crossbill	Worsening [^]	-
Pine Siskin	Potential extirpation	-
Lesser Goldfinch	Improving*	-
American Goldfinch	Stable	Potential colonization
Evening Grosbeak	Potential extirpation	-
House Sparrow	x	Potential colonization