Birds and Climate Change

National Park Service
U.S. Department of the Interior

Chiricahua 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 Chiricahua 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 26, remain stable for 26 (e.g., Figure 2), and worsen for 12 species. Suitable climate ceases to occur for 20 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 19 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 26, remain stable for 19, and worsen for 16 species. Suitable climate ceases to occur for 5 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 45 species not found at the Monument today, potentially resulting in local colonization.

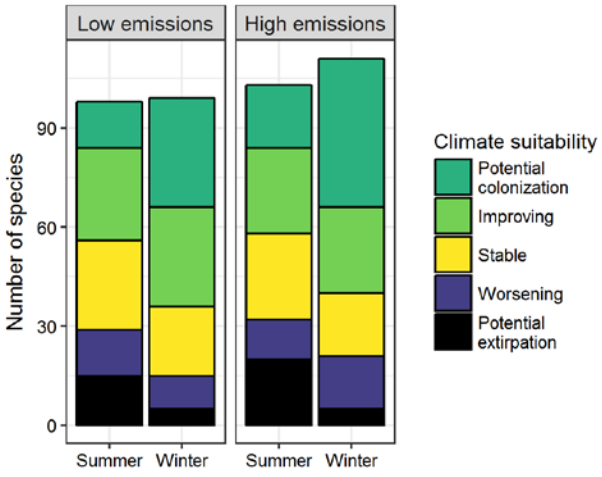

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.22 in summer (35th percentile across all national parks) and 0.16 in winter (19th percentile) under the high-emissions pathway. Potential species turnover declines to 0.17 in summer and 0.11 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 9 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 8 of these climate-sensitive species, one, the Brown Creeper (*Certhia americana*), might be extirpated from the Monument in summer by 2050.

Figure 2. Climate at the Monument in summer is projected to remain suitable for the Mourning Dove (*Zenaida macroura*) through 2050. Photo by KS Black/Flickr (Public Domain).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Chiricahua National Monument falls within the intermediate change group.** Parks anticipating intermediate 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 8 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
Black-bellied Whistling-Duck	Potential colonization	-
Wood Duck	-	Potential colonization
Blue-winged Teal	-	Potential colonization
Lesser Scaup	-	Potential colonization
Bufflehead	-	Potential colonization
Scaled Quail	Worsening*	-
Gambel's Quail	Improving*	Improving
Northern Bobwhite	Potential colonization	Potential colonization
Montezuma Quail	x	Improving
Wild Turkey	x	Stable
Pied-billed Grebe	-	Potential colonization
Wood Stork	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Neotropic Cormorant	-	Potential colonization
Anhinga	Potential colonization^	-
Great Egret	-	Potential colonization
Snowy Egret	-	Potential colonization
Cattle Egret	Potential colonization	Potential colonization
Green Heron	-	Potential colonization
Yellow-crowned Night-Heron	Potential colonization	-
Black Vulture	Potential colonization	Potential colonization
Turkey Vulture	x	Potential colonization
Osprey	-	Potential colonization
White-tailed Kite	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Golden Eagle	x	Worsening*
Mississippi Kite	Potential colonization	-
Northern Harrier	-	Improving
Cooper's Hawk	x	Improving
Northern Goshawk	x	Potential extirpation
Swainson's Hawk	Stable^	-
Red-tailed Hawk	Improving	Stable
Ferruginous Hawk	-	Stable
Limpkin	-	Potential colonization
American Avocet	-	Potential colonization^
Greater Yellowlegs	-	Potential colonization
Lesser Yellowlegs	-	Potential colonization
Dunlin	-	Potential colonization^
Western Sandpiper	-	Potential colonization
Gull-billed Tern	-	Potential colonization
Band-tailed Pigeon	Worsening	-
White-winged Dove	Improving	-
Mourning Dove	Stable	Improving
Inca Dove	Improving	-
Common Ground-Dove	Potential colonization	Potential colonization
Greater Roadrunner	Improving	Improving
Great Horned Owl	-	Stable
Lesser Nighthawk	Improving*	-
White-throated Swift	x	Improving
Black-chinned Hummingbird	Improving	-
Costa's Hummingbird	-	Potential colonization
Broad-tailed Hummingbird	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Belted Kingfisher	-	Potential colonization
Green Kingfisher	-	Potential colonization
Acorn Woodpecker	Stable	Stable
Gila Woodpecker	Improving*	-
Golden-fronted Woodpecker	Potential colonization	-
Red-naped Sapsucker	-	Worsening*
Ladder-backed Woodpecker	Improving	Improving
Hairy Woodpecker	Potential extirpation	Potential extirpation
Arizona Woodpecker	x	Improving
Red-cockaded Woodpecker	-	Potential colonization
Northern Flicker	Worsening	Worsening
Gilded Flicker	Potential colonization	-
Crested Caracara	-	Potential colonization
American Kestrel	x	Improving
Merlin	-	Improving^
Peregrine Falcon	-	Potential colonization
Northern Beardless-Tyrannulet	Potential colonization	-
Western Wood-Pewee	Worsening*^	-
Cordilleran Flycatcher	Worsening	-
Black Phoebe	Improving	-
Eastern Phoebe	-	Potential colonization
Say's Phoebe	Stable	Improving
Vermilion Flycatcher	Improving*	-
Ash-throated Flycatcher	Stable	-
Brown-crested Flycatcher	Improving*	-
Cassin's Kingbird	Stable	Potential colonization
Western Kingbird	Improving	-
Loggerhead Shrike	Worsening*	Stable

Common Name	Summer Trend	Winter Trend
Hutton's Vireo	Stable^	Improving
Warbling Vireo	Potential extirpation	-
Steller's Jay	Potential extirpation	Worsening*
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Potential extirpation	Worsening*
Mexican Jay	x	Improving
Chihuahuan Raven	Stable	Stable
Common Raven	Potential extirpation	Worsening*
Horned Lark	Potential extirpation	-
Northern Rough-winged Swallow	Potential colonization	-
Purple Martin	Potential colonization	-
Tree Swallow	-	Potential colonization
Violet-green Swallow	Potential extirpation	Potential colonization
Barn Swallow	Stable	-
Cave Swallow	Potential colonization	-
Carolina Chickadee	-	Potential colonization
Bridled Titmouse	Improving	Stable
Juniper Titmouse	Potential extirpation	Worsening*
Black-crested Titmouse	Potential colonization	-
Verdin	-	Improving
Bushtit	Worsening	Worsening*
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Stable	Stable
Pygmy Nuthatch	Worsening	Worsening*^
Brown Creeper	Potential extirpation^	Stable
Rock Wren	Stable	Stable

Common Name	Summer Trend	Winter Trend
Canyon Wren	x	Worsening
House Wren	Potential extirpation	Improving*
Bewick's Wren	Improving	Worsening
Cactus Wren	Stable	Stable
Blue-gray Gnatcatcher	Stable	-
Black-tailed Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Improving
Eastern Bluebird	-	Stable
Western Bluebird	Potential extirpation	Worsening*
Hermit Thrush	Potential extirpation	Stable
American Robin	Stable	Potential extirpation
Curve-billed Thrasher	Stable	-
Long-billed Thrasher	-	Potential colonization
Northern Mockingbird	Stable	Improving
Phainopepla	Improving*	-
Black-and-white Warbler	-	Potential colonization
Swainson's Warbler	Potential colonization	-
Orange-crowned Warbler	-	Potential colonization
Common Yellowthroat	-	Potential colonization
Yellow Warbler	Stable	-
Yellow-rumped Warbler	Stable	Improving
Grace's Warbler	Potential extirpation	-
Black-throated Gray Warbler	Potential extirpation	Potential colonization
Townsend's Warbler	-	Improving
Red-faced Warbler	Potential extirpation	-
Spotted Towhee	Worsening*	x

Common Name	Summer Trend	Winter Trend
Rufous-crowned Sparrow	x	Worsening
Canyon Towhee	Stable	Stable
Abert's Towhee	Improving*	-
Cassin's Sparrow	Worsening*	-
Bachman's Sparrow	Potential colonization	Potential colonization
Chipping Sparrow	Potential extirpation	Improving
Brewer's Sparrow	-	Stable
Vesper Sparrow	-	Improving*
Lark Sparrow	Worsening*	-
Black-throated Sparrow	Stable	-
Lark Bunting	-	Worsening
Grasshopper Sparrow	-	Potential colonization
Henslow's Sparrow	-	Potential colonization
Lincoln's Sparrow	-	Improving
Swamp Sparrow	-	Potential colonization
White-crowned Sparrow	-	Stable
Dark-eyed Junco	-	Worsening
Hepatic Tanager	Worsening*	-

Common Name	Summer Trend	Winter Trend
Summer Tanager	Improving*	-
Western Tanager	Potential extirpation	-
Northern Cardinal	Improving*	Potential colonization
Pyrrhuloxia	Stable	-
Black-headed Grosbeak	Stable	-
Blue Grosbeak	Improving	-
Painted Bunting	Potential colonization	-
Eastern Meadowlark	Stable	Improving
Western Meadowlark	-	Improving
Great-tailed Grackle	Improving	-
Bronzed Cowbird	Improving	Potential colonization
Brown-headed Cowbird	Improving	Improving*
Hooded Oriole	Improving*	-
Bullock's Oriole	Improving	-
Scott's Oriole	Stable	-
House Finch	Stable	Worsening
Pine Siskin	Potential extirpation	Potential extirpation
Lesser Goldfinch	Stable	Stable