



Coronado National Memorial

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 Coronado National Memorial (hereafter, the Memorial) 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 Memorial, 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 Memorial today, climate suitability in summer under the high-emissions pathway is projected to improve for 23, remain stable for 23 (e.g., Figure 2), and worsen for 13 species. Suitable climate ceases to occur for 10 species in summer, potentially resulting in extirpation of those species from the Memorial. Climate is projected to become suitable in summer for 25 species not found at the Memorial today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 20, remain stable for 30, and worsen for 9 species. Suitable climate ceases to occur for 5 species in winter, potentially resulting in extirpation from the Memorial. Climate is projected to become suitable in winter for 52 species not found at the Memorial 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 Memorial based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Memorial 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.

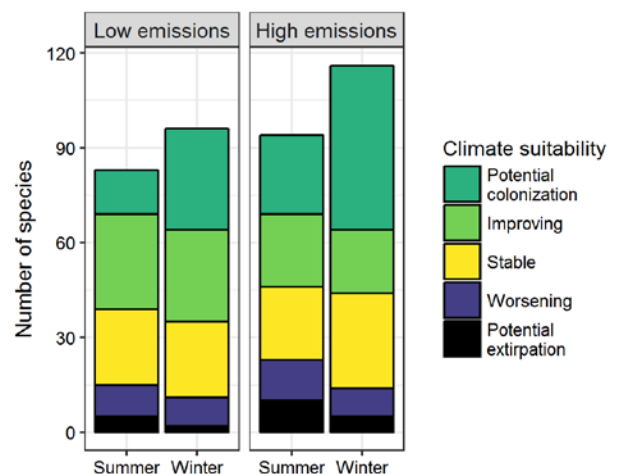


Figure 1. Projected changes in climate suitability for birds at the Memorial, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Memorial between the present and 2050 is 0.21 in summer (33rd percentile across all national parks) and 0.18 in winter (24th percentile) under the high-emissions pathway. Potential species turnover declines to 0.16 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 Memorial is or may become home to 10 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 climate is not projected to disappear for these 10 species at the Memorial; instead the Memorial may serve as an important refuge for these climate-sensitive species.



Figure 2. Climate at the Memorial 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, Coronado National Memorial 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 10 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 Memorial based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Memorial 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	-
Fulvous Whistling-Duck	Potential colonization	-
Wood Duck	-	Potential colonization
Mottled Duck	Potential colonization	-
Blue-winged Teal	-	Potential colonization
Bufflehead	-	Potential colonization
Scaled Quail	Worsening*	-
Gambel's Quail	Improving	Improving
Northern Bobwhite	Potential colonization	Potential colonization
Montezuma Quail	x	Stable
Least Grebe	-	Potential colonization
Pied-billed Grebe	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Wood Stork	Potential colonization	-
Anhinga	Potential colonization^	Potential colonization
American Bittern	-	Potential colonization^
Great Egret	Potential colonization	Potential colonization
Tricolored Heron	Potential colonization^	-
Reddish Egret	-	Potential colonization
Cattle Egret	Potential colonization	Potential colonization
Black-crowned Night-Heron	-	Potential colonization
Yellow-crowned Night-Heron	Potential colonization	-
White Ibis	Potential colonization	-
White-faced Ibis	-	Potential colonization^

Common Name	Summer Trend	Winter Trend
Roseate Spoonbill	-	Potential colonization
Black Vulture	Potential colonization	Potential colonization
Turkey Vulture	x	Improving*
Osprey	-	Potential colonization
White-tailed Kite	Potential colonization	-
Mississippi Kite	Potential colonization	-
Northern Harrier	-	Stable
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	x	Stable
White-tailed Hawk	-	Potential colonization
Swainson's Hawk	Worsening*^	-
Red-tailed Hawk	Stable	Stable
Limpkin	-	Potential colonization
Black-necked Stilt	-	Potential colonization
American Avocet	-	Potential colonization^
Snowy Plover	-	Potential colonization
Lesser Yellowlegs	-	Potential colonization
Stilt Sandpiper	-	Potential colonization
Dunlin	-	Potential colonization^
Western Sandpiper	-	Potential colonization
Gull-billed Tern	-	Potential colonization
Forster's Tern	-	Potential colonization
Band-tailed Pigeon	Potential extirpation	-
Eurasian Collared-Dove	x	Stable

Common Name	Summer Trend	Winter Trend
White-winged Dove	Improving	-
Mourning Dove	Stable	Improving
Common Ground-Dove	Improving*	-
White-tipped Dove	-	Potential colonization
Yellow-billed Cuckoo	Improving	-
Greater Roadrunner	Improving	Stable
Groove-billed Ani	-	Potential colonization
Northern Pygmy-Owl	x	Potential colonization
Common Nighthawk	Worsening*	-
Common Pauraque	-	Potential colonization
White-throated Swift	x	Stable
Black-chinned Hummingbird	Improving*	-
Anna's Hummingbird	Stable	Improving*
Costa's Hummingbird	Improving	-
Broad-tailed Hummingbird	Potential extirpation	-
Rufous Hummingbird	Stable	-
Buff-bellied Hummingbird	-	Potential colonization
Acorn Woodpecker	Stable	Stable
Gila Woodpecker	Improving*	Improving*
Golden-fronted Woodpecker	-	Potential colonization
Red-naped Sapsucker	-	Stable
Ladder-backed Woodpecker	Improving	Stable
Arizona Woodpecker	x	Improving*
Red-cockaded Woodpecker	-	Potential colonization
Northern Flicker	Potential extirpation	Worsening
Gilded Flicker	Potential colonization	-
Crested Caracara	Potential colonization	Potential colonization
American Kestrel	x	Improving

Common Name	Summer Trend	Winter Trend
Peregrine Falcon	-	Potential colonization
Prairie Falcon	-	Worsening
Western Wood-Pewee	Worsening [^]	-
Gray Flycatcher	-	Stable
Black Phoebe	Improving	Improving
Eastern Phoebe	-	Potential colonization
Say's Phoebe	Stable	Improving
Ash-throated Flycatcher	Stable	-
Brown-crested Flycatcher	Improving*	-
Cassin's Kingbird	Worsening*	-
Western Kingbird	Worsening	-
Loggerhead Shrike	Worsening*	Stable
White-eyed Vireo	Potential colonization	Potential colonization
Hutton's Vireo	Stable [^]	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Stable	-
Mexican Jay	x	Improving*
Chihuahuan Raven	Worsening*	Stable
Common Raven	Stable	Potential extirpation
Horned Lark	-	Potential extirpation
Northern Rough-winged Swallow	Potential colonization	Potential colonization
Purple Martin	Potential colonization	-
Tree Swallow	-	Potential colonization
Violet-green Swallow	Potential extirpation	Potential colonization
Barn Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization
Bridled Titmouse	Stable	Improving
Verdin	Improving*	Stable

Common Name	Summer Trend	Winter Trend
Bushtit	Stable	Stable
White-breasted Nuthatch	Potential extirpation	Potential extirpation
Rock Wren	Improving	Stable
Canyon Wren	x	Stable
House Wren	-	Improving*
Bewick's Wren	Improving*	Stable
Cactus Wren	Stable	Worsening*
Blue-gray Gnatcatcher	Stable	-
Black-tailed Gnatcatcher	Improving*	-
Ruby-crowned Kinglet	-	Improving
Western Bluebird	-	Worsening*
Hermit Thrush	-	Stable
American Robin	Potential extirpation	-
Curve-billed Thrasher	Stable	Stable
Long-billed Thrasher	Potential colonization [^]	Potential colonization
LeConte's Thrasher	-	Potential colonization
Crissal Thrasher	Improving	Stable
Northern Mockingbird	Stable	Improving
Phainopepla	Improving	Stable
Black-and-white Warbler	-	Potential colonization
Swainson's Warbler	Potential colonization	-
Nashville Warbler	Potential extirpation	-
Northern Parula	-	Potential colonization
Yellow-rumped Warbler	-	Improving
Black-throated Gray Warbler	Potential extirpation	-
Wilson's Warbler	-	Potential colonization
Olive Sparrow	Potential colonization	-
Spotted Towhee	Worsening	x

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

Common Name	Summer Trend	Winter Trend
Northern Cardinal	Potential colonization	-
Pyrrhuloxia	-	Stable
Black-headed Grosbeak	Stable	-
Blue Grosbeak	Improving	-
Indigo Bunting	-	Potential colonization
Eastern Meadowlark	Worsening*	Worsening*
Great-tailed Grackle	Improving	-
Bronzed Cowbird	Stable	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
Lesser Goldfinch	Improving	Stable
House Sparrow	x	Worsening