



Mojave National Preserve

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 Mojave National Preserve (hereafter, the Preserve) 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 Preserve, with climate suitability projected to improve for some species and worsen for others (Figure 1). Among the species likely to be found at the Preserve today, climate suitability in summer under the high-emissions pathway is projected to improve for 36, remain stable for 35, and worsen for 1 species. Suitable climate ceases to occur for 29 species in summer, potentially resulting in extirpation of those species from the Preserve (e.g., Figure 2). Climate is projected to become suitable in summer for 8 species not found at the Preserve today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 26, remain stable for 26, and worsen for 25 species. Suitable climate ceases to occur for 10 species in winter, potentially resulting in extirpation from the Preserve. Climate is projected to become suitable in winter for 35 species not found at the Preserve 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Preserve 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.

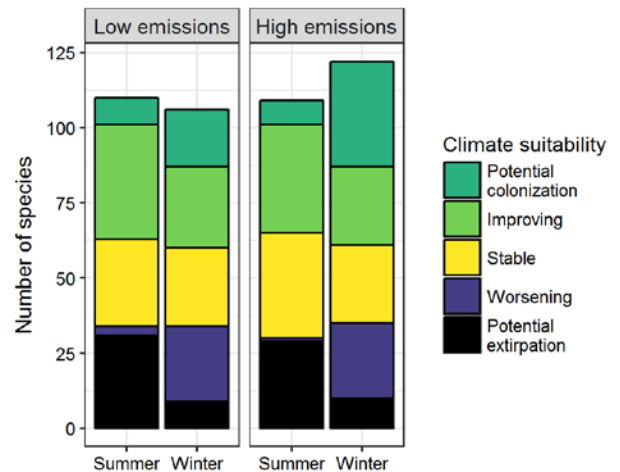


Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.13 in summer (17th percentile across all national parks) and 0.12 in winter (12th percentile) under the high-emissions pathway. Potential species turnover increases to 0.14 in summer and declines to 0.08 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 Preserve 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

Management Implications

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

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.



Figure 2. Although currently found at the Preserve, suitable climate for the Violet-green Swallow (*Tachycineta thalassina*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation. Photo by Becky Matsubara/Flickr (CC BY 2.0).

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.

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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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Preserve 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	-	Potential extirpation
Muscovy Duck	-	Potential colonization
Gadwall	-	Worsening
American Wigeon	-	Worsening
Mallard	Stable^	Potential extirpation
Blue-winged Teal	Potential extirpation	-
Cinnamon Teal	x	Stable
Northern Shoveler	-	Stable
Green-winged Teal	-	Stable
Ring-necked Duck	-	Stable
Lesser Scaup	-	Worsening
Long-tailed Duck	-	Potential colonization
Red-breasted Merganser	-	Potential colonization^
Ruddy Duck	Stable	Stable

Common Name	Summer Trend	Winter Trend
Gambel's Quail	Improving*	Improving*
Chukar	Potential extirpation	Potential extirpation
Pied-billed Grebe	-	Worsening
Magnificent Frigatebird	-	Potential colonization
Brown Pelican	Potential colonization	Potential colonization^
Great Blue Heron	Stable	Worsening
Great Egret	Potential extirpation	-
Reddish Egret	-	Potential colonization
White Ibis	-	Potential colonization
Turkey Vulture	x	Potential colonization
Golden Eagle	x	Worsening
Northern Harrier	-	Worsening
Sharp-shinned Hawk	-	Worsening

Common Name	Summer Trend	Winter Trend
Cooper's Hawk	x	Worsening
Harris's Hawk	-	Potential colonization
Red-tailed Hawk	Stable	Stable
American Coot	x	Worsening
Limpkin	-	Potential colonization
Black-necked Stilt	x	Potential colonization
Snowy Plover	-	Potential colonization
Wilson's Plover	-	Potential colonization
Semipalmated Plover	-	Potential colonization [^]
Killdeer	Stable	Worsening
Wandering Tattler	-	Potential colonization
Whimbrel	-	Potential colonization
Marbled Godwit	-	Potential colonization
Short-billed Dowitcher	-	Potential colonization [^]
Wilson's Phalarope	Improving [^]	-
Ring-billed Gull	Potential extirpation [^]	-
Royal Tern	-	Potential colonization [^]
Sandwich Tern	-	Potential colonization [^]
Black Skimmer	-	Potential colonization [^]
Rock Pigeon	Potential extirpation	Stable
Band-tailed Pigeon	Stable	-
Eurasian Collared-Dove	x	Improving
White-winged Dove	Improving*	-
Mourning Dove	Improving	Stable
White-tipped Dove	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Greater Roadrunner	Improving*	Improving
Great Horned Owl	x	Worsening*
Lesser Nighthawk	Improving*	Potential colonization
White-throated Swift	x	Improving
Anna's Hummingbird	Stable	-
Costa's Hummingbird	Stable	Improving*
Broad-tailed Hummingbird	Improving	-
Allen's Hummingbird	-	Potential colonization
Lewis's Woodpecker	-	Stable
Yellow-bellied Sapsucker	-	Improving
Red-naped Sapsucker	-	Improving*
Ladder-backed Woodpecker	Improving*	Improving*
Northern Flicker	Potential extirpation	Worsening
Gilded Flicker	Improving	Improving
American Kestrel	x	Worsening
Prairie Falcon	x	Worsening*
Northern Beardless-Tyrannulet	Potential colonization	-
Olive-sided Flycatcher	Potential extirpation	-
Western Wood-Pewee	Stable [^]	-
Willow Flycatcher	Improving	-
Gray Flycatcher	Stable	-
Dusky Flycatcher	Stable	Potential colonization
Pacific-slope Flycatcher	Potential extirpation	-
Black Phoebe	Stable	Improving*
Say's Phoebe	Improving	Improving
Vermilion Flycatcher	Improving	-
Ash-throated Flycatcher	Improving*	x
Great Kiskadee	Potential colonization	-
Cassin's Kingbird	Stable	-

Common Name	Summer Trend	Winter Trend
Western Kingbird	Stable	-
Loggerhead Shrike	Improving*	Improving
Hutton's Vireo	-	Potential colonization
Warbling Vireo	Potential extirpation	-
Black-whiskered Vireo	Potential colonization	-
Green Jay	Potential colonization	-
Pinyon Jay	Improving	Improving
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Stable	Stable
Chihuahuan Raven	Potential colonization	-
Common Raven	Worsening*	Stable
Horned Lark	Potential extirpation	Worsening*
Northern Rough-winged Swallow	Potential extirpation	-
Tree Swallow	Potential extirpation	-
Violet-green Swallow	Potential extirpation	-
Barn Swallow	Stable	-
Cliff Swallow	Stable	-
Mountain Chickadee	Stable	Potential extirpation
Juniper Titmouse	Improving	-
Verdin	Improving	Improving*
Bushtit	Stable	Stable
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
Rock Wren	Improving	Improving
Canyon Wren	x	Stable
House Wren	Potential extirpation	Stable
Marsh Wren	-	Stable
Bewick's Wren	Stable	Worsening*

Common Name	Summer Trend	Winter Trend
Cactus Wren	Improving*	Improving
Blue-gray Gnatcatcher	Improving	-
Black-tailed Gnatcatcher	Improving*	Improving*
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	Stable	Stable
Western Bluebird	-	Stable
Mountain Bluebird	-	Stable
Swainson's Thrush	Potential extirpation	-
Hermit Thrush	Stable	-
American Robin	-	Potential extirpation
Bendire's Thrasher	x	Improving
LeConte's Thrasher	Stable	Stable
Crissal Thrasher	Improving	Improving*
Sage Thrasher	-	Improving
Northern Mockingbird	Improving	Stable
European Starling	Potential extirpation	Stable
American Pipit	-	Worsening
Cedar Waxwing	Potential extirpation	Potential extirpation
Phainopepla	Improving*	Improving*
Black-and-white Warbler	-	Potential colonization
Orange-crowned Warbler	Potential extirpation	Improving
Lucy's Warbler	Improving	-
Nashville Warbler	Potential extirpation	-
Common Yellowthroat	Stable	-
Northern Parula	-	Potential colonization
Yellow Warbler	Improving	-
Yellow-rumped Warbler	Stable	Worsening
Black-throated Gray Warbler	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Townsend's Warbler	-	Potential colonization
Wilson's Warbler	Potential extirpation	-
Yellow-breasted Chat	Improving	-
Spotted Towhee	Stable	x
Rufous-crowned Sparrow	x	Potential colonization
Rufous-winged Sparrow	Potential colonization	Potential colonization
Chipping Sparrow	Stable	Improving
Brewer's Sparrow	Stable	Improving*
Black-throated Sparrow	Improving	Improving*
Sagebrush/Bell's Sparrow (Sage Sparrow)	Potential extirpation^	Stable
Savannah Sparrow	-	Worsening*
Grasshopper Sparrow	-	Potential colonization
Song Sparrow	Potential extirpation	Worsening
Lincoln's Sparrow	-	Worsening*
White-crowned Sparrow	-	Worsening
Dark-eyed Junco	x	Potential extirpation
Hepatic Tanager	Improving	-
Summer Tanager	Improving	-
Western Tanager	Stable	Potential colonization
Rose-breasted Grosbeak	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Black-headed Grosbeak	Stable	-
Lazuli Bunting	Potential extirpation	-
Indigo Bunting	Stable	-
Red-winged Blackbird	Stable	-
Eastern Meadowlark	-	Potential colonization
Western Meadowlark	Potential extirpation	Worsening*
Yellow-headed Blackbird	Stable	-
Brewer's Blackbird	Potential extirpation	Worsening
Great-tailed Grackle	Improving	Improving
Brown-headed Cowbird	Improving	-
Hooded Oriole	Improving*	-
Bullock's Oriole	Improving	-
Altamira Oriole	-	Potential colonization
Scott's Oriole	Improving	-
House Finch	Stable	Stable
Cassin's Finch	Stable	-
Lesser Goldfinch	Improving	Stable
Lawrence's Goldfinch	Potential extirpation	-
American Goldfinch	-	Potential extirpation
Evening Grosbeak	-	Potential extirpation
House Sparrow	x	Stable