Birds and Climate Change

National Park Service
U.S. Department of the Interior

Cabrillo 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 Cabrillo 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 climate suitability projected to improve for some species and worsen for others (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 5, remain stable for 38 (e.g., Figure 2), and worsen for 17 species. Suitable climate ceases to occur for 12 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 16 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 21, remain stable for 40, and worsen for 54 species. Suitable climate ceases to occur for 8 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 39 species not found at the Monument today, potentially resulting in local colonization.

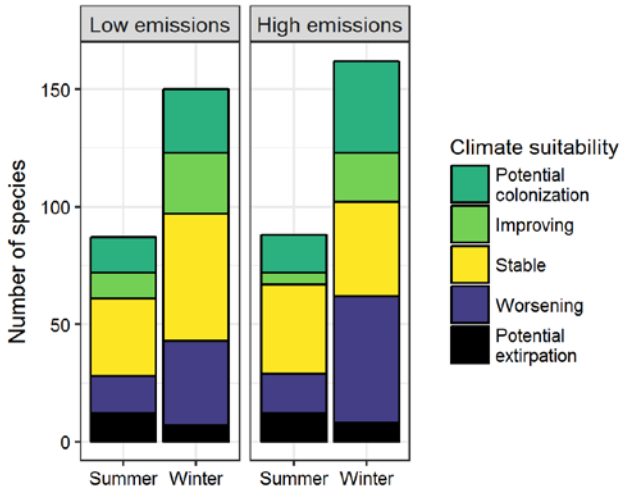

Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.09 in summer (8th percentile across all national parks) and 0.10 in winter (8th percentile) under the high-emissions pathway. Potential species turnover remains 0.09 in summer and declines to 0.07 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 20 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 20 species at the Monument; instead the Monument may serve as an important refuge for these climate-sensitive species.

Figure 2. Climate at the Monument in summer is projected to remain suitable for the Violet-green Swallow (*Tachycineta thalassina*) through 2050. Photo by Becky Matsubara/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, Cabrillo National Monument 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.

Furthermore, park managers have an opportunity to focus on supporting the 20 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	-
Brant	-	Stable
Muscovy Duck	-	Potential colonization
Mallard	Worsening^	Potential extirpation
Blue-winged Teal	Potential colonization	-
Lesser Scaup	-	Worsening
Surf Scoter	x	Stable
Bufflehead	-	Worsening
Red-breasted Merganser	-	Stable^
Ruddy Duck	Stable	Worsening
Plain Chachalaca	-	Potential colonization
California Quail	Stable	Stable
Montezuma Quail	-	Potential colonization
Red-throated Loon	-	Stable

Common Name	Summer Trend	Winter Trend
Pacific Loon	Stable	Worsening*
Common Loon	-	Stable^
Least Grebe	-	Potential colonization
Pied-billed Grebe	x	Worsening
Horned Grebe	-	Stable
Eared Grebe	x	Worsening
Western Grebe	x	Worsening
Clark's Grebe	-	Stable
Northern Fulmar	-	Improving*
Black-vented Shearwater	x	Worsening*
Wood Stork	-	Potential colonization
Magnificent Frigatebird	-	Potential colonization
Brandt's Cormorant	x	Worsening
Double-crested Cormorant	x	Worsening
Pelagic Cormorant	x	Worsening*

Common Name	Summer Trend	Winter Trend
Anhinga	-	Potential colonization
American White Pelican	-	Worsening
Brown Pelican	Improving*	Improving^
Great Blue Heron	Stable	Improving
Great Egret	Improving*	Improving
Snowy Egret	x	Improving
Little Blue Heron	Potential colonization	-
Green Heron	Potential colonization	-
Black-crowned Night-Heron	x	Worsening
Yellow-crowned Night-Heron	-	Potential colonization
White Ibis	-	Potential colonization
Roseate Spoonbill	-	Potential colonization
Black Vulture	Potential colonization	-
Turkey Vulture	x	Improving*
Osprey	x	Improving*
White-tailed Kite	Stable	-
Swallow-tailed Kite	Potential colonization	-
Mississippi Kite	Potential colonization	-
Sharp-shinned Hawk	-	Worsening
Cooper's Hawk	x	Worsening
White-tailed Hawk	-	Potential colonization
Red-shouldered Hawk	Worsening*	Worsening*
Short-tailed Hawk	-	Potential colonization
Red-tailed Hawk	Worsening*	Worsening
American Coot	x	Improving
Black Oystercatcher	x	Worsening*
Black-bellied Plover	-	Stable
Wilson's Plover	-	Potential colonization
Killdeer	-	Stable
Spotted Sandpiper	-	Stable
Wandering Tattler	x	Stable
Willet	-	Improving^
Whimbrel	x	Stable
Long-billed Curlew	Potential colonization^	Improving*
Marbled Godwit	-	Improving
Ruddy Turnstone	-	Stable^
Black Turnstone	x	Worsening*
Surfbird	-	Worsening^
Stilt Sandpiper	-	Potential colonization
Sanderling	-	Worsening
Least Sandpiper	-	Worsening
Western Sandpiper	-	Worsening
Long-billed Dowitcher	-	Worsening
Red-necked Phalarope	Stable	-
Bonaparte's Gull	-	Stable
Laughing Gull	-	Potential colonization
Heermann's Gull	x	Worsening
Mew Gull	-	Stable
Ring-billed Gull	Stable^	Stable
Western Gull	Stable	Stable^
California Gull	x	Worsening^
Herring Gull	-	Improving^
Glaucous-winged Gull	-	Worsening*
Great Black-backed Gull	-	Potential colonization
Caspian Tern	x	Improving
Forster's Tern	x	Improving
Royal Tern	x	Improving^
Sandwich Tern	-	Potential colonization^

Common Name	Summer Trend	Winter Trend
Rock Pigeon	Stable	Worsening
Eurasian Collared-Dove	x	Stable
White-winged Dove	-	Potential colonization
Mourning Dove	Stable	Stable
Inca Dove	Potential colonization	-
Greater Roadrunner	Stable	-
Common Nighthawk	Potential colonization	-
White-throated Swift	x	Worsening
Anna's Hummingbird	Stable	Worsening
Allen's Hummingbird	Stable^	Worsening*
Buff-bellied Hummingbird	-	Potential colonization
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	-	Improving
Green Kingfisher	-	Potential colonization
Ladder-backed Woodpecker	-	Potential colonization
Nuttall's Woodpecker	Worsening*	Stable
Northern Flicker	Worsening	Worsening
Crested Caracara	Potential colonization	Potential colonization
American Kestrel	x	Improving
Peregrine Falcon	x	Stable
Western Wood-Pewee	Worsening^	-
Willow Flycatcher	Stable	-
Pacific-slope Flycatcher	Stable	-
Black Phoebe	Stable	Worsening
Say's Phoebe	Worsening	Worsening
Ash-throated Flycatcher	Improving*	-
Great Crested Flycatcher	-	Potential colonization
Couch's Kingbird	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Cassin's Kingbird	Stable	Stable
Western Kingbird	Improving	-
Yellow-throated Vireo	Improving	-
Hutton's Vireo	-	Worsening*
Warbling Vireo	Stable	-
Green Jay	-	Potential colonization
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Stable	Worsening
American Crow	Potential extirpation	Worsening
Common Raven	Potential extirpation	Worsening
Northern Rough-winged Swallow	Worsening	-
Purple Martin	Potential colonization	-
Tree Swallow	Stable	Improving*
Violet-green Swallow	Stable	-
Barn Swallow	Potential extirpation	x
Cliff Swallow	Worsening	-
Bushtit	Worsening	Worsening*
Red-breasted Nuthatch	-	Potential extirpation
Brown Creeper	-	Stable
Rock Wren	-	Stable
Canyon Wren	-	Potential colonization
House Wren	Potential extirpation	Worsening
Bewick's Wren	Stable	Worsening*
Blue-gray Gnatcatcher	Stable	Improving
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Worsening
Wrentit	Stable	Worsening
Western Bluebird	Stable	Worsening
Swainson's Thrush	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Hermit Thrush	-	Stable
American Robin	Potential extirpation	Stable
Long-billed Thrasher	Potential colonization^	Potential colonization
California Thrasher	Worsening*	Stable
Crissal Thrasher	Potential colonization	-
Northern Mockingbird	Stable	Worsening
European Starling	Worsening	Worsening
American Pipit	-	Worsening
Cedar Waxwing	-	Stable
Ovenbird	-	Potential colonization
Black-and-white Warbler	Stable	-
Orange-crowned Warbler	Potential extirpation	Stable
Common Yellowthroat	Stable	Stable
Northern Parula	-	Potential colonization
Yellow Warbler	Stable	-
Pine Warbler	-	Potential colonization
Yellow-rumped Warbler	Potential extirpation	Stable
Townsend's Warbler	Potential extirpation	Stable
Wilson's Warbler	Stable	-
Olive Sparrow	Potential colonization	-
Spotted Towhee	Stable	x
Rufous-crowned Sparrow	-	Improving*
California Towhee	Stable	Worsening*
Bachman's Sparrow	-	Potential colonization
Chipping Sparrow	Potential extirpation	Stable
Black-throated Sparrow	-	Potential colonization
Savannah Sparrow	-	Worsening

Common Name	Summer Trend	Winter Trend
Henslow's Sparrow	-	Potential colonization
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	-	Potential colonization^
Seaside Sparrow	-	Potential colonization^
Fox Sparrow	-	Potential extirpation
Song Sparrow	Stable	Potential extirpation
Lincoln's Sparrow	-	Worsening
White-throated Sparrow	-	Stable
White-crowned Sparrow	-	Worsening
Golden-crowned Sparrow	-	Worsening*
Dark-eyed Junco	x	Potential extirpation
Summer Tanager	Stable	-
Western Tanager	Stable	Stable
Rose-breasted Grosbeak	Potential extirpation	-
Black-headed Grosbeak	Worsening	-
Blue Grosbeak	Stable	-
Indigo Bunting	-	Potential colonization
Painted Bunting	-	Potential colonization
Red-winged Blackbird	-	Stable
Western Meadowlark	Worsening*	Worsening
Brewer's Blackbird	Worsening*	Worsening
Boat-tailed Grackle	-	Potential colonization^
Bronzed Cowbird	-	Potential colonization
Brown-headed Cowbird	Potential extirpation	Improving
Hooded Oriole	Worsening*	-
Bullock's Oriole	Stable	x
House Finch	Worsening	Potential extirpation
Purple Finch	-	Potential

Common Name	Summer Trend	Winter Trend
		extirpation
Lesser Goldfinch	Stable	Stable

Common Name	Summer Trend	Winter Trend
American Goldfinch	-	Potential extirpation
House Sparrow	x	Stable