Birds and Climate Change

National Park Service U.S. Department of the Interior



Channel Islands 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 midcentury for birds at Channel Islands 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 18, remain stable for 20, and worsen for 23 species. Suitable climate ceases to occur for 10 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 26 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 52, remain stable for 32, and worsen for 37 species. Suitable climate ceases to occur for 6 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 27 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 parkspecific 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.

*Analysis for this brief excludes a small area of Park property on the mainland that lacks significant natural resources.

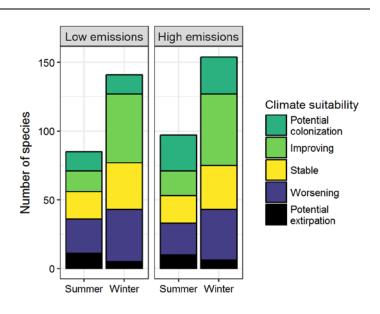


Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Park between the present and 2050 is 0.19 in summer (29th percentile across all national parks) and 0.10 in winter (8th percentile) under the high-emissions pathway. Potential species turnover declines to 0.12 in summer and 0.07 in winter under the lowemissions 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 25 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 25 species at

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Channel Islands National Park 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

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 the Park; instead the Park may serve as an important refuge for these climate-sensitive species.



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).

reducing other stressors. Furthermore, park managers have an opportunity to focus on supporting the 25 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.

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 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	Common Name	Summer Trend	Winter Tren
Brant	-	Improving	Horned Grebe	-	Stable
Muscovy Duck	-	Potential	Eared Grebe	-	Stable
		colonization	Western Grebe	х	Worsening
American Wigeon	-	Improving	Clark's Grebe	-	Stable
Mallard	Worsening^	Worsening	Northern Fulmar	Х	Worsening*
Green-winged Teal	-	Worsening	Black-vented Shearwater	Х	Worsening*
Surf Scoter	x	Worsening			Potential
White-winged Scoter	-	Worsening*	Wood Stork	-	colonization
Red-breasted Merganser	-	Stable^	Magnificent Frigatebird	-	Potential colonization
Plain Chachalaca	-	Potential colonization	Brandt's Cormorant	x	Worsening
California Quail	Worsening	Worsening	Double-crested Cormorant	х	Improving
Ring-necked Pheasant	Potential colonization	-	Pelagic Cormorant	х	Worsening*
Wild Turkey	x	Stable	Anhinga	Potential colonization^	-
Red-throated Loon	-	Stable	American White Pelican	-	Potential
Pacific Loon	Stable	Worsening*			colonization
Common Loon	-	Stable [^]	Brown Pelican	Improving	Stable [^]
Pied-billed Grebe	-	Improving	Great Blue Heron	Stable	Improving

Common Name	Summer Trend	Winter Trend	Common Name	Summer Trend	Winter Trend
Great Egret	-	Improving	Piping Plover	-	Potential colonization [^]
Snowy Egret	-	Improving*	Killdeer	Immuning	
Little Blue Heron	-	Potential colonization	Spotted Sandpiper	Improving	Improving Stable
		Potential	Wandering Tattler	x	Worsening*
Tricolored Heron	-	colonization	Willet	Α	Improving [^]
Cattle Egret	Potential colonization	-	Lesser Yellowlegs	-	Potential colonization
Green Heron	Potential colonization	-	Whimbrel	X	Improving*
Vollow anounced Night Honor	Potential	Potential	Long-billed Curlew	Improving^	Improving*
Yellow-crowned Night-Heron	colonization	colonization	Marbled Godwit	-	Improving*
White Ibis	Potential colonization	-	Black Turnstone	-	Worsening*
Osprey	X	Improving*	Sanderling	-	Improving
White-tailed Kite	Improving*	Improving*	Least Sandpiper	-	Improving
	Potential	Improving	Red-necked Phalarope	Stable	-
Swallow-tailed Kite	colonization	-	Pomarine Jaeger	х	Worsening
Golden Eagle	x	Stable	Common Murre	х	Worsening*
Mississippi Kite	Potential colonization	-	Pigeon Guillemot	Improving	Worsening
Northern Harrier	Improving^	Worsening	Rhinoceros Auklet	Х	Worsening
Sharp-shinned Hawk	-	Improving	Laughing Gull	-	Potential colonization
Cooper's Hawk	х	Stable	Heermann's Gull	X	Worsening
Bald Eagle	х	Potential extirpation	Mew Gull	-	Improving
		Potential	Ring-billed Gull	-	Improving*
Short-tailed Hawk	-	colonization	Western Gull	Improving*	Stable^
Swainson's Hawk	Potential	-	California Gull	X	Stable^
	colonization^	- 11	Herring Gull	-	Stable^
Red-tailed Hawk	Stable	Stable	Iceland Gull (Thayer's)	-	Worsening*
American Coot	-	Improving	Glaucous-winged Gull	-	Worsening
Limpkin	-	Potential colonization	Caspian Tern	X	Improving*
American Oystercatcher	X	Improving^	Forster's Tern	X	Improving*
Black Oystercatcher	X	Worsening*	Royal Tern	X	Improving^
Black-bellied Plover	х	Stable	Sandwich Tern	-	Potential colonization^
Snowy Plover	-	Improving*	Rock Pigeon	Improving	-
Wilson's Plover	-	Potential colonization	Band-tailed Pigeon	Worsening	Stable

Common Name	Summer Trend	Winter Trend	Common Name	Summer Trend	Winter Trend
Eurasian Collared-Dove	X	Improving	Brown-crested Flycatcher	Potential colonization	-
White-winged Dove	-	Potential colonization	Great Kiskadee	Potential	-
Mourning Dove	Improving	Improving		colonization	
Burrowing Owl	Potential colonization^	Stable	Western Kingbird Loggerhead Shrike	Improving* Stable	- Improving
Lesser Nighthawk	Improving	_		Potential	mproving
	Potential		Bell's Vireo	colonization	-
Common Nighthawk	colonization	-	Hutton's Vireo	Worsening*^	Worsening
White-throated Swift	х	Worsening*	Warbling Vireo	Potential extirpation	-
Black-chinned Hummingbird	Potential colonization	-	Black-whiskered Vireo	Potential colonization	-
Anna's Hummingbird	Worsening*	Worsening		Potential	
Costa's Hummingbird	Stable	-	Green Jay	colonization	-
Allen's Hummingbird	Stable [^]	Stable	American Crow	Stable	Improving
Belted Kingfisher	-	Improving	Fish Crow	Potential colonization	-
Acorn Woodpecker	Worsening*	Stable			
Golden-fronted Woodpecker	Potential colonization	-	Common Raven	Potential extirpation	Stable
Red-breasted Sapsucker	-	Worsening*	Horned Lark	Stable	Improving*
Nuttall's Woodpecker	-	Improving	Tree Swallow	Stable	-
Northern Flicker	Stable	Worsening	Barn Swallow	Potential extirpation	-
American Kestrel	X	Improving	Cliff Swallow	Worsening	-
Merlin	-	Worsening^	Bushtit	Worsening	Stable
Peregrine Falcon	х	Stable	White-breasted Nuthatch	-	Improving*
Western Wood-Pewee	Worsening*^	-	Brown-headed Nuthatch	Potential	-
Willow Flycatcher	Potential extirpation	-		colonization^	11 7 • 4
	1	Potential	Rock Wren	Stable	Worsening*
Dusky Flycatcher	-	colonization	Canyon Wren	X	Stable
Pacific-slope Flycatcher	Worsening*	-	House Wren	Stable	Improving
Black Phoebe	Stable	Worsening	Bewick's Wren	Worsening	Worsening
Say's Phoebe	-	Worsening	Blue-gray Gnatcatcher	Improving*	Improving
Vermilion Flycatcher	Potential colonization	-	Golden-crowned Kinglet	-	Potential extirpation
Ash-throated Flycatcher	Worsening*	-	Ruby-crowned Kinglet	-	Stable
	_	Potential	Hermit Thrush	-	Improving
Great Crested Flycatcher	-	colonization	American Robin	Potential	Stable

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Canyon TowheeColonizationFormati	Rufous-crowned Sparrow	х	Stable	Brewer's Blackbird	Worsening	-
Bachman's Sparrow Stable Improving Chipping Sparrow Stable Improving Vesper Sparrow - Lark Sparrow Worsening Lark Sparrow Worsening	Canyon Towhee		-	Bronzed Cowbird		-
Vesper Sparrow Potential colonization Bullock's Oriole Worsening - Lark Sparrow Worsening Improving House Finch Worsening Worsening	Bachman's Sparrow		-	Brown-headed Cowbird		-
Vesper Sparrow - Colonization House Finch Worsening Worsening	Chipping Sparrow	Stable	Improving	Hooded Oriole	Improving*	-
Lark Sparrow Worsening Improving	Vesper Sparrow	_		Bullock's Oriole	Worsening	-
Lark Sparrow Worsening Improving Purple Finch Worsening* Potential				House Finch	Worsening	Worsening
	Lark Sparrow	Worsening	Improving	Purple Finch	Worsening*	Potential

Common Name	Summer Trend	Winter Trend	Common Name	Summer Trend	Winter Trend
		extirpation	Lesser Goldfinch	Stable	Improving
Pine Siskin	-	Potential extirpation	American Goldfinch	-	Improving
			House Sparrow	х	Improving