Birds and Climate Change

National Park Service
U.S. Department of the Interior

Santa Monica Mountains National Recreation Area

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 Santa Monica Mountains National Recreation Area (hereafter, the Recreation Area) 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 Recreation Area based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Recreation Area 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 Recreation Area, 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 Recreation Area today, climate suitability in summer under the high-emissions pathway is projected to improve for 22, remain stable for 46, and worsen for 33 species. Suitable climate ceases to occur for 37 species in summer, potentially resulting in extirpation of those species from the Recreation Area (e.g., Figure 2). Climate is projected to become suitable in summer for 28 species not found at the Recreation Area today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 52, remain stable for 75, and worsen for 76 species. Suitable climate ceases to occur for 20 species in winter, potentially resulting in extirpation from the Recreation Area. Climate is projected to become suitable in winter for 45 species not found at the Recreation Area today, potentially resulting in local colonization.

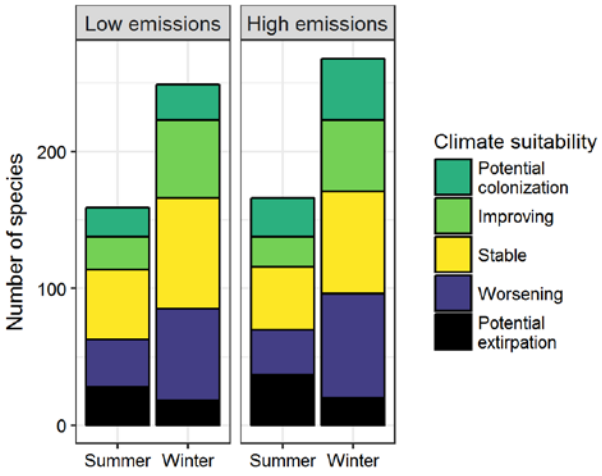

Figure 1. Projected changes in climate suitability for birds at the Recreation Area, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Recreation Area between the present and 2050 is 0.26 in summer (43rd percentile across all national parks) and 0.13 in winter (14th percentile) under the high-emissions pathway. Potential species turnover declines to 0.19 in summer and 0.09 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 Recreation Area is or may become home to 50 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 Recreation Area may serve as an important refuge for 42 of these climate-sensitive species, 8 might be extirpated from the Recreation Area in at least one season by 2050.

Figure 2. Although currently found at the Recreation Area, suitable climate for the Red-winged Blackbird (*Agelaius phoeniceus*) 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).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Santa Monica Mountains National Recreation Area falls within the high turnover group.** Parks anticipating high turnover can focus on actions that increase species' ability to respond to environmental change, such as increasing the amount of potential habitat, working with cooperating agencies and landowners to improve habitat connectivity for birds across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 42 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.

Contacts

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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 Recreation Area based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Recreation Area 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	x	Stable
Cackling/Canada Goose	x	Potential extirpation
Mute Swan	x	Potential extirpation
Muscovy Duck	-	Potential colonization
Wood Duck	x	Improving*
Gadwall	Potential extirpation^	Worsening
Eurasian Wigeon	-	Worsening
American Wigeon	Potential extirpation^	Worsening
Mallard	Potential extirpation^	Potential extirpation
Blue-winged Teal	-	Improving
Cinnamon Teal	x	Stable
Northern Shoveler	Stable^	Worsening
Northern Pintail	Stable	x
Green-winged Teal	-	Stable
Canvasback	-	Stable
Redhead	Stable^	x
Ring-necked Duck	x	Worsening
Greater Scaup	-	Worsening^
Lesser Scaup	-	Stable
Harlequin Duck	-	Potential extirpation
Surf Scoter	x	Worsening*
White-winged Scoter	x	Potential extirpation
Black Scoter	x	Potential extirpation
Long-tailed Duck	Stable	Stable
Bufflehead	x	Worsening
Common Goldeneye	-	Stable
Hooded Merganser	-	Potential extirpation^

Common Name	Summer Trend	Winter Trend
Common Merganser	-	Stable
Red-breasted Merganser	Potential extirpation	Worsening^
Ruddy Duck	Stable	Worsening
Plain Chachalaca	-	Potential colonization
California Quail	Stable	Worsening
Red-throated Loon	Stable	Worsening
Pacific Loon	Stable	Worsening*
Common Loon	Potential extirpation	Worsening^
Least Grebe	-	Potential colonization
Pied-billed Grebe	x	Stable
Horned Grebe	-	Stable
Red-necked Grebe	-	Potential extirpation^
Eared Grebe	x	Stable
Western Grebe	x	Worsening
Clark's Grebe	x	Worsening*
Northern Fulmar	x	Worsening
Black-vented Shearwater	x	Worsening*
Wood Stork	-	Potential colonization
Magnificent Frigatebird	-	Potential colonization
Brandt's Cormorant	x	Worsening*
Double-crested Cormorant	x	Improving
Pelagic Cormorant	x	Worsening*
Anhinga	Potential colonization^	Potential colonization
American White Pelican	-	Stable
Brown Pelican	Improving*	Worsening*^
American Bittern	-	Improving^
Least Bittern	x	Stable
Great Blue Heron	Stable	Improving
Great Egret	Stable	Improving

Common Name	Summer Trend	Winter Trend
Snowy Egret	x	Improving
Little Blue Heron	Improving	Potential colonization
Tricolored Heron	-	Potential colonization
Reddish Egret	x	Improving*
Cattle Egret	Improving*	Improving*
Green Heron	Improving*	Improving*
Black-crowned Night-Heron	x	Stable
Yellow-crowned Night-Heron	Improving	Improving
White Ibis	-	Potential colonization
White-faced Ibis	x	Improving*^
Roseate Spoonbill	-	Potential colonization
Black Vulture	Potential colonization	-
Turkey Vulture	x	Improving
Osprey	x	Improving*
White-tailed Kite	Stable	Stable
Swallow-tailed Kite	Potential colonization	-
Golden Eagle	x	Potential extirpation
Mississippi Kite	Potential colonization	-
Northern Harrier	Stable^	Stable
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	x	Worsening
Bald Eagle	-	Improving*
White-tailed Hawk	-	Potential colonization
Red-shouldered Hawk	Worsening	Stable
Gray Hawk	Potential colonization	-
Short-tailed Hawk	-	Potential colonization
Red-tailed Hawk	Worsening	Stable
Ferruginous Hawk	-	Stable

Common Name	Summer Trend	Winter Trend
Virginia Rail	x	Stable
Sora	x	Stable
Common Gallinule	-	Improving*
American Coot	x	Improving
Limpkin	-	Potential colonization
Black-necked Stilt	x	Stable
American Avocet	x	Improving*^
American Oystercatcher	-	Potential colonization^
Black Oystercatcher	x	Worsening*
Black-bellied Plover	x	Worsening
Snowy Plover	x	Worsening
Wilson's Plover	-	Potential colonization
Semipalmated Plover	Stable	Stable^
Piping Plover	-	Potential colonization^
Killdeer	Stable	Improving
Spotted Sandpiper	x	Stable
Wandering Tattler	x	Worsening
Greater Yellowlegs	Potential extirpation	Stable
Willet	Stable^	Worsening^
Lesser Yellowlegs	Potential extirpation^	Improving*
Whimbrel	x	Worsening
Long-billed Curlew	Improving^	Stable
Marbled Godwit	Potential extirpation^	Improving
Ruddy Turnstone	x	Worsening^
Black Turnstone	x	Worsening*
Red Knot	x	Improving*^
Surfbird	x	Worsening^
Stilt Sandpiper	-	Improving
Sanderling	x	Worsening*
Dunlin	x	Improving*^

Common Name	Summer Trend	Winter Trend
Least Sandpiper	x	Worsening
Western Sandpiper	Stable	Worsening
Short-billed Dowitcher	x	Improving*^
Long-billed Dowitcher	x	Improving
Wilson's Snipe	-	Stable
Wilson's Phalarope	Stable^	-
Red-necked Phalarope	Stable	-
Pomarine Jaeger	x	Worsening^
Parasitic Jaeger	Stable	x
Common Murre	x	Potential extirpation
Pigeon Guillemot	Stable	Stable
Ancient Murrelet	-	Worsening
Rhinoceros Auklet	x	Potential extirpation
Bonaparte's Gull	Stable	Stable
Laughing Gull	-	Potential colonization
Heermann's Gull	x	Worsening*
Mew Gull	-	Stable
Ring-billed Gull	Potential extirpation^	Improving
Western Gull	Stable	Worsening*^
California Gull	x	Worsening^
Herring Gull	Potential extirpation	Stable^
Iceland Gull (Thayer's)	-	Worsening
Glaucous-winged Gull	Stable	Worsening*
Caspian Tern	x	Improving*
Forster's Tern	x	Stable
Royal Tern	x	Stable^
Sandwich Tern	-	Potential colonization^
Black Skimmer	x	Improving*^
Rock Pigeon	Potential extirpation	Worsening
Band-tailed Pigeon	Worsening	Worsening*

Common Name	Summer Trend	Winter Trend
Eurasian Collared-Dove	x	Improving
White-winged Dove	Potential colonization	Potential colonization
Mourning Dove	Worsening	Stable
Inca Dove	Potential colonization	-
White-tipped Dove	Potential colonization	-
Greater Roadrunner	Improving	Stable
Barn Owl	x	Worsening
Western Screech-Owl	x	Stable
Great Horned Owl	x	Stable
Burrowing Owl	Potential colonization^	Improving*
Lesser Nighthawk	Improving	-
Common Nighthawk	Potential colonization	-
Common Pauraque	-	Potential colonization
White-throated Swift	x	Worsening*
Black-chinned Hummingbird	Improving	-
Anna's Hummingbird	Worsening*	Worsening
Costa's Hummingbird	Stable	Stable
Rufous Hummingbird	Stable	-
Allen's Hummingbird	Worsening^	Worsening*
Buff-bellied Hummingbird	-	Potential colonization
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	Potential extirpation	Improving
Green Kingfisher	-	Potential colonization
Lewis's Woodpecker	-	Worsening
Acorn Woodpecker	Worsening	Stable
Golden-fronted Woodpecker	Potential colonization	-
Yellow-bellied Sapsucker	-	Improving
Red-naped Sapsucker	-	Stable

Common Name	Summer Trend	Winter Trend
Red-breasted Sapsucker	Stable	Worsening*
Nuttall's Woodpecker	Worsening*	Stable
Downy Woodpecker	Stable	Potential extirpation
Hairy Woodpecker	Potential extirpation	Potential extirpation
Red-cockaded Woodpecker	-	Potential colonization
Northern Flicker	Worsening	Worsening
Gilded Flicker	Potential colonization	Potential colonization
Crested Caracara	Potential colonization	Potential colonization
American Kestrel	x	Improving
Merlin	-	Stable^
Peregrine Falcon	x	Worsening
Prairie Falcon	-	Stable
Olive-sided Flycatcher	Potential extirpation	-
Western Wood-Pewee	Worsening*^	-
Willow Flycatcher	Potential extirpation	-
Gray Flycatcher	-	Improving*
Pacific-slope Flycatcher	Worsening	x
Black Phoebe	Stable	Worsening
Eastern Phoebe	-	Improving
Say's Phoebe	Stable	Worsening
Vermilion Flycatcher	Improving	Improving*
Ash-throated Flycatcher	Stable	-
Great Crested Flycatcher	-	Potential colonization
Brown-crested Flycatcher	Potential colonization	-
Great Kiskadee	Potential colonization	-
Cassin's Kingbird	Stable	Stable
Western Kingbird	Stable	x
Loggerhead Shrike	Improving*	Stable

Common Name	Summer Trend	Winter Trend
White-eyed Vireo	Potential colonization	Potential colonization
Bell's Vireo	Improving	-
Hutton's Vireo	Worsening^	Worsening*
Warbling Vireo	Potential extirpation	-
Black-whiskered Vireo	Potential colonization	-
Green Jay	Potential colonization	-
Steller's Jay	-	Stable
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Worsening	Stable
American Crow	Worsening	Stable
Fish Crow	Potential colonization	-
Common Raven	Potential extirpation	Worsening
Horned Lark	Stable	Improving*
Northern Rough-winged Swallow	Worsening	Stable
Purple Martin	Stable	-
Tree Swallow	Potential extirpation	Stable
Violet-green Swallow	Worsening	Stable
Barn Swallow	Potential extirpation	x
Cliff Swallow	Worsening	-
Cave Swallow	Potential colonization	-
Mountain Chickadee	Potential extirpation	Worsening
Oak Titmouse	Stable	Worsening*
Black-crested Titmouse	Potential colonization	-
Bushtit	Worsening*	Worsening
Red-breasted Nuthatch	-	Potential extirpation
White-breasted Nuthatch	Potential extirpation	Potential extirpation

Common Name	Summer Trend	Winter Trend
Brown Creeper	-	Potential extirpation
Rock Wren	Stable	Worsening*
Canyon Wren	x	Improving*
House Wren	Potential extirpation	Improving
Marsh Wren	x	Worsening
Bewick's Wren	Worsening	Worsening
Cactus Wren	Improving	Stable
Blue-gray Gnatcatcher	Improving*	Improving
California Gnatcatcher	-	Stable
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Worsening
Wrentit	Worsening*	Worsening
Western Bluebird	Worsening	Worsening
Mountain Bluebird	-	Stable
Swainson's Thrush	Potential extirpation	-
Hermit Thrush	-	Stable
American Robin	Potential extirpation	Worsening
Varied Thrush	-	Potential extirpation
Long-billed Thrasher	Potential colonization^	Potential colonization
California Thrasher	Worsening*	Stable
Northern Mockingbird	Stable	Stable
European Starling	Worsening	Stable
American Pipit	-	Worsening
Cedar Waxwing	Potential extirpation	Improving
Phainopepla	Improving*	Stable
Chestnut-collared Longspur	-	Potential colonization
Ovenbird	-	Potential colonization
Orange-crowned Warbler	Worsening	Improving

Common Name	Summer Trend	Winter Trend
Common Yellowthroat	Potential extirpation	Stable
American Redstart	Potential extirpation	-
Northern Parula	Improving	Potential colonization
Yellow Warbler	Potential extirpation	x
Palm Warbler	-	Potential colonization^
Pine Warbler	-	Potential colonization
Yellow-rumped Warbler	Potential extirpation	Improving
Yellow-throated Warbler	-	Potential colonization
Black-throated Gray Warbler	Stable	Stable
Townsend's Warbler	-	Worsening*
Hermit Warbler	-	Stable^
Wilson's Warbler	Potential extirpation	Stable
Red-faced Warbler	Potential colonization	-
Yellow-breasted Chat	Improving*	-
Olive Sparrow	Potential colonization	-
Green-tailed Towhee	Stable^	-
Spotted Towhee	Worsening*	x
Rufous-crowned Sparrow	x	Stable
Canyon Towhee	Potential colonization	-
California Towhee	Stable	Worsening
Bachman's Sparrow	-	Potential colonization
Chipping Sparrow	-	Improving
Vesper Sparrow	-	Improving
Lark Sparrow	Worsening	Stable
Black-throated Sparrow	Stable	-
Sagebrush/Bell's Sparrow (Sage Sparrow)	Improving^	Stable

Common Name	Summer Trend	Winter Trend
Savannah Sparrow	Potential extirpation	Worsening
Grasshopper Sparrow	Worsening*	Improving
Henslow's Sparrow	-	Potential colonization
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	-	Potential colonization^
Seaside Sparrow	-	Potential colonization^
Fox Sparrow	-	Worsening*
Song Sparrow	Potential extirpation	Worsening
Lincoln's Sparrow	-	Stable
Swamp Sparrow	-	Improving
White-throated Sparrow	-	Improving
White-crowned Sparrow	-	Worsening
Golden-crowned Sparrow	-	Worsening
Dark-eyed Junco	x	Potential extirpation
Summer Tanager	Improving	-
Western Tanager	Potential extirpation	Improving*
Pyrrhuloxia	-	Potential colonization
Rose-breasted Grosbeak	Potential extirpation	-
Black-headed Grosbeak	Worsening*	x
Blue Grosbeak	Improving*	-
Lazuli Bunting	Worsening	x
Indigo Bunting	Improving	Potential colonization
Painted Bunting	Potential colonization	Potential colonization
Red-winged Blackbird	Potential extirpation	Improving
Tricolored Blackbird	Stable	Stable
Western Meadowlark	Worsening*	Worsening
Rusty Blackbird	-	Stable
Brewer's Blackbird	Worsening	Worsening

Common Name	Summer Trend	Winter Trend
Boat-tailed Grackle	-	Potential colonization^
Great-tailed Grackle	Improving	Stable
Bronzed Cowbird	Potential colonization	Potential colonization
Brown-headed Cowbird	Stable	Improving
Hooded Oriole	Stable	x
Bullock's Oriole	Stable	x
Audubon's Oriole	-	Potential colonization

Common Name	Summer Trend	Winter Trend
House Finch	Worsening	Worsening
Purple Finch	Potential extirpation	Potential extirpation
Pine Siskin	-	Stable
Lesser Goldfinch	Worsening	Stable
Lawrence's Goldfinch	Stable	x
American Goldfinch	Potential extirpation	Potential extirpation
House Sparrow	x	Stable