



Canaveral National Seashore

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 Canaveral National Seashore (hereafter, the Seashore) 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 Seashore, with climate suitability projected to improve for some species and worsen for others (Figure 1). Among the species likely to be found at the Seashore today, climate suitability in summer under the high-emissions pathway is projected to improve for 21, remain stable for 25 (e.g., Figure 2), and worsen for 31 species. Suitable climate ceases to occur for 11 species in summer, potentially resulting in extirpation of those species from the Seashore. Climate is projected to become suitable in summer for 20 species not found at the Seashore today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 37, remain stable for 66, and worsen for 63 species. Suitable climate ceases to occur for 20 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 28 species not found at the Seashore 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 Seashore based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Seashore 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.

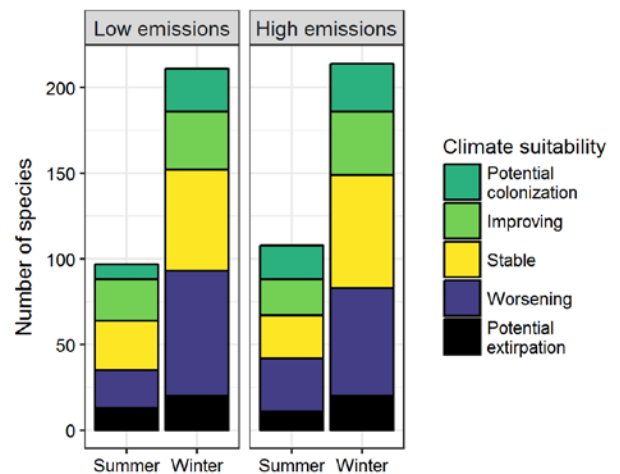


Figure 1. Projected changes in climate suitability for birds at the Seashore, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.17 in summer (25th percentile across all national parks) and 0.11 in winter (10th percentile) under the high-emissions pathway. Potential species turnover declines to 0.10 in summer and remains 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 Seashore is or may become home to 39 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, Canaveral National Seashore falls within the high potential colonization group.** Parks anticipating high potential colonization 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

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

Seashore may serve as an important refuge for 34 of these climate-sensitive species, 5 might be extirpated from the Seashore in at least one season by 2050.



Figure 2. Climate at the Seashore in summer is projected to remain suitable for the Red-winged Blackbird (*Agelaius phoeniceus*) through 2050. Photo by Andy Reago & Chrissy McClarren/Flickr (CC BY 2.0).

across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 34 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 Seashore based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Seashore 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	Improving*	x
Mute Swan	-	Improving
Muscovy Duck	-	Improving*
Wood Duck	x	Worsening
Gadwall	-	Improving*
Eurasian Wigeon	-	Stable
American Wigeon	Stable^	Stable
American Black Duck	-	Improving
Mallard	Improving^	Potential extirpation
Mottled Duck	Worsening	Improving
Blue-winged Teal	Improving	Stable
Cinnamon Teal	-	Improving*
Northern Shoveler	Improving^	Improving*
Green-winged Teal	-	Stable
Canvasback	-	Improving*
Ring-necked Duck	-	Improving

Common Name	Summer Trend	Winter Trend
Greater Scaup	-	Stable^
Lesser Scaup	x	Stable
Surf Scoter	-	Improving
White-winged Scoter	-	Potential extirpation
Black Scoter	-	Potential extirpation
Long-tailed Duck	-	Improving
Bufflehead	-	Potential extirpation
Common Goldeneye	-	Stable
Hooded Merganser	-	Potential extirpation^
Red-breasted Merganser	Potential extirpation	Potential extirpation^
Ruddy Duck	-	Improving*
Northern Bobwhite	Stable	Improving*
Wild Turkey	x	Potential extirpation

Common Name	Summer Trend	Winter Trend
Red-throated Loon	-	Potential extirpation
Common Loon	-	Worsening*^
Pied-billed Grebe	x	Stable
Horned Grebe	-	Stable
Eared Grebe	-	Stable
Wood Stork	Worsening*	Stable
Magnificent Frigatebird	x	Improving*
Northern Gannet	-	Worsening*^
Double-crested Cormorant	x	Stable
Anhinga	Worsening*^	Stable
American White Pelican	x	Improving*
Brown Pelican	Stable	Worsening^
American Bittern	-	Worsening^
Least Bittern	x	Worsening
Great Blue Heron	Worsening	Worsening
Great Egret	Worsening	Improving
Snowy Egret	x	Stable
Little Blue Heron	Worsening*	Worsening
Tricolored Heron	Worsening*^	Worsening
Reddish Egret	x	Worsening*
Cattle Egret	Worsening*	Stable
Green Heron	Worsening	Worsening
Black-crowned Night-Heron	x	Stable
Yellow-crowned Night-Heron	Stable	Stable
White Ibis	Worsening*	Worsening
Glossy Ibis	x	Stable
Roseate Spoonbill	x	Stable
Black Vulture	Worsening	Stable
Turkey Vulture	x	Improving
Osprey	x	Worsening
Swallow-tailed Kite	Stable	x
Northern Harrier	-	Improving
Sharp-shinned Hawk	-	Worsening

Common Name	Summer Trend	Winter Trend
Cooper's Hawk	x	Stable
Bald Eagle	x	Potential extirpation
Harris's Hawk	-	Potential colonization
Red-shouldered Hawk	Stable	Improving
Red-tailed Hawk	Potential extirpation	Worsening
Ferruginous Hawk	-	Potential colonization
Clapper Rail	x	Worsening*
King Rail	x	Worsening^
Virginia Rail	-	Worsening
Sora	-	Stable
Common Gallinule	x	Worsening
American Coot	x	Worsening
Limpkin	x	Worsening
Black-necked Stilt	x	Improving*
American Avocet	x	Stable^
American Oystercatcher	-	Worsening*^
Black-bellied Plover	x	Worsening
Wilson's Plover	x	Improving
Semipalmated Plover	Stable	Worsening*^
Piping Plover	-	Worsening^
Killdeer	Improving*	Stable
Spotted Sandpiper	x	Stable
Greater Yellowlegs	Potential extirpation	Stable
Willet	Worsening^	Worsening*^
Lesser Yellowlegs	Stable^	Stable
Whimbrel	-	Stable
Marbled Godwit	Stable^	Worsening
Ruddy Turnstone	x	Worsening*^
Red Knot	x	Worsening^
Stilt Sandpiper	x	Improving*
Sanderling	x	Worsening*

Common Name	Summer Trend	Winter Trend
Dunlin	-	Stable^
Least Sandpiper	x	Stable
Western Sandpiper	Stable	Stable
Short-billed Dowitcher	x	Worsening*^
Long-billed Dowitcher	x	Improving*
Wilson's Snipe	-	Improving*
American Woodcock	-	Stable
Pomarine Jaeger	-	Potential extirpation^
Bonaparte's Gull	-	Potential extirpation
Laughing Gull	Worsening*^	Stable
Ring-billed Gull	Potential extirpation^	Worsening
Yellow-footed Gull	-	Potential colonization
Herring Gull	Potential extirpation	Potential extirpation^
Great Black-backed Gull	-	Worsening*
Gull-billed Tern	x	Stable
Caspian Tern	x	Stable
Black Tern	Improving	-
Forster's Tern	x	Stable
Royal Tern	x	Worsening*^
Sandwich Tern	x	Worsening*^
Black Skimmer	x	Worsening*^
Rock Pigeon	Stable	Stable
White-crowned Pigeon	Potential colonization	-
Eurasian Collared-Dove	x	Stable
White-winged Dove	Improving*	Improving*
Mourning Dove	Worsening	Improving
Inca Dove	-	Potential colonization
Common Ground-Dove	Worsening	Improving
White-tipped Dove	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Yellow-billed Cuckoo	Improving*	-
Eastern Screech-Owl	x	Stable
Great Horned Owl	x	Potential extirpation
Barred Owl	x	Worsening
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Worsening	-
Chuck-will's-widow	Worsening	x
Chimney Swift	Worsening*	-
White-throated Swift	-	Potential colonization
Ruby-throated Hummingbird	Improving	-
Black-chinned Hummingbird	Potential colonization	-
Allen's Hummingbird	-	Potential colonization
Belted Kingfisher	Improving	Worsening
Red-headed Woodpecker	-	Worsening
Gila Woodpecker	Potential colonization	-
Golden-fronted Woodpecker	Potential colonization	-
Red-bellied Woodpecker	Improving	Stable
Yellow-bellied Sapsucker	-	Stable
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Potential extirpation	Potential extirpation
Hairy Woodpecker	-	Improving
American Three-toed Woodpecker	-	Potential colonization^
Northern Flicker	Stable	Potential extirpation
Gilded Flicker	Potential colonization	Potential colonization
Pileated Woodpecker	Worsening	Stable
Crested Caracara	Stable	Stable
American Kestrel	x	Stable

Common Name	Summer Trend	Winter Trend
Merlin	-	Stable^
Peregrine Falcon	-	Worsening
Acadian Flycatcher	Potential colonization	-
Dusky Flycatcher	-	Potential colonization
Eastern Phoebe	-	Improving
Say's Phoebe	-	Potential colonization
Great Crested Flycatcher	Worsening	Improving*
Great Kiskadee	-	Potential colonization
Couch's Kingbird	Potential colonization	Potential colonization
Western Kingbird	Potential colonization	x
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Worsening*	Worsening
White-eyed Vireo	Improving*	Worsening
Red-eyed Vireo	Stable	-
Black-whiskered Vireo	Improving	-
Green Jay	-	Potential colonization
Blue Jay	Worsening	Potential extirpation
American Crow	Improving	Stable
Fish Crow	Worsening	Worsening
Northern Rough-winged Swallow	Improving*	-
Purple Martin	Stable	x
Tree Swallow	-	Stable
Violet-green Swallow	-	Potential colonization
Barn Swallow	Improving	-
Carolina Chickadee	Potential extirpation	Worsening*
Tufted Titmouse	Worsening	Stable

Common Name	Summer Trend	Winter Trend
Verdin	Potential colonization	-
Brown-headed Nuthatch	-	Stable
House Wren	-	Worsening
Sedge Wren	-	Worsening
Marsh Wren	-	Worsening*
Carolina Wren	Improving	Worsening
Cactus Wren	-	Potential colonization
Blue-gray Gnatcatcher	Improving*	Worsening
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	Potential extirpation	Potential extirpation
Hermit Thrush	-	Worsening
American Robin	-	Potential extirpation
Gray Catbird	-	Worsening
Curve-billed Thrasher	-	Potential colonization
Brown Thrasher	Potential extirpation	Worsening
Bendire's Thrasher	-	Potential colonization
Crissal Thrasher	Potential colonization	-
Northern Mockingbird	Worsening	Stable
European Starling	Worsening	Improving
American Pipit	-	Stable
Cedar Waxwing	-	Improving
Snow Bunting	-	Improving
Ovenbird	-	Stable
Worm-eating Warbler	Potential colonization	-
Black-and-white Warbler	Improving	Stable
Orange-crowned Warbler	-	Stable
Kentucky Warbler	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Common Yellowthroat	Stable	Worsening
American Redstart	Improving	-
Northern Parula	Worsening	Stable
Palm Warbler	-	Stable^
Pine Warbler	Stable^	Worsening
Yellow-rumped Warbler	-	Worsening
Yellow-throated Warbler	-	Improving
Prairie Warbler	Improving*	Stable
Black-throated Gray Warbler	-	Potential colonization
Hermit Warbler	-	Potential colonization^
Red-faced Warbler	Potential colonization	-
Eastern Towhee	Worsening	x
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
Chipping Sparrow	-	Worsening
Field Sparrow	-	Stable
Vesper Sparrow	-	Improving
Lark Sparrow	Potential colonization	Potential colonization
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Stable
Grasshopper Sparrow	-	Worsening
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	-	Worsening^
Seaside Sparrow	Worsening^	-

Common Name	Summer Trend	Winter Trend
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	-	Stable
White-throated Sparrow	-	Stable
White-crowned Sparrow	-	Stable
Summer Tanager	Potential extirpation	-
Northern Cardinal	Stable	Stable
Blue Grosbeak	Potential extirpation	-
Indigo Bunting	Stable	Improving
Painted Bunting	Stable	Improving
Red-winged Blackbird	Stable	Stable
Tricolored Blackbird	Potential colonization	-
Eastern Meadowlark	Stable	Worsening
Western Meadowlark	-	Potential colonization
Common Grackle	Worsening	Worsening
Boat-tailed Grackle	Worsening*^	Worsening*^
Great-tailed Grackle	-	Potential colonization
Brown-headed Cowbird	Stable	Worsening
Altamira Oriole	-	Potential colonization
House Finch	Stable	Stable
American Goldfinch	-	Stable
House Sparrow	x	Potential extirpation