Birds and Climate Change

National Park Service
U.S. Department of the Interior

Fire Island 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 Fire Island 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.

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.

Results

Climate change is expected to alter the bird community at the Seashore, 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 Seashore today, climate suitability in summer under the high-emissions pathway is projected to improve for 38, remain stable for 41, and worsen for 8 species. Suitable climate ceases to occur for 23 species in summer, potentially resulting in extirpation of those species from the Seashore (e.g., Figure 2). Climate is projected to become suitable in summer for 14 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 54, remain stable for 44, and worsen for 17 species. Suitable climate ceases to occur for 9 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 35 species not found at the Seashore today, potentially resulting in local colonization.

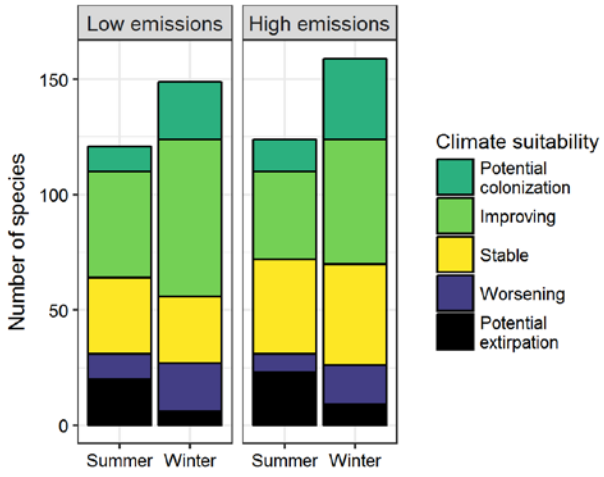

Figure 1. Projected changes in climate suitability for birds at the Seashore, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.26 in summer (42nd percentile across all national parks) and 0.16 in winter (20th percentile) under the high-emissions pathway. Potential species turnover declines to 0.20 in summer and 0.12 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 33 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 Seashore may serve as an important refuge for 32 of these climate-sensitive species, one, the Mallard (*Anas platyrhynchos*), might be extirpated from the Seashore in summer by 2050.

Figure 2. Although currently found at the Seashore, suitable climate for the American Goldfinch (*Spinus tristis*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation. Photo by John Benson/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, Fire Island National Seashore 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 32 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 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
Brant	x	Stable
Cackling/Canada Goose	x	Worsening
Mute Swan	x	Worsening*
Wood Duck	x	Improving
Gadwall	Improving^	Improving
Eurasian Wigeon	-	Improving
American Wigeon	-	Improving
American Black Duck	x	Worsening*
Mallard	Potential extirpation^	Worsening
Blue-winged Teal	-	Potential colonization
Northern Shoveler	-	Improving
Green-winged Teal	-	Improving
Canvasback	-	Stable
Ring-necked Duck	-	Improving
Greater Scaup	-	Improving^
Lesser Scaup	-	Stable

Common Name	Summer Trend	Winter Trend
Common Eider	x	Stable
Harlequin Duck	-	Stable
Surf Scoter	x	Improving
White-winged Scoter	x	Stable
Black Scoter	x	Improving
Long-tailed Duck	Stable	Stable
Bufflehead	-	Improving
Common Goldeneye	-	Worsening
Barrow's Goldeneye	-	Potential colonization^
Hooded Merganser	x	Improving^
Common Merganser	-	Potential extirpation
Red-breasted Merganser	Improving	Improving^
Ruddy Duck	Improving	Improving
Northern Bobwhite	Improving*	-
Wild Turkey	x	Potential extirpation

Common Name	Summer Trend	Winter Trend
Red-throated Loon	Stable	Stable
Common Loon	Stable	Improving^
Pied-billed Grebe	-	Stable
Horned Grebe	-	Improving
Red-necked Grebe	-	Stable^
Eared Grebe	-	Potential colonization
Northern Gannet	Improving^	Improving^
Double-crested Cormorant	x	Improving
Great Cormorant	-	Stable
American White Pelican	-	Potential colonization
Brown Pelican	Stable	Potential colonization^
American Bittern	Stable	Improving^
Great Blue Heron	Improving	Improving
Great Egret	Improving*	Improving*
Little Blue Heron	Improving	Potential colonization
Tricolored Heron	Stable^	Potential colonization
Cattle Egret	Improving	-
Green Heron	Improving*	-
Black-crowned Night-Heron	x	Stable
Yellow-crowned Night-Heron	Improving	-
Black Vulture	Potential colonization	Potential colonization
Turkey Vulture	x	Improving
Mississippi Kite	Potential colonization	-
Northern Harrier	Stable^	Improving
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	x	Stable
Bald Eagle	x	Improving
Red-shouldered Hawk	Potential colonization	Potential colonization
Red-tailed Hawk	Improving	Worsening

Common Name	Summer Trend	Winter Trend
Rough-legged Hawk	-	Potential extirpation
King Rail	x	Improving^
Common Gallinule	x	Improving
American Coot	-	Worsening*
Black-bellied Plover	x	Improving
Semipalmated Plover	Stable	Potential colonization^
Killdeer	Improving	Improving*
Greater Yellowlegs	Improving	Improving*
Willet	Stable^	-^
Lesser Yellowlegs	Stable^	Potential colonization
Marbled Godwit	Stable^	-
Ruddy Turnstone	x	Stable^
Red Knot	x	Stable^
Sanderling	x	Improving
Dunlin	x	Improving^
Purple Sandpiper	-	Stable
Least Sandpiper	x	Potential colonization
Western Sandpiper	Stable	Potential colonization
Short-billed Dowitcher	x	Potential colonization^
Long-billed Dowitcher	x	Potential colonization
American Woodcock	x	Improving*
Wilson's Phalarope	Stable^	-
Red-necked Phalarope	Stable	-
Pomarine Jaeger	-	Potential colonization^
Parasitic Jaeger	Stable	-
Bonaparte's Gull	Stable	Improving
Laughing Gull	Stable^	Potential colonization
Ring-billed Gull	Stable^	Improving
Herring Gull	Improving	Stable^

Common Name	Summer Trend	Winter Trend
Glaucous Gull	Stable	x
Great Black-backed Gull	x	Stable
Black Tern	Improving	-
Arctic Tern	Improving	-
Forster's Tern	x	Potential colonization
Rock Pigeon	Worsening	Potential extirpation
Eurasian Collared-Dove	-	Potential colonization
Mourning Dove	Stable	Worsening
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Potential extirpation	-
Barn Owl	-	Potential colonization
Eastern Screech-Owl	x	Stable
Great Horned Owl	x	Stable
Snowy Owl	-	Stable
Chuck-will's-widow	Improving	-
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Improving*	-
Belted Kingfisher	Stable	Stable
Red-bellied Woodpecker	Improving	Stable
Yellow-bellied Sapsucker	-	Improving
Downy Woodpecker	Improving	Worsening
Hairy Woodpecker	Stable	Worsening*
Northern Flicker	Stable	Stable
Pileated Woodpecker	Potential colonization	-
American Kestrel	x	Improving
Merlin	-	Improving^
Peregrine Falcon	x	Stable
Eastern Wood-Pewee	Improving	-
Acadian Flycatcher	Stable	-
Willow Flycatcher	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Eastern Phoebe	Stable	Potential colonization
Great Crested Flycatcher	Improving	-
Eastern Kingbird	Worsening	-
Loggerhead Shrike	Potential colonization	Potential colonization
White-eyed Vireo	Improving*	Potential colonization
Bell's Vireo	Potential colonization	-
Warbling Vireo	Potential extirpation	-
Red-eyed Vireo	Potential extirpation	-
Blue Jay	Stable	Worsening
American Crow	Worsening	Worsening
Fish Crow	Improving	Stable
Horned Lark	Stable	Worsening*
Northern Rough-winged Swallow	Improving	-
Purple Martin	Improving*	-
Tree Swallow	Potential extirpation	Improving
Barn Swallow	Improving	-
Cliff Swallow	Improving	-
Carolina Chickadee	-	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Tufted Titmouse	Improving	Stable
Red-breasted Nuthatch	-	Stable
White-breasted Nuthatch	Potential extirpation	Potential extirpation
Brown-headed Nuthatch	Potential colonization^	Potential colonization
Brown Creeper	-	Stable
House Wren	Potential extirpation	Potential colonization
Pacific/Winter Wren	-	Improving

Common Name	Summer Trend	Winter Trend
Sedge Wren	-	Potential colonization
Marsh Wren	x	Potential colonization
Carolina Wren	Improving	Stable
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Improving
Eastern Bluebird	Potential colonization	Stable
Veery	Potential extirpation	-
Hermit Thrush	Stable	Improving
Wood Thrush	Worsening*	-
American Robin	Worsening	Improving
Gray Catbird	Potential extirpation	Stable
Brown Thrasher	Stable	Improving*
Northern Mockingbird	Improving	Improving
European Starling	Worsening	Stable
American Pipit	-	Potential colonization
Cedar Waxwing	Potential extirpation	Stable
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Potential extirpation
Ovenbird	Stable	-
Blue-winged Warbler	Stable	-
Black-and-white Warbler	Stable	-
Prothonotary Warbler	Potential colonization	-
Swainson's Warbler	Potential colonization	-
Orange-crowned Warbler	-	Potential colonization
Common Yellowthroat	Stable	-
American Redstart	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Northern Parula	Potential colonization	-
Yellow Warbler	Potential extirpation	-
Chestnut-sided Warbler	Potential extirpation	-
Pine Warbler	Stable^	-
Yellow-rumped Warbler	-	Improving
Prairie Warbler	Stable	-
Eastern Towhee	Stable	x
American Tree Sparrow	-	Potential extirpation
Chipping Sparrow	Potential extirpation	Improving*
Field Sparrow	Improving	Improving
Vesper Sparrow	-	Potential colonization
Savannah Sparrow	Potential extirpation	Improving*
LeConte's Sparrow	-	Potential colonization
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	x	Stable^
Seaside Sparrow	Stable^	-
Fox Sparrow	-	Improving
Song Sparrow	Potential extirpation	Stable
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	Potential extirpation	Improving
White-throated Sparrow	-	Stable
Dark-eyed Junco	-	Worsening
Summer Tanager	Potential colonization	-
Scarlet Tanager	Potential extirpation	-
Northern Cardinal	Stable	Worsening
Rose-breasted Grosbeak	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Blue Grosbeak	Potential colonization	-
Indigo Bunting	Improving*	-
Painted Bunting	Potential colonization	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	-	Improving
Brewer's Blackbird	-	Potential colonization
Common Grackle	Worsening	Improving
Boat-tailed Grackle	Improving^	Stable^
Brown-headed Cowbird	Stable	Improving

Common Name	Summer Trend	Winter Trend
Orchard Oriole	Improving*	-
Baltimore Oriole	Potential extirpation	-
Pine Grosbeak	-	Stable
House Finch	Worsening*	Potential extirpation
White-winged Crossbill	-	Stable
Common Redpoll	-	Stable
Pine Siskin	-	Stable
American Goldfinch	Potential extirpation	Worsening
House Sparrow	x	Worsening