



Assateague 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 Assateague 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.

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 28, remain stable for 61, and worsen for 21 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 11 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 80, remain stable for 60, and worsen for 24 species. Suitable climate ceases to occur for 13 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 26 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.

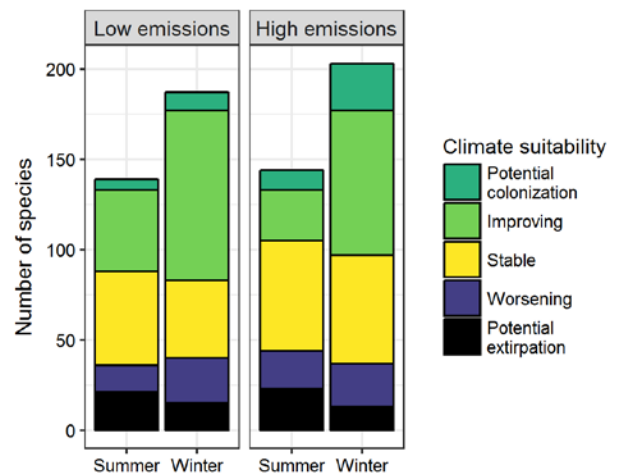


Figure 1. Projected changes in climate suitability for birds at the Seashore, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.18 in summer (28th percentile across all national parks) and 0.18 in winter (22nd percentile) under the high-emissions pathway. Potential species turnover declines to 0.13 in summer and 0.14 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 Seashore may serve as an important refuge for

Management Implications

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

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

38 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).

other stressors. Furthermore, park managers have an opportunity to focus on supporting the 38 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
Fulvous Whistling-Duck	Potential colonization	-
Brant	x	Worsening*
Cackling/Canada Goose	x	Worsening
Mute Swan	x	Potential extirpation
Tundra Swan	Stable	x
Wood Duck	x	Improving
Gadwall	Improving^	Improving
Eurasian Wigeon	-	Stable
American Wigeon	Improving^	Improving
American Black Duck	x	Potential extirpation
Mallard	Potential extirpation^	Stable
Blue-winged Teal	Stable	Improving
Northern Shoveler	Improving^	Improving
Northern Pintail	Potential extirpation	x

Common Name	Summer Trend	Winter Trend
Green-winged Teal	x	Improving
Canvasback	-	Stable
Ring-necked Duck	-	Improving
Greater Scaup	-	Improving^
Lesser Scaup	x	Improving
Common Eider	-	Worsening
Harlequin Duck	-	Stable
Surf Scoter	x	Worsening*
White-winged Scoter	x	Worsening*
Black Scoter	x	Stable
Long-tailed Duck	Stable	Worsening*
Bufflehead	-	Improving
Common Goldeneye	-	Potential extirpation
Hooded Merganser	x	Stable^
Common Merganser	-	Potential extirpation
Red-breasted Merganser	Stable	Stable^

Common Name	Summer Trend	Winter Trend
Ruddy Duck	Stable	Improving
Northern Bobwhite	Worsening	Worsening*
Wild Turkey	x	Potential extirpation
Red-throated Loon	Stable	Worsening*
Common Loon	Stable	Stable^
Pied-billed Grebe	x	Improving
Horned Grebe	-	Stable
Red-necked Grebe	-	Stable^
Eared Grebe	-	Improving
Northern Gannet	Stable^	Worsening*^
Neotropic Cormorant	-	Potential colonization
Double-crested Cormorant	x	Improving
Great Cormorant	-	Worsening*
Anhinga	Potential colonization^	Potential colonization
American White Pelican	-	Improving*
Brown Pelican	Stable	Stable^
American Bittern	Stable	Improving^
Great Blue Heron	Improving*	Improving
Great Egret	Improving*	Improving*
Snowy Egret	x	Improving
Little Blue Heron	Improving*	Improving
Tricolored Heron	Improving^	Improving
Cattle Egret	Improving*	Potential colonization
Green Heron	Improving*	-
Black-crowned Night-Heron	x	Improving
Yellow-crowned Night-Heron	Improving	Improving
White Ibis	Improving	Improving
Glossy Ibis	x	Improving
Black Vulture	Improving	Stable
Turkey Vulture	x	Improving
Osprey	x	Improving

Common Name	Summer Trend	Winter Trend
Mississippi Kite	Potential colonization	-
Northern Harrier	Stable^	Improving
Sharp-shinned Hawk	x	Stable
Cooper's Hawk	x	Stable
Northern Goshawk	-	Potential extirpation
Bald Eagle	x	Stable
Red-shouldered Hawk	Improving	Improving
Red-tailed Hawk	Stable	Stable
Rough-legged Hawk	-	Potential extirpation
Clapper Rail	x	Stable
King Rail	x	Potential colonization^
Virginia Rail	x	Improving
Sora	-	Potential colonization
Common Gallinule	x	Improving
American Coot	x	Improving
American Avocet	x	Improving^
American Oystercatcher	x	Stable^
Black-bellied Plover	x	Stable
American Golden-Plover	Stable	-
Semipalmated Plover	Stable	Stable^
Piping Plover	x	Improving^
Killdeer	Improving	Improving
Spotted Sandpiper	x	Potential colonization
Solitary Sandpiper	Stable	-
Greater Yellowlegs	Stable	Improving*
Willet	Stable^	Improving^
Lesser Yellowlegs	Stable^	Improving
Whimbrel	x	Stable
Marbled Godwit	Improving^	Stable
Ruddy Turnstone	x	Worsening*^
Red Knot	x	Stable^

Common Name	Summer Trend	Winter Trend
Sanderling	x	Worsening*
Dunlin	x	Stable^
Purple Sandpiper	-	Worsening*
Least Sandpiper	x	Improving*
Western Sandpiper	Stable	Improving
Short-billed Dowitcher	x	Stable^
Long-billed Dowitcher	x	Improving
Wilson's Snipe	-	Stable
American Woodcock	x	Stable
Wilson's Phalarope	Stable^	-
Red-necked Phalarope	Stable	-
Bonaparte's Gull	Stable	Stable
Laughing Gull	Worsening**^	Stable
Ring-billed Gull	Stable^	Stable
Herring Gull	Stable	Worsening^
Glaucous Gull	Stable	x
Great Black-backed Gull	x	Stable
Gull-billed Tern	x	Potential colonization
Black Tern	Improving	-
Arctic Tern	Stable	-
Forster's Tern	x	Improving*
Black Skimmer	x	Stable^
Rock Pigeon	Worsening	Potential extirpation
Eurasian Collared-Dove	-	Improving*
White-winged Dove	-	Potential colonization
Mourning Dove	Worsening	Worsening
Inca Dove	-	Potential colonization
Common Ground-Dove	Potential colonization	-
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Stable	-
Greater Roadrunner	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Groove-billed Ani	-	Potential colonization
Barn Owl	x	Improving
Eastern Screech-Owl	x	Stable
Great Horned Owl	x	Stable
Snowy Owl	-	Improving
Barred Owl	-	Improving
Common Nighthawk	Improving*	-
Chuck-will's-widow	Improving	-
Chimney Swift	Worsening	-
Ruby-throated Hummingbird	Stable	-
Belted Kingfisher	Stable	Improving
Red-headed Woodpecker	Improving	Stable
Red-bellied Woodpecker	Improving	Stable
Yellow-bellied Sapsucker	-	Improving
Downy Woodpecker	Stable	Worsening
Hairy Woodpecker	Potential extirpation	Worsening
Red-cockaded Woodpecker	-	Potential colonization
Northern Flicker	Improving	Stable
Pileated Woodpecker	Stable	Stable
American Kestrel	x	Improving
Merlin	-	Improving^
Peregrine Falcon	x	Stable
Olive-sided Flycatcher	Stable	-
Eastern Wood-Pewee	Worsening	-
Acadian Flycatcher	Stable	-
Willow Flycatcher	Potential extirpation	-
Eastern Phoebe	Stable	Improving*
Great Crested Flycatcher	Stable	-
Western Kingbird	Potential colonization	-
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Loggerhead Shrike	Potential colonization	Potential colonization
Northern Shrike	-	Stable
White-eyed Vireo	Stable	Potential colonization
Yellow-throated Vireo	Stable	-
Warbling Vireo	Potential extirpation	-
Red-eyed Vireo	Potential extirpation	-
Blue Jay	Stable	Improving
American Crow	Worsening	Worsening
Fish Crow	Stable	Improving*
Horned Lark	Potential extirpation	Stable
Northern Rough-winged Swallow	Stable	-
Purple Martin	Improving	-
Tree Swallow	Potential extirpation	Stable
Barn Swallow	Stable	-
Cliff Swallow	Improving*	-
Carolina Chickadee	Stable	Stable
Tufted Titmouse	Worsening	Worsening
Red-breasted Nuthatch	-	Stable
White-breasted Nuthatch	Potential extirpation	Potential extirpation
Brown-headed Nuthatch	Stable^	Stable
Brown Creeper	-	Worsening
House Wren	Potential extirpation	Improving*
Pacific/Winter Wren	-	Improving
Sedge Wren	-	Improving*
Marsh Wren	x	Improving*
Carolina Wren	Stable	Stable
Blue-gray Gnatcatcher	Stable	Potential colonization
Golden-crowned Kinglet	-	Stable

Common Name	Summer Trend	Winter Trend
Ruby-crowned Kinglet	-	Improving
Eastern Bluebird	Stable	Stable
Hermit Thrush	-	Improving
Wood Thrush	Worsening	-
American Robin	Potential extirpation	Improving
Gray Catbird	Potential extirpation	Stable
Brown Thrasher	Worsening	Improving
Northern Mockingbird	Improving	Improving
European Starling	Worsening	Stable
American Pipit	-	Improving*
Sprague's Pipit	-	Potential colonization
Cedar Waxwing	Potential extirpation	Improving
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Potential extirpation
Ovenbird	Potential extirpation	-
Worm-eating Warbler	Worsening	-
Black-and-white Warbler	Stable	Potential colonization
Prothonotary Warbler	Improving*	-
Swainson's Warbler	Potential colonization	-
Orange-crowned Warbler	-	Improving*
Kentucky Warbler	Stable	-
Common Yellowthroat	Worsening	Improving*
Hooded Warbler	Stable	-
American Redstart	Stable	-
Northern Parula	Stable	-
Yellow Warbler	Potential extirpation	-
Palm Warbler	-	Stable^
Pine Warbler	Worsening^	Improving*

Common Name	Summer Trend	Winter Trend
Yellow-rumped Warbler	-	Improving
Yellow-throated Warbler	Stable	Potential colonization
Prairie Warbler	Stable	-
Yellow-breasted Chat	Stable	-
Eastern Towhee	Worsening*	x
Bachman's Sparrow	Potential colonization	Potential colonization
American Tree Sparrow	-	Potential extirpation
Chipping Sparrow	Potential extirpation	Improving*
Field Sparrow	Worsening*	Stable
Vesper Sparrow	Potential extirpation	Improving*
Lark Sparrow	-	Potential colonization
Savannah Sparrow	-	Improving
Grasshopper Sparrow	Worsening*	-
Henslow's Sparrow	-	Potential colonization
LeConte's Sparrow	-	Improving*
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	x	Stable^
Seaside Sparrow	Stable^	Stable^
Fox Sparrow	-	Improving
Song Sparrow	Potential extirpation	Stable
Lincoln's Sparrow	-	Potential colonization
Swamp Sparrow	Stable	Improving
White-throated Sparrow	-	Improving
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Stable

Common Name	Summer Trend	Winter Trend
Dark-eyed Junco	-	Worsening
Summer Tanager	Stable	-
Scarlet Tanager	Potential extirpation	-
Northern Cardinal	Improving	Worsening
Rose-breasted Grosbeak	Potential extirpation	-
Blue Grosbeak	Worsening	-
Indigo Bunting	Stable	-
Painted Bunting	Potential colonization	-
Red-winged Blackbird	Worsening	Improving
Eastern Meadowlark	Improving*	Improving
Rusty Blackbird	-	Improving
Brewer's Blackbird	-	Potential colonization
Common Grackle	Worsening	Improving
Boat-tailed Grackle	Stable^	Worsening*^
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Worsening	Improving
Orchard Oriole	Stable	-
Baltimore Oriole	Potential extirpation	-
House Finch	Potential extirpation	Potential extirpation
Purple Finch	-	Stable
Common Redpoll	-	Stable
Pine Siskin	-	Stable
American Goldfinch	Potential extirpation	Worsening
Evening Grosbeak	-	Potential extirpation
House Sparrow	x	Stable