Birds and Climate Change

National Park Service
U.S. Department of the Interior

Gulf Islands 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 Gulf Islands 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 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 19, remain stable for 47 (e.g., Figure 2), and worsen for 18 species. Suitable climate ceases to occur for 12 species in summer, potentially resulting in extirpation of those species from the Seashore. Climate is projected to become suitable in summer for 16 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 39, remain stable for 83, and worsen for 39 species. Suitable climate ceases to occur for 14 species in winter, potentially resulting in extirpation from the Seashore. Climate is projected to become suitable in winter for 37 species not found at the Seashore today, potentially resulting in local colonization.

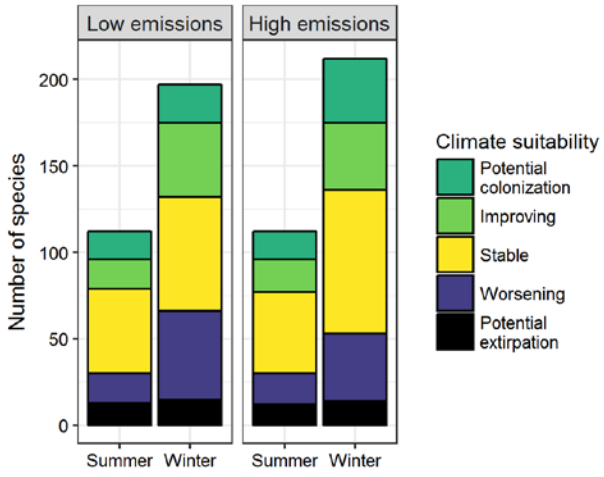

Figure 1. Projected changes in climate suitability for birds at the Seashore, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Seashore between the present and 2050 is 0.14 in summer (19th percentile across all national parks) and 0.12 in winter (12th percentile) under the high-emissions pathway. Potential species turnover increases to 0.15 in summer and declines to 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 Seashore is or may become home to 37 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 34 of these climate-sensitive species, 3 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 Northern Cardinal (*Cardinalis cardinalis*) through 2050. Photo by Andy Morffew/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, Gulf Islands 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 other stressors.

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.

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

Gregor Schuurman, Ph.D.
Ecologist, NPS Climate Change Response Program
970-267-7211, gregor_schuurman@nps.gov

Joanna Wu
Biologist, National Audubon Society
415-644-4610, science@audubon.org

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
Mute Swan	-	Stable
Muscovy Duck	-	Improving
Wood Duck	-	Worsening
Gadwall	-	Improving
American Wigeon	-	Improving
Mallard	Stable^	Stable
Mottled Duck	Improving*	Improving*
Blue-winged Teal	Improving	Improving*
Cinnamon Teal	-	Potential colonization
Northern Shoveler	-	Improving*
Green-winged Teal	-	Stable
Canvasback	-	Improving*
Redhead	Stable^	x
Ring-necked Duck	-	Stable
Greater Scaup	-	Stable^
Lesser Scaup	-	Stable

Common Name	Summer Trend	Winter Trend
Surf Scoter	-	Improving
White-winged Scoter	-	Stable
Black Scoter	-	Potential extirpation
Long-tailed Duck	-	Stable
Bufflehead	-	Potential extirpation
Common Goldeneye	-	Stable
Hooded Merganser	-	Potential extirpation^
Red-breasted Merganser	Stable	Worsening*^
Ruddy Duck	-	Stable
Plain Chachalaca	-	Potential colonization
Scaled Quail	Potential colonization	Potential colonization
Northern Bobwhite	Improving*	-
Red-throated Loon	-	Potential extirpation
Pacific Loon	-	Improving

Common Name	Summer Trend	Winter Trend
Common Loon	Potential extirpation	Worsening*^
Pied-billed Grebe	x	Stable
Horned Grebe	-	Potential extirpation
Magnificent Frigatebird	x	Potential colonization
Northern Gannet	Potential extirpation^	Worsening*^
Double-crested Cormorant	x	Stable
Anhinga	Stable^	Improving*
American White Pelican	-	Improving*
Brown Pelican	Worsening	Stable^
American Bittern	-	Stable^
Great Blue Heron	Stable	Stable
Great Egret	Stable	Stable
Snowy Egret	x	Improving
Little Blue Heron	Stable	Stable
Tricolored Heron	Stable^	Worsening*
Reddish Egret	x	Improving
Cattle Egret	Improving*	Improving*
Green Heron	Stable	Stable
Black-crowned Night-Heron	x	Improving
Yellow-crowned Night-Heron	Stable	Stable
White Ibis	Stable	Improving
Black Vulture	Stable	Improving*
Turkey Vulture	x	Improving
Osprey	x	Stable
Swallow-tailed Kite	Stable	x
Mississippi Kite	Worsening	-
Northern Harrier	-	Stable
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	x	Stable
Bald Eagle	-	Stable
Harris's Hawk	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Red-shouldered Hawk	Stable	Improving
Red-tailed Hawk	Stable	Stable
Ferruginous Hawk	-	Potential colonization
Clapper Rail	x	Worsening*
King Rail	x	Worsening^
Virginia Rail	-	Worsening
Sora	-	Worsening
Common Gallinule	x	Stable
American Coot	x	Stable
Limpkin	-	Potential colonization
American Oystercatcher	x	Stable^
Black-bellied Plover	x	Worsening*
Snowy Plover	x	Improving
Semipalmated Plover	Stable	Stable^
Piping Plover	-	Worsening^
Killdeer	Improving*	Stable
Spotted Sandpiper	-	Improving
Greater Yellowlegs	Stable	Stable
Willet	Worsening^	Stable^
Lesser Yellowlegs	Stable^	Improving*
Marbled Godwit	Stable^	Improving
Ruddy Turnstone	x	Stable^
Red Knot	x	Stable^
Sanderling	x	Worsening*
Dunlin	-	Stable^
Least Sandpiper	x	Stable
Western Sandpiper	-	Stable
Short-billed Dowitcher	x	Stable^
Wilson's Snipe	-	Stable
American Woodcock	-	Improving*
Bonaparte's Gull	-	Stable
Laughing Gull	Worsening*^	Stable

Common Name	Summer Trend	Winter Trend
Ring-billed Gull	Potential extirpation^	Worsening
Herring Gull	Stable	Stable^
Caspian Tern	x	Stable
Black Tern	Stable	-
Forster's Tern	x	Stable
Royal Tern	x	Worsening*^
Sandwich Tern	x	Improving^
Black Skimmer	x	Stable^
Rock Pigeon	Improving*	Stable
Eurasian Collared-Dove	x	Stable
White-winged Dove	Improving*	Improving*
Mourning Dove	Stable	Improving
Common Ground-Dove	Improving*	Improving*
White-tipped Dove	-	Potential colonization
Yellow-billed Cuckoo	Improving	-
Greater Roadrunner	-	Potential colonization
Barn Owl	-	Improving*
Eastern Screech-Owl	-	Improving
Great Horned Owl	x	Potential extirpation
Burrowing Owl	-	Potential colonization
Lesser Nighthawk	Potential colonization	Improving
Common Nighthawk	Stable	-
Common Pauraque	-	Potential colonization
Chuck-will's-widow	Stable	-
Chimney Swift	Worsening	-
Ruby-throated Hummingbird	Stable	x
Buff-bellied Hummingbird	-	Improving
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	Stable	Worsening

Common Name	Summer Trend	Winter Trend
Red-headed Woodpecker	Worsening	Worsening
Golden-fronted Woodpecker	Potential colonization	-
Red-bellied Woodpecker	Improving	Worsening
Yellow-bellied Sapsucker	-	Stable
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Worsening	Potential extirpation
Hairy Woodpecker	-	Stable
Red-cockaded Woodpecker	-	Stable
Northern Flicker	Improving	Potential extirpation
Gilded Flicker	Potential colonization	Potential colonization
Pileated Woodpecker	Improving*	Potential extirpation
American Kestrel	x	Worsening
Merlin	-	Stable^
Peregrine Falcon	-	Improving*
Northern Beardless-Tyrannulet	Potential colonization	-
Eastern Wood-Pewee	Stable	-
Eastern Phoebe	-	Improving
Say's Phoebe	-	Potential colonization
Vermilion Flycatcher	-	Improving*
Great Crested Flycatcher	Stable	Potential colonization
Great Kiskadee	Potential colonization	Potential colonization
Couch's Kingbird	Potential colonization	Potential colonization
Eastern Kingbird	Stable	-
Loggerhead Shrike	Stable	Stable
White-eyed Vireo	Improving	Improving*
Red-eyed Vireo	Stable	-
Green Jay	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Blue Jay	Worsening	Worsening
American Crow	Stable	Potential extirpation
Fish Crow	Worsening*	Worsening*
Northern Rough-winged Swallow	Stable	-
Purple Martin	Worsening	x
Tree Swallow	Stable	Worsening*
Violet-green Swallow	-	Potential colonization
Barn Swallow	Potential extirpation	-
Cliff Swallow	Stable	-
Carolina Chickadee	Worsening*	Worsening*
Tufted Titmouse	Stable	Stable
Verdin	Potential colonization	Potential colonization
Red-breasted Nuthatch	-	Stable
Brown-headed Nuthatch	Worsening^	Worsening*
Brown Creeper	-	Stable
House Wren	-	Worsening
Pacific/Winter Wren	-	Stable
Sedge Wren	-	Stable
Marsh Wren	x	Worsening
Carolina Wren	Worsening	Worsening
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Improving*	Stable
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	Potential extirpation	Worsening
Hermit Thrush	-	Worsening
Wood Thrush	Stable	-
American Robin	Improving	Potential extirpation

Common Name	Summer Trend	Winter Trend
Gray Catbird	Potential extirpation	Stable
Curve-billed Thrasher	-	Potential colonization
Brown Thrasher	Potential extirpation	Worsening
Long-billed Thrasher	Potential colonization^	-
Bendire's Thrasher	-	Potential colonization
Crissal Thrasher	Potential colonization	-
Sage Thrasher	-	Potential colonization
Northern Mockingbird	Worsening	Stable
European Starling	Stable	Stable
American Pipit	-	Improving
Cedar Waxwing	-	Potential extirpation
Chestnut-collared Longspur	-	Potential colonization
Smith's Longspur	-	Potential colonization
Black-and-white Warbler	Improving	Stable
Prothonotary Warbler	Worsening*	-
Orange-crowned Warbler	-	Worsening
Common Yellowthroat	Potential extirpation	Stable
Hooded Warbler	Stable	-
Northern Parula	Stable	-
Yellow Warbler	Improving	-
Palm Warbler	-	Stable^
Pine Warbler	Stable^	Stable
Yellow-rumped Warbler	-	Worsening
Yellow-throated Warbler	Stable	Stable
Prairie Warbler	Improving	-
Black-throated Gray Warbler	-	Potential colonization
Hermit Warbler	-	Potential colonization^

Common Name	Summer Trend	Winter Trend
Olive Sparrow	-	Potential colonization
Green-tailed Towhee	-	Stable
Eastern Towhee	Potential extirpation	x
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	-	Potential colonization
Chipping Sparrow	Stable	Stable
Field Sparrow	-	Stable
Vesper Sparrow	-	Stable
Lark Sparrow	Potential colonization	Improving*
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Worsening
Nelson's/Saltmarsh Sparrow (Sharp-tailed Sparrow)	-	Worsening^
Seaside Sparrow	-	Worsening^
Fox Sparrow	-	Stable
Song Sparrow	-	Potential extirpation
Swamp Sparrow	-	Worsening
White-throated Sparrow	-	Worsening
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Stable

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