Birds and Climate Change

National Park Service
U.S. Department of the Interior

Timucuan Ecological and Historic Preserve

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 Timucuan Ecological and Historic Preserve (hereafter, the Preserve) 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Preserve 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 Preserve, 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 Preserve today, climate suitability in summer under the high-emissions pathway is projected to improve for 30 (e.g., Figure 2), remain stable for 26, and worsen for 27 species. Suitable climate ceases to occur for 13 species in summer, potentially resulting in extirpation of those species from the Preserve. Climate is projected to become suitable in summer for 18 species not found at the Preserve today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 42, remain stable for 50, and worsen for 65 species. Suitable climate ceases to occur for 21 species in winter, potentially resulting in extirpation from the Preserve. Climate is projected to become suitable in winter for 34 species not found at the Preserve today, potentially resulting in local colonization.

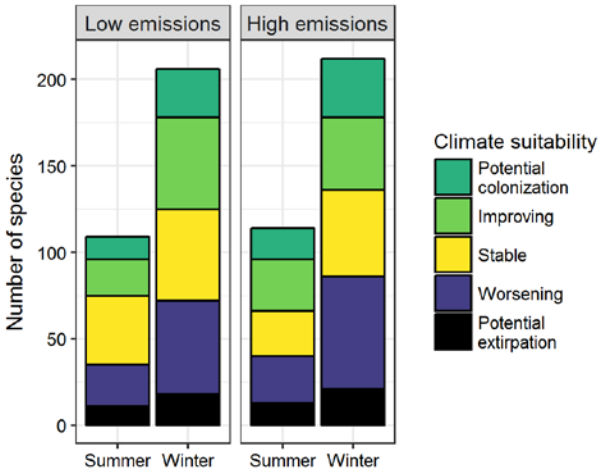

Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.17 in summer (24th percentile across all national parks) and 0.13 in winter (13th percentile) under the high-emissions pathway. Potential species turnover declines to 0.11 in summer and 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 Preserve is or may become home to 38 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 Preserve may serve as an important refuge for 33 of these climate-sensitive species, 5 might be extirpated from the Preserve in at least one season by 2050.

Figure 2. Climate at the Preserve 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).

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Timucuan Ecological and Historic Preserve 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 across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 33 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 Preserve based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Preserve 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*	-
Muscovy Duck	x	Improving*
Wood Duck	x	Worsening
Gadwall	-	Improving*
American Wigeon	-	Stable
American Black Duck	-	Potential extirpation
Mallard	Stable^	Stable
Mottled Duck	Improving*	Improving*
Blue-winged Teal	Improving	Improving*
Cinnamon Teal	-	Potential colonization
Northern Shoveler	Improving^	Improving*
Green-winged Teal	-	Improving
Canvasback	-	Improving*
Ring-necked Duck	-	Improving
Greater Scaup	-	Potential extirpation^
Lesser Scaup	-	Stable
Common Eider	-	Stable
Surf Scoter	-	Worsening
White-winged Scoter	-	Potential extirpation
Black Scoter	x	Potential extirpation
Bufflehead	-	Potential extirpation
Hooded Merganser	x	Potential extirpation^
Red-breasted Merganser	Potential extirpation	Worsening*^
Ruddy Duck	-	Stable
Plain Chachalaca	-	Potential colonization
Scaled Quail	Potential colonization	Potential colonization
Northern Bobwhite	Improving*	Improving*

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

Common Name	Summer Trend	Winter Trend
Mississippi Kite	Stable	-
Northern Harrier	-	Stable
Sharp-shinned Hawk	-	Potential extirpation
Cooper's Hawk	x	Stable
Bald Eagle	x	Potential extirpation
Harris's Hawk	Potential colonization	Potential colonization
Red-shouldered Hawk	Worsening	Improving
Short-tailed Hawk	-	Potential colonization
Red-tailed Hawk	Potential extirpation	Worsening
Ferruginous Hawk	-	Potential colonization
Clapper Rail	x	Worsening*
Virginia Rail	-	Worsening
Sora	-	Worsening
Common Gallinule	x	Improving*
American Coot	x	Stable
American Avocet	x	Improving^
American Oystercatcher	x	Worsening*^
Black-bellied Plover	x	Stable
Snowy Plover	-	Improving*
Wilson's Plover	x	Stable
Semipalmated Plover	Stable	Worsening*^
Piping Plover	-	Worsening^
Killdeer	Improving*	Stable
Spotted Sandpiper	x	Improving
Greater Yellowlegs	Potential extirpation	Stable
Willet	Worsening^	Worsening^
Lesser Yellowlegs	Stable^	Improving
Long-billed Curlew	-	Improving*
Marbled Godwit	Improving^	Worsening
Ruddy Turnstone	x	Worsening*^

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

Common Name	Summer Trend	Winter Trend
Greater Roadrunner	Potential colonization	-
Eastern Screech-Owl	x	Stable
Great Horned Owl	x	Potential extirpation
Burrowing Owl	-	Potential colonization
Barred Owl	x	Worsening
Lesser Nighthawk	Potential colonization	-
Common Nighthawk	Improving	-
Common Pauraque	-	Potential colonization
Chuck-will's-widow	Worsening*	-
Chimney Swift	Worsening	-
Ruby-throated Hummingbird	Improving*	x
Belted Kingfisher	Improving	Worsening
Red-headed Woodpecker	Stable	Worsening
Red-bellied Woodpecker	Stable	Worsening
Yellow-bellied Sapsucker	-	Stable
Downy Woodpecker	Worsening*	Potential extirpation
American Three-toed Woodpecker	-	Potential colonization^
Northern Flicker	Stable	Potential extirpation
Gilded Flicker	Potential colonization	-
Pileated Woodpecker	Worsening	Worsening
American Kestrel	x	Stable
Merlin	-	Potential extirpation^
Peregrine Falcon	-	Improving*
Northern Beardless-Tyrannulet	Potential colonization	-
Acadian Flycatcher	Stable	-
Eastern Phoebe	-	Improving
Say's Phoebe	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Great Crested Flycatcher	Worsening	Potential colonization
Great Kiskadee	Potential colonization	Potential colonization
Couch's Kingbird	Potential colonization	Potential colonization
Eastern Kingbird	Stable	-
Loggerhead Shrike	Stable	Improving
White-eyed Vireo	Improving	Stable
Yellow-throated Vireo	Worsening	-
Red-eyed Vireo	Potential extirpation	-
Green Jay	Potential colonization	Potential colonization
Blue Jay	Worsening	Worsening
American Crow	Stable	Potential extirpation
Fish Crow	Worsening*	Worsening
Chihuahuan Raven	Potential colonization	Potential colonization
Horned Lark	-	Improving
Northern Rough-winged Swallow	Improving	-
Purple Martin	Worsening	x
Tree Swallow	-	Worsening*
Violet-green Swallow	-	Potential colonization
Barn Swallow	Potential extirpation	-
Carolina Chickadee	Worsening*	Worsening
Tufted Titmouse	Worsening*	Stable
Verdin	Potential colonization	-
Red-breasted Nuthatch	-	Improving
Brown-headed Nuthatch	Worsening^	Worsening*
Rock Wren	-	Potential colonization
House Wren	Improving	Worsening
Sedge Wren	-	Worsening

Common Name	Summer Trend	Winter Trend
Marsh Wren	x	Worsening
Carolina Wren	Worsening	Worsening
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Improving*	Worsening
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Worsening
Eastern Bluebird	Potential extirpation	Worsening
Hermit Thrush	-	Worsening
American Robin	Improving	Potential extirpation
Gray Catbird	Stable	Worsening
Curve-billed Thrasher	-	Potential colonization
Brown Thrasher	Potential extirpation	Worsening
Bendire's Thrasher	-	Potential colonization
Sage Thrasher	-	Potential colonization
Northern Mockingbird	Stable	Stable
European Starling	Stable	Improving
American Pipit	-	Improving*
Cedar Waxwing	-	Potential extirpation
Snow Bunting	-	Stable
Ovenbird	-	Improving
Black-and-white Warbler	Stable	Worsening
Orange-crowned Warbler	-	Worsening
Common Yellowthroat	Potential extirpation	Worsening
Hooded Warbler	Stable	-
American Redstart	Improving	-
Northern Parula	Worsening	Stable
Yellow Warbler	Improving	x

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

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