Big Cypress National 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 Big Cypress National 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 26, remain stable for 21 (e.g., Figure 2), and worsen for 17 species. Suitable climate ceases to occur for 7 species in summer, potentially resulting in extirpation of those species from the Preserve. Climate is projected to become suitable in summer for 15 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 56, and worsen for 48 species. Suitable climate ceases to occur for 12 species in winter, potentially resulting in extirpation from the Preserve. Climate is projected to become suitable in winter for 42 species not found at the Preserve today, potentially resulting in local colonization.

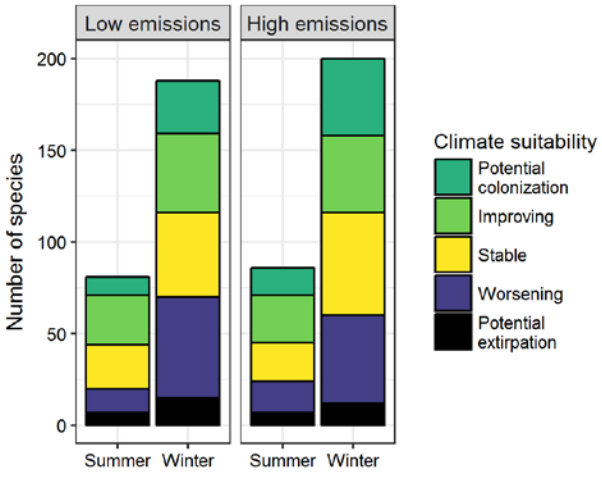

Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.12 in summer (15th percentile across all national parks) and 0.15 in winter (18th percentile) under the high-emissions pathway. Potential species turnover declines to 0.10 in summer and 0.13 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 30 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 25 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 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, Big Cypress National Preserve 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 25 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	x
Brant	-	Potential colonization
Muscovy Duck	-	Stable
Wood Duck	-	Improving
Gadwall	-	Improving*
Mallard	-	Potential extirpation
Mottled Duck	Stable	Worsening*
Blue-winged Teal	-	Stable
Cinnamon Teal	-	Potential colonization
Northern Shoveler	-	Potential colonization
Green-winged Teal	-	Improving*
Ring-necked Duck	-	Worsening
Lesser Scaup	-	Stable
Surf Scoter	-	Potential colonization
Black Scoter	-	Improving
Hooded Merganser	-	Improving^
Red-breasted Merganser	-	Stable^
Ruddy Duck	-	Stable
California Quail	-	Potential colonization
Northern Bobwhite	Improving	Improving
Wild Turkey	x	Stable
Common Loon	-	Potential extirpation^
Pied-billed Grebe	x	Worsening
Horned Grebe	-	Potential colonization
Eared Grebe	-	Potential colonization
Black-vented Shearwater	-	Potential colonization
Wood Stork	Stable	Worsening
Magnificent Frigatebird	x	Improving*

Common Name	Summer Trend	Winter Trend
Northern Gannet	-	Worsening*^
Neotropic Cormorant	-	Potential colonization
Double-crested Cormorant	x	Stable
Great Cormorant	-	Potential colonization
Anhinga	Worsening^	Worsening
American White Pelican	-	Stable
Brown Pelican	Stable	Stable^
American Bittern	-	Stable^
Least Bittern	x	Improving
Great Blue Heron	Improving*	Stable
Great Egret	Worsening*	Worsening
Snowy Egret	x	Worsening
Little Blue Heron	Stable	Worsening
Tricolored Heron	Stable^	Worsening
Reddish Egret	x	Stable
Cattle Egret	Worsening*	Worsening
Green Heron	Worsening	Worsening
Black-crowned Night-Heron	x	Worsening*
Yellow-crowned Night-Heron	Stable	Worsening*
White Ibis	Stable	Worsening
Glossy Ibis	x	Stable
White-faced Ibis	-	Potential colonization^
Roseate Spoonbill	x	Worsening*
Black Vulture	Worsening*	Worsening
Turkey Vulture	x	Stable
Osprey	x	Worsening
White-tailed Kite	-	Potential colonization
Swallow-tailed Kite	Stable	x
Golden Eagle	-	Stable
Northern Harrier	-	Improving*

Common Name	Summer Trend	Winter Trend
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	-	Improving
Bald Eagle	-	Potential extirpation
Harris's Hawk	-	Potential colonization
Red-shouldered Hawk	Worsening	Worsening
Short-tailed Hawk	x	Stable
Red-tailed Hawk	Stable	Stable
Ferruginous Hawk	-	Potential colonization
King Rail	x	Improving^
Virginia Rail	-	Stable
Sora	-	Worsening
Common Gallinule	x	Worsening*
American Coot	x	Stable
Limpkin	x	Worsening
Black-necked Stilt	x	Improving*
American Oystercatcher	-	Worsening*^
Black-bellied Plover	-	Stable
Wilson's Plover	-	Improving*
Semipalmated Plover	-	Stable^
Killdeer	Improving	Worsening
Spotted Sandpiper	-	Worsening
Greater Yellowlegs	-	Stable
Willet	Potential extirpation^	Stable^
Lesser Yellowlegs	-	Worsening
Ruddy Turnstone	x	Stable^
Sanderling	-	Improving
Dunlin	-	Improving^
Least Sandpiper	-	Improving
Western Sandpiper	-	Improving*
Short-billed Dowitcher	-	Stable^
Long-billed Dowitcher	-	Improving*
Wilson's Snipe	-	Improving

Common Name	Summer Trend	Winter Trend
American Woodcock	-	Improving
Pomarine Jaeger	-	Potential colonization^
Bonaparte's Gull	-	Improving
Laughing Gull	Improving*^	Stable
Ring-billed Gull	Potential extirpation^	Improving
Herring Gull	-	Potential extirpation^
Caspian Tern	x	Improving
Forster's Tern	x	Improving*
Royal Tern	x	Stable^
Sandwich Tern	x	Worsening*^
Black Skimmer	x	Worsening^
Rock Pigeon	Improving	Stable
White-crowned Pigeon	-	Improving
Eurasian Collared-Dove	x	Stable
White-winged Dove	Improving*	Improving*
Mourning Dove	Stable	Improving
Inca Dove	Potential colonization	-
Common Ground-Dove	Improving*	Stable
Yellow-billed Cuckoo	Improving	-
Greater Roadrunner	Potential colonization	Potential colonization
Barn Owl	-	Potential colonization
Eastern Screech-Owl	x	Worsening
Great Horned Owl	x	Potential extirpation
Burrowing Owl	Potential colonization^	Stable
Barred Owl	x	Improving
Common Nighthawk	Worsening*	-
Chuck-will's-widow	Improving	x
Chimney Swift	Improving	-
White-throated Swift	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Ruby-throated Hummingbird	Improving	x
Black-chinned Hummingbird	Potential colonization	-
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	Improving	Worsening
Green Kingfisher	-	Potential colonization
Red-headed Woodpecker	-	Stable
Gila Woodpecker	Potential colonization	Potential colonization
Red-bellied Woodpecker	Worsening	Worsening
Yellow-bellied Sapsucker	-	Stable
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Potential extirpation	Potential extirpation
Hairy Woodpecker	-	Improving
Red-cockaded Woodpecker	x	Improving
Northern Flicker	Potential extirpation	Potential extirpation
Gilded Flicker	Potential colonization	Potential colonization
Pileated Woodpecker	Worsening	Worsening*
Crested Caracara	Stable	Improving
American Kestrel	x	Stable
Merlin	-	Potential extirpation^
Peregrine Falcon	-	Improving*
Eastern Phoebe	-	Worsening
Vermilion Flycatcher	-	Potential colonization
Great Crested Flycatcher	Stable	Worsening
Couch's Kingbird	-	Potential colonization
Cassin's Kingbird	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Eastern Kingbird	Improving*	-
Loggerhead Shrike	Worsening	Worsening
White-eyed Vireo	Stable	Stable
Red-eyed Vireo	Improving	-
Blue Jay	Potential extirpation	Potential extirpation
American Crow	Potential extirpation	Stable
Fish Crow	Worsening	Worsening
Northern Rough-winged Swallow	Improving	Improving*
Purple Martin	Improving*	x
Tree Swallow	Improving	Improving
Violet-green Swallow	-	Potential colonization
Barn Swallow	Improving	-
Tufted Titmouse	Worsening*	x
Brown-headed Nuthatch	Improving^	Stable
House Wren	-	Worsening*
Sedge Wren	-	Stable
Marsh Wren	-	Stable
Carolina Wren	Worsening	Stable
Cactus Wren	-	Potential colonization
Blue-gray Gnatcatcher	Improving*	Worsening
California Gnatcatcher	-	Potential colonization
Black-tailed Gnatcatcher	-	Potential colonization
Ruby-crowned Kinglet	-	Improving
Eastern Bluebird	Improving*	Stable
Hermit Thrush	-	Potential extirpation
American Robin	-	Stable
Gray Catbird	-	Stable
Curve-billed Thrasher	Potential colonization	Potential colonization
Brown Thrasher	Stable	Worsening

Common Name	Summer Trend	Winter Trend
Crissal Thrasher	Potential colonization	-
Northern Mockingbird	Improving	Worsening
European Starling	Stable	Improving
American Pipit	-	Improving
Cedar Waxwing	-	Improving
Phainopepla	Potential colonization	-
Ovenbird	-	Stable
Black-and-white Warbler	Improving	Worsening*
Prothonotary Warbler	Stable	-
Swainson's Warbler	Potential colonization	-
Orange-crowned Warbler	-	Improving
Common Yellowthroat	Stable	Stable
Northern Parula	Stable	Stable
Palm Warbler	-	Stable^
Pine Warbler	Stable^	Worsening
Yellow-rumped Warbler	-	Worsening
Yellow-throated Warbler	-	Stable
Prairie Warbler	Improving*	Worsening
Olive Sparrow	-	Potential colonization
Green-tailed Towhee	-	Potential colonization
Eastern Towhee	Potential extirpation	x
California Towhee	Potential colonization	Potential colonization
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
Chipping Sparrow	-	Stable
Lark Sparrow	Potential colonization	Potential colonization

Common Name	Summer Trend	Winter Trend
Black-throated Sparrow	-	Potential colonization
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Worsening*
Grasshopper Sparrow	-	Worsening
LeConte's Sparrow	-	Potential colonization
Seaside Sparrow	Stable^	-
Song Sparrow	-	Stable
Swamp Sparrow	-	Improving
Northern Cardinal	Stable	Stable
Pyrrhuloxia	Potential colonization	Potential colonization
Indigo Bunting	-	Stable

Common Name	Summer Trend	Winter Trend
Painted Bunting	-	Stable
Red-winged Blackbird	Worsening	Stable
Eastern Meadowlark	Worsening	Potential extirpation
Western Meadowlark	-	Potential colonization
Common Grackle	Worsening	Worsening*
Boat-tailed Grackle	Worsening*^	Worsening^
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Improving	Stable
House Finch	-	Improving
American Goldfinch	-	Improving*
House Sparrow	x	Potential extirpation