Big Thicket 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 Thicket 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 climate suitability projected to improve for some species and worsen for others (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 20 (e.g., Figure 2), remain stable for 49, and worsen for 17 species. Suitable climate ceases to occur for 4 species in summer, potentially resulting in extirpation of those species from the Preserve. Climate is projected to become suitable in summer for 21 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 22, remain stable for 49, and worsen for 26 species. Suitable climate ceases to occur for 11 species in winter, potentially resulting in extirpation from the Preserve. Climate is projected to become suitable in winter for 36 species not found at the Preserve today, potentially resulting in local colonization.

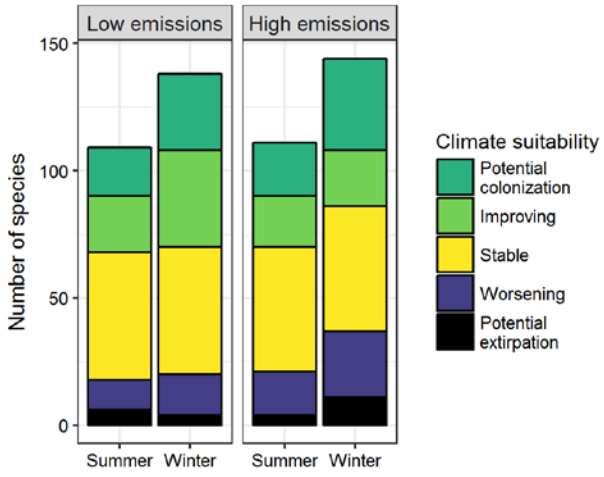

Figure 1. Projected changes in climate suitability for birds at the Preserve, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Preserve between the present and 2050 is 0.16 in summer (23rd percentile across all national parks) and 0.12 in winter (12th percentile) under the high-emissions pathway. Potential species turnover declines to 0.15 in summer and remains 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 Preserve is or may become home to 7 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 6 of these climate-sensitive species, one, the Hooded Merganser (*Lophodytes cucullatus*), might be extirpated from the Preserve in winter 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, Big Thicket National 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 6 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	-	Potential colonization
Wood Duck	x	Worsening*
Gadwall	-	Stable
Mallard	-	Stable
Cinnamon Teal	-	Potential colonization
Hooded Merganser	-	Potential extirpation^
Plain Chachalaca	-	Potential colonization
Scaled Quail	Potential colonization	-
Northern Bobwhite	Improving*	Improving*
Pacific Loon	-	Potential colonization
Pied-billed Grebe	-	Stable
Wood Stork	Stable	-

Common Name	Summer Trend	Winter Trend
Magnificent Frigatebird	-	Potential colonization
Double-crested Cormorant	-	Worsening
Anhinga	Stable^	Improving*
American White Pelican	-	Improving
Great Blue Heron	Worsening*	Worsening
Great Egret	Improving	Stable
Snowy Egret	x	Improving*
Little Blue Heron	Stable	Improving*
Cattle Egret	Stable	Stable
Green Heron	Improving*	-
Yellow-crowned Night-Heron	Worsening	-
White Ibis	Worsening	Improving*
Black Vulture	Stable	Improving
Turkey Vulture	x	Improving
Osprey	-	Stable
Swallow-tailed Kite	Stable	-

Common Name	Summer Trend	Winter Trend
Mississippi Kite	Stable	-
Northern Harrier	-	Worsening
Sharp-shinned Hawk	-	Stable
Cooper's Hawk	-	Stable
Bald Eagle	-	Stable
Harris's Hawk	Potential colonization	Potential colonization
Red-shouldered Hawk	Stable	Stable
Red-tailed Hawk	Potential extirpation	Stable
American Coot	-	Stable
Wilson's Plover	-	Potential colonization
Killdeer	Stable	Worsening
Spotted Sandpiper	-	Improving
American Woodcock	-	Improving
Ring-billed Gull	-	Potential extirpation
Forster's Tern	-	Stable
Rock Pigeon	Stable	Stable
White-winged Dove	Improving*	Stable
Mourning Dove	Worsening	Improving
Inca Dove	Stable	Improving*
White-tipped Dove	Potential colonization	Potential colonization
Yellow-billed Cuckoo	Improving	-
Greater Roadrunner	Improving*	Improving*
Eastern Screech-Owl	-	Improving
Great Horned Owl	x	Stable
Barred Owl	x	Stable
Lesser Nighthawk	Potential colonization	Potential colonization
Common Pauraque	-	Potential colonization
Chuck-will's-widow	Worsening	x
Chimney Swift	Stable	-

Common Name	Summer Trend	Winter Trend
Ruby-throated Hummingbird	Improving	x
Anna's Hummingbird	-	Improving
Ringed Kingfisher	-	Potential colonization
Belted Kingfisher	Improving	Worsening
Lewis's Woodpecker	-	Potential colonization
Red-headed Woodpecker	Worsening*	Worsening*
Gila Woodpecker	Potential colonization	-
Red-bellied Woodpecker	Stable	Stable
Yellow-bellied Sapsucker	-	Stable
Ladder-backed Woodpecker	-	Potential colonization
Downy Woodpecker	Stable	Potential extirpation
Hairy Woodpecker	Stable	Potential extirpation
American Three-toed Woodpecker	-	Potential colonization^
Northern Flicker	Improving	Potential extirpation
Pileated Woodpecker	Stable	Stable
American Kestrel	x	Worsening
Merlin	-	Stable^
Peregrine Falcon	-	Potential colonization
Eastern Wood-Pewee	Stable	-
Acadian Flycatcher	Stable	-
Gray Flycatcher	-	Potential colonization
Dusky Flycatcher	-	Potential colonization
Eastern Phoebe	-	Stable
Say's Phoebe	-	Potential colonization
Vermilion Flycatcher	-	Improving*
Great Crested Flycatcher	Stable	Potential colonization

Common Name	Summer Trend	Winter Trend
Great Kiskadee	Potential colonization	Potential colonization
Couch's Kingbird	Potential colonization	-
Western Kingbird	Potential colonization	-
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Improving*	-
Loggerhead Shrike	Stable	Stable
White-eyed Vireo	Improving	Improving*
Bell's Vireo	Potential colonization	-
Yellow-throated Vireo	Worsening	-
Red-eyed Vireo	Improving*	-
Green Jay	Potential colonization	Potential colonization
Blue Jay	Worsening	Worsening
American Crow	Stable	Potential extirpation
Fish Crow	Stable	Worsening*
Chihuahuan Raven	Potential colonization	-
Purple Martin	Worsening*	x
Barn Swallow	Worsening*	-
Cliff Swallow	Stable	-
Carolina Chickadee	Worsening*	Worsening
Tufted Titmouse	Stable	Worsening
Verdin	Potential colonization	Potential colonization
Red-breasted Nuthatch	-	Stable
White-breasted Nuthatch	Stable	Improving
Brown-headed Nuthatch	Worsening^	Stable
Brown Creeper	-	Potential extirpation
House Wren	-	Worsening
Pacific/Winter Wren	-	Stable
Sedge Wren	-	Stable
Carolina Wren	Stable	Worsening

Common Name	Summer Trend	Winter Trend
Bewick's Wren	-	Stable
Cactus Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Stable	Stable
Black-tailed Gnatcatcher	Potential colonization	Potential colonization
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Stable
Eastern Bluebird	Worsening	Worsening
Hermit Thrush	-	Worsening
Wood Thrush	Improving	-
American Robin	Improving	Worsening
Gray Catbird	Stable	Stable
Curve-billed Thrasher	Potential colonization	Potential colonization
Brown Thrasher	Potential extirpation	Worsening
Bendire's Thrasher	-	Potential colonization
LeConte's Thrasher	Potential colonization	-
Sage Thrasher	-	Potential colonization
Northern Mockingbird	Stable	Stable
European Starling	Stable	Stable
Cedar Waxwing	-	Potential extirpation
Chestnut-collared Longspur	-	Potential colonization
Ovenbird	-	Potential colonization
Worm-eating Warbler	Stable	-
Black-and-white Warbler	Improving	Stable
Prothonotary Warbler	Worsening*	x
Swainson's Warbler	Stable	-
Orange-crowned Warbler	-	Worsening
Kentucky Warbler	Improving*	-
Common Yellowthroat	Potential extirpation	Stable

Common Name	Summer Trend	Winter Trend
Hooded Warbler	Stable	-
American Redstart	Stable	-
Northern Parula	Stable	-
Pine Warbler	Stable^	Stable
Yellow-rumped Warbler	-	Worsening
Yellow-throated Warbler	Stable	-
Prairie Warbler	Stable	-
Black-throated Gray Warbler	-	Potential colonization
Yellow-breasted Chat	Stable	-
Olive Sparrow	-	Potential colonization
Green-tailed Towhee	-	Potential colonization
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	Potential colonization	Potential colonization
Bachman's Sparrow	Stable	-
Chipping Sparrow	Stable	Stable
Field Sparrow	-	Improving
Vesper Sparrow	-	Stable
Black-throated Sparrow	Potential colonization	Potential colonization
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Worsening
Grasshopper Sparrow	-	Improving
Henslow's Sparrow	-	Worsening
Fox Sparrow	-	Potential extirpation
Song Sparrow	-	Potential extirpation
Lincoln's Sparrow	-	Stable

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