Birds and Climate Change

National Park Service
U.S. Department of the Interior

Fort Vancouver National Historic Site

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 Fort Vancouver National Historic Site (hereafter, the Site) 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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Site 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 Site, 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 Site today, climate suitability in summer under the high-emissions pathway is projected to improve for 10, remain stable for 19 (e.g., Figure 2), and worsen for 18 species. Suitable climate ceases to occur for 15 species in summer, potentially resulting in extirpation of those species from the Site. Climate is projected to become suitable in summer for 31 species not found at the Site today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 26, remain stable for 34, and worsen for 31 species. Suitable climate ceases to occur for 6 species in winter, potentially resulting in extirpation from the Site. Climate is projected to become suitable in winter for 51 species not found at the Site today, potentially resulting in local colonization.

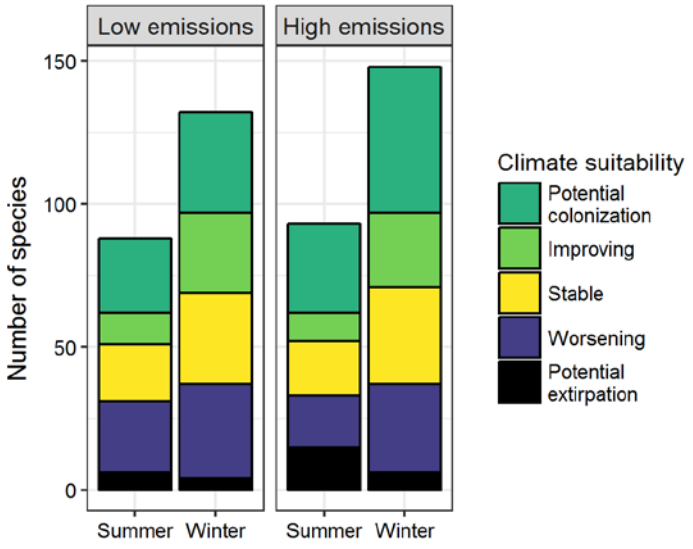

Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Site between the present and 2050 is 0.42 in summer (76th percentile across all national parks) and 0.27 in winter (41st percentile) under the high-emissions pathway. Potential species turnover declines to 0.32 in summer and 0.23 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 Site is or may become home to 26 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 Site may serve as an important refuge for 24 of these climate-sensitive species, 2 might be extirpated from the Site in at least one season by 2050.

Figure 2. Climate at the Site in summer is projected to remain suitable for the American Goldfinch (*Spinus tristis*) through 2050. Photo by John Benson/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, Fort Vancouver National Historic Site falls within the high turnover group.** Parks anticipating high turnover 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 24 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 Site based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Site 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
Cackling/Canada Goose	x	Worsening
Wood Duck	-	Improving
Gadwall	-	Stable
American Wigeon	-	Worsening
Mallard	Stable^	Stable
Northern Shoveler	-	Worsening
Ring-necked Duck	-	Stable
Greater Scaup	-	Stable^
Lesser Scaup	-	Worsening
Surf Scoter	-	Stable
White-winged Scoter	-	Stable
Bufflehead	-	Worsening
Common Goldeneye	-	Stable
Barrow's Goldeneye	-	Stable^
Hooded Merganser	-	Worsening^
Common Merganser	x	Potential extirpation
Ruddy Duck	-	Stable

Common Name	Summer Trend	Winter Trend
Northern Bobwhite	Potential colonization	-
Red-throated Loon	-	Stable
Common Loon	-	Improving^
Pied-billed Grebe	x	Stable
Horned Grebe	-	Improving
Red-necked Grebe	-	Potential extirpation^
Western Grebe	x	Worsening
Clark's Grebe	-	Stable
Double-crested Cormorant	x	Stable
Brown Pelican	Potential colonization	Potential colonization^
American Bittern	-	Potential colonization^
Least Bittern	-	Potential colonization
Great Blue Heron	Improving	Worsening
Great Egret	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Snowy Egret	-	Potential colonization
Cattle Egret	-	Potential colonization
Green Heron	Improving	-
Black-crowned Night-Heron	-	Improving
Black Vulture	Potential colonization	-
Turkey Vulture	x	Improving*
Osprey	x	Potential colonization
White-tailed Kite	Potential colonization	-
Northern Harrier	-	Potential colonization
Sharp-shinned Hawk	-	Improving
Cooper's Hawk	x	Stable
Bald Eagle	x	Worsening
Red-shouldered Hawk	Potential colonization	Potential colonization
Red-tailed Hawk	Stable	Improving
Clapper Rail	-	Potential colonization
Sora	-	Potential colonization
Common Gallinule	-	Potential colonization
American Coot	-	Worsening
American Avocet	-	Potential colonization^
Black-bellied Plover	-	Potential colonization
Snowy Plover	-	Potential colonization
Semipalmated Plover	-	Potential colonization^
Killdeer	Stable	Improving
Spotted Sandpiper	x	Improving
Greater Yellowlegs	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Willet	-	Potential colonization^
Lesser Yellowlegs	-	Potential colonization
Whimbrel	-	Potential colonization
Long-billed Curlew	-	Potential colonization
Marbled Godwit	-	Potential colonization
Ruddy Turnstone	-	Potential colonization^
Western Sandpiper	-	Potential colonization
Short-billed Dowitcher	-	Potential colonization^
American Woodcock	-	Potential colonization
Bonaparte's Gull	-	Potential colonization
Laughing Gull	Potential colonization^	-
Mew Gull	-	Stable
Ring-billed Gull	Stable^	Improving
Western Gull	Stable	Worsening^
California Gull	x	Stable^
Herring Gull	-	Improving^
Iceland Gull (Thayer's)	-	Stable
Glaucous-winged Gull	Stable	Worsening
Forster's Tern	-	Potential colonization
Rock Pigeon	Improving	Stable
Band-tailed Pigeon	Worsening	Worsening
Eurasian Collared-Dove	-	Improving*
Mourning Dove	Improving	Improving
Western Screech-Owl	x	Worsening
Great Horned Owl	-	Improving
Burrowing Owl	-	Potential colonization
Common Nighthawk	Stable	-

Common Name	Summer Trend	Winter Trend
Chuck-will's-widow	Potential colonization	-
Chimney Swift	Potential colonization	-
Black-chinned Hummingbird	Potential colonization	-
Anna's Hummingbird	Stable	Worsening*
Rufous Hummingbird	Potential extirpation	-
Belted Kingfisher	Stable	Worsening
Acorn Woodpecker	-	Stable
Red-bellied Woodpecker	Potential colonization	-
Yellow-bellied Sapsucker	-	Potential colonization
Red-breasted Sapsucker	Potential extirpation	Worsening*
Downy Woodpecker	Improving	Stable
Hairy Woodpecker	Worsening	Stable
Northern Flicker	Worsening	Improving
Pileated Woodpecker	-	Worsening
American Kestrel	x	Improving
Merlin	-	Stable^
Peregrine Falcon	x	Stable
Western Wood-Pewee	Worsening*^	-
Acadian Flycatcher	Potential colonization	-
Willow Flycatcher	Potential extirpation	-
Eastern Phoebe	-	Potential colonization
Loggerhead Shrike	Potential colonization	Potential colonization
White-eyed Vireo	Potential colonization	-
Steller's Jay	Worsening	Worsening*
California/Woodhouse's Scrub-Jay (Western Scrub-Jay)	Worsening	Stable
Yellow-billed Magpie	-	Potential colonization^

Common Name	Summer Trend	Winter Trend
American Crow	Stable	Improving
Fish Crow	Potential colonization	-
Common Raven	Potential extirpation	Potential extirpation
Northern Rough-winged Swallow	Stable	-
Purple Martin	Improving*	-
Tree Swallow	Potential extirpation	Potential colonization
Violet-green Swallow	Worsening*	-
Barn Swallow	Improving	-
Cliff Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Chestnut-backed Chickadee	Worsening*	Worsening*
Tufted Titmouse	Potential colonization	-
Bushtit	Worsening	Stable
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Improving	Stable
Brown-headed Nuthatch	-	Potential colonization
Brown Creeper	Stable^	Worsening
House Wren	Stable	Potential colonization
Pacific/Winter Wren	-	Worsening
Carolina Wren	Potential colonization	-
Bewick's Wren	Worsening	Worsening
Blue-gray Gnatcatcher	Potential colonization	-
Golden-crowned Kinglet	Potential extirpation	Worsening
Ruby-crowned Kinglet	-	Improving
Swainson's Thrush	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Hermit Thrush	-	Improving
American Robin	Worsening	Improving
Varied Thrush	-	Worsening*
Brown Thrasher	-	Potential colonization
Northern Mockingbird	Potential colonization	Potential colonization
European Starling	Improving	Stable
American Pipit	-	Improving*
Cedar Waxwing	Potential extirpation	Improving*
Worm-eating Warbler	Potential colonization	-
Prothonotary Warbler	Potential colonization	-
Orange-crowned Warbler	Worsening	Potential colonization
Kentucky Warbler	Potential colonization	-
Common Yellowthroat	-	Potential colonization
Hooded Warbler	Potential colonization	-
Yellow Warbler	Potential extirpation	-
Palm Warbler	-	Potential colonization^
Pine Warbler	Potential colonization^	Potential colonization
Yellow-rumped Warbler	-	Improving
Yellow-throated Warbler	Potential colonization	-
Prairie Warbler	Potential colonization	-
Black-throated Gray Warbler	Worsening	-
Townsend's Warbler	-	Stable
Wilson's Warbler	Potential extirpation	Potential colonization
Spotted Towhee	Worsening	x
Chipping Sparrow	Improving	Potential colonization

Common Name	Summer Trend	Winter Trend
Lark Sparrow	-	Potential colonization
Savannah Sparrow	-	Potential colonization
Grasshopper Sparrow	Potential colonization	-
Fox Sparrow	-	Worsening
Song Sparrow	Worsening	Stable
Lincoln's Sparrow	-	Worsening*
Swamp Sparrow	-	Potential colonization
White-throated Sparrow	-	Improving
White-crowned Sparrow	Potential extirpation	Worsening
Golden-crowned Sparrow	-	Worsening*
Dark-eyed Junco	x	Worsening
Western Tanager	-	Potential colonization
Northern Cardinal	Potential colonization	-
Black-headed Grosbeak	Worsening	-
Blue Grosbeak	Potential colonization	-
Lazuli Bunting	Worsening	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Potential colonization	Potential colonization
Western Meadowlark	-	Stable
Yellow-headed Blackbird	Potential extirpation	-
Brewer's Blackbird	Worsening*	Stable
Boat-tailed Grackle	-	Potential colonization^
Brown-headed Cowbird	Stable	Potential colonization
House Finch	Stable	Stable
Purple Finch	-	Worsening
Red Crossbill	Potential extirpation^	x

Common Name	Summer Trend	Winter Trend
Pine Siskin	-	Potential extirpation
Lesser Goldfinch	Stable	Stable

Common Name	Summer Trend	Winter Trend
American Goldfinch	Stable	Improving
House Sparrow	x	Stable