



Saint-Gaudens 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 Saint-Gaudens 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.

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 23 (e.g., Figure 2), remain stable for 13, and worsen for 14 species. Suitable climate ceases to occur for 25 species in summer, potentially resulting in extirpation of those species from the Site. Climate is projected to become suitable in summer for 22 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 29, remain stable for 9, and worsen for 3 species. Suitable climate ceases to occur for 5 species in winter, potentially resulting in extirpation from the Site. Climate is projected to become suitable in winter for 40 species not found at the Site today, potentially resulting in local colonization.

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.

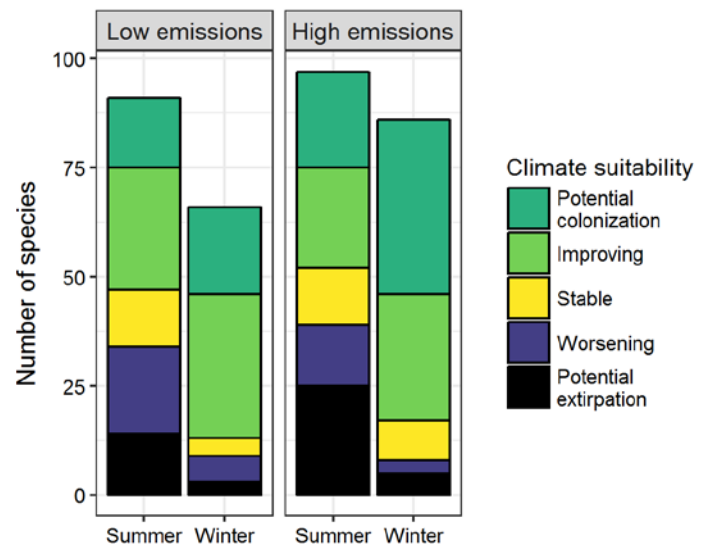


Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Site between the present and 2050 is 0.43 in summer (78th percentile across all national parks) and 0.57 in winter (99th percentile) under the high-emissions pathway. Potential species turnover declines to 0.31 in summer and 0.43 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 6 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

Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Saint-Gaudens 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

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

serve as an important refuge for 3 of these climate-sensitive species, 3 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 Red-winged Blackbird (*Agelaius phoeniceus*) through 2050. Photo by Andy Reago & Chrissy McClarren/Flickr (CC BY 2.0).

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 3 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.

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	Improving
Mute Swan	-	Potential colonization
Wood Duck	x	Potential colonization
Gadwall	-	Potential colonization
American Wigeon	-	Potential colonization
American Black Duck	-	Stable
Mallard	Potential extirpation [^]	Improving
Northern Shoveler	-	Potential colonization
Green-winged Teal	-	Potential colonization
Ring-necked Duck	-	Potential colonization
Greater Scaup	-	Potential colonization [^]
Lesser Scaup	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Hooded Merganser	-	Improving [^]
Common Merganser	x	Stable
Northern Bobwhite	Potential colonization	Potential colonization
Ring-necked Pheasant	-	Potential colonization
Common Loon	Potential extirpation	-
Great Blue Heron	Improving	Potential colonization
Green Heron	Improving	-
Black Vulture	-	Potential colonization
Turkey Vulture	x	Potential colonization
Northern Harrier	-	Potential colonization
Sharp-shinned Hawk	-	Improving
Cooper's Hawk	-	Improving
Bald Eagle	x	Improving

Common Name	Summer Trend	Winter Trend
Red-shouldered Hawk	-	Potential colonization
Red-tailed Hawk	Potential colonization	Improving
Killdeer	Improving	-
Ring-billed Gull	-	Potential colonization
Herring Gull	-	Potential colonization [^]
Rock Pigeon	Worsening	Improving
Mourning Dove	Improving	Worsening*
Yellow-billed Cuckoo	Improving*	-
Black-billed Cuckoo	Worsening	-
Eastern Screech-Owl	-	Potential colonization
Great Horned Owl	-	Potential colonization
Chimney Swift	Improving	-
Ruby-throated Hummingbird	Stable	-
Belted Kingfisher	Stable	Improving
Red-headed Woodpecker	Potential colonization	Potential colonization
Red-bellied Woodpecker	Improving*	Improving*
Yellow-bellied Sapsucker	Potential extirpation	Potential colonization
Downy Woodpecker	Improving	Worsening
Hairy Woodpecker	Potential extirpation	Worsening*
Northern Flicker	Potential extirpation	Improving
Pileated Woodpecker	Worsening	Stable
American Kestrel	-	Potential colonization
Eastern Wood-Pewee	Improving	-
Acadian Flycatcher	Potential colonization	-
Alder Flycatcher	Potential extirpation	-
Willow Flycatcher	Stable	-

Common Name	Summer Trend	Winter Trend
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Worsening	-
Great Crested Flycatcher	Worsening	-
Eastern Kingbird	Improving	-
White-eyed Vireo	Potential colonization	-
Bell's Vireo	Potential colonization	-
Yellow-throated Vireo	Improving	-
Warbling Vireo	Improving	-
Red-eyed Vireo	Worsening	-
Blue Jay	Stable	Stable
American Crow	Worsening	Stable
Fish Crow	Potential colonization	Potential colonization
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	-	Potential colonization
Northern Rough-winged Swallow	Potential colonization	-
Purple Martin	Potential colonization	-
Tree Swallow	Potential extirpation	-
Barn Swallow	Improving	-
Carolina Chickadee	Potential colonization	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Tufted Titmouse	Improving*	Improving
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Stable	Stable
Brown Creeper	Potential extirpation [^]	Improving
House Wren	Stable	-
Pacific/Winter Wren	-	Improving
Carolina Wren	Improving*	Improving*

Common Name	Summer Trend	Winter Trend
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Potential colonization
Eastern Bluebird	Improving	Improving*
Veery	Potential extirpation	-
Hermit Thrush	Potential extirpation	Improving
Wood Thrush	Stable	-
American Robin	Stable	Improving
Gray Catbird	Stable	Potential colonization
Brown Thrasher	Improving	Potential colonization
Northern Mockingbird	Potential colonization	Potential colonization
European Starling	Improving	Improving
Bohemian Waxwing	-	Potential extirpation
Cedar Waxwing	Worsening	Improving
Snow Bunting	-	Potential extirpation
Ovenbird	Potential extirpation	-
Worm-eating Warbler	Potential colonization	-
Black-and-white Warbler	Potential extirpation	-
Kentucky Warbler	Potential colonization	-
Common Yellowthroat	Worsening	-
American Redstart	Potential extirpation	-
Blackburnian Warbler	Potential extirpation	-
Yellow Warbler	Worsening	-
Chestnut-sided Warbler	Potential extirpation	-
Black-throated Blue Warbler	Potential extirpation	-

Common Name	Summer Trend	Winter Trend
Pine Warbler	Potential extirpation^	-
Yellow-rumped Warbler	Potential extirpation	Potential colonization
Yellow-throated Warbler	Potential colonization	-
Prairie Warbler	Potential colonization	-
Black-throated Green Warbler	Potential extirpation	-
Yellow-breasted Chat	Potential colonization	-
Eastern Towhee	Potential colonization	-
American Tree Sparrow	-	Stable
Chipping Sparrow	Stable	-
Field Sparrow	-	Potential colonization
Savannah Sparrow	Potential extirpation	-
Grasshopper Sparrow	Potential colonization	-
Fox Sparrow	-	Potential colonization
Song Sparrow	Worsening	Improving
Swamp Sparrow	Potential extirpation	Potential colonization
White-throated Sparrow	-	Improving
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Potential colonization
Dark-eyed Junco	-	Improving
Summer Tanager	Potential colonization	-
Scarlet Tanager	Worsening	-
Northern Cardinal	Improving	Improving
Rose-breasted Grosbeak	Worsening	-
Blue Grosbeak	Potential colonization	-
Indigo Bunting	Improving	-

Common Name	Summer Trend	Winter Trend
Dickcissel	Potential colonization	-
Red-winged Blackbird	Improving	Potential colonization
Eastern Meadowlark	-	Potential colonization
Rusty Blackbird	-	Potential colonization
Common Grackle	Stable	Potential colonization
Brown-headed Cowbird	Improving	Improving

Common Name	Summer Trend	Winter Trend
Orchard Oriole	Potential colonization	-
Baltimore Oriole	Stable	-
House Finch	Stable	Improving
Purple Finch	-	Improving
Pine Siskin	-	Stable
American Goldfinch	Worsening	Improving
House Sparrow	x	Improving