



Alagnak Wild River and 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 Alagnak Wild River and Preserve (hereafter, the River) 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 River, 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 River today, climate suitability in summer under the high-emissions pathway is projected to improve for 1, remain stable for 0, and worsen for 7 species. Suitable climate ceases to occur for 2 species in summer, potentially resulting in extirpation of those species from the River (e.g., Figure 2). Climate is projected to become suitable in summer for 38 species not found at the River today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 0, remain stable for 0, and worsen for 1 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 35 species not found at the River 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 River based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the River 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.

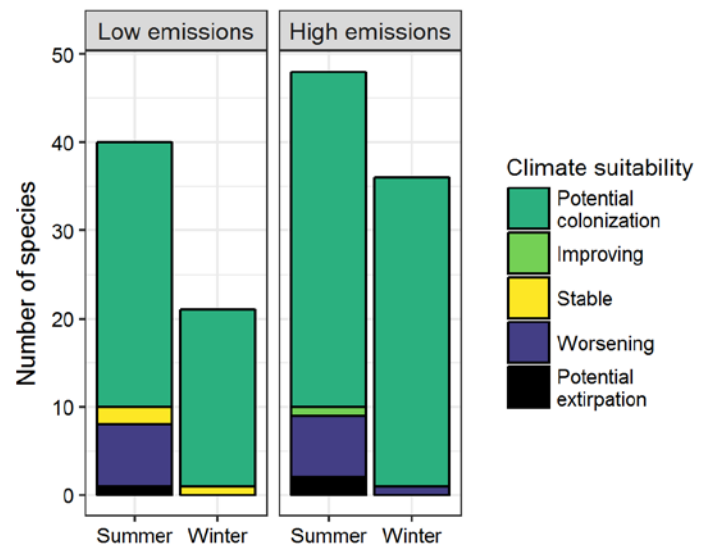


Figure 1. Projected changes in climate suitability for birds at the River, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the River between the present and 2050 is 0.36 in summer (63rd percentile across all national parks) and 0.31 in winter (48th percentile) under the high-emissions pathway. Potential species turnover declines to 0.28 in summer and 0.17 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 River is or may become home to 11 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). Suitable

Management Implications

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

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

climate is not projected to disappear for these 11 species at the River; instead the River may serve as an important refuge for these climate-sensitive species.



Figure 2. Although currently found at the River, suitable climate for the Northern Pintail (*Anas acuta*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation. Photo by Becky Matsubara/Flickr (CC BY 2.0).

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 11 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 River based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the River 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

Common Name	Summer Trend	Winter Trend
Eurasian Wigeon	-	Potential colonization
American Wigeon	Worsening*^	-
American Black Duck	-	Potential colonization
Northern Pintail	Potential extirpation	-
Greater Scaup	-	Potential colonization^
Harlequin Duck	-	Potential colonization
White-winged Scoter	-	Potential colonization
Black Scoter	-	Potential colonization
Bufflehead	-	Potential colonization
Red-breasted Merganser	-	Potential colonization^
Ring-necked Pheasant	Potential colonization	Potential colonization
Ruffed Grouse	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Red-throated Loon	-	Potential colonization
Common Loon	-	Potential colonization^
Horned Grebe	-	Potential colonization
Red-necked Grebe	-	Potential colonization^
Northern Gannet	-	Potential colonization^
Great Cormorant	-	Potential colonization
American Bittern	Potential colonization	-
Rough-legged Hawk	-	Potential colonization
Upland Sandpiper	Potential colonization	-
Red Knot	-	Potential colonization^
Sanderling	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Purple Sandpiper	-	Potential colonization
Wilson's Snipe	-	Potential colonization
Pomarine Jaeger	-	Potential colonization^
Black Guillemot	-	Potential colonization
Ring-billed Gull	Potential colonization^	-
Herring Gull	-	Potential colonization^
Iceland Gull (Thayer's)	-	Potential colonization
Glaucous-winged Gull	Worsening*	-
Great Black-backed Gull	-	Potential colonization
Arctic Tern	Worsening	-
Common Nighthawk	Potential colonization	-
Rufous Hummingbird	Potential colonization	-
Belted Kingfisher	Potential colonization	Potential colonization
Red-naped Sapsucker	Potential colonization^	-
Red-breasted Sapsucker	Potential colonization	-
Hairy Woodpecker	Potential colonization	-
Yellow-bellied Flycatcher	Potential colonization	-
Willow Flycatcher	Potential colonization	-
Least Flycatcher	Potential colonization	-
Pacific-slope Flycatcher	Potential colonization	-
Warbling Vireo	Potential colonization	-
American Crow	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Northwestern Crow	Potential colonization	-
Cliff Swallow	Potential colonization	-
Pacific/Winter Wren	Potential colonization	-
Sedge Wren	Potential colonization	-
Golden-crowned Kinglet	-	Potential colonization
American Robin	Worsening	-
Cedar Waxwing	Potential colonization	-
Golden-winged Warbler	Potential colonization	-
Black-and-white Warbler	Potential colonization	-
Orange-crowned Warbler	Worsening*	-
Nashville Warbler	Potential colonization	-
MacGillivray's Warbler	Potential colonization	-
Mourning Warbler	Potential colonization	-
American Redstart	Potential colonization	-
Cape May Warbler	Potential colonization	-
Magnolia Warbler	Potential colonization	-
Black-throated Green Warbler	Potential colonization	-
Canada Warbler	Potential colonization	-
Wilson's Warbler	Worsening*	-
American Tree Sparrow	Potential extirpation	Potential colonization
Clay-colored Sparrow	Potential colonization	-
Savannah Sparrow	Improving	-
Song Sparrow	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Swamp Sparrow	Potential colonization	-
White-throated Sparrow	Potential colonization	-
Dark-eyed Junco	-	Potential colonization
Western Tanager	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Brewer's Blackbird	Potential colonization	Potential colonization
Purple Finch	Potential colonization	Potential colonization
Cassin's Finch	-	Potential colonization
Common Redpoll	Worsening*	Worsening*
Evening Grosbeak	Potential colonization	Potential colonization