



Aniakchak National Monument 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 Aniakchak National Monument and Preserve (hereafter, the Monument) 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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Monument 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 Monument, with climate suitability projected to improve for some species and worsen for others (Figure 1). Among the species likely to be found at the Monument today, climate suitability in summer under the high-emissions pathway is projected to improve for 6 (e.g., Figure 2), remain stable for 7, and worsen for 15 species. Suitable climate ceases to occur for 2 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 27 species not found at the Monument today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 5, remain stable for 7, and worsen for 2 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 21 species not found at the Monument today, potentially resulting in local colonization.

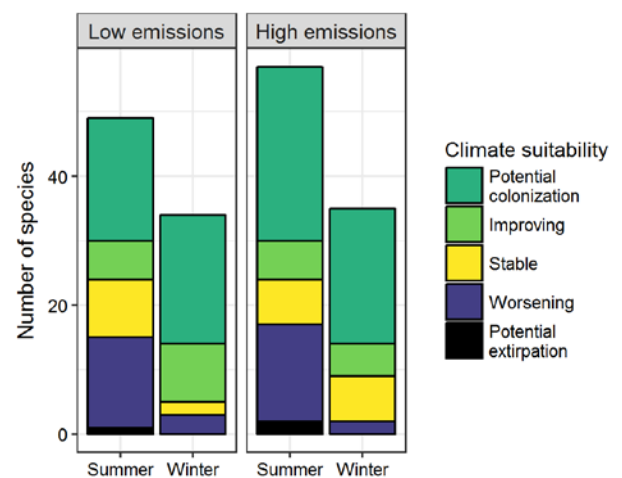


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.20 in summer (31st percentile across all national parks) and 0.13 in winter (14th percentile) under the high-emissions pathway. Potential species turnover declines to 0.13 in summer and increases to 0.14 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 Monument 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).

Management Implications

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

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

While the Monument may serve as an important refuge for 10 of these climate-sensitive species, one, the Lesser Yellowlegs (*Tringa flavipes*), might be extirpated from the Monument in summer by 2050.



Figure 2. Climate at the Monument in summer is projected to remain suitable for the American Robin (*Turdus migratorius*) through 2050. Photo by Andy Reago & Chrissy McClarren/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 10 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 Monument based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Monument 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
American Wigeon	-	Potential colonization
Mallard	Improving [^]	Potential colonization
Blue-winged Teal	Potential colonization	-
Northern Pintail	Worsening	-
Greater Scaup	Worsening	Improving [^]
Harlequin Duck	x	Stable
Red-breasted Merganser	Worsening*	Stable [^]
Ring-necked Pheasant	Potential colonization	-
Ruffed Grouse	-	Potential colonization
Willow Ptarmigan	Worsening	Worsening*
Rock Ptarmigan	Potential extirpation	Stable
Western Grebe	-	Potential colonization
Brandt's Cormorant	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Pelagic Cormorant	x	Stable
Great Blue Heron	-	Potential colonization
Northern Harrier	Stable [^]	-
Bald Eagle	x	Improving
Rough-legged Hawk	Worsening	-
Semipalmated Plover	Worsening	-
Greater Yellowlegs	Stable	-
Lesser Yellowlegs	Potential extirpation [^]	-
Rock Sandpiper	x	Stable
Long-billed Dowitcher	-	Potential colonization
Wilson's Snipe	Worsening	Potential colonization
Red-necked Phalarope	Worsening	-
Common Murre	x	Improving
Pigeon Guillemot	Improving	Improving*
Ancient Murrelet	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Rhinoceros Auklet	-	Potential colonization
Bonaparte's Gull	Stable	-
Heermann's Gull	-	Potential colonization
Mew Gull	Worsening*	-
Ring-billed Gull	Potential colonization^	-
Western Gull	Potential colonization	-
California Gull	-	Potential colonization^
Iceland Gull (Thayer's)	-	Potential colonization
Glaucous-winged Gull	Improving	Improving
Arctic Tern	Stable	-
Western Screech-Owl	-	Potential colonization
Northern Pygmy-Owl	-	Potential colonization
Common Nighthawk	Potential colonization	-
Allen's Hummingbird	Potential colonization^	-
Belted Kingfisher	Improving*	Potential colonization
Red-naped Sapsucker	Potential colonization^	-
Hairy Woodpecker	Potential colonization	-
Merlin	-	Potential colonization^
Willow Flycatcher	Potential colonization	-
Warbling Vireo	Potential colonization	-
Steller's Jay	Potential colonization	-
Common Raven	Stable	Stable
Northern Rough-winged Swallow	Potential colonization	-
Cliff Swallow	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Chestnut-backed Chickadee	Potential colonization	Potential colonization
Brown Creeper	Potential colonization^	-
Swainson's Thrush	Potential colonization	-
Hermit Thrush	Improving	-
American Robin	Improving	-
American Pipit	Worsening	-
Lapland Longspur	Worsening*	-
Snow Bunting	x	Worsening*
Golden-winged Warbler	Potential colonization	-
American Redstart	Potential colonization	-
Yellow Warbler	Stable	-
Wilson's Warbler	Worsening	-
Spotted Towhee	Potential colonization	-
American Tree Sparrow	-	Potential colonization
Savannah Sparrow	Stable	-
Fox Sparrow	Worsening*	-
Song Sparrow	Potential colonization	-
Swamp Sparrow	Potential colonization	-
Golden-crowned Sparrow	Worsening*	-
Dark-eyed Junco	-	Potential colonization
Western Tanager	Potential colonization	-
Lazuli Bunting	Potential colonization	-
Brewer's Blackbird	Potential colonization	Potential colonization
Bullock's Oriole	Potential colonization	-
Cassin's Finch	Potential colonization	-
Common Redpoll	Worsening*	Stable

Common Name	Summer Trend	Winter Trend
Evening Grosbeak	Potential colonization	-