



Cape Krusenstern National Monument

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 Cape Krusenstern National Monument (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.

Results

Climate change is expected to alter the bird community at the Monument, 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 Monument today, climate suitability in summer under the high-emissions pathway is projected to improve for 10 (e.g., Figure 2), remain stable for 11, and worsen for 16 species. Suitable climate ceases to occur for 1 species in summer, potentially resulting in extirpation of those species from the Monument. Climate is projected to become suitable in summer for 45 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 0, remain stable for 1, and worsen for 0 species. Suitable climate does not cease to occur for any species in winter. Climate is projected to become suitable in winter for 18 species not found at the Monument 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 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.

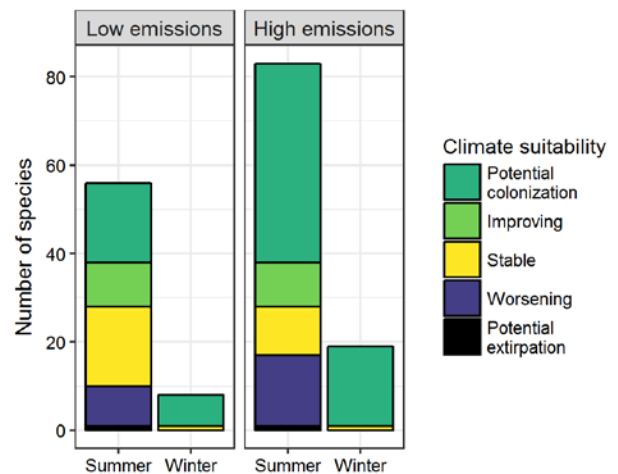


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

Results (continued)

Potential Turnover Index

Potential bird species turnover for the Monument between the present and 2050 is 0.30 in summer (51st percentile across all national parks) and 0.25 in winter (36th percentile) under the high-emissions pathway. Potential species turnover declines to 0.16 in summer and 0.10 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 20 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, Cape Krusenstern National Monument 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

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

Suitable climate is not projected to disappear for these 20 species at the Monument; instead the Monument may serve as an important refuge for these climate-sensitive species.



Figure 2. Climate at the Monument in summer is projected to remain suitable for the Northern Pintail (*Anas acuta*) through 2050. Photo by Becky Matsubara/Flickr (CC BY 2.0).

across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 20 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
Tundra Swan	Improving	-
Gadwall	Potential colonization [^]	-
American Wigeon	Improving ^{*^}	-
Mallard	Potential colonization [^]	-
Blue-winged Teal	Potential colonization	-
Northern Shoveler	Improving [^]	-
Northern Pintail	Improving	-
Redhead	Potential colonization [^]	-
Greater Scaup	Stable	-
Harlequin Duck	-	Potential colonization
White-winged Scoter	-	Potential colonization
Long-tailed Duck	Stable	Potential colonization
Common Goldeneye	-	Potential colonization

Common Name	Summer Trend	Winter Trend
Common Merganser	-	Potential colonization
Red-breasted Merganser	Stable	-
Ruddy Duck	Potential colonization	-
Gray Partridge	Potential colonization	-
Willow Ptarmigan	Worsening [*]	-
Rock Ptarmigan	Worsening [*]	-
Sharp-tailed Grouse	-	Potential colonization
Red-throated Loon	Improving	-
Pacific Loon	Worsening	-
Common Loon	Potential colonization	-
Red-necked Grebe	-	Potential colonization [^]
Northern Fulmar	-	Potential colonization
Northern Harrier	Stable [^]	-

Common Name	Summer Trend	Winter Trend
Bald Eagle	-	Potential colonization
Rough-legged Hawk	Worsening*	-
American Golden-Plover	Stable	-
Semipalmated Plover	Worsening	-
Greater Yellowlegs	Potential colonization	-
Dunlin	x	Potential colonization ^
Western Sandpiper	Improving	-
Wilson's Snipe	Stable	-
Wilson's Phalarope	Potential colonization ^	-
Red-necked Phalarope	Worsening*	-
Parasitic Jaeger	Worsening	-
Long-tailed Jaeger	Worsening*	-
Marbled Murrelet	Potential colonization	-
Franklin's Gull	Potential colonization	-
Mew Gull	Improving	-
Ring-billed Gull	Potential colonization ^	-
Herring Gull	Stable	-
Glaucous Gull	Worsening*	-
Arctic Tern	Stable	-
Snowy Owl	-	Potential colonization
Great Gray Owl	-	Potential colonization ^
Calliope Hummingbird	Potential colonization	-
Belted Kingfisher	Potential colonization	-
Red-breasted Sapsucker	Potential colonization	-
Black-backed Woodpecker	-	Potential colonization
Olive-sided Flycatcher	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Western Wood-Pewee	Potential colonization ^	-
Alder Flycatcher	Potential colonization	-
Pacific-slope Flycatcher	Potential colonization	-
Eastern Phoebe	Potential colonization	-
Northern Shrike	x	Potential colonization
Philadelphia Vireo	Potential colonization	-
Gray Jay	Potential colonization	-
Steller's Jay	-	Potential colonization
Black-billed Magpie	Potential colonization ^	-
Clark's Nutcracker	Potential colonization ^	-
Common Raven	Improving	Stable
Horned Lark	Potential extirpation	-
Tree Swallow	Potential colonization	-
Violet-green Swallow	Potential colonization	Potential colonization
Cliff Swallow	Potential colonization	-
Black-capped Chickadee	Potential colonization	-
Mountain Chickadee	Potential colonization	-
Boreal Chickadee	Potential colonization ^	-
Ruby-crowned Kinglet	Potential colonization	-
Arctic Warbler	Stable	-
Townsend's Solitaire	Potential colonization ^	-
Gray-cheeked Thrush	Stable	-
Swainson's Thrush	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Hermit Thrush	Potential colonization	-
American Robin	Improving	-
American Pipit	Stable	-
Sprague's Pipit	Potential colonization [^]	-
Bohemian Waxwing	-	Potential colonization
Lapland Longspur	Worsening*	-
Chestnut-collared Longspur	Potential colonization [^]	-
Snow Bunting	x	Potential colonization
Tennessee Warbler	Potential colonization	-
Yellow Warbler	Worsening	-
Yellow-rumped Warbler	Potential colonization	-
Townsend's Warbler	Potential colonization	-

Common Name	Summer Trend	Winter Trend
Wilson's Warbler	Worsening	-
American Tree Sparrow	Worsening*	-
Savannah Sparrow	Worsening*	-
Baird's Sparrow	Potential colonization [^]	-
LeConte's Sparrow	Potential colonization [^]	-
Lincoln's Sparrow	Potential colonization	-
Swamp Sparrow	Potential colonization	-
White-throated Sparrow	Potential colonization	-
White-crowned Sparrow	Worsening	-
White-winged Crossbill	Potential colonization	-
Common Redpoll	Improving*	-
Hoary Redpoll	Worsening	-