



## Homestead National Monument of America

### 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 Homestead National Monument of America (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 21, remain stable for 23, and worsen for 7 species. Suitable climate ceases to occur for 14 species in summer, potentially resulting in extirpation of those species from the Monument (e.g., Figure 2). Climate is projected to become suitable in summer for 23 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 9, remain stable for 15, and worsen for 11 species. Suitable climate ceases to occur for 1 species in winter, potentially resulting in extirpation from the Monument. Climate is projected to become suitable in winter for 46 species not found at the

#### 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.

Monument today, potentially resulting in local colonization.

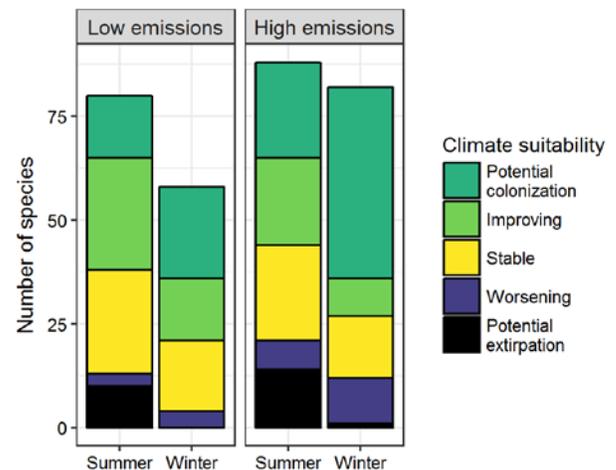


Figure 1. Projected changes in climate suitability for birds at the Monument, by emissions pathway and season.

## Results (continued)

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### Potential Turnover Index

**Potential bird species turnover for the Monument between the present and 2050 is 0.26 in summer (43<sup>rd</sup> percentile across all national parks) and 0.25 in winter (38<sup>th</sup> percentile) under the high-emissions pathway. Potential species turnover declines to 0.18 in summer and 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 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).

## Management Implications

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Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Homestead National Monument of America 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 4 of these climate-sensitive species, 2 might be extirpated from the Monument in at least one season by 2050.



**Figure 2. Although currently found at the Monument, suitable climate for the American Goldfinch (*Spinus tristis*) may cease to occur here in summer by 2050, potentially resulting in local seasonal extirpation.** Photo by John Benson/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 4 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
Fulvous Whistling-Duck	Potential colonization	-
Cackling/Canada Goose	x	Stable
Blue-winged Teal	-	Potential colonization
Northern Shoveler	Potential extirpation <sup>^</sup>	-
Greater Scaup	-	Potential colonization <sup>^</sup>
Bufflehead	-	Potential colonization
Hooded Merganser	-	Potential colonization <sup>^</sup>
Red-breasted Merganser	-	Potential colonization <sup>^</sup>
Scaled Quail	Potential colonization	-
Northern Bobwhite	Improving	Improving
Ring-necked Pheasant	Worsening	Worsening*
Common Loon	-	Potential colonization <sup>^</sup>

Common Name	Summer Trend	Winter Trend
Least Grebe	-	Potential colonization
Horned Grebe	-	Potential colonization
Eared Grebe	-	Potential colonization
Double-crested Cormorant	-	Potential colonization
Great Blue Heron	Improving	Improving
Great Egret	Potential colonization	-
Little Blue Heron	Potential colonization	-
Cattle Egret	Potential colonization	-
Green Heron	Potential colonization	-
Yellow-crowned Night-Heron	Potential colonization	-
Osprey	-	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Mississippi Kite	Potential colonization	-
Northern Harrier	Potential extirpation^	Improving
Red-shouldered Hawk	-	Potential colonization
Red-tailed Hawk	Stable	Stable
Ferruginous Hawk	-	Potential colonization
Rough-legged Hawk	-	Worsening*
Killdeer	Worsening	Stable
Greater Yellowlegs	-	Potential colonization
Least Sandpiper	-	Potential colonization
Bonaparte's Gull	-	Potential colonization
Gull-billed Tern	-	Potential colonization
Forster's Tern	-	Potential colonization
Rock Pigeon	Stable	Worsening*
Eurasian Collared-Dove	-	Potential colonization
White-winged Dove	-	Potential colonization
Mourning Dove	Stable	Stable
Yellow-billed Cuckoo	Improving	-
Black-billed Cuckoo	Potential extirpation	-
Greater Roadrunner	-	Potential colonization
Barn Owl	-	Potential colonization
Great Horned Owl	x	Worsening*
Lesser Nighthawk	Potential colonization	-
Common Pauraque	-	Potential colonization
Chuck-will's-widow	Potential colonization	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Chimney Swift	Improving	-
Ruby-throated Hummingbird	Potential colonization	-
Belted Kingfisher	Stable	-
Red-headed Woodpecker	Stable	-
Red-bellied Woodpecker	Improving	Improving
Downy Woodpecker	Stable	Worsening
Hairy Woodpecker	Stable	Stable
Northern Flicker	Stable	Worsening
Gilded Flicker	Potential colonization	-
Pileated Woodpecker	-	Potential colonization
Eastern Wood-Pewee	Improving	-
Eastern Phoebe	Improving	Potential colonization
Great Crested Flycatcher	Improving*	-
Brown-crested Flycatcher	Potential colonization	-
Western Kingbird	Worsening	-
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Improving	-
Bell's Vireo	Improving*	-
Yellow-throated Vireo	Stable	-
Warbling Vireo	Worsening*	-
Red-eyed Vireo	Stable	-
Blue Jay	Stable	Stable
American Crow	Improving	Stable
Chihuahuan Raven	Potential colonization	-
Horned Lark	-	Worsening*
Northern Rough-winged Swallow	Improving	-
Barn Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Black-capped Chickadee	Stable	Potential extirpation
Tufted Titmouse	Improving*	Improving
White-breasted Nuthatch	Stable	Worsening
Brown Creeper	-	Worsening*
Canyon Wren	-	Potential colonization
House Wren	Potential extirpation	-
Sedge Wren	-	Potential colonization
Carolina Wren	Potential colonization	-
Bewick's Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Improving*	-
Black-tailed Gnatcatcher	Potential colonization	-
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Potential colonization
Eastern Bluebird	Improving	Improving
Mountain Bluebird	-	Potential colonization
American Robin	Potential extirpation	Stable
Gray Catbird	Potential extirpation	-
Curve-billed Thrasher	-	Potential colonization
Brown Thrasher	Stable	Potential colonization
Northern Mockingbird	-	Potential colonization
European Starling	Worsening	Worsening
Sprague's Pipit	-	Potential colonization
Cedar Waxwing	Potential extirpation	-
Chestnut-collared Longspur	-	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Smith's Longspur	-	Potential colonization
Common Yellowthroat	Potential extirpation	-
Yellow Warbler	Potential extirpation	-
Eastern Towhee	Potential extirpation	-
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
American Tree Sparrow	-	Stable
Chipping Sparrow	Potential extirpation	-
Field Sparrow	Improving	Potential colonization
Vesper Sparrow	-	Potential colonization
Lark Sparrow	Stable	-
Lark Bunting	-	Potential colonization
Savannah Sparrow	-	Potential colonization
Grasshopper Sparrow	Stable	-
Henslow's Sparrow	-	Potential colonization
LeConte's Sparrow	-	Potential colonization
Song Sparrow	Potential extirpation	Stable
Lincoln's Sparrow	-	Potential colonization
Harris's Sparrow	-	Improving
Dark-eyed Junco	-	Stable
Summer Tanager	Potential colonization	-
Scarlet Tanager	Stable	-
Northern Cardinal	Improving	Improving
Rose-breasted Grosbeak	Potential extirpation	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Indigo Bunting	Improving	-
Painted Bunting	Potential colonization	-
Dickcissel	Improving	-
Red-winged Blackbird	Improving	Stable
Eastern Meadowlark	Improving	-
Western Meadowlark	Worsening*	Stable
Rusty Blackbird	-	Improving
Common Grackle	Stable	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Bronzed Cowbird	-	Potential colonization
Brown-headed Cowbird	Worsening	-
Orchard Oriole	Stable	-
Hooded Oriole	Potential colonization	-
Baltimore Oriole	Stable	-
House Finch	Stable	-
American Goldfinch	Potential extirpation	Stable
House Sparrow	x	Worsening