



## Golden Spike 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 Golden Spike 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 2, remain stable for 15 (e.g., Figure 2), and worsen for 15 species. Suitable climate ceases to occur for 10 species in summer, potentially resulting in extirpation of those species from the Site. Climate is projected to become suitable in summer for 30 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 15, remain stable for 13, and worsen for 7 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 31 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.

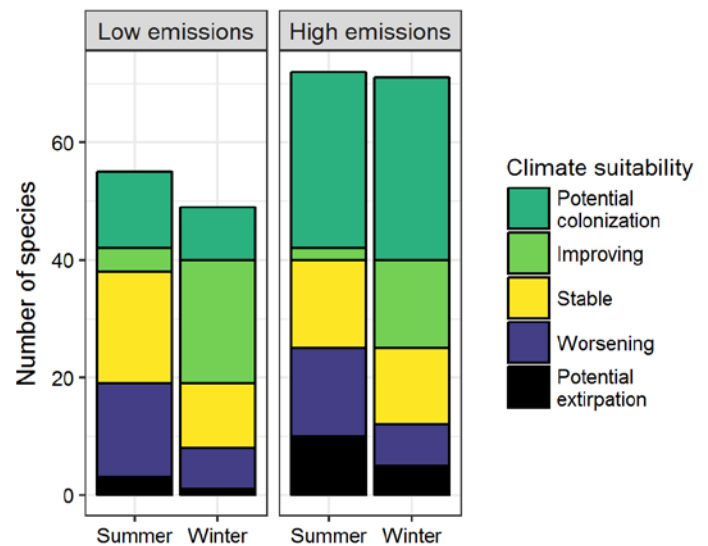


Figure 1. Projected changes in climate suitability for birds at the Site, by emissions pathway and season.

## Results (continued)

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### Potential Turnover Index

**Potential bird species turnover for the Site between the present and 2050 is 0.36 in summer (63<sup>rd</sup> percentile across all national parks) and 0.19 in winter (26<sup>th</sup> percentile) under the high-emissions pathway. Potential species turnover declines to 0.21 in summer and 0.07 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 10 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

### 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, Golden Spike 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 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

Site may serve as an important refuge for 9 of these climate-sensitive species, one, the Sharp-tailed Grouse (*Tympanuchus phasianellus*), might be extirpated from the Site in summer 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).

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 9 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	Stable
Mallard	-	Improving
Northern Shoveler	Worsening <sup>^</sup>	Improving
Green-winged Teal	-	Stable
Greater Scaup	-	Potential colonization <sup>^</sup>
Hooded Merganser	-	Potential colonization <sup>^</sup>
Scaled Quail	Potential colonization	-
Gambel's Quail	Potential colonization	-
Northern Bobwhite	Potential colonization	Potential colonization
Chukar	Stable	Stable
Gray Partridge	-	Potential extirpation
Ring-necked Pheasant	Worsening	Worsening*
Sharp-tailed Grouse	Potential extirpation <sup>^</sup>	Potential extirpation

Common Name	Summer Trend	Winter Trend
Clark's Grebe	-	Potential colonization
Great Blue Heron	Improving	Improving
Cattle Egret	Potential colonization	-
Yellow-crowned Night-Heron	Potential colonization	-
Golden Eagle	x	Stable
Mississippi Kite	Potential colonization	-
Northern Harrier	Worsening* <sup>^</sup>	Improving
Bald Eagle	x	Worsening
Swainson's Hawk	Worsening <sup>^</sup>	-
Red-tailed Hawk	Worsening	Improving
Rough-legged Hawk	-	Worsening*
Killdeer	-	Stable
Greater Yellowlegs	-	Potential colonization
Long-billed Curlew	Worsening* <sup>^</sup>	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Franklin's Gull	Potential extirpation	-
Rock Pigeon	-	Potential extirpation
Eurasian Collared-Dove	x	Stable
Mourning Dove	Stable	Improving
Inca Dove	-	Potential colonization
Yellow-billed Cuckoo	Potential colonization	-
Greater Roadrunner	Potential colonization	Potential colonization
Barn Owl	-	Stable
Burrowing Owl	Worsening^	-
Common Nighthawk	Worsening	-
Chuck-will's-widow	Potential colonization	-
Black-chinned Hummingbird	Improving	-
Red-headed Woodpecker	Potential colonization	-
Gila Woodpecker	-	Potential colonization
Ladder-backed Woodpecker	Potential colonization	-
Northern Flicker	Worsening	Improving
Gilded Flicker	Potential colonization	-
American Kestrel	x	Improving
Prairie Falcon	x	Worsening
Say's Phoebe	Stable	Potential colonization
Ash-throated Flycatcher	Potential colonization	-
Cassin's Kingbird	Potential colonization	-
Western Kingbird	Stable	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Stable	Improving*

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Northern Shrike	-	Potential extirpation
Bell's Vireo	Potential colonization	-
Black-billed Magpie	Worsening*^	Worsening*
Chihuahuan Raven	Potential colonization	-
Common Raven	Potential extirpation	Potential extirpation
Horned Lark	Potential extirpation	Stable
Northern Rough-winged Swallow	Stable	-
Violet-green Swallow	Stable	Potential colonization
Barn Swallow	Stable	-
Cliff Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization
Rock Wren	Stable	Potential colonization
Bewick's Wren	Potential colonization	Potential colonization
Blue-gray Gnatcatcher	Potential colonization	Potential colonization
Black-tailed Gnatcatcher	Potential colonization	-
American Robin	Potential extirpation	Improving
Curve-billed Thrasher	Potential colonization	Potential colonization
Sage Thrasher	Worsening	Potential colonization
Northern Mockingbird	Potential colonization	Potential colonization
European Starling	Potential extirpation	Stable
Chestnut-collared Longspur	-	Potential colonization
Green-tailed Towhee	Stable^	-
Rufous-crowned Sparrow	-	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Canyon Towhee	-	Potential colonization
Abert's Towhee	Potential colonization	-
Rufous-winged Sparrow	-	Potential colonization
Cassin's Sparrow	Potential colonization	-
American Tree Sparrow	-	Worsening
Brewer's Sparrow	Worsening*	Potential colonization
Field Sparrow	Potential colonization	Potential colonization
Vesper Sparrow	-	Potential colonization
Lark Sparrow	Stable	-
Black-throated Sparrow	-	Potential colonization
Sagebrush/Bell's Sparrow (Sage Sparrow)	-	Potential colonization
Savannah Sparrow	-	Potential colonization
LeConte's Sparrow	-	Potential colonization
Song Sparrow	-	Improving
White-crowned Sparrow	Potential extirpation	Improving

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Dark-eyed Junco	x	Improving
Pyrrhuloxia	-	Potential colonization
Blue Grosbeak	Potential colonization	-
Lazuli Bunting	Worsening	-
Dickcissel	Potential colonization	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Potential colonization	Potential colonization
Western Meadowlark	Worsening	Improving
Yellow-headed Blackbird	Worsening*	-
Brewer's Blackbird	Potential extirpation	Stable
Great-tailed Grackle	Potential colonization	-
Brown-headed Cowbird	Potential extirpation	Potential colonization
House Finch	Stable	Stable
Pine Siskin	Potential extirpation	Worsening*
American Goldfinch	Stable	Stable
House Sparrow	-	Stable