

# Projected Bird Impacts of Climate Change

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## Background

Point Pelee National Park is located in southwest Ontario 80 km from Windsor. It is one of Canada's smallest national parks, but Internationally renowned for its bird watching each spring and rated one of the premier birding locations in North America (Harrison, 1976). Each spring, nearly 57,000 visitors, including nearly 20,000 bird watchers, come to Point Pelee National Park during the northward migration of birds. Considerable tourism benefits are associated with this annual birding phenomenon.

Birds are useful indicators of ecological changes because they are highly mobile, occupy a broad range of ecological niches, and are generally conspicuous. As climate changes in any given place, the suitability of the area may worsen for some bird species and improve for others. These changes in climate may create the potential for local extirpation (wiping out or elimination) or new colonization. Parks Canada, National Audubon, and Bird Studies Canada have partnered to evaluate projected changes in climate suitability for birds by 2050 at Point Pelee National Park under two climate change scenarios (see Langham et al., 2015 and Wu et al., 2018 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 intermediate-emissions pathway (RCP4.5) incorporates 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 presented in this indicator report are model-based projections of how species distributions may change in response to climate change, and are based on the present climate tolerances of each species. A 10-km buffer was applied to the 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. Trends in climate suitability for all species currently reported in the park are based on both Parks Canada and Bird Studies Canada observational data (Nature Counts, 2018), plus those species for which climate at the park is projected to become suitable in the future.

## Trends in Climate Change Impacts on Birds

Adequate models were available for 117 of the 165 species currently found at the park in summer and 113 of the 130 species currently found at the park in winter. Climate change is expected to alter the bird community at the park, with greater impacts under the high-emissions pathway than under the intermediate-emissions pathway (Parker et al., 2019; Figure 1). Improving climate suitability indicates that climate in this park may change in ways that are increasingly favourable to a species. Worsening climate suitability indicates that climate may change in ways that make persistence more difficult for a species.

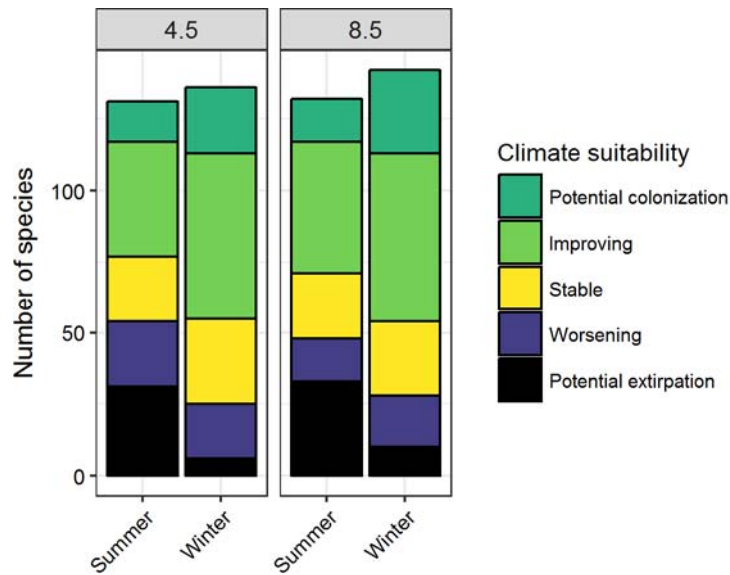


Figure 1. Projected changes in climate suitability for birds at the park, by RCP emissions pathway and season (Parker et al., 2019). Potential colonization indicates species not currently found at the park but may find suitable climate here in the future. Potential extirpation is a subset of species for which climate suitability worsens so much they may no longer persist at the park.

### Summer

Among the species likely to be found at the park today, climate suitability in summer under the high-emissions pathway is projected to improve for 46, remain stable for 23, and worsen for 15 species. The climate in the park will no longer be suitable for 33 species in summer, potentially resulting in extirpation of those species from the park. Climate is projected to become suitable in summer for 15 species not found at the park today, potentially resulting in local colonization.

### Winter

Climate suitability in winter under the high-emissions pathway is projected to improve for 59, remain stable for 26, and worsen for 18 species. The climate in the park will no longer be suitable for 10 species in winter, potentially resulting in extirpation from the park. Climate is projected to become suitable in winter for 29 species not found at the park today, potentially resulting in local colonization.

### Potential Turnover Index

Potential bird species turnover for the park between the present and 2050 is 35% in summer and 29% in winter under the high-emissions pathway. Potential species turnover

becomes 31% in summer and 25% in winter under the intermediate-emissions pathway. Turnover index was calculated based on the theoretical proportions of potential extirpations and potential colonizations by 2050 relative to today, 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 100%.

### Climate Sensitive Species

The park 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 by 2050; Table 1; Langham et al. 2015). While the park may serve as an important haven for 17 of these climate-sensitive species, 3 might be extirpated from the park in at least one season by 2050.

Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the park based on both Parks Canada and Bird Studies Canada observation data from 1980 to 2018, plus those species for which climate at the park 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 observation 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 order, denoted by alternating background shading.

- Species not found or found only occasionally, and not projected to colonize by 2050

x Species not modeled in this season

^ Species that are highly climate sensitive

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Canada/Cackling Goose	x	Worsening
Mute Swan	x	Worsening
Wood Duck	x	Improving
Gadwall	Potential extirpation <sup>^</sup>	Improving
American Wigeon	Potential extirpation <sup>^</sup>	Improving
American Black Duck	x	Worsening
Mallard	Worsening <sup>^</sup>	Worsening
Blue-winged Teal	Potential extirpation	Improving
Northern Shoveler	Improving <sup>^</sup>	Improving
Northern Pintail	Potential extirpation	x
Green-winged Teal	x	Improving
Canvasback	-	Improving
Ring-necked Duck	x	Stable
Greater Scaup	-	Improving <sup>^</sup>
Lesser Scaup	x	Stable
Surf Scoter	-	Improving
White-winged Scoter	-	Stable
Long-tailed Duck	-	Stable
Bufflehead	x	Improving
Common Goldeneye	-	Stable
Hooded Merganser	x	Improving <sup>^</sup>
Common Merganser	-	Worsening
Red-breasted Merganser	Potential extirpation	Stable <sup>^</sup>
Ruddy Duck	Improving	Improving
Northern Bobwhite	Potential colonization	Potential colonization
Wild Turkey	x	Stable
Red-throated Loon	-	Improving
Pacific Loon	-	Stable
Common Loon	-	Improving <sup>^</sup>
Pied-billed Grebe	x	Improving

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Horned Grebe	x	Improving
Double-crested Cormorant	x	Improving
American White Pelican	x	Potential colonization
Brown Pelican	-	Potential colonization ^
American Bittern	Improving	Potential colonization ^
Great Blue Heron	Stable	Improving
Great Egret	Improving	Potential colonization
Little Blue Heron	Improving	-
Cattle Egret	Improving	-
Green Heron	Improving	-
Black-crowned Night-Heron	x	Improving
Yellow-crowned Night-Heron	Potential colonization	-
Black Vulture	Potential colonization	-
Turkey Vulture	x	Improving
Golden Eagle	-	Stable
Mississippi Kite	Potential colonization	-
Northern Harrier	Worsening ^	Improving
Sharp-shinned Hawk	x	Improving
Cooper's Hawk	x	Worsening
Northern Goshawk	-	Potential extirpation
Bald Eagle	x	Stable
Red-shouldered Hawk	Improving	Improving
Red-tailed Hawk	Improving	Stable
Rough-legged Hawk	-	Worsening
Clapper Rail	-	Potential colonization
Virginia Rail	x	Improving
American Coot	x	Improving
Black-bellied Plover	-	Potential colonization
Killdeer	Improving	Improving
Greater Yellowlegs	-	Potential colonization

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Willet	Potential colonization ^	Potential colonization ^
Marbled Godwit	-	Potential colonization
Ruddy Turnstone	-	Potential colonization ^
Dunlin	-	Potential colonization ^
Least Sandpiper	-	Potential colonization
Western Sandpiper	-	Potential colonization
Long-billed Dowitcher	-	Potential colonization
American Woodcock	x	Improving
Laughing Gull	- ^	Potential colonization
Ring-billed Gull	Worsening ^	Improving
Herring Gull	Stable	Stable ^
Great Black-backed Gull	x	Worsening
Black Tern	Potential extirpation	-
Forster's Tern	x	Potential colonization
Rock Pigeon	Worsening	Potential extirpation
Mourning Dove	Improving	Stable
Yellow-billed Cuckoo	Improving	-
Black-billed Cuckoo	Worsening	-
Eastern Screech-Owl	x	Worsening
Great Horned Owl	x	Stable
Snowy Owl	-	Worsening
Common Nighthawk	Improving	-
Chuck-will's-widow	Improving	-
Chimney Swift	Stable	-
Ruby-throated Hummingbird	Improving	-
Belted Kingfisher	Potential extirpation	Improving
Red-headed Woodpecker	Stable	Stable
Red-bellied Woodpecker	Improving	Improving
Yellow-bellied Sapsucker	-	Improving
Downy Woodpecker	Improving	Improving

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Hairy Woodpecker	Improving	Stable
Northern Flicker	Stable	Worsening
Pileated Woodpecker	-	Potential colonization
American Kestrel	x	Improving
Merlin	x	Improving <sup>^</sup>
Peregrine Falcon	x	Improving
Eastern Wood-Pewee	Improving	-
Acadian Flycatcher	Improving	-
Alder Flycatcher	Potential extirpation	-
Willow Flycatcher	Potential extirpation	-
Least Flycatcher	Potential extirpation	-
Eastern Phoebe	Stable	Improving
Great Crested Flycatcher	Improving	-
Eastern Kingbird	Stable	-
Scissor-tailed Flycatcher	Potential colonization	-
Loggerhead Shrike	Potential colonization	Potential colonization
Northern Shrike	-	Potential extirpation
White-eyed Vireo	Improving	-
Bell's Vireo	Potential colonization	-
Yellow-throated Vireo	Potential extirpation	-
Warbling Vireo	Stable	-
Red-eyed Vireo	Worsening	-
Blue Jay	Stable	Worsening
American Crow	Worsening	Stable
Fish Crow	Improving	Stable
Horned Lark	Potential extirpation	Worsening
Northern Rough-winged Swallow	Improving	-
Purple Martin	Improving	-
Tree Swallow	Potential extirpation	Potential colonization
Barn Swallow	Improving	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Cliff Swallow	Stable	-
Carolina Chickadee	Potential colonization	Potential colonization
Black-capped Chickadee	Potential extirpation	Potential extirpation
Tufted Titmouse	Improving	x
Red-breasted Nuthatch	Potential extirpation	Potential extirpation
White-breasted Nuthatch	Stable	Stable
Brown Creeper	Potential extirpation <sup>^</sup>	Stable
House Wren	Worsening	-
Sedge Wren	Worsening	Potential colonization
Marsh Wren	x	Improving
Carolina Wren	Improving	Improving
Bewick's Wren	Potential colonization	-
Blue-gray Gnatcatcher	Improving	-
Golden-crowned Kinglet	-	Stable
Ruby-crowned Kinglet	-	Improving
Eastern Bluebird	Stable	Stable
Hermit Thrush	Potential extirpation	Improving
Wood Thrush	Stable	-
American Robin	Worsening	Improving
Gray Catbird	Worsening	Improving
Brown Thrasher	Improving	Improving
Northern Mockingbird	Improving	Improving
European Starling	Worsening	Stable
American Pipit	-	Stable
Cedar Waxwing	Potential extirpation	Stable
Smith's Longspur	-	Potential colonization
Snow Bunting	-	Worsening
Ovenbird	Stable	-
Worm-eating Warbler	Improving	-
Northern Waterthrush	Potential extirpation	-



<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Blue-winged Warbler	Potential extirpation	-
Black-and-white Warbler	Stable	-
Prothonotary Warbler	Improving	-
Mourning Warbler	Potential extirpation	-
Kentucky Warbler	Improving	-
Common Yellowthroat	Stable	Improving
Hooded Warbler	Stable	-
American Redstart	Potential extirpation	-
Northern Parula	Potential colonization	-
Yellow Warbler	Potential extirpation	-
Chestnut-sided Warbler	Potential extirpation	-
Palm Warbler	-	Potential colonization ^
Pine Warbler	-	Potential colonization
Yellow-rumped Warbler	-	Improving
Yellow-throated Warbler	Potential colonization	-
Prairie Warbler	Potential colonization	-
Canada Warbler	Potential extirpation	-
Yellow-breasted Chat	Improving	-
Eastern Towhee	Improving	x
American Tree Sparrow	-	Worsening
Chipping Sparrow	Potential extirpation	Improving
Clay-colored Sparrow	Stable	-
Field Sparrow	Stable	Improving
Vesper Sparrow	Potential extirpation	-
Lark Sparrow	Improving	-
Savannah Sparrow	Potential extirpation	Improving
Grasshopper Sparrow	Improving	-
Le Conte's Sparrow	-	Potential colonization
Fox Sparrow	-	Improving
Song Sparrow	Potential extirpation	Worsening

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Swamp Sparrow	Potential extirpation	Improving
White-throated Sparrow	-	Improving
Harris's Sparrow	-	Potential colonization
White-crowned Sparrow	-	Worsening
Dark-eyed Junco	-	Stable
Summer Tanager	Improving	-
Scarlet Tanager	Stable	-
Northern Cardinal	Improving	Improving
Rose-breasted Grosbeak	Stable	-
Blue Grosbeak	Improving	-
Indigo Bunting	Improving	-
Painted Bunting	Potential colonization	-
Dickcissel	Improving	-
Bobolink	Potential extirpation	-
Red-winged Blackbird	Stable	Improving
Eastern Meadowlark	Improving	Improving
Rusty Blackbird	-	Improving
Brewer's Blackbird	-	Potential colonization
Common Grackle	Stable	Improving
Great-tailed Grackle	Potential colonization	Potential colonization
Brown-headed Cowbird	Improving	Improving
Orchard Oriole	Improving	-
Baltimore Oriole	Worsening	-
House Finch	Worsening	Potential extirpation
Purple Finch	Potential extirpation	Potential extirpation
White-winged Crossbill	-	Potential extirpation
Common Redpoll	-	Potential extirpation
Pine Siskin	Potential extirpation	Potential extirpation
American Goldfinch	Worsening	Improving
House Sparrow	x	Worsening

## Management Implications

Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. Under the high-emissions pathway, Point Pelee 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 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 17 species that are highly sensitive to climate change across their range (Table 1; Langham et al., 2015) for which the park is a potential refuge. Monitoring to identify changes in bird communities will inform the selection of appropriate management responses.

## 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). 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 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.

## References

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