Alaska

Survival by Degrees: 389 Species on the Brink

Background

Birds form part of healthy ecosystems, bring joy to people, and benefit local economies throughout the United States. In 2011, birdwatching-related industries drove $41 billion in expenditures and $107 billion in total industry output nationally. There are more than 512,000 total birders in Alaska alone [1]. Additionally, birds play critical roles in pollination, insect control, forest generation, seed dispersal, carrion scavenging, and many other ecosystem services we rely on.

However, the future of birds is at risk with alarming losses of biodiversity occurring worldwide. Global extinction rates are now 100 times higher than background rates outside of mass extinction events [2]. Climate change exacerbates the global biodiversity crisis, with an anticipated rate of change 20 times faster in the next century than during the past two million years.

Audubon leads the way in conducting science to understand the vulnerability and threats to birds from climate change. Our science shows that stabilizing warming at a global average of 1.5°C (2.7°F), as recommended by the IPCC (Intergovernmental Panel on Climate Change) to reduce the global risk of climate change, would also reduce vulnerability and threats for many species of birds. To save birds we must address the underlying causes of climate change (*climate change mitigation*), and protect places that birds need now and will need in the future (*climate change adaptation*). Climate change mitigation means reducing or preventing the causes of climate change, such as greenhouse gas emissions. Climate change adaptation includes efforts to alter and adapt both our natural surroundings as well as our infrastructure to better withstand the threats of climate change.

Audubon's 2019 Report, *Survival by Degrees: 389 Bird Species on the Brink* [3], is a powerful look at how vulnerable birds are to climate change across North America based on a new, updated scientific analysis that leverages big data and incorporates the unique biology of each bird to determine its vulnerability. In this research, we related bird observations for 604 species with climate and habitat conditions at these locations and used modeling algorithms to capture the unique composition of each species's suitable range. We then mapped and compared the projected current and future ranges to estimate the projected range loss and gain under multiple future climate change scenarios. These projections were then used to assess how vulnerable each species was to climate change [4,5].

Figure 1. Snowy Owl. Photo: Deborah Johnston/Audubon Photography Awards

Future Climate and Habitat in Alaska

Across the state of Alaska, without substantial climate change mitigation (i.e., a 3°C/5.4°F global warming scenario), average temperatures during the warmest month are expected to increase approximately 4.5°C (8.1°F), and average temperatures during the coldest month are expected to increase approximately 9.3°C (17°F) from 2010 to the end of the century. Average annual precipitation is expected to increase by approximately 230 mm (9.1 in). Despite the overall increase in precipitation, available moisture is expected to decrease by 10% across the state due to increases in evaporation, or water transfer to the atmosphere [6].

The distribution of vegetation biomes, critical for plants and animals, are also projected to change under climate change scenarios [7]. By the end of the century under a 3°C (5.4°F) global warming scenario, approximately 61% of the state of Alaska will transition to a different biome. At present, the largest biome in the state is boreal forest, covering 50% of the state. By the end of the century, boreal forest will cover approximately 34% of the state.

All of these changes in climate and vegetation will alter plant and insect communities; influence availability of food, water, and shelter for birds; and will likely cause ecological disruption as species assemblages reshuffle. Over time, a complex suite of changes in climate and vegetation will inevitably affect Alaska's bird communities.

Climate Change Vulnerability

Climate change will negatively affect many birds in the state. Here, we assess vulnerability based on the amount of a species's range that may be gained or lost with climate change. We designate species that may lose much more range across North America than they have the potential to gain as *climate vulnerable*. In Alaska, 166 out of 212 species in summer are climate vulnerable under the 3°C scenario, meaning they stand to lose more of their North American summer range than they would gain under a warming climate. Reducing emissions to 1.5°C reduces the number of vulnerable species to 133. Impacts are somewhat lessened in winter, with 36 out of 114 species vulnerable under 3°C of warming and 20 species vulnerable under 1.5°C.

Each bird was grouped by its primary habitat (see Table 2 for groupings), and these groups are not equally affected. In Alaska, the habitat groups with the most species vulnerable to the impacts of ongoing and future climate change are waterbird (59 species) and boreal forest (34 species) in summer (Figure 2). In winter, boreal forest (15 species) and coastal (7 species) groups have the most vulnerable species.

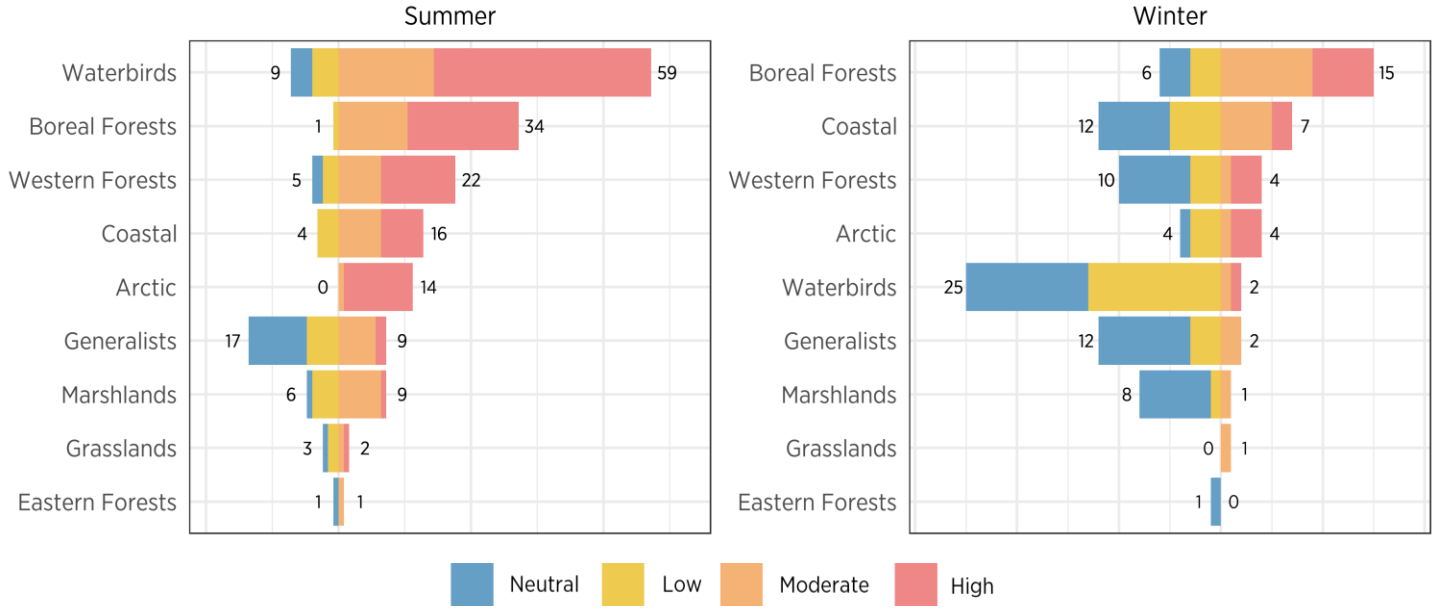

Figure 2. Number of species by their vulnerability to climate change in each habitat group under a global 3°C warming scenario. The species in each group are ones that currently live in the state, though vulnerability is assessed across the species's full North American range to better account for range-wide changes. Red and orange indicate number of vulnerable (high and moderate) species, and yellow and blue indicate non-vulnerable (low and neutral) species.

Climate-Related Threats

In addition to changes in climate across North America, we assessed the potential impacts of other forecasted threats related to climate change. These threats were specific to Alaska and included drought, extreme heat, flammability, length of growing season, extreme precipitation, rain on snow events, decreased snowfall, increased snowfall, shoreline change, cropland expansion, and loss of sea ice (Table 1). These threats are relevant to both birds and the places they need, and were analyzed separately from vulnerability. This analysis provides information on how each location and the birds that occur there may be exposed to these specific, climate-related threats (Figure 3) and risk, an index of combined threats and vulnerability (Figure 4) beyond their range-wide vulnerability described above.

Here we summarize threats occurring within the state. Nine climate-related threats will affect portions of Alaska (Table 1). The threat affecting both the greatest area and number of species in the state is extreme heat.

In Alaska, species that are most threatened by a combination of climate change and additional climate-related threats under 3°C of warming include King Eider, Spectacled Eider, Willow Ptarmigan, Rock Ptarmigan, American Golden-Plover, Black-bellied Plover, Semipalmated Plover, Least Sandpiper, and Wandering Tattler. For information on threats for individual species in Alaska, see Table 2.

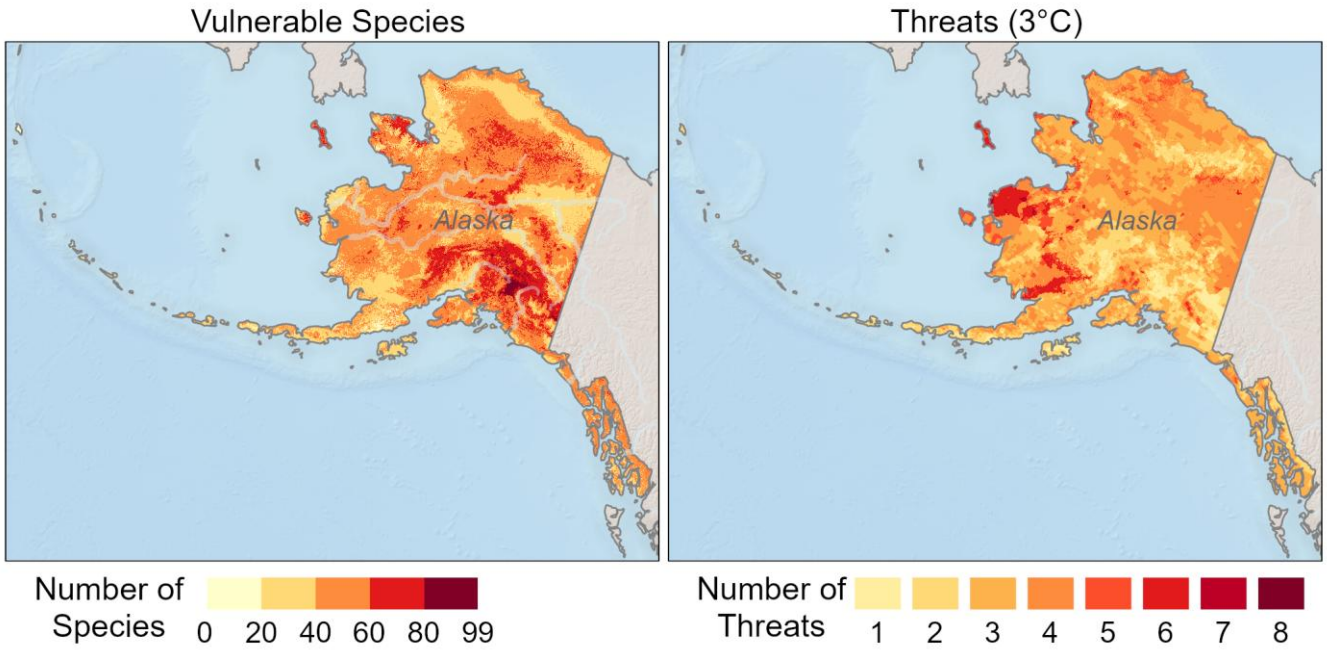

Figure 3. The number and distribution of vulnerable species in summer, and overlapping climate-related threats in Alaska under a future global change scenario of 3°C.

We also mapped risk, areas of high conservation value for birds that are exposed to climate change-related threats. For any one location, risk is the product of the number of overlapping climate change-related threats, the total number of bird species that occur under future climate, and the number of species with range-wide vulnerability under future climate. Risk is greater across Alaska in summer relative to winter.

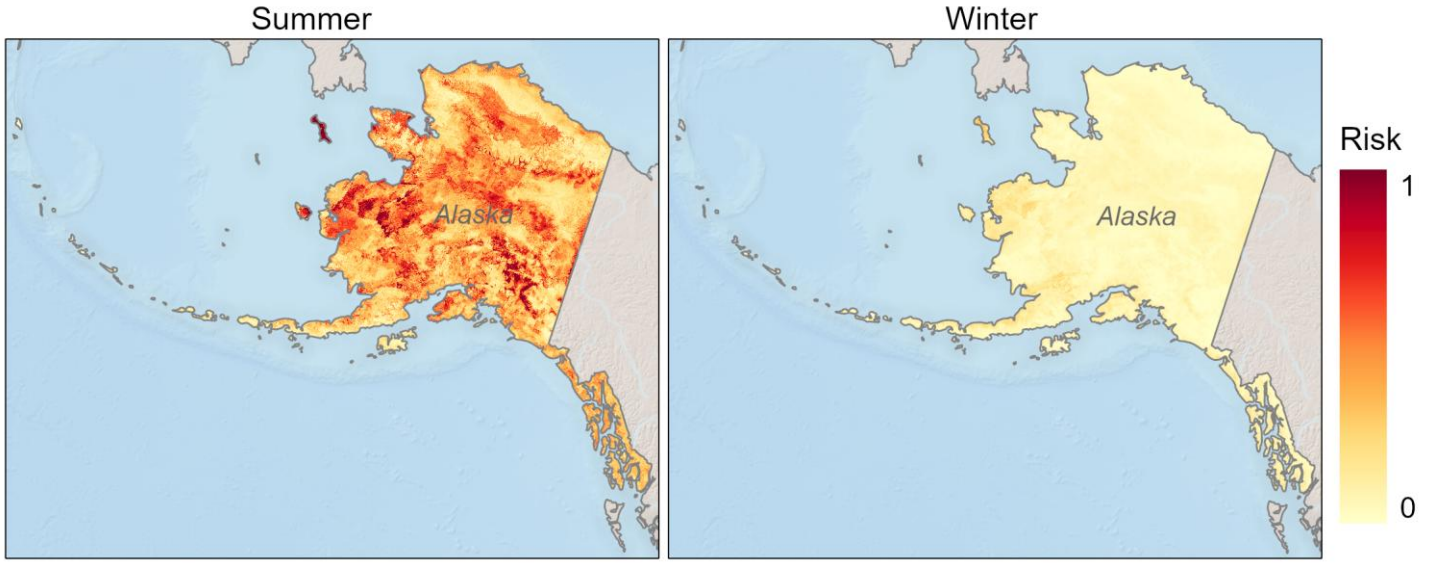

Figure 4. Risk to birds in summer and winter under a future global change scenario of 3°C. Risk is the product of the number of overlapping climate threats, the total number of bird species that occur under future climate, and the number of species with range-wide vulnerability under future climate.

Climate-Related Threats (Cont.)

Table 1. Climate-related threats that Alaska is expected to experience under the 3°C (5.4°F) warming scenario, and the projected area and number of species affected. Drought destroys water and food resources for many species. Extreme heat stresses birds and endangers young birds in the nest. Wildfires incinerate habitat, and it they burn repeatedly, prevent it from recovering. The length of growing season is the change in when the final spring frost and the first fall occurs, and affects the timing of plant and insect events that birds rely on. Extreme precipitation can flood nests and impede parents from feeding their chicks. Rain on snow events cover the habitat in a hard, icy crust, destroying food resources for many species. Changes in snowfall affect species ecologically adapted for snowy landscapes and affect the timing of plant and insect events that birds rely on. Shoreline change permanently alters and consumes coastal habitat. Threats and scenarios were omitted if no species were affected in that scenario (i.e., cropland expansion and loss of sea ice).

Threat	Scenario	Area Affected (acres)	Summer (Vulnerable) Species Affected	Winter (Vulnerable) Species Affected
 Drought	3°C	243,932,172	258 (191)	156 (43)
 Extreme Heat	3°C	426,712,528	264 (196)	157 (44)
 Flammability	3°C	47,571,913	24 (11)	37 (3)
 Length of Growing Season	3°C	316,278,585	263 (195)	157 (44)
 Extreme Precipitation	3°C	82,315,618	85 (62)	102 (24)
 Rain on Snow	3°C	168,413,671	226 (173)	101 (26)
 Decreased Snowfall	3°C	27,082,955	1 (1)	9 (1)
 Increased Snowfall	3°C	24,147,595	11 (10)	0 (0)
 Permafrost	3°C	16,418,892	64 (56)	5 (3)
 Sea Ice Degradation	3°C	8,176,952	10 (8)	20 (3)
 Shoreline Change	3°C	5,301,638	15 (14)	1 (1)

Conclusions and Caveats

Birds are early responders to climate change and can be important indicators of large-scale ongoing and future ecological change. We found that 79% of Alaska's 217 bird species are vulnerable to climate change across seasons. A rapidly changing climate could lead to population declines and local extinctions if species are not able to adapt. In addition, the reshuffling of bird communities at a continental scale will bring together species that previously lived in isolation, leading to novel, unpredictable interactions. Disruptions in food and nesting resources further compound vulnerabilities to climate change.

Although we project range gains offsetting loss for some species, especially in winter, it is unknown whether birds will establish populations in these new locations because of other factors not assessed here. On top of this, the added stressors of extreme weather events and other climate change-related threats will make establishment and persistence of populations difficult in the coming decades.

While these studies did not assess the effects of climate change on people, we know that the fate of humans and birds are deeply connected. Climate change is currently and will continue to cause harm to people too, who face threats like extreme weather, loss of coastal areas and changing economic patterns, to name a few. Climate change will cause disproportionate harm to vulnerable communities, subsistence hunters, children, the elderly, the sick, and the poor, who may have fewer resources available to move or protect themselves from these threats. If we drastically reduce carbon emissions, we help people and birds alike.

This is the most comprehensive assessment of climate change vulnerability of birds in North America to date, but even this assessment may reasonably be considered conservative because the pace of change is exceeding the scenarios considered in this study. Our work concludes that climate change will have multiple, compounding effects on birds and will likely amplify biodiversity loss, unless actions are taken to lessen its effects.

Call to Action

We know what to do.

The scientific consensus is clear. We must reduce greenhouse gas emissions at an urgent speed and on a wide scale from every sector of the economy to achieve a more favorable future for birds and people. There is no single perfect solution, but we can make a series of changes that lead to large-scale, systemic adjustments to achieve the required reductions.

Addressing the underlying causes of climate change.

Audubon is pursuing policies that together can drive down emissions at the scale and speed we need. For instance, we can invest in 100% clean energy, energy efficiency, and clean transportation policies that will dramatically reduce carbon emissions from the U.S. and world economies. We can adapt, improve, and innovate. We can power our cars, homes, cities, factories, farms, communities, and economy with clean energy-without contributing to climate change. We are working to implement policies and conservation practices that offset what we cannot eliminate, such as planting forests and testing new technologies to capture (i.e., sequester) carbon through industrial processes and permanently store it underground. We can do all of this in ways that spur innovation, create good jobs, promote homegrown industries, and build our economy for a smarter future.

Protecting the places birds need.

We can also pursue policies and conservation practices that help us avoid some of the worst effects of climate change by building more resilient infrastructure—meaning our cities, roads, and other structures—or even ranches, parks, floodplains, forests, and wetlands that can serve as good wildlife habitat and simultaneously protect our communities from extreme weather.

Audubon has identified the best opportunities to increase the resilience of coastal wetlands in key places that can serve as the first line of defense against the threat of sea level rise. We work to ensure key landscapes that are critical for birds have clean and reliable sources of water, now and in the future, and we advocate for conservation-minded management of working and urban landscapes that can help birds adapt to the changing climate.

We still have time.

We can avert and limit dangerous warming and its worst effects if we act quickly. Science tells us that in order to limit warming to a rise of 1.5°C (2.7°F), we must reduce greenhouse gas emissions 45% below 2010 levels by 2030 and reach net-zero carbon emissions by 2050.

We must act now.

We are on a dangerous path, but we have the power to chart a better one. Still, change will come only if we demand action from the public officials who represent us and the businesses we support.

We ask you to join us.

Be part of the solution. We can do this, together.

How You Can Help in Alaska

We still have time.

We can focus on state-based solutions to address climate mitigation. Using the Anchorage Climate Plan, and supporting climate plans in other cities and communities across the state will give us the collective power to implement a statewide climate plan. We also need to hold our decision makers accountable for funding and resources to address real climate change catastrophes. Right now, communities are relocating in Alaska because of climate change, yet funding is limited, and our legislators continue to support actions that exacerbate climate change impacts. If we hold them accountable for their actions, they will address the issues that Alaskans care about now and in the future.

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Science tells us that in order to limit warming to a rise of 1.5°C (2.7°F), we must reduce greenhouse gas emissions 45% below 2010 levels by 2030 and reach net-zero carbon emissions by 2050. This will require a combination of policy and action. We can reduce emissions in our communities, but we also need to protect the intact landscapes that will be part of our climate solutions framework. Alaska is 60% public lands, and U.S. public lands currently emit 25% of our annual carbon emissions. By protecting the Arctic Wildlife Refuge, we can reduce our carbon emissions by 12%. By protecting roadless areas on the Tongass National Forest, we are protecting the forest's role in sequestering 10% of the total carbon sequestered on all our national forests. This means Alaska has the ability to reduce our nation's carbon emissions by almost 25%. Big Alaska landscapes can be large components of global climate solutions, but only if we start looking at our public lands as key components of mitigating climate change and creating resilient communities for our future.

More Information

This project was conducted by the National Audubon Society. For more information, including details on the methods, please see the project website (climate.audubon.org) and the scientific publications [5,8].

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Species Projections

Table 1. Climate suitability projections in summer and winter under the 3°C warming scenario for birds in Alaska. Each bird is associated with the *Habitat Group* representing its primary habitat (see classification key below). *Range-wide Vulnerability* is the vulnerability of each species, across its full North American range under 3°C of global warming, based on long-term climate and vegetation change. High and moderately vulnerable species are considered vulnerable to climate change, whereas low and neutral species are considered not vulnerable. In *State Trends*, we show the top two trends in climate and habitat suitability for select birds in Alaska, with colors reflecting the trend according to the legend below and percentages reflecting the percent of the state's area in which each trend will occur. The total percentage reflects the area of the state that the species currently occupies and is projected to occupy in the future. Potential colonization indicates that climate and habitat are projected to become suitable for the species, whereas potential extirpation indicates that climate and habitat are suitable today but projected to become unsuitable. *State Threats* shows the additional climate-related threats each species might face, indicated by icons as in Table 1. Threats shown here were assessed within each state for species under either 1.5°C or 3°C warming (i.e., species that will be completely extirpated from the state do not have threats shown). Omitted species are either not present in the state during that season or not modeled due to data deficiency. These lists may have been further reduced by local experts. For a full list of species modeled in Alaska, see the project website (climate.audubon.org).

Habitat classifications:

F-B = Boreal Forests

F-E = Eastern Forests

F-W = Western Forests

F-S = Subtropical Forests

A = Arctic

D = Aridlands

G = Grasslands

M = Marshlands

C = Coastal

W = Waterbirds

Gen = Generalists

Trend classifications: