



alaska

Spawning pink salmon. © JEFF MONDRAGON/MONDRAGONPHOTO.COM

Climate Change in Alaska: Adapting Today for a Better Future

From the Arctic coastlands of the far north to countless miles of salmon streams and into the vast rugged Interior, Alaska's lands and waters bolster our economy and determine our quality of life. Breathtakingly beautiful and teeming with diverse wildlife, these landscapes have enriched our lives and shaped the values that define us as the 49th state.

But today, climate change and its impacts threaten Alaska's lands and waters—and the services they provide to both people and nature. The world's best climate models project that annual temperatures may increase from 3-8 degrees Fahrenheit across Alaska and the polar north by the middle of the century—more than anywhere else on Earth. This change affects every acre of land and every mile of river in Alaska.

As warming continues, scientists also project a range of consequences around the world, including sea-level rise that will bring coastal flooding and erosion, stronger storms, increased risk of wildfires and drought, threats to public health, and consequences for wildlife and native plants. Thawing permafrost contributes methane, a potent greenhouse gas, to the atmosphere. As atmospheric levels of carbon dioxide rise, the acidity of the world's oceans increases and affects life at even the base of the food web.

Tundra ponds that migratory bird species rely on during the breeding season are also drying up as warmer conditions persist. Pest outbreaks—which have already decimated hundreds of thousands of acres of spruce forest—will increase with climate change, intensifying wildfire risk. Scientists project that climate change will alter the very character and composition of Alaska's forests. The home ranges of native plant and animal species, including wild salmon, may gradually shift to more northern areas or higher elevations.

One main cause of global climate change is the emission of greenhouse gases—chiefly carbon dioxide—from deforestation, vehicles, power plants, and industrial processes. Our nation has the technology to make significant reductions in greenhouse gas emissions.

We have the opportunity to play a vital role in addressing how our nation responds to the challenges of a changing climate. As a world leader, the United States has a responsibility to lead international cooperation on addressing the impacts of climate change. As a country of innovators, we can turn a crisis into opportunity.

Climate Change and Its Effects on Alaska

Subsistence Impacts

For thousands of years, Native people have relied on Alaska's abundant wildlife to sustain their communities and their cultures. The rich traditions of hunting, gathering and fishing have created complex systems of traditional knowledge and practice that have shaped the very lives and cultures of indigenous people. Climate change is already affecting these subsistence activities. As sea ice thins, as species migrate to different areas, and as seasons shift, indigenous peoples' entire way of life is at risk of disappearing forever.

Recreation/Tourism Impacts

The beauty and unparalleled natural diversity of Alaska's coasts, mountains and forests attract visitors from around the world. But higher temperatures, sea-level changes, loss of wildlife and the increased severity of storms could affect outdoor recreation and tourism—such as wildlife viewing, sportfishing and hunting. Alaska's tourism industry accounts for thousands of jobs and hundreds of millions of dollars in economic activity.

Fisheries Impacts

Salmon and other fish are at the heart of the Alaskan way of life. Alaskans depend on fish to feed their families, recreate, and provide jobs in sport-fishing, commercial fishing, and tourism. Each year, Alaskans and visitors spend millions of dollars fishing Alaska's legendary rivers. Commercial fishing is one of the top industries in Alaska, bringing millions of dollars to communities throughout the state. But salmon and trout are especially sensitive to the effects of climate change because they cannot withstand temperature increases of even a few degrees. Warmer stream temperatures create a host of consequences for salmon: fewer eggs survive, growth rates decrease and fish become more vulnerable to pollutants.

While the specific impacts of climate change on the state's fishing industry may not be fully understood, we do know drought, lower snowpacks, the spread of invasive species, the rise in ocean acidity and increasing water temperatures will affect fish habitat. Rising ocean water temperatures are already forcing Alaska's commercial fisheries species to shift northward, causing fishing fleets to travel farther into northern habitats and increasing production costs.

Coastal Impacts

Changing sea levels and increasingly severe storms are forcing the costly evacuation of several remote coastal villages, and more than 100 report serious concerns about eroding shorelines. Moving the Yukon-Kuskokwim Delta village of Newtok, the first of these villages to plan its own evacuation, is estimated to cost hundreds of millions of dollars.

Infrastructure Impacts

Climate change undermines Alaska's basic infrastructure. Eroding coastlines and thawing permafrost will increase the cost of main-



Tatshenshini River. © CATHY HART

taining buildings, power lines and bridges. By 2080, the cost of maintaining such fixtures is expected to cost \$5.6-\$7.6 billion—an increase of 10-12 percent. Thawing permafrost also shortens the construction season and complicates oil and gas production in northern oil fields.

Public Health Impacts

Additional climate change could boost populations of disease-carrying mosquitoes, ticks and rodents, elevating the transmission of illnesses such as Lyme disease and West Nile virus.

As permafrost thaws, some wastewater systems could fail, threatening public health. Drinking water could be compromised by saltwater intrusion, drought, and disappearing aquifers caused by thawing permafrost. And survival of some subsistence communities is already at risk where permafrost is thawing and affecting food storage in the use of ice cellars or changing the shorefast ice near the coast that helps buffer communities from ocean storms.

Wildlife Impacts

The loss and alteration of habitats will affect wildlife all across Alaska. In addition to significant risks to waterfowl and wild salmon, species dependent on Arctic sea ice, such as Pacific walrus and polar bear, are expected to decline. Already, polar bears are more frequently denning on land and fewer cubs are surviving.

Tundra species such as caribou and muskoxen suffer from warmer winter temperatures when freezing rain locks forage beneath ice. Outbreaks of spruce bark beetle have killed more than 4 million acres of spruce forest. Forest-dependent species such as migratory birds will decline as warming reduces forest cover. Twenty percent of the continent's waterfowl nest in Alaska's wetland habitat; these waterfowl are at risk as permafrost thaws and wetlands dry up.

SOURCES: Alaska Climate Impact Assessment Commission; Larsen, P.H., et al., Estimating Future Costs for Alaska Public Infrastructure at Risk from Climate Change. Global Environmental Change (2008), doi:10.1016/j.gloenvcha.2008.03.005; U.S. Government Accountability Office, Alaska Native Villages: Most Are Affected by Flooding and Erosion, but Few Qualify for Federal Assistance (2004); The Nature Conservancy.

Hope for the Future

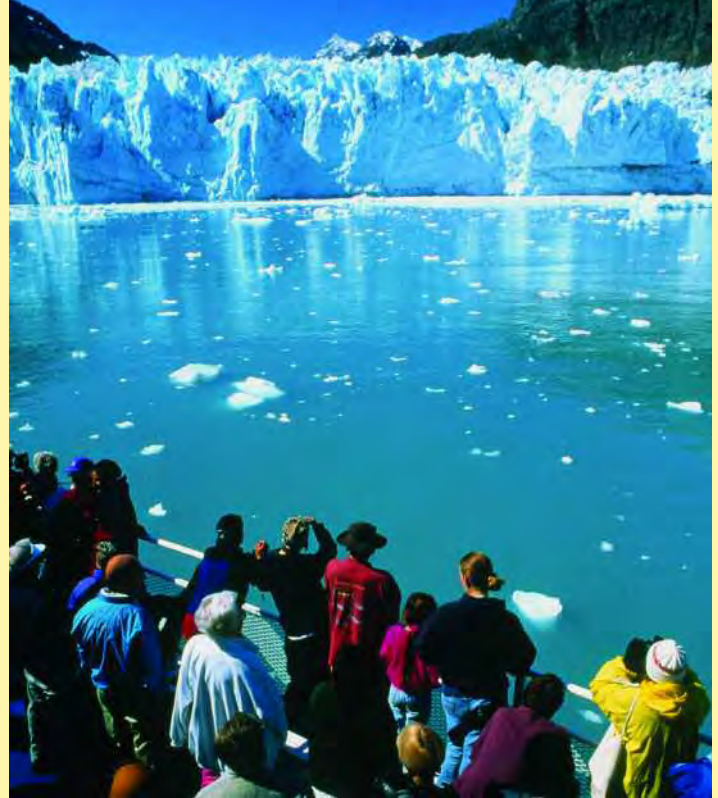
Steps to Address Climate Change at a National Level

The Nature Conservancy believes that for national legislation to address climate change effectively, it must contain the following elements:

- A near term reduction in U.S. greenhouse gas emissions of 20 percent or more by 2020, and substantial reductions thereafter on a trajectory to achieve at least an 80 percent reduction in net U.S. emissions by 2050.
- Creation of incentives to reduce emissions from deforestation and to absorb carbon from the atmosphere by restoring forests.
- Establishment of planning considerations and dedicated funding to help the natural world adapt to the impacts of climate change.

Climate change is happening. But these solutions offer ways to invigorate our economy and establish the United States as a leader in the global effort to reduce emissions. Acting today is our best hope for a stronger, more secure future.

Because scientists believe that healthy, functioning ecosystems will be best-suited to withstand the extreme weather events and disruptions expected as the climate warms, we can act now to ensure that Alaska's natural areas are in prime condition today



Glacier Bay National Park. © KIM HEACOX/ACCENTALASKA.COM

and tomorrow. Whether restoring salmon streams, restoring seabird habitat or conserving estuaries, commonsense conservation will help us protect investments in our state's land, air, water and wildlife. Our history *and* the future call on us to secure these places and all that they provide.



Smoke, steam and particulate matter pour forth from tall stacks at a manufacturing facility in the southeastern United States contributing greenhouse gases and pollution to the environment. © MARK GODFREY

Climate Change: The Basics

Unequivocal scientific evidence indicates that climate change is now occurring at an unprecedented rate. In the past, the planet has gone through cycles of gradual warming and cooling, but the changes seen today are happening faster than during a natural cycle.

While there are some natural causes to the climate change we are experiencing today, the primary drivers of this rapid climate change are the increased concentrations of greenhouse gases, particularly carbon dioxide, in the atmosphere.¹ The global increase in these gases is overwhelmingly due to the actions of people—most significantly through fossil fuel use and forest loss and degradation.

Carbon dioxide concentrations are now at their highest level in the atmosphere in over 650,000 years, outweighing all other factors that contribute to climate change.² Orbital cycles, solar flares, volcanic activity, and other natural factors appear to account for less than 10 percent of observed changes in global temperatures.³ Motor vehicles, power plants, buildings and industrial sources produce about 80 percent of the greenhouse gases from human activities while forest loss and forest degradation, and other land use change contributes the balance.

Though there will be some localized positive impacts of climate change, most of the changes to people and the ecosystems they depend on will be negative. Nature and the world's poor are expected to suffer disproportionately, forcing vulnerable people to change patterns of resource use, to migrate, or to place even greater demands on existing natural ecosystems, including protected areas.

1 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) 4TH ASSESSMENT SYNTHESIS REPORT (2007), 1.1, P.36.

2 IBID, 2.2, P.37.

3 IPCC 4TH ASSESSMENT WORKING GROUP 1 SUMMARY FOR POLICYMAKERS (2007), P.10.

Solutions in Alaska

While climate change is already affecting Alaska's landscapes, it is not too late to adapt to its effects. In Alaska and across the planet, the Conservancy is implementing science-based solutions that are mutually beneficial to both humans and natural environments.

Shaping Policy

The rapid increase in global demand for energy is likely to pose a threat to the natural systems that humans, animals and plants rely on for survival. In Alaska, The Nature Conservancy is beginning to build partnerships with industry, government agencies, and

conservation groups in an effort to encourage policymakers to support mandatory reductions in greenhouse gas emissions and provide funding for nature-based adaptation activities.

Alaskans have made substantial investments in the lands and waters that support our economy and define our heritage—assets worth protecting for the future.

Identifying Impacts of Climate Change

Working with the University of Alaska Fairbanks, an international leader in Arctic climate research, the Conservancy is beginning to research wildlife-related impacts of climate change in northern Alaska and the Northwest Territories of Canada. Because the effects of climate change are happening now, answers will help the Conservancy define appropriate strategies that help these ecosystems cope with the impacts of climate change.

Encouraging Nature's Resilience to Climate Change

Scientists know that healthy ecosystems are better able to withstand the negative impacts of environmental change. For example, to conserve Alaska's wild salmon as water temperatures increase, the Conservancy is putting protections in place that improve water quality, maintain natural water flows, and preserve stream-side trees and shrubs—all vital to sustaining healthy habitat. We are also restoring damaged stream habitats to ensure salmon have access to more spawning and rearing habitat as climate change continues to stress fish.



Drying fish in the Yukon-Kuskokwim Delta. © CLARK JAMES MISHLER




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The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

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