

# Regional Climate Projections— North Slope and Northwest Coast

## Alaska Climate Change Adaptation Series



*The climate of Alaska's North Slope and Northwest Coast is best described as moist polar. All months have mean temperatures below 50°F and precipitation is light, increasing somewhat towards the foothills of the Brooks Range. Vegetation is primarily tundra, and permafrost is continuous with varying degrees of thickness. The coast is bordered by sea ice in the winter. Climate projections show increasing temperatures in this area over the next century with increased evapotranspiration outweighing slight increases in precipitation. Reduced sea ice, a drier landscape, and a longer snow-free season could have profound impacts on vegetation, wildlife, and subsistence activities.*

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### Statewide Trends

Temperatures and precipitation are expected to increase across the state throughout the next century. The growing season will lengthen, and glaciers, sea ice, and permafrost will be reduced. Significant ecosystem shifts are likely statewide.

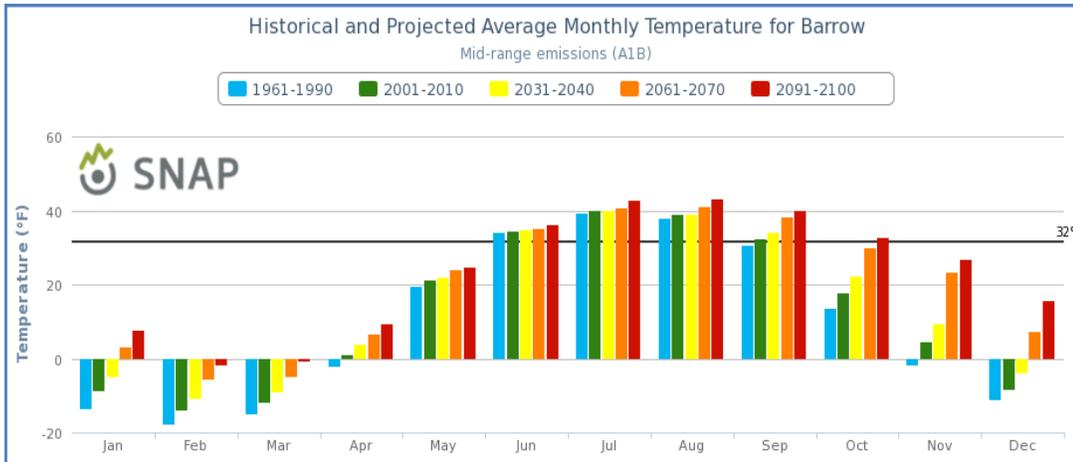
## North Slope and Northwest Coast Projections

Significant temperature change is predicted for this region, particularly in fall and winter months. In Barrow, average

Loss of sea ice also impacts habitat for arctic species and affects subsistence activities. Reductions in sea ice will drastically shrink marine habitat for polar bears, seals and seabirds, which could push some species toward extinction. Changing sea ice conditions present serious challenges to travel, which in turn threatens food security of communities that rely on subsistence hunting, fishing and gathering.

High temperatures and a longer growing season are already causing an increase in shrub cover in

the tundra, and higher evapotranspiration is likely to cause drying of some soils and wetlands. Warmer winters and lower water availability may impact the manner in which heavy industry can operate on the North Slope. On the other hand, a decline in the extent and thickness of arctic sea ice would improve ship accessibility in the Arctic Ocean,

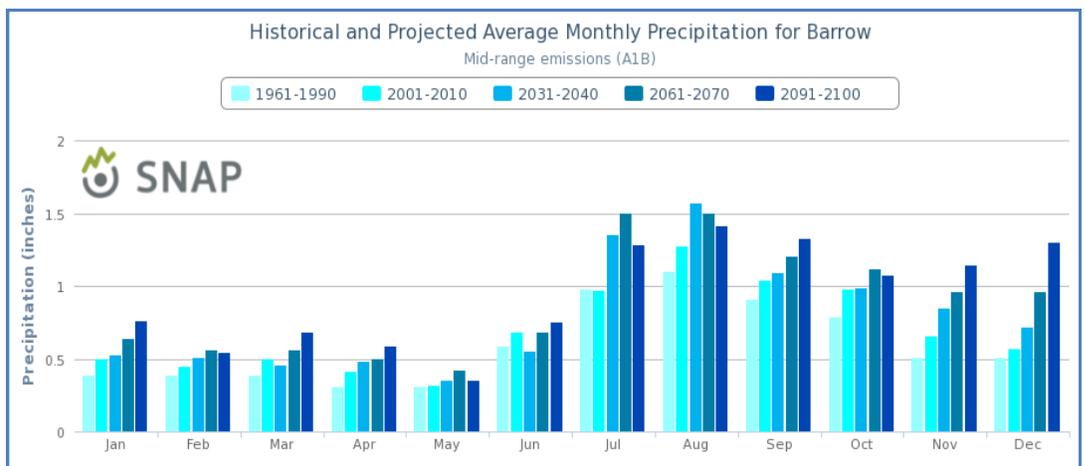


June temperatures are projected to rise only 2-3°F this century, but October-March temperatures are projected to increase by 20-25°F. Projections for precipitation are less linear, but show significant changes for every month throughout the year. The increase in arctic precipitation is likely to be most concentrated over coastal regions and in the fall and winter.

## Regional Impacts

For some coastal communities in this region, erosion is by far the most pressing issue. Loss of landfast sea ice and thawing of frozen ground along coastlines allows for greater wind and water erosion, especially during severe storms. A combination of erosion and sea level rise can eventually force some coastal communities to relocate.

Shishmaref, Alaska, has already lost several buildings due to erosion of its northern shoreline, which is eroding at an average of 3-5 feet per year. The community has chosen to relocate to a nearby mainland location that is suitable for subsistence and preserves the culture and integrity of their community.



increasing marine transport and access to resources.

Shifting tree-line and changing hydrology will likely lead to species shifts and habitat loss for some arctic flora and fauna. New species assemblages may become predominant as conditions change, particularly in western coastal areas. Shrub cover, drying and lightning together are likely to result in higher fire incidence.

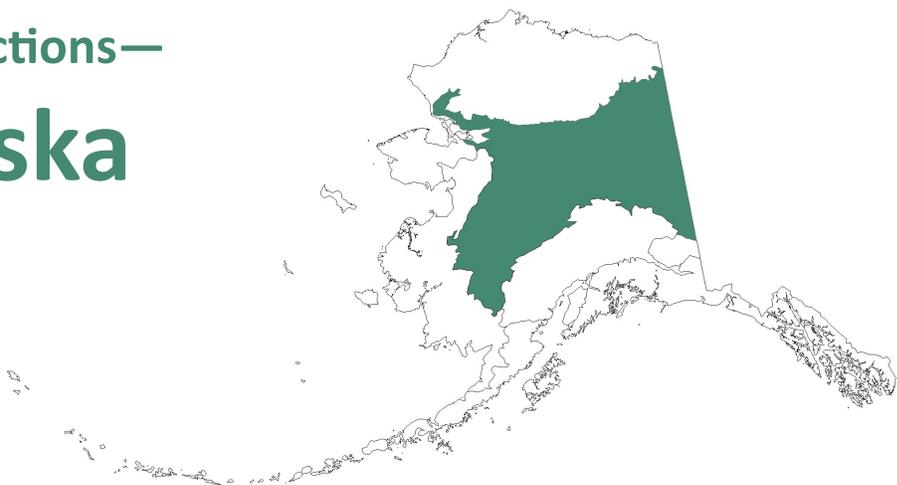
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# Regional Climate Projections— Interior Alaska

## Alaska Climate Change Adaptation Series



*Interior Alaska has a continental climate with the warmest summers in the state and the coldest winters. The Interior is projected to become warmer and drier over the next century. Warmer temperatures and a longer growing season are expected to increase evapotranspiration enough to outweigh a regional increase in precipitation. Seasonal changes in climate will have profound impacts on the condition and health of wildlife habitat, cause widespread loss of permafrost, lead to increased fire risk, and contribute to the drying of wetlands, streams, and lakes.*

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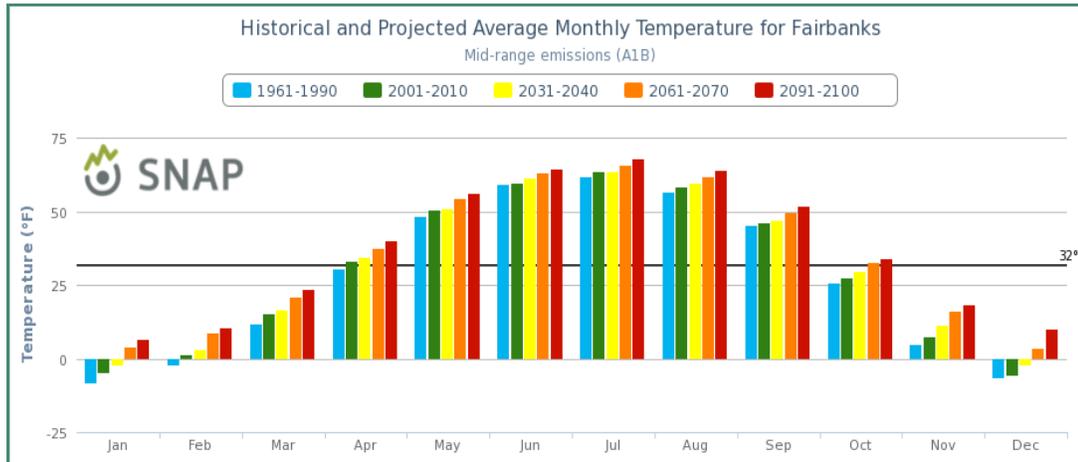
### Statewide Trends

Temperatures and precipitation are expected to increase across the state throughout the next century. The growing season will lengthen, and glaciers, sea ice, and permafrost will be reduced. Significant ecosystem shifts are likely statewide.

## Interior Alaska Projections

Even taking into account the natural variability of the climate system, it is likely that temperatures will continue to increase in the Interior, with the most significant increases

in the winter. Over the next century, average temperatures in Fairbanks are projected to increase by roughly 10-15°F in winter and 5-10°F in summer. Projections indicate more precipitation overall, but because of hotter weather, an increase in overall drying and an increase in extreme fire seasons are expected. Shorter winters may mean less snowpack even with higher overall precipitation.



ly longer growing season would have a positive impact on agriculture in the Interior. However, these conditions may also allow more invasive plants to enter the region. The migration of spruce northward and upward in elevation and the introduction of lodgepole pine into the Interior are likely. These vegetation shifts would affect the composition and frequency of the wildlife that depends upon those plant species for food and cover.

As winter temperatures increase, insect outbreaks could spread north into the boreal forest. The response of

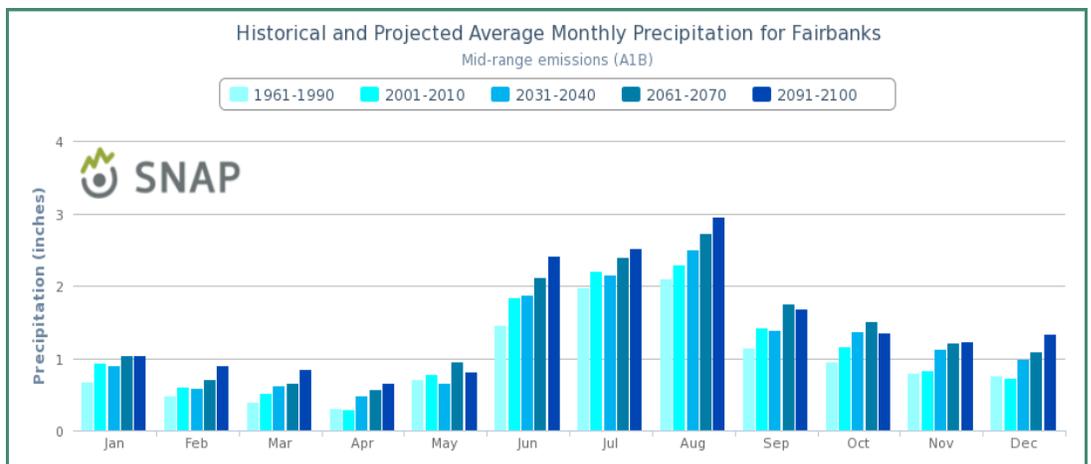
the boreal forests to wildfire is different than it used to be for several reasons, including decreased tree resilience (due to insect infestations or drought stress). Changes in fire patterns are likely to have significant impacts on ecosystems, and fires may become more frequent and more intense due to drying soils.

With higher temperatures, permafrost thaw will affect roads, pipelines, buildings and other infrastructure. Also, pollutants such as mercury are released into aquatic environments when permafrost thaws. Permafrost degradation leads to the formation of thermokarsts, which can drain lakes and ponds, significantly altering wetland areas and other wildlife habitats.

## Regional Impacts

Increasing temperatures in the Interior will cause shifts in vegetation, fire regimes, and wildlife habitat and migration patterns. Changes in hydrology and permafrost, as well as warmer winter temperatures, are also likely to cause species shifts, including the potential for increased invasive species occurrences, and an increase in deciduous tree stands as compared to old growth spruce forests.

Climate change could also bring increased opportunity. More favorable weather during shoulder seasons may increase tourism, and a significant-



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# Regional Climate Projections— Southcentral Alaska

## Alaska Climate Change Adaptation Series



*Southcentral Alaska includes the Alaska Range, Wrangell Mountains, Copper River Basin and Cook Inlet areas. In much of this region, including Anchorage, mean annual temperatures are above freezing, and precipitation is substantially higher than in interior Alaska. Projected increases in temperature and precipitation coupled with the drying effects of greater evapotranspiration are expected to result in higher incidence of insect outbreaks and forest fires and the further spread of invasive species. Ocean acidification may impact fisheries.*

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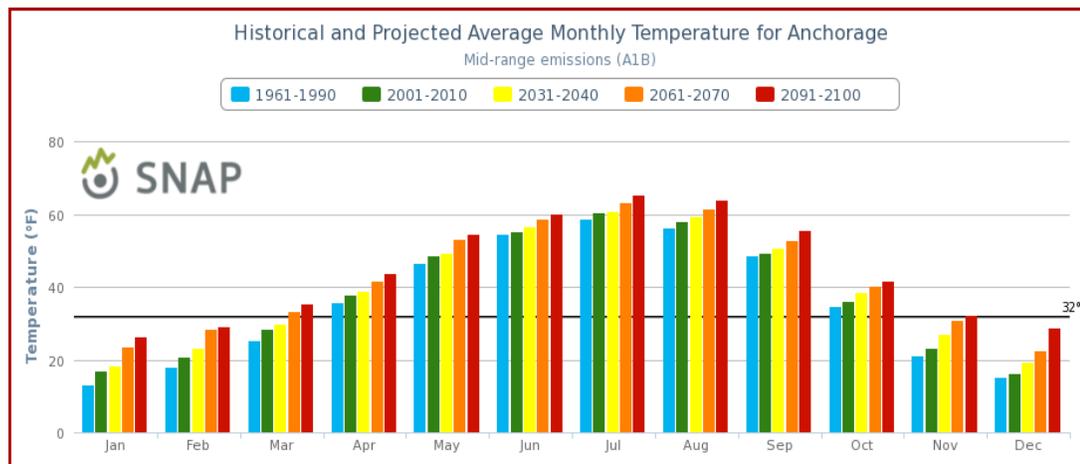
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## Southcentral Alaska Projections

Temperatures in this region are projected to increase over the coming decades at an average rate of about 1°F per decade. Mean temperatures in Anchorage are project-

Species shifts could negatively impact ecosystem function and subsistence activities. However, longer growing seasons and milder winters could also expand agricultural potential. Higher temperatures result in a longer growing



season, which could have significant effects on wildlife mating cycles, plant growth and flowering, water availability in soil and rivers, and hunting and fishing.

In the Southcentral boreal forest, invasive species are the dominant mechanism of change. Invasive plants such as orange hawkweed, purple loosestrife and white

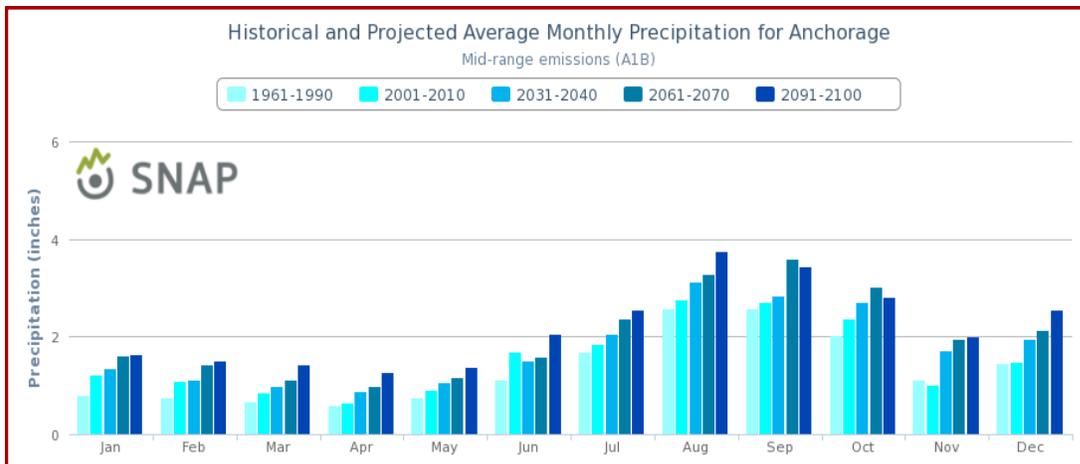
ed to rise from well below freezing in November and March to slightly above freezing, with corresponding increases in December-February. Milder winters will likely result in significant reductions in snowpack, since a higher percentage of precipitation would occur as rain. Precipitation is predicted to increase in this region, though it will be offset by an increase in evapotranspiration from warmer temperatures and a longer growing season. As a result, conditions are expected to become substantially drier in the summer and potentially icier in winter.

sweetclover spread aggressively and out-compete native vegetation. The spread of invasive species alters forest structure and regeneration. The indirect effects on water and nutrient availability will likely determine future productivity of trees in Southcentral Alaska.

Around Cook Inlet, storm severity and the associated risks from flooding and erosion are likely to increase. This area has experienced multiple hundred-year floods in the

## Regional Impacts

In southcentral Alaska, warmer and drier conditions will likely cause further shifts in native and invasive species. Shorter, milder winters allow for greater survival of pest species, as was the case with recent bark beetle outbreaks. Non-native insects such as the green alder sawfly have caused extensive mortality of thinleaf alders in this region. Warmer weather and insect-killed trees may also lead to increased incidence and severity of forest fire.



last few decades. Local salmon streams are also showing alarming warming trends. High stream temperatures make fish more vulnerable to pollution, predation and disease.

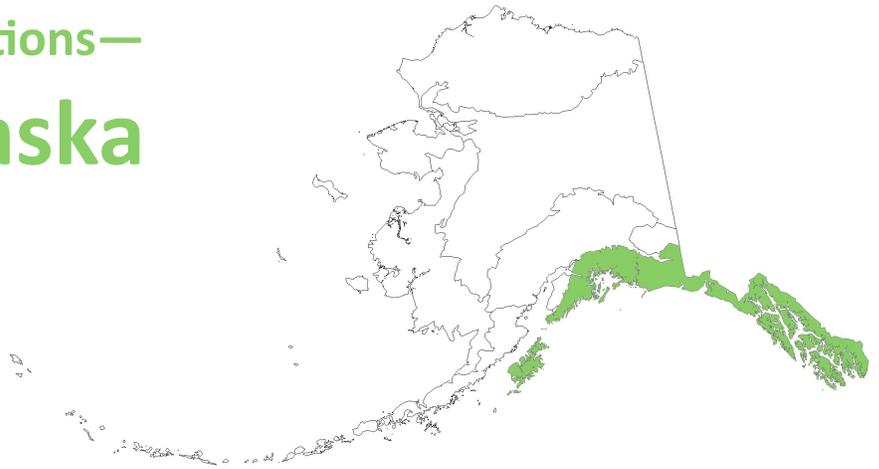
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# Regional Climate Projections— Southeast Alaska

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*The Southeast Alaska region encompasses the Chugach-St. Elias Mountains, Boundary Ranges and Alexander Archipelago. This temperate maritime area has cool summers, relatively warm winters, and some of the highest precipitation totals in the state. It supports temperate rainforests and forested wetlands. The mountain ranges have large icefields, glaciers, and alpine communities of plants and animals. Climate change may cause species shifts and major hydrologic change as glaciers recede and winter precipitation shifts from snow to rain. Fisheries may also be impacted by ocean acidification.*

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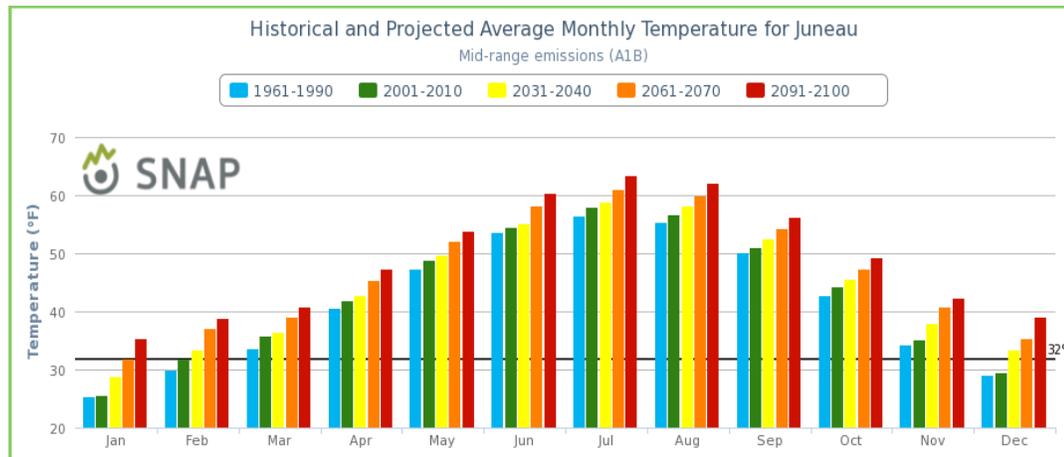
### Statewide Trends

Temperatures and precipitation are expected to increase across the state throughout the next century. The growing season will lengthen, and glaciers, sea ice, and permafrost will be reduced. Significant ecosystem shifts are likely statewide.



## Southeast Alaska Projections

SNAP models suggest that below-freezing temperatures and snowfall will become increasingly rare in this re-



gion. In Juneau and other locations in Southeast, mean winter temperatures are projected to rise from below freezing to well above freezing in the next few decades, potentially leading to little or no snowpack, except at the highest elevations. This will affect hydrologic cycles, since winter runoff is likely to increase and less snowpack will be available to feed spring runoff.

### Regional Impacts

Long-term projections indicate that most glaciers in southeast Alaska follow a regional and global trend of accelerated melting. Locally, land surface rises as a result of the loss of glacial ice (isostatic rebound), and this will likely be at a rate greater than the rate of sea level rise. Melting glaciers also affect the seasonal discharge and turbidity of glacial streams, which impacts aquatic productivity and hydroelectric potential.

Changes in climate may outpace the capacity of some plants and animals to adapt, resulting in local or global extinctions. Shrubs and trees will colonize elevations that are

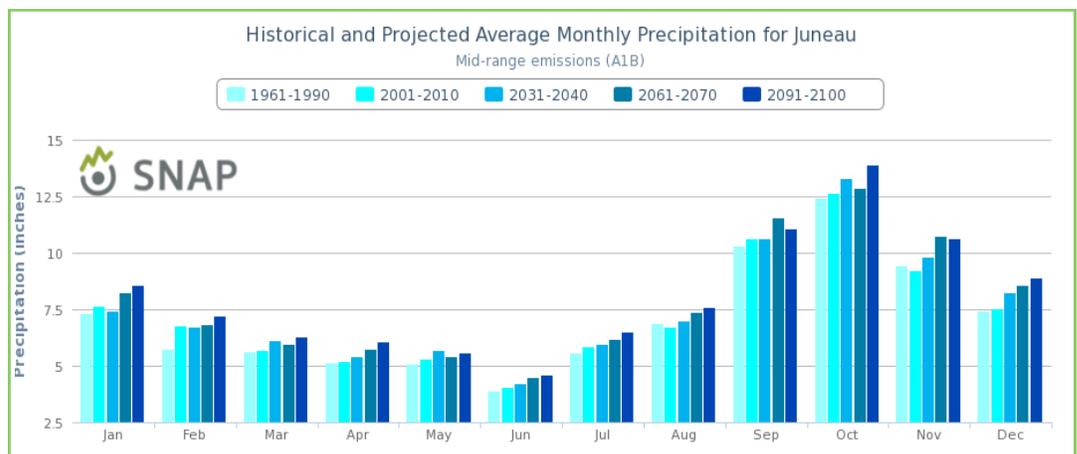
currently characterized as alpine or tundra habitat in southeastern Alaska. Warming and drying of soils and insect infestations may increase fire risk over the coming decades.

The loss of insulating snow cover allows yellow cedar trees to freeze in the spring. Reductions in winter snow cover at lower elevations will also negatively impact winter recreational activities.

Rapid changes of terrestrial and marine environments will alter commercial, subsistence and recreational harvesting in ways that cannot be readily predicted.

Increasing temperature and precipitation will likely alter the ecology of salmon fisheries. Early entry of salmon into the marine environment—when food resources are low—will decrease their growth and survival. Changes in ocean temperature, invasive species, erosion and storms may impact the fishing industry. However, since fisheries in other parts of the world may be impacted also, it is hard to predict the relative competitiveness of Alaska fisheries.

Longer and warmer summers could potentially benefit the tourism industry. However, SNAP models predict relatively modest increases in temperatures during the May-September season. Increased intensity and frequency of coastal storms will negatively impact shoreline and wetland areas, which could impact tourism as well.



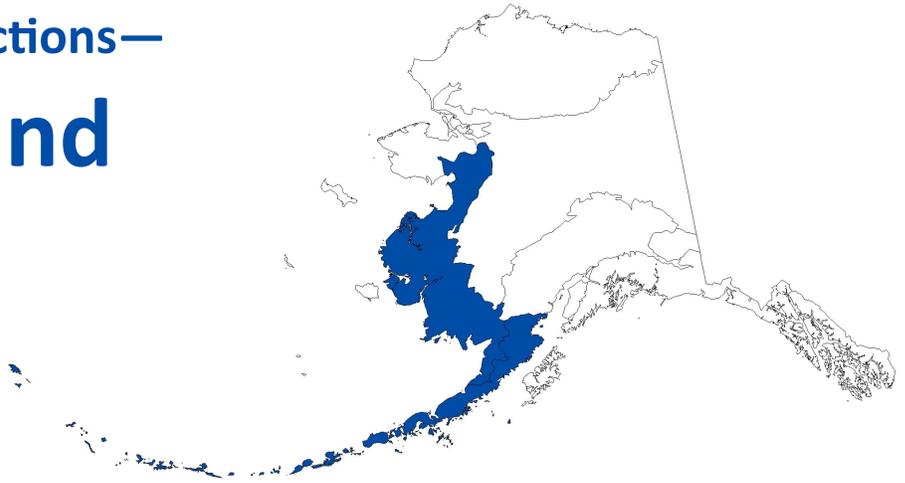
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# Regional Climate Projections— Southwest and Aleutians

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*This region encompasses the Aleutian Islands, with a maritime climate, and the southwest coast, a region of maritime influence. Though mean annual temperatures are similar to inland sites at the same latitudes, the seasonal range of temperatures is much lower and the winds are much higher, yielding ecosystems dominated by grasslands and shrubs rather than forests. As temperatures increase, loss of permafrost and shorter seasons for land-fast ice will exacerbate the erosion caused by coastal storms. Both terrestrial and marine ecosystem shifts are likely.*

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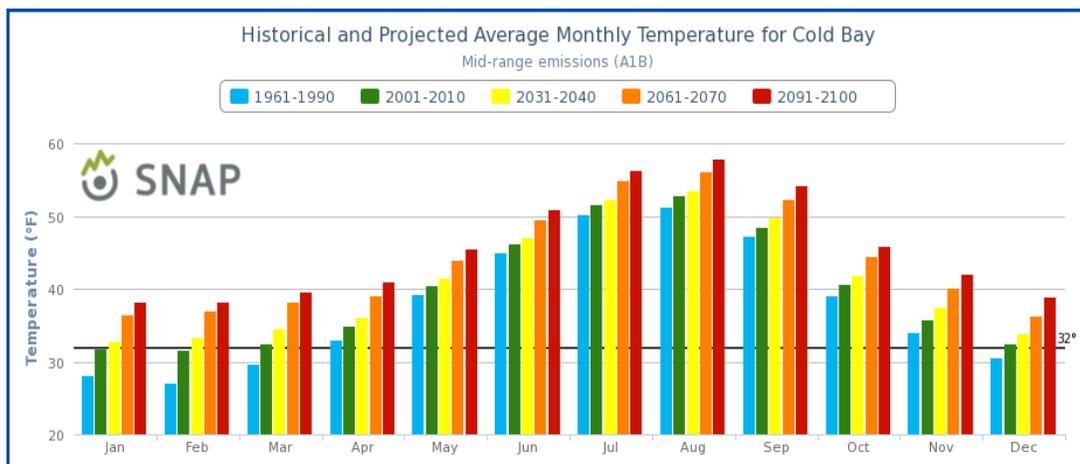
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## Southwest Alaska and Aleutians Projections

Temperatures in this region are projected to increase, resulting in a transition from average annual temperatures near the freezing point to temperatures well above



the freezing point. In many parts of the Aleutians, decreased (or completely absent) snowfall may occur as the mean winter temperature rises above freezing. Precipitation is also projected to increase throughout southwest Alaska and across the Aleutian chain, and winter precipitation may increase by as much as 19% by the end of the century.

## Regional Impacts

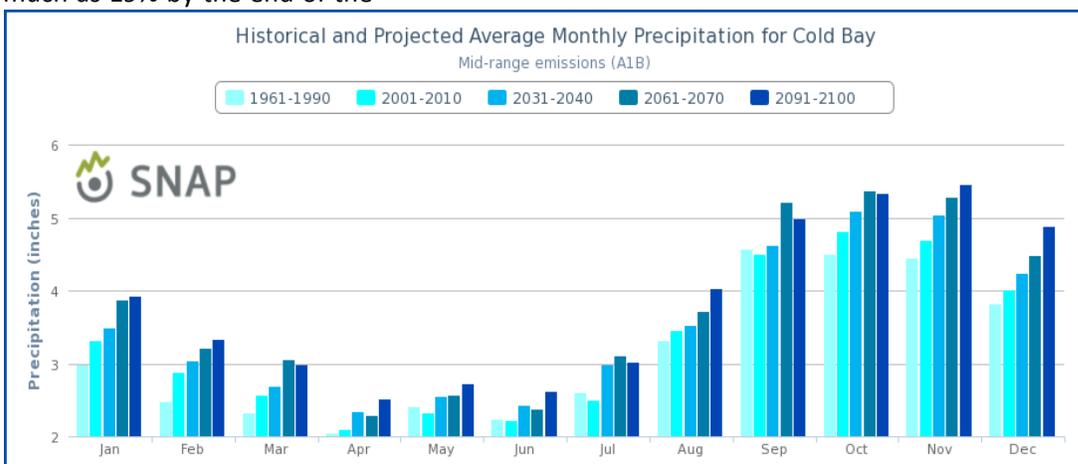
Increased incidence and severity of storms are of significant concern in this region. Southwest Alaska has also seen a decline in shore ice in the winter, making coastal villages more vulnerable to winter storm wave action. In Nelson Lagoon, for instance, the breakwall designed to brace shore ice provides little protection against the full force of storm waves.

As a result of sea level rise and storm surges, erosion may also be a problem, although coastal areas that are historically free of sea ice, which includes the Aleutian

Islands, probably will not experience the more extreme erosion of more northern regions.

Higher ocean temperatures are altering the Bering Sea ecosystem, impacting marine mammals, fish and birds. Non-indigenous warm-water fish species have already been observed in the North Pacific and Bering Sea. Large northward shifts in fish and shellfish species are expected, and it may become necessary to relocate fisheries infrastructure.

Subsistence hunting and fishing could be impacted in positive and negative ways. While some animal species are driven out by changes to habitat, higher temperatures allow other animals such as fur seals and Steller sea lions to remain on the islands throughout the winter.



Lack of hard frost may also drive species shifts and allow invasive species to encroach, although more remote islands may be less susceptible than other parts of the state. It is possible that some species shifts may not occur as rapidly as needed to keep up with changing climate conditions. Tree line will continue to move westward as wet tundra areas dry.

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