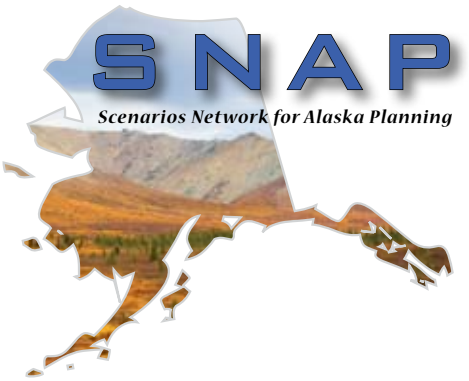
Alaska Regional Climate Projections



Who We Are

- **SNAP** - The **Scenarios Network for Alaska Planning** is a network linking university researchers with communities and resource managers. Through collaborative partnerships involving data sharing, research, modeling, and interpretation of model results, SNAP addresses some of the complex challenges of adapting to future conditions.
- **CES** - The **Cooperative Extension Service** was established by the US Congress as the educational outreach component of the national land grant university system—in Alaska, the University of Alaska Fairbanks. They conduct research and provide educational outreach statewide.
- **ACCAP** - The mission of the **Alaska Center for Climate and Policy** is to assess the socio-economic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate.

ACCAP Alaska Center for Climate Assessment & Policy

UNIVERSITY of ALASKA
Many Traditions One Alaska

COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF ALASKA FAIRBANKS

Planning for Change

Background

Alaskans are faced with many new challenges, including high energy costs and the impacts of climate change. Rising energy costs have impacted the costs of food and other services as well as fuel prices. Changes in temperature and moisture can trigger profound landscape-level changes such as sea level rise; changing patterns of storms, flooding, or fire; and different migration routes, breeding patterns, or survivorship of fish and wildlife.

Everyone—from engineers to wildlife managers to farmers—will need to take economic change, social change, and climate change into account when planning for the future, in order to avoid costly mistakes. Planning requires objective analysis—including clear explanations of the uncertainty inherent in all forms of forecasting. ***Together, SNAP, ACCAP, and CES can provide a variety of services that may help you in meeting your community planning needs.***

SNAP climate projections

As a starting point, SNAP offers statewide maps of temperature and precipitation projections, and basic data for 353 communities. These projections are based on global models used by the Intergovernmental Panel on Climate Change (IPCC), using a moderate scenario (A1B). Results from the five models that perform most accurately in Alaska and other northern regions were downscaled using local data.

Climate Change by Region

Introduction

The following graphs are provided as examples of climate change projections for communities around the state. Each graph shows mean monthly temperatures **(°F)** or mean monthly precipitation **(inches)** for three periods: 1961–1990 (actual historical data), 2041–2050, and 2091–2100 (projections). Note that graph scales differ by region.

Statewide trends

In general, temperatures and precipitation are expected to increase across all regions. Temperature increases are predicted for every month, and increases are expected to continue throughout the century. The growing season is likely to increase statewide. Note that precipitation alone does not predict ecosystem moisture limitations. Increased plant growth and increased evaporation due to

higher temperatures may more than offset the additional precipitation, resulting in overall drying of soils.

Uncertainty

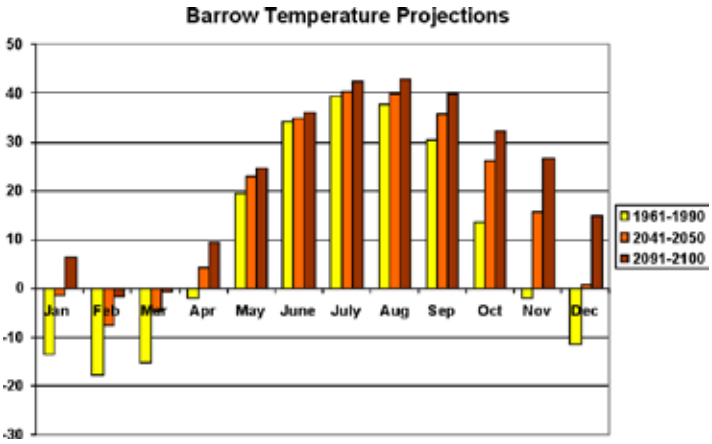
While values are based on the best available models, they are estimates only. There is variation among the five models used, and annual variation within each model. In general, uncertainty is higher for precipitation than for temperature, particularly for dry regions where small differences can represent large percentage changes. Interpretation of the impacts of temperature and precipitation change adds additional uncertainty.

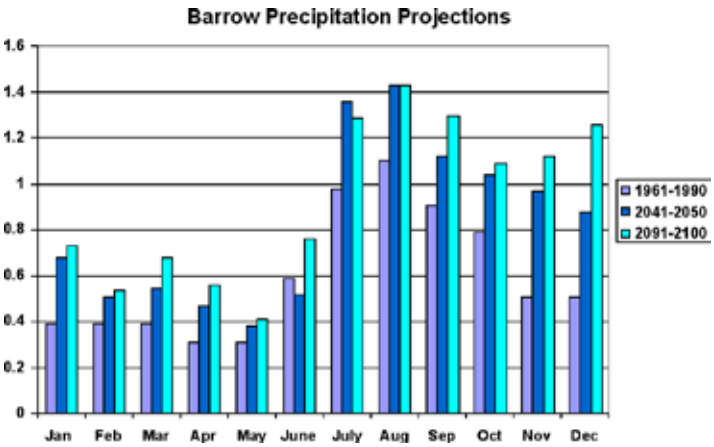
North Slope and Northwest coast

For some coastal communities, **erosion** is by far the most pressing issue. Loss of sea-ice and thawing of frozen ground along coastlines allows for greater wind and water erosion, especially during severe storms. Warming oceans and melting glaciers increase ocean volume, causing sea level rise.

Loss of sea-ice and other climate shifts are also changing habitat for arctic species, impacting **subsistence** activities.

Significant temperature change is predicted, particularly in fall and winter months. Note that in Barrow, June temperatures are projected to rise only 2–3° this century, but October-March temperatures are projected to increase by 20–25°

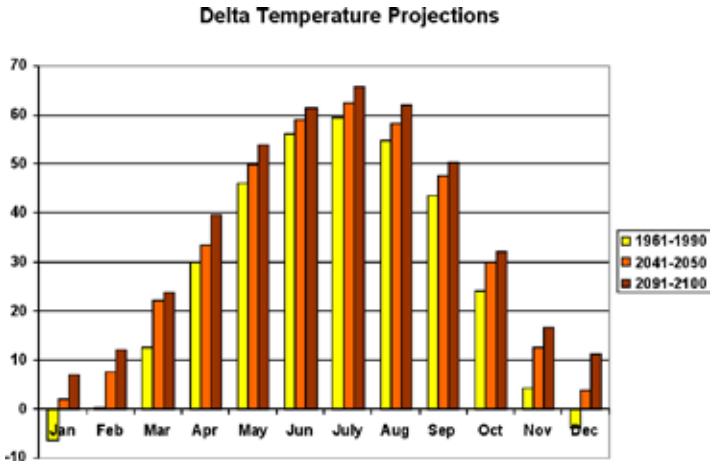


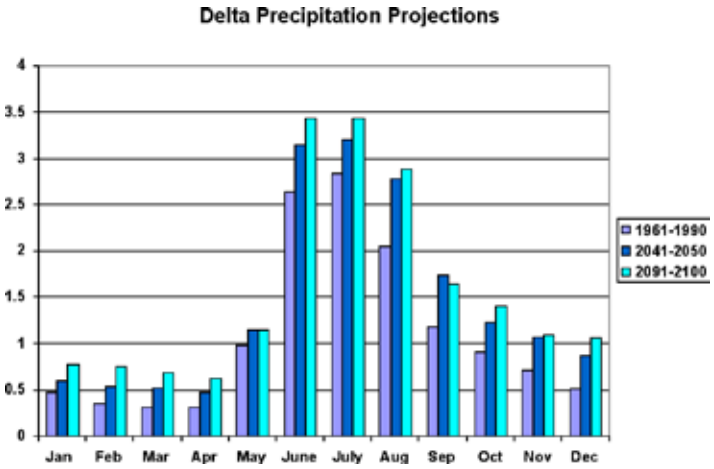


Warmer temperatures and a longer growing season are already causing an increase in shrub cover in the tundra, and higher evapotranspiration is likely to cause drying of some soils and wetlands. Thunderstorms may also become more frequent. Shrub cover, drying, and lightning together may result in higher fire incidence.

Warmer winter temperatures and lower water availability may impact the manner in which heavy industry can operate on the North Slope.

Interior





In central Alaska, **changes in fire patterns** are likely to have significant impacts on ecosystems. Fires may become more frequent and more intense due to drying soils. Note that little or no increase in precipitation is expected in spring (May), and that shorter winters may mean less snowpack even with higher overall precipitation.

Winter temperatures are projected to increase by as much as 15° by 2100. Insect outbreaks may spread north into the boreal forest as winter conditions become warmer, since cold winters are often the population-limiting factor for insects such as the spruce bark beetle.

Permafrost is currently discontinuous in the Interior. With increased temperatures, **permafrost thaw** may affect roads, pipelines, buildings, and other infrastructure.

A significantly longer growing season may have a positive impact on agriculture in the Interior, allowing for longer-season crops and reduced need for greenhouses. However, this more favorable growing environment may also allow for more invasive plants to enter the region. The migration of spruce northward and upward in elevation and lodgepole pine into the Interior is likely.

South Central

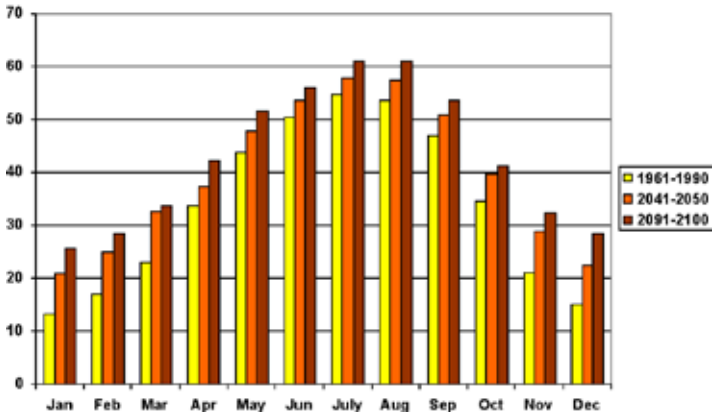
In south central Alaska, warming temperatures and associated drought stress may increase invasive species and other **species shifts**, including the incidence of insect outbreaks. Warmer weather, drying, and insect-killed trees may also increase the incidence and severity of **forest fire**.

Note that mean temperatures in Kenai are projected to rise from well below freezing in November and March to slightly above freezing, with corresponding increases in December-February. Shorter milder winters may allow for greater survival of pest species that have been naturally excluded previously, as was the case with recent bark beetle outbreaks in this region.

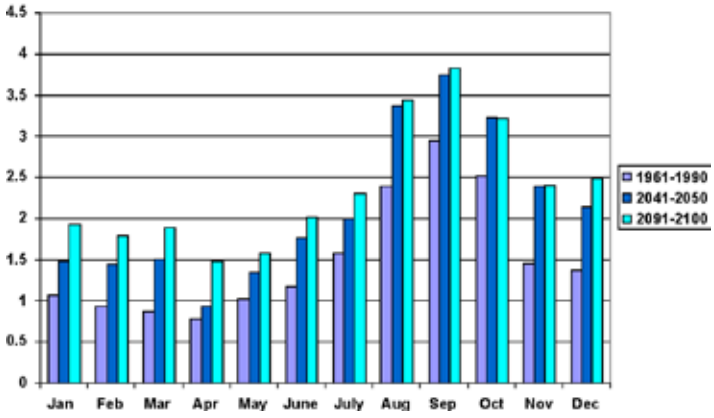
Species shifts may negatively impact ecosystem function and subsistence activities. However, longer growing seasons and milder winters may expand the agricultural potential of this region, allowing greater success for long-season annual crops as well as for fruit trees and other perennials.

In coastal areas, storm severity may increase, with associated risks from flooding and erosion.

Kenai Temperature Projections

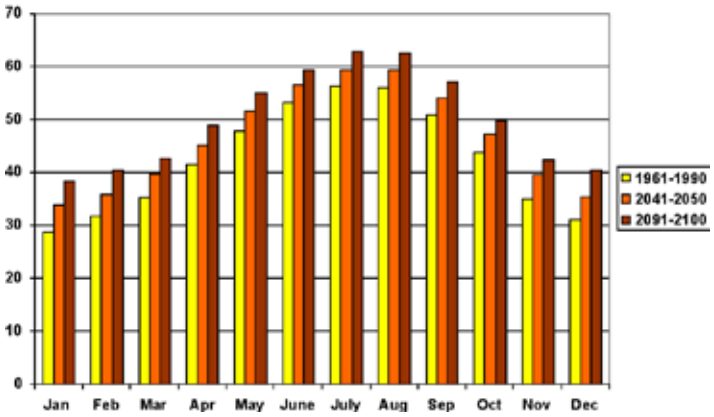


Kenai Precipitation Projections

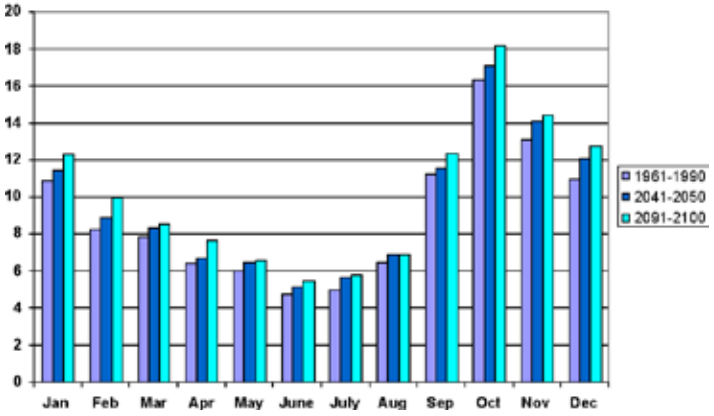


Southeast

Petersburg Temperature Projections



Petersburg Precipitation Projecitons



Changing ocean temperature, invasive species, erosion and storms may impact the **fishing industry** in southeast Alaska. However, since fisheries in other parts of the world may be impacted also, it is hard to predict the relative competitiveness of Alaska fisheries.

Tourism is a major source of revenue in southeast Alaska, and longer and warmer summers may benefit this industry. However, our models predict relatively modest increases in temperatures during the May-September season, and larger changes from October to April.

Although high precipitation has generally prevented forest fire from being a major driver in southeast Alaska in the past, warming and drying of soils may increase **fire risk** over the coming decades.

Our models suggest that below-freezing temperatures and snowfall will become increasingly rare in this region, at least at low elevations. Note that mean winter temperatures in Petersburg are projected to rise from below freezing to well above freezing in the next few decades.

Southwest/Aleutians

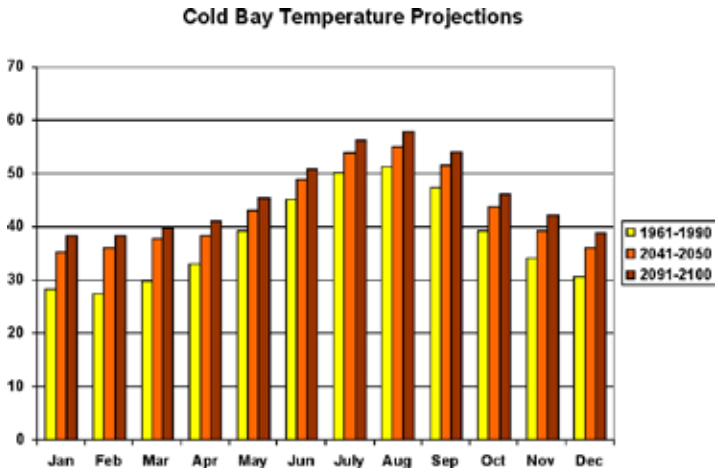
Increased incidence and severity of **storms** are likely to be of concern in Southwest Alaska.

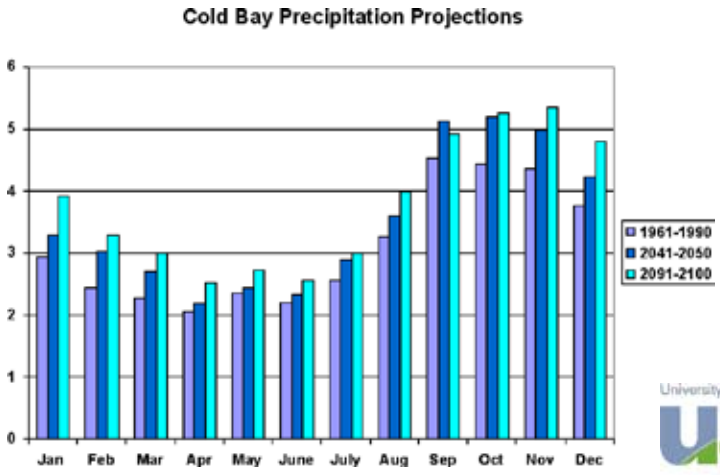
As a result of sea level rise and storm surges, **erosion** may also be a problem. However, because these coastal areas are historically free of sea ice they will probably not experience the more extreme erosion of more northern regions.

In many parts of the Aleutians, decreased (or completely absent) snowfall may occur as mean winter temperature rise above freezing. 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 due to the effects of island biogeography. In fact, it's possible that in some cases 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 and become occupied by the westward movement of the boreal forest.

Warming ocean temperatures are **altering the Bering Sea ecosystem**, impacting fish, marine mammals, and birds.





Additional Information

Sample questions

The group(s) most suited to assist with each question are noted in italics.

- How can we make a difference in our future given the realities that we face? *SNAP, CES, ACCAP*
- What are the simplest and most cost effective community changes that will improve quality of life, given current and future energy needs and climate conditions? *SNAP, CES, ACCAP*
- What are the specific climate projections for our community? *SNAP*
- How might we develop a sustainable community woodlot program to reduce fossil fuel use? Can we get carbon credits for such a program? *CES*
- Are there economically viable products that we can produce and sell to a larger market? *CES*
- How might climate change impact natural resources, businesses, and infrastructure in our community? *SNAP*
- Are there energy programs available? *CES*
- Can we develop an educational program to raise climate change awareness and engage students in monitoring impacts? *CES, SNAP, ACCAP*
- Can our community monitor the efficacy of emission reduction efforts? *CES*
- Can we do more to grow our own food and become more self-sufficient? *CES*

Contact Us

- To learn more about Alaska climate projections and how your agency or community can become a SNAP collaborator, visit the SNAP website: **www.snap.uaf.edu** or contact: Dr. Nancy Fresco: ffnlf@uaf.edu (907) 474-2405
- For additional information about climate change in Alaska, visit the ACCAP website: **www.uaf.edu/accap** or contact Dr. Sarah Trainor: accap@uaf.edu phone: (907) 474-7878
- For more information about Cooperative Extension services through the University of Alaska Fairbanks: **www.alaska.edu/uaf/ces**
- *Valuable additional information can be found at the **Alaska Climate Change Strategy web site: www.climatechange.alaska.gov***

University of Alaska Geography Program
uagp
SNRAS Pub. No. MP 2009-04
School of Natural Resources & Agricultural Sciences
PO Box 752700, Fairbanks AK 99775-7200
www.uaf.edu/snras/ • fynras@uaf.edu