

# Projected climate change scenarios for Glacier Bay National Park & Preserve



Average Annual Temperature (°F)

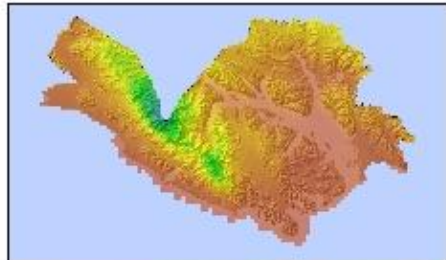
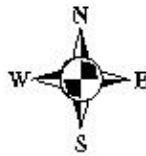


1961-1990

PRISM 30-year historical average



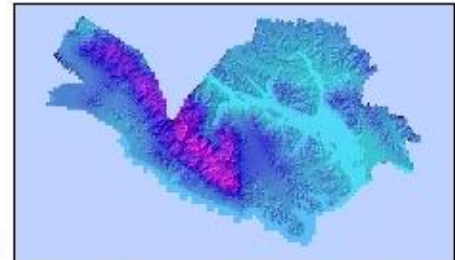
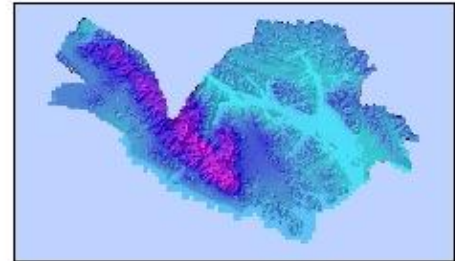
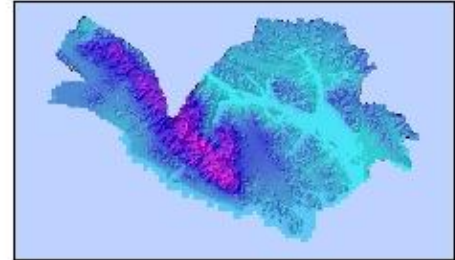
2035-2044



2075-2084

20° 35°

Total Annual Precipitation (inches)



60" 510"



## Magnitude of climatic change

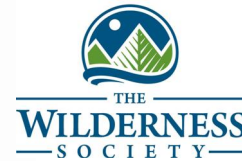
Projected Temperature (TEMP) Change (°F)				Projected Precipitation (PRCP) Change (in.)				
Season	Time	Avg. TEMP	Δ TEMP*	Season	Time	Total PRCP	Δ PRCP*	% Δ PRCP*
Annual	Hist.	35.4 ± 1.9	NA	Annual	Hist.	159.4 ± 29.2	NA	NA
	2040	38.7 ± 1.9	3.2		2040	166.4 ± 29.2	7.0	4%
	2080	41.5 ± 1.9	6.1		2080	170.4 ± 29.2	11.1	7%
Summer	Hist.	47.3 ± 1.6	NA	Summer	Hist.	52.0 ± 8.1	NA	NA
	2040	49.6 ± 1.6	2.3		2040	54.6 ± 8.2	2.6	5%
	2080	52.1 ± 1.6	4.8		2080	55.4 ± 8.1	3.4	7%
Winter	Hist.	27.0 ± 2.2	NA	Winter	Hist.	107.4 ± 21.3	NA	NA
	2040	30.9 ± 2.2	3.9		2040	111.9 ± 21.3	4.4	4%
	2080	34.0 ± 2.2	7.0		2080	115.1 ± 21.3	7.7	7%

\* Δ PRCP/TEMP: change in decadal precipitation/temperature average from historic value

For more information:

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# Climate Change Implications for Glacier Bay National Park & Preserve



## Climate Change in Alaska

**Many areas in Alaska are already showing signs of climate change.** Scientists have reported observations of wetland drying, glacial and polar sea ice recession, spruce-bark beetle infestations, and an increase in fire frequency and intensity throughout the state. A better understanding of where and when such changes could continue to occur is needed to help decision makers identify how Alaska's ecosystems may respond in the future.

In order to understand what these changes may be like, data from a composite of five down-scaled global circulation models was used to estimate decadal averages of future temperature and precipitation values within the preserve. These models assume a steady increase in carbon dioxide (CO<sub>2</sub>) emissions from fossil fuel combustion over the first several decades of the 21<sup>st</sup> century, followed by a gradual decline in emissions as several kinds of low-emission energy alternatives become more prevalent. This emissions regime is considered a “moderate” estimate<sup>1</sup>. Several other scenarios have predicted higher emission rates, and scientists have since determined current levels<sup>2</sup> are significantly greater than even the most extreme concentrations analyzed by the Intergovernmental Panel on Climate Change. Higher emissions rates will likely accelerate changes in climate and lead to more severe ecosystem impacts.

## Temperature changes in Glacier Bay National Park & Preserve

**Temperatures are projected to increase over the coming decades at an average rate of about 1°F per decade.** Average annual temperature is expected to rise by about 3°F by 2040 and as much as 6°F by 2080.

Considering the natural variation in temperatures across the study area, this is likely to result in a transition from average annual temperatures near the freezing point (~35°F), to temperatures well above the freezing point (~42°F).

A likely outcome of these changes is a lengthening of the growing season, a change that could have profound effects on wildlife mating cycles, plant growth and flowering, water availability in soil and rivers, and hunting and fishing.

**Winter temperatures are projected to change the most dramatically.** Mean winter temperatures could reach a high of 34°F by 2080, a figure that represents an impressive 7°F rise from the historical 27°F average. Average summer temperatures are projected to rise by almost 5°F by 2080 (from ~47°F to ~52°F). Some species may benefit from these changes, while others may not be able to adapt or find suitable habitat conditions to sustain their populations.

## Precipitation changes in Glacier Bay National Park & Preserve

**Precipitation is predicted to increase across the study area.** Despite this area-wide increase, conditions are expected to become substantially drier in the summer and fall and potentially icier in winter. Although summer rainfall is expected to rise by 7%, this increase is unlikely to be enough to offset an increase in evapotranspiration caused by warmer temperatures and a longer growing season. Winter precipitation may also increase by as much as 7% and could fall in the form of snow, ice, or rain, depending on the temperature. Ultimately, the timing and intensity of precipitation will determine how these changes affect the landscape and hydrology of the Preserve.

## Summary of findings

**Glacier Bay National Park & Preserve 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, lead to increased fire risk, and contribute to the likelihood of wetlands, streams, and lakes drying.

It is important to note that predicting changes in environmental variables is difficult, especially in Alaska where historical climate monitoring data is sparse. Increasing the scope of precipitation, temperature, and ecological monitoring throughout Alaska is one of the best strategies for improving our understanding of changes in climate and the response of ecosystems.

<sup>1</sup> This emissions outlook is the “A1B” scenario from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment, published in 2007. The models used in this analysis included ECHAM5, GFDL2.1, MIROC3.2MR, HadCM3, and CGCM3.1.

<sup>2</sup> Recent rates of global CO<sub>2</sub> emissions can be found on the Carbon Dioxide Information Analysis Center website ([www.cdiac.esd.ornl.gov](http://www.cdiac.esd.ornl.gov)).