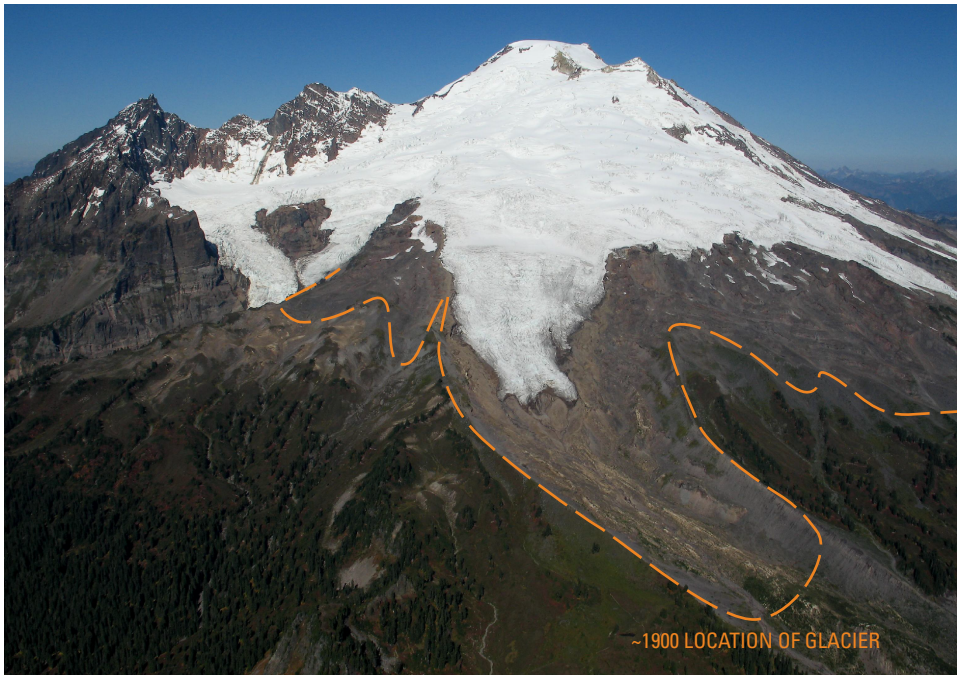
GLACIERS & SNOWPACK

THE CHALLENGE

There are about 375 glaciers in the Skagit River watershed, and vast areas of the upper watershed are covered in snow each winter. These massive accumulations of ice and snow produce stream flows that provide hydroelectric power, support agricultural production, provide recreational opportunities, and create habitat for salmon and other fish and wildlife.

Glaciers are extremely sensitive to climate change. A warming climate increases rates of melting, reduces winter snow accumulation, and alters the timing and duration of runoff. When freezing elevations move higher, as they have over the past several decades, glaciers are not able to fully rebuild themselves in the winter through accumulated snowfall. In the Skagit, the average winter freezing elevation has risen consistently since 1948.



A glacier forms when winter snowfall exceeds summer melting. It shrinks or "retreats" when melting outpaces the accumulation of new snow. The Easton Glacier (above) located on the south face of Mt. Baker has retreated significantly over the past century.

The melting of glaciers and rising snow elevations has implications for people, salmon, and forests:

COLD WATER STORAGE

The Skagit River basin is rapidly losing its "bank account" of cold water (stored as ice) as glaciers retreat. Glaciers supply continual cool water to the mainstem river and tributary streams. This is important especially during late summer and drought periods when there is little rainfall and snow has melted. Between 1959 and 2009, the net loss of glaciers from surface melting equals 800 billion gallons of water.

INCREASED FLOODING

As air temperatures rise, more precipitation falls as rain and less as snow. As a result, the amount of water in the Skagit River during the winter is projected to increase, raising the risk of large floods. Larger and more frequent floods will also lead to increased sediment flowing through the system, which will fill in rivers, reduce the capacity of the channelized system to carry flood waters, and increase the pressures on levees.

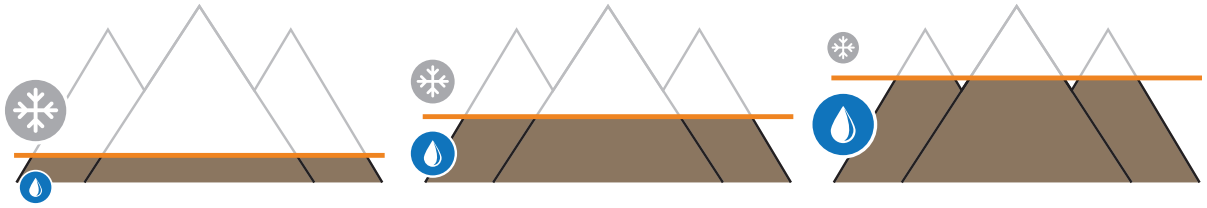
SALMON NEEDS

Increasing air temperature and glacial melting have effects on stream temperatures. Projections suggest it will be increasingly difficult to meet the habitat need for cold water at sufficient flows for some salmon species as the glaciers retreat. Without cold glacial melt water, temperature-sensitive aquatic species, such as salmon, will experience increased stress and mortality, disrupting the basis of the aquatic food chain for salmon. Spawning, egg incubation, and rearing of various salmon species can also be negatively affected.

FOREST ECOSYSTEMS

Rising winter freezing elevations that result in less winter snow, will affect the ecology of forests by changing soil moisture conditions and microclimates. Climate change is expected to alter the nature and extent of disease and pest infestations in forests. Fires are expected to increase in frequency and in area burned.

Rising Winter Freezing Levels



When precipitation falls as snow, it is stored as ice and snow that slowly melts, providing water to the Skagit River throughout the year, including late summer and drought periods.

FREEZING LEVEL

When precipitation falls as rain, water quickly enters the Skagit River during fall and winter, often contributing to flood risk. As freezing levels rise, the area potentially susceptible to flooding increases.

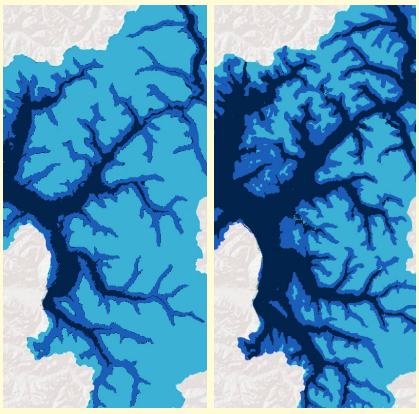
In the Skagit, the average winter freezing elevation has risen consistently since 1948.

SC² AS A PROVEN RESOURCE

SC² scientist Dr. Jon Riedel is a leading expert on glaciers in the Skagit River watershed. He has worked with other SC² scientists to integrate glacial melt rates and stream flow rates to understand the implications of glacial loss on the river, its tributaries, and downstream communities. Because pictures can say a thousand words, Riedel and colleagues have compiled compelling and stunning sets of "past-present" photographic images that show the loss of glaciers over time: http://www.nps.gov/noca/learn/nature/glacial-mass-balance8.htm. They have also mapped and quantified projected changes in area that is likely to shift from snow to rain (right).

LOOKING FORWARD TO MORE SOLUTIONS, MORE ACTION

The consequences of melting glaciers and rising freezing levels are not fully known or understood. Managers of forests, dams, farms, water supply, and recreation areas as well as salmon advocates need information to make decisions in their daily work. SC² seeks to better understand the impacts to cold water storage, salmon habitat, forest ecology, agriculture, and water volume in the Skagit River basin as glaciers retreat. We plan to continue to expand the collective knowledge base through more research of glaciers, improved modeling, and interactions with stakeholders to clarify how changes affect their interests.



1991 2080

SNOW-DOMINATED
PEAK RAIN-ON-SNOW
RAIN-DOMINATED

Rising freezing levels in winter increase the land area in the Skagit Basin that captures rain instead of snow, resulting in water entering the river rapidly and contributing to floods. SC² scientists project a doubling of the area that receives rain instead of snow from 1999 to 2080.

SC² SKAGIT CLIMATE SCIENCE CONSORTIUM

The Skagit Climate Science Consortium (SC²)
SC² is a nonprofit 501c(3) organization consisting of scientists working with local people to assess, plan, and adapt to climate related impacts. Composed of research scientists from universities and federal, municipal, and tribal governments and agencies working in the Skagit basin, SC² members seek to understand how the landscape, plants, animals and people may be affected by changes in the patterns of rain, snow, temperature, storms and tides.

www.skagitclimatescience.org

Visit our website to learn more about who we are, what we do, and the various resources we can provide.

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