DELTA ECOSYSTEMS

THE CHALLENGE

Delta ecosystems include sand and mud flats, eelgrass and kelp beds, salt marshes, and tidally-influenced shrub and forested wetlands. These ecosystems are critical for numerous birds, mammals, fish, and shellfish, all of which are valued by many. Delta ecosystems are also a significant tribal resource that provides salmon and shellfish for tribal food supply, profitable harvests, and cultural practices. A significant portion of the Skagit delta was altered at the turn of the century when much of it was diked and drained for agricultural and other purposes. Today, the fish and wildlife in the delta face threats and changes from climate related impacts such as high water temperatures, rising sea levels, increasing sediment loads, and increasing frequency and magnitude of floods. Science and restoration practitioners are working to improve their understanding of how much climate change, in conjunction with other actions, will alter delta ecosystems and how best to guide protection and restoration actions and investments to be most effective.

Some key issues for delta ecosystem restoration:

BALANCING INCOMING SEAS AND OUTGOING SEDIMENT

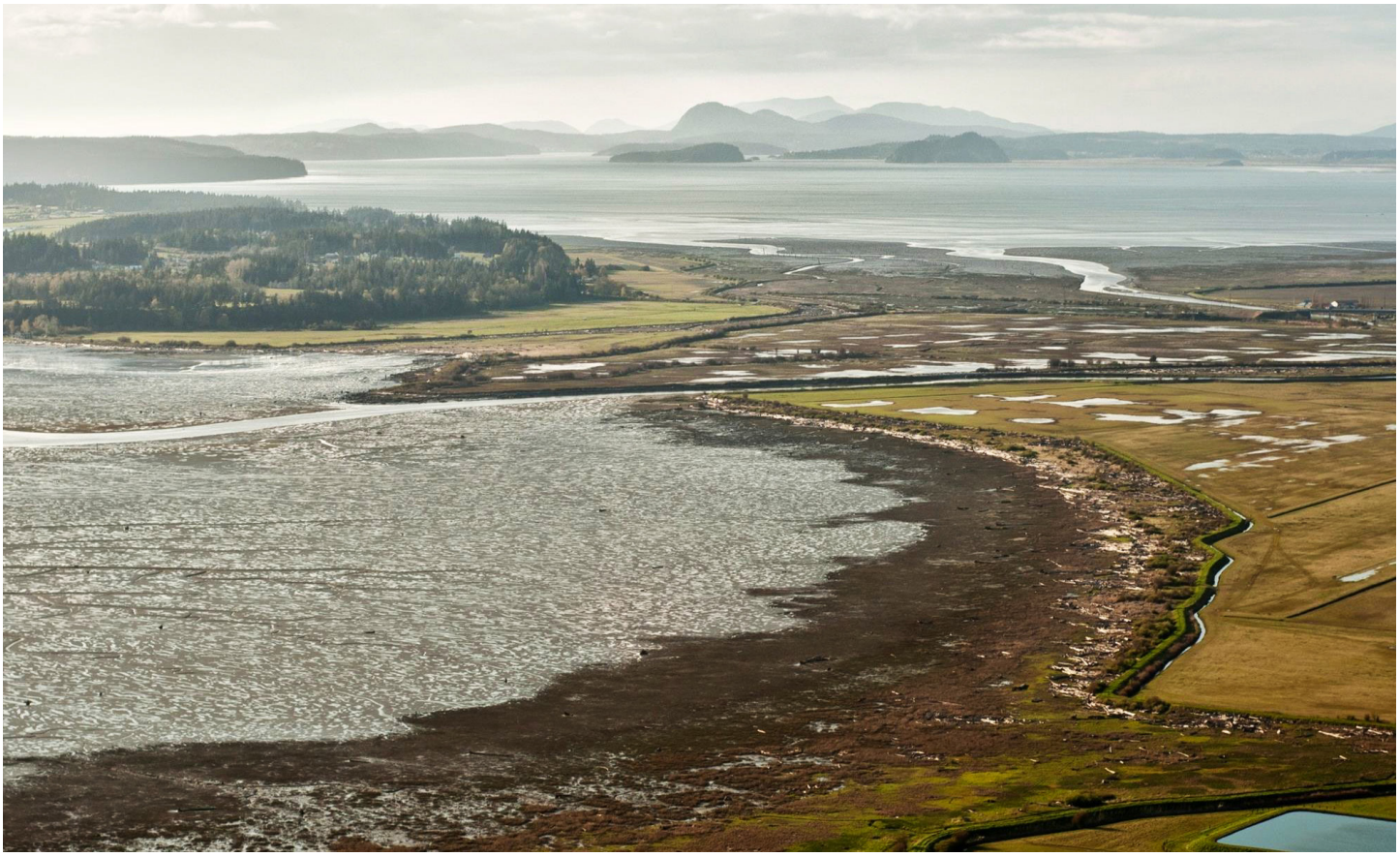
Natural delta habitats are built and maintained over time by a continuous supply of sediment transported down eroding slopes and river channels. Much of the area encompassing the Skagit delta is slowly sinking due to natural and human-induced subsidence and the lack of new sediment, which is mostly cut off by dikes and levees and a channelized river. As sea levels rise and more sediment is transported through the watershed as a result of climate change, how will delta habitats react? Where will sediment be deposited? Will the sediment continue to help habitats build and "keep pace" with a rising sea level? Will sediment fill in too quickly and cover important habitats like eelgrass beds? Will sea levels rise and submerge existing habitat resulting in different landscapes and a set of vegetation or mudflats?

SALMON SURVIVAL AND REPRODUCTION

All Pacific salmon species swim through river deltas as they move from their freshwater birth place to the Puget Sound saltwater and back. Each species uses delta habitats differently and at different times of year. Salmon are potentially affected by rising sea levels and ocean acidification through changes in quantity and quality of estuary rearing habitat, prey supply, migration timing and success, and loss of previous restoration actions as a result of sedimentation or sea level rise. Changes in upstream hydrology and increases in sediment affect fish survival through egg scour and suffocation, stranding, high water temperatures, and habitat alteration or lack of access at peak or low flows. How can restoration activities in the delta be designed to meet these changing conditions? Where and what type of habitat restoration would best ensure salmon survival and reproduction into the future?

BEAVERS AND VEGETATION CHANGES

Beavers in the Skagit Delta rely on tidal shrub habitats. As "nature's engineers", beaver dams and lodges create deep pools in the tidal channels of the delta and these pools serve as high quality rearing and refuge habitat for juvenile salmon and other small fish. In fact, beaver dams can quadruple the number of low-tide pools, which in turn support three times the amount of juvenile salmon as low-tide shallow waters. One recent study found 117 functional beaver dams in the Skagit delta. Tidal shrub vegetation appears to be more sensitive to sea level rise and changes in salinity than other vegetation types, thus there is concern for the long-term viability of this habitat and its benefits for salmon. Furthermore, due to past alteration, there is very little tidal shrub habitat remaining in the delta magnifying the importance of this habitat.



Skagit Delta

LOOKING FORWARD TO MORE SOLUTIONS, MORE ACTION

SC^2 scientists have the opportunity to better understand the linkages between salmon survival thresholds and projected changes in temperature, peak and low flows, erosion, and shifts in vegetation as a result of changes in salinity, water levels, and sediment from a changing climate.

We are conducting extensive hydrodynamic modeling of restoration efforts in the Skagit delta, which will inform discussions between farmers, salmon advocates, and flood risk managers. We can use empirical models to further determine how tidal marsh vegetation and habitats will react to changes in sea level rise and changes in upstream flow patterns. Lastly, we are pursuing more information about the role tidal marshes can play in protecting important dike and levee infrastructure from storm surge, waves, and flooding.

SKAGIT CLIMATE SCIENCE CONSORTIUM

The Skagit Climate Science Consortium (SC^2)

SC^2 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, SC^2 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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