Preparing for the Effects of Climate Change

- What do we know?
- What are we doing?
- What are you doing?
- Can we work together?

Climate Change Vulnerability Assessment for Aquatic Resources of the Tongass National Forest

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Meeting the challenges of climate change

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Meeting the challenges of climate change

A Climate Change Vulnerability Assessment for Aquatic Resources in the Tongass National Forest

A report to the Tongass National Forest

EcoAdapt

November 2014

Many Other References…

- Wolken, J. M. et al, 2011. Evidence and implications of recent and projected climate change in Alaska's forest ecosystems. *Ecosphere* 2(11).
- Shanley, C. S., et al. 2015. Climate change implications in the northern coastal temperate rainforest of North America. *Climate Change*
- O'Neel, S. et al, 2015. Icefield-to-Ocean Linkages across the Northern Pacific Coastal Temperate Rainforest Ecosystem. *BioScience*.

******Southeast Alaska Fish Habitat Partnership website!******

Climate Drivers / Projected Trends

- Air temperature
- Precipitation
- Wind
- Cloud cover

- Warmer, wetter, windier
- Less precipitation as snow
- Accelerated glacial melt
- Decreasing snowpack
- Increasing snowline elevation
- Higher tides, rising sea level

Implications for Rivers and Streams and Fish

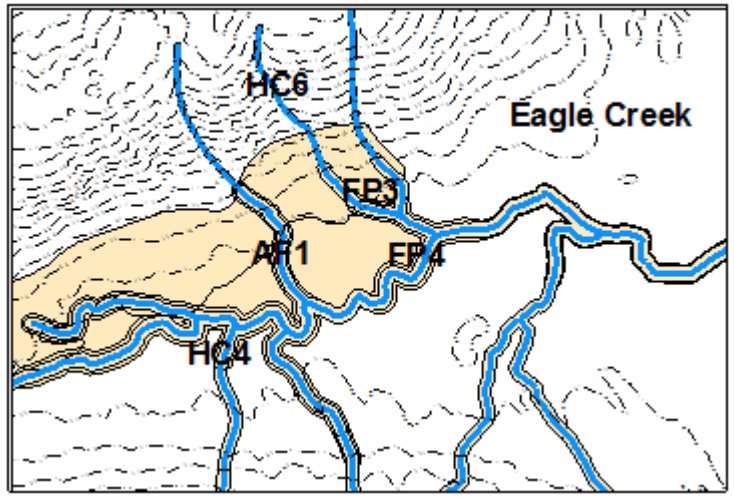
- Glacial/Snow/Rain dominated - complex responses
- **Latitudinal gradients and geomorphic diversity translate to resiliency at multiple scales in intact watersheds**
- Less water stored as ice and snow, increased variability in seasonal flows, higher magnitude flows
- Glacial stream temperature initially colder, then warmer as ice cover declines
- Groundwater-fed streams and ponds important refugia (flow and temperature)
- Floodplain connectivity important
- Estuaries inundated/revived
- **Fish can adapt!**

Forest Service Approach to Climate Change Adaptation

- **2015 Strategic Plan, Objective A: Foster resilient, adaptive ecosystems to mitigate climate change**
  - **Use vulnerability assessments to inform adaptive management strategies**
  - **Restore and maintain resilient watershed conditions**
  - **Collaborate broadly**
  - **Coordinate inventories, monitoring, and assessments across all lands**

DEVELOPMENT AND IMPLEMENTATION OF A RIPARIAN CONSERVATION STRATEGY FOR THE TONGASS NATIONAL FOREST

Steve J Paustian*



Riparian areas are managed according to fundamental ecological principals designed to maintain (and restore) function and resilience to natural disturbances.

Flood plain Process Group Prescriptions:

- "No commercial timber harvest within 100 feet (30m) of class I and II (fish) streams.
- "No…harvest in the Riparian Management Area" (defined as the greatest of flood plain soils or vegetation extent, or the height of a site-potential tree).
- "Manage an appropriate distance beyond the no-harvest zone to provide for a reasonable assurance of wind firmness of the RMA".
- "Locate roads in the RMA only when other feasible routes do not exist".
- "Do not develop gravel borrow pits within the active flood plain".
- "Maintain fish passage and access to all available habitats."
- "Avoid diverting natural surface drainage channels".

Tongass National Forest Adaptation Strategies

Maintain Ecological Function – aquatic examples

Tongass National Forest Adaptation Strategies

Restore Ecological Function – aquatic examples

Twelvemile Creek Restoration

Assessment of 2014 Flooding

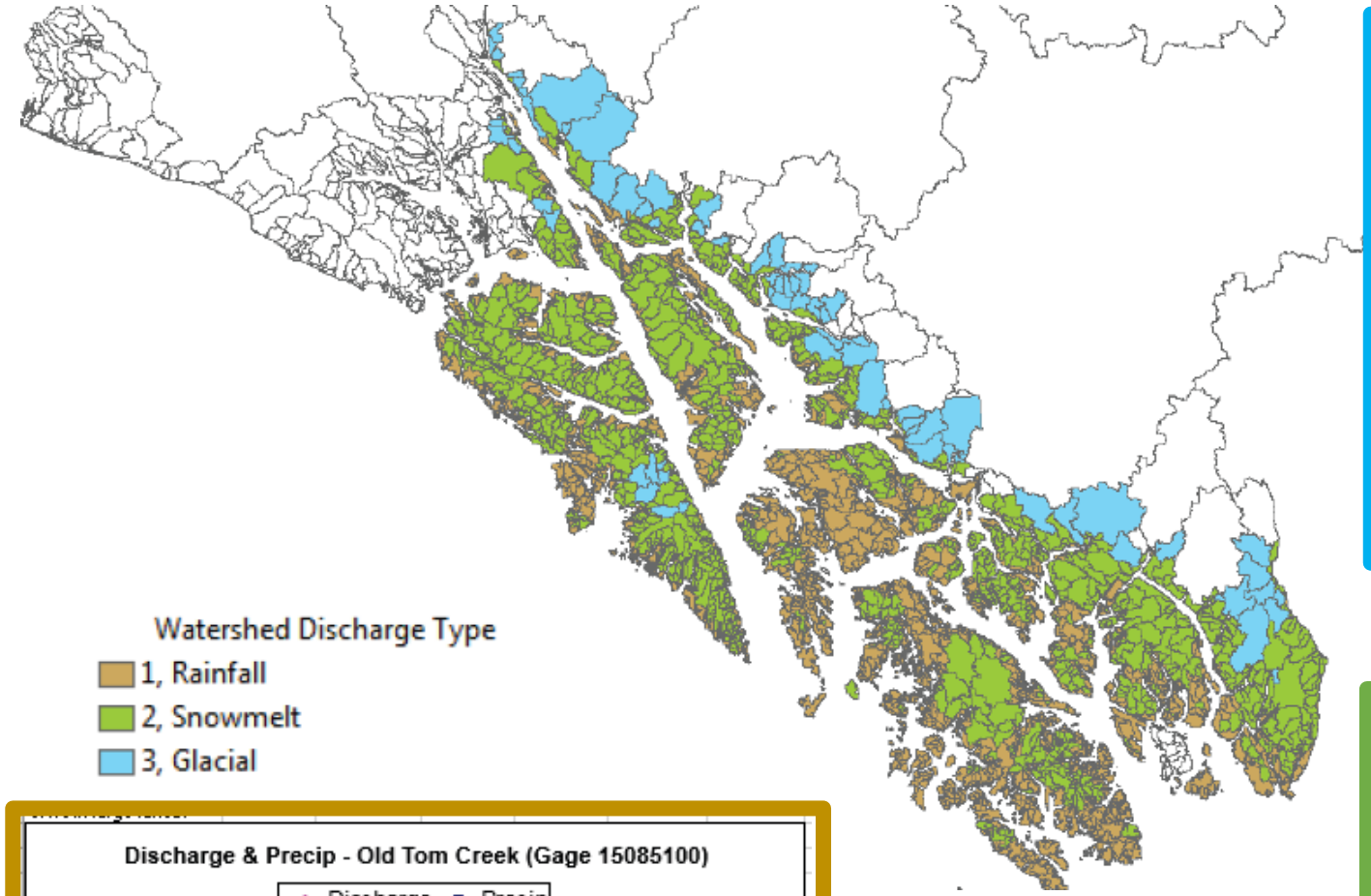
USDA Forest Service, Craig Ranger District

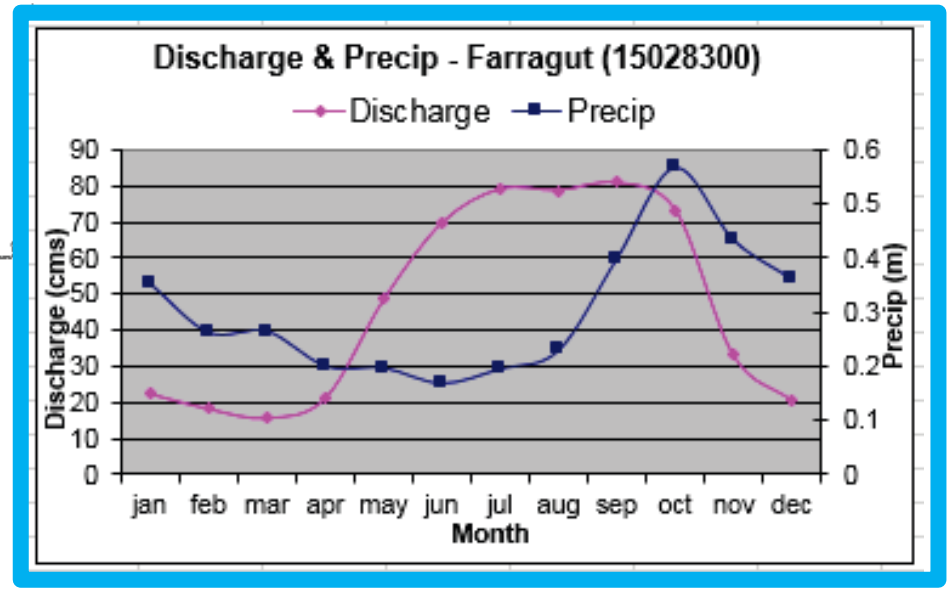
&

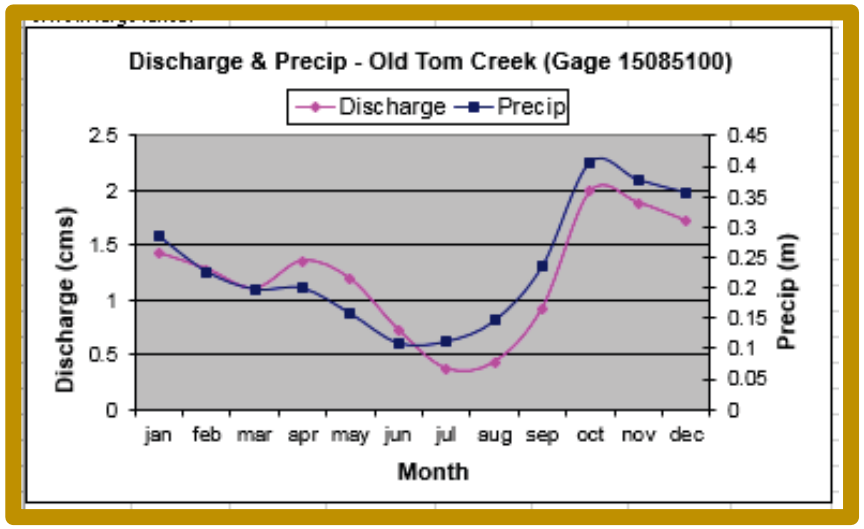
TEAMS Enterprise Unit Watershed Restoration Division

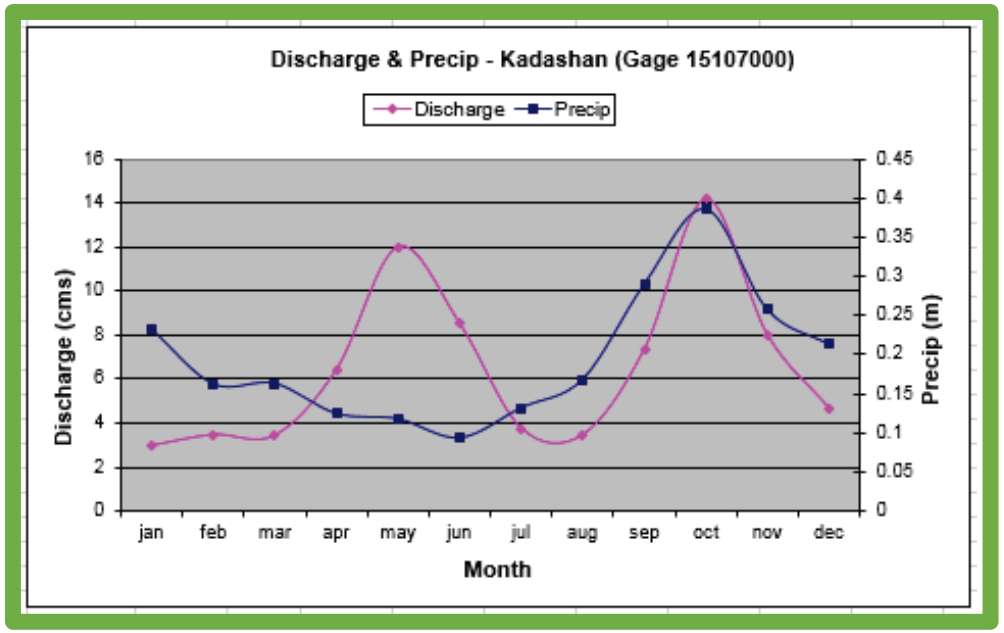
February 25, 2015

Figure 7. Photos Pre and post flood of an FMF structure where only structure elevation could mitigate for durability, no burial and no live trees to incorporate. Large wood was placed on the floodplain and bank on the outside of the meander bend. Following the January flood the site was completely displaced and the vertical bank exposed.


Watershed Discharge Type
1, Rainfall
2, Snowmelt
3, Glacial

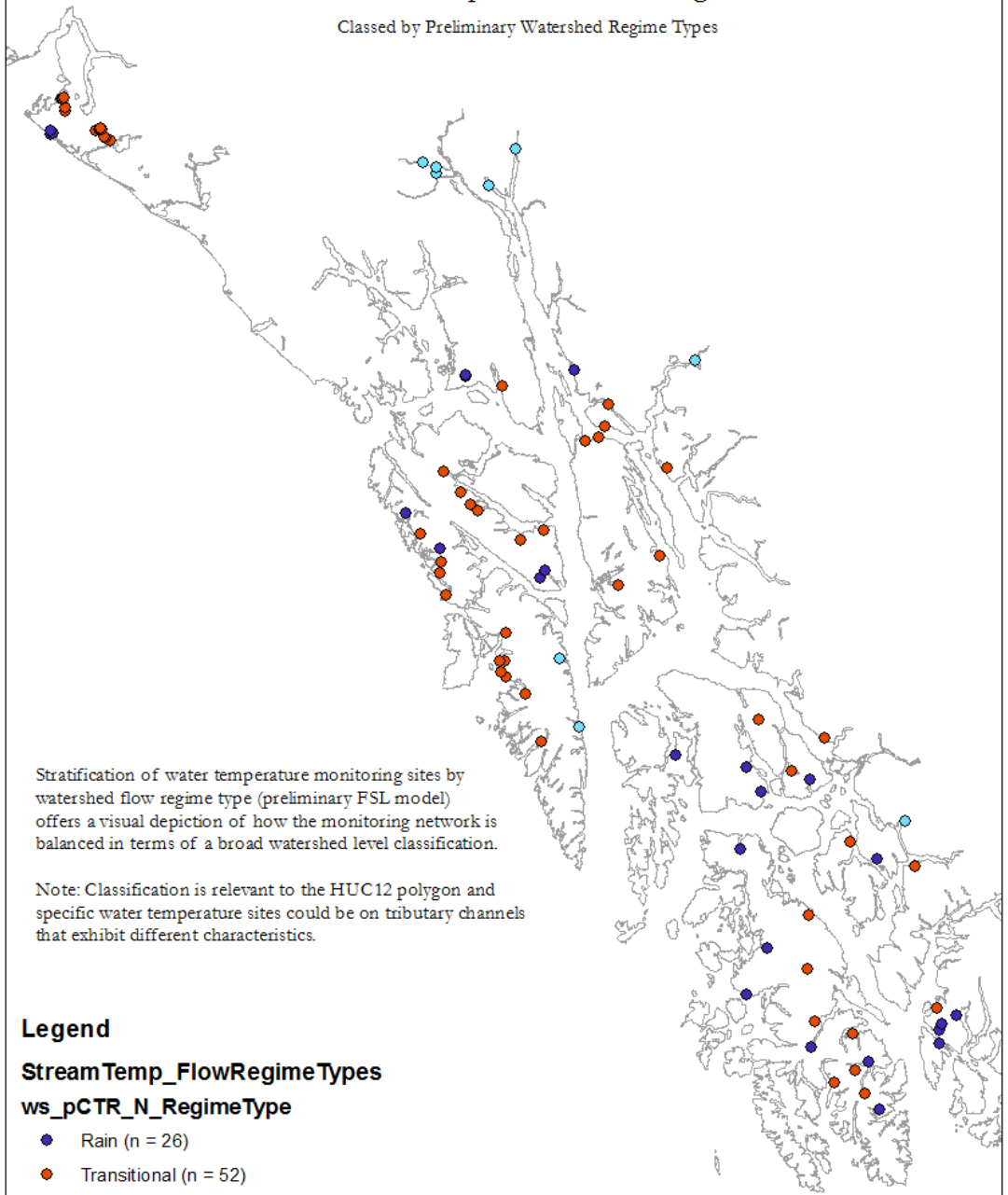

Discharge & Precip - Farragut (15028300)
Discharge
Precip
Discharge (cms)
Precip (m)
jan feb mar apr may jun jul aug sep oct nov dec
Month


Discharge & Precip - Old Tom Creek (Gage 15085100)
Discharge
Precip
Discharge (cms)
Precip (m)
jan feb mar apr may jun jul aug sep oct nov dec
Month


Discharge & Precip - Kadashan (Gage 15107000)
Discharge
Precip
Discharge (cms)
Precip (m)
jan feb mar apr may jun jul aug sep oct nov dec
Month

Southeast Alaska Water Temperature Monitoring Network 5/2017

Classed by Preliminary Watershed Regime Types



Stratification of water temperature monitoring sites by watershed flow regime type (preliminary FSL model) offers a visual depiction of how the monitoring network is balanced in terms of a broad watershed level classification.

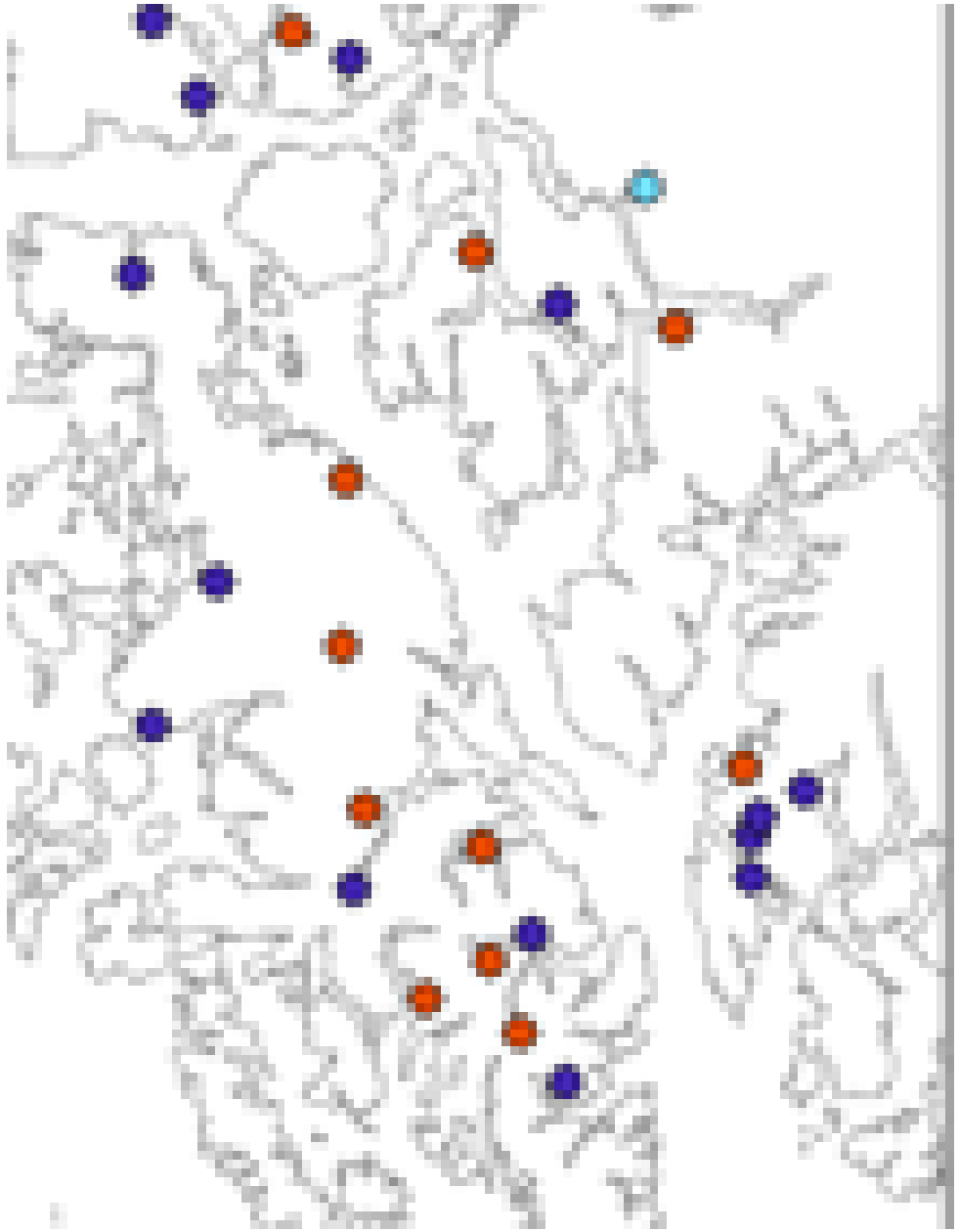
Note: Classification is relevant to the HUC12 polygon and specific water temperature sites could be on tributary channels that exhibit different characteristics.

Legend

StreamTemp_FlowRegimeTypes

ws_pCTR_N_RegimeType

- Rain (n = 26)
- Transitional (n = 52)
- Snow (n = 10)



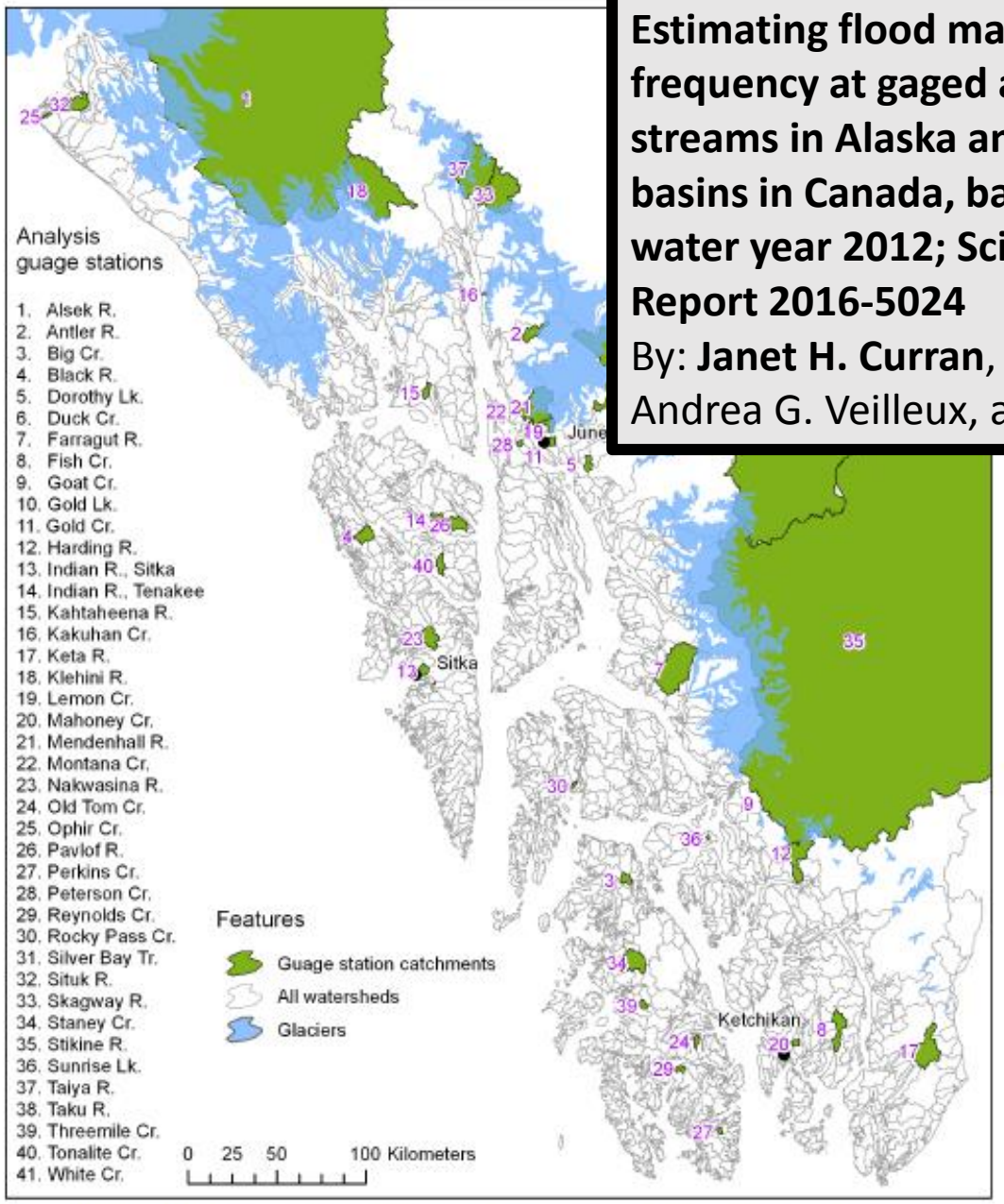
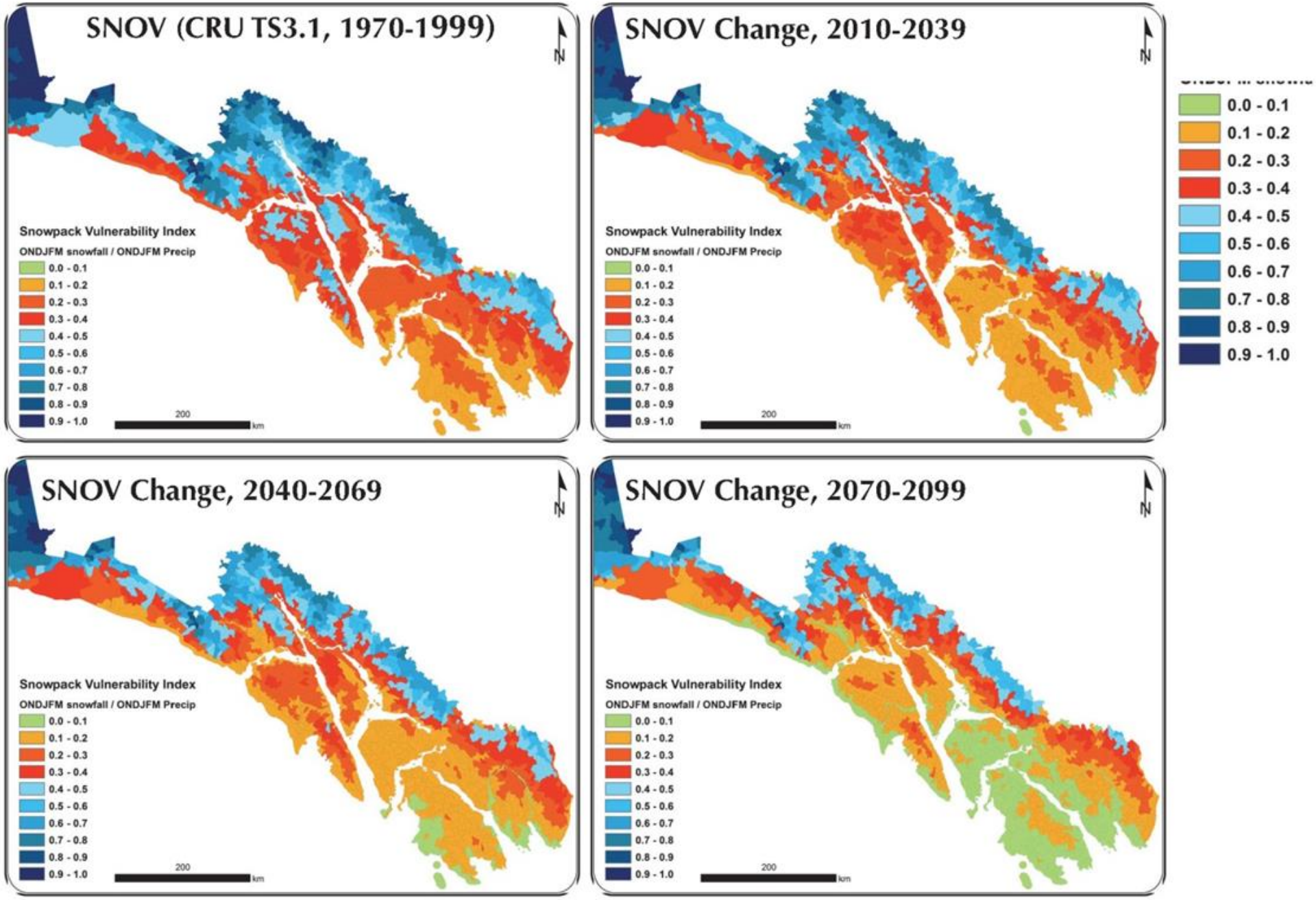


Figure 1. The watersheds of southeast, Alaska, USA, with the 41 gauge station catchments used for the development of regional multiple regression-based monthly discharge models.
doi:10.1371/journal.pone.0104799.g001

Estimating flood magnitude and frequency at gaged and ungaged sites on streams in Alaska and conterminous basins in Canada, based on data through water year 2012; Scientific Investigations Report 2016-5024
By: **Janet H. Curran**, Nancy A. Barth, Andrea G. Veilleux, and Robert T. Ourso

Sloat, M. R., Reeves, G. H. and Christiansen, K. R. (2016), Stream network geomorphology mediates predicted vulnerability of anadromous fish habitat to hydrologic change in southeast Alaska. Glob Change Biol. doi:10.1111/gcb.13466

Shanley CS, Albert DM (2014) Climate Change Sensitivity Index for Pacific Salmon Habitat in Southeast Alaska. PLoS ONE 9(8): e104799. doi:10.1371/journal.pone.0104799


SNOV (CRU TS3.1, 1970-1999)
SNOV Change, 2010-2039
SNOV Change, 2040-2069
SNOV Change, 2070-2099
Snowpack Vulnerability Index
ONDJFM snowfall / ONDJFM Precip
0.0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1.0
200
km
N
Rain - dominant
Transitional
Snowpack - dominant
(5 model composite: HADCM3, MIROC3.2,
GFDL, CGCM3, ECHAM5) CMIP3 models, A2)