Landscape controls on stream temperature and thermal sensitivity

Assessing climate change impacts in Mat-Su salmon streams

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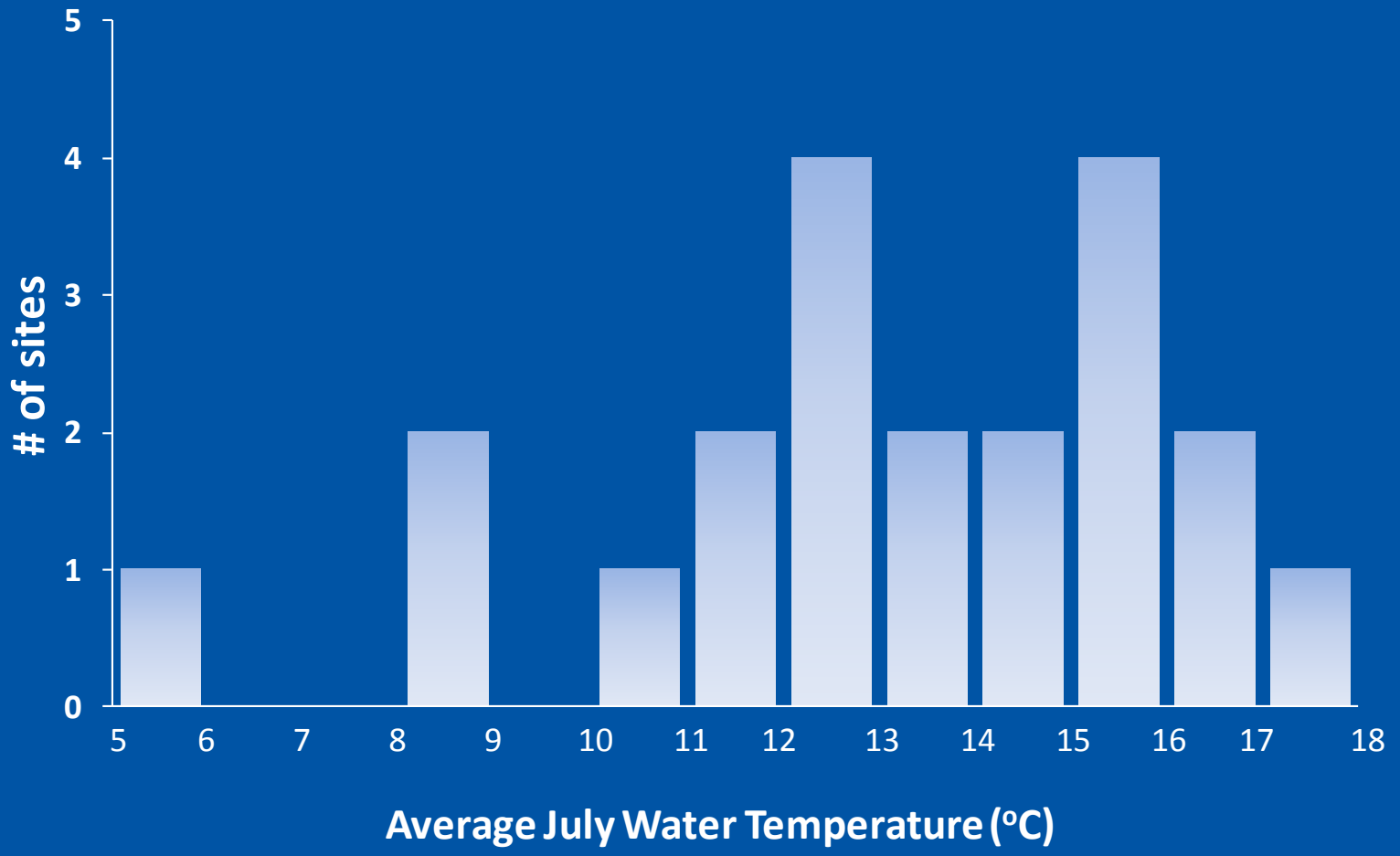
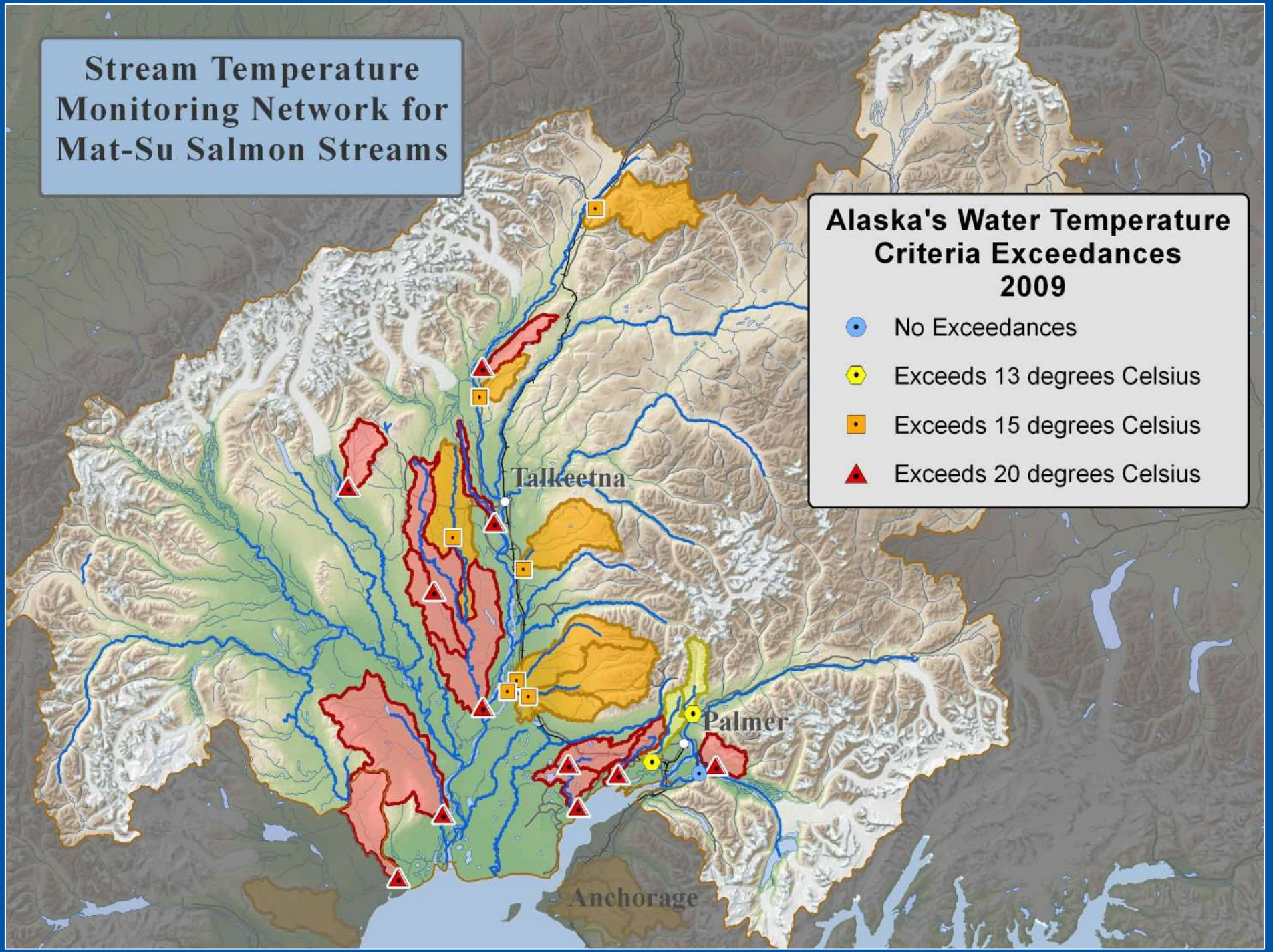
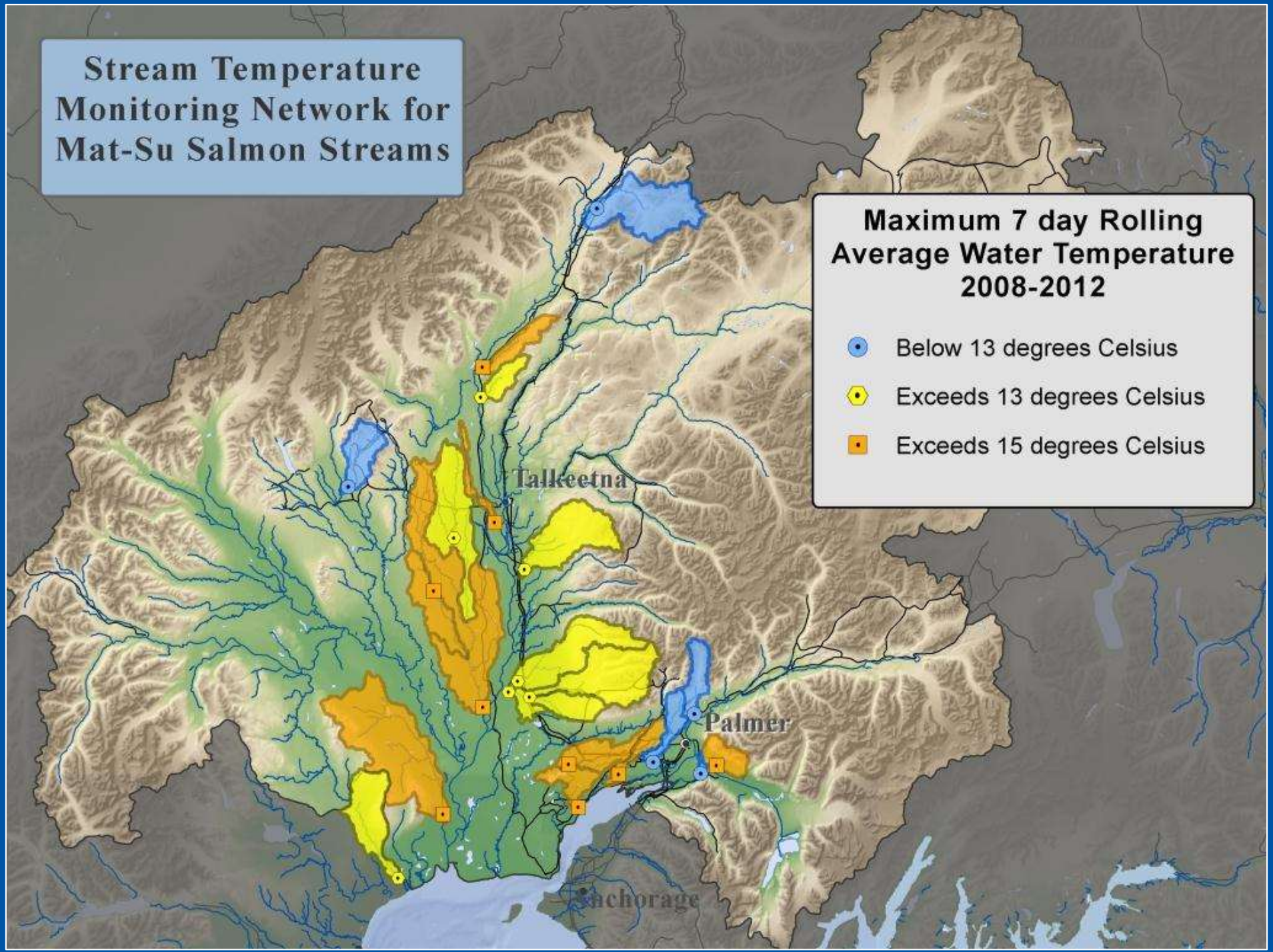
Regional stream temperature patterns
Landscape controls
Relationship to air temperature
Climate change vulnerability
Relevance for Mat-Su Partnership


East Fork
Chulitna
Byers
Creek
Troublesome
Creek
Cache
Creek
Trapper
Creek
Talkeetna
Moose
Creek
Montana
Creek
Chijuk
Creek
Willow
Creek
Little Willow
Creek
Deception
Creek
Moose
Creek
Kroto Creek
(Deshka)
Meadow
Creek
Wasilla
Creek
Palmer
Jim
Creek
Alexander
Creek
Fish
Creek
Cottonwood
Creek
Theodore
Creek
Anchorage

Regional Patterns




Stream Temperature Monitoring Network for Mat-Su Salmon Streams
Alaska's Water Temperature Criteria Exceedances 2009
No Exceedances
Exceeds 13 degrees Celsius
Exceeds 15 degrees Celsius
Exceeds 20 degrees Celsius
Talkeetna
Palmer
Anchorage


Stream Temperature Monitoring Network for Mat-Su Salmon Streams
Maximum 7 day Rolling Average Water Temperature 2008-2012
Below 13 degrees Celsius
Exceeds 13 degrees Celsius
Exceeds 15 degrees Celsius
Talkeetna
Palmer
Anchorage

Landscape Controls

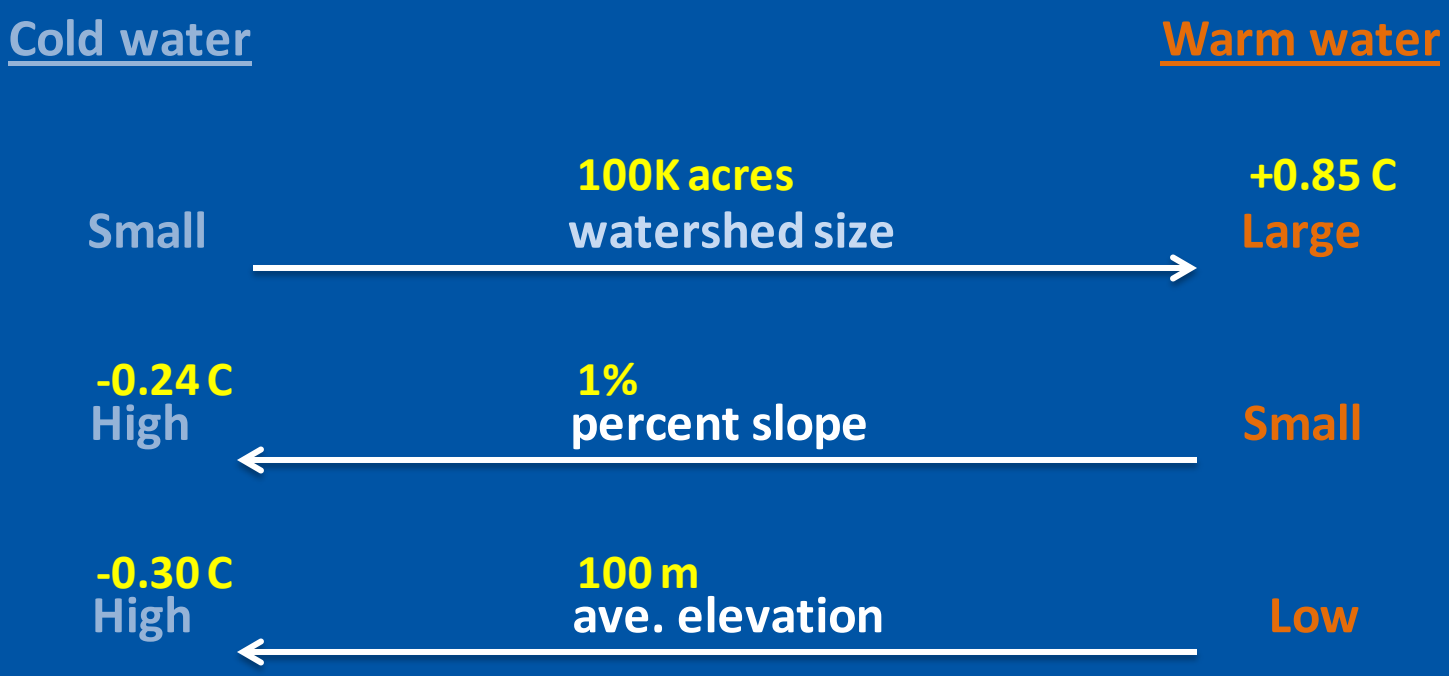
24 → 8 predictor variables

Watershed Size
Watershed slope
Average elevation
South aspect percentage
Wetland percentage
Developed percentage
Lake influence
Air temperature

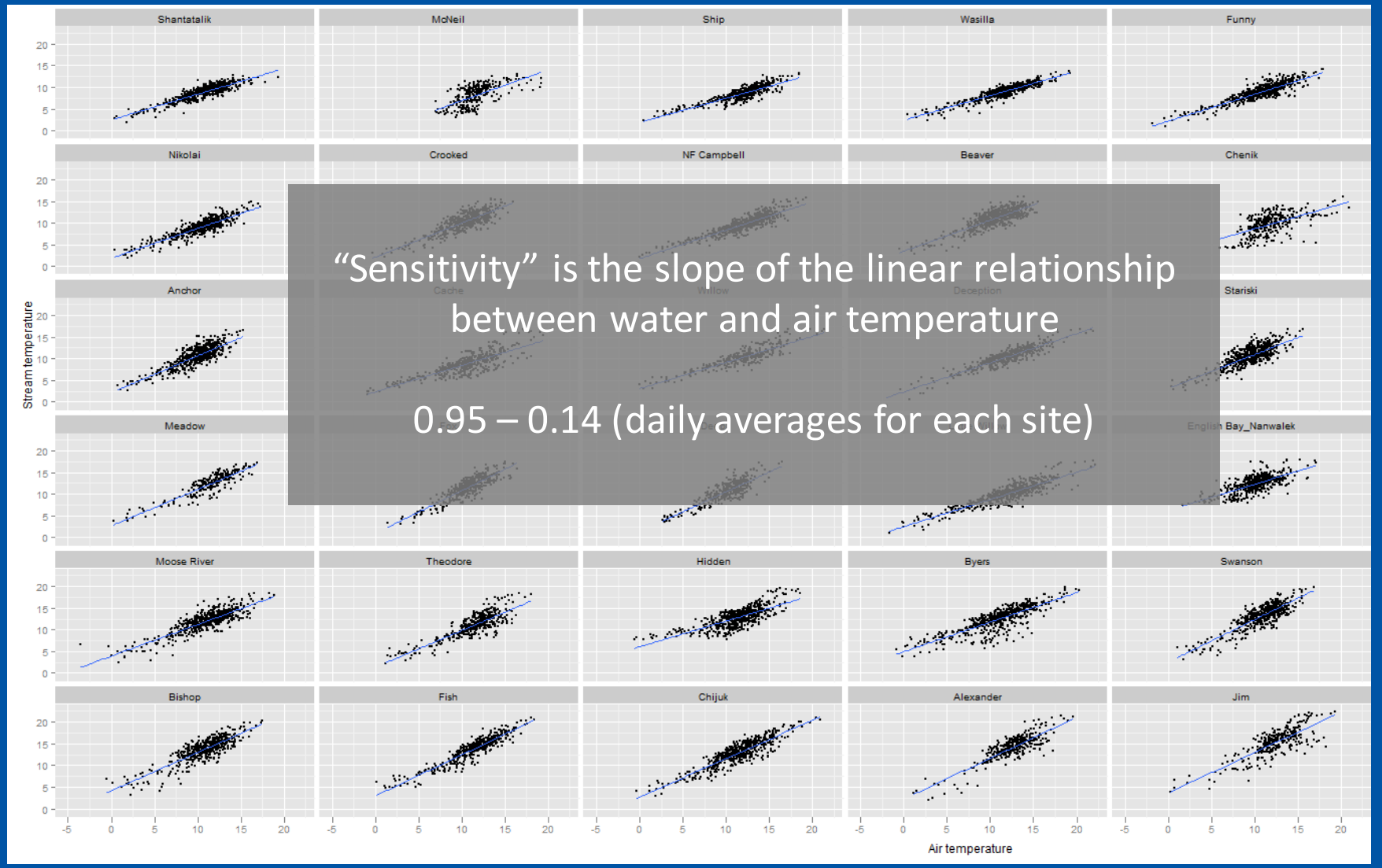
Multiple linear regression models used to explain differences in temperature profiles

'Best' models included only geomorphic variables

Landscape Controls

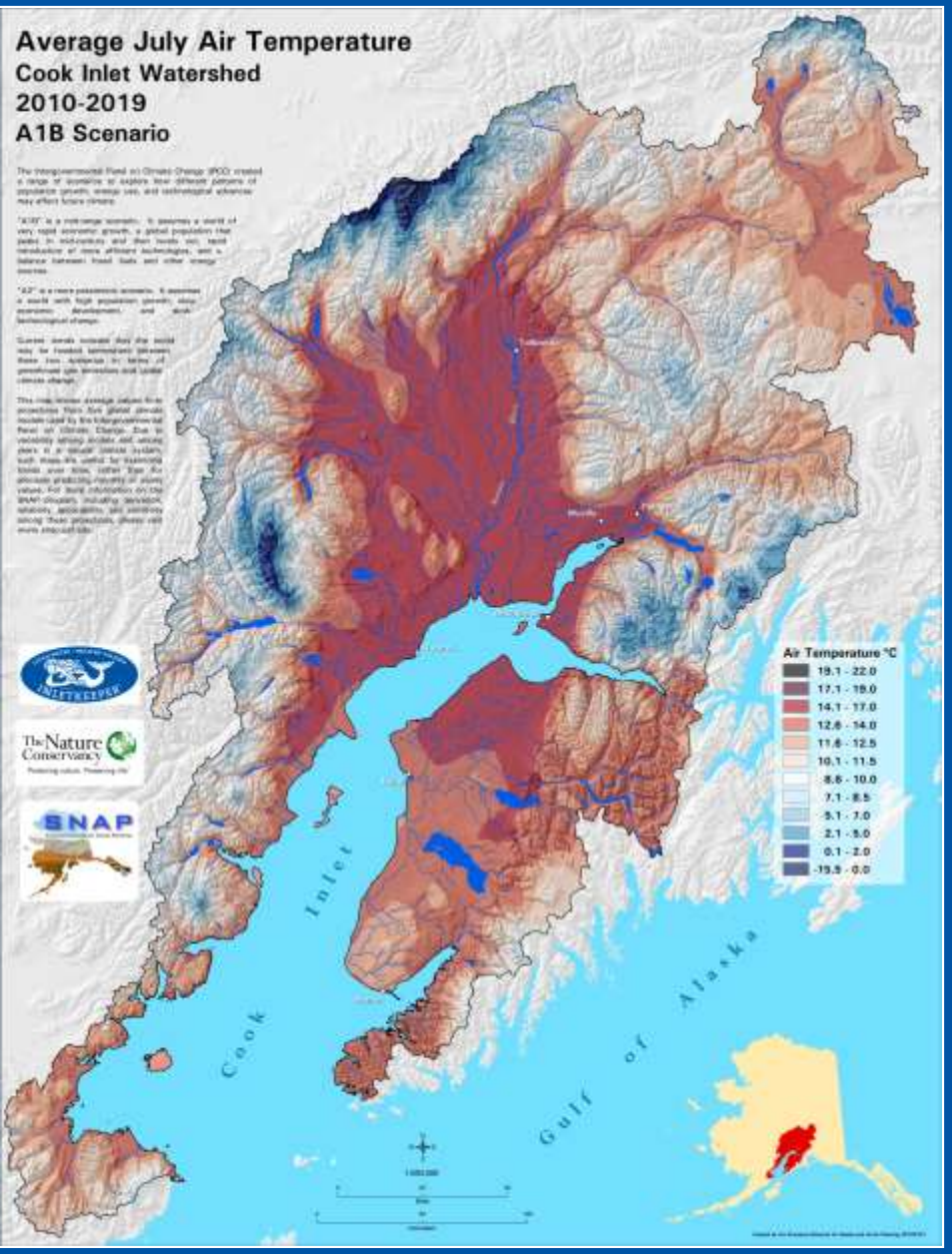


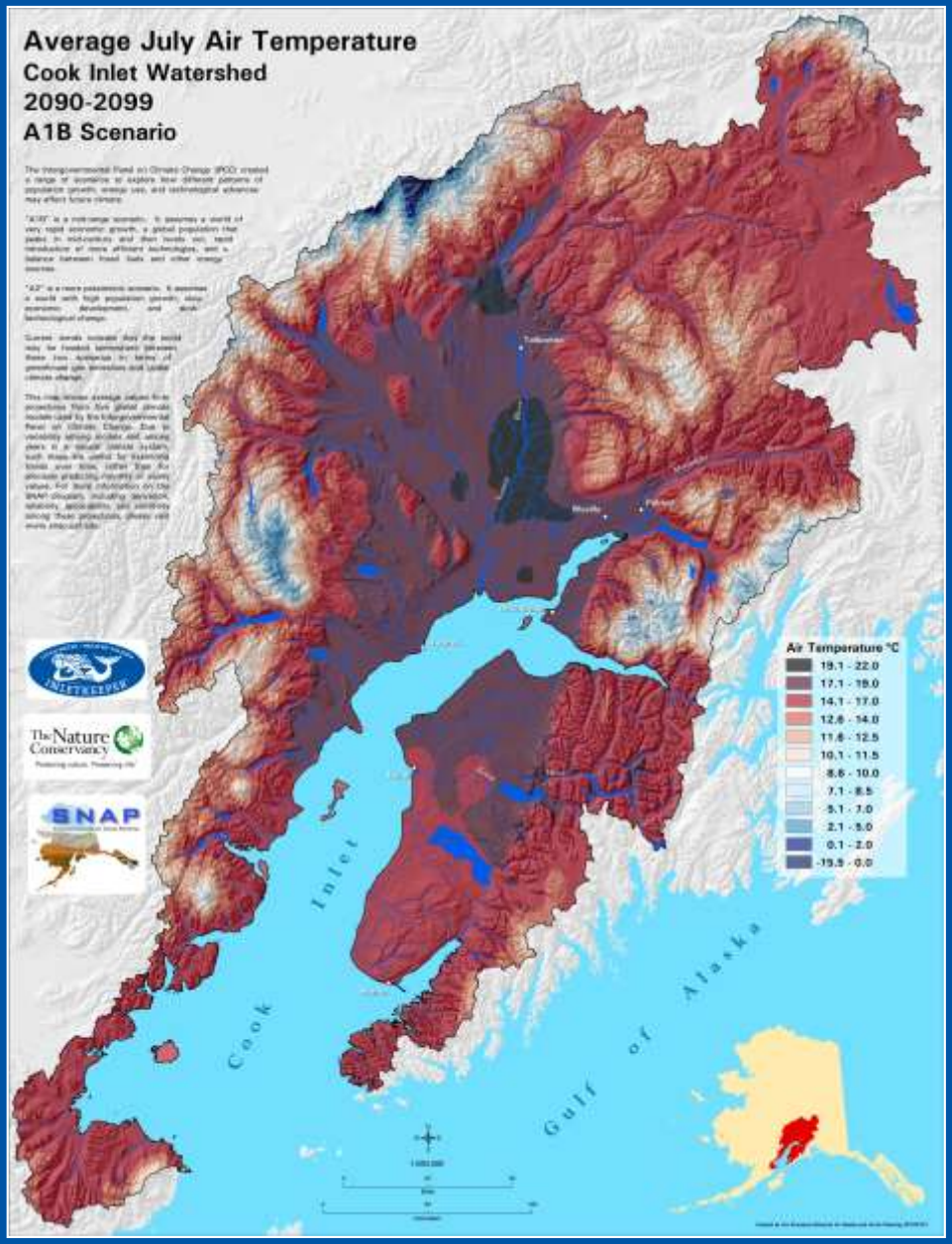
Relationship to air temperature



"Sensitivity" is the slope of the linear relationship between water and air temperature

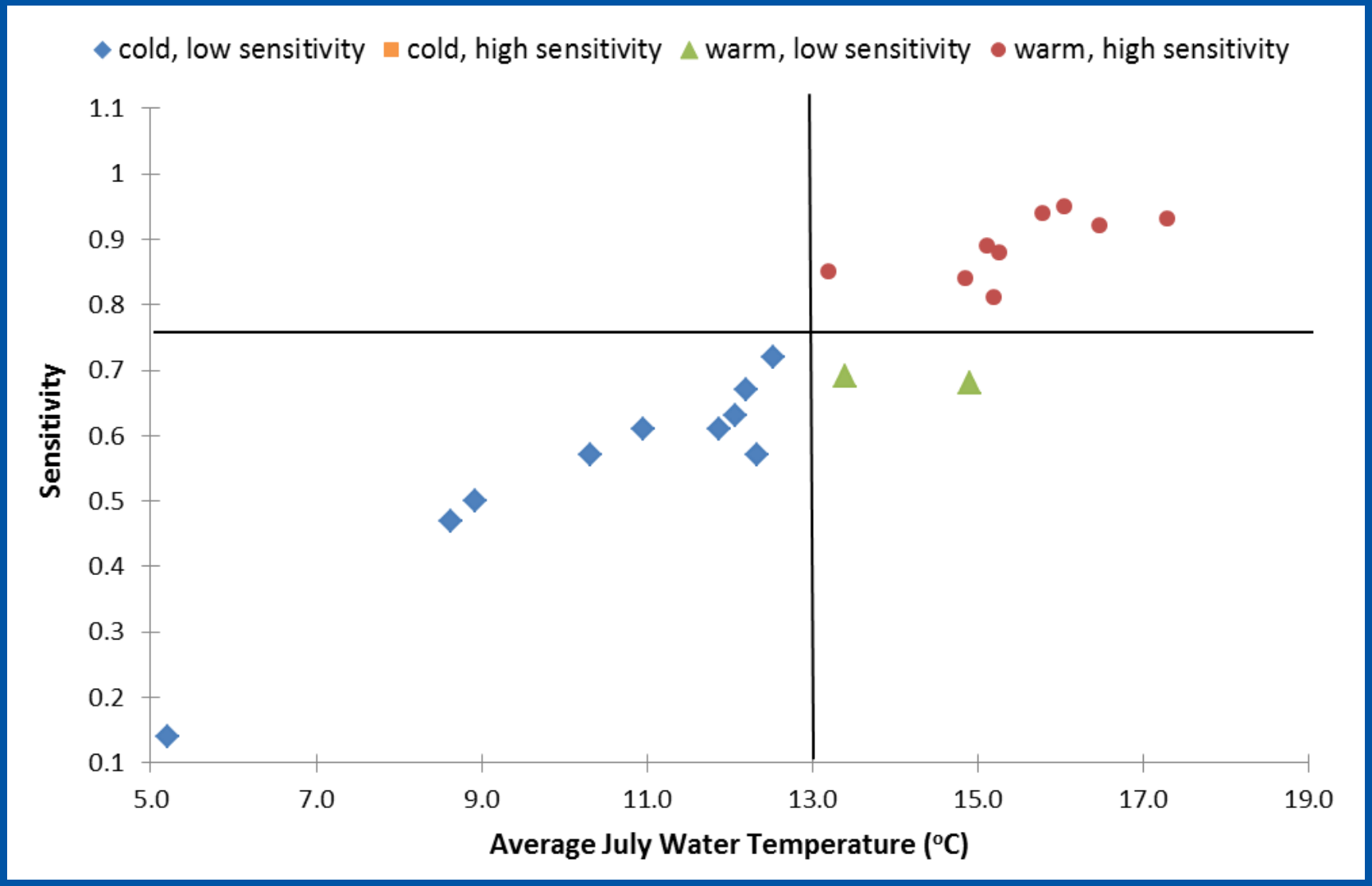
0.95 – 0.14 (daily averages for each site)





July air temperature will increase by 2.6 – 2.9°C at all sites by 2099

Vulnerability Framework



Vulnerability Framework

Cold, low sensitivity	Cold, high sensitivity	Warm, low sensitivity	Warm, high sensitivity
Bodenburg Creek		Moose Creek (Talkeetna)	Theodore River
East Fork Chulitna River		Byers Creek	Meadow Creek
Moose Creek (Palmer)			Chijuk Creek
Wasilla Creek			Trapper Creek
Cache Creek			Cottonwood Creek
Willow Creek			Alexander Creek
Little Willow Creek			Fish Creek
Deception Creek			Kroto (Deshka) Creek
Montana Creek			Jim Creek
Troublesome Creek			

Relevance for Mat-Su Partnership

Thermal vulnerability framework can be a useful tool to prioritize future research, protection and restoration activities:

"warm, high sensitivity" streams

- research at the reach-level to identify critical cool water refugia that might be important to help salmon move up and down an otherwise warm channel.
- restoring degraded riparian areas might improve temperature profiles by increasing stream shade.

"cold, low sensitivity" streams

- resolving fish passage issues important
- protecting key habitats through conservation easements could help maintain fish populations for both the short and long term.

2013 and beyond

Long term monitoring will be needed to track climate change vulnerability:

“cold, low sensitivity” - Wasilla Creek, Little Willow Creek

“warm, high sensitivity” - Fish Creek, Deshka

Thank you!