

# Applying the Index of Watershed Integrity to the Matanuska-Susitna Basin

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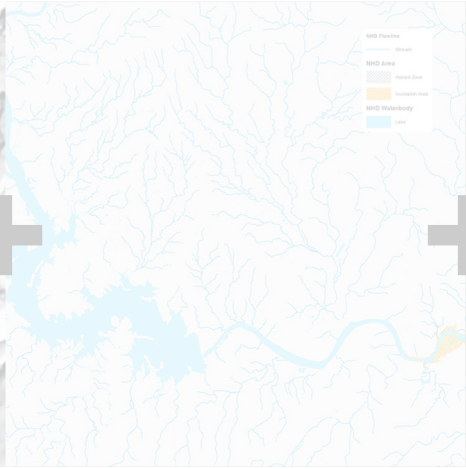
**Matanuska-Susitna Salmon Science and Conservation Symposium**  
**14 November 2018**

- 1** Demonstrate how NHDPlus can be used in Alaska
- 2** Share the Results

# NHDPlus



Digital Elevation Model



National Hydrography Dataset

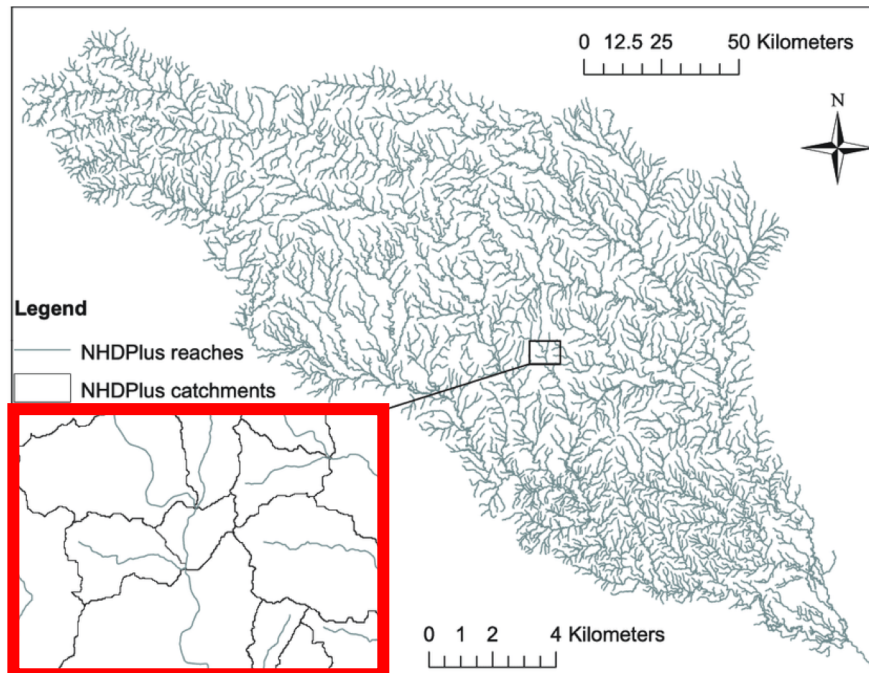
**WBD**  
Watershed Boundary Dataset



Watershed Boundary Dataset






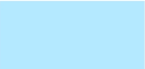
National Landcover Dataset

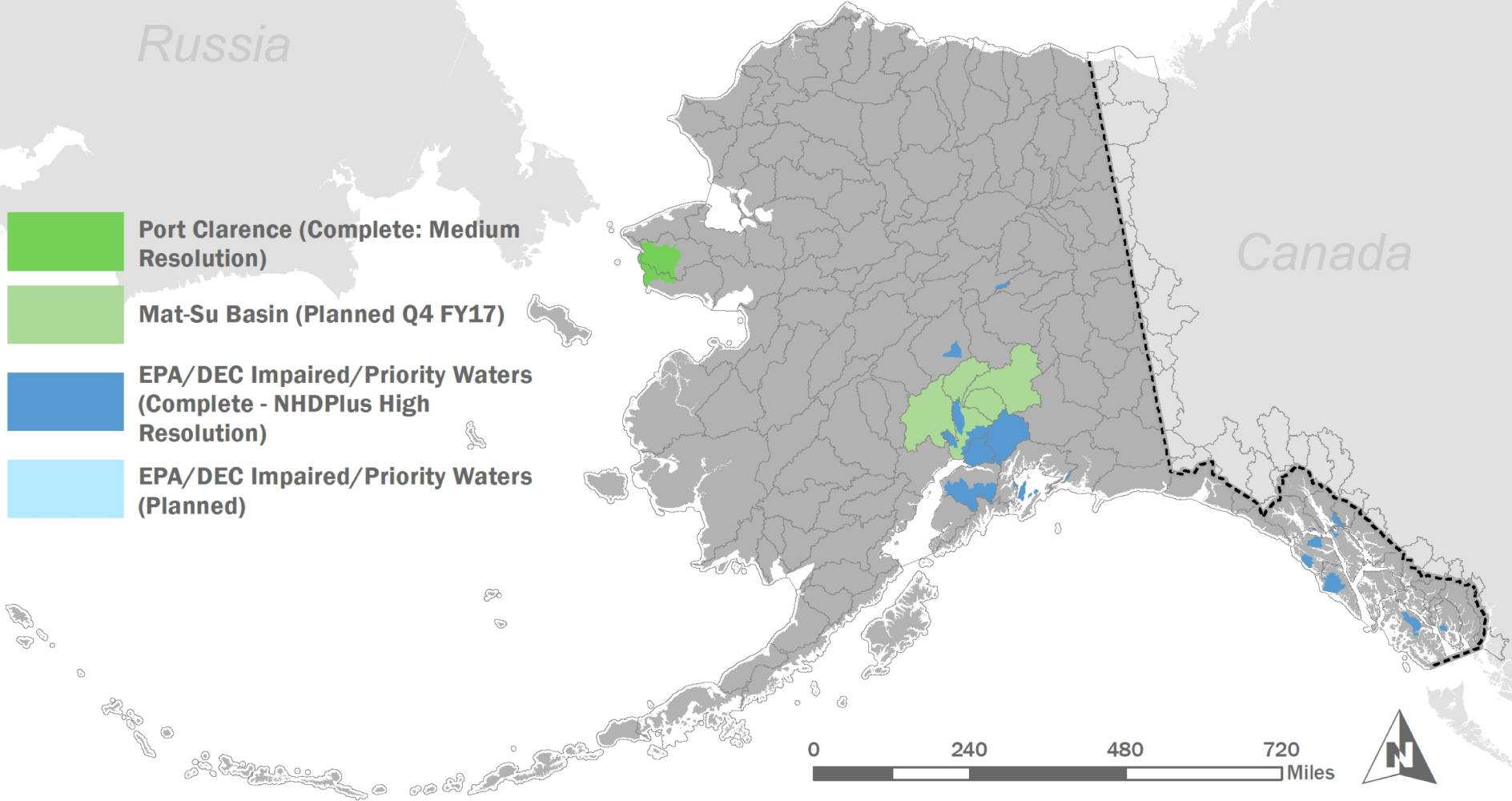


# NHDPlus

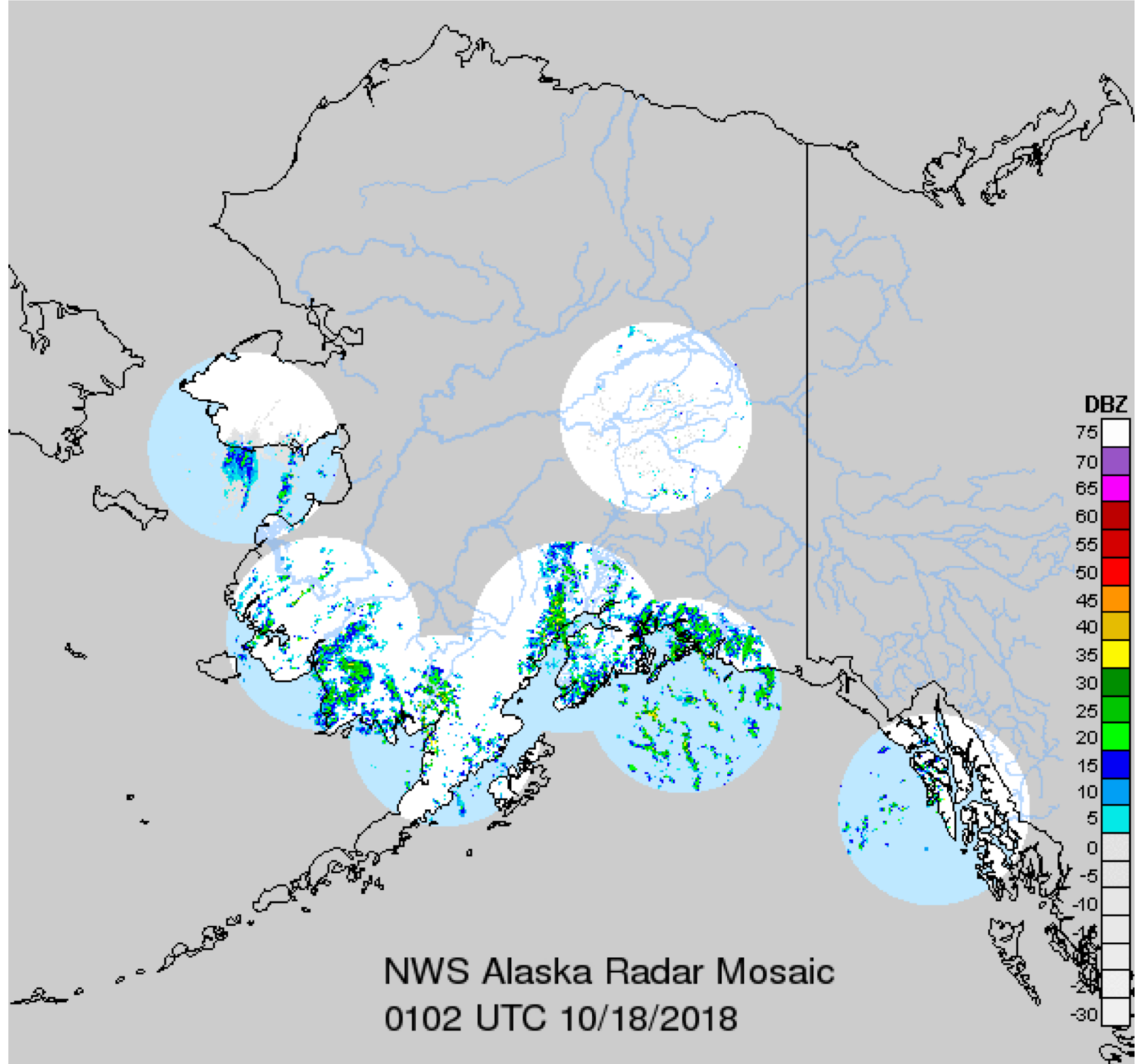
Russia

Canada

-  Port Clarence (Complete: Medium Resolution)
-  Mat-Su Basin (Planned Q4 FY17)
-  EPA/DEC Impaired/Priority Waters (Complete - NHDPlus High Resolution)
-  EPA/DEC Impaired/Priority Waters (Planned)



**So what?**



NWS Alaska Radar Mosaic  
0102 UTC 10/18/2018



Image Landsat

Google earth

## Potential Threats to Mat-Su Basin Salmon

Aquatic Invasive Species

Climate Change

Development in Estuaries and Nearshore Habitats

Ground & Surface Water Withdrawals

Household On-site Septic Systems & Wastewater

Large-scale Resource Development

Motorized Off-road Recreation

Residential, Commercial, & Industrial Development

Roads & Railroads

Stormwater Runoff

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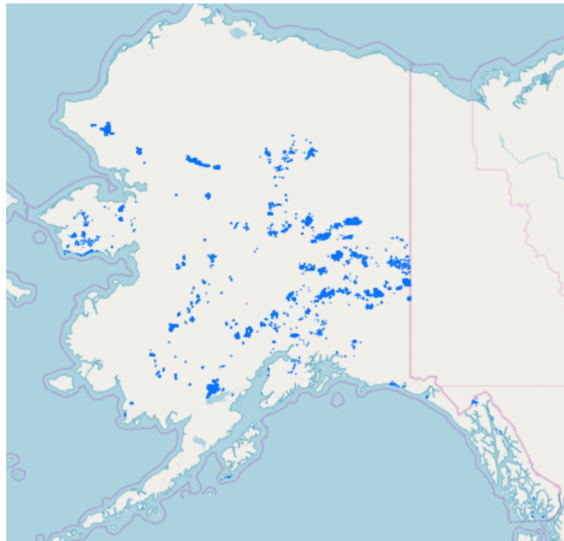
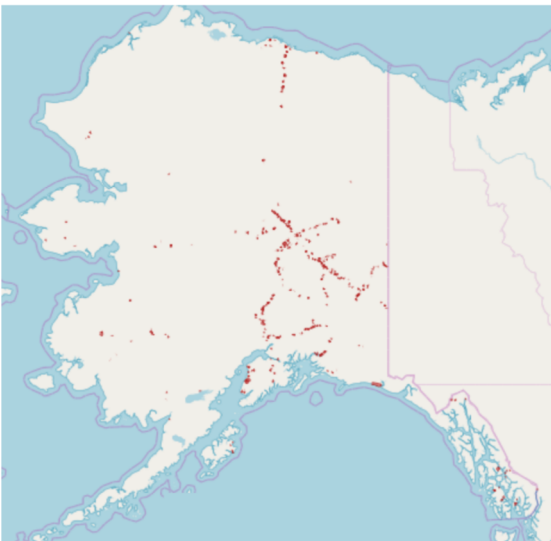
Large-scale Resource Development

Motorized Off-road Recreation

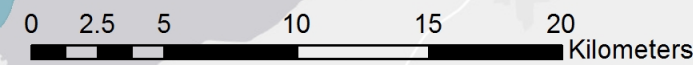
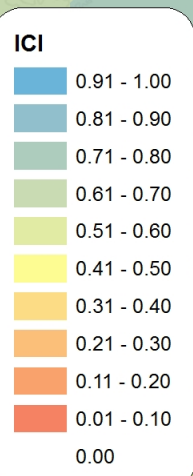
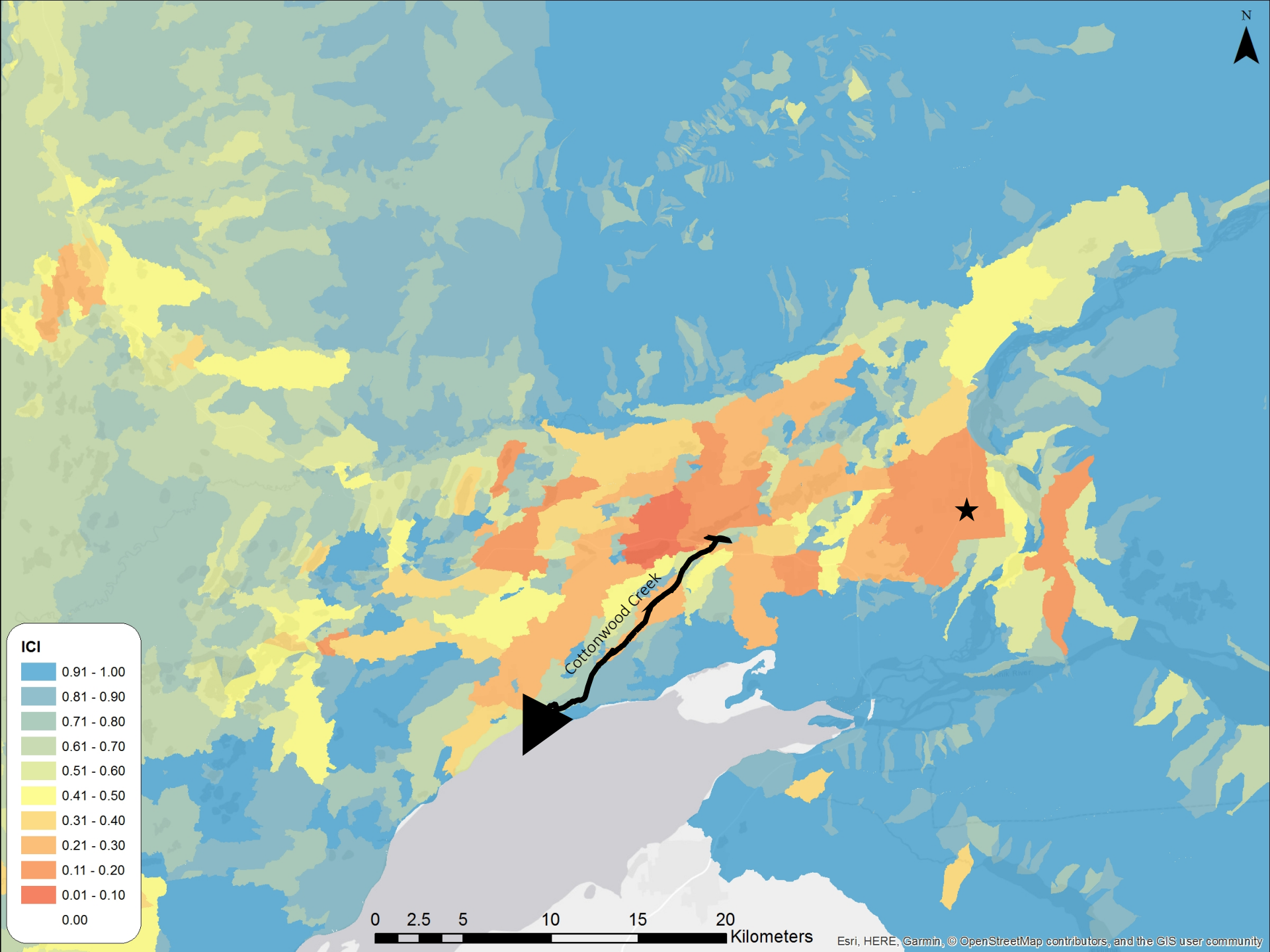
Residential, Commercial, & Industrial Development

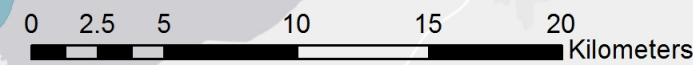
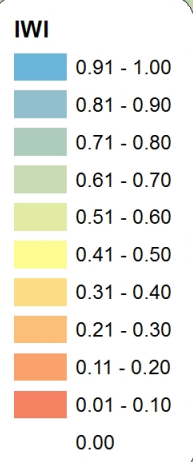
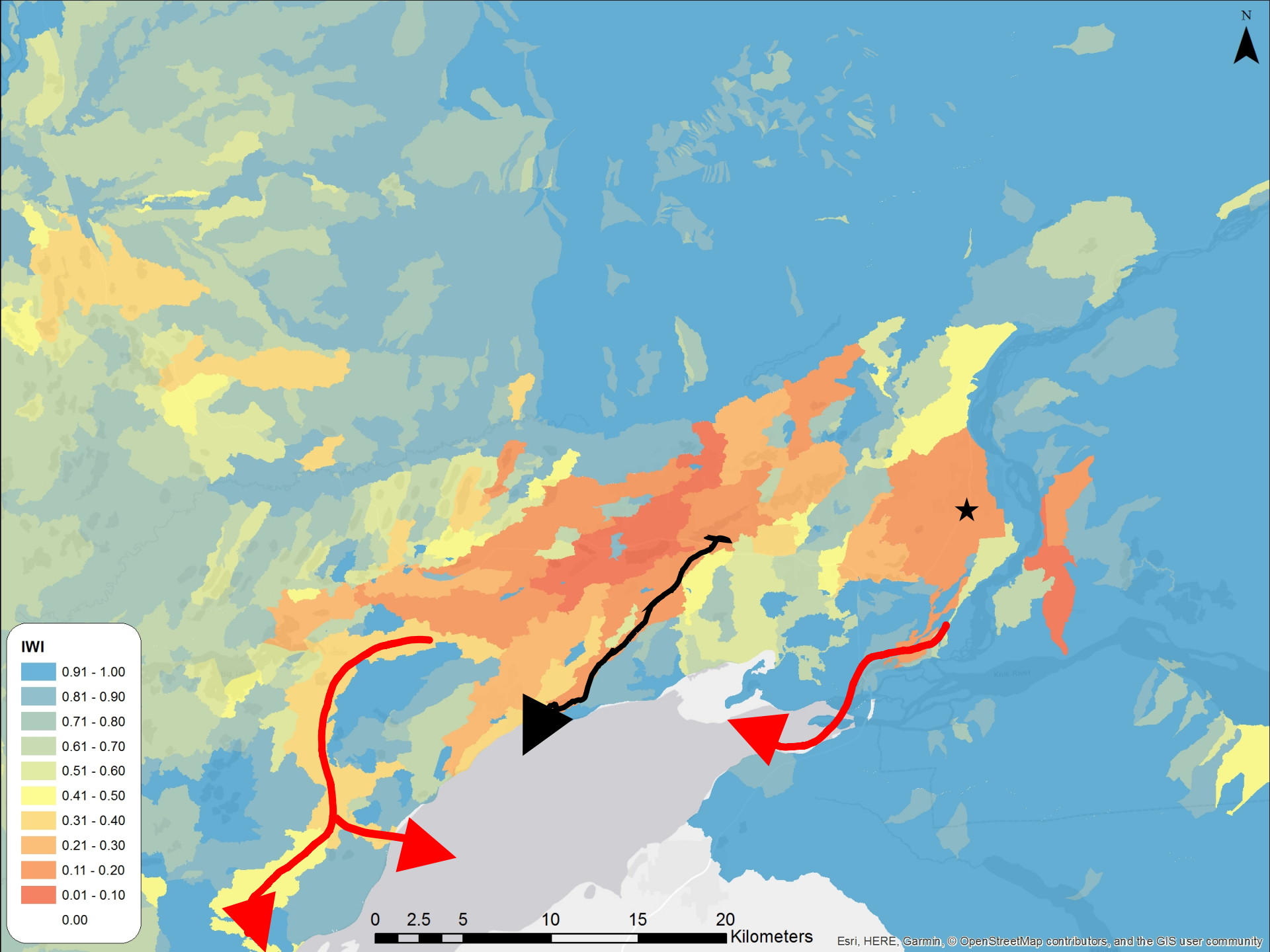
Roads & Railroads

Stormwater Runoff





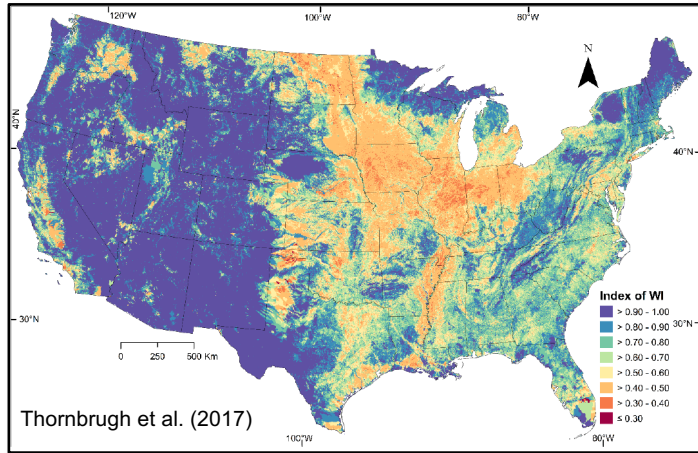




# What is the Index of Watershed Integrity?

Uses a **Human Health** approach to evaluate the condition of vital systems

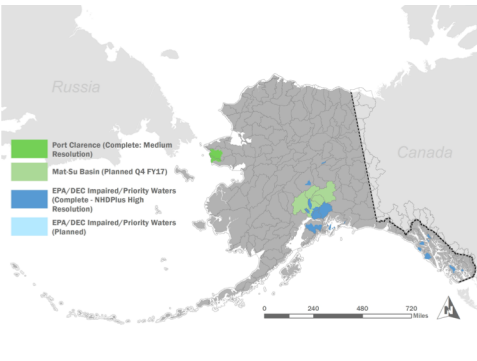
0 (worst) ← → 1 (best)



FUNCTIONAL COMPONENTS					
HYDROLOGIC REGULATION	REGULATION OF WATER CHEMISTRY	SEDIMENT REGULATION	HYDROLOGIC CONNECTIVITY	TEMPERATURE REGULATION	HABITAT PROVISION
Density of Reservoirs (DenResvr)	Density of Reservoirs (DenResvr)	Density of Reservoirs (DenResvr)	Density of Reservoirs (DenResvr)	Density of Reservoirs (DenResvr)	Density of Reservoirs (DenResvr)
Density of Culverts (DenCulv)	Density of Culverts (DenCulv)	Density of Culverts (DenCulv)	Density of Culverts (DenCulv)	Percent of Agricultural Land Cover (PctAg)	Percent of Urban Land Cover in the Riparian Zone (PctUrbDevRp)
Percent of Agricultural Land Cover (PctAg)	Percent of Urban Land Cover (PctUrbDev) Percent of Agricultural Land Cover (PctAg)	Density of Mines, Historical Mining Disturbance, State Prospecting Sites (DenMine)	Density of Septic and Sewer (DenSepSew)	Percent of Urban Land Cover in the Riparian Zone (PctUrbDevRp)	Percent of Agricultural Land Cover (PctAg)
Density of Canals, Ditches, and Pipelines (DenCDP)	Density of Contaminated Sites, Wastewater Treatment Facilities, Industrial Facilities (DenPoll) Density of Septic and Sewer (DenSepSew)	Density of Conditional Use Permits for Gravel, Parcels with Material Sales, Timber Sales (DenMaterial)	Density of Cadastral Subdivisions (DenSubd)	Density of Contaminated Sites, Wastewater Treatment Facilities, Industrial Facilities (DenPoll)	Density of Railroad, Road, Trail-Stream Intersections (DenTranspStCrS)
Percent Imperviousness of Human-Related Landscapes (PctImp)	Density of Mines, Historical Mining Disturbance, State Prospecting Sites (DenMine)	Density of Airports, Roads, Railroads, Trails (DenTransp)	Density of Railroad, Road, Trail-Stream Intersections Weighted by the Slope of the Stream Reach (SlopeTranspStCrS) Density of Canals, Ditches, and Pipelines (DenCDP) Percent of Urban Land Cover in the Riparian Zone (PctUrbDevRp)		Density of Housing within the riparian Zone (DenHouseRp)
Rate of Rain on Snow Events (RateROS)	Density of Conditional Use Permits for Gravel, Parcels with Material Sales, Timber Sales (DenMaterial)	Rate of Rain on Snow Events (RateROS)	Percent of Agricultural Land Cover in the Riparian Zone (PctAgRp)	Density of Septic and Sewer (DenSepSew)	Density of Airports, Railroads, Roads, Trails in the Riparian Zones (DenTranspRp)

STRESSORS

Stressors identified by EPA and Mat-Su Salmon Partnership (MSSP) | At least 1 unique stressor identified by the MSSP | Stressor Unique to Cold Climate Hydrology

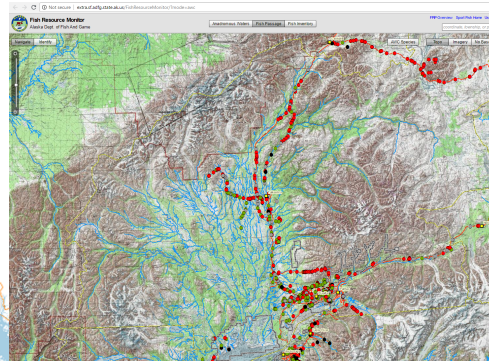
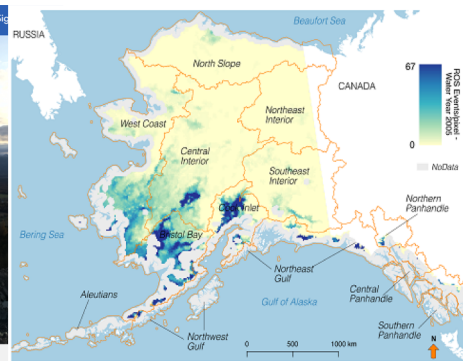


Matanuska-Susitna Borough

## Open Data

For a Smarter Community

This site provides easy access to the latest Matanuska-Susitna Borough spatial data, web applications, and documents that help support the Borough's Smart Community initiative. We are a member of the [Alaska Smart Communities Forum](#). Scroll down this page or enter a search to see what is available.



**1** Pilot the USGS-EPA National Hydrography Dataset Plus

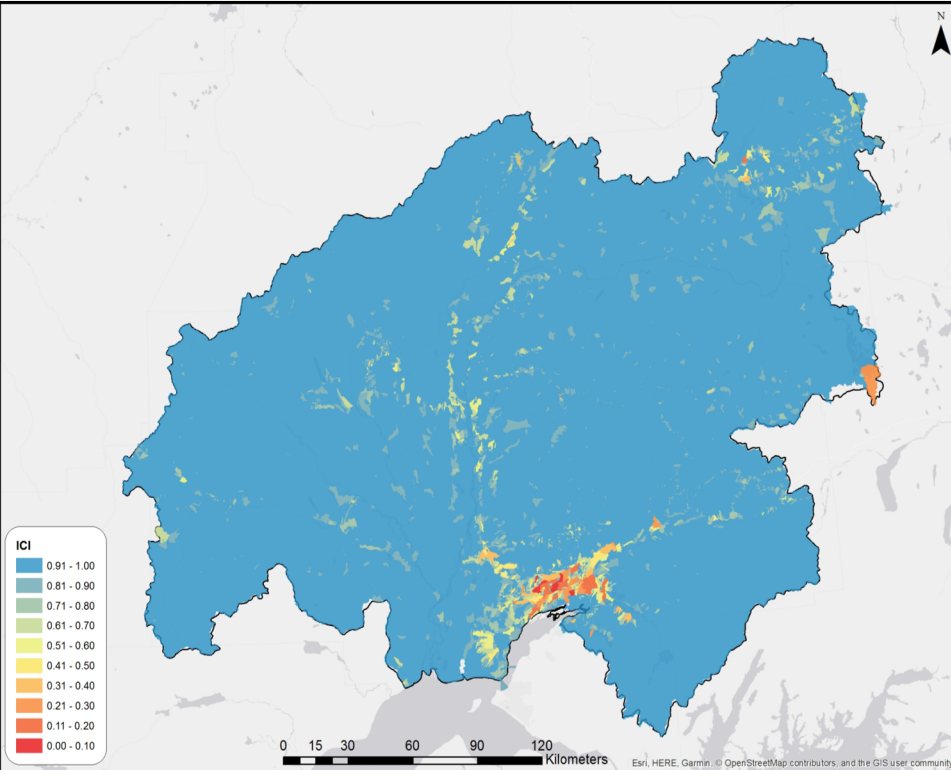
**2** Pilot the use of local data

**3** Pilot cold-climate hydrology

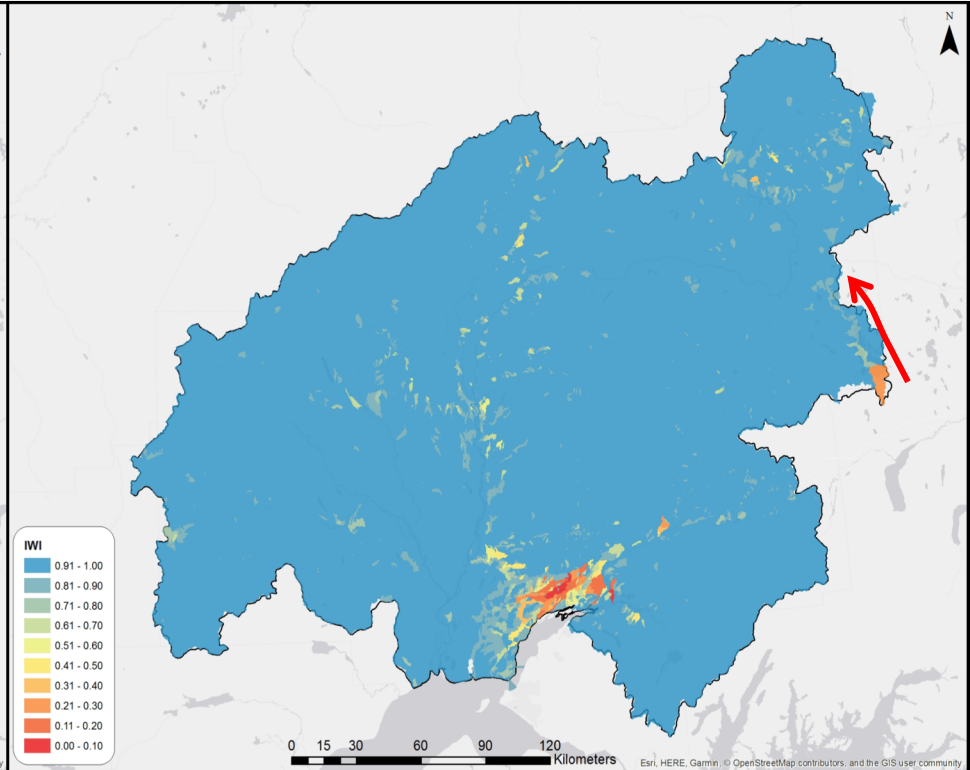
**4** Produce practitioner-friendly applications

# Results

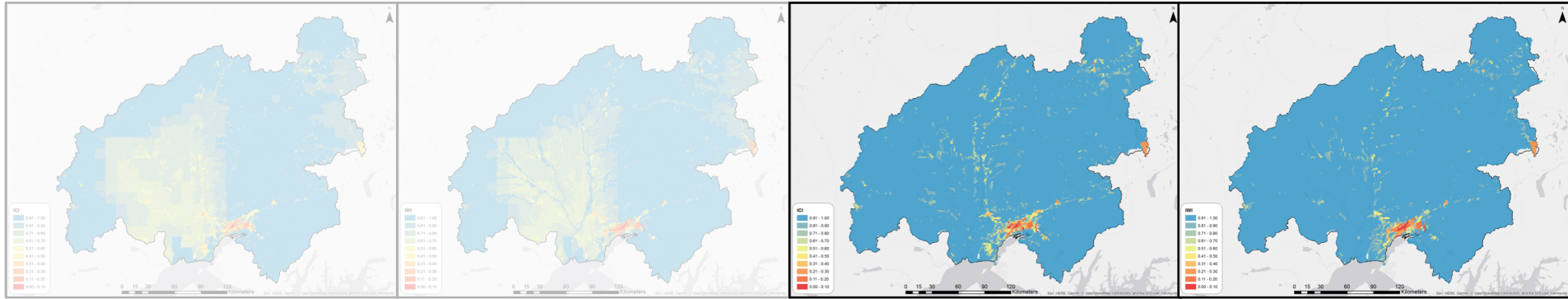
**Index of Catchment Integrity (local)**  
without Rain on Snow Events



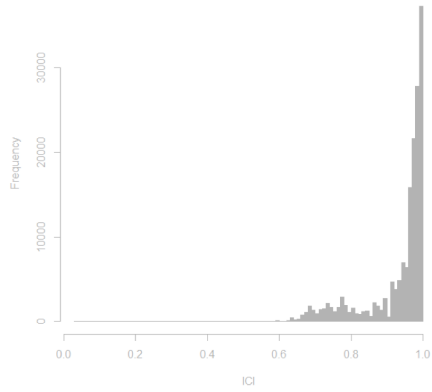
**Index of Watershed Integrity (accumulated)**  
without Rain on Snow Events



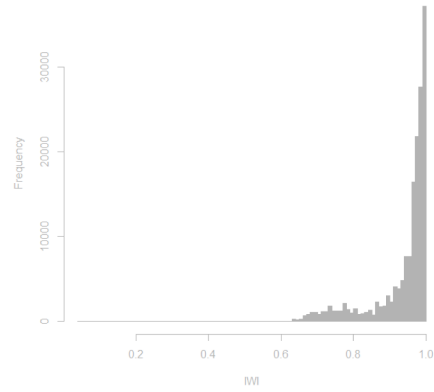
# Results



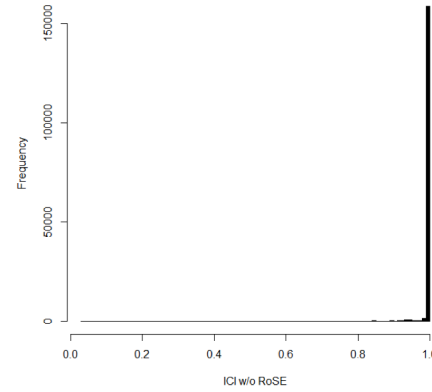
Histogram of ICI



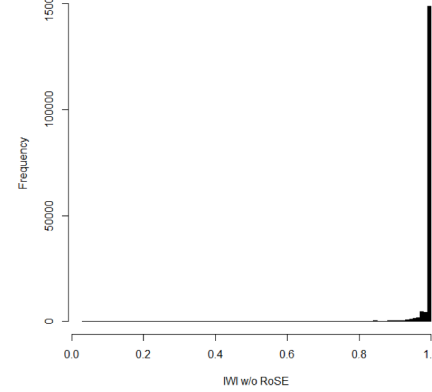
Histogram of IW



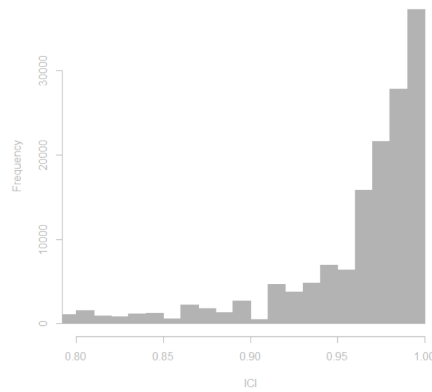
Histogram of ICI w/o RoSE



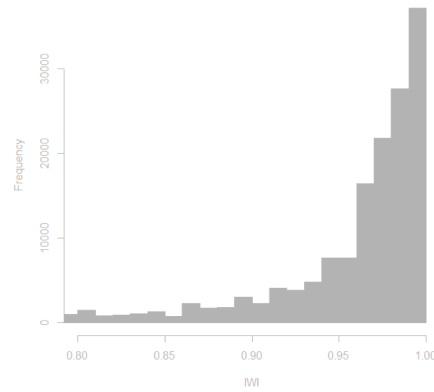
Histogram of IW w/o RoSE



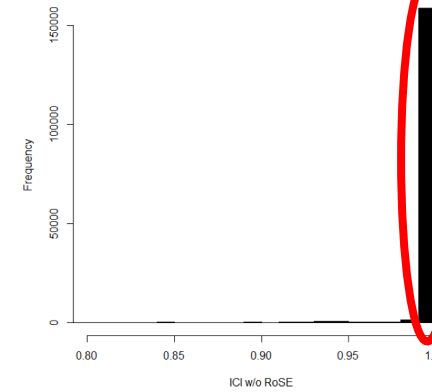
Histogram of ICI



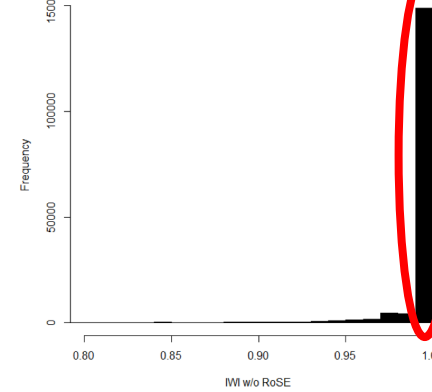
Histogram of IW



Histogram of ICI w/o RoSE

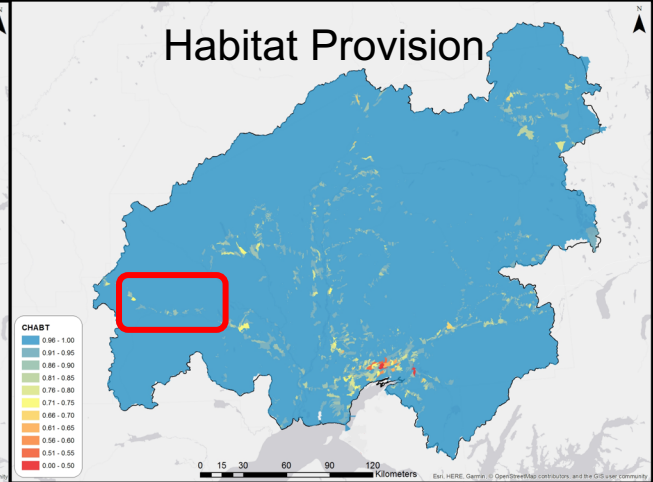
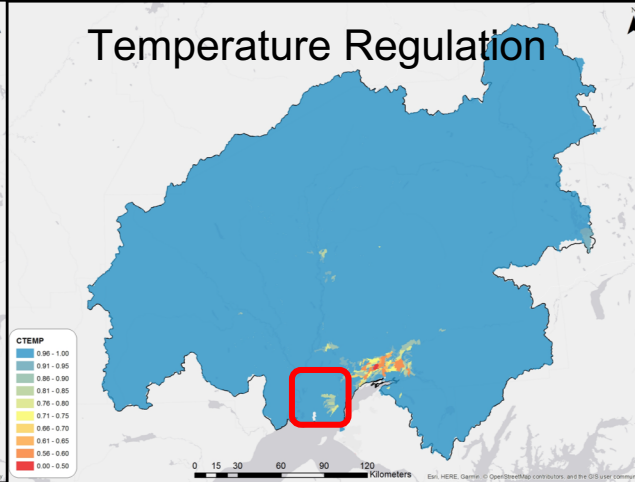
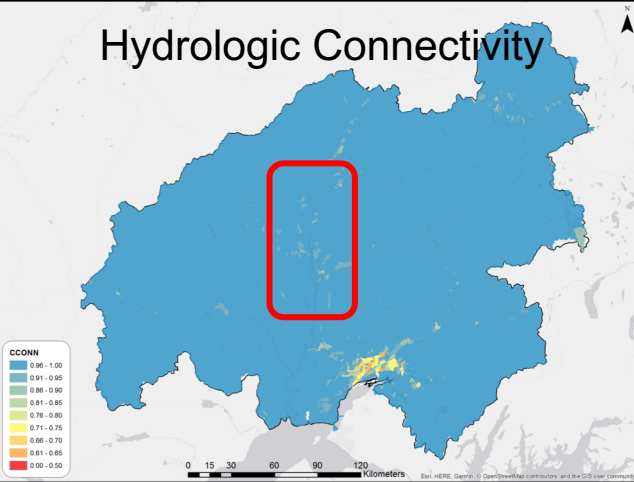
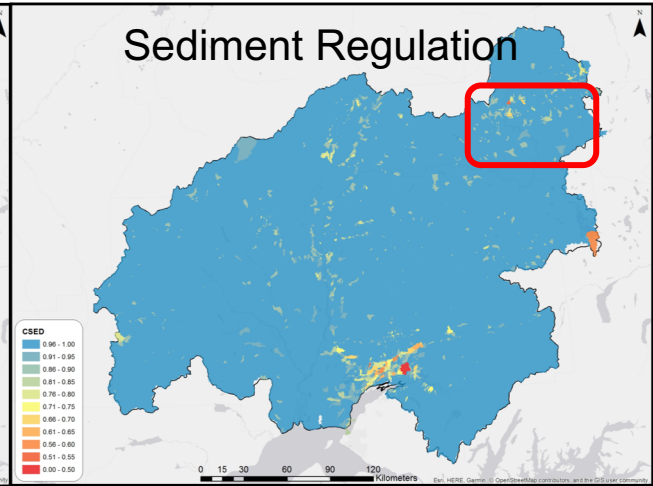
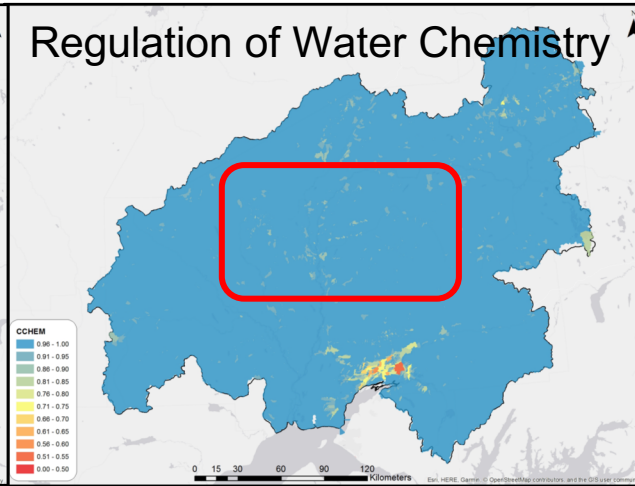
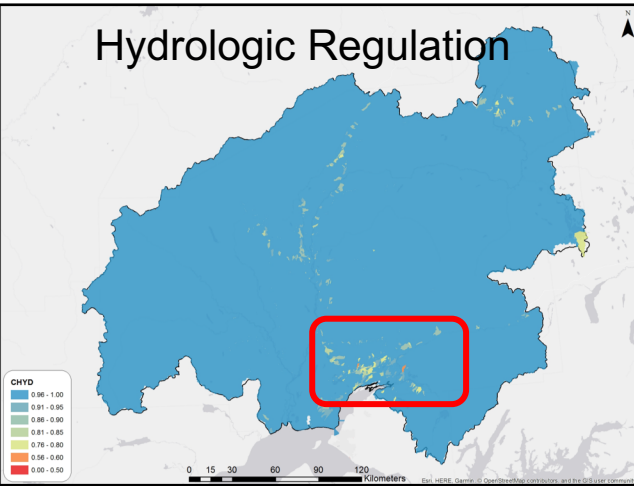


Histogram of IW w/o RoSE



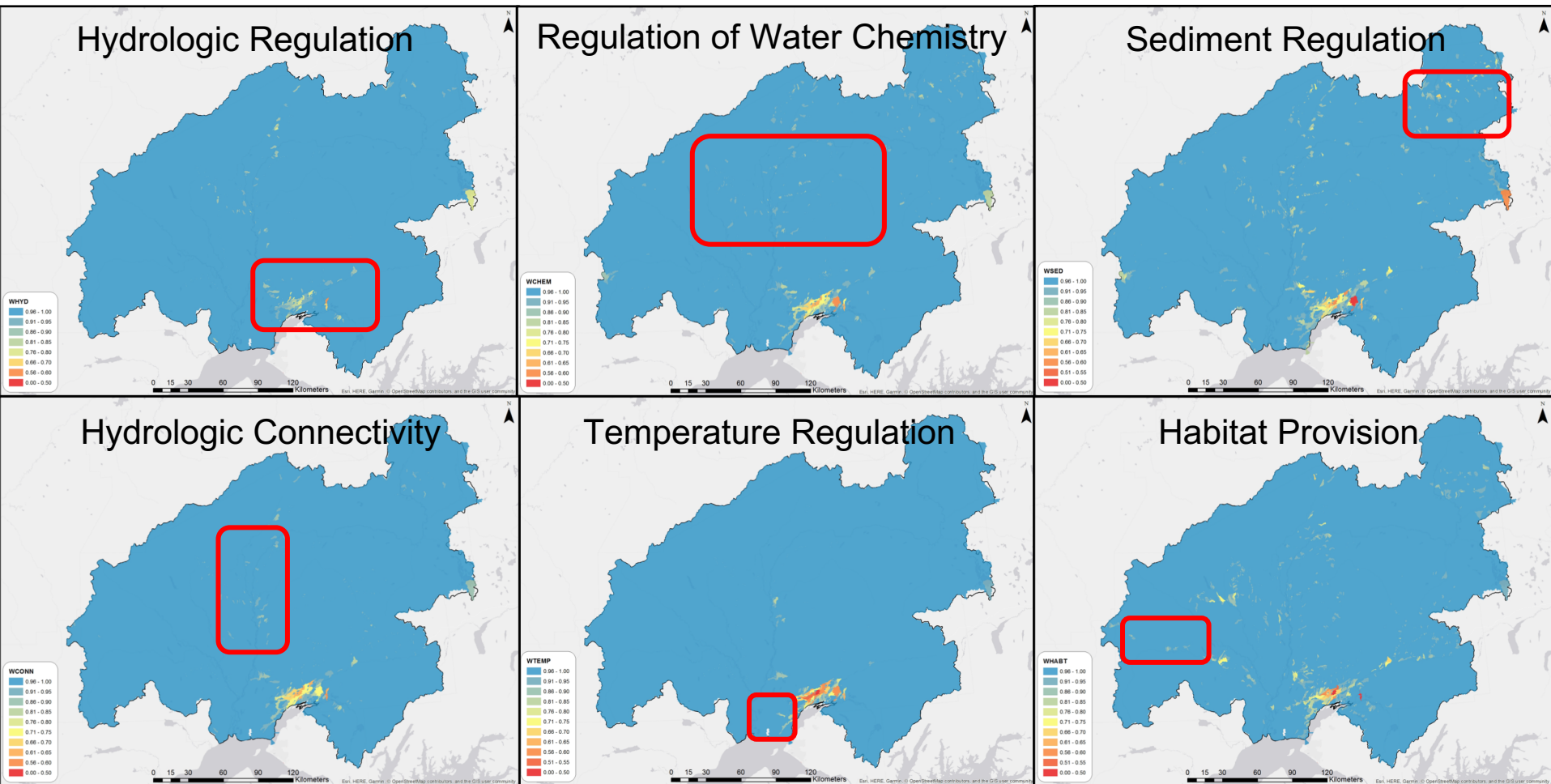
# Results

## ICI (local) Functional Components without ROS



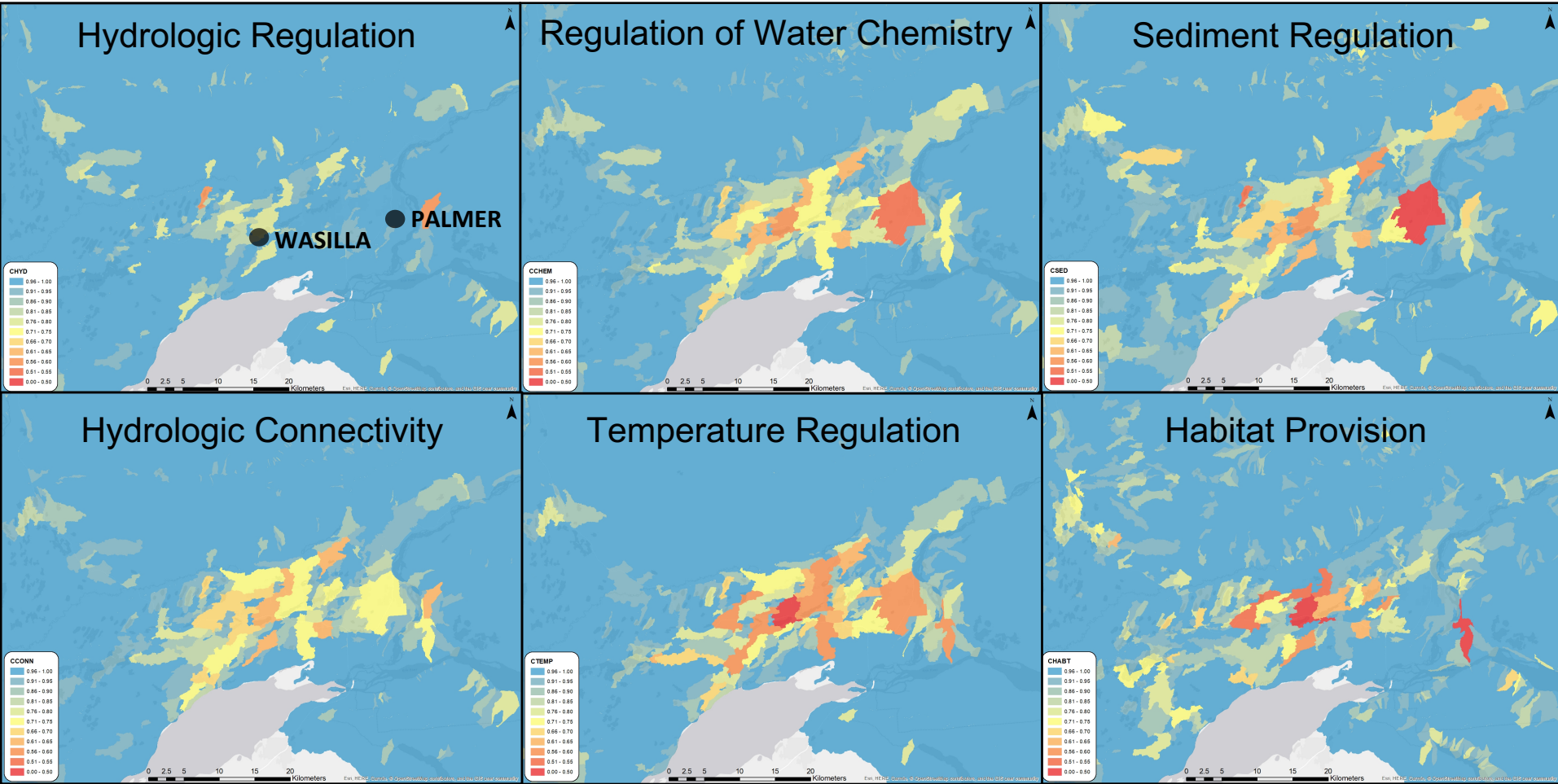
# Results

## IWI (accumulated) Functional Components without ROS



# Results

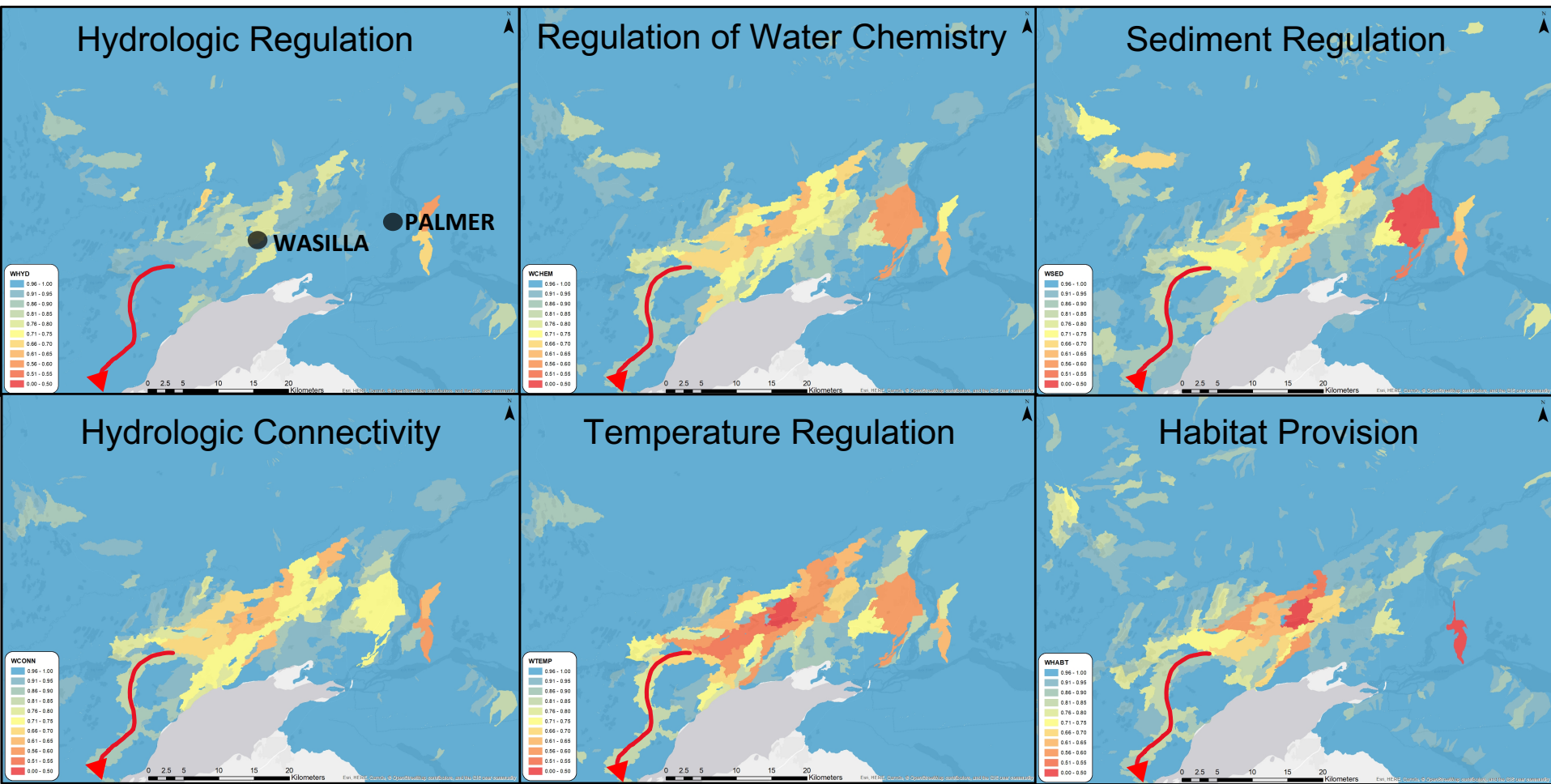
## ICI (local) Functional Components without ROS for the Core Area





# Results

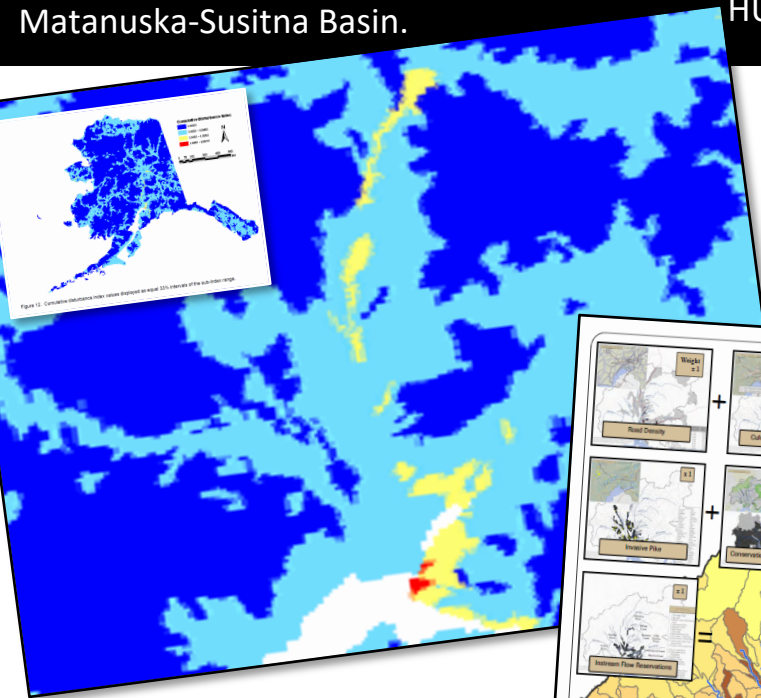
## IWI (accumulated) Functional Components without ROS for the Core Area



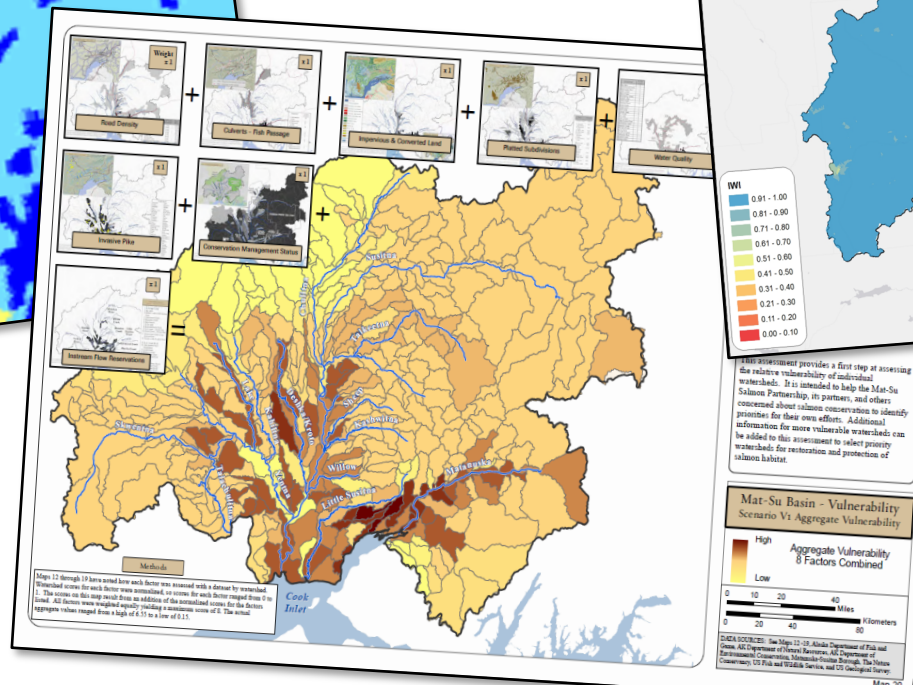
# Comparison

## Human Disturbance to Fish Habitat (NFHAP 2010)

summarizes land uses, barriers to fish movement, landing strips/airports, mines, point-source pollutant sites, and infrastructure like pipelines, railroads, and roads for Alaska and for **596** HUC12s in the Matanuska-Susitna Basin.

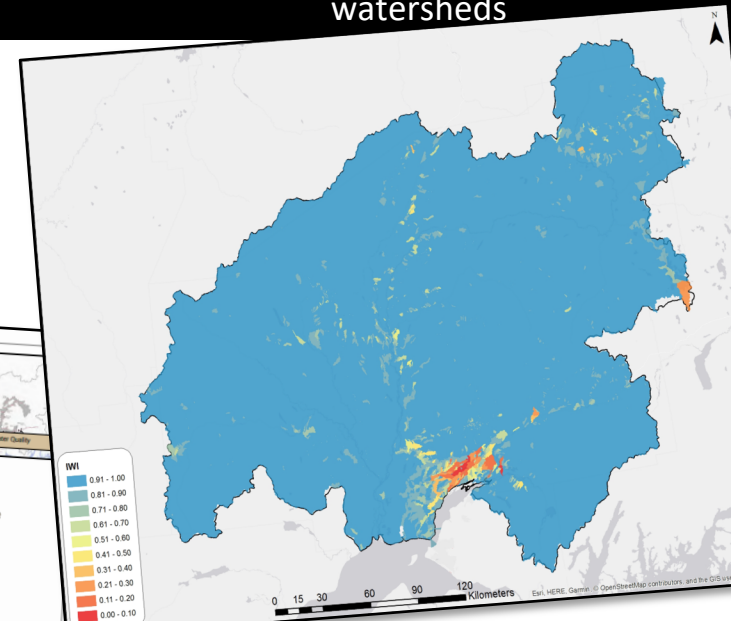


**Vulnerability** from *A Map Atlas to Prioritize Conservation* (Smith 2009) summarizes road density, culverts that impede fish passage, impervious and converted land cover, platted subdivisions, **water quality**, **invasive Northern pike**, **conservation management status**, **instream flow reservations** for **329** HUC10s and HUC12 in the Matanuska-Susitna Basin.

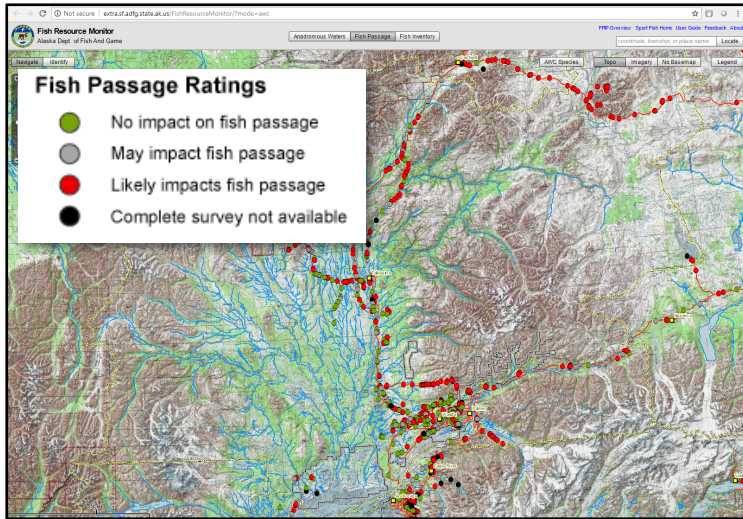


## Index of Watershed Integrity

summarizes and accumulates 26 stressors for **169641** catchments and watersheds

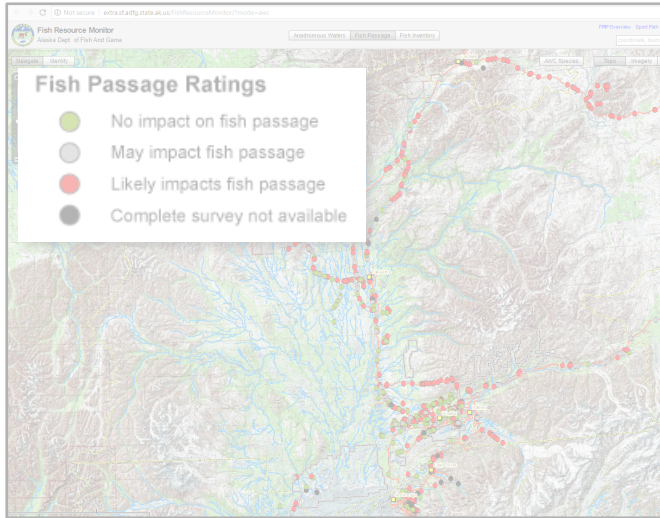


# Application

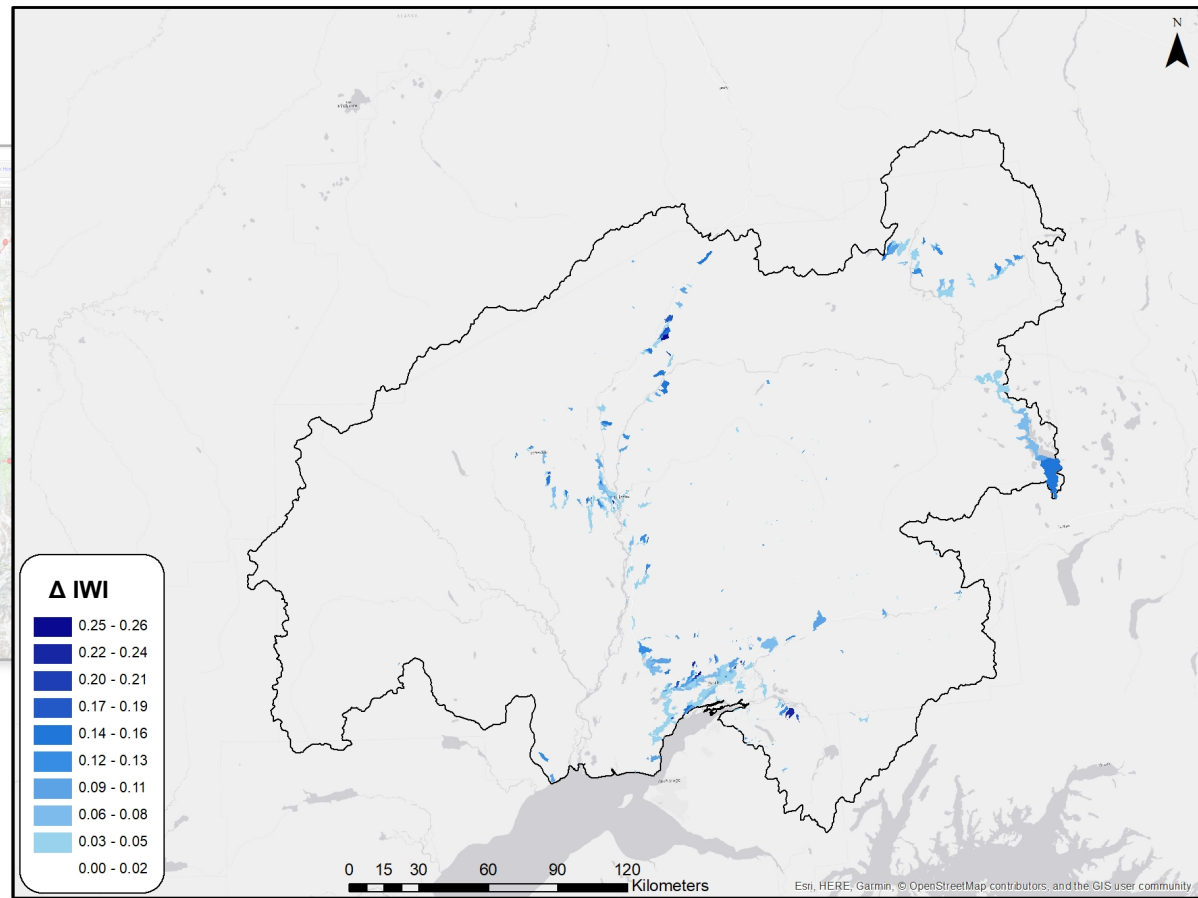


If 1 or more culvert  
**Likely impacts fish passage** or May impact fish passage in a CM or WS, the culvert with the worst fish passage is improved to **No impact on fish passage**.

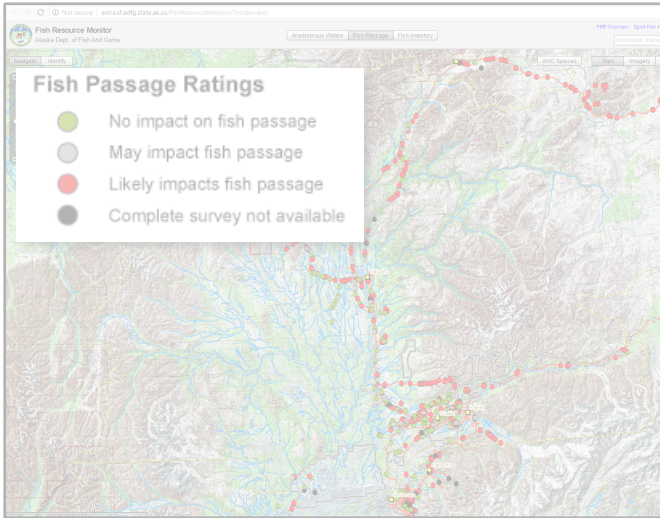
# Application



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# Application



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Different Original and Scenario 1 Values										
*Small changes since values are left-skewed										
Metric	ICI	IWI	CHYD	CCHEM	CSED	CCONN	WHYD	WCHEM	WSED	WCONN
Δ (min.)	0.0001	0.0001	0.0706	0.0000	0.0230	0.0192	0.0000	0.0000	0.0000	0.0225
Δ (mean)	0.0004	0.0005	0.0005	0.0003	0.0004	0.0004	0.0002	0.0001	0.0002	0.0002



Local ⇔ hydrologic regulation

Accumulated (regional) ⇔ hydrologic connectivity



**R and Python scripts:** [https://github.com/USEPA/watershed\\_integrity](https://github.com/USEPA/watershed_integrity)  
**StreamCat:** <https://www.epa.gov/national-aquatic-resource-surveys/streamcat>

**For more information please contact**  
**[ahokelsey@gmail.com](mailto:ahokelsey@gmail.com) [kaho3@alaska.edu](mailto:kaho3@alaska.edu)**