Integrating Remote Sensing and Traditional Knowledge to Assess Hazardous River Conditions

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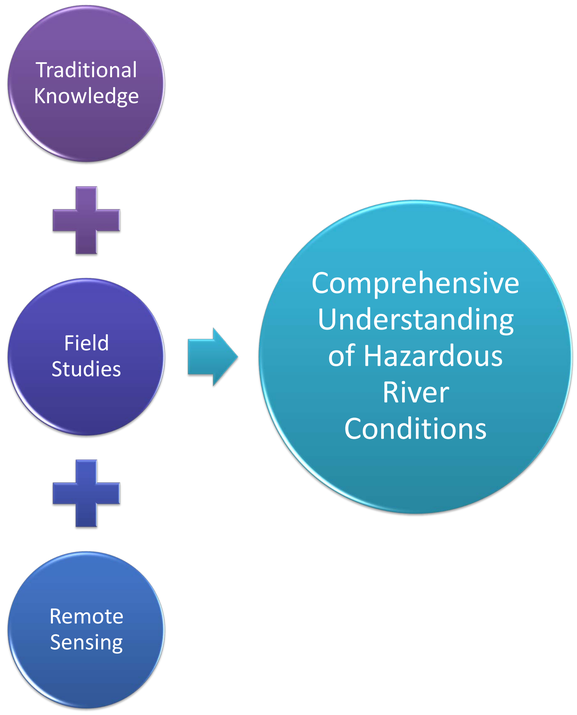
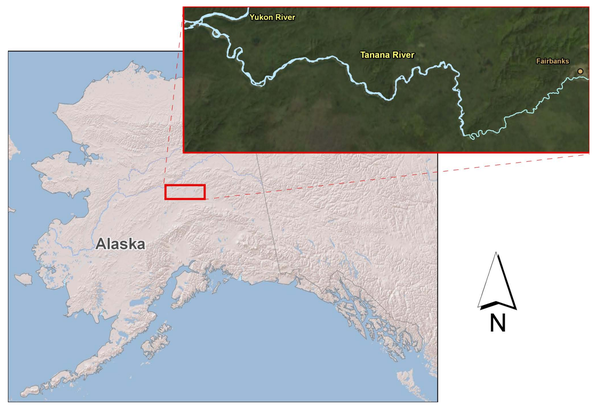
ABSTRACT: This research relies upon scientific collaborations and traditional knowledge to gain a comprehensive understanding of hazardous river conditions facing subsistence users in rural Alaskan communities. River conditions are projected to become less predictable in interior Alaska and increased variability in river conditions (e.g. timing of break-up and freeze-up, flood magnitude and frequency, ice conditions) may have adverse impacts on many rural Alaskan residents. Our research combines remote sensing, field studies, and traditional knowledge to examine the seasonal nature of river conditions from freeze-up through break-up on the Tanana River in Alaska by addressing two primary research questions:

1) What physical factors influence seasonal ice dynamics on the Tanana River?
2) What are the magnitudes of spatial and temporal changes in seasonal river ice dynamics (distribution, surface texture and morphology) on the Tanana River?



Study Area



This research is focused upon the Tanana River, from its confluence with the Yukon River to 200 miles upstream. We will have field sites near the communities of Tanana, Manley, Nenana, and Fairbanks.

Remote Sensing

Remote sensing will be used to study modern and historic river conditions. Satellite-based Synthetic Aperture Radar (SAR) data will be used to study spatial and temporal changes in seasonal river ice distribution, surface texture and morphology and possibly ice thickness between freeze-up and spring break-up. Forward Looking Infrared imagery (FLIR) will be used to determine the influence of groundwater on river conditions.

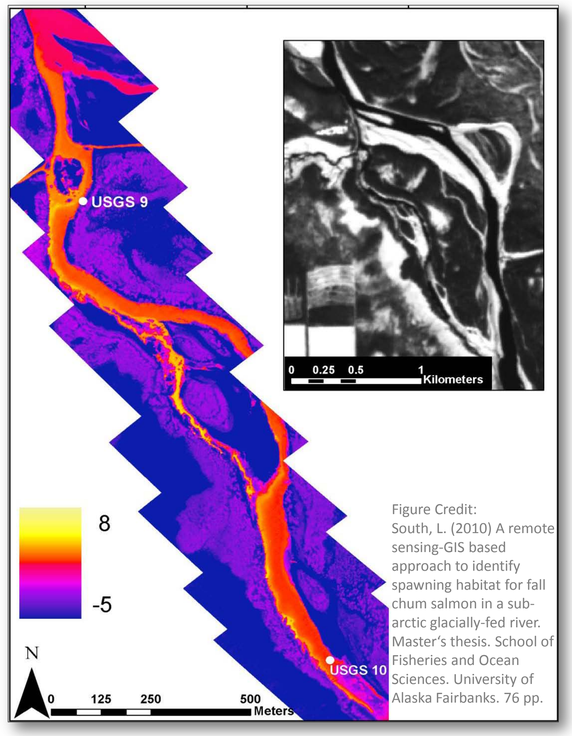


Figure Credit: South, L. (2010) A remote sensing-GIS based approach to identify spawning habitat for fall chum salmon in a sub-arctic glacially-fed river. Master's thesis. School of Fisheries and Ocean Sciences. University of Alaska Fairbanks. 76 pp.

Image illustrates the use of FLIR to observe temperature fluctuations attributed to groundwater influx on the Tanana River.

Field Studies

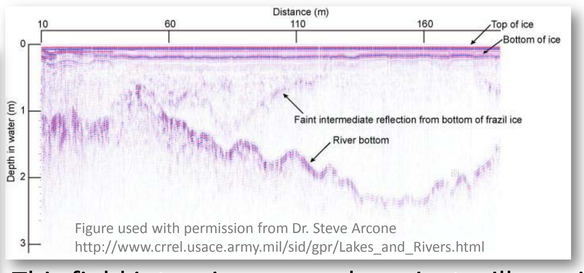


Figure used with permission from Dr. Steve Arcone http://www.crrel.usace.army.mil/sid/gpr/Lakes_and_Rivers.html

This field intensive research project will provide insight into the environmental drivers that determine ice condition at a particular location and time. Field data will include:

- Cross-section survey (ice thickness, water depth, water velocity, discharge)
- Weather station data (temperature, corrected snow accumulation, AFDD)
- Vertical temperature profile (air, snow, ice, water, sediment)
- Time lapsed photography (daily)
- Water chemistry (conductivity; stable isotopes)

Collaborating with Rural Alaskans

Rural Alaskans are partners in this research and assist by identifying field sites, providing site history, and offering contextual understanding of the importance of rivers as transportation networks for subsistence activities in winter and summer.