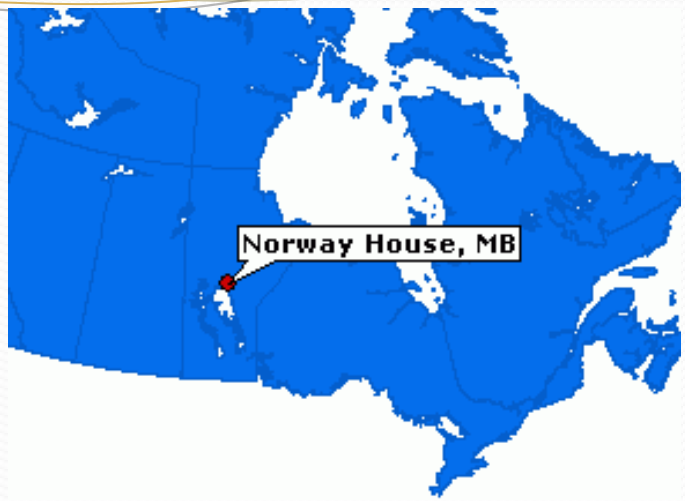
Identifying Sediment Sources In Norway House Cree Nation Source Water Using Sediment Fingerprinting

Johanna Theroux, Annemieke Farenhorst, David Lobb

University of Manitoba, Department of Soil Science



- Located at the confluence of the Nelson River and Lake Winnipeg
- Source of drinking water is Jack River
- Industry: commercial fisheries and hydro power development
- Water is essential to the community for fishing, drinking, recreation, and is part of everyday life

Research Questions

- Are sediments affecting water quality entering the Jack River drinking water inlet?
  - Turbidity measurements/ previous data/oral history
    - Yes, at specific times of year
    - Sediments are contaminant vectors
- Where are sediments coming from?
  - Erosion from 2-Mile Channel concerns community
  - Sediment Fingerprinting
    - Use geochemical/physical properties to link the sediment back to its source

Study Area

- 2-Mile Channel was built in 1970s by Manitoba Hydro to increase water flow to Jenpeg
- Natural outlet at Warren's Landing
- Area borders 2 different ecoregions- different soils/landscape features
- High rates of erosion along the north shore of Lake Winnipeg

Methods

- Suspended Sediment sampling
  - Phillips samplers(2 at 6 locations)
  - Voli modified samplers (2 at 1 location)
  - Centrifuge samples
- Source sediment sampling
  - 80 Samples at 6 locations
  - Bottom grab samples (Ponar)
  - Bank grab samples
  - Soil cores

Sediment Fingerprinting

Based on the assumption that one or more of the properties of the suspended sediment will reflect its origins and can be used as a tracer to track the sediment back to its source(s)

Techniques for identifying tracers:

- Geochemisty
- Radiochemistry
- Stable isotopes
- Spectral reflectance (colour)
  - FieldSpecPro

Figure 1 : Color Analysis with FieldSpecPro

Results so Far…

- Huge amounts were retrieved from 2-Mile (>500g)
- Turbidity was low at intake (June-October 2014)
- Insufficient sediment was retrieved from the Opatinow Channel and the Jack River Intake (<10g)
  - Water quality highly affected by Jenpeg dam/water levels
  - Spring melt may cause a peak in turbidity (not captured in 2014)
  - Spring 2015: sample with continuous flow centrifuge and Voli sampler(April-May)

Results continued…

- Centrifuge was very effective at collecting a point-sample for mid-April and mid-May (>10g)
- Voli sampler was not effective
  - Samplers easily damaged
  - Turbidity not high enough to capture sample in 1 week

- Next steps
  - Color analysis on remaining samples
  - Narrow down tracers using discriminant function analysis/normality tests
  - Input into MixSIAR modelling software to determine proportion of each source at the intake

Thank you/Ekosi

Acknowledgments: Loretta Mowatt, James Dixon, Ken Budd, Carmen Anderson, Vanja Karpisek, Brendan Brooks, Jaymie Balfour