



PRESENTER

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# Increases in Costs Associated with Maintaining Highway Infrastructure Due to Climate Change in Yukon

## Background

- Climate change is driving widespread changes that increase the vulnerability of northern transportation systems.
- Thawing permafrost has been a main cause of road damage as the bearing capacity of the ground is significantly reduced and subsequently subsides.
- Changing precipitation patterns, extreme temperature, and storminess are other climate factors that affect infrastructure conditions and road safety.
- Quantification of climate induced maintenance expenditures in relation to permafrost/ground ice occurrence will provide insight on the resiliency of northern highways in Canada subject to continuing climate change.

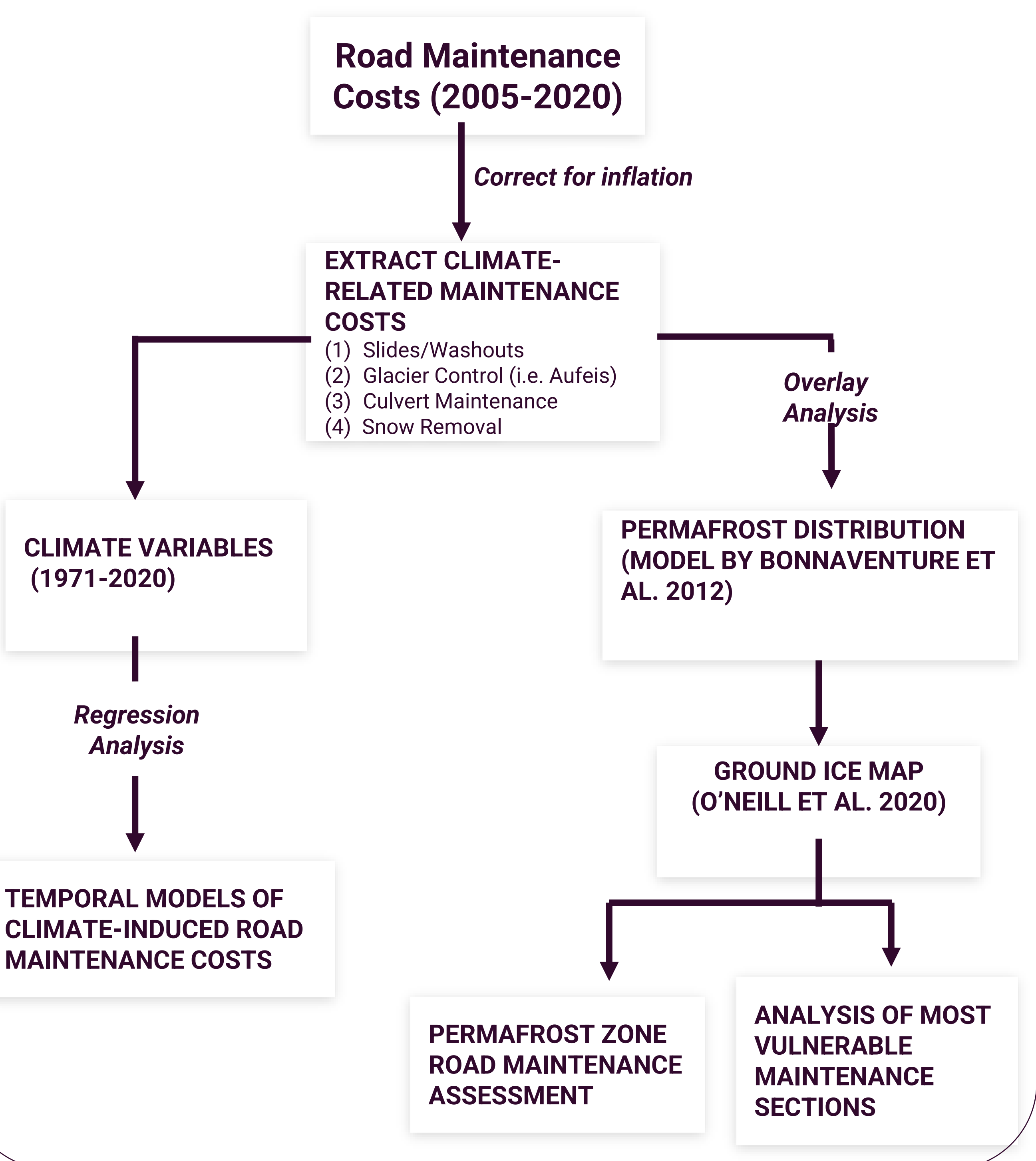
## Objective

Quantify the financial impact of climate change on highway infrastructure maintenance in Yukon.

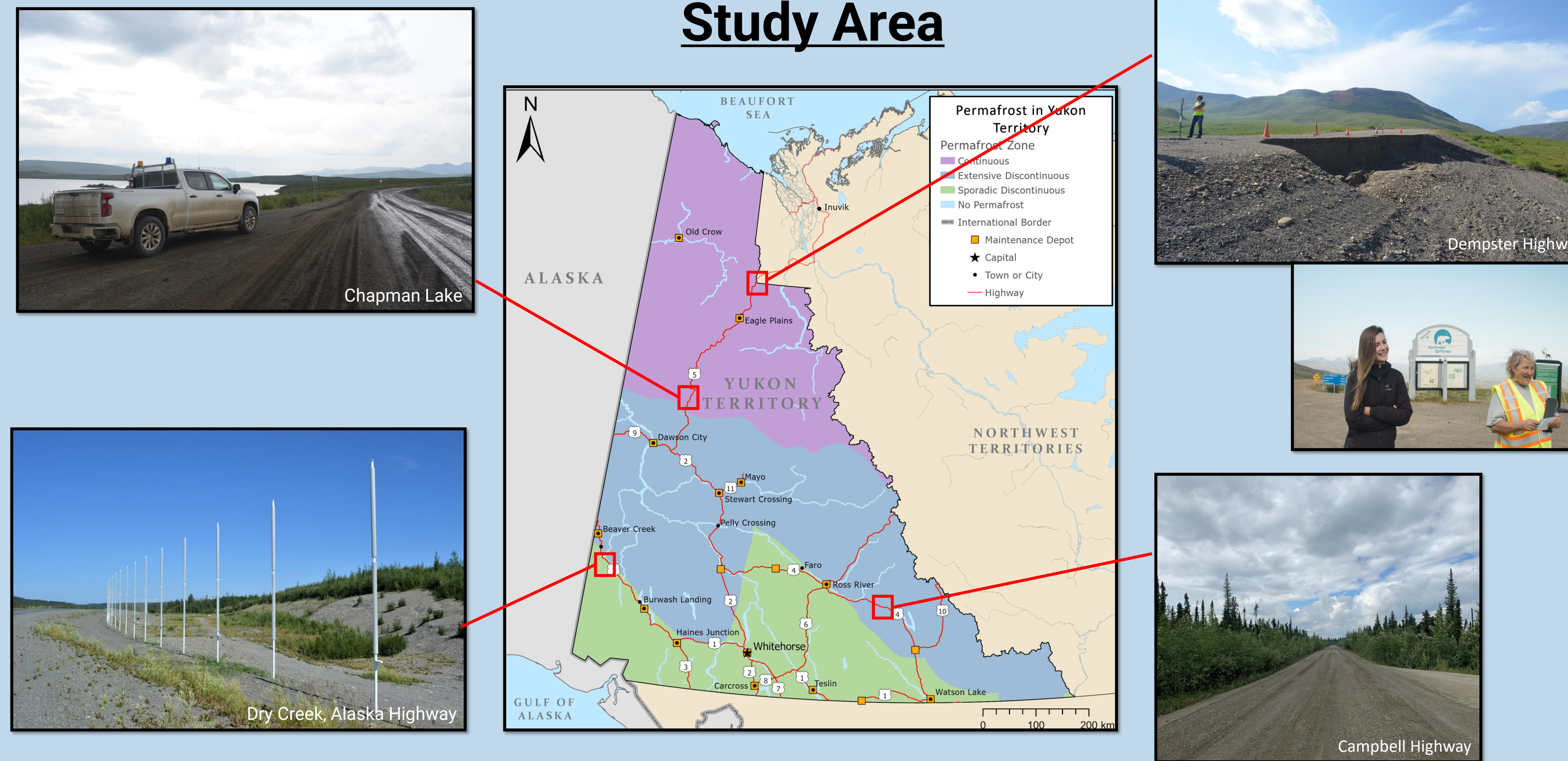
- Are there differences in maintenance expenditures between highway sections constructed on different permafrost zones?
- Are spatial and temporal variations in highway maintenance costs associated with climate change and permafrost distribution in the study region?
- Which highway maintenance sections are most vulnerable to climate-induced damage and, as a result, require repetitive maintenance?



## Methods

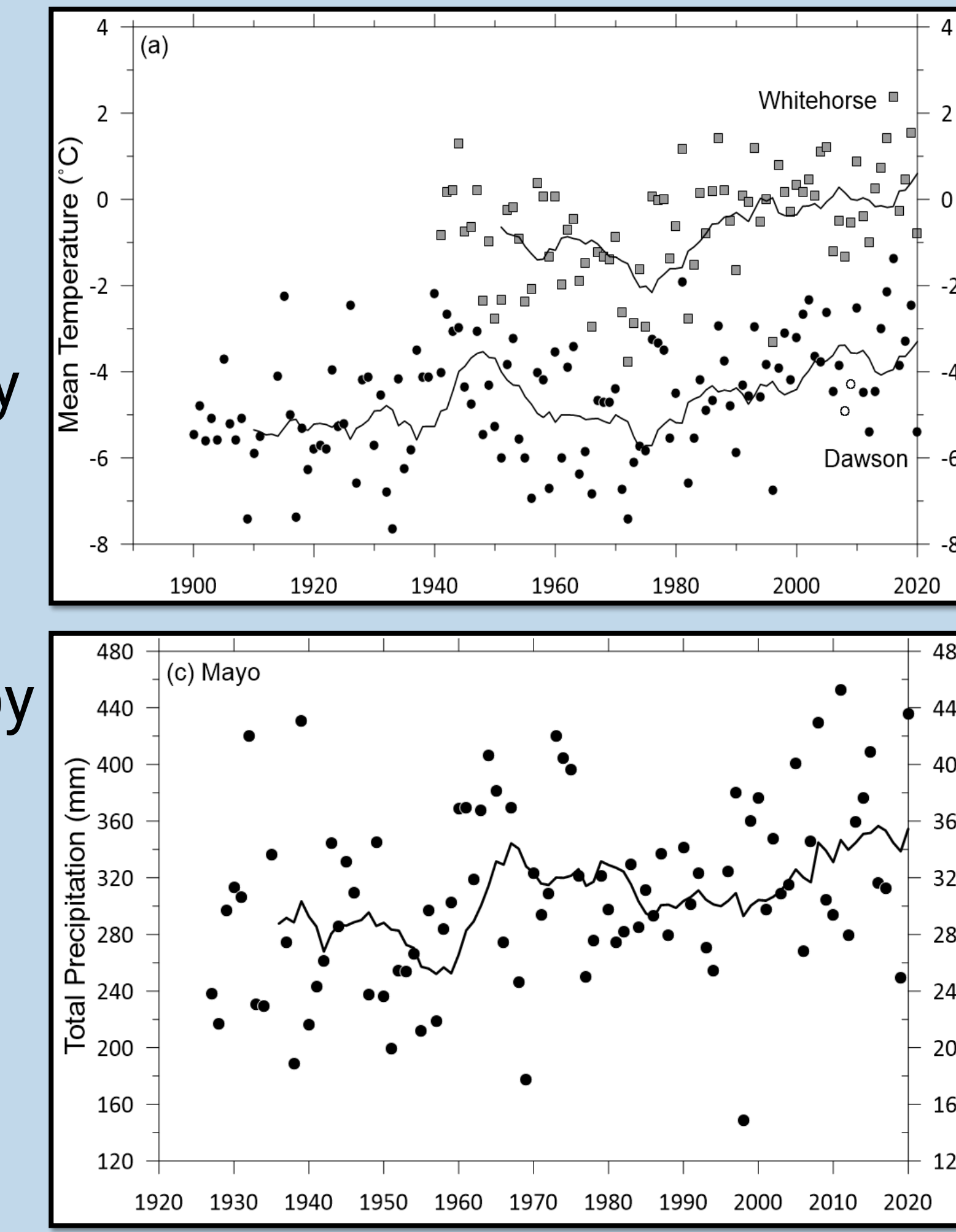


## Study Area



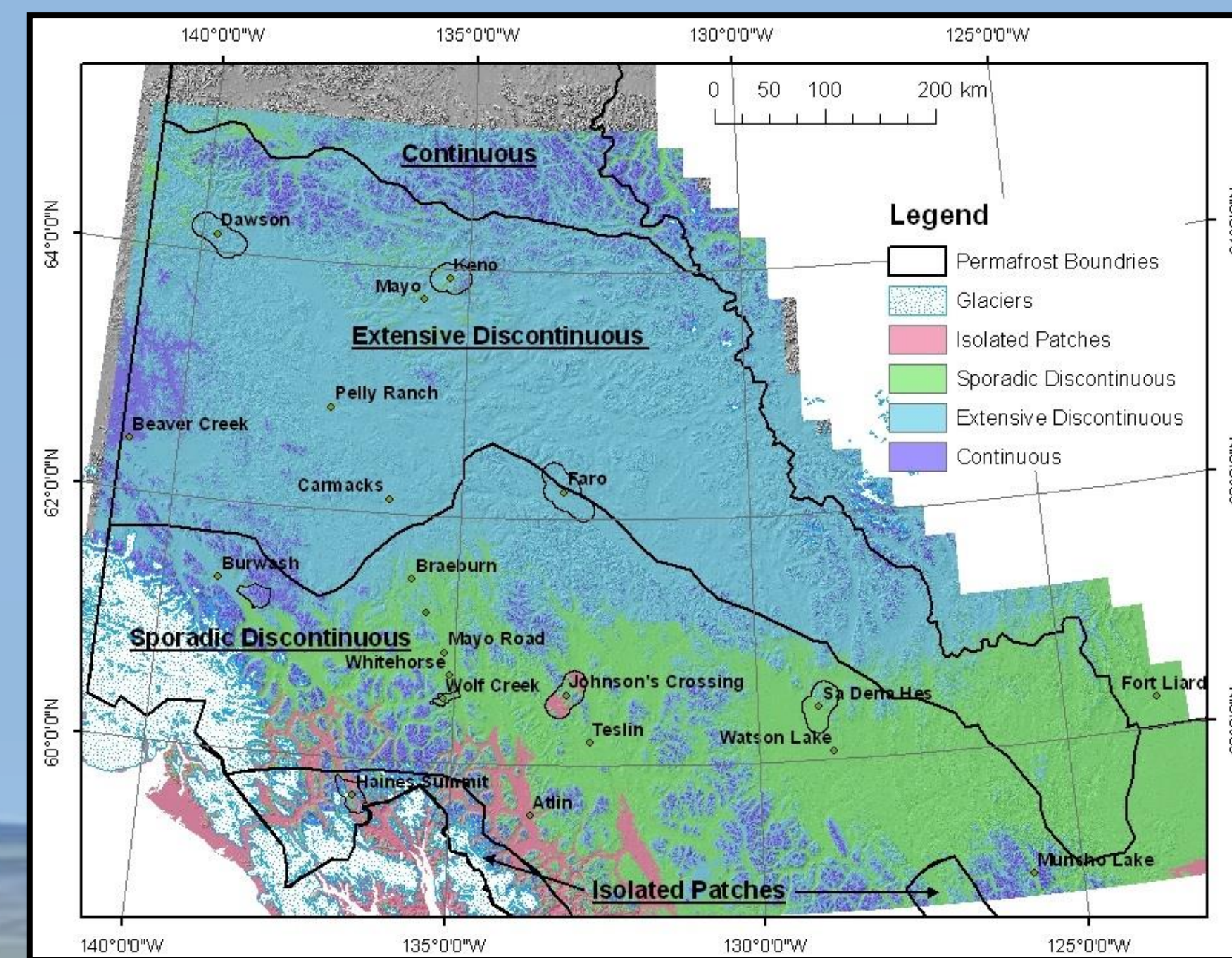
## Climate Data

- Temperature**
- Southern Yukon (Whitehorse) annual temperature increased by 1.1 °C since 1961-1990
  - Lower Mackenzie Valley (Inuvik) annual temperature increased by 2.4 °C since 1961-1990
- Precipitation**
- No distinct trends in precipitation



## Permafrost Conditions

- High resolution (30x30m) permafrost probability model (Bonnaventure et al. 2012) for Yukon
- Ground ice map of Canada (O'Neill et al. 2020)
- Empirical data from boreholes
  - Ground temperature data
  - Ground ice descriptions



## Consultation

- What is included in the costs for each climate related maintenance category (i.e. materials, wages, etc)?
- How often are highways surveyed for damage and/or required maintenance?
- Have protocols/standards changed over the years?

