Effects of permafrost degradation, geohazards, and flooding on the performance and integrity of the Hudson Bay Railway

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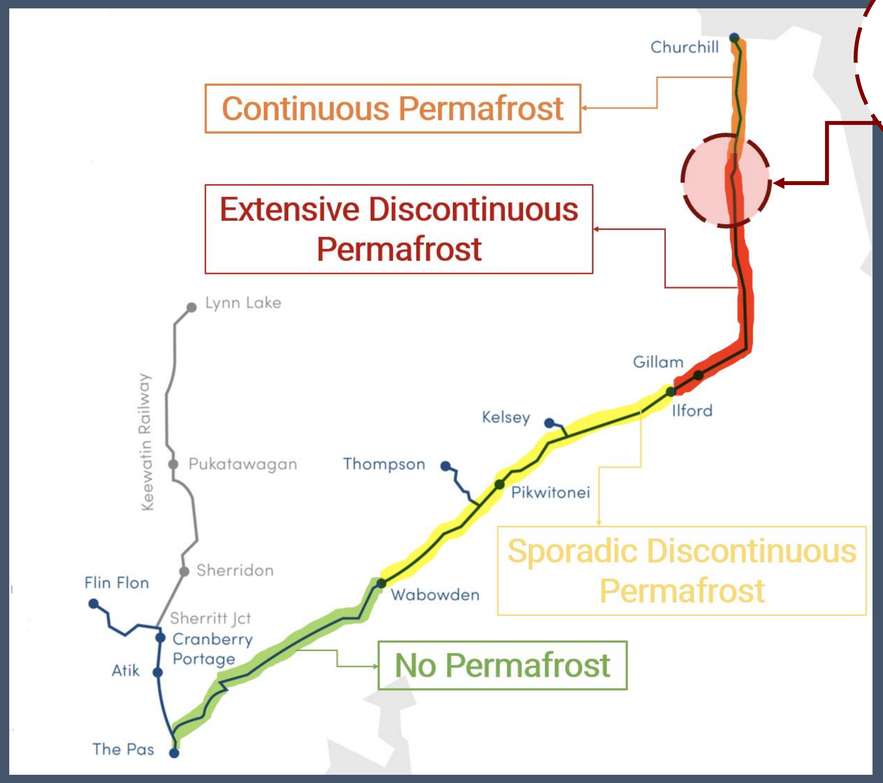
Introduction

The Hudson Bay Railway (HBR), located in northern Manitoba, traverses varied terrain units, including permafrost, peatland, and wetland regions. The various ground conditions may pose to the HBR the risk of geohazards, such as subsidence, permafrost degradation due to climate change effects, and flooding events, especially from Gillam (milepost 326) to Churchill (milepost 510), which is on discontinuous permafrost terrain. This may lead to impaired serviceability, increased frequency of service disruption, increased risk to asset performance and integrity, and increased costs to meet levels of service or incurred liabilities. There is a need to support informed decision-making under uncertainty in order to develop sustainable engineered solutions with predictable outcomes, improve operational practices and develop effective adaptation strategies that mitigate risk.

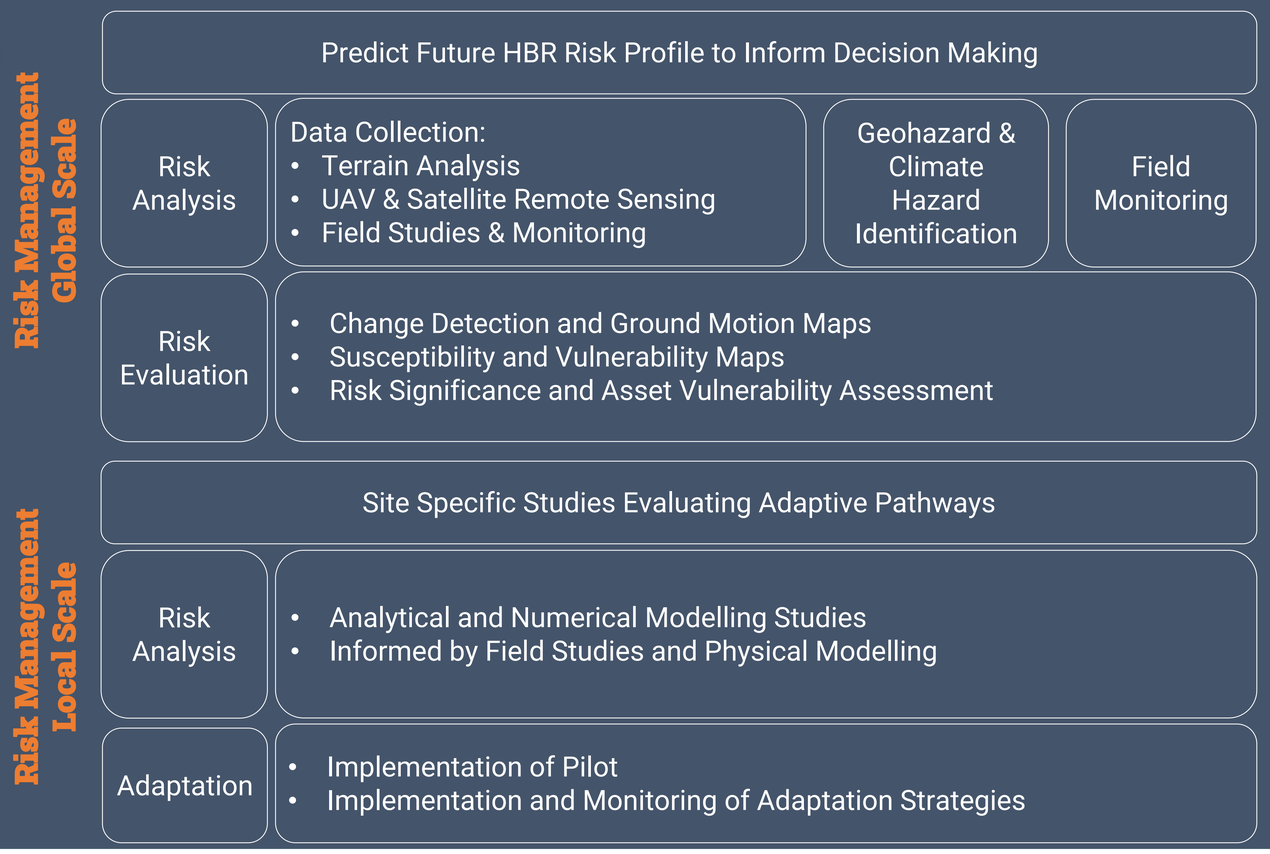
Research Objectives

This study will evaluate the risks threatening the HBR through change detection mapping using remote sensing observations (optical, LiDAR, RADAR) from unmanned aerial vehicles (UAV) and satellite-based sensors. Terrestrial characteristics, including Land Surface Temperature (LST), surface water bodies, soil moisture, and vegetation cover changes over time, will be mapped to monitor and predict permafrost degradation or aggradation along the HBR. Also, field studies will be conducted to monitor other practical characteristics, including active layer thickness (ALT) and subsurface water content, using geophysical data collection methods such as ground penetrating radar (GPR) and track geometry data. This will improve the knowledge base and monitor the current condition of the field. Moreover, a global risk framework will be developed to assess hazards on the future performance and integrity of HBR, evaluate the effectiveness of adaptation strategies for site-specific hazards, and develop numerical analysis and physical experiments.

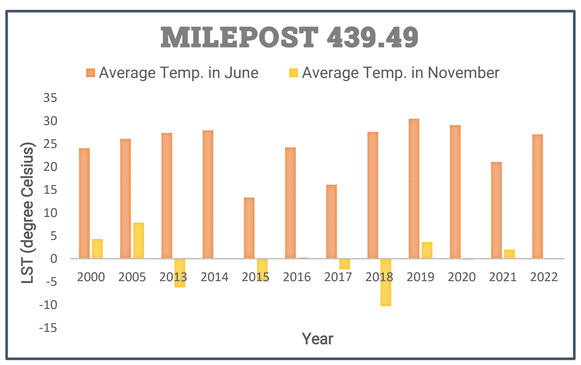
Study Area

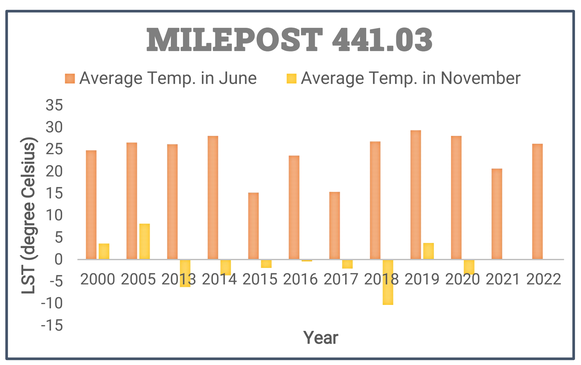


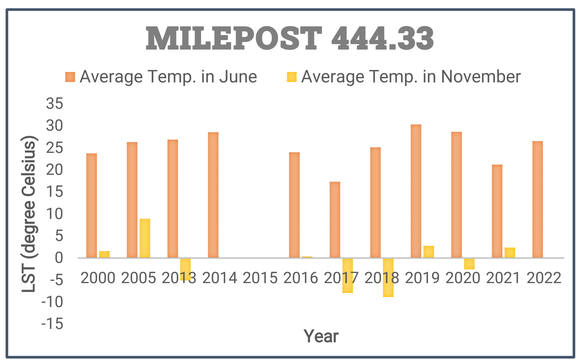
Methodology

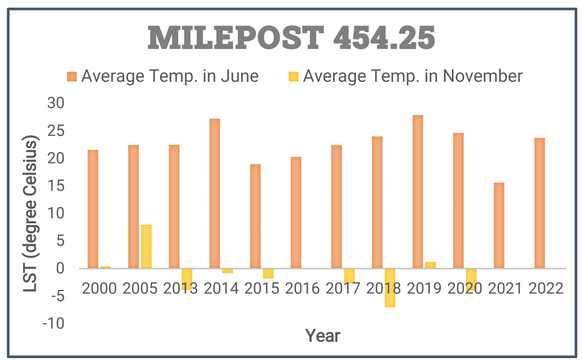


Remote Sensing Satellite Image Analysis









Collaborators/ Acknowledgements

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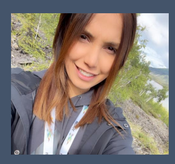

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