Future Planting Locations of **Salmonberry** and **Sword Fern** by Johic Mes

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Land Acknowledgement

I acknowledge that my research is conducted on the traditional, ancestral, and unceded territory of the Musqueam people. I recognize their deep connections to this land, which have been maintained since time immemorial, and I express gratitude for the opportunity to learn and work here. My project aims to respectfully engage with the knowledge and stewardship practices of the Musqueam community, recognizing their ongoing relationship with this land and the importance of Indigenous perspectives in environmental and climate research.

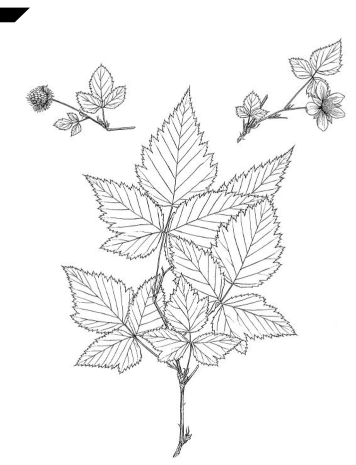
Introduction

Urban greenspaces, including forests, parks, and planted boulevards, provide essential ecosystem services and support biodiversity. (Gill et al., 2007; Nielsen et al., 2014). Beyond ecological benefits, these spaces hold cultural significance, particularly for Indigenous populations with deep-rooted connections to the land (Dickinson & Hobbs, 2017). However, they face threats from climate change, densification, and poor management practices (Aronson et al., 2017; Faeth et al., 2011). A key research gap exists in integrating planting guidelines with future climate suitability. This study aims to address this gap by modeling future planting locations for culturally significant plants for the Musqueam people at UBC Vancouver.

Methods

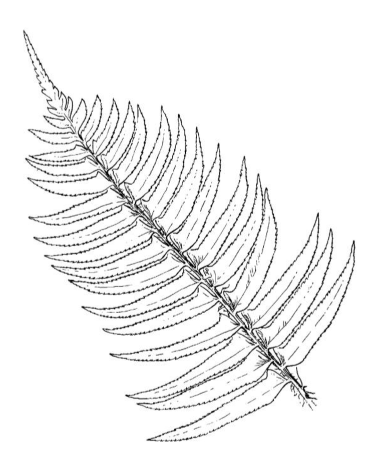
This study identifies suitable planting locations for Salmonberry (Rubus spectabilis) and Sword Fern (Polystichum munitum), by integrating future climate data with species distribution modeling.

- Future climate data was generated using ClimateBC, software capable deriving climate values based on location, elevation and climate scenario (Spittlehouse, 2008).
- Two Shared Socioeconomic Pathways (SSP) were chosen: SSP 2-4.5 (moderate emissions) and SSP 5-8.5 (high emissions).



Salmonberry

- Categorical variables, including slope, aspect, and shade, were derived using a DEM, DSM and CHM.

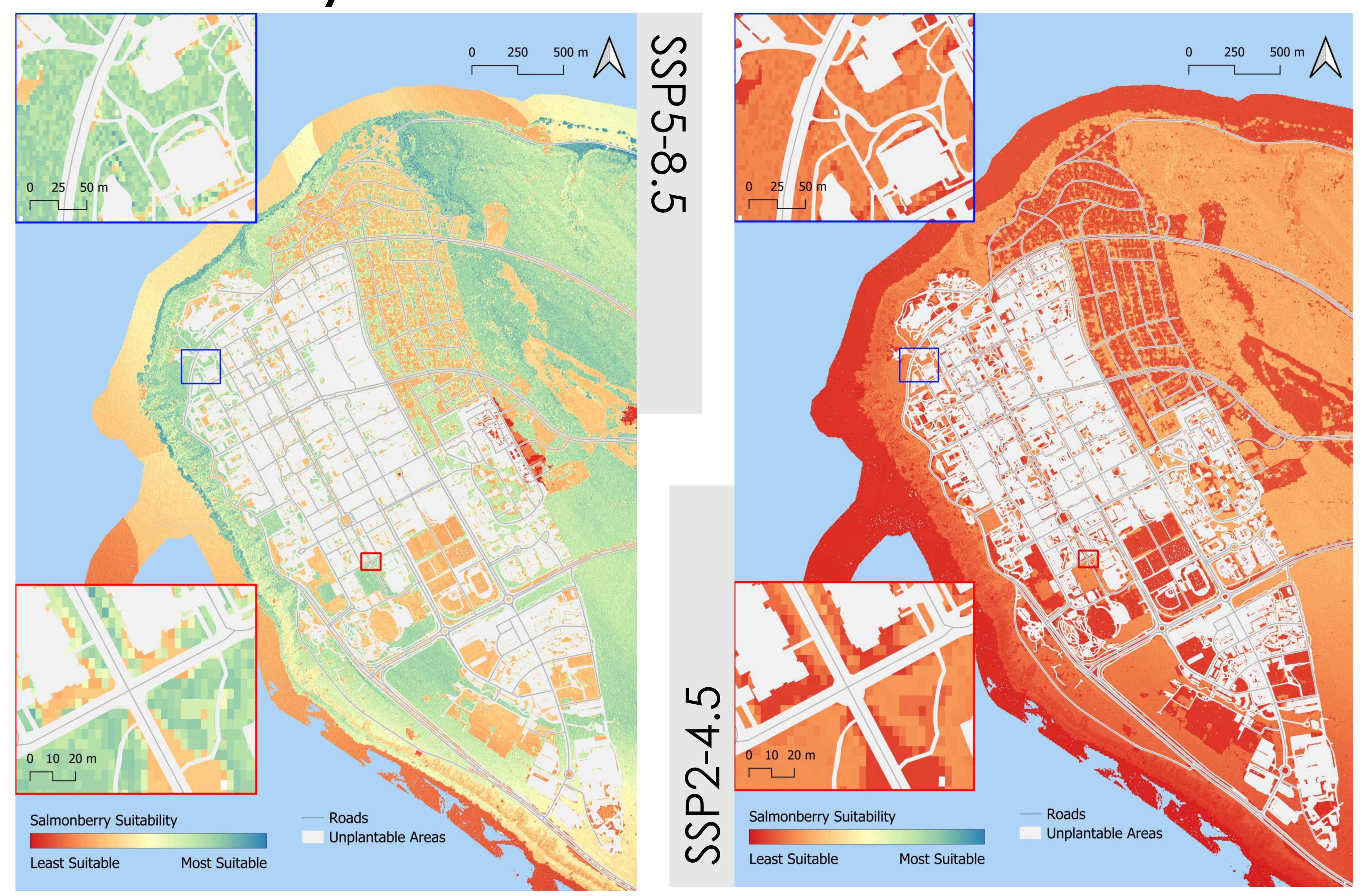


Sword Fern

- MaxEnt, a machine-learning algorithm that predicts species distribution based on presence data and biological variables, was used to predict future plant suitability.
- The final model was run for each plant species under both climate scenarios, generating mean probability rasters for the year 2100.

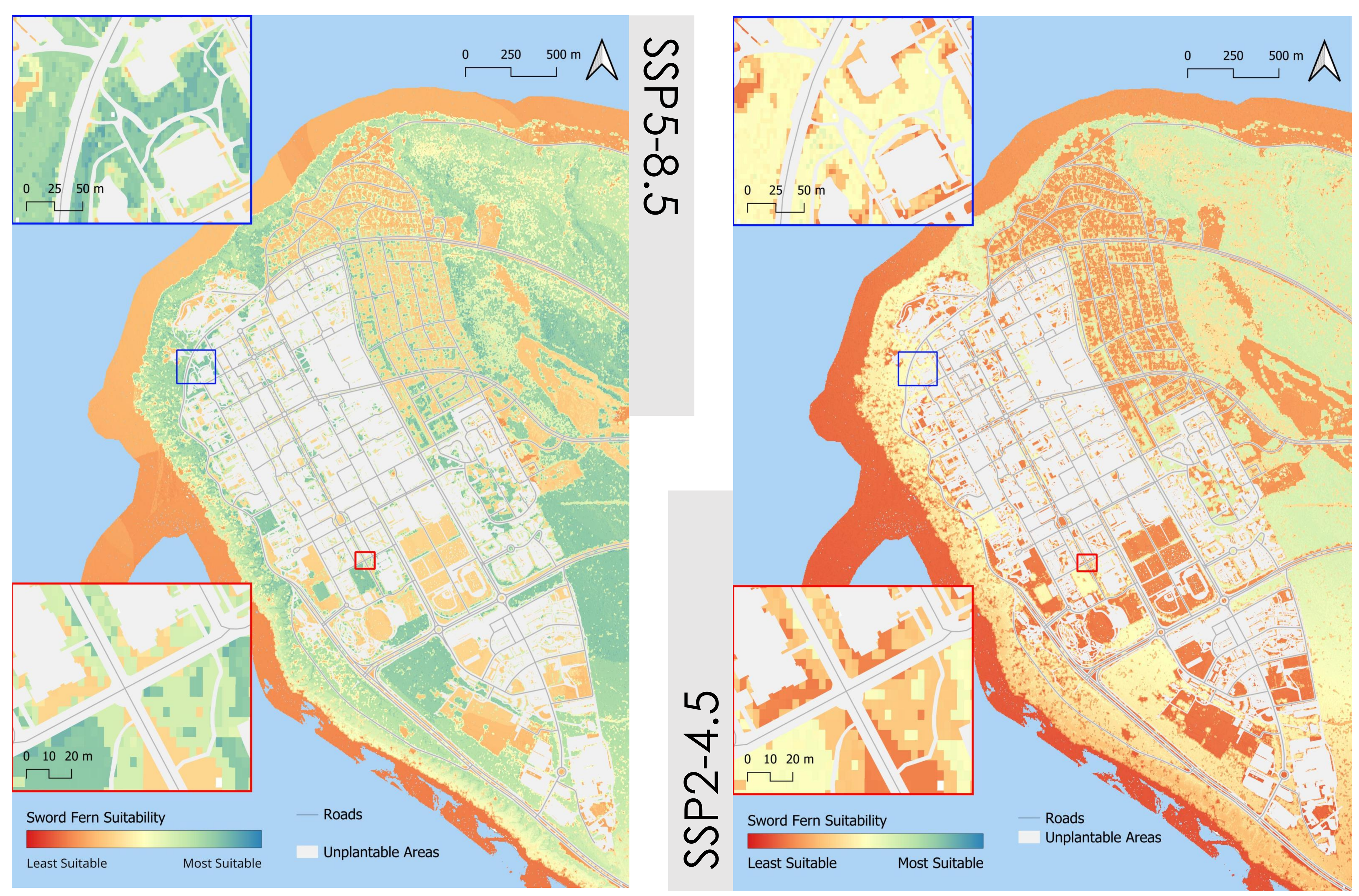
Results

Salmonberry Results



- SSP5-8.5 scenario has planting suitability values ranging from 0.048 to 0.933.
- SSP2-4.5 scenario has planting suitability values ranging from 0.008 to 0.362.

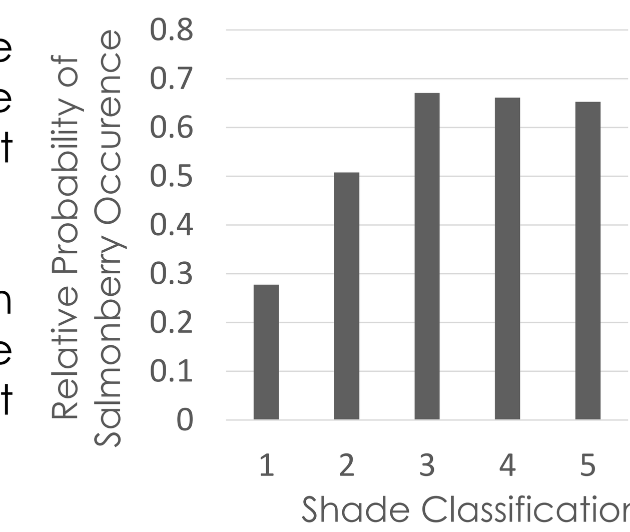
Sword Fern Results

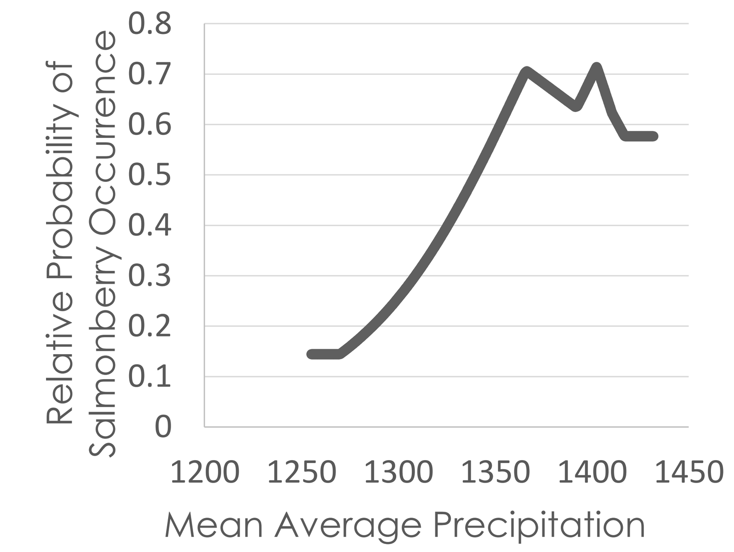


- SSP5-8.5 scenario has planting suitability values ranging from 0.145 to 0.896.
- SSP2-4.5 scenario has planting suitability values ranging from 0.089 to 0.715.

MaxEnt Model Results

- For each plant and climate scenario, shade was the variable with the largest contribution to the model.
- Mean average precipitation (MAP) and mean average temperature (MAT) in distant second and third place.





- Unlike the smooth shade response curve, MAT and MAP had jagged, spiking and noisy response curves.

Discussion

Salmonberry
- Results indicated a preference for moderate shade with high precipitation and temperature, aligning with known seedling preferences (United States Forest Service, 2019).

Sword Fern
- Results indicated a preference for full shade and high precipitation, aligning with known preferences (United States Forest Service, 2019).
- An unexpected preference for cooler temperatures may be due to the spatial concentration of occurrence data, mostly found in forested areas, intersecting with cooler areas of the studied area.

Model performance
- Potential overfitting, with shade contributing up to 92% of predictions, possibly due to limited environmental variability.
- Jagged response curves for temperature and precipitation further indicates spatial bias.
- Reliance on complex relationships and low regularization multipliers may have reduced model generalizability.

Future improvements
- Incorporating soil data as a relevant local variable.
- Combining models at different spatial scales to improve climate variance representation.

References & Acknowledgments

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Plant images from: https://blogs.ubc.ca/coastal-plants/plants-of-bc/

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