

Final Project Proposal Form

Group Number 19

Group Members and Lab Sections

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Project Title and Description

Title: Suitable Kiwi growing Locations in BC

Description: The aim of this project is to find all suitable locations for kiwi plantations in BC

Project Data Acquisition

Dataset name	Data Type: Vector, raster, or tabular	Key Attributes: What features/phenomena does this dataset represent?	Source
Elevation : Topography	Raster	To find areas with suitable elevation	hectaresbc
Aspect : Topography	Raster	To find areas with suitable aspect	hectaresbc
Slope : Topography	Raster	To find areas with suitable slope	hectaresbc
Mean Annual Temperature : Climate Most Recent Decade	Raster	To find areas with suitable temperature	hectaresbc
Mean Annual Precipitation : Climate Most Recent Decade	Raster	To find areas with suitable precipitation	hectaresbc

Soil Development : Soil Landscapes	Raster	To find areas with suitable soil orders	hectaresbc
Number of Frost Free Days : Climate Most Recent Decade	Raster	To find areas with suitable climate	hectaresbc
Roads	Vector	To find areas where roads are present	databc

Project Analysis (a rough outline of your analysis steps in bullet point or flowchart is fine)

- Project to BC Albers
- Project vector road layer
- Isolate the suitable areas by using raster calculator and reclassification on raster layers
- Create maps to show individual layers (for data visualization)
- Use model builder to create the flowchart of all the steps
- Write report

Final Project Report

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Introduction

Using ArcGIS Pro and data acquired from Hectares BC, the Provincial Agricultural Land Commission, and DataBC, we wanted to determine locations suitable for growing the kiwi fruit. In recent years, more research has been conducted on the viability of large-scale vineyards in the Pacific Northwest. Kiwi growing serves to benefit British Columbia by expanding its agricultural and economic potential, especially since Canada imports nearly \$60 million CAD of kiwi from exporting countries every year (Canadian Importers Database, 2020). Locally grown fruit has the potential to create economic opportunity and growth. BC is the only place in Canada where kiwifruit is commercially grown. In BC, kiwifruit is grown almost exclusively on the southern tip of Vancouver Island (British Columbia Agriculture in the Classroom Foundation, 2008). Since the commercial demand for kiwifruits has increased dramatically since 1985, we would like to explore possible growing places for kiwifruits in BC. *Our research aims to determine if British Columbia is host to regions with suitable geographical and climate conditions for growing kiwis.*

For our analysis, we have based our growing requirements on the most common kiwifruit cultivar, “Hayward”, of the *Actinidia deliciosa* species.

Kiwi Growing Conditions:

- Sun exposure: Full Sun
- Soil Type: Loamy/Sandy, well-drained soil
- Temperature: -12 to 45 °C
- Precipitation: ≥1250mm
- Days without frost: 225 days

Data Sources

A chart documenting all of the data used can be seen below. All data was provided by Hectares BC, the Provincial Agricultural Land Commission, and DataBC.

Datasets Used For Analysis

Dataset	Data Type	Details	Source
Agricultural Land Reserve	Vector	Shows land where farming is encouraged	Provincial Agricultural Land Commission
Mean Annual Precip. : Climate Most Recent Decade	Raster	Avg. annual precipitation for an area	Hectares BC
Vegetation Cover: Soil Landscapes	Raster	Vegetation coverage in BC by location	Hectares BC
Number of Frost Free Days: Climate Most Recent Decade	Raster	# of days a year w/o frost	Hectares BC
Mean Annual Temp. : Climate Most Recent Decade	Raster	Avg. annual temp for an area	Hectares BC
Roads	Vector	Roads in BC	DataBC

Methods for Finding Suitable Kiwi Vineyard Locations in BC

The first step in our analysis was to download all the necessary datasets. All the raster data was downloaded from Hectares BC, and the vector data was downloaded from Data BC and the Provincial Agricultural Land Commission, hence all layers were projected through the NAD 1983 BC Environment Albers coordinate system. Slight angling can be observed on the map which would be due to the said projection. The Agricultural Land Commission was established under the Provincial government in 1973, with the intent of highlighting areas where agricultural land use is promoted (BC Gov News, 2019). Such areas, better known as Agricultural Land Reserves, have some of the most fertile soils in British Columbia and therefore need to be protected from urban development. All the layers were added to the base map.

The analysis began by creating a suitability index designed to determine which areas were the aptest for growing kiwis in British Columbia. This was done by reclassifying the rasters and using a raster calculator to produce values that can be turned into classes of suitability.

1. Vegetation Cover was reclassified by giving areas with agricultural cover, coniferous forests, deciduous forests, mixed forests, grasslands, parklands, and shrublands a value of 1. All other types of coverage were given a value of zero as they are not suitable to be converted into agricultural use.
2. Reclassification for Mean Annual Precipitation was done so that all areas between 1,250mm and 2,249mm were reclassified with a value of 1, while all other values were

assigned a value of zero. Water availability greatly determines the plant's establishment and fruit size. Therefore, emphasis is placed on the minimum precipitation value of 1250mm as anything below that would likely lead to plant deformations and excess water use (Salinger & Kenny, 1995). Additional irrigation methods may be required to account for dry spells.

3. Reclassification for the Number of Frost Free Days was done so that all values above 225 were reclassified as 1, and all below were reclassified as zero. This is to ensure that fruits can have adequate time to grow and mature to size (Davis & Strik, 2021).
4. Reclassification for the Mean Annual Temperature was done so that all temperatures above -12°C were given a value of 1 while all below were given a value of zero. Dormant kiwi vines cannot tolerate temperatures lower than -12°C (Morton, 1987). No upper bound value was used because the highest annual average temperature was only 10.9°C which is still a suitable temperature given that kiwis can survive in temperatures up to 40°C.
5. The Agricultural Land Reserve was reprojected from vector polygon to a raster layer, which was then reclassified. This raster was given a single value of 1, as all the area was suitable.

All the rasters were then compiled into the raster calculator with the following formula:

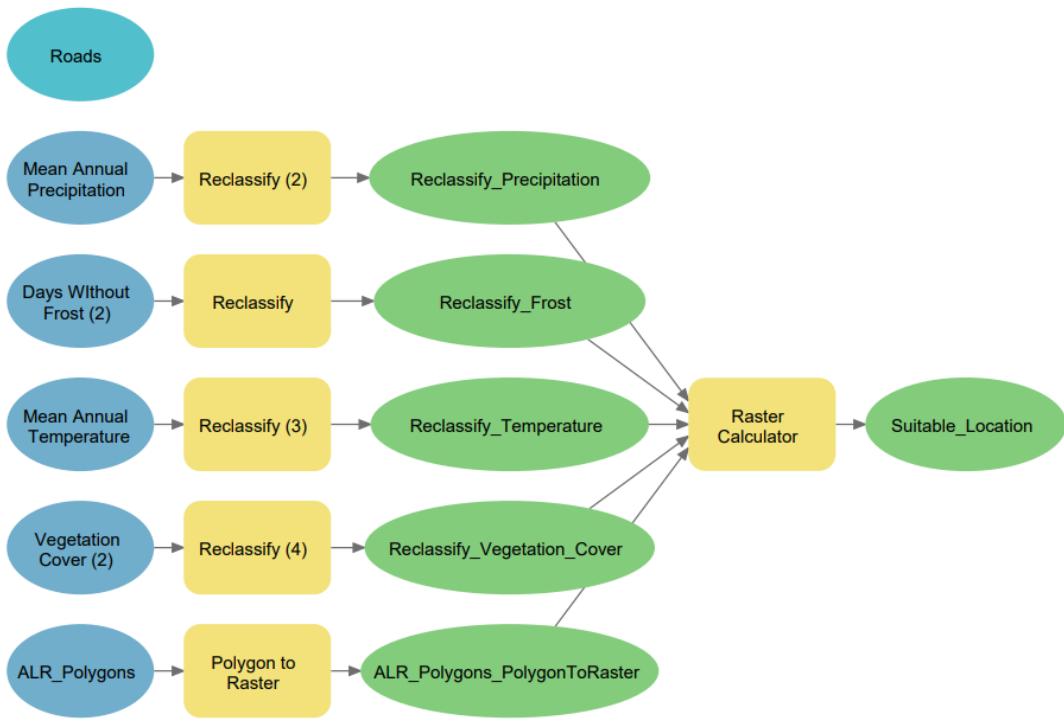
$$\text{Vegetation Cover}^* \times (\text{Precipitation} + \text{Temperature} + \text{Frost Free} + \text{Agricultural Land Reserve})$$

*Vegetation cover was multiplied to the sum of all other values because given that the vegetation cover was incompatible with any sort of growing (value of 0), ex. a bog, then the suitability of said location would automatically be given a value of 0 since even if other factors were ideal, the land is still unsuitable for any sort of agriculture. Vegetation cover was not added since the final suitability value could be unclear. If vegetation cover was added, then the maximum suitability value would be 5. However, any other suitability values would be unclear as the vegetation cover would be unknown despite it being a necessary condition for agriculture whereas other factors are sufficient conditions.

This would result in a numerical answer between 0 and 4. A zero would denote an incompatible vegetation zone. Although a 1 is possible, we did not encounter it within our model. Both 1 and 2 would be unfeasible for growing, as only one or two of the growing conditions were met. A 3 would denote a feasible growing location as it met 4 of the conditions. A 4 would be the most suitable, as it would be a location where all the categories are sufficient for kiwi growth, as well as being within the Agricultural Land Reserve.

Roads were then added to contextualize the connectivity of the suitable areas to major roadways and cities in BC.

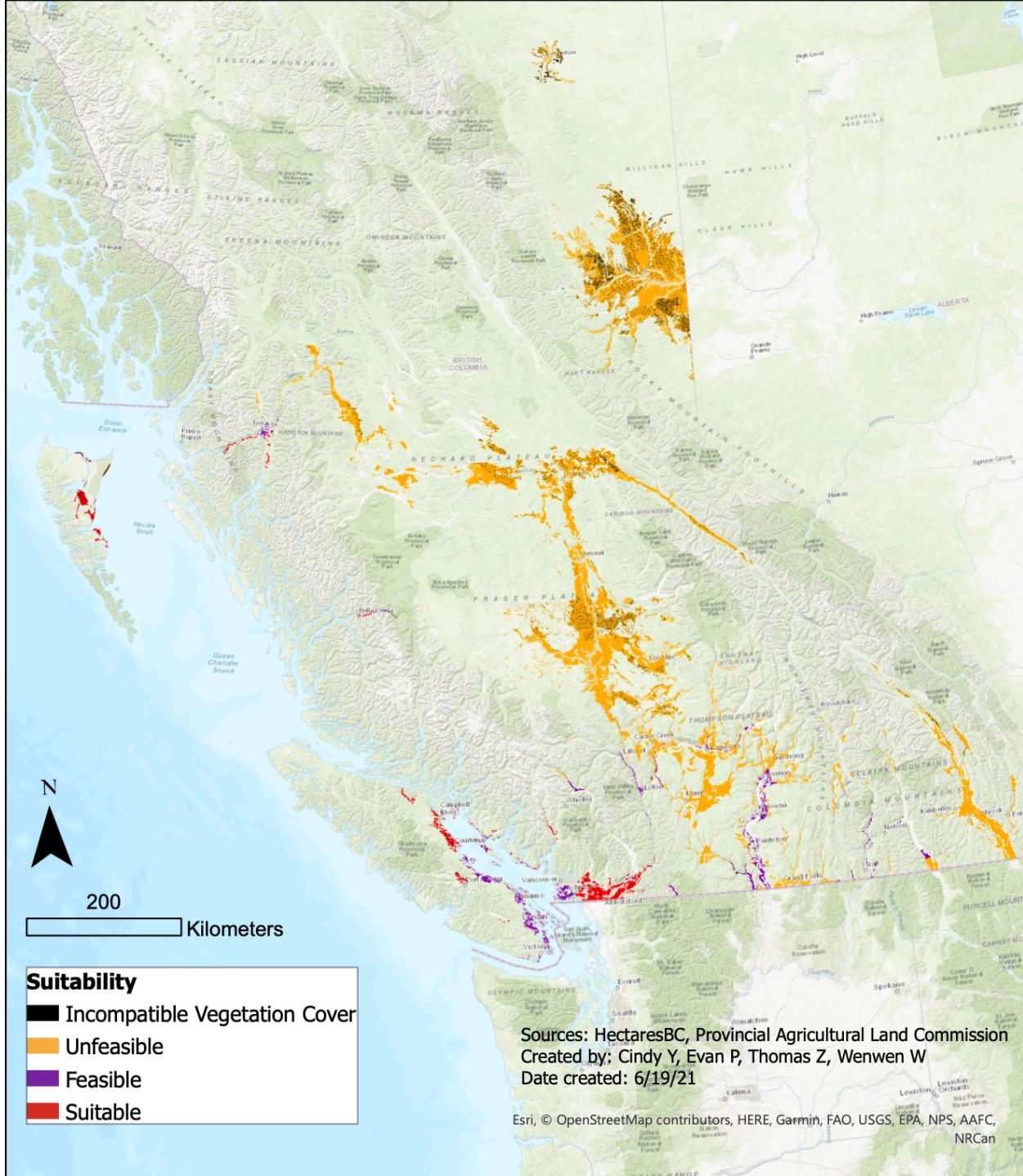
The methodology can be followed in the model flow chart:



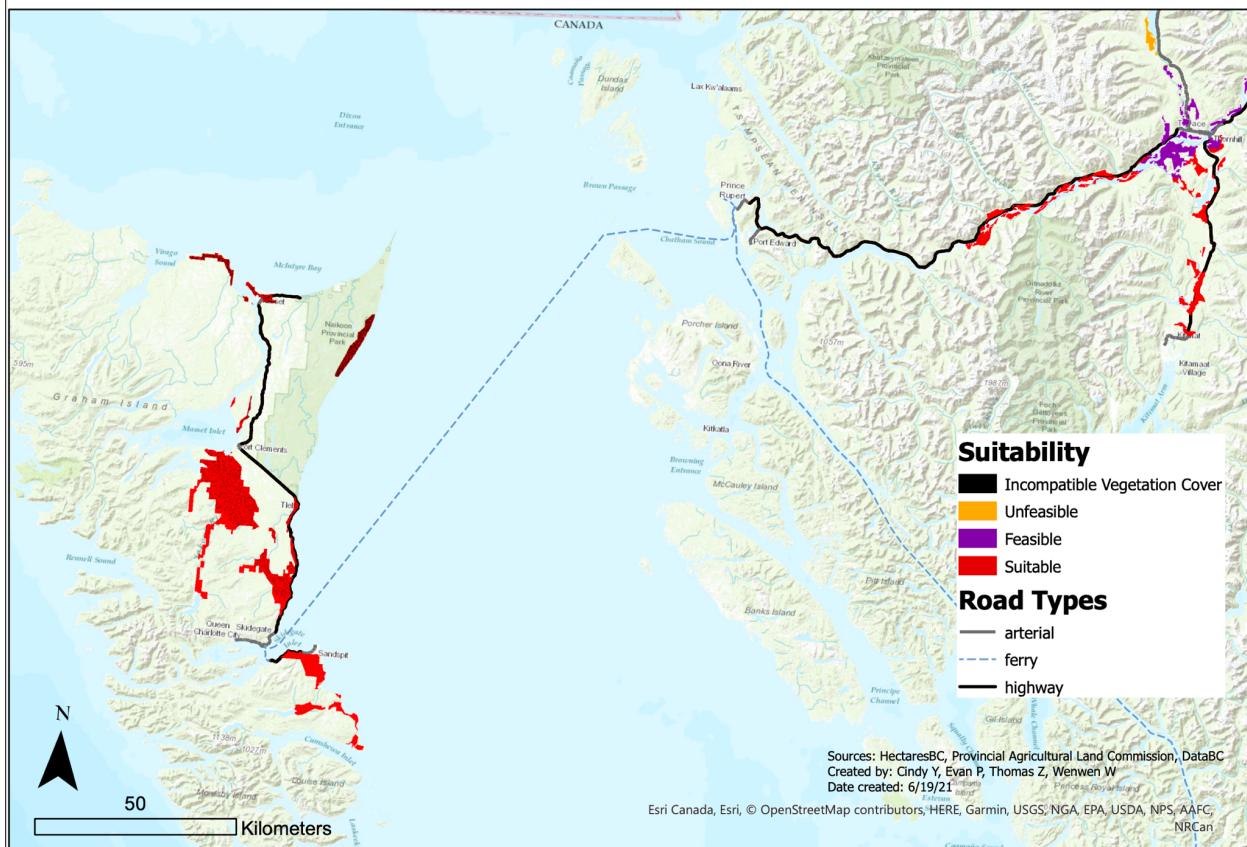
Results

Ultimately, we found a few regions in British Columbia that are suitable for kiwi growth. We found a heavy concentration of suitable areas near and on Haida Gwaii, as well as the Metro Vancouver area. A look at the locations within British Columbia can be referenced in the map “Suitable Locations in British Columbia for Kiwi Growing” and a larger-scale look of Haida Gwaii and Metro Vancouver can be referenced in the maps “Suitable Locations Near Haida Gwaii for Kiwi Growing” and “Suitable Locations in Metro Vancouver for Kiwi Growing” respectively. Generally, both areas have climatic conditions where kiwi growing is possible and are close to major roadways for transport. Our results, however, are limited. We only took average values for temperature and precipitation, which could lack the representation of dramatic fluctuations in temperatures or precipitation that could preclude certain locations. Although we did find regions suitable for kiwi growth on paper, a more in-depth analysis is needed to determine whether a specific area is suitable for growth. This could include assessments of currently occupied space, topography, or accessibility.

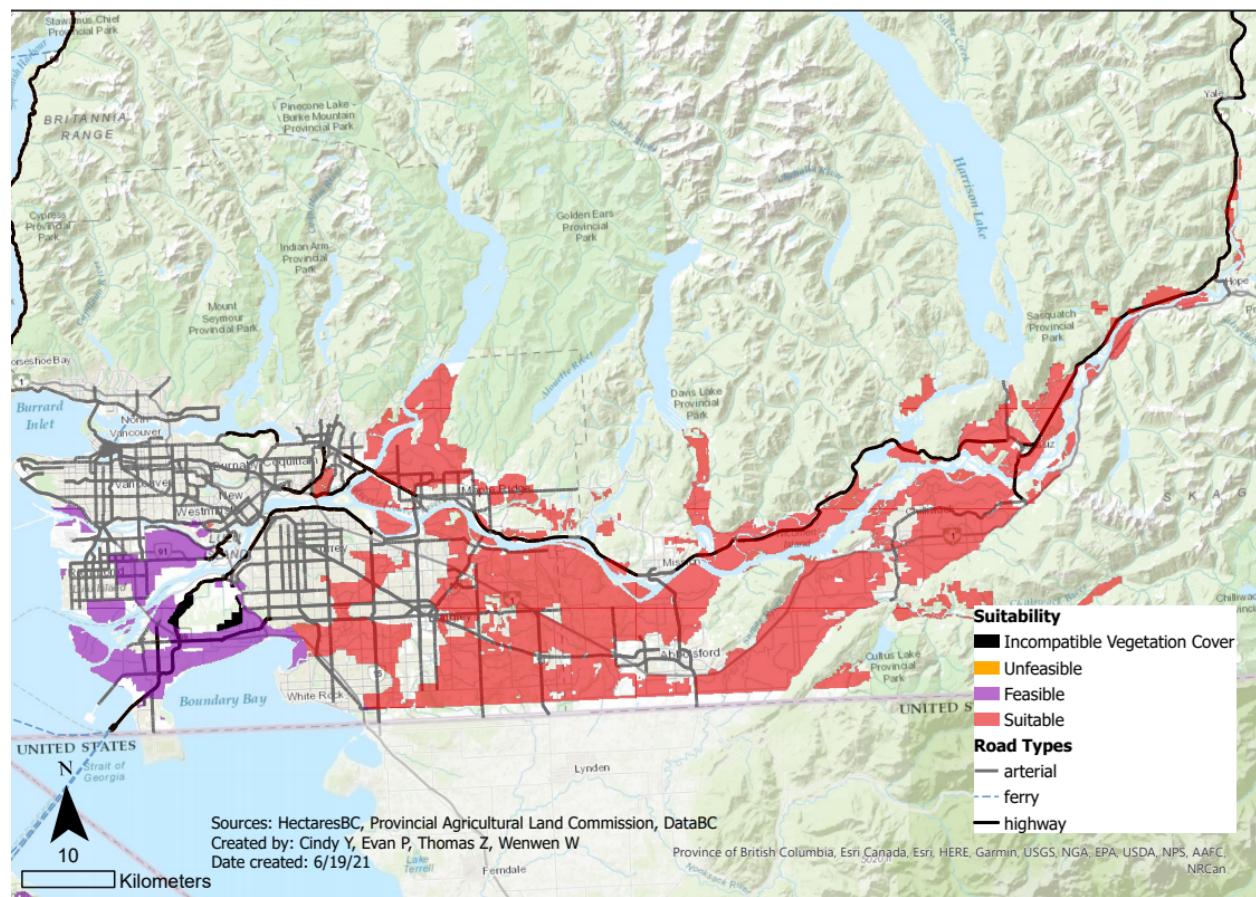
Suitable Locations in British Columbia for Kiwi Growing



Suitable Locations Near Haida Gwaii for Kiwi Growing



Suitable Locations in Metro Vancouver for Kiwi Growing



Conclusions

In conclusion, we did find areas in British Columbia that are suitable for growing the Haywood cultivar. Farmers may consider more hardy species like *Actinidia arguta* to expand areas of production. Future analysis could determine the most economical areas to grow kiwi, or take a more complex look into the areas we have found to determine their specific physical characteristics. Overall, our analysis did yield results that could be an initial step in expanding kiwi fruit production in British Columbia.

Bibliography

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