Agricultural Land Reserve of the Northern Rockies

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EXECUTIVE SUMMARY

This project was a biogeographical and social analysis into the Agricultural Land Reserve (ALR) of the Northern Rockies subpanel region. Our main objective was to determine the true area size of the ALR within the Northern Rockies census division, excluding any land from the given estimate that was unsuitable for actual agricultural use. In our analysis we excluded areas of buffered roads and water features, poor soil types, slopes too steep for farming, park land, and areas containing reservoirs or quarries. In total approximately 5000 hectares of estimated ALR were eliminated, bringing the actual total of ALR in this subpanel to approximately 43119.4 hectares.

INTRODUCTION

In this project our group conducted GIS analysis to determine the true area of the Agricultural Land Reserve (ALR) in the Northern Rockies subpanel division. The Northern Rockies census division is located in the Northeastern corner of British Columbia. In order to determine the actual ALR area for this particular subdivision, data for the ALR was collected and analyzed using a series of GIS techniques. This data was processed and compiled into maps, as well as analyzed to obtain specific area values. In order to obtain the most accurate ALR estimate, certain elements of the topography such as roads, rivers, and parks had to be excluded from the total area of the Northern Rockies ALR. Data used for this project includes TRIM data, environmental survey information, and census and demographic data. This data was downloaded primarily from government websites. Our study focused on two major topics of investigation categorized into biogeographical and social analysis. Biogeographical analysis looked at the natural aspects of the landscape such as soil type, and water features. Social analysis explored human interactions with the area, including population demographics and manmade implementations such as roads.

OVERVIEW

In the original shapefile for the Northern Rockies subpanel region, the total ALR land area was 48432.6 hectares. This represents 0.6% of the complete census division area. A visual representation of the reported ALR land can be seen in Map 1 of the appendix.

BIOGEOGRAPHICAL

In the original shapefile for the Northern Rockies there is a variety of land cover types. The land cover types, and amount of area each covers in the ALR is outlined in the table below. A visual representation of this data can be seen in Map 2 of the appendix. In order to identify the different types of land cover, the land cover shapefile was first clipped to the Northern Rockies ALR region. Then, a table of the different land cover types was made, and this was used to determine the area of each land cover. The percentages of total area covered where then manually determined by dividing the area of the land cover type, by the total ALR area of our census division, and multiplying by 100.

Land Cover Type	Area (ha)	Percentage of Total Area
Cloud	3100.0	6.4%
Shadow	14.5	0.03%
Water	678.0	1.4%
Rock/Rubble	2.4	0.005%
Exposed Land	2905.9	6.0%
Developed	48.4	0.1%
Tall Shrub	1.9	0.004%
Low Shrub	3002.8	6.2%
Wetland Tree	1743.6	3.6%
Wetland Shrub	96.9	0.2%
Wetland Herb	775.0	1.6%
Herb	435.9	0.9%
Annual Crops	1210.8	2.5%
Perennial Crops and Pasture	435.9	0.9%
Coniferous-Dense	48.4	0.01%
Coniferous-Open	5279.2	10.9%
Coniferous-Sparse	48.4	0.1%
Broadleaf-Open	28236.2	58.3%
Broadleaf-Sparse	48.4	0.1%
Mixed Wood-Open	435.9	0.9%

Upon analysis of land cover types, water features were identified using TRIM data. By opening and identifying the different categories of water features in the layer properties, converting the necessary line water features into polygons, then clipping the features to the ALR area, and finally applying a 10m buffer, areas of water features were identified. The percentage of land occupied by water features was once again determined manually using the same procedure as for the land cover types. Analysis determined that the total area of water within the the ALR was 2293.7 ha divided as 222.5 ha of lake area, and 2071.2 ha of river area. This means that 4.735% of the ALR in the Northern Rockies region is water features.

In addition to classifying land cover types and water features, our analysis also identified the soil agricultural capability class types. In a similar fashion to the prior analysis performed, area of each soil class was determined and calculated as a percentage of the total ALR area. Data was downloaded from British Columbia's ministry of environment website, and clipped to the area of the ALR. The summarize function was applied to divide the region by soil class. This information is outlined in the table below, and visual representation of both water features and soil classes is presented in Map 3 of the appendix.

Soil Class	Area (ha)	Percentage of Total Area
Class 0: Organic soils	3063.5	6.3%
Class 1: No significant limitations in use for crops	807.1	1.67%
Class 2: Moderate limitations	2373.5	4.9%

Class 3: Moderately severe limitations	23376.0	48.3%
Class 4: Severe limitations	12064.2	24.9%
Class 5: Very Severe limitations	4422.4	9.1%
Class 6: Capable of only producing perennial forage crops, improvement practices not feasible	18.9	0.03%
Class 7: No capacity for arable culture or permanent pasture	1814.6	3.7%
Undefined	367.7	0.07%

Land considered too steep for agriculture exceeds a 30-degree slope. In order to determine what area of land was too steep for agriculture in our subpanel, raster slope data was downloaded from the government of Canada GeoGratis website. This raster data was clipped to the area of ALR and then reclassified to highlight any areas that were steeper than 30 degrees. In our subpanel region, 14.5 ha or 0.03% of the total ALR area exceeds a 30-degree slope. Areas too steep for agriculture are shown in Map 4 of the appendix. According to the 2011 Agricultural Census, obtained from the government of British Columbia website, the Northern Rockies ALR has 8068 ha of farmland area amongst 28 farms. Of that farmland, 2144 ha is crops, 106 ha is summerfallow, 787 ha is tame or seeded pasture, 1288 ha is natural pasture land, and the remaining 3743 ha is other land. Of the entire crop area, 2079 ha are hay crops and 1 ha is sod that is grown for sale. Farm animal statistics tell us that there are 129 chickens, 714 cows and calves, and 299 horses and ponies in the Northern Rockies ALR.

SOCIAL

The first step in our social analysis was road identification. In order to determine the type of roads and the number of kilometers the roads occupied of the ALR, the road file obtained from the TRIM data was clipped to the ALR region, and roads were selected by attribute. The table below describes the types of roads and their corresponding lengths.

Road Type	Length (km)
Gravel Road 1 Lane	8.1
Gravel Road 2 Lanes	84.8
Overgrown Roads	54.0
Paved Roads 2 Lanes	1.1
Rough Roads	24.2
Decommissioned Roads	588.2

Upon determining the type and length of the roads, a 10m buffer was applied to the roads, and it was found that the total land surface covered by buffered roads is 1673.3 ha, or 3.5% of the total

ALR of the Northern Rockies. All roads of our region are depicted pictorially in Map 5 of the appendix.

Then using Provincial and National Park data downloaded from DataBC and clipping it to the size of our subpanel region, it was determined that 118.5 ha or 0.2% of the ALR is in parks. It should be noted that upon trimming the data, no National Parks appeared within the ALR subpanel region. Furthermore, Poplar Hills, the only golf course in the vicinity also did not fall within the Northern Rockies ALR region. This data is visually represented in Map 6 within the appendix.

The next procedure of social analysis was determining population size and demographics of our ALR. By using Population of Census Data from Census Canada, it was established that the Northern Rockies have a population of 5578 persons, with Fort Nelson, which is not within our ALR boundary, boasting 3902 of those people. Due to the fact that the Northern Rockies census area has such a small population, with 70% of the population falling within Fort Nelson itself, most of the inhabited ALR regions cannot be estimated strongly. Even population subsections within the Northern Rockies census area are so large due to sparse population, a strong estimate can not be formulated. Demographic data was also obtained from the census area of the Northern Rockies. Once again, due to the very low population density of our region ($0.06/km^2$), and the fact that most of the dissemination areas fall within Fort Nelson, it is difficult to even gauge a rough estimate of populations within this ALR zone. However, the following demographic data was collected from census Canada and compiled into the graphs below.

Ethnicity Demographics in the Northern Rockies

Ethnicity	Total (people)	Male	Female
Aboriginals · First Nations · Metis	720 · 565 · 195	340 · 305 · 70	375 · 260 · 125
Europe · British Isles · French Origins · West Europe · North Europe · South Europe · East Europe	3660 · 2685 · 660 · 1110 · 330 · 720 · 100	1960 · 1450 · 275 · 555 · 160 · 360 · 55	1710 · 1240 · 385 · 555 · 170 · 360 · 55
Asia · South Asia · East Asia	350 · 150 · 165	240 · 85 · 135	115 · 60 · 30
Africa	0	0	0
South, Central Americas	0	0	0

| *Caribbean* | 0 | 0 | 0 |

Age demographics in the Northern Rockies

Age	Male	Female	Both Genders
0-14	635	545	1190
16-64	2210	1940	4150
65+	135	105	240
total	2985	2595	5580

Family Characteristics

Total Number of Families	1555
Number of 2 Person Families	725
Number of 3 Person Families	365
Number of 4 Person Families	310
Number of 5+ Person Families	155

Based on our research into the Northern Rockies ALR area, we believe that Quarries are the most prevalent threat to the ALR in our census division. This observation does not indicate an abundance of quarries in the area, it simply asserts quarries as potentially being the most harmful. It was found that only ten non-agricultural land uses fell within our ALR region. Eight of these non-agricultural land features are quarries, while the two remaining land uses are reservoirs. These ten land use areas make up a very small percentage of the ALR area (<1%), while the rest of the ALR is either still untouched, or in agricultural use. Quarries are considered most harmful due to a full loss of area that cannot be replaced, or restored to full potential. Also, if some quarries are not viewed as environmentally friendly, they can have a significant impact on the surrounding land. Neither quarries nor reservoirs are considered permitted under the law. Non-agricultural land uses are shown in Map 7 of the appendix.

SUMMARY

In the final processed shapefile, we found that the ALR represents approximately 43119.4 hectares of feasible agricultural land, which is about 0.5% of the entire census division area. The ALR of the Northern Rockies following our analysis is visually displayed in Map 8 of the appendix. Approximately 5000 hectares of land were eliminated from the original ALR estimate for our region. Crops cannot be grown on water bodies and roads located in the area, and thus 2293.7 ha of buffered water features and 760.4 km of buffered road were removed. It was necessary to add ten-meter buffer zones to rivers and roads to take into account fish riparian zones and areas around the roads that can not support actual agriculture. 118.5 ha of protected

parks were also eliminated, because although they can not be used for any commercial purposes, the area is considered to be of ecological importance and can not be converted into farmland. Reservoirs and quarries accounted for a small proportion eliminated land, because these are locations of the ALR that have already been repurposed and are not available to for agricultural use. Only areas of Soil Classification 6 and 7 were omitted, because these have been classified as areas that are either severely limited or unfeasible for growing crops. These two soil classifications amount to 1833.5 ha of area. While a large proportion of the remaining land has some limitations for use as farming lands, by the Agri-Canada's standards these areas can be improved with a number of practices and were therefore not eliminated. Likewise, 14.5 ha representing land that had a slope of 30 degrees or greater was also eliminated due to the impracticality of bringing in machines and farming techniques to use on these steep hills.

When comparing our analyzed shapefile to the original Northern Rockies ALR shapefile it is evident that the initial estimates of the Northern Rockies ALR is inaccurate. While it is clear that only a small proportion of the ALR has been incorrectly categorized, this is still a significant loss of potential crop area for the region. Considering that the small population of this region is relatively isolated from larger, urbanized cities; the approximately 5000 hectares of lost protected farmlands presents an unnecessary strain on the population's access to food. Furthermore, when taking into account the staggeringly small percentage of the Northern Rockies census district that was initially declared as ALR, any loss of serviceable crops is a huge detriment to the region. Upon further analysis of the Northern Rockies ALR we have come to the conclusion that a proper reclassification of the ALR is required to emphasize the importance of what little ALR can actually be used, and to assist local governments in prioritizing which areas need extensive improvement before any agriculture can even be produced in those spots.

ERRORS AND UNCERTAINTIES

Within this project there are many uncertainties, and errors which can occur. One source of uncertainty arises through the gathering of data for the project. We gathered information from numerous sources such as; Data BC, Stats Canada, the British Columbia Ministry of Agriculture, Natural Resources Canada, and the British Columbia Census of Agriculture. Although these sources seem reliable, it is very difficult to judge the accuracy and integrity of this data. It also can not be guaranteed that the data released to the public isn't biased or completely accurate. Further errors could arise from converting the data to the needed projection system. If there was an error in conversion, or a mistake in the data that was not repaired before conversion, all of the information contained within the analysis or maps would be inaccurate. Additionally, uncertainty in data could have been introduced during the actual collection of data. There may be errors in the actual positioning of features within the ALR if coordinate systems are not properly aligned. This may place some aspects of the landscape such as swamps in the ALR, when in fact they fall outside of the boundary. The date of data collection also factors into uncertainty of our analysis, because more recent data may account for additional development features such as new roads, or housing complexes which would take away from actual ALR area even further.

Uncertainties can also be identified in the maps themselves, due to scale and resolution. Certain features needed to be exaggerated in order to be seen on the maps. For example, on Map 5 in the appendix we see many lines representative of roads crossing through the map, but these

lines have been enlarged and therefore distorted in order to appear visible on the projection. This exaggeration of features can make the ALR appear smaller in size than it really is.

FURTHER RESEARCH/RECOMMENDATIONS

Our analyses of the Northern Rockies ALR is merely an initial look at the accuracy of the ALR estimates and further research must be undertaken in order to further evaluate the area in greater depth. The highest priority of local governments should be to expand the Agricultural Land Reserve. This initiative would require an intensive study of the surrounding areas in census districts to identify the locations of rich soils that are ideal for growing crops. Placing an immediate urgency on protecting these areas would prevent the unwise repurposing of crucial farmland areas that are already geographically limited for growing crops. Focusing on the already outlined ALR in our specific subpanel region, further research is necessary for gaining information of the area far south of Fort Nelson. This small square of ALR is considered important First Nations grounds and identifying whether or not the area is currently being used to grow crops will provide decision makers with better insight into managing the rest of the ALR. If there are portions of the ALR that are considered sacred ground, or are used for housing and not agricultural purposes, then that portion of farmland that is protected by the ALR will be further reduced. Collecting more relevant data will allow for better accuracy in ALR assessment. Some possible sources of data that should also be considered in ALR assessment include migratory patterns of birds in the area, and endangered species that use parts of the ALR as their habitat. Moreover, identification of areas within the ALR that are not easily accessible to farmers and as a result would require development, should also be excluded from future ALR estimates.
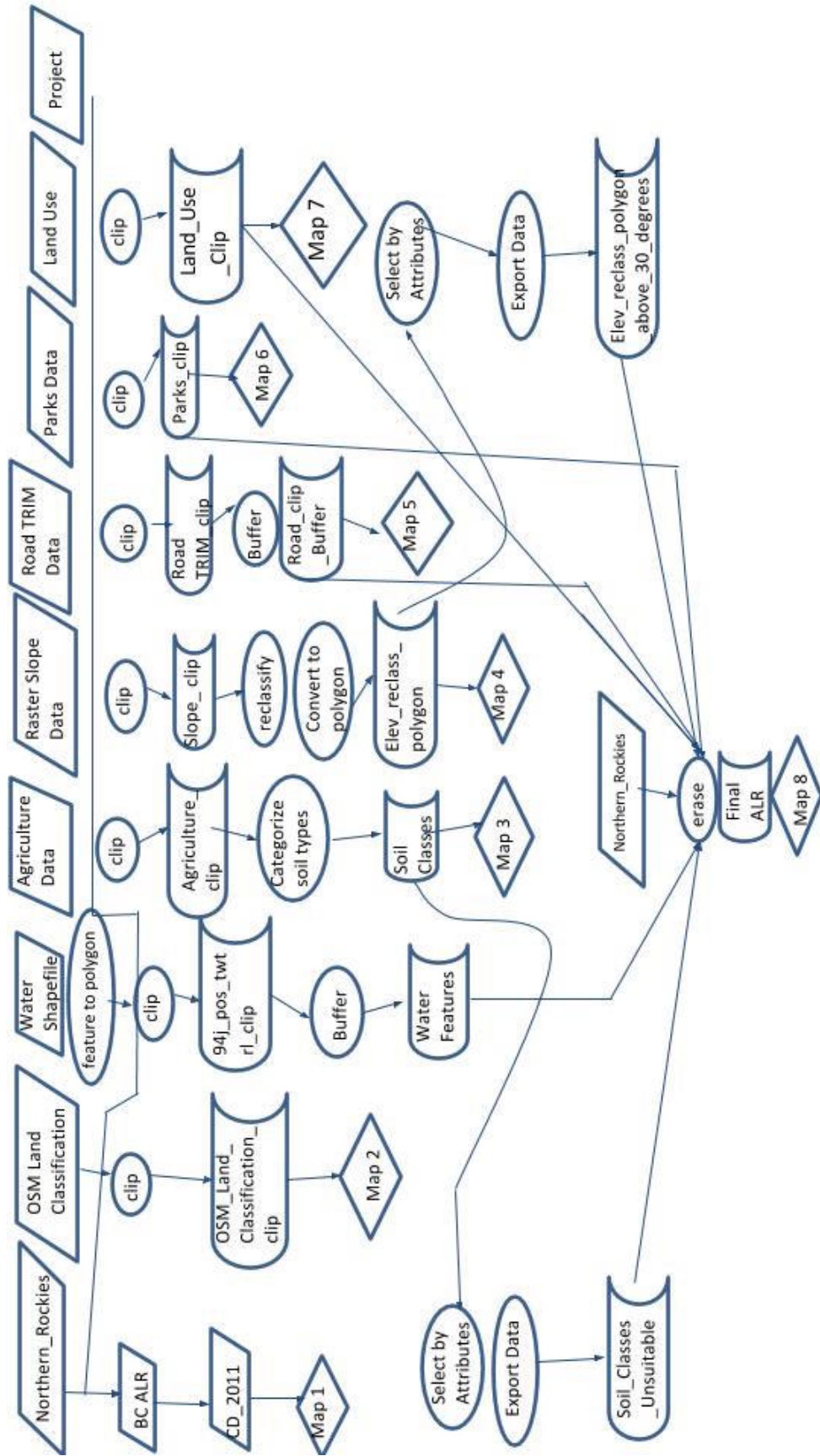
APPENDIX

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   =E&Geo1=CSD&Code1=5959007&Geo2=PR&Code2=01&Data=Count&SearchText=n
   orthern%20rockies&SearchType=Begins&SearchPR=01&B1=All&Custom=&TABID=1

Data Sources

- Data BC
- Stats Canada
- The British Columbia Ministry of Agriculture
- Natural Resources Canada
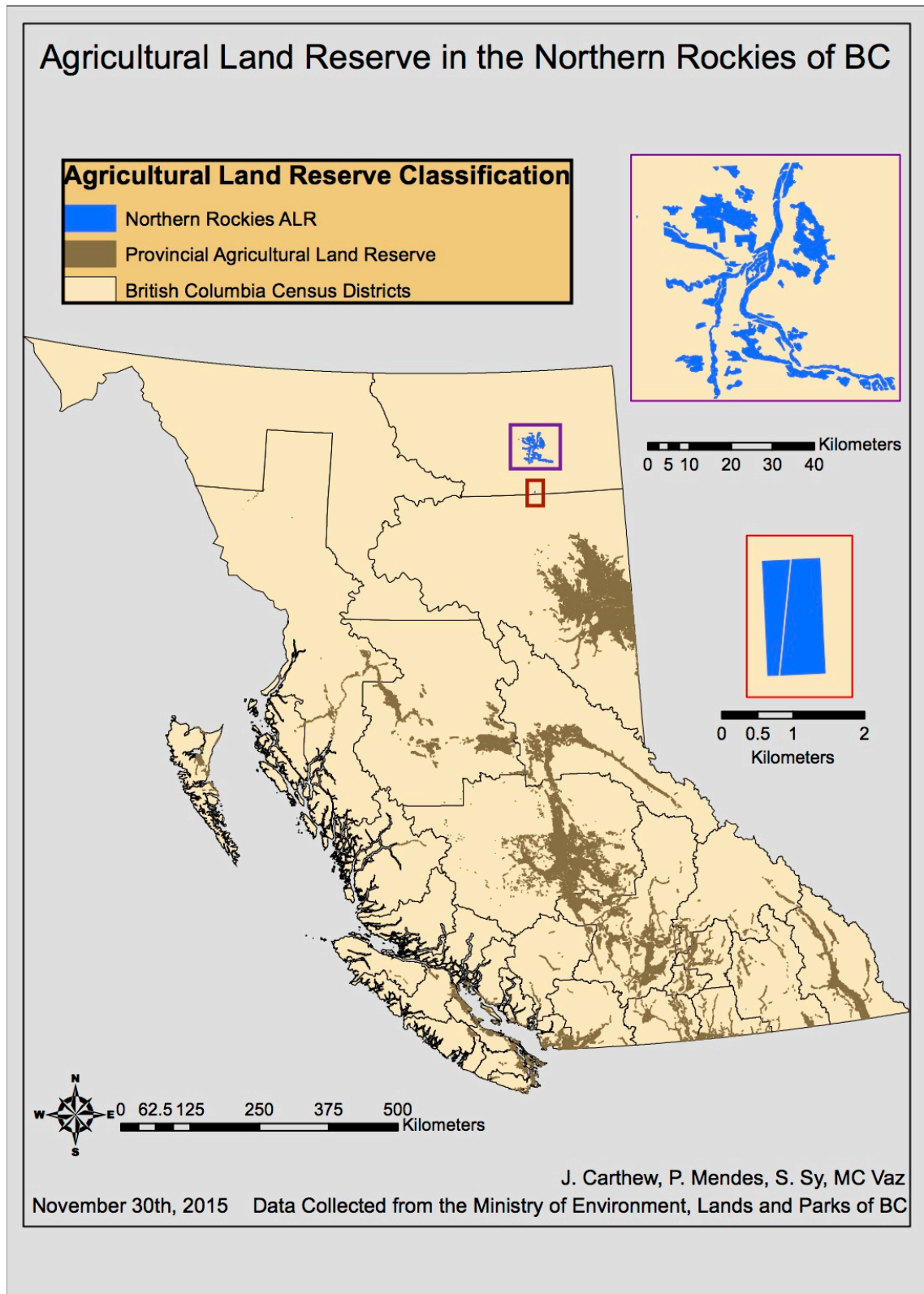- The British Columbia Census of Agriculture

Review of Team Member Contribution

- Overview – Everyone
- Biogeographical Analysis – James Carthew
- Social Analysis – MC Vaz
- Summary – Everyone
- Maps – Steven Sy
- Final Report – Patricia Mendes
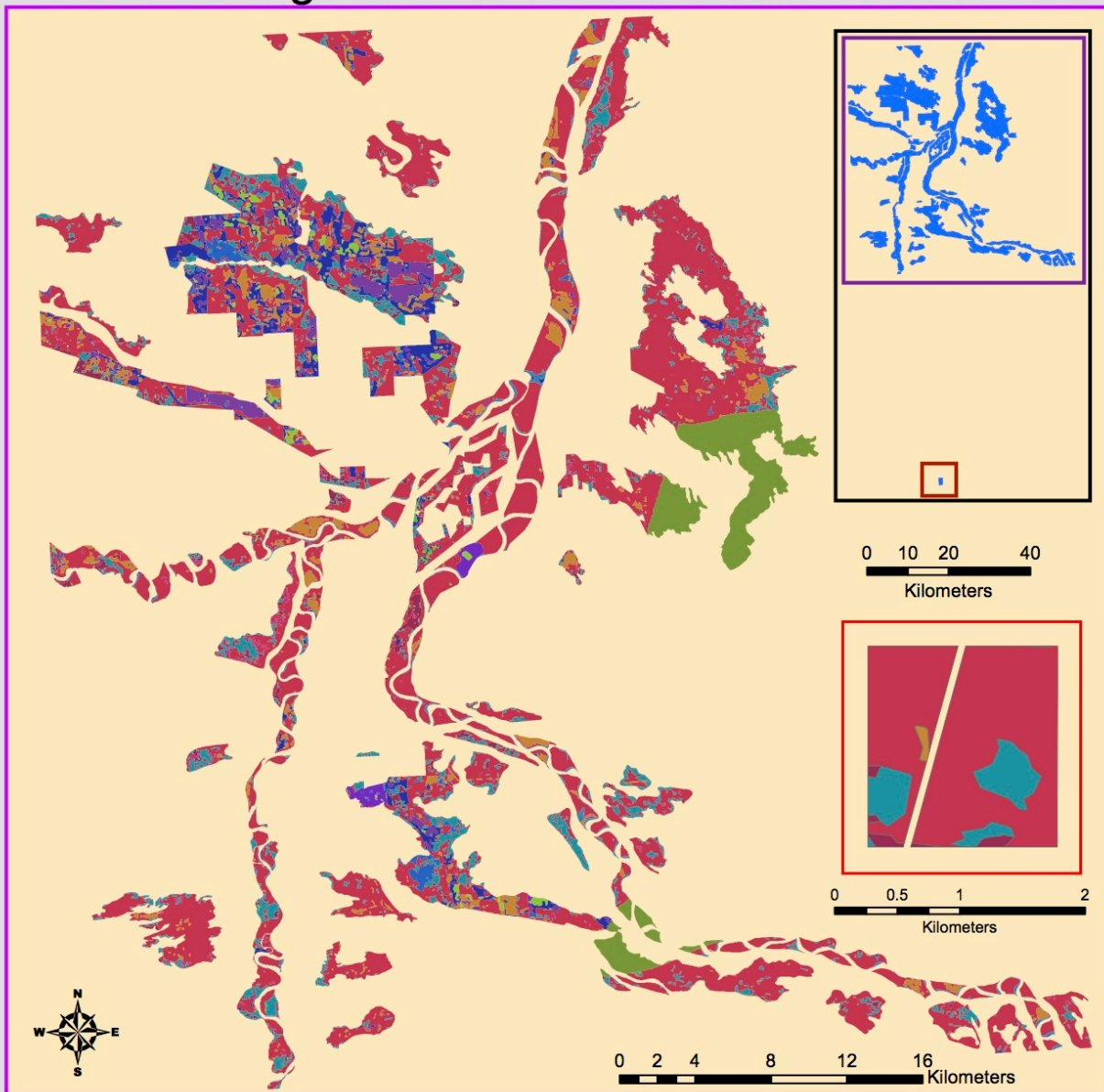- Flow Chart – Everyone
- References – Everyone

Flowchart

Map 1

Agricultural Land Reserve in the Northern Rockies of BC

Agricultural Land Reserve Classification
- Northern Rockies ALR
- Provincial Agricultural Land Reserve
- British Columbia Census Districts

Kilometers
0 5 10 20 30 40

0 0.5 1 2
Kilometers

N W E S
0 62.5 125 250 375 500
Kilometers

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November 30th, 2015   Data Collected from the Ministry of Environment, Lands and Parks of BC

Map 2

Land Coverage of the Northern Rockies ALR in BC

ALR Land Classification

Cloud	Developed	Wetland Herb	Coniferous Open	Outside ALR
Shadow	Tall Shrub	Herb	Coniferous Sparse	Northern Rockies ALR
Water	Low Shrub	Annual Crops	Broadleaf Open	
Rock/Rubble	Wetland Treed	Perennial Crops and Pasture	Broadleaf Sparse	
Exposed Land	Wetland Shrub	Coniferous Dense	Mixed Wood	

0   10   20   40
Kilometers

0   0.5   1   2
Kilometers
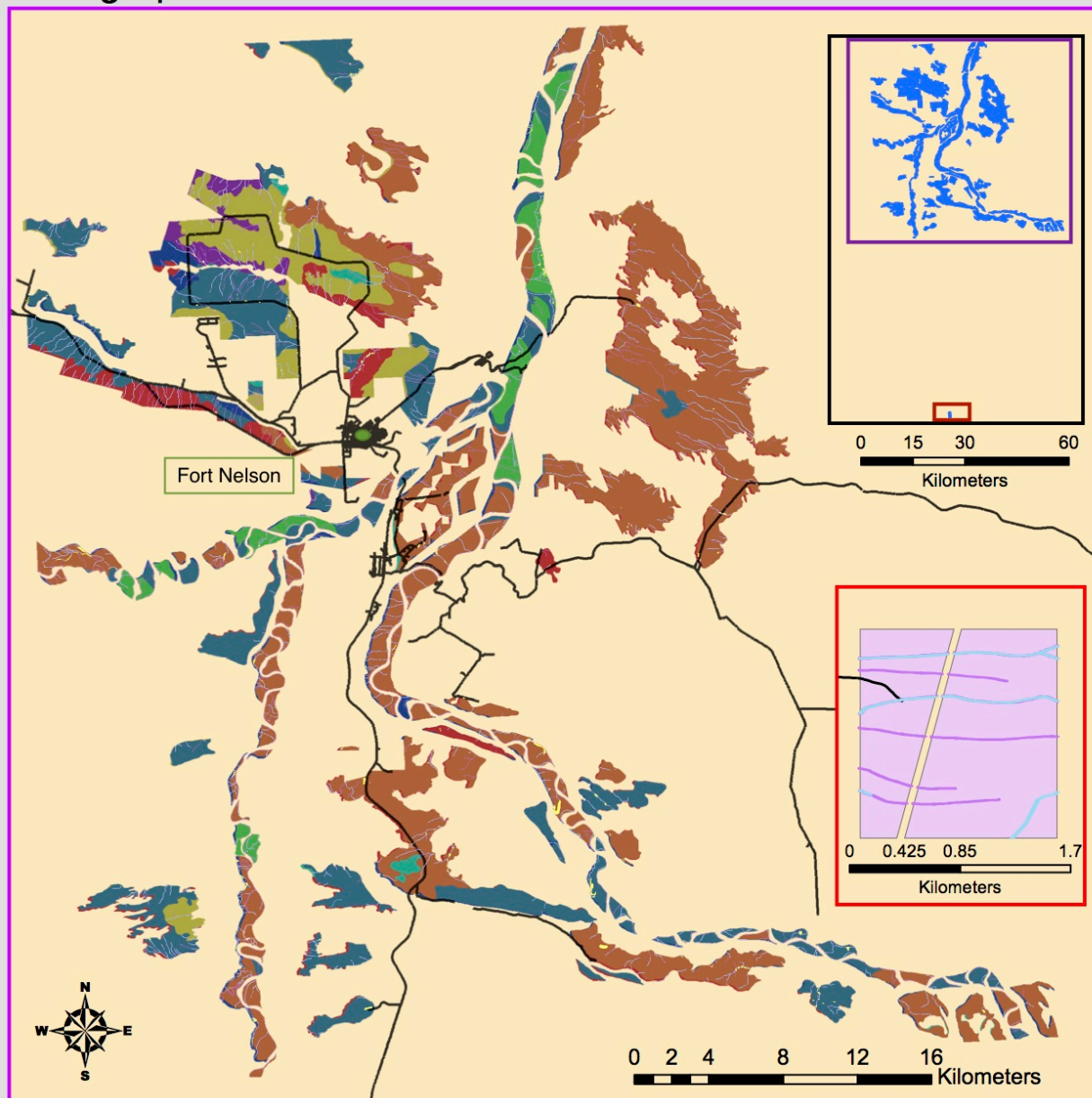
0   2   4   8   12   16
Kilometers

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December 3rd, 2015

Data Collected from the Ministry of Environment, Lands and Parks of BC

Map 3

Geographical Breakdown of the Northern Rockies ALR in BC

Fort Nelson

0   15   30   60
Kilometers

0   0.425   0.85   1.7
Kilometers

N
W   E
S

0 2 4   8   12   16
Kilometers

Waterbodies and Soil Classification of the ALR

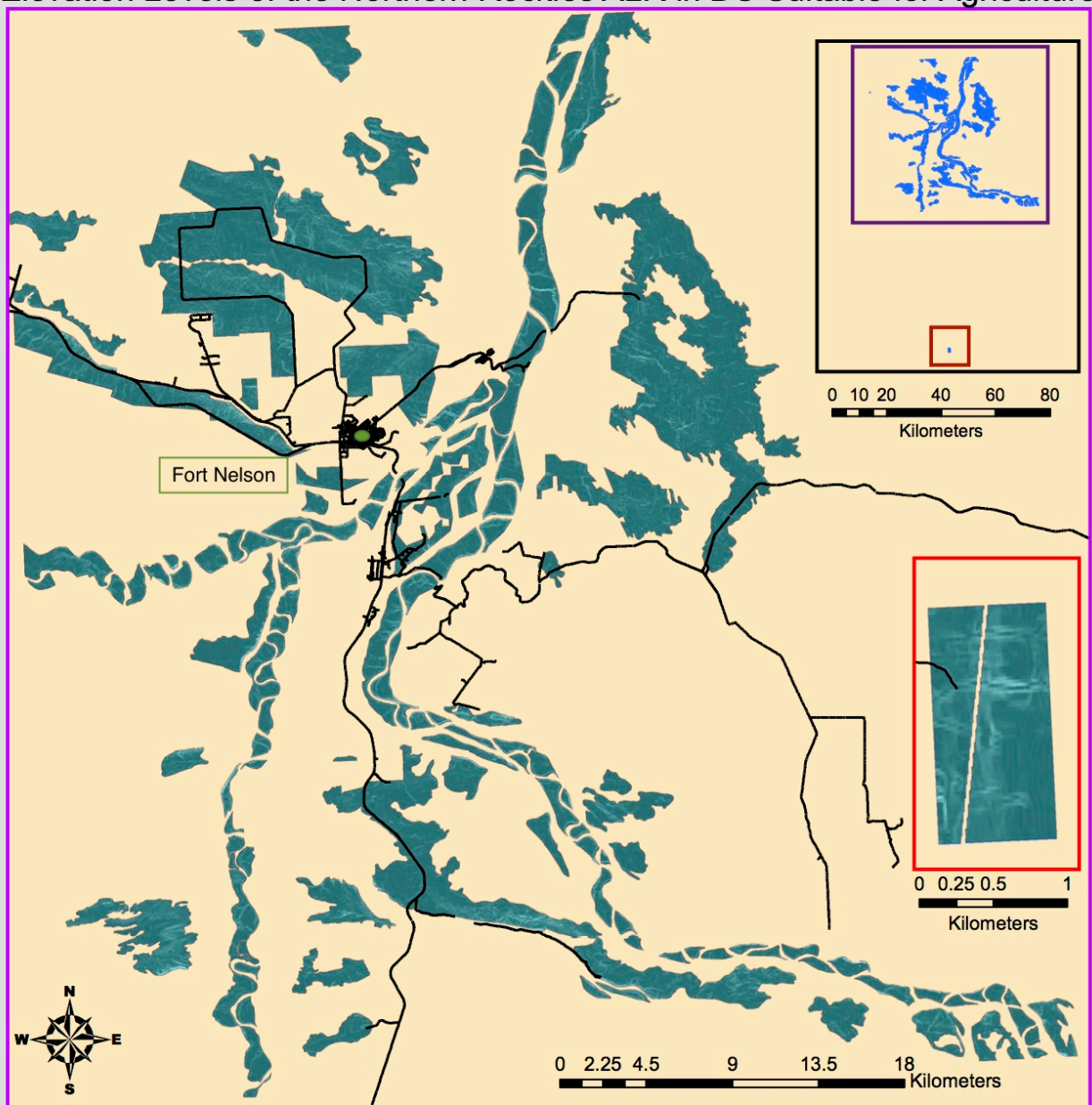|			
Waterways	Northern Rockies ALR	**Soil Agriculture Capability**	Satisfactory	Uncapable
Riparian Rivers	Outside ALR	**Class Types**	Limited	Unknown
Riparian Lakes		Ideal	Severely Limited	Organic
Main Roads		Moderate	Non-feasible	

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Data Collected from the Ministry of Environment BC, Canada and Agriculture and Agri-Food of Canada

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Map 4

Elevation Levels of the Northern Rockies ALR in BC Suitable for Agriculture

Fort Nelson

0 10 20   40   60   80
Kilometers

0 0.25 0.5   1
Kilometers

0   2.25 4.5   9   13.5   18
Kilometers

Elevation Classifcation Scheme by Steepness

—— Main Roads

Suitable for Agriculture (Below 30 Degrees)

Unsuitable for Agriculture (Above 30 Degrees)
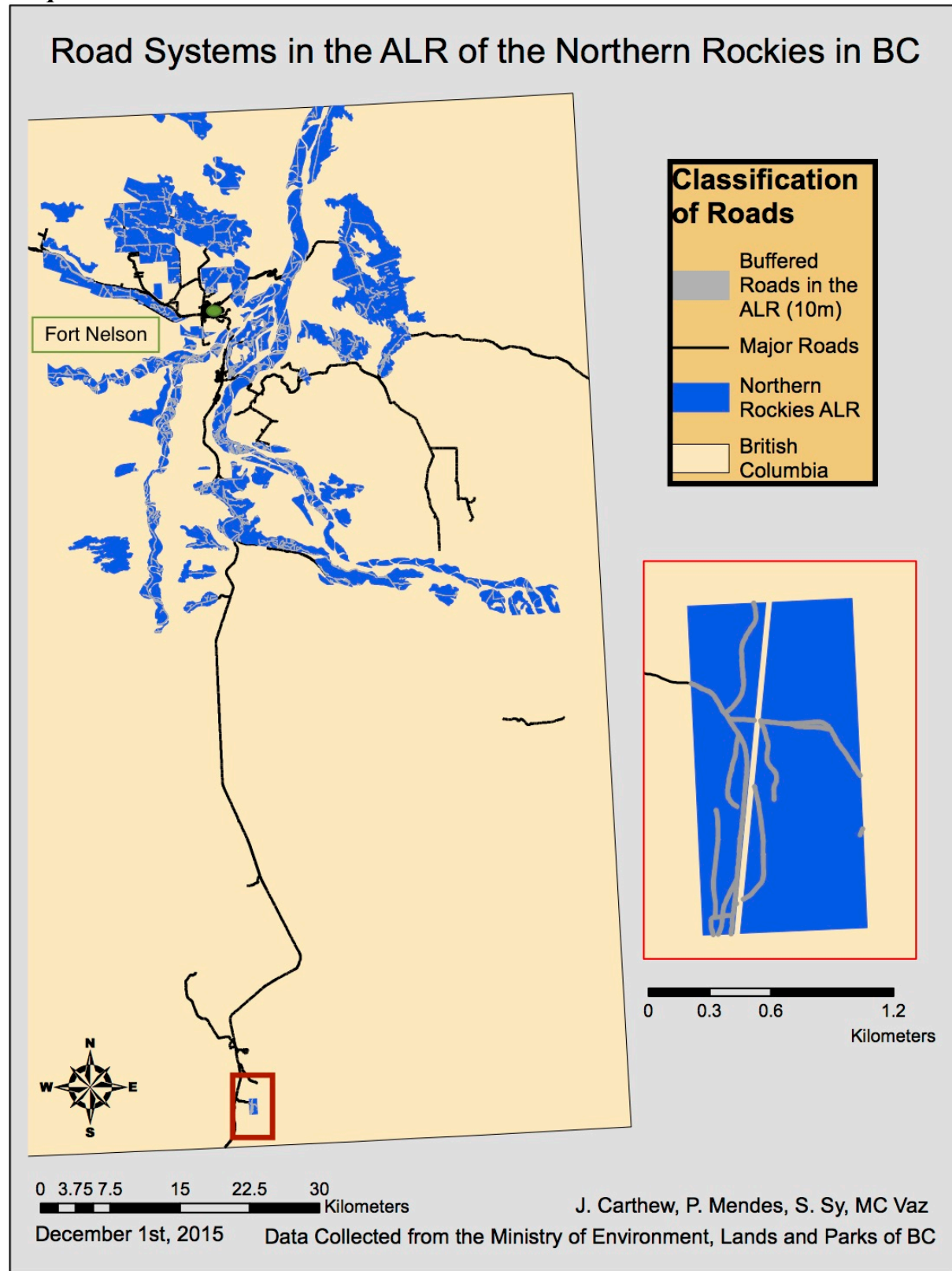
Northern Rockies ALR

Outside ALR

N W E S

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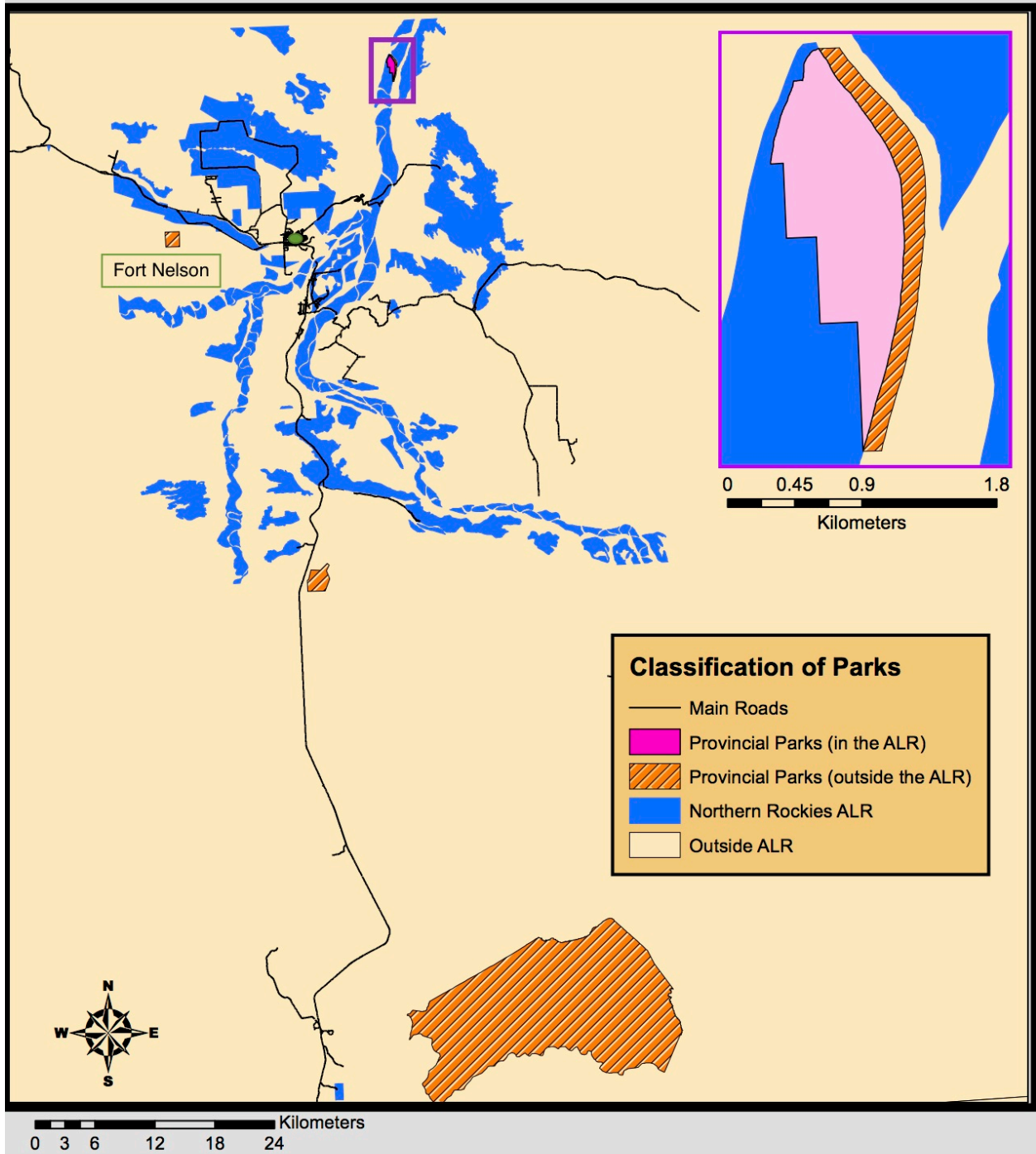Data Collected from the Ministry of Environment, Lands and Parks of BC and GeoGratis Canada

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Map 5

Road Systems in the ALR of the Northern Rockies in BC

Fort Nelson

Classification of Roads

Buffered Roads in the ALR (10m)

Major Roads

Northern Rockies ALR

British Columbia

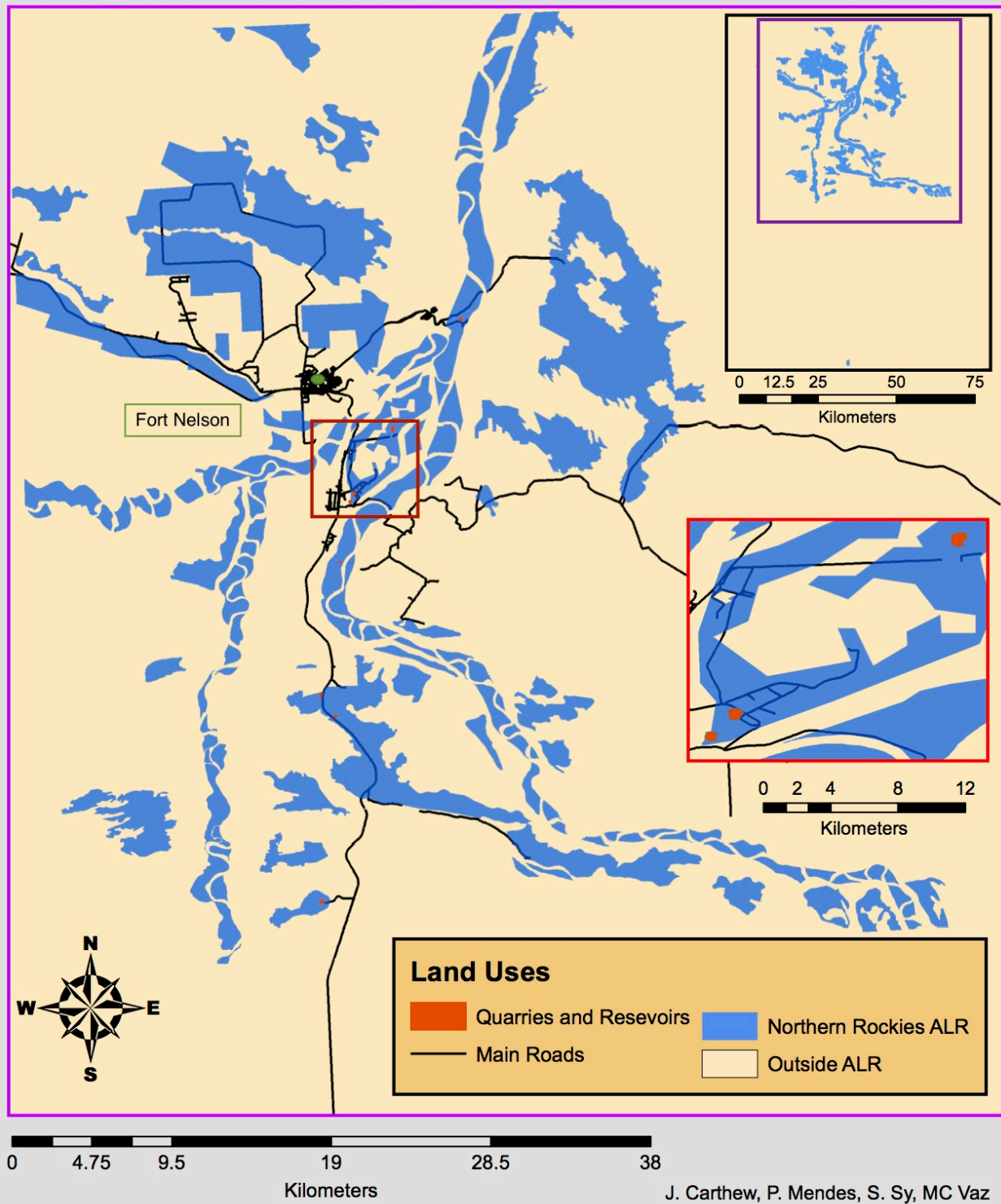0   0.3   0.6   1.2
Kilometers

0 3.75 7.5   15   22.5   30
Kilometers

December 1st, 2015

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Data Collected from the Ministry of Environment, Lands and Parks of BC

Map 6

Provincial Parks of the Northern Rockies ALR in BC

Fort Nelson

0   0.45   0.9   1.8
Kilometers

Classification of Parks
—— Main Roads
Provincial Parks (in the ALR)
Provincial Parks (outside the ALR)
Northern Rockies ALR
Outside ALR

N
W   E
S

Kilometers
0 3 6   12   18   24

December 4th, 2015

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Data Collected from the Ministry of Environment, Lands and Parks of BC and DataBC

Map 7

Non-Agricultural land Useage of the Northern Rockies ALR in BC

Fort Nelson

0 12.5 25   50   75
Kilometers

0 2 4   8   12
Kilometers

Land Uses

Quarries and Resevoirs

Main Roads

Northern Rockies ALR

Outside ALR

N
W   E
S

0   4.75   9.5   19   28.5   38
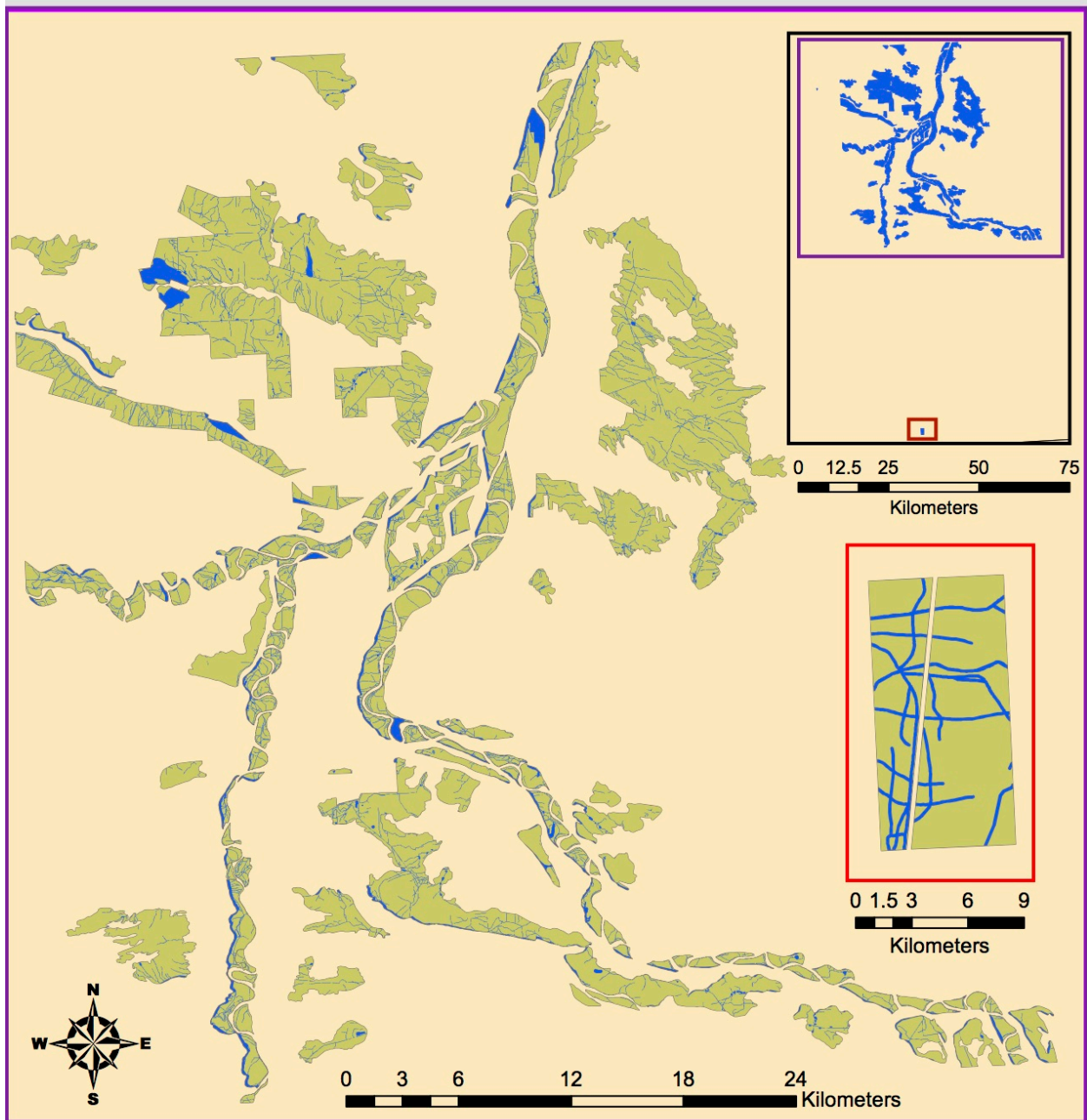Kilometers

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December 4th, 2015   Data Collected from the Ministry of Environment, Lands and Parks of BC and Open Street Map

Map 8

## Actual Agricultural Land Reserve of the Northern Rockies in BC

0   12.5   25   50   75
Kilometers

0 1.5 3   6   9
Kilometers

N
W   E
S

0   3   6   12   18   24
Kilometers

ALR Comparisons

Suitable ALR   Original Northern Rockies ALR   Outside ALR

December 4th, 2015

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Data Collected from the Ministry of Environment, Lands and Parks of BC, DataBC and Open Street Map