Introduction

The purpose of this report is to evaluate the general characteristics of the existing plant material within the Mount Royal University landscape based on the following criteria:

- Diversity
- Pollinator importance
- Fruiting food source for bird species
- Drought tolerance
- Origin of the species

The criteria were selected to help determine whether the existing plant material is meeting our current sustainable objectives. These objectives include:

- Creating a highly diverse plant population (where the population is not dominated by a small number of plant species).
- Ensuring over that over 50% of the total plant population is providing a source of nectar or pollen for insect and bird and species.
- Ensuring that over 50% of the total tree and shrub population is providing a source of food for bird species.
- Establishing a plant population whereby greater than 50% of the total population can tolerate periods of drought.
- Incorporating plants that are native to Alberta, Canada, and North America. Greater than 25% of the total plant population should be native to North America.

The information provided will be used as a baseline for future data collection, analysis and reporting. This will include an extensive inventory of shrubs and herbaceous perennials (a tree inventory has already been completed), and an assessment of the overall health of the existing plant population. The data collected will enable us to target our efforts on deficient and problematic areas, and perform a risk assessment and appraisal on individual trees for risk and asset management purposes. In the future, the data will also be used to perform calculations on carbon sequestration and capture, reduction of heat island effect, and storm water retention. A database and a GIS map have also been created to assist in these endeavors.

1. Tree Population Characteristics

Based on the 2017 tree inventory:

- There are 2,878 trees on Mount Royal University property.
- The total tree population represents 22 different genera.
- 47 different species of trees have been identified.
- 5 trees have yet to be identified beyond genus.

- Some trees have yet to be identified to the cultivar or variety level of classification, therefore the inventory does not yet include these categories.

Classifying based on tree genus gives us a more generalized view of our tree diversity. According to the number of different genera, our diversity seems reasonable (Table 1a.). Looking at the actual number of trees within each genus gives us a much different picture. Based on the data, 73.78% of our trees belong to only four genera (Table 1b.), and 26.22% belong to the remaining 18 (Table 1c.). This indicates that there is significantly less tree diversity on campus when tree numbers are considered.

Table 1: a.) Frequency and percentage of the 22 tree genera represented in the population (Mount Royal University, 2017). b.) Frequency and percentage of the four major tree genera in the population (Mount Royal University, 2017). c.) Frequency and percentage of the remaining 18 tree genera in the population (Mount Royal University, 2017).

a.)

Genus	Frequency	Frequency Percent
Eleagnus	1	0.03%
Gleditsia	2	0.07%
Thuja	3	0.10%
Aesculus	4	0.14%
Salix	11	0.38%
Pryrus	13	0.45%
Quercus	13	0.45%
Sorbus	13	0.45%
Tilia	13	0.45%
Crataegus	21	0.73%
Juniperus	21	0.73%
Betula	32	1.11%
Acer	33	1.15%
Pinus	48	1.67%
Larix	54	1.88%
Syringa	125	4.34%
Malus	167	5.80%
Prunus	181	6.29%
Ulmus	274	9.52%
Populus	484	16.85%
Fraxinus	542	18.83%
Picea	823	28.59%
22	2878	100%

b.)

Genus	Frequency	Frequency Percent
Ulmus	274	9.52%
Populus	484	16.85%
Fraxinus	542	18.83%
Picea	823	28.59%
4	2123	73.78%

c.)

Genus	Frequency	Frequency Percent
Eleagnus	1	0.03%
Gleditsia	2	0.07%
Thuja	3	0.10%
Aesculus	4	0.14%
Salix	11	0.38%
Pryrus	13	0.45%
Quercus	13	0.45%
Sorbus	13	0.45%
Tilia	13	0.45%
Crataegus	21	0.73%
Juniperus	21	0.73%
Betula	32	1.11%
Acer	33	1.15%
Pinus	48	1.67%
Larix	54	1.88%
Syringa	125	4.34%
Malus	167	5.80%
Prunus	181	6.29%
18	755	26.22%

Examining the data in a pie chart gives a better visual sense of how limited the diversity on campus really is (Figure 1.1). The lack of diversity in trees could be potentially devastating in the event of a pest or disease outbreak. For example, if the Emerald Ash Borer became a serious problem in Calgary, our

Fraxinus (Ash) population would be completely decimated and we would lose 18.83% of our tree population.
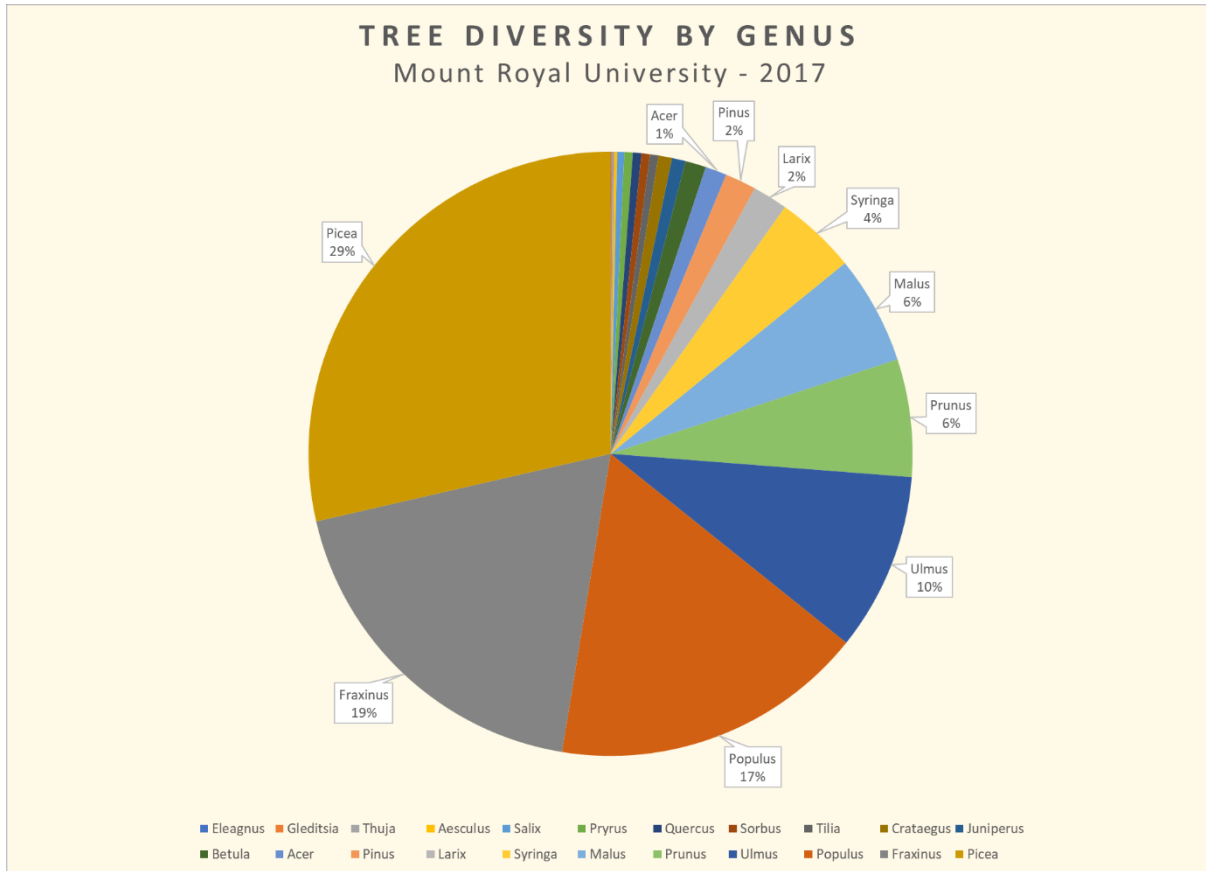

Figure 1.1: Tree diversity by genus showing the ten highest frequency percentages. (Mount Royal University, 2017).

Classifying based on species gives a more detailed evaluation of our tree diversity. Again, if we simply examine the number of different species, our diversity seems healthy (Table 2a). After examination of the actual tree numbers within each species, however, we see there are a handful of dominant species, much like there was in the genera. Based on the data, 56.25% of our trees belong to only three species (Table 2b.), and 43.75% belong to the remaining 44 (Table 2c.). Again, this indicates that there is significantly less tree diversity on campus when tree numbers are considered, however there is slightly more diversity on the species level.

Table 2: a.) a.) Frequency and percentage of the forty- four tree species represented in the total population (Mount Royal University, 2017). b.) Frequency and percentage of the three major tree species in the total population (Mount Royal University, 2017). c.) Frequency and percentage of the remaining 44 tree species in the total population (Mount Royal University, 2017).

Species	Frequency	Frequency Percent
Pine spp.	1	0.03%
Russian Olive	1	0.03%
White Pine	1	0.03%
Autumn Blaze Maple	2	0.07%
Bristlecone Pine	2	0.07%
Golden Willow	2	0.07%
Honeylocust	2	0.07%
Pin Cherry	2	0.07%
Rocky Mountain Juniper	2	0.07%
White Cedar	3	0.10%
Willow	3	0.10%
Ohio Buckeye	4	0.14%
Weeping Birch	4	0.14%
Columnar Blue Spruce	5	0.17%
Amur Cherry	6	0.21%
Laurel Leaf Willow	6	0.21%
Mountain Pine	6	0.21%
Tower Poplar	7	0.24%
Blue Globe Spruce	8	0.28%
Maple spp.	9	0.31%
Ponderosa Pine	9	0.31%
Norway Maple	10	0.35%
Paper Birch	10	0.35%
White Spruce	10	0.35%
Mountain Ash	12	0.42%
Silver Cloud Maple	12	0.42%
Bur Oak	13	0.45%
Linden spp.	13	0.45%
Pear	13	0.45%
Clump Paper Birch	18	0.63%
Wichita Blue Juniper	19	0.66%
Hawthorn spp.	21	0.73%
Mayday	27	0.94%
Lodgepole Pine	29	1.01%
Dolgo Crabapple	47	1.64%
Thunderchild Crabapple	47	1.64%
Northwest Poplar	48	1.67%
Siberian Larch	54	1.88%
Flowering Crabapple	73	2.54%
Poplar spp.	83	2.89%
Japanese Tree Lilac	125	4.35%
Schubert Chokecherry	142	4.94%
Trembling Aspen	163	5.67%
Swedish Columnar Aspen	183	6.37%
Brandon Elm	274	9.54%
Foothills Green Ash	542	18.87%
Colorado Blue Spruce	800	27.85%
47	**2873**	**100.00%**

a.)

Species	Frequency	Frequency Percent
Brandon Elm	274	9.54%
Foothills Green Ash	542	18.87%
Colorado Blue Spruce	800	27.85%
3	**1616**	**56.25%**

b.)

Species	Frequency	Frequency Percent
Pine spp.	1	0.03%
Russian Olive	1	0.03%
White Pine	1	0.03%
Autumn Blaze Maple	2	0.07%
Bristlecone Pine	2	0.07%
Golden Willow	2	0.07%
Honeylocust	2	0.07%
Pin Cherry	2	0.07%
Rocky Mountain Juniper	2	0.07%
White Cedar	3	0.10%
Willow	3	0.10%
Ohio Buckeye	4	0.14%
Weeping Birch	4	0.14%
Columnar Blue Spruce	5	0.17%
Amur Cherry	6	0.21%
Laurel Leaf Willow	6	0.21%
Mountain Pine	6	0.21%
Tower Poplar	7	0.24%
Blue Globe Spruce	8	0.28%
Maple spp.	9	0.31%
Ponderosa Pine	9	0.31%
Norway Maple	10	0.35%
Paper Birch	10	0.35%
White Spruce	10	0.35%
Mountain Ash	12	0.42%
Silver Cloud Maple	12	0.42%
Bur Oak	13	0.45%
Linden spp.	13	0.45%
Pear	13	0.45%
Clump Paper Birch	18	0.63%
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Flowering Crabapple	73	2.54%
Poplar spp.	83	2.89%
Japanese Tree Lilac	125	4.35%
Schubert Chokecherry	142	4.94%
Trembling Aspen	163	5.67%
Swedish Columnar Aspen	183	6.37%
44	**1257**	**43.75%**

c.)

TREE DIVERSITY BY SPECIES
Mount Royal University - 2017

Colorado Blue Spruce 28%
Siberian Larch 2%
Flowering Crabapple 3%
Poplar spp. 3%
Japanese Tree Lilac 4%
Schubert Chokecherry 5%
Trembling Aspen 6%
Swedish Columnar Aspen 6%
Brandon Elm 10%
Foothills Green Ash 19%

Legend:
- Pine spp.
- Russian Olive
- White Pine
- Autumn Blaze Maple
- Bristlecone Pine
- Golden Willow
- Honeylocust
- Pin Cherry
- Rocky Mountain Juniper
- White Cedar
- Willow
- Ohio Buckeye
- Weeping Birch
- Columnar Blue Spruce
- Amur Cherry
- Laurel Leaf Willow
- Mountain Pine
- Tower Poplar
- Blue Globe Spruce
- Maple spp.
- Ponderosa Pine
- Norway Maple
- Paper Birch
- White Spruce
- Mountain Ash
- Silver Cloud Maple
- Bur Oak
- Linden spp.
- Pear
- Clump Paper Birch
- Wichita Blue Juniper
- Hawthorn spp.
- Mayday
- Lodgepole Pine
- Dolgo Crabapple
- Thunderchild Crabapple
- Northwest Poplar
- Siberian Larch
- Flowering Crabapple
- Poplar spp.
- Japanese Tree Lilac
- Schubert Chokecherry
- Trembling Aspen
- Swedish Columnar Aspen
- Brandon Elm
- Foothills Green Ash
- Colorado Blue Spruce

Figure 1.2: Tree diversity by species showing the ten highest frequency percentages (excluding the five unidentified species). (Mount Royal University, 2017).

The MRU tree population was further classified based on Pollinator Importance (Figure 1.3), Food Source for Bird Species (Figure 1.4), Drought Tolerance (Figure 1.5), and Origin (Figure 1.6).

According to the data, 67% of the tree population is a source of pollen or nectar to various species of bees, wasps, butterflies, moths, flies, beetles, and hummingbirds (Figure 1.3). This indicates that we have a healthy supply of trees for pollinators, and that we are above our target of 50%.
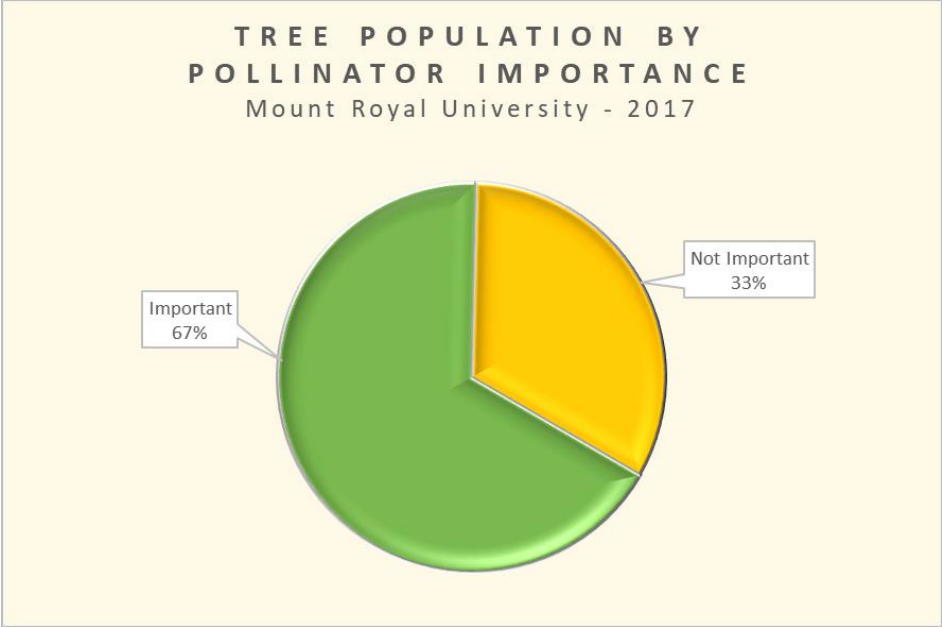
Figure 1.3: Percentage of the tree population with pollinator importance.

Currently, 47% of our tree population provides a food source for bird species (Figure 1.4). This is a relatively high number; however, this number needs to be increased by a minimum of 3%.
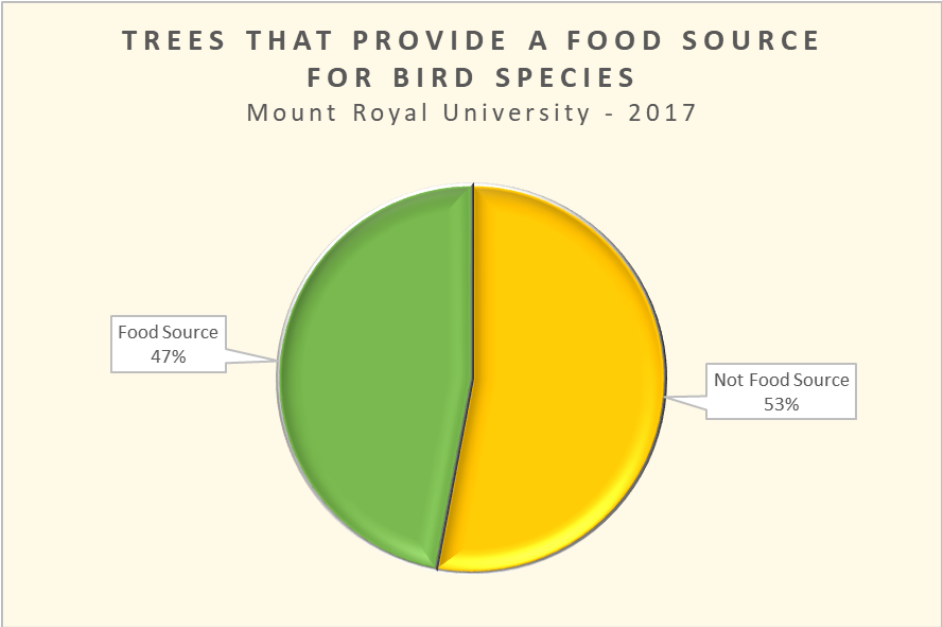

Figure 1.4: Percentage of the tree population that provide a fruiting food source for bird species.

The existing tree population consists of 1,998 trees that are drought tolerant. This number represents 69% of the total number of trees (Figure 1.5). Of the remaining 31%, 29% shows moderate drought

tolerance, while a mere 2% fall into the poor category. Based on these percentages, we can conclude that the tree population exhibits good overall drought tolerance, well above the aim of 50%.
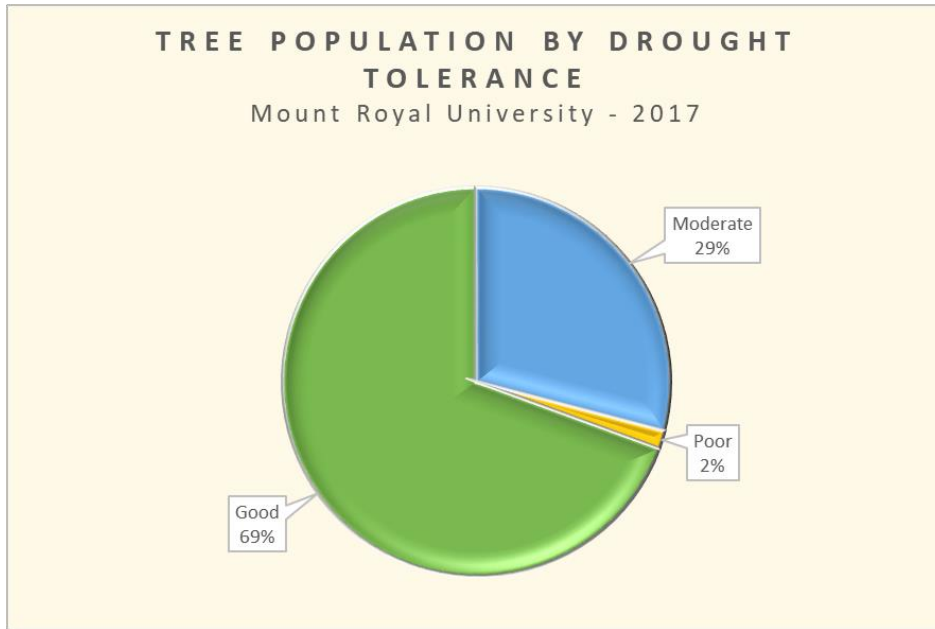
Figure 1.5: Percentage of the tree population with Good, Moderate, or Poor drought tolerance.

Based on the data, the tree population consists of 11% native to Alberta, 20% native to Canada, and 28% native to North America (excluding Canada) (Figure 1.6). The percentage of trees native to Alberta is relatively low, however the percent encompassing all North America totals 59% when Alberta, Canada and North America (excluding Canada) categories are considered.

A low percentage in the Alberta native category can be attributed to a couple of important factors. Firstly, Calgary is already limited in number of native species due to the harsh winters and Chinooks. Secondly, if we are interested in drought tolerance, the selection of native trees available becomes even more limited. As a result, using a higher percentage of native trees decreases the diversity significantly, and if we also include the less drought tolerant native species, our drought tolerance would also decrease. This becomes tricky to balance, and raises the question of whether having a higher percentage of native species is more important than more diversity and drought tolerance.
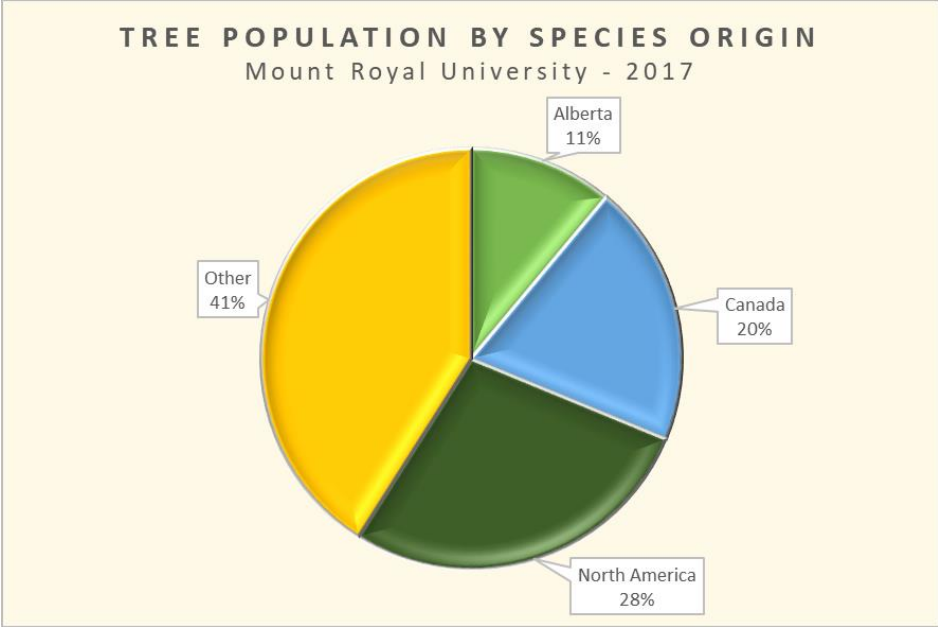
TREE POPULATION BY SPECIES ORIGIN
Mount Royal University - 2017

Alberta 11%

Other 41%

Canada 20%

North America 28%

Figure 1.6: Percentage of the tree population with origins in Alberta, Canada, North America (excluding Canada) and Other.

2. Shrub Characteristics

The shrubs were classified based on Pollinator Importance (Figure 2.1), Fruiting Food Source for Bird Species (Figure 2.2), Drought Tolerance (Figure 2.3), and Origin (Figure 2.4). The shrub data does not represent the entire population. It is based solely on the different genera and species within the MRU property. An extensive inventory with actual shrub numbers will be undertaken in 2018. The charts give an overview of the general characteristics of the shrub population.

SHRUB SPECIES BY POLLINATOR IMPORTANCE
Mount Royal University - 2017

Not Important 15%
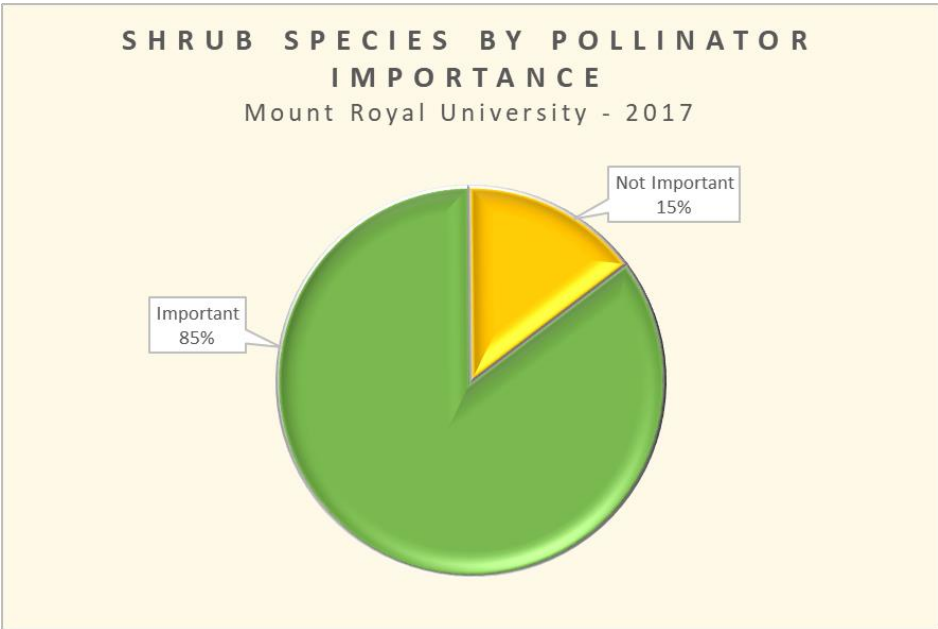
Important 85%

Figure 2.1: Percentage of shrub species with pollinator importance.
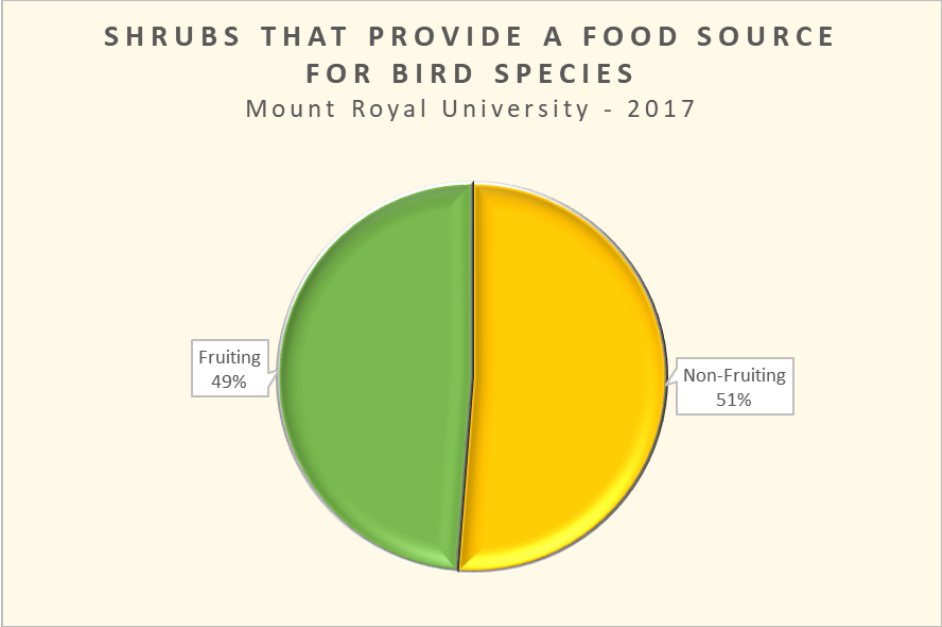
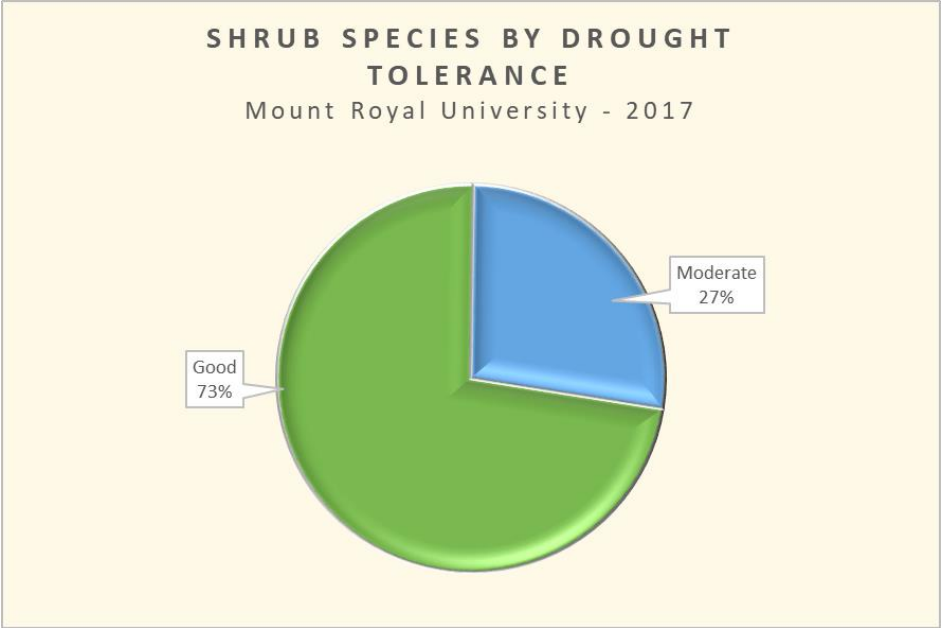**Figure 2.2: Percentage of shrub species that provide a fruiting food source for bird species.**

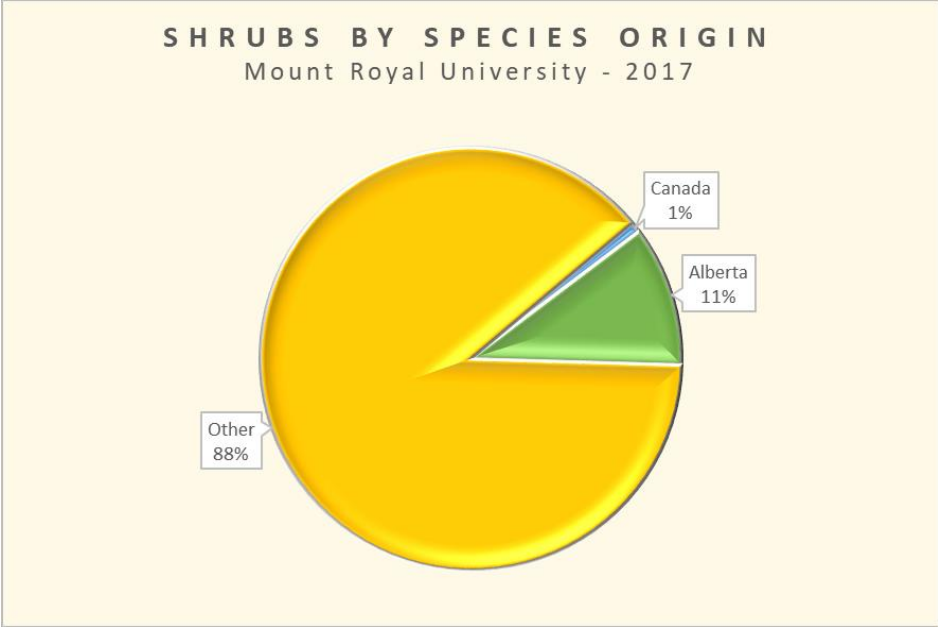**Figure 2.3: Percentage of shrubs with Good, Moderate, or Poor drought tolerance.**

SHRUBS BY SPECIES ORIGIN
Mount Royal University - 2017

Canada 1%
Alberta 11%
Other 88%

Figure 2.4: Percentage of shrubs with origins in Alberta, Canada, or Other.

3. Herbaceous Plant Characteristics

The herbaceous plants were classified based on Pollinator Importance (Figure 3.1), Drought Tolerance (Figure 3.2), and Origin (Figure 3.3). The herbaceous plant data does not represent the entire population. It is based solely on the different genera and species within the MRU property. An extensive inventory with actual herbaceous plant numbers will be undertaken in 2018. The charts give an overview of the general characteristics of the herbaceous plant population.
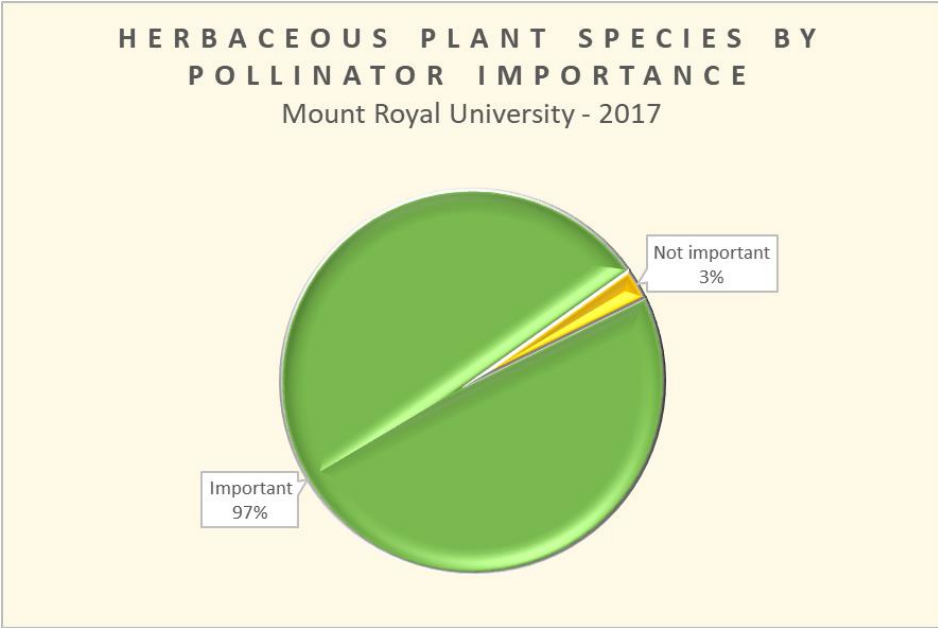

HERBACEOUS PLANT SPECIES BY POLLINATOR IMPORTANCE
Mount Royal University - 2017

Not important 3%
Important 97%

Figure 2.1: Percentage of herbaceous plant species with pollinator importance.
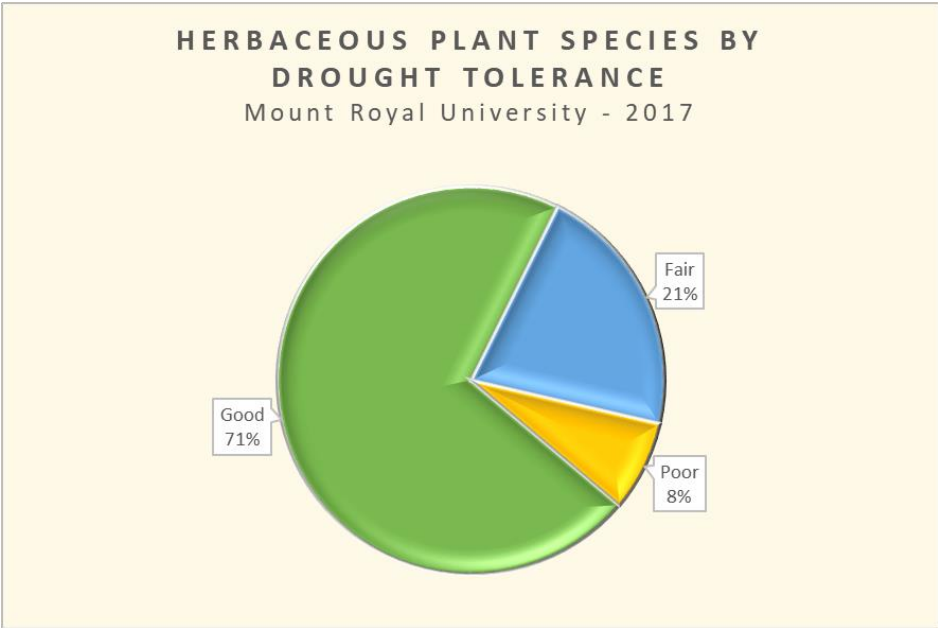
Figure 2.2: Percentage of herbaceous plant species with Good, Moderate, or Poor drought tolerance.
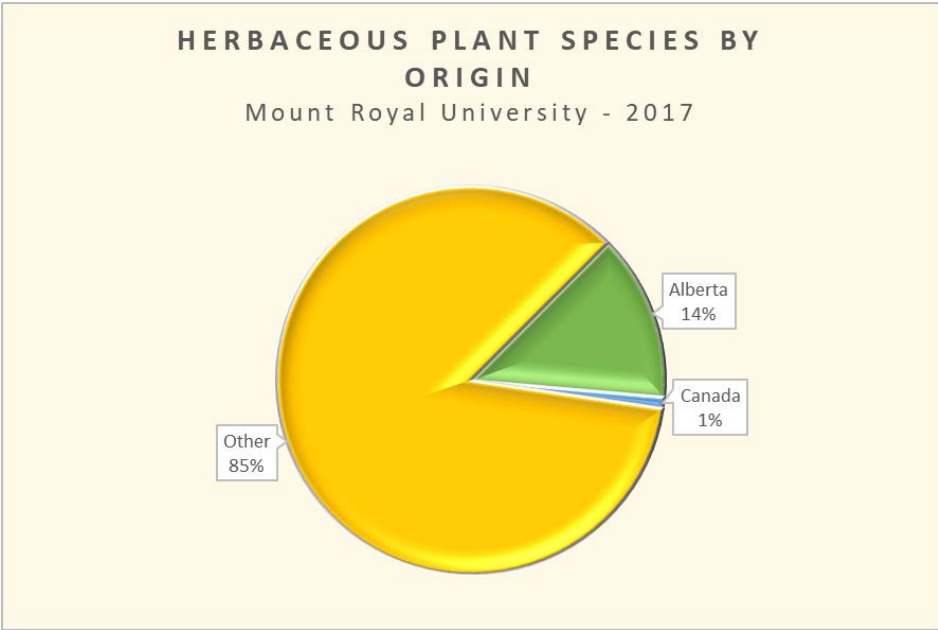

Figure 2.3: Percentage of herbaceous plant species with origins in Alberta, Canada, or Other.

Resources

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