Vegetation Surveys of Winter Cover Crop Fields over the 2019-20 Winter Season

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Introduction

Agricultural fields in the Fraser River delta provide important foraging and overwintering habitat for waterfowl. For the past four years, DF&WT has been conducting waterfowl surveys throughout Delta and south Richmond to assess waterfowl use of these fields. Surveys have been conducted in cooperation with Canadian Wildlife Service and Ducks Unlimited Canada, and they provide a useful overview of the abundance and diversity of waterfowl species on different types of cropland. However, visual surveys are limited to birds present on the field at the time of observation. Accounts from local farmers indicate that a significant amount of grazing occurs overnight, and this activity goes undetected in the waterfowl survey. Therefore, an additional method of measuring waterfowl use was necessary. The purpose of this vegetation study was to quantify the amount of grazing occurring on cover cropped fields and to assess the value of different types of cover crops.

Methods

Winter cover cropped fields throughout Delta and south Richmond were surveyed three times over the winter season to measure vegetation height and cover. Initial measurements were taken at three points in each field between October 21 and November 4, 2019. A second round of measurements were taken at the same points between December 2 and December 18, and final measurements took place between March 20 and March 24, 2020. At each sample point, height was measured to the nearest centimetre and cover was determined by estimating the percentage of vegetation cover within a 1 m by 1 m square (Figure 1). Additionally, the percentage of the total field with visible grazing was estimated. The level of intensity of grazing was recorded as a number between zero and four, with zero being no grazing and four being completely grazed (Figure 2).

Figure 1. Example of 5% vegetation cover in a 1 m by 1 m square using the Ministry of Forests, Lands and Natural Resource Operation's comparison chart for estimating cover percent.

Intensity 0	*Intensity 1*	*Intensity 2*	*Intensity 3*	*Intensity 4*
No grazing	<50% of vegetation height grazed	>50% of vegetation height grazed	Only stubs left	No cover crop left

Figure 2. Photos showing levels of intensity of grazing from lowest on the left to highest on the right.

Results

A total of 113 cover cropped fields were surveyed over 18 fields days. By December, 49 fields showed at least some evidence of grazing, with 9 fields being grazed completely to the roots (Figure 3). When fields were visited in March, four fields had been tilled so final measurements were not possible. Of the 109 remaining fields, 55 were grazed to the roots and only two showed no evidence of grazing (Figure 4).

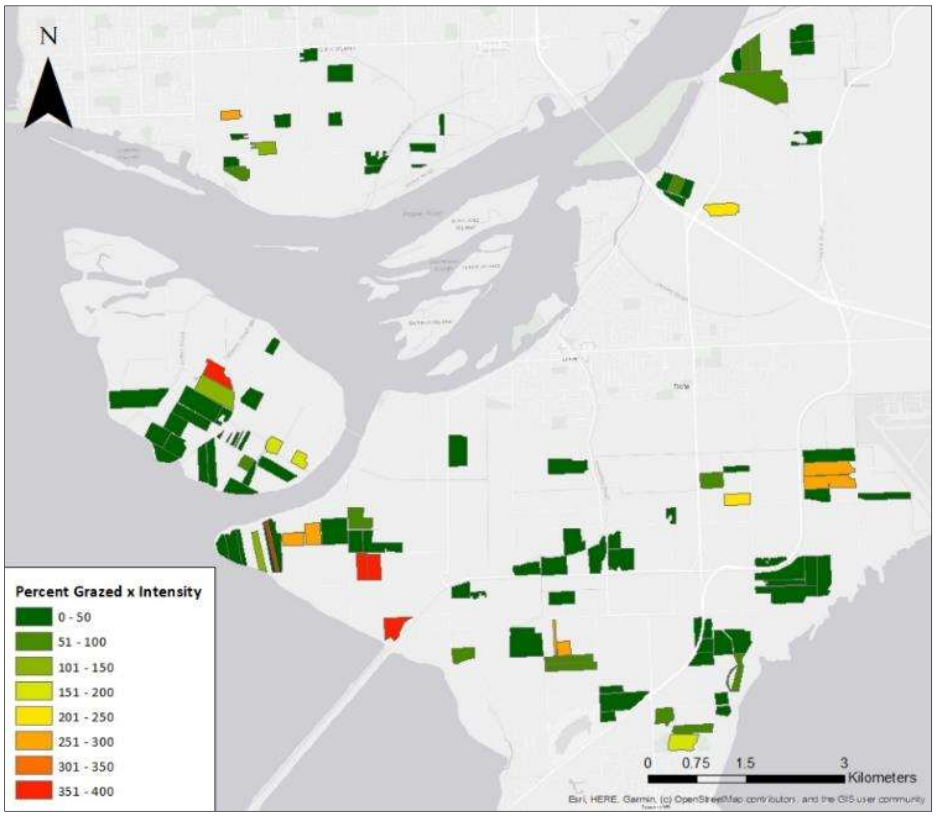

Figure 3. Map of Delta and Richmond showing levels of grazing on cover cropped fields in December 2019. Values calculated by multiplying the percentage of field grazed by the intensity of grazing (maximum value 400 represents 100% grazed at intensity 4). See Figure 2 for intensity definition.

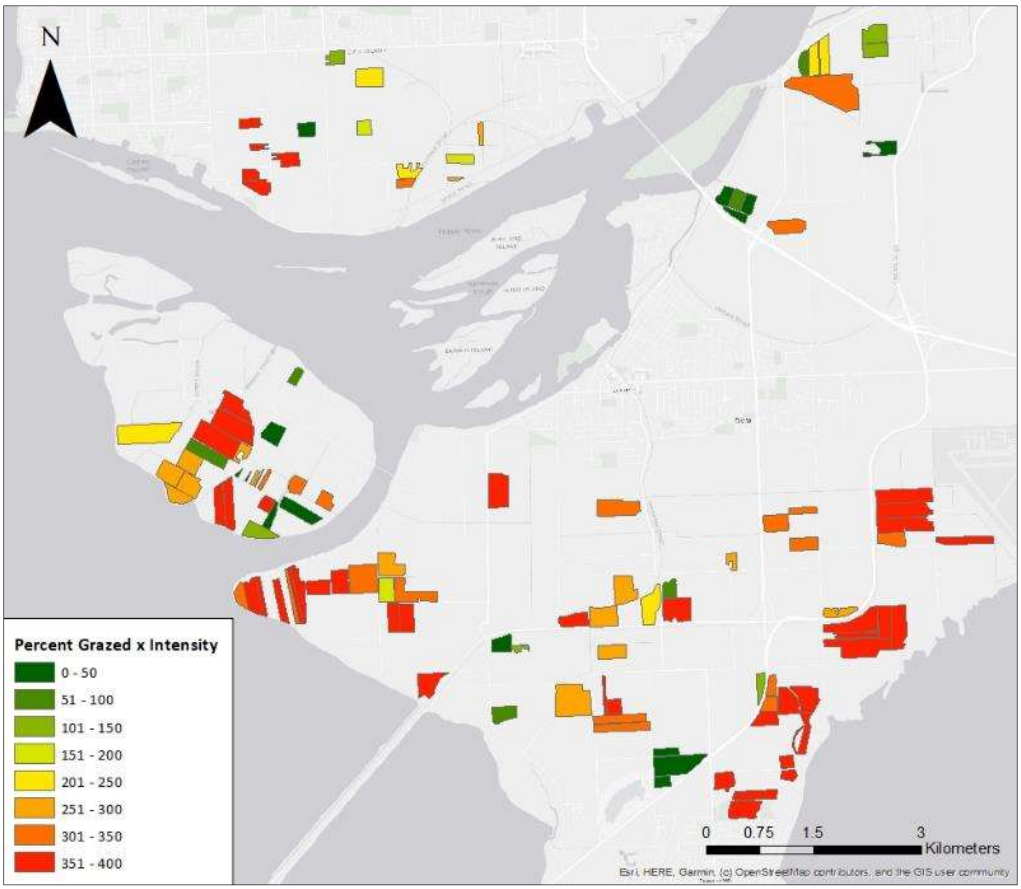

Figure 4. Map of Delta and Richmond showing levels of grazing on cover cropped fields in March 2020. Values calculated by multiplying the percentage of field grazed by the intensity of grazing (maximum value 400 represents 100% grazed at intensity 4). See Figure 2 for intensity definition.

Winter cover crop fields were planted with either spring cereals or a novel crop mixture. Both types of fields experienced extensive grazing by the end of winter (Table 1). Spring cereals were either barley (n=66) or oats (n=28), and novel crop mixtures were tillage radish (n=2) or pollinator mix (n=13). Pollinator mix fields experienced the greatest percentage of grazing compared to other crop types (Figure 5).

Table 1. Mean percentage of field area grazed and the mean intensity of grazing in December 2019 and March 2020 by type of cover crop.

		December Measurement		March Measurement	
Cover Crop	**Number of Fields**	**Mean Percent Grazed (%)**	**Mean Intensity of Grazing**	**Mean Percent Grazed (%)**	**Mean Intensity of Grazing**
Novel Mix	15	21.3	1.1	85.3	3.3
Spring Cereal	94	23.0	1.0	74.5	3.1
Total	109	22.8	1.0	76.0	3.1

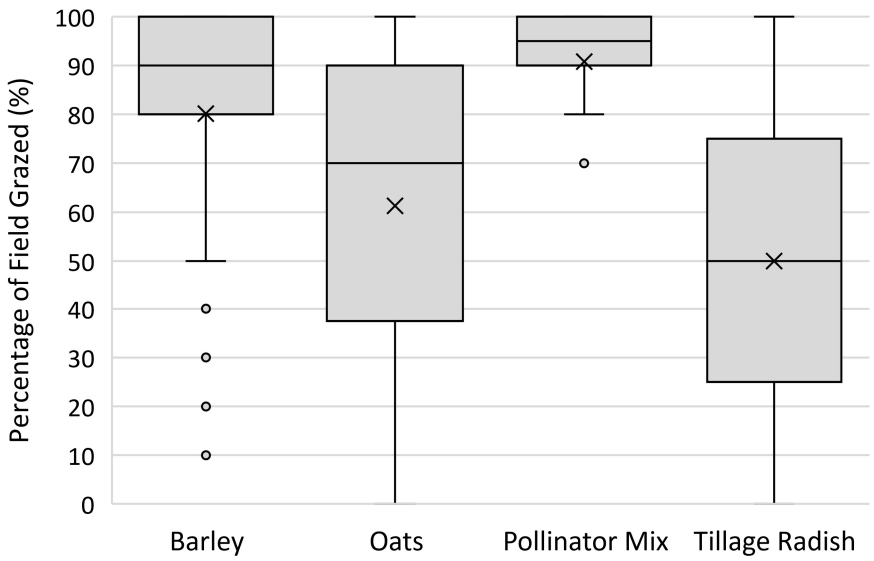

Figure 5. Percentage of field grazed at the end of winter (March 2020 measurement) by cover crop; quartiles represented by boxes, maximum and minimum values represented by whiskers, mean value represented by an "x", and outliers represented by dots.

Measurements of vegetation cover and height showed steep declines by the end of winter. Overall, winter cover crops decreased by 63.0% in cover and 66.0% in height from October to March (Figure 6 and Figure 7). When measured in December, spring cereals showed a slight average increase in cover by 8.5% and height by 5.3%, but this was largely due to significant growth of oat crops during November. Pollinator mix fields experienced the greatest reduction between October and March, decreasing by 82.0% in cover and 86.1% in height.

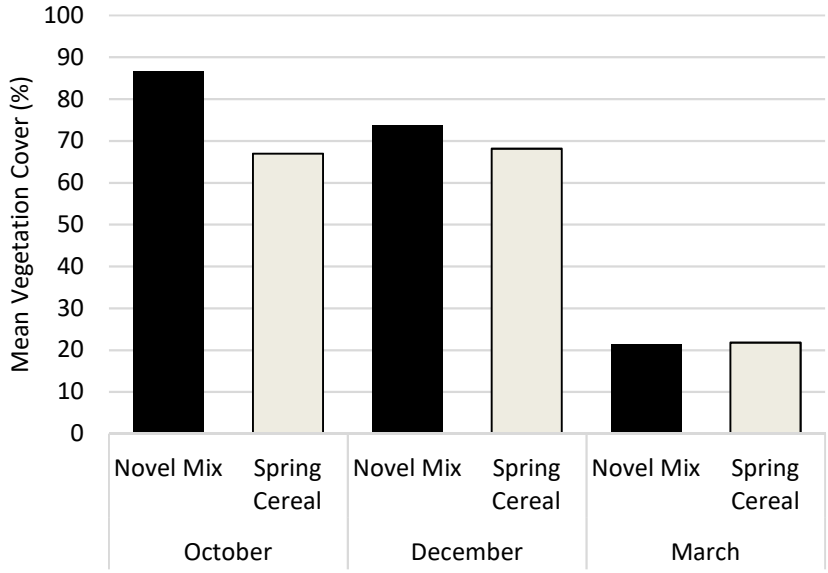

Figure 6. Mean percentage of vegetation cover on novel crop mixtures and spring cereal fields in October and December 2019 and March 2020.

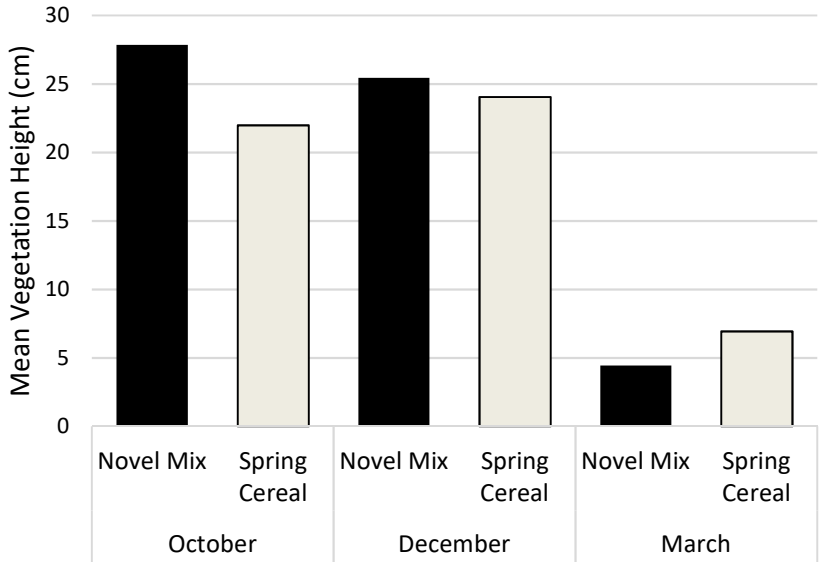

Figure 7. Mean vegetation height in centimetres on novel crop mixtures and spring cereal fields in October and December 2019 and March 2020.

Finally, the extent of grazing was compared with the mean waterfowl seen per hectare per survey day in the DF&WT waterfowl survey. Both studies were conducted between October 2019 and March 2020, and only fields that were included in both studies were compared. Using the Pearson correlation coefficient, the correlation was significant but weak (Figure 8). If the waterfowl survey was detecting a representative portion of grazing activity, a stronger correlation would be expected.

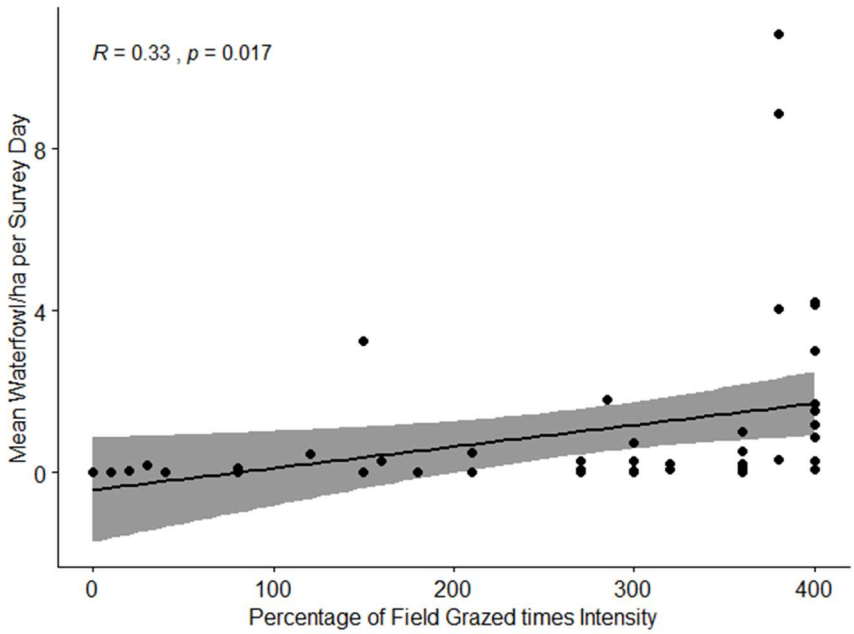

Figure 8. Correlation between the level of grazing on a given field (calculated by multiplying the percentage of the field grazed by the level of intensity) and the mean number of waterfowl/ha per survey day.

Conclusion

The results of this study support the high value of winter cover cropped fields to overwintering waterfowl in the Fraser River delta. High levels of grazing were evident throughout Delta and south Richmond and across all types of fields. Grazing activity was moderate in December but increased dramatically by March. Novel crop mixtures, and pollinator mix in particular, experienced higher levels of grazing than spring cereals. However, the difference between crop types was relatively small and further studies are necessary to determine the value of novel crop mixtures.

A comparison of the results of this vegetation study to the DF&WT waterfowl survey demonstrate that both studies are important to understanding waterfowl activity. The vegetation study was effective at measuring total grazing regardless of when the foraging occurred, while the waterfowl survey does not account for overnight activity. However, the vegetation study gives no information about the species distribution or diversity. Therefore both studies should continue to best capture all aspects of overwintering waterfowl use of cover cropped fields.

Recommendations

Estimates of the total percentage of field grazed and intensity of grazing were useful metrics in measuring waterfowl use. Vegetation height and cover were sometimes impacted by factors other than grazing, such as winterkill or flooding, so they were not adequate on their own to describe grazing impacts. Grazing percentage and intensity should continue to be measured in addition to vegetation height and cover in future years of this study.

Measuring fields three times throughout the study gave a good comparison of cover cropped fields at the beginning and end of winter. However, performing more frequent measurements would give more detailed information about which fields are being grazed first. Visual inspections while performing other DF&WT surveys showed that some fields were grazed in January, whereas others were not touched until late February or March. By surveying more frequently, patterns may be revealed about crop types or locations that are foraged before others. I recommend selecting a manageable subset of fields and surveying monthly or biweekly.