Vegetation Survey of Cover Crop Fields

November 2023 – March 2024

Image 1. A cover crop in November (left) compared to the same field in March (right), Delta, BC.

Program Background

The purpose of this vegetation study was to quantify the amount of grazing occurring on cover crop fields and to assess the value of different types of cover crops. Agricultural fields in the Fraser River delta provide important foraging and overwintering habitat for waterfowl. For the past seven years, Delta Farmland and Wildlife Trust (DFWT) 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 croplands.

The 2023-2024 season was the first time that the DFWT expanded its cover crop program beyond Richmond and Delta, and farmers from Metro Vancouver and Abbotsford were given the opportunity to enroll. This expansion provides a larger sampling size of cover cropped fields and the ability to assess waterfowl activity past the borders of Richmond and Delta.

Survey Methods

A total of 206 cover cropped fields and 28 cereal habitat enhancement fields enrolled in the DFWT Stewardship program were surveyed three times over the winter season to measure vegetation height, cover, and the intensity of waterfowl grazing. Initial measurements were taken at three points along a 60m transect in each field in November 2023. A second round of measurements were taken in January 2024 within the same fields and final measurements took place in March 2024. At each sample point, maximum vegetation height was measured to the nearest centimeter and the percentage of vegetation cover was estimated within a 1 m by 1 m quadrat *(Figure 1*). 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*).

Within each sample, vegetation was classified into 5 different subcategories: Grasses, Brassicas, Legumes, Phacelia/Sunflower, and Weeds. Percentage of cover and grazing intensity was measured for each subsample to determine the dominant vegetation within fields planted with a diverse seed mix, as well as to see waterfowl grazing preferences.

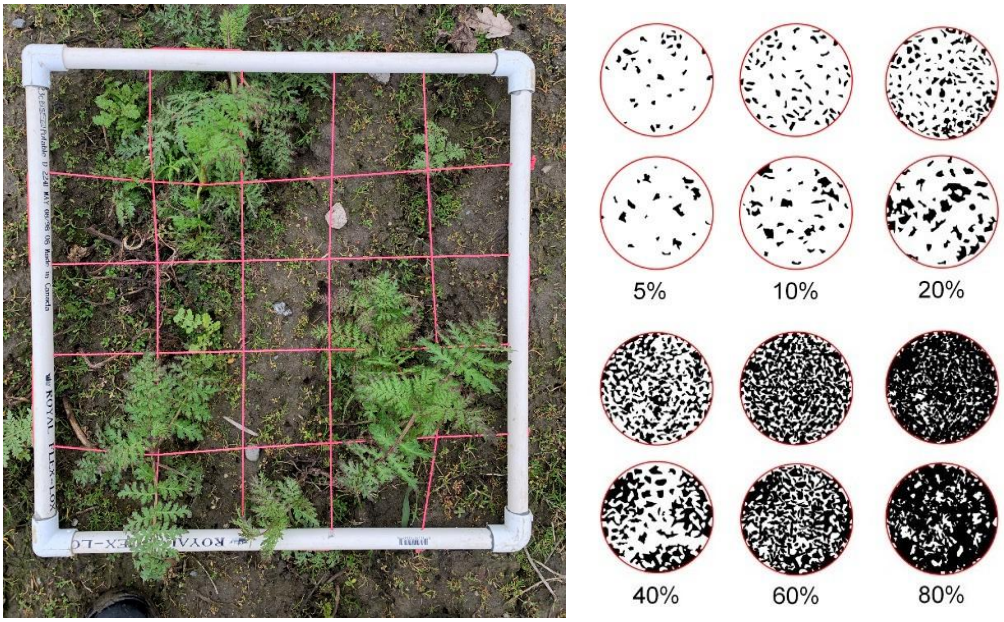


Figure 1. Example of 40% vegetation cover in a 1 m by 1 m quadrat using the Ministry of Forests, Lands and Natural Resource Operation's comparison chart for estimating cover percent.

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

Cover Crop Species

Cover crop fields were divided into four groups based on the types of species planted: Spring cereals, Winter cereals and grasses, Pollinator Mixes, and Novel Mixes. The spring cereals that were planted were barley and oats (n = 103). Winter cereals and grasses included winter wheat, fall rye, triticale, and annual and Italian ryegrass (n = 46). Two different Pollinator mixes were used (n = 36), consisting of either chickpea, faba bean, winter lentil, red clover, berseem clover, sorghum, phacelia, and sunflower, or, crimson clover, faba bean, oats, barley, purple top turnip, and forage turnip. Novel Mixes (n = 21) contained various mixtures of the following: radish, barley, oats, clover, vetch, peas, and wheat.

		November			January			March		
Cover Crop	**Number of Fields**	**Mean Vegetation Height (cm)**	**Mean Percent Cover (%)**	**Mean Intensity of Grazing**	**Mean Vegetation Height (cm)**	**Mean Percent Cover (%)**	**Mean Intensity of Grazing**	**Mean Vegetation Height (cm)**	**Mean Percent Cover (%)**	**Mean Intensity of Grazing**
Novel Mix	21	42.08	87.11	0.19	30.15	69.60	0.81	11.55	34.35	1.46
Pollinator Mix	36	26.65	51.05	1.53	16.27	24.51	2.61	2.11	7.26	3.53
Spring Cereal	103	29.15	56.14	0.94	25.59	51.56	1.53	4.74	33.46	2.23
Winter Cereal and Grasses	46	20.97	63.65	0.22	21.78	69.24	0.64	10.94	38.01	1.08
Total	**206**	**29.71**	**64.49**	**0.72**	**23.45**	**53.73**	**1.40**	**7.33**	**28.27**	**2.08**

Table 1 Mean vegetation height, cover, and intensity of grazing (0-4) of each cover crop type.

Vegetation Height

Vegetation height decreased throughout the winter. The Novel Mix cover crops (42cm) had the highest vegetation height compared to each other category, with winter cereals (21cm) reaching only half the height of the Novel Mix (Figure 3). On average, cover crops experienced a 75% decrease in height from January to March, as most grasses experienced winterkill, or waterfowl grazing.

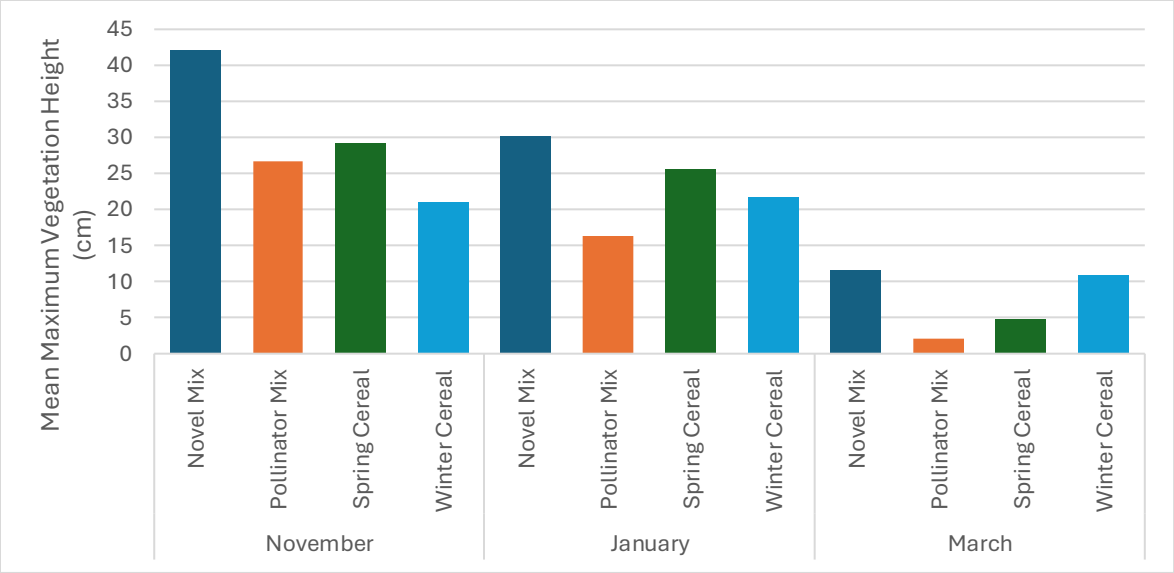


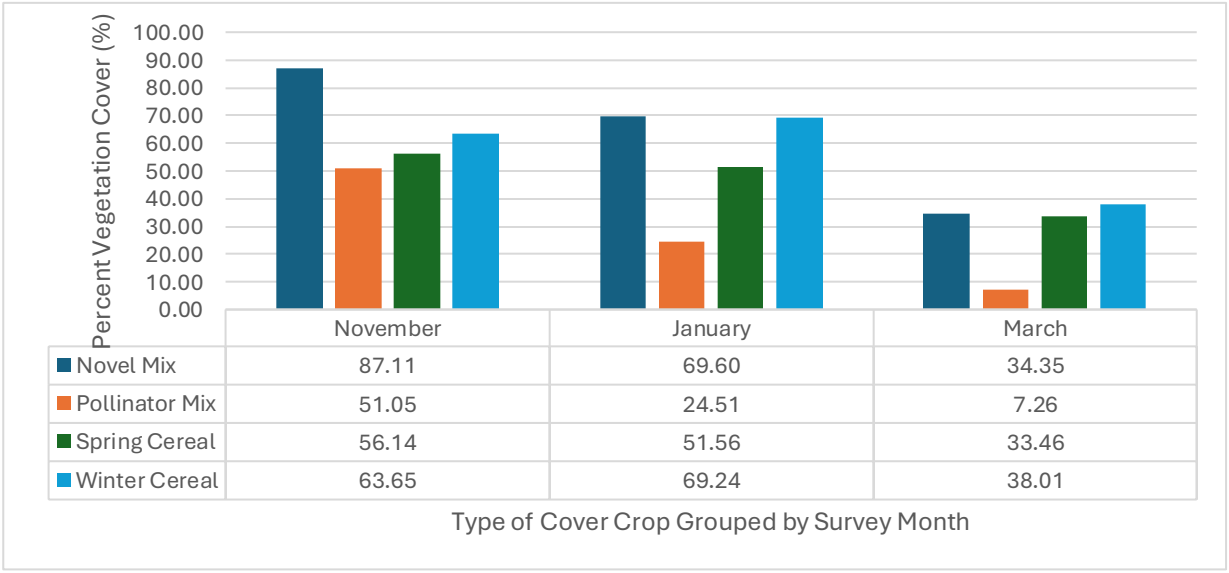
Figure 3 Graph of mean vegetation height of each cover crop mix.

Crop Cover

Throughout the surveys, mean percent vegetation cover peaked at 64% in November (*Table 1*). Percent cover continuously decreased in each survey period, during the last sample fields had an average of 28% vegetation cover (Table 1).

The mean percentage of vegetation cover in fields planted with a novel mix, a pollinator mix, and spring cereals all experienced a decrease, 8%, 52%, and 20%, respectively, in vegetation cover from November to January, while the percent cover of winter cereal fields increased by 9%.

From January to March every cover crop experienced further decrease in vegetation cover, with Novel Mixes decreasing 51%, Pollinator Mix 70%, Spring Cereals 35%, and Winter Cereals 45% (*Figure 4*).



	November	January	March
Novel Mix	87.11	69.60	34.35
Pollinator Mix	51.05	24.51	7.26
Spring Cereal	56.14	51.56	33.46
Winter Cereal	63.65	69.24	38.01

Figure 4 Cover crop mean percent vegetation cover based on survey month.

During the January and March vegetation surveys, the composition of each sample point was broken down into 5 categories to determine the dominant vegetation type in each field. Barley, rye, oats, and wheat were categorized as grasses. Brassicas contained tillage/forage radishes and turnips. Legumes consisted of peas, lentils, chickpeas, and clover.

Overall, the grasses were the most dominant vegetation type in each seed mix. Weeds were present in every field but were lowest in those planted with a Pollinator Mix.

	Mean Grass Cover (%)	Mean Brassica Cover (%)	Mean Legume Cover (%)	Mean Phacelia/ Sunflower Cover (%)	Mean Weed Cover (%)
Novel Mix	56.20	22.50	28.33		11.57
Pollinator Mix	14.37	9.08	1.57	4.48	7.31
Spring Cereal	52.52				10.13
Winter Cereal	54.32				10.39
Total	**47.86**	**14.07**	**11.30**	**4.48**	**9.90**

Table 2 Mean cover of grass, brassica, legume, phacelia/sunflower, and weeds in each cover crop type.

Grazing

A total of 206 fields were surveyed over two weeks in each survey period. In November, 131(64%) fields showed no signs of waterfowl grazing (*Figure 5*), which decreased to 36 (17%) in March (*Figure 6)*. Eight fields (4%) located in Delta had been grazed completely to the roots (grazing intensity = 4), Grazing peaked in March, by which time 40 fields (19%) were grazed completely.

Figure 5 Map of Delta and Richmond (left), Surrey and Langley (center), and Abbotsford (right) showing levels of grazing on cover cropped fields in November 2023. Values calculated by multiplying the percentage of field grazed by the intensity of grazing (maximum value 400 represents 100% grazed at intensity 4).

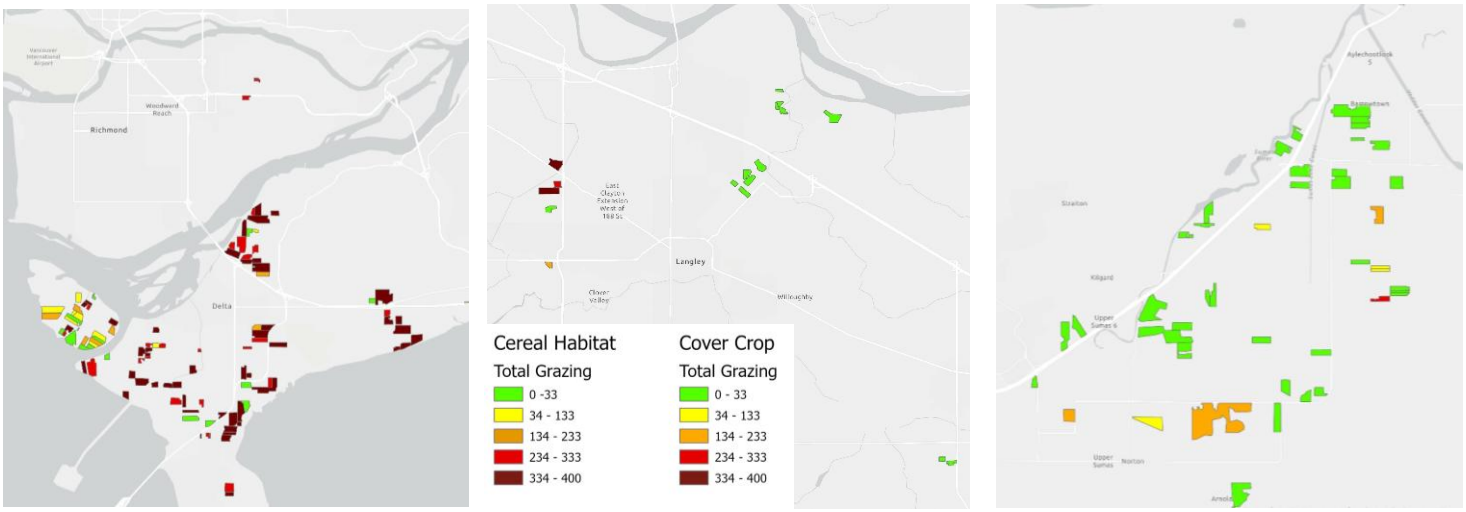


Figure 6 Map of Delta and Richmond (left), Surrey and Langley (center), and Abbotsford (right) showing levels of grazing on cover cropped fields in March 2024. Values calculated by multiplying the percentage of field grazed by the intensity of grazing.

When comparing total grazing between geographic regions, Delta, Richmond, and Surrey experienced the highest degree of grazing when compared to regions further east (*Figure 7*). Langley and Abbotsford both experienced minimal amounts of grazing throughout the entire survey period. This may be due to the distance from the foreshore, and the location of the pacific flyaway where migratory birds are more likely to be traveling through Delta, Richmond, or Surrey.

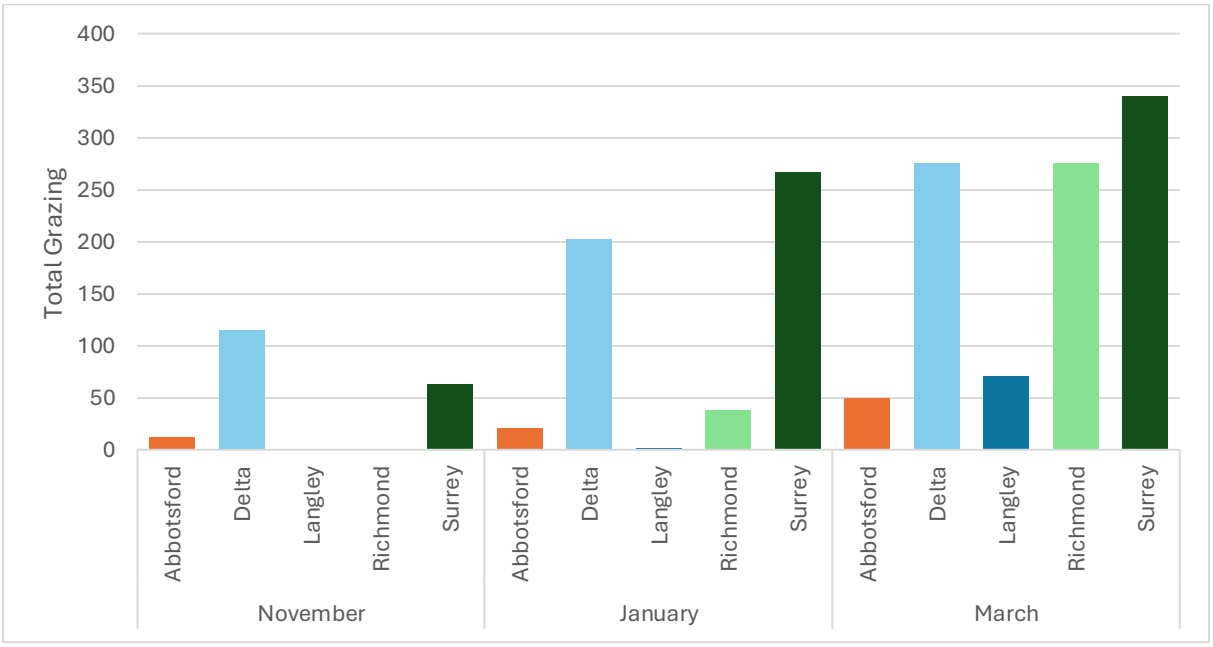


Figure 7 Total grazing based on geographic location. Total Grazing is calculated by multiplying the level of grazing intensity (scale of 0-4) with the Percentage of the field that was grazed, to a maximum of 400 (whole field grazed to level 4).

Total Grazing was compared between each cover crop mix using a one-factor ANOVA test, and it was found that the Pollinator Mix experienced less grazing than the Novel Mix, and both the Winter

and Spring Cereals ($p < 0.001$). The Winter cereal group also experienced less grazing when compared to the Spring Cereals ($p < 0.001$).

Cereal Habitat Enhancement Program

In addition to the cover crop fields surveyed, 28 Cereal Habitat Enhancement (CHEP) fields were surveyed. CHEP fields were planted with either barley (n=25), oats (n=2), or a mixture of sunflower and oats (n=1) (Table 4).

Compared to Cover Crops, the CHEP fields had higher vegetation height and cover, as well as a lower intensity of grazing. CHEP fields were seeded by spreading the residual seed from spring cereal crops harvested in the summer, giving the cover crop more time to establish before winter. The maturity of the vegetation may have been a factor in the reduced waterfowl grazing observed on these fields compared to the standard cover crop fields, which were planted later.

		November			January			March		
	Number of Fields	Mean Vegetation Height (cm)	Mean Percent Cover (%)	Mean Intensity of Grazing	Mean Vegetation Height (cm)	Mean Percent Cover (%)	Mean Intensity of Grazing	Mean Vegetation Height (cm)	Mean Percent Cover (%)	Mean Intensity of Grazing
Barley	25	37.21	70.42	0.21	23.44	62.68	0.52	7.86	52.40	1.44
Oats	2	53.67	84.33	0.00	51.83	90.83	0.00	21.67	79.17	0.17
Sunflower and Oats	1	91.67	45.00	0.00	35.67	63.33	0.00	19.33	60.00	0.00
Grand Total	**28**	**40.44**	**70.51**	**0.19**	**26.00**	**64.79**	**0.46**	**9.49**	**54.94**	**1.28**

Table 3 Mean Vegetation height, cover, and intensity of grazing of Cereal Habitat Enhancement fields.

Season Summary

Winter cover crops continue providing valuable resources to both farmers and wildlife in the Fraser River delta. With only 17% of cover crop fields remaining ungrazed throughout the winter of 2023-2024, it is evident that cover crop fields are heavily utilized by waterfowl throughout the season, and act as an important resource for migratory birds. Though above ground biomass may experience grazing throughout the winter, cover crops still provide benefits to the soil through their root structures, which help to improve water infiltration as well as decreasing bulk density and soil compaction.